transitions to San Tomas Expressway at US 101. In the vicinity of the project site, Montague Expressway is a six-lane roadway. Approximately three miles to the northeast, Montague Expressway contains HOV lanes. The HOV lane designation is in effect in both directions of travel during both the AM and PM peak commute hours and is otherwise open to all users. Montague Expressway provides access to and from the project site via Mission College Boulevard.

Great America Parkway is a north-south thoroughfare that begins at US 101 and extends northward to SR 237. Full interchanges are located at both US 101 and SR 237. Great America Parkway is primarily a six-lane roadway, with an additional northbound lane between Tasman Drive and US 101. Great America Parkway provides access to and from the project site via Mission College Boulevard and Patrick Henry Drive with direct access via one right-turn only driveway.

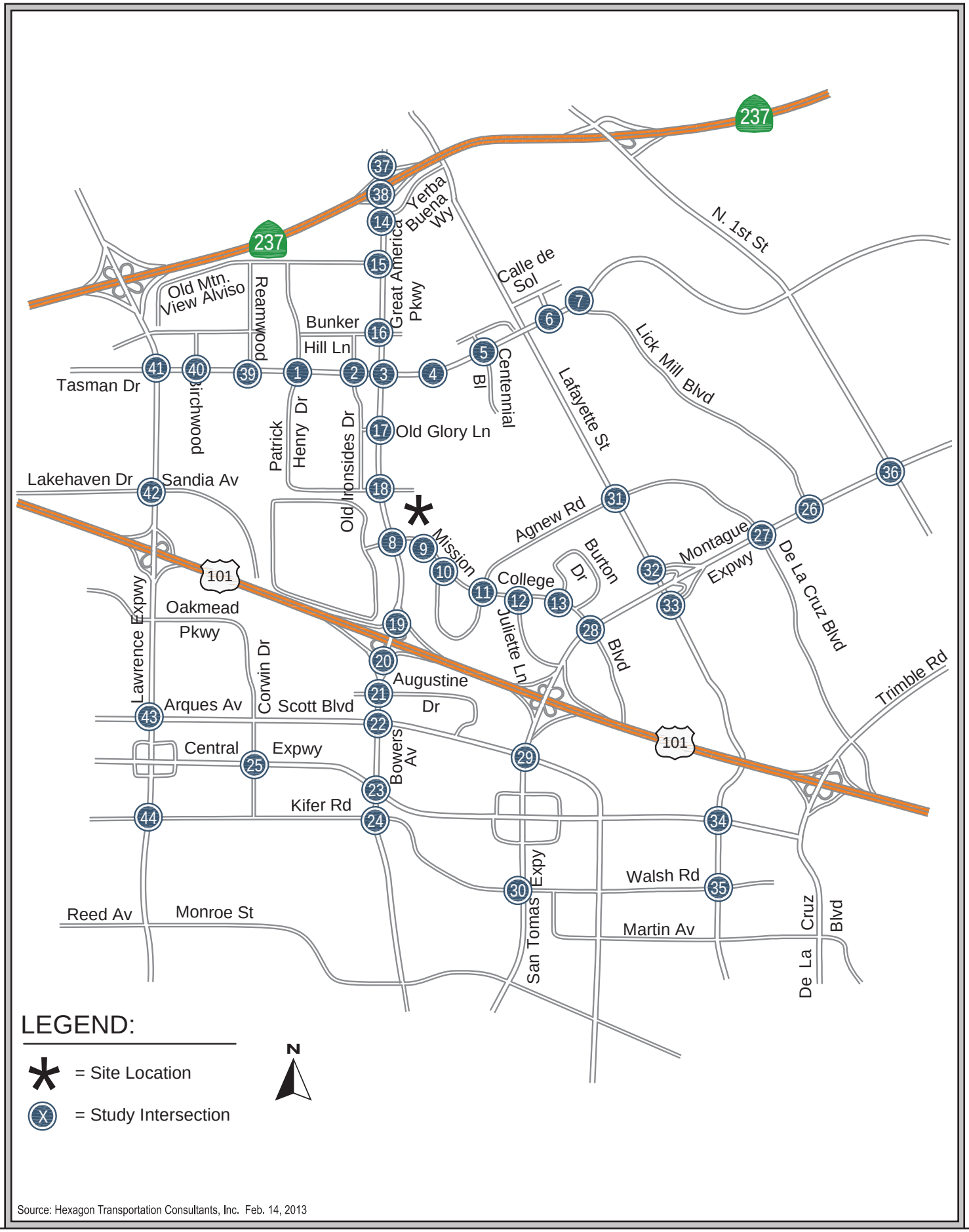
Bowers Avenue is the southern extension of Great America Parkway. It begins at US 101 as a six-lane roadway and extends southward to Kifer Road, where it transitions into a four-lane roadway with a divided median. At Chromite Drive to the south, Bowers Avenue becomes a four-lane road with no median divider. Bowers Avenue continues south to its intersection with El Camino Real (SR 82) where it transitions to Kiely Boulevard. A full interchange is located at US 101. Bowers Avenue provides access to and from the project site via Great America Parkway and Mission College Boulevard.

Central Expressway is a six-lane east-west expressway. Central Expressway begins at its junction with De la Cruz Boulevard and extends westward into Palo Alto, where it transitions into Alma Street at San Antonio Road. Central Expressway provides access to and from the project site via Bowers Avenue and San Tomas Expressway.

Scott Boulevard is a divided four-lane roadway that runs north-south from Saratoga Avenue to Space Park Drive in Santa Clara and east-west from Space Park Drive to Oakmead Parkway in Sunnyvale. Scott Boulevard provides access to the project site via Bowers Avenue and San Tomas Expressway.

Mission College Boulevard to the west of Great America Parkway is a loop road around Mission College and the Mercado Shopping Center. The eastern portion of Mission College Boulevard is a four-lane east-west thoroughfare, running between Great America Parkway and Montague Expressway. This segment of Mission College Boulevard provides access to numerous industrial and office uses, as well as some hotels. The eastern segment of Mission College Boulevard borders the south side of the project site and provides direct access to the project via the north leg of the Marriott Hotel entrance and Mission College Boulevard intersection. At the site location, Mission College Boulevard has a fixed median divider.

Patrick Henry Drive is a two-lane roadway with striped center median that runs between Great America Parkway and Old Mountain View-Alviso Road. Patrick Henry borders the northern side of the project site and provides direct access to the project via the east leg of its intersection with Great America Parkway.



Source: Hexagon Transportation Consultants, Inc. Feb. 14, 2013

ROADWAY NETWORK AND STUDY INTERSECTIONS FIGURE 3.2-1

3.2.1.3 *Existing Bicycle and Pedestrian Facilities*

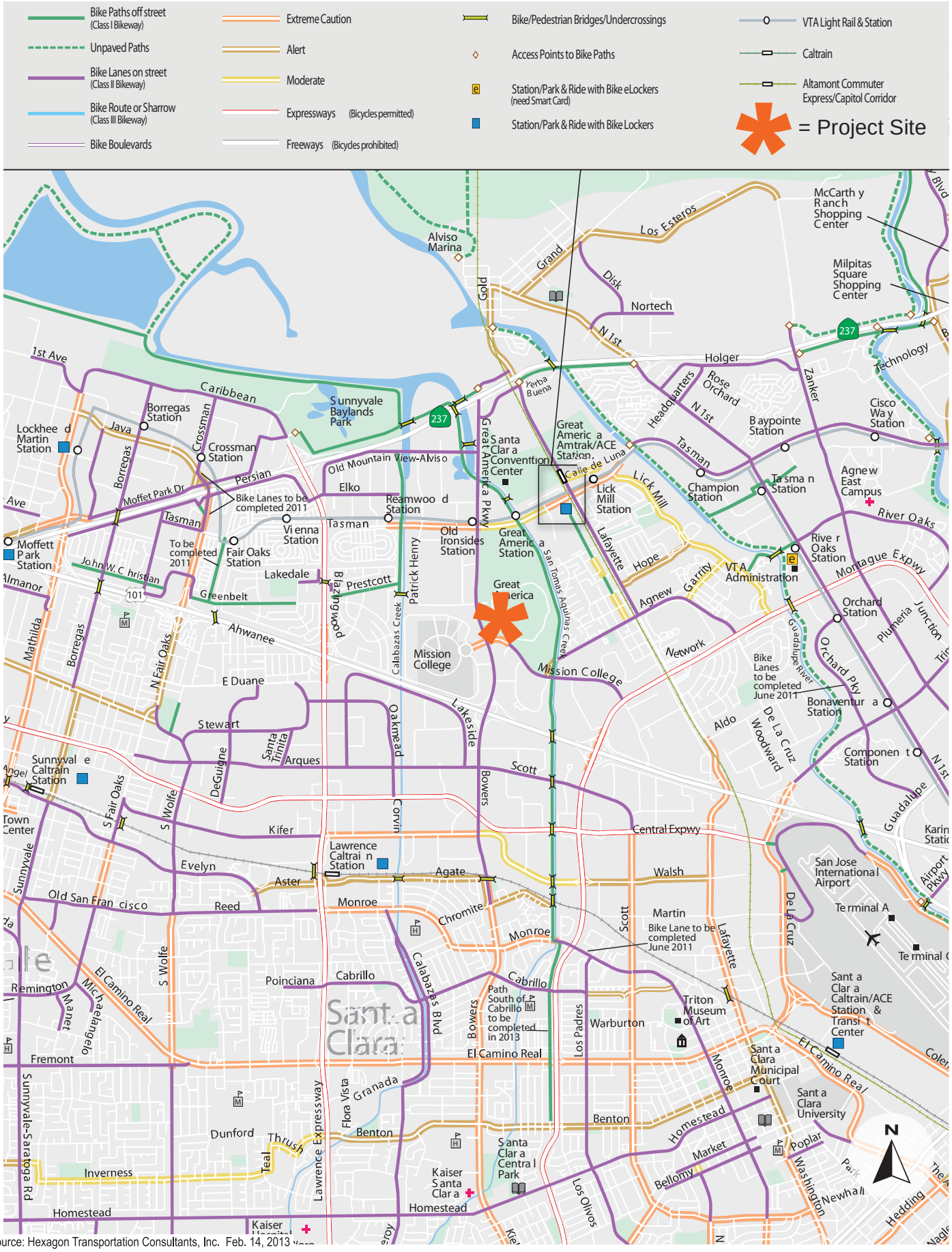
There are several bike lanes and bike paths in the vicinity of the project site. The San Tomas Aquino Creek trail runs from Benton Street to Sunnyvale Baylands Park with access to the bike path located at Mission College Boulevard and Agnew Road, east of the project site. Bike lanes in the vicinity of the site are listed below and shown on Figure 3.2-2:

- Bowers Avenue, from Chromite Drive extending onto Great America Parkway ;
- Great America Parkway, from US 101 to SR 237;
- Mission College Boulevard, from Montague Expressway to east of Great America Parkway;
- Agnew Road, from Mission College Boulevard onto Lick Mill Road to Montague Expressway;
- Scott Boulevard, from Central Expressway onto Arques Avenue to North Fair Oaks Avenue in Sunnyvale;
- Lakeside Drive; and
- Oakmead Parkway, from Central Expressway to Lawrence Expressway.

Bicycles are also permitted on San Tomas/Montague Expressway and Central Expressway.

Due to the project's proximate location to the freeway interchange with the County expressway, pedestrian facilities in the project area are limited. Mission College Boulevard has a continuous sidewalk on the south side of the street between Montague Expressway and Great America Parkway. The north side of Mission College Boulevard has continuous sidewalks from Montague Expressway to Agnew Road, east of the site, and intermittent sidewalks westward to Great America Parkway. Patrick Henry Drive has sidewalks on its north side only. Pedestrian crosswalks and signal heads with pushbutton actuators are present at all signalized intersections, including the Marriott Hotel Entrance and Mission College Boulevard and Patrick Henry Drive and Great America Parkway intersections. Some retail is present on the west side of the Mission College Boulevard and Great America Parkway intersection. Sidewalks, crosswalks, and pedestrian pushbuttons and signal heads are present to connect these retail properties to the project site for pedestrians.

Beyond the immediate project area, sidewalks are present on both sides of Great America Parkway north to Tasman Drive and on the south side of Tasman Drive west to the Old Ironsides Light Rail Station. Sidewalks continue on both sides of Great America Parkway south across the US 101 interchange through the Bowers Avenue and Central Expressway intersection. Sidewalks are present on both sides of Montague Expressway/San Tomas Expressway to the south of Mission College Boulevard, across the US 101 interchange to Scott Boulevard.



Source: Hexagon Transportation Consultants, Inc. Feb. 14, 2013

EXISTING BICYCLE FACILITIES

FIGURE 3.2-2

3.2.1.4 *Existing Transit Service*

Existing local transit service to the study area is provided by VTA bus service. Regional transit to the project area is provided by Caltrain and ACE, which have shuttle bus routes along Mission College Boulevard. Bus stops are located along Great America Parkway, at Patrick Henry Drive and Mission College Boulevard, and along Mission College Boulevard, at Freedom Circle, Agnew Road, and east of Great America Parkway to connect with both local and regional transit services. Additionally, the Old Ironsides Light Rail Station is located approximately two-thirds of a mile north of the project site, along Tasman Drive, serving the Mountain View-Winchester line. The transit service is described below and shown on Figure 3.2-3.

Local Route 57 operates on Great America Parkway in the study area. This route runs between West Valley College in Saratoga and Old Ironsides Drive at Tasman Drive (Great America) in Santa Clara. Route 57 runs between 5:45 AM and 11:00 PM with 30-minute headways during the AM and PM peak hours.

Local Route 60 operates on Great America Parkway and Mission College Boulevard in the study area. This route runs between the Winchester Transit Center in Campbell and Old Ironsides Drive at Tasman Drive (Great America) in Santa Clara. Route 60 runs between 5:30 AM and 11:00 PM with 15- to 30-minute headways during the AM and PM peak hours.

Express Bus Route 121 is an express bus (limited stops) with a scheduled stop at Old Ironsides Drive at Tasman Drive in the vicinity of the project. This route runs between the Gilroy Transit Center and the Lockheed Martin Transit Center in Mountain View. Express Route 121 provides service on weekdays only and runs in the northbound direction in the morning (between 4:30 and 8:45 AM) and in the southbound direction in the evening (between 3:00 and 7:30 PM) with 30- to 60-minute headways.

Express Bus Route 140 is an express bus (limited stops) with scheduled stops at Old Ironsides Drive at Tasman Drive and Mission College Boulevard and Montague Expressway in the vicinity of the project. It runs between the Fremont BART Station and Mission College/Montague Expressway. Express route 140 provides service on weekdays only with three runs in the southbound direction in the morning (between 7:12 and 9:39 AM) and three runs in the northbound direction in the evening (between 4:22 and 7:06 PM) with approximately 60-minute headways.

Limited Stop Route 321 operates on Great America Parkway, with a scheduled stop at Patrick Henry Drive and Tasman Drive, on its route between the Lockheed Martin Transit Center in Mountain View and the Great Mall Transit Center in Milpitas. It operates on weekdays only with one westbound run in the morning (between 8:10 and 8:44 AM) and one eastbound run in the evening (between 5:50 and 6:32 PM).

Limited Stop Route 330 operates on Great America Parkway and Mission College Boulevard, with scheduled stops at Old Ironsides Drive at Tasman Drive and Mission College Boulevard at Burton Drive in the vicinity of the project site, on its route between Almaden Expressway/Camden Avenue in San Jose and Alder Drive at Tasman Drive in Milpitas. It provides service on weekdays only with four runs in the northbound direction in the morning (between 6:45 and 9:21 AM) and 4 runs in the

southbound direction in the evening (between 4:20 and 7:19 PM) with approximately 30- to 60-minute headways.

ACE Yellow Shuttle (827) operates on Great America Parkway and Mission College Boulevard, with scheduled stops at Mission College Boulevard/Wyatt Drive and Great America Parkway/Mission College Boulevard, on its route between the Great America ACE Station and Scott Boulevard at San Tomas Expressway. It provides service on weekdays only with four runs in the southbound direction in the morning (between 6:16 and 9:47 AM) and four runs in the northbound direction in the evening (between 3:13 and 6:39 PM). The ACE Yellow Shuttle is a free service sponsored by the Bay Area Air Quality Management District.

Additionally, the Mission Area Caltrain Shuttle operates along Mission College Boulevard and has a nearby stop at Mission College Boulevard and Great America Parkway, adjacent to the project site. The Caltrain Shuttle also stops at the Intel facilities along Juliette Lane just south of the project site. The transit lines that operate within the study area are listed in Table 3.2-1.

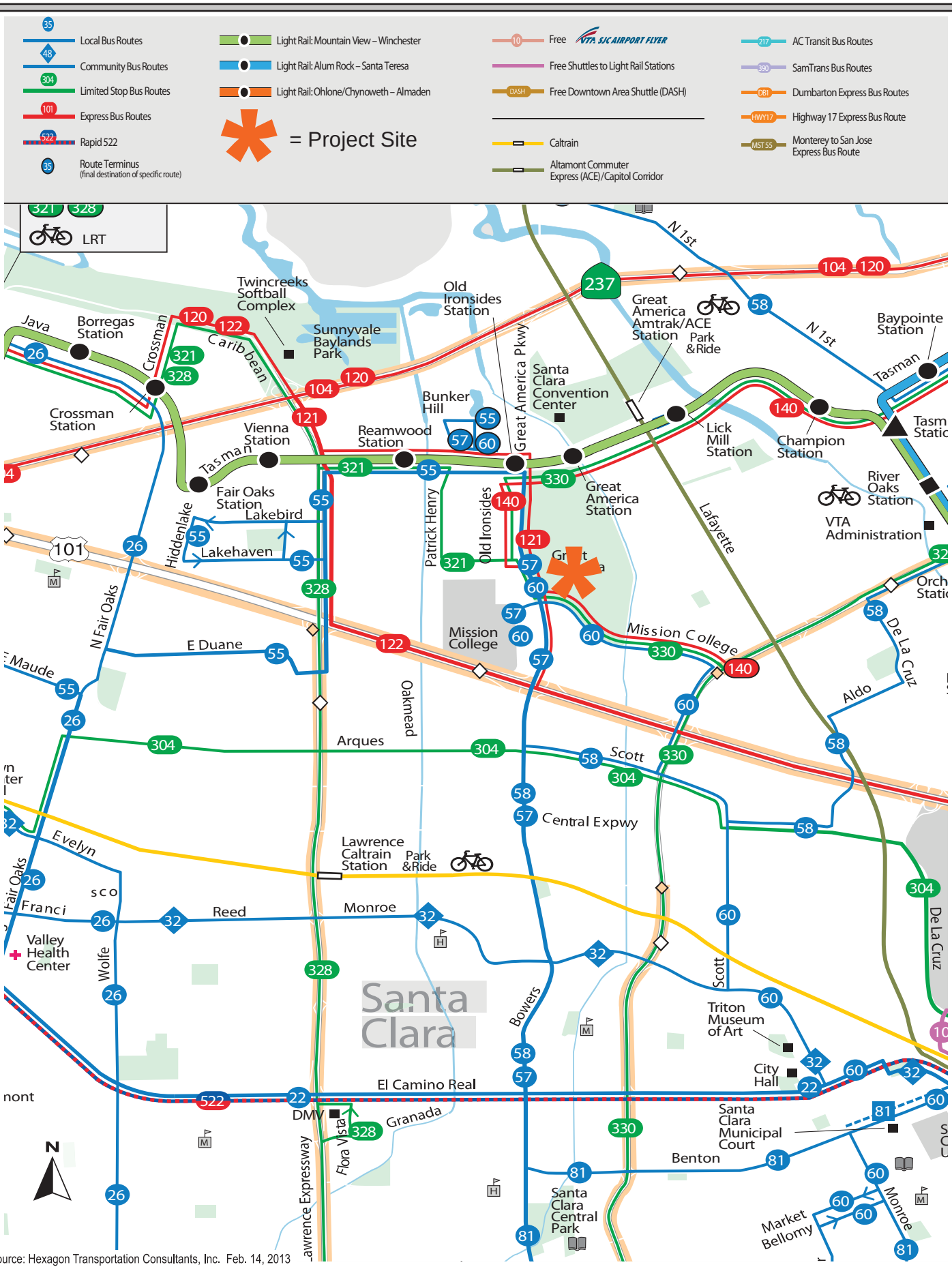
Table 3.2-1
Transit Service in the Study Area

Route	Route Description	Peak Hour Headways (minutes)
Local Route 57	West Valley College to Old Ironsides Drive/ Tasman Drive	30
Local Route 60	Winchester Transit Center to Old Ironsides Drive/Tasman Drive	15-30
Express Route 121[1]	Gilroy Transit Center to Lockheed Martin Transit Center	30-60
Express Route 140[1]	Fremont BART to Mission College Boulevard/Montague Expressway	60
Limited Stop Route 321[1]	Lockheed Martin Transit Center to Great Mall	--
Limited Stop Route 330[1]	Almaden Expressway/Camden Avenue to Alder Drive/Tasman Drive	30-60
ACE Yellow 827 Shuttle[1]	ACE Great America Station to Scott Boulevard /Walsh Avenue	60
Caltrain Shuttle[1]	Juliette Lane to Lawrence Caltrain Station	30

Notes: [1]Limited hours of operation.

3.2.1.5 *Level of Service Standards and Analysis Methodologies*

Traffic conditions at the study intersections were evaluated using level of service (LOS). *Level of Service* is a qualitative description of operating conditions ranging from LOS A, or free-flow conditions with little to no delay, to LOS F, or jammed conditions with excessive delays. Existing traffic conditions at the study intersections were evaluated using the LOS standards of the Cities of Santa Clara, San Jose, and Sunnyvale and the Santa Clara County Congestion Management Program (CMP), which is administered by VTA.



EXISTING TRANSIT FACILITIES

FIGURE 3.2-3

City of Santa Clara Signalized Intersections

Signalized study intersections that are not part of the CMP roadway network are subject to the local municipalities' LOS standards. The Cities of Santa Clara, San Jose, and Sunnyvale LOS methodology is TRAFFIX, which evaluates signalized intersection operations on the basis of average delay time for all vehicles at the intersection. Since TRAFFIX is also the CMP-designated intersection LOS methodology, each of the Cities' methodologies employs the CMP default values for the analysis parameters.

Each of the Cities' LOS standard for signalized intersections is LOS D or better. The correlation between average delay and LOS is shown in Table 3.2-2, on the following page.

CMP Intersections

Since TRAFFIX is the designated LOS methodology for both the CMP and the local municipalities, the CMP study intersections are not analyzed separately, but rather are among the local municipalities' signalized intersections analyzed using TRAFFIX. The only difference between the local municipalities' and CMP analyses is that the project impacts are determined on the basis of a different LOS standard – the CMP LOS standard for signalized intersections is LOS E or better, where the local municipalities' LOS standard for signalized intersections is LOS D or better.

Table 3.2-2
Signalized Intersection Level of Service Definitions

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Operations with very low delay occurring with favorable progression and/or short cycle lengths.	Up to 10.0
B	Operations with low delay occurring with good progression and/or short cycle lengths.	10.1 to 20.0
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	20.1 to 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 to 55.0
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences. This is considered to be the limit of acceptable delay.	55.1 to 80.0
F	Operation with delays unacceptable to most drivers occurring due to oversaturation, poor progression, or very long cycle lengths.	Greater than 80.0

Source: Transportation Research Board, 2*000 Highway Capacity Manual*, (Washington D.C. 2000)

Freeway Segments

As prescribed in the CMP technical guidelines, the LOS for freeway segments is estimated based on vehicle density. The vehicle density on a segment is correlated to LOS standards as shown in Table 3.2-3. The CMP defines an acceptable LOS for freeway segments as LOS E or better.

Table 3.2-3
Freeway Level of Service Definitions Based on Density

Level of Service	Description	Density (Vehicles/ Mile/Lane)
A	Average operating speeds at the free-flow speed generally prevail. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream.	0-11
B	Speeds at the free-flow speed are generally maintained. The ability to maneuver within the traffic stream is only slightly restricted, and the general level of physical and psychological comfort to drivers is still high.	>11-18
C	Speeds at or near the free-flow speed of the freeway prevail. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more vigilance on the part of the driver.	>18-26
D	Speeds begin to decline slightly with increased flows at this level. Freedom to maneuver within the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort levels.	>26-46
E	At this level, the freeway operates at or near capacity. Operations in this level are volatile, because there are virtually no usable gaps in the traffic stream, leaving little room to maneuver within the traffic stream.	>46-58
F	Vehicular flow breakdowns occur. Large queues form behind breakdown points.	>58

Source: Santa Clara County 2004 CMP (Based on the *Highway Capacity Manual* (2000, Washington, D.C.)

3.2.1.5 *Existing Conditions*

Existing Intersection Levels of Service

Existing peak-hour traffic volumes were obtained from new intersection turn movement counts (September 2012), previously completed traffic studies, and the CMP database. The existing peak-hour intersection volumes, traffic count data and peak hour intersection turning movement volumes for all intersections and study scenarios are included in Appendix A of this EIR.

The results of the LOS analysis under existing conditions are summarized in Table 3.2-4. The results show that, measured against the applicable level of service standards, all of the study intersections currently operate at an acceptable level of service under existing conditions.

Table 3.2-4
Existing and Background Intersection Levels of Service Summary

Intersection		Peak Hour	Existing		Background	
			Avg. Delay	LOS	Avg. Delay	LOS
1	Patrick Henry Drive and Tasman Drive	AM	17.5	B	23.0	C
		PM	15.6	B	29.3	C
2	Old Ironsides Drive and Tasman Drive	AM	10.8	B	20.3	C
		PM	11.5	B	26.1	C
3	Great America Parkway and Tasman Drive*	AM	28.2	C	30.0	C
		PM	28.6	C	36.5	D
4	Convention Circle and Tasman Drive	AM	9.4	A	9.6	A
		PM	9.9	A	10.0	A
5	Centennial Boulevard and Tasman Drive	AM	10.2	B	10.2	B
		PM	10.6	B	10.3	B
6	Calle del Sol and Tasman Drive	AM	16.3	B	16.9	B
		PM	13.5	B	14.7	B
7	Lick Mill Boulevard and Tasman Drive	AM	32.9	C	31.8	C
		PM	29.1	C	29.9	C
8	Great America Parkway and Mission College Boulevard*	AM	38.8	D	44.3	D
		PM	46.9	D	54.8	D
9	Marriott Hotel entrance and Mission College Boulevard	AM	12.0	B	13.8	B
		PM	10.2	B	12.1	B
10	Freedom Circle and Mission College Boulevard (West)	AM	10.8	B	10.6	B
		PM	18.7	B	19.0	B
11	Freedom Circle and Mission College Boulevard (East)	AM	16.5	B	16.0	B
		PM	19.3	B	19.0	B
12	Juliette Lane and Mission College Boulevard	AM	20.8	C	24.1	C
		PM	21.9	C	28.5	C
13	Burton Drive and Mission College Boulevard	AM	15.5	B	19.9	B
		PM	16.9	B	15.2	B
14	Great America Parkway and Yerba Buena Way	AM	13.7	B	21.6	C
		PM	18.2	B	31.6	C
15	Great America Parkway and Old Mountain View-Alviso Road	AM	9.7	A	12.1	B
		PM	14.2	B	19.8	B
16	Great America Parkway and Bunker Hill Lane	AM	12.6	B	11.7	B
		PM	14.5	B	13.3	B
17	Great America Parkway and Old Glory Lane	AM	12.8	B	16.2	B
		PM	11.7	B	22.3	C
18	Great America Parkway and Patrick Henry Drive	AM	19.6	B	25.1	C
		PM	24.9	C	26.2	C
19	Great America Parkway and Northbound US 101*	AM	14.6	B	22.1	C
		PM	9.1	A	16.4	B
20	Bowers Avenue and Southbound US 101*	AM	22.6	C	24.1	C
		PM	8.9	A	8.0	A
21	Bowers Avenue and Augustine Drive	AM	24.3	C	32.8	C
		PM	33.1	C	**73.0**	**E**
22	Bowers Avenue and Scott Boulevard*	AM	29.3	C	36.1	D
		PM	29.2	C	34.6	C
23	Bowers Avenue and Central Expressway*	AM	45.2	D	71.3	E
		PM	42.0	D	**97.0**	**F**

Table 3.2-4
Existing and Background Intersection Levels of Service Summary

Intersection		Peak Hour	Existing		Background	
			Avg. Delay	LOS	Avg. Delay	LOS
24	Bowers Avenue and Kifer Road/Walsh Avenue	AM	20.6	C	19.3	B
		PM	20.9	C	21.6	C
25	Corwin Drive and Central Expressway*	AM	21.1	C	28.2	C
		PM	22.5	C	30.2	C
26	Lick Mill Boulevard and Montague Expressway	AM	29.3	C	32.0	C
		PM	20.9	C	20.8	C
27	De La Cruz Boulevard and Montague Expressway*	AM	38.3	D	48.9	D
		PM	38.7	D	40.2	D
28	Montague Expressway and Mission College Boulevard*	AM	72.2	E	**111.2**	**F**
		PM	41.3	D	62.5	E
29	San Tomas Expressway and Scott Boulevard*	AM	31.0	C	41.4	D
		PM	43.9	D	77.8	E
30	San Tomas Expressway and Walsh Avenue	AM	23.5	C	44.1	D
		PM	30.8	C	68.3	E
31	Lafayette Street and Agnew Road	AM	34.5	C	33.0	C
		PM	38.2	D	39.0	D
32	Lafayette Street and Montague Expressway (North)	AM	29.9	C	32.4	C
		PM	26.1	C	27.5	C
33	Lafayette Street and Montague Expressway (South)	AM	14.7	B	13.6	B
		PM	11.5	B	11.6	B
34	Lafayette Street and Central Expressway*	AM	55.8	E	68.6	E
		PM	53.1	D	62.5	E
35	Lafayette Street and Walsh Avenue	AM	12.8	B	13.4	B
		PM	18.8	B	23.8	C
36	N. First Street and Montague Expressway*	AM	49.9	D	**121.1**	**F**
		PM	58.4	E	**132.1**	**F**
37	Great America Parkway (North) and SR 237*	AM	16.7	B	23.7	C
		PM	17.4	B	22.8	C
38	Great America Parkway (South) and SR 237*	AM	12.0	B	16.6	B
		PM	9.2	A	13.0	B
39	Reamwood Avenue and Tasman Drive	AM	6.2	A	7.8	A
		PM	9.9	A	38.1	D
40	Birchwood Avenue and Tasman Drive	AM	17.1	B	33.1	C
		PM	17.2	B	30.7	C
41	Lawrence Expressway and Tasman Drive*	AM	34.9	C	45.8	D
		PM	51.2	D	59.3	E
42	Lawrence Expressway and Lakehaven Drive/Sandia Avenue	AM	35.0	D	34.2	C
		PM	42.9	D	44.6	D
43	Lawrence Expressway and Scott Boulevard/Arques Avenue*	AM	25.9	C	29.0	C
		PM	56.1	E	**88.1**	**F**
44	Lawrence Expressway and Kifer Road	AM	28.0	C	27.4	C
		PM	58.9	E	**80.1**	**F**

*Denotes CMP intersection.
Bold indicates a substandard level of service.

Existing Freeway Levels of Service

Traffic volumes for the subject freeway segments were obtained from the *2011 CMP Annual Monitoring Report*. The results of the analysis are summarized in Table 3.2-5. The results show that the mixed-flow lanes on 24 of the 34 directional freeway segments analyzed currently operate at an unacceptable LOS F during at least one of the peak hours. The results also show that seven of the directional HOV lane segments analyzed currently operate at an unacceptable LOS F during at least one of the peak hours.

Table 3.2-5
Existing Freeway Segment Levels of Service

Freeway Segment		Peak Hour	Mixed-Flow Lanes		HOV Lanes	
			Density	LOS	Density	LOS
US 101 NB	I-880 to Old Bayshore Highway	AM	**121**	**F**	**92**	**F**
		PM	14	B	8	A
	Old Bayshore Highway to N. First Street	AM	**109**	**F**	**93**	**F**
		PM	18	B	12	B
	N. First Street to Guadalupe Parkway	AM	**83**	**F**	**81**	**F**
		PM	17	B	17	B
	Guadalupe Parkway to De La Cruz Boulevard	AM	**107**	**F**	**92**	**F**
		PM	24	C	15	B
	De La Cruz Boulevard to Montague Expressway	AM	54	E	44	D
		PM	32	D	13	B
	Montague Expressway to Great America Parkway	AM	52	E	29	D
		PM	30	D	13	B
	Great America Parkway to Lawrence Expressway	AM	**61**	**F**	30	D
		PM	33	D	11	A
	Lawrence Expressway to N. Fair Oaks Avenue	AM	**61**	**F**	32	D
		PM	28	D	13	B
	N. Fair Oaks Avenue to N. Mathilda Avenue	AM	**74**	**F**	30	D
		PM	26	C	10	A
	N. Mathilda Avenue to SR 237	AM	**71**	**F**	40	D
		PM	34	D	22	C
SR 237 EB	US 101 to N. Mathilda Avenue	AM	**74**	**F**	--	--
		PM	32	D	--	--
	N. Mathilda Avenue to N. Fair Oaks Avenue	AM	58	E	27	D
		PM	47	E	18	B
	N. Fair Oaks Avenue to Lawrence Expressway	AM	37	D	17	B
		PM	**87**	**F**	23	C
	Lawrence Expressway to Great America Parkway	AM	47	E	16	B
		PM	**100**	**F**	28	D
	Great America Parkway to N. First Street	AM	37	D	20	C
		PM	**87**	**F**	28	D
	N. First Street to Zanker Road	AM	42	D	15	B
		PM	**62**	**F**	27	D
	Zanker Road to McCarthy Boulevard	AM	29	D	7	A
		PM	47	E	23	C

Table 3.2-5
Existing Freeway Segment Levels of Service

Freeway Segment		Peak Hour	Mixed-Flow Lanes		HOV Lanes	
			Density	LOS	Density	LOS
US 101 SB	SR 237 to N. Mathilda Avenue	AM	26	C	27	D
		PM	25	C	30	D
	N. Mathilda Avenue to N. Fair Oaks Avenue	AM	27	D	20	C
		PM	32	D	14	B
	North Fair Oaks Avenue to Lawrence Expressway	AM	30	D	16	B
		PM	38	D	17	B
	Lawrence Expressway to Great America Parkway	AM	25	C	13	B
		PM	**106**	**F**	**64**	**F**
	Great America Parkway to Montague Expressway	AM	22	C	8	A
		PM	**100**	**F**	**64**	**F**
	Montague Expressway to De La Cruz Boulevard	AM	26	C	11	A
		PM	**96**	**F**	40	D
	De La Cruz Boulevard to Guadalupe Parkway	AM	23	C	7	A
		PM	50	E	31	D
	Guadalupe Parkway to N. First Street	AM	15	B	4	A
		PM	**69**	**F**	18	B
	N. First Street to Old Bayshore Highway	AM	21	C	8	A
		PM	**112**	**F**	36	D
	Old Bayshore Highway to I-880	AM	14	B	8	A
		PM	**123**	**F**	36	D
SR 237 WB	McCarthy Boulevard to Zanker Road	AM	**93**	**F**	**73**	**F**
		PM	45	D	13	B
	Zanker Road to N. First Street	AM	58	E	40	D
		PM	**61**	**F**	14	B
	N. First Street to Great America Parkway	AM	37	D	33	D
		PM	**82**	**F**	16	B
	Great America Parkway to Lawrence Expressway	AM	32	D	33	D
		PM	55	E	12	B
	Lawrence Expressway to N. Fair Oaks Avenue	AM	58	E	50	E
		PM	**75**	**F**	28	D
	N. Fair Oaks Avenue to N. Mathilda Avenue	AM	**86**	**F**	--	--
		PM	**100**	**F**	--	--
	N. Mathilda Avenue to US 101	AM	57	E	--	--
		PM	42	D	--	--

Source: Santa Clara Valley Transportation Authority Congestion Management Program Monitoring Study, 2011.
Notes: **Bold** indicates a substandard level of service.

3.2.1.6 *Background Conditions*

Background conditions are defined as conditions just prior to completion of the proposed project. Traffic volumes for background conditions comprise volumes from the existing traffic counts plus traffic generated by other approved developments in the vicinity of the site. This traffic scenario represents a more congested traffic condition than the existing conditions scenario, because it

includes traffic from approved projects. The background conditions analysis is consistent with City of Santa Clara policy for transportation analyses though it is not required under CEQA.

Background Roadway Network

Under background conditions, the transportation network is assumed to be the same as the existing transportation network, with the exception of the following improvements. These improvements were identified as mitigation measures to be completed by the City's Capital Improvement Program (CIP) or other approved development projects in the study area.

1. Great America Parkway and Mission College Boulevard – Addition of a third westbound left-turn lane, fourth southbound through lane, third northbound left-turn lane, and separate westbound right-turn lane. (CIP)
2. Old Ironsides Drive and Tasman Drive – Addition of a second northbound left-turn lane (Yahoo!)
3. Great America Parkway and Old Glory Lane – Addition of a second northbound left-turn lane (Yahoo!)
4. Great America Parkway and Patrick Henry Drive – Addition of a second northbound left-turn lane and eastbound free-right-turn lane. The eastbound right-turn lane includes the addition of a fourth southbound lane on Great America Parkway between Patrick Henry Drive and Mission College Boulevard. (Yahoo!)
5. Bowers Avenue and Augustine Drive – Addition of a second southbound left-turn lane, third eastbound left-turn lane, and second westbound right-turn lane (3333 Scott and EOP Office)

Background Traffic Volumes

Background peak-hour traffic volumes were estimated by adding to existing volumes the estimated traffic from approved, but not yet constructed, developments. The added traffic from approved but not yet constructed developments was provided by the City of Santa Clara's TRAFFIX network, which was updated with the current list of approved projects provided by City staff. Traffic generated by Phase 1 of the North San Jose Development Policy and approved projects within the City of Sunnyvale also were included in the background traffic volumes.

In addition, all existing buildings on the project site (a total of 418,000 s.f. office space) were vacant at the time traffic counts were collected at non-CMP intersections. Thus, traffic trips associated with the existing 418,000 s.f. of unoccupied office space at full occupancy were added to the background traffic volumes since those are trips already entitled to the site. These trips were estimated by applying the *Institute of Transportation Engineers'* (ITE) trip generation rate for general office space to the size of the vacant buildings.[7]

It should be noted that for CMP intersections, the available count data (obtained from the CMP) is from the year 2010. In 2010, two of the existing buildings on site (total of 300,000 s.f.) were still occupied. Therefore, at CMP intersections, trip credit was given only for the vacant office space at

[7] One of the buildings on-site has since been partially occupied.

the time the counts were conducted (118,000 s.f.). The list of approved but not yet constructed projects is included in Appendix A.

Background Intersection Levels of Service

The results of the intersection LOS analysis under existing and background conditions are summarized in Table 3.2-4. Measured against the applicable LOS standards, the results show that under background conditions, during at least one peak hour, the following six intersections would operate at unacceptable levels of service:

- No. 21 – Bowers Avenue and Augustine Drive (PM Peak Hour);
- No. 23 – Bowers Avenue and Central Expressway (PM Peak Hour);
- No. 28 – Mission College Boulevard and Montague Expressway (AM Peak Hour);
- No. 36 – North First Street and Montague Expressway (AM and PM Peak Hours);
- No. 43 – Lawrence Expressway and Scott Boulevard/Arques Avenue (PM Peak Hour); and
- No. 44 – Lawrence Expressway and Kifer Road (PM Peak Hour).

All the other study signalized intersections would operate at an acceptable level of service.

3.2.2 Transportation Impacts

3.2.2.1 *Thresholds of Significance*

For the purposes of this EIR, a near-term transportation impact is considered significant if the project would:

- Cause the level of service at any local signalized intersection to degrade from an acceptable LOS D or better under background conditions to an unacceptable LOS E or F under project conditions;
- Increase the average critical delay by four (4) seconds or more and the volume-to-capacity ratio (V/C) by 0.01 at any local intersections currently operating at LOS E or LOS F and at CMP intersections currently operating at LOS F under background conditions;
- Cause the level of service at a CMP signalized intersection to degrade from an acceptable LOS E or better under existing or background conditions to an unacceptable LOS F under baseline plus project or background plus project conditions;
- Increase the critical V/C value by 0.01 or more when the addition of project traffic reduces the amount of average delay for critical movements at non-CMP intersections currently operating at LOS E or LOS F and at CMP intersections currently operating at LOS F under existing or background conditions;
- Cause the LOS on a freeway segment to degrade from an acceptable LOS E or better under existing or background conditions to an unacceptable LOS F under project conditions;
- Contribute one percent of capacity on a freeway segment operating at an unacceptable LOS F under project conditions;
- Substantially impede the operation of a transit system as a result of congestion; or
- Create an operational safety hazard.

3.2.2.2 *Baseline Plus Project Conditions*

CEQA requires that project conditions be evaluated versus a "baseline" condition representing the environmental setting without the project, typically the existing condition. However, acknowledging that environmental conditions can vary over time, CEQA allows a lead agency the discretion to establish a baseline condition other than existing conditions, based on substantial evidence. This baseline condition can provide a more realistic condition against which the project's impacts will be measured than may be presented by existing conditions at the time the project is proposed. In the case of the subject project site, a baseline reflecting full occupancy of the three vacant buildings is appropriate given their history of full occupancy at various points in time over the past several decades and their suitability for continued use.

Traffic Estimates

The magnitude of traffic produced by a new development and the locations where that traffic would appear are estimated using a three-step process: (1) trip generation, (2) trip distribution, and (3) trip assignment. In determining project trip generation, the magnitude of traffic entering and exiting the site is estimated for the AM and PM peak hours. As part of the project trip distribution step, an estimate is made of the directions to and from which the project trips would travel. In the project trip assignment step, the project trips are assigned to specific streets and intersections in the study area.

Trip Generation

The traffic generated by the proposed project was estimated by applying the appropriate standard trip rates to the size of development. For most common land uses there are standard trip generation rates that can be applied to predict the future traffic increases that would result from a proposed development. Project trip estimates were based on trip generation rates obtained from ITE's *Trip Generation, Eighth Edition* (2008).

The City will require that the proposed project implement Transportation Demand Management (TDM) measures that would result in a reduction in vehicle trips by a minimum of five percent on the entire site (refer to Appendix A). Therefore, the project trip estimates include a five percent trip reduction for TDM. It is estimated that the proposed 600,000 s.f. of additional office space would generate an additional 6,046 daily trips, with 851 trips (749 inbound and 102 outbound) occurring during the AM peak hour and 818 trips (139 inbound and 679 outbound) occurring during the PM peak hour. The traffic that would be generated by the existing office space[8] on site (418,000 s.f.) was estimated in a similar manner and included within baseline conditions for this analysis. The trip generation estimates associated with the proposed project are presented in Table 3.2-6, below.

[8] As previously discussed, the three buildings on the site were vacant at the time non-CMP intersection counts were made. One of the on-site buildings is now partially occupied.

Table 3.2-6
Baseline Plus Project Trip Generation

Land Use	Size (s.f.)	Daily Trips	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
Existing Office	418,000	4,602	570	78	648	106	517	623
Proposed Office	1,018,000	11,208	1,389	189	1,578	258	1,259	1,517
Net Increase	600,000	6,606	818	112	930	152	742	894
5% TDM Red. Proposed		-330	-41	-6	-47	-8	-37	-45
5% TDM Red. Existing		-230	-29	-4	-32	-5	-26	-31
Net Project Trips		6,046	749	102	851	139	679	818

Notes: A TDM reduction was applied to the trip generation estimates per City requirement that the project achieve a minimum of 5% reduction in trips through implementation of a TDM program on the entire site.
Source: ITE *Trip Generation, Eighth Edition*, 2008. Land Use (710), General Office Building, average rate.

Trip Distribution and Trip Assignment

The trip distribution pattern for the proposed office development was estimated based on traffic patterns on the surrounding roadway system and on the locations of complementary land uses. The peak-hour trips associated with the proposed project were added to the transportation network in accordance with the distribution pattern.

Baseline Plus Project Traffic Volumes

The occupancy of the existing buildings on site has varied between 2010 and 2012, during which time the existing intersection traffic counts were collected. Therefore, to establish baseline conditions, the existing peak hour traffic volumes at each individual study intersections were adjusted to account for traffic associated with the existing 418,000 s.f. of office space on the project site since those are trips already entitled to the site and the existing office space could be occupied at any time.

All existing buildings on site (a total of 418,000 s.f. office space) were vacant at the time traffic counts were collected at non-CMP intersections. Thus, traffic associated with the existing 418,000 s.f. of unoccupied office space on the project site were added to the existing traffic volumes. It should be noted that for CMP intersections, the available count data (obtained from the CMP) is from the year 2010. In 2010, two of the existing buildings on site (total of 300,000 s.f.) were still occupied. Therefore, at CMP intersections, trip credit was given only for the vacant office space at the time the counts were conducted (118,000 s.f.).

Project trips associated with the proposed project (600,000 s.f. of office), as represented in the above project trip assignment, were added to the baseline traffic volumes to obtain baseline plus project traffic volumes.

Baseline Plus Project Intersection Level of Service

The results of the intersection LOS analysis under baseline plus project conditions are summarized in Table 3.2-7. The level of service results under baseline plus project conditions show that all of the signalized study intersections would continue to operate at acceptable levels of service.

Table 3.2-7
Baseline Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Baseline		Baseline Plus Project	
			Avg. Delay	LOS	Avg. Delay	LOS
1	Patrick Henry Drive and Tasman Drive	AM	17.5	B	17.5	B
		PM	15.7	B	15.8	B
2	Old Ironsides Drive and Tasman Drive	AM	10.7	B	10.7	B
		PM	11.5	B	11.5	B
3	Great America Parkway and Tasman Drive*	AM	28.1	C	28.1	C
		PM	28.6	C	28.8	C
4	Convention Circle and Tasman Drive	AM	9.3	A	9.3	A
		PM	9.9	A	9.9	A
5	Centennial Boulevard and Tasman Drive	AM	10.2	B	10.1	B
		PM	10.6	B	10.6	B
6	Calle del Sol and Tasman Drive	AM	16.1	B	15.9	B
		PM	13.4	B	13.3	B
7	Lick Mill Boulevard and Tasman Drive	AM	32.8	C	32.7	C
		PM	29.1	C	29.1	C
8	Great America Parkway and Mission College Boulevard*	AM	38.9	D	38.1	D
		PM	47.6	D	59.2	E
9	Marriott Hotel entrance and Mission College Boulevard	AM	14.9	B	18.5	B
		PM	13.3	B	18.5	B
10	Freedom Circle and Mission College Boulevard (West)	AM	10.6	B	10.6	B
		PM	18.6	B	18.7	B
11	Freedom Circle and Mission College Boulevard (East)	AM	16.4	B	16.5	B
		PM	19.0	B	18.7	B
12	Juliette Lane and Mission College Boulevard	AM	20.5	C	18.5	B
		PM	21.9	C	21.9	C
13	Burton Drive and Mission College Boulevard	AM	15.7	B	16.0	B
		PM	16.5	B	16.0	B
14	Great America Parkway and Yerba Buena Way	AM	13.6	B	13.5	B
		PM	17.8	B	17.4	B
15	Great America Parkway and Old Mountain View-Alviso Road	AM	9.6	A	9.5	A
		PM	14.7	B	15.7	B
16	Great America Parkway and Bunker Hill Lane	AM	13.3	B	12.9	B
		PM	14.6	B	15.1	B
17	Great America Parkway and Old Glory Lane	AM	12.5	B	12.2	B
		PM	12.0	B	12.2	B
18	Great America Parkway and Patrick Henry Drive	AM	21.3	B	25.3	C
		PM	25.1	C	25.4	C
19	Great America Parkway and Northbound US 101*	AM	14.5	B	14.0	B
		PM	9.1	A	8.8	A
20	Bowers Avenue and Southbound US 101*	AM	22.7	C	23.5	C
		PM	9.0	A	9.2	A
21	Bowers Avenue and Augustine Drive	AM	24.1	C	23.5	C
		PM	33.1	C	33.0	C
22	Bowers Avenue and Scott Boulevard*	AM	29.3	C	29.6	C
		PM	29.1	C	28.8	C
23	Bowers Avenue and Central Expressway*	AM	45.6	D	47.2	D
		PM	42.2	D	43.8	D

Table 3.2-7
Baseline Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Baseline		Baseline Plus Project	
			Avg. Delay	LOS	Avg. Delay	LOS
24	Bowers Avenue and Kifer Road/Walsh Avenue	AM	20.6	C	20.7	C
		PM	20.9	C	20.7	C
25	Corwin Drive and Central Expressway*	AM	21.1	C	21.1	C
		PM	22.6	C	22.7	C
26	Lick Mill Boulevard and Montague Expressway	AM	29.2	C	29.1	C
		PM	20.9	C	20.8	C
27	De La Cruz Boulevard and Montague Expressway*	AM	38.3	D	38.6	D
		PM	38.7	D	38.9	D
28	Montague Expressway and Mission College Boulevard*	AM	73.0	E	76.5	E
		PM	41.7	D	41.3	D
29	San Tomas Expressway and Scott Boulevard*	AM	31.0	C	30.9	C
		PM	43.9	D	44.0	D
30	San Tomas Expressway and Walsh Avenue	AM	23.5	C	23.4	C
		PM	30.8	C	30.8	C
31	Lafayette Street and Agnew Road	AM	34.5	C	34.7	C
		PM	38.2	D	38.5	D
32	Lafayette Street and Montague Expressway (North)	AM	29.7	C	29.4	C
		PM	26.1	C	26.1	C
33	Lafayette Street and Montague Expressway (South)	AM	14.4	B	13.9	B
		PM	11.8	B	12.1	B
34	Lafayette Street and Central Expressway*	AM	55.9	E	56.6	E
		PM	53.1	D	53.7	D
35	Lafayette Street and Walsh Avenue	AM	12.8	B	12.8	B
		PM	18.8	B	18.9	B
36	N. First Street and Montague Expressway*	AM	50.1	D	50.3	D
		PM	58.5	E	58.7	E
37	Great America Parkway (North) and SR 237*	AM	16.7	B	16.8	B
		PM	17.4	B	17.7	B
38	Great America Parkway (South) and SR 237*	AM	11.5	B	11.1	B
		PM	9.1	A	8.6	A
39	Reamwood Avenue and Tasman Drive	AM	6.2	A	6.1	A
		PM	9.9	A	9.9	A
40	Birchwood Avenue and Tasman Drive	AM	17.1	B	17.1	B
		PM	17.2	B	17.1	B
41	Lawrence Expressway and Tasman Drive*	AM	35.0	C	35.0	D
		PM	51.2	D	51.4	D
42	Lawrence Expressway and Lakehaven Drive/Sandia Avenue	AM	35.1	D	35.1	D
		PM	42.9	D	43.0	D
43	Lawrence Expressway and Scott Boulevard/Arques Avenue*	AM	26.0	C	26.2	C
		PM	56.1	E	56.6	E
44	Lawrence Expressway and Kifer Road	AM	28.0	C	28.0	C
		PM	59.1	E	59.8	E

*Denotes CMP intersection.

Impact TRANS-1: Implementation of the proposed project would have a less than significant impact on study intersections during both of the peak hours under baseline plus project conditions. **(Less Than Significant Impact)**

3.2.2.3 *Background Plus Project Conditions*

Traffic Estimates

As stated in 3.2.2.2 of this Chapter, the magnitude of traffic produced by a new development and the locations where that traffic would appear are estimated using a three-step process: (1) trip generation, (2) trip distribution, and (3) trip assignment. In determining project trip generation, the magnitude of traffic entering and exiting the site is estimated for the AM and PM peak hours. As part of the project trip distribution step, an estimate is made of the directions to and from which the project trips would travel. In the project trip assignment step, the project trips are assigned to specific streets and intersections in the study area.

Trip Generation

As stated in 3.2.2.2 of this Chapter, the traffic generated by the proposed project was estimated by applying the appropriate standard trip rates to the size of development. For most common land uses there are standard trip generation rates that can be applied to predict the future traffic increases that would result from a proposed development. Project trip estimates were based on trip generation rates obtained from ITE's *Trip Generation, Eighth Edition* (2008). Project trip estimates were generated for an additional 600,000 s.f. of office space on the site. The traffic that would be generated by the unoccupied office space on site (418,000 s.f.) at full occupancy was estimated and included in the background conditions.

The City will require that the proposed project implement TDM measures that would result in a reduction in vehicle trips by a minimum of five percent on the entire site. Therefore, the project trip estimates include a five percent trip reduction for TDM. It is estimated that the proposed construction of 600,000 s.f. of office space would generate an additional 6,046 daily trips, with 851 trips (749 inbound and 102 outbound) occurring during the AM peak hour and 818 trips (139 inbound and 679 outbound) occurring during the PM peak hour. The project trip generation estimates are presented in Table 3.2-8, below.

Table 3.2-8
Background Plus Project Trip Generation

Land Use	Size (s.f.)	Daily Trips	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Existing Office	418,000	4,602	570	78	648	106	517	623
Proposed Office	1,018,000	11,208	1,389	189	1,578	258	1,259	1,517
Total Net Increase	600,000	6,606	818	112	930	152	742	894
5% TDM Red. Proposed		-330	-41	-6	-47	-8	-37	-45
5% TDM Red. Existing		-230	-29	-4	-32	-5	-26	-31
Net Project Trips		6,046	749	102	851	139	679	818

Notes: A TDM reduction was applied to the trip generation estimates per City requirement that the project achieve a minimum of 5% reduction in trips through implementation of a TDM program on the entire site.
Source: ITE *Trip Generation, Eighth Edition*, 2008. Land Use (710), General Office Building, average rate.

Trip Distribution and Trip Assignment

The trip distribution pattern for the proposed office development was estimated based on traffic patterns on the surrounding roadway system and on the locations of complementary land uses. The peak-hour trips associated with the proposed project were added to the transportation network in accordance with the distribution pattern.

Background Plus Project Roadway Network

It is assumed in this analysis that the transportation network under background plus project conditions would be the same as described under background conditions.

Background Plus Project Traffic Volumes

Project trips, as described in the above project trip assignment, were added to the background traffic volumes to obtain background plus project traffic volumes.

Background Plus Project Intersection Level of Service

The results of the intersection LOS analysis under background plus project conditions are summarized in Table 3.2-9. Under background plus project conditions, the results show that six of the study intersection would operate at unacceptable levels of service, according to the applicable level of service standards.

Table 3.2-9
Background Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Background		Background Plus Project			
			Average Delay	LOS	Average Delay	LOS	Critical Delay Incr.	Critical V/C Incr.
1	Patrick Henry Drive and Tasman Drive	AM	23.0	C	23.3	C	0.2	0.004
		PM	29.3	C	30.4	C	2.0	0.011
2	Old Ironsides Drive and Tasman Drive	AM	20.3	C	20.3	C	0.0	0.003
		PM	26.1	C	26.2	C	0.1	0.001
3	Great America Parkway and Tasman Drive*	AM	30.0	C	30.9	C	1.6	0.050
		PM	36.5	D	37.7	D	1.8	0.013
4	Convention Circle and Tasman Drive	AM	9.6	A	9.6	A	0.1	0.011
		PM	10.0	A	10.0	B	0.1	0.010
5	Centennial Boulevard and Tasman Drive	AM	10.2	B	10.2	B	0.0	0.010
		PM	10.3	B	10.3	B	0.1	0.009
6	Calle del Sol and Tasman Drive	AM	16.9	B	16.7	B	-0.1	0.011
		PM	14.7	B	14.6	B	0.0	0.012
7	Lick Mill Boulevard and Tasman Drive	AM	31.8	C	31.7	C	0.0	0.001
		PM	29.9	C	30.0	C	0.1	0.009
8	Great America Parkway and Mission College Boulevard*	AM	44.3	D	48.4	D	7.6	0.048
		PM	54.8	D	71.6	E	25.5	0.075

Table 3.2-9
Background Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Background		Background Plus Project			
			Average Delay	LOS	Average Delay	LOS	Critical Delay Incr.	Critical V/C Incr.
9	Marriott Hotel entrance and Mission College Boulevard	AM	13.8	B	18.6	B	7.7	0.146
		PM	12.1	B	18.5	B	9.0	0.230
10	Freedom Circle and Mission College Boulevard (West)	AM	10.6	B	10.9	B	0.6	0.049
		PM	19.0	B	19.6	B	1.2	0.045
11	Freedom Circle and Mission College Boulevard (East)	AM	16.0	B	17.8	B	4.6	0.129
		PM	19.0	B	19.1	B	0.7	0.025
12	Juliette Lane and Mission College Boulevard	AM	24.1	C	24.3	C	0.0	0.000
		PM	28.5	C	29.7	C	1.7	0.025
13	Burton Drive and Mission College Boulevard	AM	19.9	B	21.5	C	2.1	0.038
		PM	15.2	B	15.2	B	0.1	0.023
14	Great America Parkway and Yerba Buena Way	AM	21.6	C	21.8	C	0.4	0.030
		PM	31.6	C	32.7	C	1.8	0.027
15	Great America Parkway and Old Mountain View-Alviso Road	AM	12.1	B	13.0	B	1.4	0.033
		PM	19.8	B	21.4	C	3.2	0.030
16	Great America Parkway and Bunker Hill Lane	AM	11.7	B	11.6	B	0.0	0.031
		PM	13.3	B	13.1	B	-0.1	0.028
17	Great America Parkway and Old Glory Lane	AM	16.2	B	17.1	B	1.4	0.046
		PM	22.3	C	22.7	C	1.1	0.009
18	Great America Parkway and Patrick Henry Drive	AM	25.1	C	29.5	C	0.7	0.027
		PM	26.1	C	27.9	C	2.7	0.067
19	Great America Parkway and Northbound US 101*	AM	22.1	C	23.5	C	2.1	0.045
		PM	16.4	B	21.9	C	7.2	0.040
20	Bowers Avenue and Southbound US 101*	AM	24.1	C	26.1	C	2.4	0.064
		PM	8.0	A	8.5	A	0.7	0.029
21	Bowers Avenue and Augustine Drive	AM	32.8	C	34.3	C	2.1	0.025
		PM	73.0	E	**78.8**	**E**	**8.9**	**0.023**
22	Bowers Avenue and Scott Boulevard*	AM	36.1	D	37.8	D	2.6	0.037
		PM	34.6	C	34.9	C	0.5	0.018
23	Bowers Avenue and Central Expressway*	AM	71.3	E	77.7	E	10.6	0.023
		PM	97.0	F	**104.7**	**F**	**6.9**	**0.018**
24	Bowers Avenue and Kifer Road/Walsh Avenue	AM	19.3	B	19.7	D	0.6	0.019
		PM	21.6	C	21.7	C	0.4	0.011
25	Corwin Drive and Central Expressway*	AM	28.2	C	28.3	C	0.2	0.002
		PM	30.2	C	30.8	C	0.5	0.002
26	Lick Mill Boulevard and Montague Expressway	AM	32.0	C	32.1	C	0.2	0.007
		PM	20.8	C	20.7	C	0.0	0.006
27	De La Cruz Boulevard and Montague Expressway*	AM	48.9	D	50.7	D	3.4	0.013
		PM	40.2	D	40.6	D	0.4	0.003
28	Montague Expressway and Mission College Boulevard*	AM	111.2	F	**115.4**	**F**	**7.9**	**0.017**
		PM	62.5	E	71.0	E	13.6	0.032
29	San Tomas Expressway and Scott Boulevard*	AM	41.4	D	41.4	D	0.0	0.005
		PM	77.8	E	79.1	E	2.4	0.005

Table 3.2-9
Background Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Background		Background Plus Project			
			Average Delay	LOS	Average Delay	LOS	Critical Delay Incr.	Critical V/C Incr.
30	San Tomas Expressway and Walsh Avenue	AM	44.1	D	44.5	D	0.7	0.006
		PM	68.3	E	69.4	E	1.8	0.005
31	Lafayette Street and Agnew Road	AM	33.0	C	33.2	C	0.4	0.004
		PM	39.0	D	39.3	D	0.4	0.007
32	Lafayette Street and Montague Expressway (North)	AM	32.4	C	32.2	C	0.0	0.000
		PM	27.5	C	27.5	C	0.0	0.000
33	Lafayette Street and Montague Expressway (South)	AM	13.6	B	13.5	B	-0.1	0.011
		PM	11.6	B	11.8	B	0.4	0.022
34	Lafayette Street and Central Expressway*	AM	68.6	E	70.6	E	-7.8	-0.047
		PM	62.5	E	64.1	E	2.9	0.010
35	Lafayette Street and Walsh Avenue	AM	13.4	B	13.4	B	0.1	0.011
		PM	23.8	C	24.1	C	0.5	0.010
36	N. First Street and Montague Expressway*	AM	121.1	F	122.1	F	1.4	0.003
		PM	132.1	F	132.8	F	1.4	0.003
37	Great America Parkway (North) and SR 237*	AM	23.7	C	26.8	C	4.5	0.039
		PM	22.8	C	23.4	C	0.7	0.019
38	Great America Parkway (South) and SR 237*	AM	16.6	B	17.3	B	1.2	0.034
		PM	13.0	B	13.3	B	0.6	0.033
39	Reamwood Avenue and Tasman Drive	AM	7.8	A	7.9	A	0.1	0.009
		PM	38.1	D	41.7	D	5.3	0.009
40	Birchwood Avenue and Tasman Drive	AM	33.1	C	36.2	D	4.3	0.010
		PM	30.7	C	32.9	C	3.4	0.009
41	Lawrence Expressway and Tasman Drive*	AM	45.8	D	46.8	D	2.7	0.016
		PM	59.3	E	60.0	E	1.4	0.006
42	Lawrence Expressway and Lakehaven Drive/Sandia Avenue	AM	34.2	C	34.2	C	0.0	0.001
		PM	44.6	D	44.7	D	0.1	0.002
43	Lawrence Expressway and Scott Boulevard/Arques Avenue*	AM	29.0	C	29.4	C	0.7	0.006
		PM	88.1	F	88.6	F	0.9	0.003
44	Lawrence Expressway and Kifer Road	AM	27.4	C	27.4	C	0.0	0.004
		PM	80.1	F	81.6	F	2.9	0.007

*Denotes CMP intersection.
Bold indicates a significant impact.

As shown above in Table 3.2-9, of the six intersections projected to operate at unacceptable levels of service, the following three intersections would be impacted by the proposed project during at least one of the peak hours:

- No. 21 – Bowers Avenue and Augustine Drive (PM Peak Hour);
- No. 23 – Bowers Avenue and Central Expressway (PM Peak Hour); and
- No. 28 – Mission College Boulevard and Montague Expressway (AM Peak Hour).

Impact TRANS-2: The Bowers Avenue and Augustine Drive intersection would operate at LOS E during the PM peak hour under background conditions. The addition of project traffic would cause the critical-movement delay at the intersection to increase by four or more seconds and the volume-to-capacity ratio (V/C) to increase by .01 or more during the PM peak hour under background plus project conditions. **(Significant Impact)**

Impact TRANS-3: The Bowers Avenue and Central Expressway intersection would operate at LOS F during the PM peak hour under background conditions. The addition of project traffic would cause the critical-movement delay at the intersection to increase by four or more seconds and the volume-to-capacity ratio (V/C) to increase by .01 or more during the PM peak hour under background plus project conditions. **(Significant Impact)**

Impact TRANS-4: The Mission College Boulevard and Montague Expressway intersection is expected to operate at LOS F during the AM peak hour under background conditions. The addition of project traffic would cause the critical-movement delay at the intersection to increase by four or more seconds and the volume-to-capacity ratio (V/C) to increase by .01 or more during the AM peak hour under background plus project conditions. **(Significant Impact)**

3.2.2.4 *Project Freeway Segment Analysis*

Traffic volumes on the study freeway segments under project conditions were estimated by adding the proposed net project trips to the existing volumes obtained from the *2011 CMP Annual Monitoring Report*. The results of the freeway analysis are summarized in Table 3.2-10, on the following page. The results show that the project would have a significant impact on 11 directional freeway segments:

- US 101 northbound from I-880 to Old Bayshore Highway (AM Peak Hour – Mixed-Flow & HOV);
- US 101 northbound from Old Bayshore Highway to North First Street (AM Peak Hour – Mixed-Flow & HOV);
- US 101 northbound from North First Street to Guadalupe Parkway (AM Peak Hour – Mixed-Flow & HOV);
- US 101 northbound from Guadalupe Parkway to De La Cruz Boulevard (AM Peak Hour – Mixed-Flow & HOV);
- SR 237 eastbound from Great America Parkway to North First Street (PM Peak Hour);
- SR 237 eastbound from North First Street to Zanker Road (PM Peak Hour);
- US 101 southbound from Great America Parkway to Montague Expressway (PM Peak Hour – Mixed-Flow & HOV);
- US 101 southbound from Montague Expressway to De La Cruz Boulevard (PM Peak Hour);
- US 101 southbound from Guadalupe Parkway to North First Street (PM Peak Hour);
- SR 237 westbound from McCarthy Boulevard to Zanker Road (AM Peak Hour – Mixed-Flow & HOV); and

- SR 237 westbound from Zanker Road to North First Street (AM Peak Hour).

The Valley Transportation Authority *Valley Transportation Plan* (*VTP 2030*) identifies improvements to regional facilities, including freeways, for which a regional funding plan could be used to fund the improvements. The following improvements to impacted freeway segments are identified in the VTP 2030:

- US 101 auxiliary lane widenings between Trimble Road and Montague Expressway;
- US 101 southbound auxiliary lane between Great America Parkway and Lawrence Expressway; and
- SR 237 westbound auxiliary lane between Coyote Creek Bridge and North First Street.

There is currently no mechanism in place to collect funds for these improvements.

Impact TRANS-5: The proposed project would contribute in excess of one percent of segment capacity to 11 directional freeway segments already operating at LOS F during either the AM or PM peak hour. **(Significant Impact)**

3.2.2.5 *Transit, Pedestrian and Bicycle Analysis*

Transit

Some quantity of future project trips may be made on buses and other transit service. Applying an average transit use rate of two percent yields an estimate of 19 and 18 additional transit trips during the AM and PM peak hours, respectively. The 57 and 60 bus lines directly serve the project site with a stop located along Great America Parkway. Given that there are also other bus routes within walking distance of the project site, the projected transit riders associated with the project could be accommodated by the existing service.

Pedestrian Facilities

There are existing sidewalks provided along the project's frontages on Mission College Boulevard, Great America Parkway, and Patrick Henry Drive. The existing sidewalks along the project's frontage on Great America Parkway and Mission College Boulevard provide the required pedestrian realm of 15 feet prescribed by the VTA's *Pedestrian Technical Guidelines*, October 2003 for urban roads.

Pedestrian crosswalks and signal heads with pushbuttons are present at all signalized intersections, including the Marriott Hotel entrance and Mission College Boulevard and Patrick Henry Drive and Great America Parkway intersections. Some retail is present at the southwest and northwest corners of Mission College Boulevard and Great America Parkway. Sidewalks, crosswalks, and pedestrian pushbuttons and signalheads are present to connect these retail properties to the project site for pedestrians. The existing network of sidewalks in Santa Clara would connect pedestrians to their destinations. The existing pedestrian facilities would be adequate to support pedestrians walking to and from the project site.

Table 3.2-10
Project Freeway Segment Levels of Service

Freeway	Segment	Peak Hour	Mixed-Flow Lanes				HOV Lanes			
			Capacity	LOS	Volume	% Capacity	Capacity	LOS	Volume	% Capacity
US 101 NB	I-880 to Old Bayshore Highway	AM	6,900	**F**	**81**	**1.2**	1,650	**F**	**36**	**2.2**
		PM	6,900	B	18	0.3	1,650	A	4	0.2
	Old Bayshore Highway to N. First Street	AM	6,900	**F**	**85**	**1.2**	1,650	**F**	**32**	**1.9**
		PM	6,900	B	18	0.3	1,650	B	4	0.3
	N. First Street to Guadalupe Parkway	AM	6,900	**F**	**87**	**1.3**	1,650	**F**	**30**	**1.8**
		PM	6,900	B	16	0.2	1,650	B	6	0.3
	Guadalupe Parkway to De La Cruz Boulevard	AM	6,900	**F**	**85**	**1.2**	1,650	**F**	**32**	**2.0**
		PM	6,900	C	18	0.3	1,650	B	4	0.2
	De La Cruz Boulevard to Montague Expressway	AM	6,900	E	86	1.2	1,650	D	31	1.9
		PM	6,900	D	19	0.3	1,650	B	3	0.2
	Montague Expressway to Great America Parkway	AM	6,900	E	90	1.3	1,650	D	27	1.6
		PM	6,900	D	19	0.3	1,650	B	3	0.2
	Great America Parkway to Lawrence Expressway	AM	6,900	B	13	0.2	1,650	D	4	0.3
		PM	6,900	D	99	1.4	1,650	A	12	0.7
	Lawrence Expressway to N. Fair Oaks Avenue	AM	6,900	F	13	0.2	1,650	D	4	0.3
		PM	6,900	D	95	1.4	1,650	B	16	1.0
	N. Fair Oaks Avenue to N. Mathilda Avenue	AM	6,900	F	12	0.2	1,650	D	4	0.3
		PM	6,900	C	93	1.4	1,650	A	13	0.8
	N. Mathilda Avenue to SR 237	AM	6,900	F	11	0.2	1,650	D	5	0.3
		PM	6,900	D	86	1.2	1,650	C	20	1.2
SR 237 EB	US 101 to N. Mathilda Avenue	AM	4,400	F	39	0.9	N/A	N/A	N/A	N/A
		PM	4,400	D	7	0.2	N/A	N/A	N/A	N/A
	N. Mathilda Avenue to N. Fair Oaks Avenue	AM	4,400	E	27	0.6	1,650	D	12	0.7
		PM	4,400	E	5	0.1	1,650	B	2	0.1
	N. Fair Oaks Avenue to Lawrence Expressway	AM	4,400	D	31	0.	1,650	B	8	0.5
		PM	4,400	F	5	0.1	1,650	C	2	0.1
	Lawrence Expressway to Great America Parkway	AM	4,400	E	31	0.7	1,650	B	8	0.5
		PM	4,400	F	4	0.1	1,650	D	3	0.2
	Great America Parkway to N. First Street	AM	4,400	D	12	0.3	1,650	C	4	0.2
		PM	4,400	**F**	**65**	**1.5**	1,650	D	41	2.5
	N. First Street to Zanker Road	AM	4,400	D	13	0.3	1,650	B	3	0.2
		PM	4,400	**F**	**72**	**1.6**	1,650	D	34	2.1
	Zanker Road to McCarthy Boulevard	AM	4,400	D	14	0.3	1,650	A	2	0.1
		PM	4,400	E	77	1.8	1,650	C	29	1.7

Table 3.2-10
Project Freeway Segment Levels of Service

Freeway	Segment	Peak Hour	Mixed-Flow Lanes				HOV Lanes			
			Capacity	LOS	Volume	% Capacity	Capacity	LOS	Volume	% Capacity
US 101 SB	SR 237 to N. Mathilda Avenue	AM	6,900	C	87	1.3	1,650	D	30	1.8
		PM	6,900	C	15	0.2	1,650	D	7	0.4
	N. Mathilda Avenue to N. Fair Oaks Avenue	AM	6,900	D	94	1.4	1,650	C	23	1.4
		PM	6,900	D	19	0.3	1,650	B	3	0.2
	North Fair Oaks Avenue to Lawrence Expressway	AM	6,900	D	104	1.5	1,650	B	19	1.2
		PM	6,900	D	19	0.3	1,650	B	4	0.2
	Lawrence Expressway to Great America Parkway	AM	6,900	C	104	1.5	1,650	B	19	1.1
		PM	6,900	F	15	0.2	1,650	F	8	0.5
	Great America Parkway to Montague Expressway	AM	6,900	C	14	0.2	1,650	A	2	0.1
		PM	6,900	**F**	**73**	**1.1**	1,650	**F**	**33**	**2.0**
	Montague Expressway to De La Cruz Boulevard	AM	6,900	C	14	0.2	1,650	A	2	0.1
		PM	6,900	**F**	**68**	**1.0**	1,650	D	38	2.3
	De La Cruz Boulevard to Guadalupe Parkway	AM	6,900	C	15	0.2	1,650	A	1	0.
		PM	6,900	E	79	1.1	1,650	D	27	1.6
	Guadalupe Parkway to N. First Street	AM	6,900	B	15	0.2	1,650	A	1	0.1
		PM	6,900	**F**	**87**	**1.3**	1,650	B	19	1.2
	N. First Street to Old Bayshore Highway	AM	6,900	C	14	0.2	1,650	A	2	0.1
		PM	6,900	F	63	0.9	1,650	D	43	2.6
	Old Bayshore Highway to I-880	AM	6,900	B	13	0.2	1,650	A	3	0.2
		PM	6,900	F	60	0.9	1,650	D	46	2.8
SR 237 WB	McCarthy Boulevard to Zanker Road	AM	5,280	**F**	**77**	**1.5**	1,650	**F**	**40**	**2.4**
		PM	5,280	D	19	0.4	1,650	B	3	0.2
	Zanker Road to N. First Street	AM	4,400	**F**	**76**	**1.7**	1,650	D	41	2.5
		PM	4,400	F	18	0.4	1,650	B	4	0.3
	N. First Street to Great America Parkway	AM	4,400	D	79	1.8	1,650	D	38	2.3
		PM	4,400	F	16	0.4	1,650	B	6	0.3
	Great America Parkway to Lawrence Expressway	AM	4,400	D	3	0.1	1,650	D	2	0.1
		PM	4,400	E	29	0.7	1,650	B	6	0.4
	Lawrence Expressway to N. Fair Oaks Avenue	AM	4,400	E	3	0.1	1,650	E	2	0.1
		PM	4,400	F	21	0.5	1,650	D	14	0.8
	N. Fair Oaks Avenue to N. Mathilda Avenue	AM	6,900	F	5	0.1	N/A	N/A	N/A	N/A
		PM	6,900	F	35	0.5	N/A	N/A	N/A	N/A
	N. Mathilda Avenue to US 101	AM	4,400	E	5	0.1	N/A	N/A	N/A	N/A
		PM	4,400	D	35	0.8	N/A	N/A	N/A	N/A

Source: Santa Clara Valley Transportation Authority Congestion Management Program Monitoring Study, 2011.
Notes: **Bold** text indicates a significant impact.

Bicycle Facilities

Bicycle trips are estimated at one percent of total project-generated trips. Therefore the project could be estimated to generate nine new bicycle trips. The existing bicycle facilities would be adequate to serve the anticipated demand. There are bike lanes provided on Great America Parkway along the project's frontage. The striping for bike lanes along Great America Parkway is discontinuous between the Mission College Boulevard intersection and the first project driveway, to allow for weaving of buses to the bus stop just north of the Mission College Boulevard intersection and right-turning vehicles from Mission College Boulevard. The lack of bike lane striping along this stretch of the project site would not result in a safety hazard due to the infrequency of buses stopping in this location and the presence of the stoplight and crosswalks at the Mission College Boulevard and Great America Parkway intersection which serve to slow vehicles and require greater driver awareness of pedestrians and cyclists in the area.

VTA recommends new developments provide bicycle parking, and provides recommended bicycle parking rates in their *VTA Countywide Bicycle Plan Technical Guidelines*, September 1999. Two types of bicycle parking are described by VTA: Class I and Class II. Class I bicycle parking include bicycle lockers, rooms with key access for regular bicycle commuters, guarded parking areas, and valet or check-in parking. Class II bicycle parking refers to a bicycle rack to which the frame and at least one wheel of the bicycle can be secured with a user-provided lock and cable. According to VTA's recommended rates, an office project (such as the proposed project) should provide one bicycle parking space for every 6,000 s.f. of proposed space. Class I and II should have 75 and 25 percent of the new parking spaces, respectively. According to the recommended rates, the proposed project should provide 75 Class I and 25 Class II bicycle parking spaces to serve the proposed office space. The City of Santa Clara, however, will condition the project to provide bicycle parking in excess of the VTA recommended rates. The City of Santa Clara will require that the project provide 128 Class I and 42 Class II bicycle parking spaces to serve the proposed office space.

Impact TRANS-6: The existing transit, pedestrian, and bicycle facilities in the project area are adequate to serve the proposed project. **(Less than Significant Impact)**

3.2.3 Mitigation Measures for Transportation Impacts

3.2.3.1 *Mitigation for Intersection LOS Impacts*

A significant impact is said to be satisfactorily mitigated when measures are implemented that would restore intersection LOS to an acceptable level or equivalent to background conditions. The following mitigation measures identify roadway improvements that could reduce impacts to the affected intersections. The feasibility of each mitigation measure is addressed below. Only those mitigation measures which are deemed feasible and/or the payment of impact fees (where applicable) are proposed as part of the project would reduce the identified traffic impact.

As a condition of approval, the City of Santa Clara will collect applicable local traffic fees. This is consistent with City policy to collect fees from projects that have a significant impact on local or

regional facilities. In addition, as a condition of approval, the project will pay a fair share contribution toward improvement programs currently approved by the County of Santa Clara. Identified improvements for intersections and/or roadway segments which are listed as possible mitigation and are not controlled by the City of Santa Clara, and are subject to financial contributions from Santa Clara, must complete the necessary environmental review and be certified by the Lead Agency with jurisdiction over the intersection/roadway in conformance with CEQA prior to the payment of fees toward those improvements.

MM TRANS-2: At the intersection of Bowers Avenue and Augustine Drive, improvements consisting of the addition of a second southbound left-turn lane, a separate westbound right-turn lane, and a third eastbound left-turn lane have been identified as part of other approved development in the project area. The intersection would, however, continue to operate at LOS E during the PM peak hour with the planned improvements with or without the proposed project. There are no further feasible improvements at the intersection due to right-of-way constraints. Therefore, the project impact is significant and unavoidable. **(Significant Unavoidable Impact)**

MM TRANS-3: The significant impact at the Bowers Avenue and Central Expressway intersection could be satisfactorily mitigated by adding third eastbound and southbound left-turn lanes. With these improvements, the intersection would continue to operate at LOS F during the PM peak hour. The average vehicular delay; however, would be less than that under background conditions; therefore, the impact would be considered mitigated. While the intersection is under the jurisdiction of the County and not the City of Santa Clara, the City has discussed this improvement with the County and they are conceptually in agreement with the identified improvements which can be constructed within the existing roadway right-of-way. The City intends to add these improvements to the Capital Improvement Plan (CIP) and program funds toward their construction. A previously approved project has already been conditioned to contribute toward a portion of these improvements. The project will pay a fair share contribution towards the improvements; thereby reducing the project's impact to a less than significant level. **(Less Than Significant Impact with Mitigation)**

MM TRANS-4: The Comprehensive County Expressway Planning Study identifies at-grade improvements at the Mission College Boulevard and Montague Expressway intersection as a Tier 1A priority along with the planned Tier 1B improvement of the US 101 and Montague Expressway partial cloverleaf interchange improvement project. The project will pay a fair share contribution toward these improvements. The effects of the planned improvements cannot be reflected in level of service calculations because the specific details of the interchange design are not available, but it is expected that the intersection would be improved to acceptable levels. **(Less Than Significant Impact with Mitigation)**

3.2.3.2 *Mitigation for Freeway LOS Impacts*

A significant freeway LOS impact is said to be satisfactorily mitigated when measures are implemented that would restore freeway conditions to better than background conditions.

MM TRANS-5: Full mitigation of significant project impacts on freeway segments would require roadway widening to construct additional through lanes, thereby increasing freeway capacity. Due to constraints in acquisition and cost of right-of-way, it is not feasible for an individual development project to bear responsibility for implementing such extensive transportation system improvements. No comprehensive project to add through lanes has been developed by Caltrans or VTA for individual projects to contribute to and, therefore, the significant impacts on the 11 directional freeway segments identified above are significant and unavoidable. **(Significant Unavoidable Impact)**

3.2.4 Conclusion

Impact TRANS-1: Implementation of the proposed project would have a less than significant impact on study intersections during both of the peak hours under baseline plus project conditions. **(Less Than Significant Impact)**

Impact TRANS-2: There are no further feasible improvements at the Bowers Avenue and Augustine Drive intersection due to right-of-way constraints. Therefore, the project impact is considered significant and unavoidable. **(Significant Unavoidable Impact)**

Impact TRANS-3: The City of Santa Clara will include the required improvements to the Bowers Avenue and Central Expressway intersection in the CIP and program funds toward their construction. The project will pay a fair share contribution towards the improvements; thereby reducing the project's impact to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact TRANS-4: The project will pay a fair share contribution toward improvements currently approved by the County of Santa Clara for the intersection of Mission College Boulevard and Montague Expressway. **(Less Than Significant Impact with Mitigation)**

Impact TRANS-5: The 11 freeway segment LOS impacts of the proposed project would remain significant and unavoidable due to the lack of feasible mitigation measures. **(Significant Unavoidable Impact)**

Impact TRANS-6: The existing transit, pedestrian, and bicycle facilities in the project area are adequate to serve the proposed project. **(Less than Significant Impact)**

3.3 AIR QUALITY

The following discussion is based on an Air Quality and Greenhouse Gas Emission Assessment prepared by *Illingworth & Rodkin, Inc.* in March 2013. A copy of this report is included as Appendix B in this EIR.

3.3.1 Existing Setting

3.3.1.1 *Air Pollution Climatology*

Air quality is determined by the concentration of various pollutants in the atmosphere. Units of concentration are expressed in parts per million (ppm) or micrograms per kilograms (μg/kg).

The amount of a given pollutant in the atmosphere is determined by the amount of pollutant released in an area, transport of pollutants to and from surrounding areas, local and regional meteorological conditions, and the surrounding topography of the air basin. The major determinants of transport and dilution are wind, atmospheric stability, terrain and for photochemical pollutants, sunshine.

Santa Clara is located in the southern portion of the San Francisco Bay Area Air Basin. The proximity of this location to both the Pacific Ocean and San Francisco Bay has a moderating influence on the climate. Northwest winds and northerly winds are most common in the project area, reflecting the orientation of the Bay and the San Francisco Peninsula. Winds from these directions carry pollutants released by autos and factories from upwind areas of the Peninsula toward Santa Clara, particularly during the summer months. Winds are lightest on the average in fall and winter. Every year in fall and winter there are periods of several days when winds are very light and local pollutants can build up.

Pollutants can be diluted by mixing in the atmosphere both vertically and horizontally. Vertical mixing and dilution of pollutants are often suppressed by inversion conditions, when a warm layer of air traps cooler air close to the surface. During the summer, inversions are generally elevated above ground level, but are present over 90 percent of the time in both the morning and afternoon. In winter, surface based inversions dominate in the morning hours, but frequently dissipate by afternoon.

Topography can restrict horizontal dilution and mixing of pollutants by creating a barrier to air movement. The South Bay has significant terrain features that affect air quality. The Santa Cruz Mountains and Diablo Range on either side of the South Bay restrict horizontal dilution, and this alignment of the terrain also channels winds from the north to south, carrying pollution from the northern Peninsula toward Santa Clara.

The combined effects of moderate ventilation, frequent inversions that restrict vertical dilution and terrain that restrict horizontal dilution give Santa Clara a relatively high atmospheric potential for pollution compared to other parts of the San Francisco Bay Air Basin and provide a high potential for transport of pollutants to the east and south.

3.3.1.2 *Overview of Regulatory Setting*

The Federal Clean Air Act governs air quality in the United States. In addition to being subject to federal requirements, air quality in California is also governed by more stringent regulations under the California Clean Air Act. At the federal level, the U.S. Environmental Protection Agency (EPA) administers the Federal Clean Air Act. The California Clean Air Act is administered by the California Air Resource Board (CARB) at the state level, and the Air Quality Management District (BAAQMD) regulates air quality at the regional level, which includes the nine-county Bay Area.

3.3.1.3 *Ambient Air Quality Standards*

National and State Standards

Both the EPA and CARB have established ambient air quality standards for common pollutants. The EPA is responsible for establishing the National Ambient Air Quality Standards (NAAQS) and the CARB is responsible for establishing the California Ambient Air Quality Standards (CAAQS). As required by the Federal Clean Air Act, the NAAQS have been established for six major air pollutants: carbon monoxide (CO), nitrogen oxides (NO_x), ozone (O_3), sulfur oxides (SO_x), respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$). Table 3.3-1 lists these pollutants, their sources and effects, and the related standards. Pursuant to the California Clean Air Act, the State of California has also established the CAAQS that are generally more stringent than the corresponding federal standards and incorporate additional standards for pollutants such as sulfates, hydrogen sulfide, vinyl chloride and visibility reducing particles. Because CAAQS are more stringent than NAAQS, CAAQS are used as the comparative standard in this analysis.

Table 3.3-1
Major Criteria Air Pollutants and Standards

	Pollutant					
	Ozone	**Carbon Monoxide**	**Nitrogen Dioxide**	**Sulfur Dioxide**	**PM_{10}**	**$PM_{2.5}$**
Health Effects	Eye irritation, respiratory function impairment	Aggravation of cardio-vascular disease, fatigue, headache, confusion, dizziness, can be fatal	Increased risk of acute and chronic respiratory disease	Aggravation of lung disease, increased risk of acute and chronic respiratory disease	Aggravation of chronic disease and heart/lung disease symptoms	Aggravation of chronic disease and heart/lung disease symptoms
Major Sources	Combustion sources, evaporation of solvents and fuels	Combustion of fuel, combustion of wood in stoves and fireplaces	Motor vehicle exhaust, industrial processes, fossil-fueled power plants	Diesel exhaust, oil power plants, industrial processes	Combustion, cars, field burning, factories, unpaved roads, construction	Combustion, cars, field burning, factories, unpaved roads, construction
Federal Standard	1-hr: n/a 8-hr: .075ppm	1-hr: 35ppm 8-hr: 9ppm	1-hr: .100 ppm AA: .053 ppm	1-hr: .075 ppm 24-hr: n/a	24-hr: 150 $\mu g/m^3$ AA: n/a	24-hr: 35 $\mu g/m^3$ AA: 15 $\mu g/m^3$
State Standard	1-hr: .09ppm 8-hr: .07ppm	1-hr: 20ppm 8-hr: 9ppm	1-hr: .18 ppm AA: .03 ppm	1-hr: .25ppm 24-hr:.04ppm	24-hr: 50 $\mu g/m^3$ AA: 20 $\mu g/m^3$	24-hr: n/a AA: 12 $\mu g/m^3$
Bay Area Attainment Status	federal – N state (8-hr) – N state (1-hr) – N	A	federal – A state (1-hr) – U state (AA) – A	A	federal – U state – N	federal (24-hr) – N federal (AA) -A state – N

Attainment Status: A = attainment N = nonattainment, U = Unclassified
PM_{10} = particulate matter, 10 microns in size $PM_{2.5}$ = particulate matter, 2.5 microns in size
ppm = parts per million $\mu G/m^3$ = micrograms per cubic meter
AA = annual average 1-hr = 1-hour average 8-hr = 8-hour average
24-hr = 24-hour average n/a = not applicable

Attainment Status

The Federal CAA and the California CAA of 1988 require that CARB, based on air quality monitoring data, designate portions of the state where federal or state ambient air quality standards are not met as "nonattainment areas". Because of the differences between the federal and state standards, the designation of "nonattainment area" is different under the federal and state legislation. The Bay Area is considered a non-attainment area for ground-level O_3 and fine particulate matter ($PM_{2.5}$) under both the Federal Clean Air Act and the California Clean Air Act. The area is also considered non-attainment for respirable particulates or particulate matter with a diameter of less

than 10 micrometers (PM_{10}) under the California Clean Air Act, but not the federal act. The area has attained both state and federal ambient air quality standards for carbon monoxide.

3.3.1.4 *Existing Air Quality Conditions*

Air quality studies generally focus on five criteria pollutants that are most commonly measured and regulated: CO, ground level O_3, N_2O, SO_2, and PM_{10} and $PM_{2.5}$. In Santa Clara County, O_3 and PM_{10} and $PM_{2.5}$ are the pollutants of greatest concern since measured air pollutant levels exceed the state and federal air quality standards concentrations at times.

Ozone

While O_3 serves a beneficial purpose in the upper atmosphere (stratosphere) by reducing ultraviolet radiation, when it reaches elevated concentrations in the lower atmosphere it can be harmful to the human respiratory system and to sensitive species of plants. O_3 concentrations build to peak levels during periods of light winds, bright sunshine, and high temperatures. Short-term O_3 exposure can reduce lung function in children, make persons susceptible to respiratory infection, and produce symptoms that cause people to seek medical treatment for respiratory distress. Long-term exposure can impair lung defense mechanisms and lead to emphysema and chronic bronchitis. Sensitivity to O_3 varies among individuals, but about 20 percent of the population is sensitive to O_3, with exercising children being particularly vulnerable. Ozone is formed in the atmosphere by a complex series of photochemical reactions that involve "ozone precursors" that are two families of pollutants: oxides of nitrogen (NOx) and reactive organic gases (ROG). NO_x and ROG are emitted from a variety of stationary and mobile sources. While N_2O is another criteria pollutant itself, ROGs are not in that category, but are included in this discussion as ozone precursors. The U.S. EPA recently established a new more stringent standard for O_3 of 0.75 ppm for 8-hour exposures, based on a review of the latest new scientific evidence.

Carbon Monoxide

CO, a colorless and odorless gas, interferes with the transfer of oxygen (O_2) to the brain. It can cause dizziness and fatigue, and can impair central nervous system functions. Highest CO concentrations measured in the South Bay Area have been well below the national and State ambient standards. Since the primary sources of CO are cars and trucks, highest concentrations would be found near congested roadways that carry large volumes of traffic. CO emitted from a vehicle is highest near the origin of a trip and considerably lower once the automobile is warmed up (usually five to ten minutes into a trip). This is different, however, for vehicles of different ages, where older cars require a longer warm up period.

Nitrogen Dioxide

N_2O, a reddish-brown gas, irritates the lungs. Exposure to N_2O can cause breathing difficulties at high concentrations. Clinical studies suggest that N_2O exposure to levels near the current standard may worsen the effect of allergens in allergic asthmatics, especially in children. Similar to O_3, N_2O is not directly emitted, but is formed through a reaction between nitric oxide (NO) and atmospheric O_2. NO and N_2O are collectively referred to as NO_x and are major contributors to ozone formation.

N_2O is emitted from combustion of fuels, with higher rates at higher combustion temperatures. Nitrogen dioxide also contributes to the formation of PM_{10} (see discussion of PM_{10} below). Monitored levels in the Bay Area are well below ambient air quality standards.

Sulfur Oxides

SO_x, primarily SO_2, are a product of high-sulfur fuel combustion. The main sources of SO_2 are coal and oil used in power stations, in industries, and for domestic heating. SO_x is an irritant gas that attacks the throat and lungs. It can cause acute respiratory symptoms and diminished breathing functions in children. Concentrations of SO_2 in the Bay Area are at levels well below the State and national standards, but further reductions in emissions are needed to attain compliance with standards for PM_{10}, to which SO_2 is a contributor.

PM_{10} and $PM_{2.5}$

Respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$) consist of particulate matter that is ten microns or less in diameter and 2.5 microns or less in diameter, respectively, and represent fractions of particulate matter that can be inhaled and cause adverse health effects. Both PM_{10} and $PM_{2.5}$ are health concerns, particularly at levels above the federal and state ambient air quality standards. Scientific studies have suggested links between fine particulate matter and numerous health problems including asthma, bronchitis, and acute and chronic respiratory symptoms such as shortness of breath and labored breathing. Children are more susceptible to the health risks of $PM_{2.5}$ because their immune and respiratory systems are still developing.

Both PM_{10} and $PM_{2.5}$ pose a greater health risk than larger particles because these tiny particles can penetrate the human respiratory system's natural defenses and damage the respiratory tract, increasing the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections. Whereas larger particles tend to collect in the upper portion of the respiratory system, $PM_{2.5}$ is miniscule and can penetrate deeper into the lungs and damage lung tissues. Suspended particulates also damage and discolor surfaces on which they settle, as well as produce haze and reduce regional visibility. Most stations in the Bay Area reported exceedances of the State standard on the same fall/winter days as reported in the South Bay. This indicates a regional air quality problem.

The primary sources of these pollutants are wood smoke and local traffic. Meteorological conditions that are common during this time of the year produce calm winds and strong surface-based inversions that trap pollutants near the surface. The high levels of PM_{l0} result in not only health effects, but also reduced visibility.

Ambient Air Quality

Air quality in the region is controlled by the rate of pollutant emissions and meteorological conditions. Meteorological conditions, such as wind speed, atmospheric stability, and mixing height may all affect the atmosphere's ability to mix and disperse pollutants. Long-term variations in air quality typically result from changes in air pollutant emissions, while frequent, short-term variations result from changes in atmospheric conditions. The San Francisco Bay Area is considered to be one

of the cleanest metropolitan areas in the country with respect to air quality. BAAQMD monitors air quality conditions at over 30 locations throughout the Bay Area. There are several BAAMQD monitoring stations near Santa Clara.

As shown in Table 3.3-2, violations of state and federal standards at the downtown San José monitoring station (the nearest monitoring station to the project site) during the 2009-2011 period (the most recent years for which data is available) include high levels of O_3 and $PM_{2.5}$. Violations of the CO standard have not been recorded since 1992.

Table 3.3-2
Number of Ambient Air Quality Standards Violations (2009-2011)

Pollutant	Standard	Days Exceeding Standard		
		2009	2010	2011
San Jose Central Station				
Ozone	state 1-hour	0	5	1
	state 8-hour	0	3	0
	federal 8-hour	0	3	0
Carbon Monoxide	federal 8-hour	0	0	0
	state 8-hour	0	0	0
Nitrogen Dioxide	state 1-hour	0	0	0
PM_{10}	federal 24-hour	0	0	0
	state 24-hour	0	0	0
$PM_{2.5}$	federal 24-hour	0	3	3

Source: Bay Area Air Quality Management District, Bay Area Air Pollution Summary.

3.3.1.5 *Toxic Air Contaminants*

In addition to the "criteria" air pollutants, there is another group of substances found in ambient air referred to as Hazardous Air Pollutants (HAPs) under the Federal Clean Air Act and Toxic Air Contaminants (TACs) under the California Clean Air Act. These contaminants tend to be localized and are found in relatively low concentrations in ambient air. However, they can result in adverse chronic health effects if exposure to low concentrations occurs for long periods. They are regulated at the local, state, and federal level.

Toxic air contaminants are a broad class of compounds known to cause morbidity or mortality (cancer risk). TACs are found in ambient air, especially in urban areas, and are caused by industry, agriculture, fuel combustion, and commercial operations (e.g., dry cleaners). TACs are typically found in low concentrations, even near their source (e.g., diesel particulate matter near a freeway). Chronic exposure to TACs can result in adverse health effects.

Particulate matter from diesel exhaust is the predominant TAC in urban air and was estimated to represent about three-quarters of the cancer risk from TACs (based on the Bay Area average).

According to CARB, diesel exhaust is a complex mixture of gases, vapors and fine particles. This complexity makes the evaluation of health effects of diesel exhaust a complex scientific issue. Some chemicals in diesel exhaust, such as benzene and formaldehyde, have been previously identified as TACs by CARB, and are listed as carcinogens either under State Proposition 65 or under the Federal Hazardous Air Pollutants programs.

CARB has adopted and implemented a number of regulations for stationary and mobile sources to reduce emissions of diesel particulate matter (DPM). Several of these regulatory programs affect medium and heavy duty diesel trucks that represent the bulk of DPM emissions from California highways. These regulations include the solid waste collection vehicle (SWCV) rule, in-use public and utility fleets, and the heavy-duty diesel truck and bus regulations. In 2008, CARB approved a new regulation to reduce emissions of DPM and NO_x from existing on-road heavy-duty diesel fueled vehicles. The regulation requires affected vehicles to meet specific performance requirements between 2011 and 2023, with all affected diesel vehicles required to have 2010 model-year engines or equivalent by 2023. These requirements are phased in over the compliance period and depend on the model year of the vehicle.

3.3.1.6 *Sensitive Receptors*

CARB has identified the following groups of people that are most likely to be affected by air pollution: children under 14; the elderly over 65; athletes; and people with cardiovascular and chronic respiratory diseases. These groups are classified as sensitive receptors. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, places of assembly and parks. The closest sensitive receptors to the site are located in the residential areas north of Agnew Road approximately 2,000 feet east of the project site. Great America Theme Park visitors are not considered sensitive receptors due to the limited duration and frequency of exposure to any given source of air pollution while attending the park.[9]

3.3.2 <u>Air Quality Impacts</u>

3.3.2.1 *Thresholds of Significance*

For the purposes of this EIR, an air quality impact is considered significant if the project would:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Violate an ambient air quality standard or contribute substantially to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative threshold for ozone precursors);
- Expose sensitive receptors to substantial levels of toxic air contaminants; or
- Create objectionable odors affecting a substantial number of people.

[9] Significance thresholds for health risk assessments are based on a 70-year exposure.

3.3.2.2 *CEQA Thresholds Used in the Analysis*

As discussed in CEQA Guidelines Section 15064(b), the determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the Lead Agency and must be based to the extent possible on scientific and factual data. The City of Santa Clara, and other jurisdictions in the San Francisco Bay Area Air Basin, often utilize the thresholds and methodology for assessing air emissions and/or health effects developed by the BAAQMD based upon the scientific and other factual data prepared by BAAQMD in developing those thresholds.

In December 2010, the California Building Industry Association (BIA) filed a lawsuit in Alameda County Superior Court challenging TACs and $PM_{2.5}$ thresholds adopted by BAAQMD in its 2010 CEQA Air Quality Guidelines (California Building Industry Association v. Bay Area Air Quality Management District, Alameda County Superior Court Case No. RG10548693). One of the identified concerns is inhibiting infill and smart growth in the urbanized Bay Area. On March 5, 2012, the Superior Court found that the adoption of thresholds by the BAAQMD in its CEQA Air Quality Guidelines is a CEQA project and BAAQMD is not to disseminate officially sanctioned air quality thresholds of significance until BAAQMD fully complies with CEQA. No further findings or rulings on the thresholds in the BAAQMD CEQA Air Quality Guidelines were made.

The City understands the effect of the lawsuit to be that BAAQMD may eventually prepare an environmental review document before BAAQMD adopts the same or revised thresholds. The ruling in the case; however, does not equate to a finding that the quantitative metrics in the BAAQMD thresholds are incorrect or unreliable for meeting goals in the Bay Area 2010 Clean Air Plan. Moreover, as noted above, the determination of whether a project may have a significant effect on the environment is subject to the discretion of each Lead Agency, based upon substantial evidence. Notwithstanding the BIA lawsuit, which has no binding or preclusive effect on the City of Santa Clara's discretion to decide on the appropriate thresholds to use for determining the significance of air quality impacts, the City has carefully considered the thresholds previously prepared by BAAQMD and regards the thresholds listed below to be based on the best information available for the San Francisco Bay Area Air Basin and conservative in terms of the assessment of health effects associated with TACs and $PM_{2.5}$. Evidence supporting these thresholds has been presented in the following documents:

- BAAQMD. *Thresholds Options and Justification Report*. 2009.
- BAAQMD. *CEQA Air Quality Guidelines.* May 2011. (Appendix D)
- California Air Pollution Control Officers Association (CAPCOA). *Health Risk Assessments for Proposed Land Use Projects*. 2009.
- California Environmental Protection Agency, California Air Resources Board (CARB). *Air Quality and Land Use Handbook: A Community Health Perspective*. 2005.

The analysis in this EIR is based upon the general methodologies in the most recent BAAQMD CEQA Air Quality Guidelines (May 2012) and numeric thresholds for the San Francisco Bay Basin, including the thresholds listed in Table 3.3-3.

Table 3.3-3
Thresholds of Significance Used in Air Quality Analyses

Pollutant	Construction	Operation-Related	
	Average Daily Emissions (pounds/day)	Average Daily Emissions (pounds/day)	Maximum Annual Emissions (tons/year)
ROG, NO_x	54	54	10
PM_{10}	82 (exhaust)	82	15
$PM_{2.5}$	54 (exhaust)	54	10
Fugitive Dust (PM_{10}/$PM_{2.5}$)	Best Management Practices	None	None
Risk and Hazards for New Sources and Receptors (Project)	Same as Operational Threshold	• Increased cancer risk of >10.0 in one million • Increased non-cancer risk of > 1.0 Hazard Index (chronic or acute) • Ambient $PM_{2.5}$ increase: > 0.3 μ/m^3 [Zone of influence: 1,000-foot radius from property line of source or receptor]	
Risk and Hazards for New Sources and Receptors (Cumulative)	Same as Operational Threshold	• Increased cancer risk of >100 in one million • Increased non-cancer risk of > 10.0 Hazard Index (chronic or acute) • Ambient $PM_{2.5}$ increase: > 0.8 μ/m^3 [Zone of influence: 1,000-foot radius from property line of source or receptor]	

Sources: *BAAQMD Thresholds Options and Justification Report (2009)* and *BAAQMD CEQA Air Quality Guidelines* (dated May 2011).

3.3.2.3 *Long-Term Air Quality Impacts*

2010 Clean Air Plan

The most recent regional clean air plan is the *Bay Area 2010 Clean Air Plan* (2010 CAP) that was adopted by BAAQMD in September 2010. This plan addresses air quality impacts with respect to obtaining ambient air quality standards for non-attainment pollutants (i.e., O_3, PM_{10} and $PM_{2.5}$), reducing exposure of sensitive receptors to TACs, and reducing greenhouse gas (GHG) emissions such that the region can meet AB 32 goals of reducing emissions to 1990 levels by 2020. The consistency of the proposed project with this regional plan is primarily a question of the consistency with the population/ employment assumptions utilized in developing the 2010 CAP, which were based on Association of Bay Area Governments (ABAG) Projections. While the proposed project would increase jobs, it would not affect population in the region and is consistent with the 2010 CAP.

The 2010 CAP includes about 55 control measures that are intended to reduce air pollutant emissions in the Bay Area either directly or indirectly. The control measures are divided into five categories that include:

- Measures to reduce stationary and area sources;
- Mobile source measures;
- Transportation control measures;
- Land use and local impact measures; and
- Energy and climate measures

The consistency of the proposed project was evaluated with respect to each set of control measures. The analysis found that because the project will be required to implement a TDM program, it is consistent with the CAP. The CAP includes transportation control measures (TCMs) that are strategies meant to reduce vehicle trips, vehicle use, vehicle miles traveled (VMT), vehicle idling, or traffic congestion for the purpose of reducing motor vehicle emissions. While most of the TCMs are implemented at the regional level [e.g., by the Metropolitan Transportation Commission (MTC) or Caltrans], there are measures that the CAP relies upon local communities to assist with implementation. The City's latest General Plan update includes measures to reduce vehicle travel that are consistent with the CAP TCMs. In addition, the 2010-2035 General Plan committed the City to developing and adopting a Climate Action Plan that would require additional TCMs consistent with CAP measures intended to reduce automobile use and to facilitate non-auto linkages through a network. Because the project will be required to implement a TDM program, it is considered to have a less than significant impact.

Impact AQ-1: The proposed project will implement a TDM program and will comply with the 2010 Clean Air Plan. **(Less Than Significant Impact)**

Impacts on Regional Air Quality

The Bay Area is considered a non-attainment area for ground-level O_3 and $PM_{2.5}$ under both the Federal Clean Air Act and the California Clean Air Act. The area is also considered non-attainment for respirable particulates or particulate matter with a diameter of less than 10 micrometers (PM_{10}) under the California Clean Air Act.

The CalEEMod model along with the project vehicle trip generation rates were used to analyze air pollutant emissions associated with operation of the proposed project. The model uses mobile emission factors from the CARB's EMFAC2007 model and adjusts these based on the effect of new regulations to reduce GHG emissions. These regulations include the Pavley Rule that increases fleet efficiency (reducing fuel consumption) and the low carbon fuel standard. This model is sensitive to the year selected, since vehicle emissions have and continue to be reduced due to more stringent exhaust controls, newer vehicle fleet, fuel efficiency standards and low carbon fuels.

The proposed development was assumed to be fully operational in 2017. The project trip generation rates were used to calculate vehicle emissions and incorporated a five percent trip reduction for the entire development based on the proposed TDM program. In addition to vehicle trips, the proposed 600,000 s.f. of new office space was assumed to be constructed with LEED Silver energy efficiency measures. The analysis also accounted for area source emissions associated with natural gas consumption (primarily space and water heating), use of landscape equipment, consumer products, and architectural coatings.

In summary, the project would expand the existing office space on the site by 600,000 s.f. The expanded office space and additional traffic trips were modeled for year 2017 (the earliest practical occupancy date). Estimated daily emissions are shown in Table 3.3-4 and compared against the applicable air quality thresholds.

Table 3.3-4
Project Regional Emissions in Pounds Per Day

	ROG	NO_x	PM_{10}	$PM_{2.5}$
Proposed Project 2017	93.2	59.5	54.6	4.9
Existing Use 2013	43.0	35.2	23.8	2.3
Net Emissions	50.2	24.3	30.8	2.6
Daily Emissions Threshold	54	54	82	54

The project would include diesel-powered emergency generators at each building. The specifications of these generators have not been identified at this time. Diesel generators would be a source of air pollutant emissions during routine testing which would occur monthly for 15 minutes to an hour. The primary emissions are NO_x and DPM. Since these generators are likely to exceed 50 horsepower, they would be subject to BAAQMD permitting requirements. The generator engines would be required to meet BAAQMD emission standards to ensure that health risks associated with DPM emissions would be acceptable. Sources of air pollutant emissions complying with all applicable BAAQMD regulations generally are not considered to have a significant air quality impact. No other stationary air pollutant sources have been identified. Stationary sources that are exempt from BAAQMD permit requirements due to low emission thresholds would not be considered to have a significant air quality impact.

Project development would increase emissions of ROG, NO_x and PM_{10}. As shown in Table 3.3-4, these emissions would not exceed the air quality significance thresholds.

Impact AQ-2: The proposed project would not result in significant regional air quality impacts associated with reactive organic gases (ROG), nitrogen oxides (NO_x), respirable particulates (PM_{10}), and fine particulate ($PM_{2.5}$) emissions. **(Less Than Significant Impact)**

Impacts on Local Air Quality

CO emissions from traffic generated by the project would be the greatest pollutant concern at the local level. Congested intersections with a large volume of traffic have the greatest potential to cause high-localized concentrations of CO. Measured CO levels have been at healthy levels (i.e., below state and federal standards) in the Bay Area since the early 1990s. As a result, the region has been designated as attainment for the standard. There is an ambient air quality monitoring station in central San José that measures CO concentrations. The highest measured level over any eight-hour

averaging period during the last three years is less than 3.0 parts per million (ppm) compared to the ambient air quality standard of 9.0 ppm.

The project screening guidance recommended by BAAQMD indicates that the project would not contribute significantly to CO levels if project traffic levels would not exceed 44,000 vehicles per hour at any affected intersection. The project would generate 6,046 net new daily trips and would not result in any of the affected study intersection exceeding 44,000 vehicles per hour.

Impact AQ-3: Vehicle emissions from project-generated traffic would not result in a significant increase in carbon monoxide levels at local intersections. **(Less Than Significant Impact)**

Community Risk Impacts

Local community risk and hazard impacts are associated with TACs and $PM_{2.5}$ because emissions of these pollutants can have significant health impacts at the local level. Although located near Great America Parkway and Mission College Boulevard, sources of TAC emissions from traffic, the project site does not include sensitive receptors. There are no sensitive receptors[10] located near the project site, therefore, emissions of TACs associated with construction and operation of the project would not impact sensitive receptors.

Impact AQ-4: The project does not include sensitive receptors and it would not generate TAC emissions in proximity to sensitive receptors and, therefore, would have a less than significant community risk impact. **(Less Than Significant Impact)**

3.3.2.4 *Short-Term Air Quality Impacts*

Construction Dust Emissions

Dust would be generated during demolition, grading and construction activities. Most of the dust would be generated during grading activities. The amount of dust generated would be highly variable and is dependent on the size of the area disturbed at any given time, amount of activity, soil conditions and meteorological conditions. Typical winds during late spring through summer are from the north. Nearby land uses include commercial space or offices, hotels, and the Great America theme park. These nearby active land uses could be adversely affected by dust generated during construction activities.

Impact AQ-5: Dust generated by grading and construction activities would result in a significant temporary impact. **(Significant Impact)**

[10] Great America Theme Park visitors are not considered sensitive receptors for air quality analysis due to the limited duration and frequency of visits to the park.

Construction Exhaust Emissions

Construction of the project is anticipated to begin in September of 2014 and last for approximately 30 months, ending in March of 2017. While it is not certain at this time if demolition of existing buildings will occur, demolition of an existing 118,000 s.f. building is possible and was included in the modeling to provide for a worst-case construction emissions scenario. Similarly, the construction of 718,000 s.f. of new office buildings was assumed for modeling, though as little as 600,000 s.f. of new office building construction may ultimately occur. The construction of new parking structure with up to 3,359 spaces was also included in the modeling. No import or export of fill material was assumed for construction given the limited grading necessary for project construction.
Table 3.3-5 summarizes the estimated average daily emissions from project construction. Average daily emissions were computed by dividing the total construction period emissions by the number of anticipated construction days. Much of the emissions were anticipated to occur over approximately 660 work days during the approximately 30-month construction period.

Construction exhaust emissions would be significant, since NO_x emissions are anticipated to exceed the significance threshold of 54 pounds per day, on an average daily basis. ROG emissions are just below the significance threshold. Construction BMPs are necessary during trenching and grading activities to avoid generation of dust that may affect nearby sensitive receptors. The implementation of BMPs would reduce exhaust emissions by approximately five percent. Additional mitigation measures would be needed to reduce exhaust emissions during construction.

Table 3.3-5
Construction Emissions

	ROG	NO_x	PM_{10}	$PM_{2.5}$
2014 Annual Emissions (tons)	0.31	2.44	0.11	0.11
2015 Annual Emissions (tons)	1.63	8.73	0.37	0.37
2014 Annual Emissions (tons)	1.48	7.75	0.33	0.33
2015 Annual Emissions (tons)	14.37	0.20	0.02	0.02
Average Daily Emissions (lbs/day)	53.9	57.9	2.5	2.5
Daily Emissions Threshold	54	54	82	54

Impact AQ-6: Project construction activities would emit significant levels of criteria air pollutants that would affect local and regional air quality. **(Significant Impact)**

Construction Community Risk Impacts

Construction activity would generate dust and equipment exhaust on a temporary basis that could affect nearby land uses. Construction activity is anticipated to include demolition of an existing building and associated paved areas, grading and excavation, building construction, paving, and application of architectural coatings. The closest residences or sensitive receptors are located greater

than 1,000 feet from the project site. According to BAAQMD screening guidance, project construction activities for 1,000,000 s.f office buildings would have less than significant health risk impacts at distances of 300 meters (~1,000 feet) from the edge of construction sites. Therefore, a health risk assessment is not necessary to conclude the project would have less than significant impacts on sensitive receptors due to TACs and $PM_{2.5}$ emissions from construction.

Impact AQ-7: The project is not located proximate to sensitive receptors that would be affected by construction TAC and $PM_{2.5}$ emissions. **(Less Than Significant Impact)**

3.3.2.5 *Odor Impacts*

The proposed office uses would not produce offensive odors. During construction, the various diesel powered vehicles and equipment in use on-site may create localized odors. These odors would be temporary and not likely to be noticeable for extended periods of time much beyond the boundaries of the project site. There are no sensitive receptors[11] adjacent to the site that would be adversely affected by construction-related odors. The project site is not affected by existing odor sources that would cause odor complaints.

Impact AQ-8: The proposed project would not result in significant localized or long-term odor. **(Less Than Significant Impact)**

3.3.3 Mitigation Measures

As conditions of approval, the project applicant shall be responsible for the implementation of the following measures to reduce construction air quality impacts:

MM AQ-5.1: During any construction ground disturbance, implement measures to control dust and exhaust. Implementation of the measures recommended by BAAQMD, and listed below, would reduce the air quality impacts associated with grading and new construction to a less than significant level. The contractor shall implement the following BMPs that are required of all development projects:

- All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
- All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 mph.
- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after

[11] Ibid.

grading unless seeding or soil binders are used.

- All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.
- Post a publicly visible sign with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

MM AQ-6.1: Consistent with guidance from the BAAQMD, the following additional actions shall be required of construction contracts and specifications for the project:

- Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to two minutes. Clear signage shall be provided for construction workers at all access points.
- The project shall develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used in the construction project (i.e., owned, leased, and subcontractor vehicles) would achieve a project wide fleet-average 20 percent NO_X reduction compared to the most recent Air Resources Board (ARB) fleet average. Acceptable options for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available.
- All construction equipment, diesel trucks, and generators shall be equipped with Best Available Control Technology for emission reductions of NO_X.
- All contractors shall use equipment that meets ARB's most recent certification standard for off-road heavy duty diesel engines.

After implementation of Mitigation Measure AQ-5.1 (estimated five percent reactive organic gases, NO_X and particulate matter reduction for off-road equipment exhaust emissions) and AQ-6.1 (estimated 20 percent NO_X reduction for off-road equipment), NO_X emissions are estimated to be 52.2 pounds per day, which is below the significance threshold of 54 pounds per day.

3.3.4 Conclusion

Impact AQ-1: The proposed project will implement a TDM program and will comply with the 2010 Clean Air Plan. **(Less Than Significant Impact)**

Impact AQ-2: The proposed would not result in significant regional air quality impacts associated with ROG, NOx, PM_{10}, and $PM_{2.5}$ emissions. **(Less Than Significant Impact)**

Impact AQ-3: Vehicle emissions from project-generated traffic would not result in a significant increase in CO levels at local intersections. **(Less Than Significant Impact)**

Impact AQ-4: The project does not include sensitive receptors and it would not generate TAC emissions in proximity to sensitive receptors and, therefore, would have a less than significant community risk impact. **(Less Than Significant Impact)**

Impact AQ-5: Implementation of the mitigation measure identified above would reduce dust generated by grading and construction activities to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact AQ-6: Implementation of the mitigation measures identified above would reduce levels of criteria air pollutants from dust and exhaust emissions generated during construction of the project to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact AQ-7: The project is not located proximate to sensitive receptors that would be affected by construction TAC and $PM_{2.5}$ emissions. **(Less Than Significant Impact)**

Impact AQ-8: The proposed project would not result in significant localized or long-term odor. **(Less Than Significant Impact)**

3.4 NOISE AND VIBRATION

The following discussion is based on an Environmental Noise Assessment prepared by *Illingworth & Rodkin, Inc.* in May 2013. A copy of this report is included as Appendix C in this EIR.

3.4.1 Existing Setting

3.4.1.1 *Fundamental Concepts of Environmental Noise and Vibration*

Environmental Noise

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB) with 0 dB corresponding roughly to the threshold of human hearing.

There are several methods of characterizing sound. The most common in California is the A-weighted sound level or dBA. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive.

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources, which create a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors, L_{01}, L_{10}, L_{50}, and L_{90}, are commonly used. They are the A-weighted noise levels equaled or exceeded during one percent, 10 percent, 50 percent, and 90 percent of a stated time period. A single number descriptor called the L_{eq} is also widely used. The L_{eq} is the average A-weighted noise level during a stated period of time. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

Sound level meters can accurately measure environmental noise levels to within plus or minus one dBA. Since the sensitivity to noise increases during the evening hours, 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Day/Night Average Sound Level, Ldn*, is the average A-weighted noise level during a 24-hour day, obtained after the addition of 10 dB to noise levels measured in the nighttime between 10:00 PM and 7:00 AM.

The most widespread and continual source of noise in Santa Clara is transportation and transportation-related facilities. Freeways, local arterials, the Norman Y. Mineta San Jose International Airport, railroads, and Light Rail Transit are all major contributors to noise in Santa Clara. The Great America Theme Park is located along the eastern property boundary of the project site. The park is open seven days a week during the summer months and on weekends during the spring and fall and would also be a source of noise in the project area during the months of the year the park is operational.

Groundborne Vibration

Several different methods are typically used to quantify groundborne vibration amplitude. One is the peak particle velocity (PPV) and another is the root mean square (RMS) velocity. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration. In this analysis, a PPV descriptor with units of millimeters per second (mm/sec.) or inches per second (in/sec.) is used to evaluate construction generated vibration for building damage and human complaints. The reactions of people and the effects on buildings that continuous vibration levels produce are shown in Table 3.4-1.

Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Table 3.4-1
Reaction of People and Damage to Buildings for Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe – Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation- and Construction-Induced Vibration Guidance Manual, California Department of Transportation, June 2004.

3.4.1.2 *Regulatory Background*

Environmental Noise

The State of California and the City of Santa Clara have established plans and policies designed to limit noise exposure at noise sensitive land uses. These plans and policies are contained in the following documents: (1) the State CEQA Guidelines, Appendix G, (2) the State of California Building Code, (3) the City of Santa Clara's Noise Element of the 2010-2035 General Plan, and (4) the City of Santa Clara Municipal Code.

State CEQA Guidelines

The California Environmental Quality Act (CEQA) contains guidelines to evaluate the significance of effects resulting from a proposed project. These guidelines have been used in this EIR as thresholds for establishing potentially significant noise and vibration impacts and are listed in *Section 3.4.2.1 Thresholds of Significance*.

CEQA does not define what noise level increase would be considered substantial. Typically, an increase in the L_{dn} noise level resulting from the project at noise sensitive land uses of three dBA L_{dn} or greater would be considered a significant impact when projected noise levels would exceed those considered acceptable for the affected land use (60 dBA L_{dn}). An increase of five dBA L_{dn} or greater would be considered a significant impact when projected noise levels would remain within those considered acceptable for the affected land use.

State of California Building Code (2010)

The Green Building Standards of the State of California Code of Regulations (CALGreen Code) establishes mandatory exterior sound transmission control standards for new non-residential buildings. Acoustical controls require that new construction employ building assemblies and components with Sound Transmission Class (STC) values determined in accordance with ASTM E90 and ASTM E413 or Outdoor-Indoor Sound Transmission Class (OITC) determined in accordance with ASTM E1332.

City of Santa Clara 2010-2035 General Plan

Based on the City's 2010-2035 General Plan Noise Element, Table 3.4-2 shows the noise levels considered compatible with specific land uses. Commercial land uses, including offices, are considered compatible with L_{dn} noise levels of up to 65 dBA and acceptable with design and insulation techniques in areas with L_{dn} noise levels up to 75 dBA.

Table 3.4-2
Noise and Land Use Compatibility (L_{dn} & CNEL)

Land Use	50	55	60	65	70	75	80	85
Residential								
Educational								
Recreational								
Commercial								
Industrial								
Open Space								

Compatible

Require Design and insulation to reduce noise levels

Incompatible. Avoid land use except when entirely indoors and an interior noise level of 45 Ldn can be maintained

Source: *City of Santa Clara 2010-2035 General Plan*

City of Santa Clara Municipal Code

The City's Municipal Code establishes noise level performance standards for fixed sources of noise. Noise levels generated on the project site would be limited to 65 dBA during daytime hours and 60 dBA at night at adjoining commercial land uses. Construction activities occurring during daytime hours are specifically exempted from these limits. Section 9.10.230 limits construction within 300 feet of any residentially zoned properties between the hours of 7:00 A.M. to 6:00 P.M. on weekdays other than holidays, and within the hours of 9:00 A.M. to 6:00 P.M. on Saturdays and is prohibited on Sundays and holidays.

Groundborne Vibration

City of Santa Clara Municipal Code

The City's Municipal Code qualitatively discusses vibration levels from fixed sources of vibration. Vibration resulting from construction activities is exempt from the Municipal Code standards provided that construction activities occur during allowable daytime hours, as stated above.

3.4.1.3 *Existing Noise Environment*

The project site is located northeast of the intersection of Great America Parkway and Mission College Boulevard. The site is bordered by commercial land uses including hotels, office buildings, and the Great America Theme Park. The nearest residential land uses are located approximately 2,000 feet east of the site, opposite the theme park.

An ambient noise monitoring survey was conducted on the afternoon of December 3, 2007 to quantify existing noise levels at the project site. The predominant sources of noise measured at the site included vehicular traffic along Great America Parkway and jet aircraft from the Norman Y. Mineta San José International Airport. Aside from the Santa Clara Stadium Project that is currently under construction, there have not been any other major developments in the project vicinity within the last five years that would substantially change existing ambient noise levels. The noise data collected at the site in 2007 are still considered representative of existing conditions, and are consistent with existing traffic noise levels modeled during the General Plan Update project in 2010.

Short-term noise measurement location ST-1 was approximately 150 feet from the center of Great America Parkway at the approximate 30-foot setback from the property line for allowed office buildings on the site. Noise levels were measured for a period of ten minutes beginning at 1:25 P.M. The average noise level measured at this location was 62 dBA L_{eq}. The short-term noise measurement was then compared to noise data collected over a 24-hour period in the project vicinity[12] to estimate the relationship between mid-day noise levels and daily average noise levels (L_{dn}). The L_{dn} noise levels at this location are estimated to be 64 dBA. A second short-term noise measurement was made at the site's easternmost property boundary, adjacent to the Great America Theme Park. The theme park was closed at the time. Ambient noise levels measured at this location were primarily the result of distant vehicular traffic and jet aircraft. The average noise level was 56 dBA L_{eq}. The L_{dn} at this location is estimated to be 60 dBA.

Noise attributable to operations at the Great America Theme Park has been estimated at the project site based on a review of a report prepared by *Wilson, Ihrig, and Associates, Inc*. in 2008 to identify noise levels from a proposed roller coaster. As part of the previous study, worst-case screaming noise levels were determined to reach 91 dBA L_{max}[13] at a distance of 50 feet. Shielding and directionality result in approximately two to four dBA of noise reduction and these noise levels attenuate at a rate of 4.5 to 6 dB per doubling of distance from the noise source. Based on the above data, noise levels resulting from riders' screams at the Great America Theme Park are estimated to be 77 to 82 dBA L_{max} at the eastern property line of the site.

3.4.2 Noise and Vibration Impacts

3.4.2.1 *Thresholds of Significance*

For the purposes of this EIR, a noise or vibration impact is considered significant if the project would:

- Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Expose persons to, or generate excessive groundborne vibration or groundborne noise levels;
- Create a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

[12] Illingworth & Rodkin, Inc. *49ers Stadium Project Environmental Noise Assessment*. February 24, 2009.
[13] L_{max} is the maximum A-weighted noise level reached during a given measurement period.

- Create a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;
- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels; or
- For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels.

A substantial permanent noise increase would occur if the noise level increase resulting from the project is three dBA L_{dn} or greater at noise-sensitive land uses, with a future noise level of 60 dBA L_{dn} or greater, or five dBA L_{dn} or more where future noise levels would remain below 60 dBA L_{dn}. A substantial temporary noise level increase would occur where noise from construction activities exceeds 70 dBA L_{eq} and the ambient noise environment by at least five dBA L_{eq} at adjacent land uses in the project vicinity for a period of one year or more.

3.4.2.2 *Noise Impacts to the Project*

Future Noise Levels

Office buildings proposed as part of the project would be set back a minimum of 30 feet from the property lines located on Patrick Henry Drive, Great America Parkway, and Mission College Boulevard. Future traffic noise levels are anticipated to increase by three dBA L_{dn} above existing conditions as a result of cumulative growth forecast in the 2010-2035 General Plan. Exterior noise levels would reach 70 dBA L_{dn} at the westernmost or southernmost facades of office buildings proposed along Great America Parkway and Mission College Boulevard. The exterior noise environment would exceed the City's 65 dBA L_{dn} compatibility threshold for proposed commercial land uses. Similarly, office buildings proposed within 200 feet of the center of Great America Parkway or 150 feet of Mission College Boulevard could be exposed to noise levels exceeding 65 dBA L_{dn}, triggering mandatory exterior sound transmission controls, as established by the CALGreen Building Code.

For office developments, the noise and land use compatibility guidelines are designed to screen projects and provide guidance in determining when special building sound insulation treatments may be necessary in order to adequately control the intrusion of environmental noise. The noise level goal for average noise levels inside offices varies depending upon the type of office space. Typically, traffic noise levels should be reduced to an hourly average noise level between 35 and 45 dBA L_{eq}. Standard office construction normally provides 30 dBA of noise reduction in interior spaces. An additional five dBA reduction in noise levels typically results due to room absorption and spreading losses as the noise propagates within the interior of the office. Predicted interior noise levels in proposed office buildings would be approximately 40 dBA L_{eq} assuming standard office construction. These interior noise levels would be compatible with the proposed use and would meet the 50 dBA L_{eq} noise limit established in the CALGreen Code.

Office buildings may be constructed as close as 10 feet from the easternmost boundary of the site, near the Great America Theme Park. At this location, intermittent peak noise levels resulting from amusement park-riders' screams are calculated to be 77 to 82 dBA L_{max} at the office building facade.

Assuming standard office construction methods, room absorption, and spreading losses, predicted interior noise levels resulting from amusement park-riders' screams would range from 42 to 47 dBA L_{max} which is still within the 50 dBA noise limit established in the CALGreen Code.

While it is not necessary as mitigation for a noise impact, additional noise control could be accomplished for private offices and conference rooms, as needed, through building design by selecting sound-rated windows (STC 35-40 or greater) for sensitive interior spaces along the westernmost or southernmost facades of the proposed buildings, adjacent to traffic noise sources, and along the facades of buildings oriented toward Great America Theme Park.

A review of the 65 dBA CNEL noise contour map in the adopted CLUP for the Norman Y. Mineta San José International Airport indicates that the project site is located outside of the future 65 dBA CNEL noise contour. Office land uses would be compatible in such an exterior noise environment and standard construction methods would adequately reduce aircraft noise levels indoors.

Impact NV-1: Standard office construction practices would provide sufficient noise reduction in interior spaces to comply with noise limits established in the CALGreen Code. **(Less Than Significant Impact)**

3.4.2.3 *Noise Impacts from the Project*

Project-Generated Traffic Noise

Project-generated traffic noise level increases along roadways in the project vicinity were calculated based on turning movement counts at 43 intersections for baseline conditions and baseline plus project conditions. Roadway link volumes (the total volume of traffic along a roadway segment) were calculated based on turning movement data and compared to existing conditions to calculate the anticipated noise level increase attributable to the project. Noise levels along roadways in the site vicinity will increase by less one dBA L_{dn} as a result of the project.

Impact NV-2: Traffic-generated noise levels would not be noticeably or measurably increased as a result of the project. **(Less Than Significant Impact)**

Operational Noise Sources

The operation of the project would introduce new sources of noise that may permanently increase noise levels at adjacent receivers. These sources of noise would be similar to current noise sources resulting from the existing land use including the operation of mechanical equipment and the operation of the proposed parking garage and surface parking areas.

Mechanical equipment associated with office buildings normally includes heating, ventilation, and air conditioning systems. Emergency generators are proposed to provide power to the office buildings in case of power outages. Specific details regarding the size, type, and locations of the generators are unknown at this time. This analysis assumes that the proposed generators would be located in acoustical enclosures, similar to existing emergency generators located on the site. The Municipal Code requires that noise from the operation of such equipment not exceed 65 dBA during

the day or 60 dBA at night at nearby commercial uses. Although detailed specifications regarding these systems are not available during this early phase of project planning, noise levels resulting from the operation of HVAC equipment or emergency generators is not anticipated to exceed 65 dBA during the day or 60 dBA at night at commercial uses in the project's vicinity or be audible above ambient conditions given the multitude of noise sources in the area. The operation of HVAC equipment or emergency generators would not be audible at nearby hotels located south of the site or at residences located over 2,000 feet away given the existing noise levels on the site, with buildings containing such equipment, and the distance to sensitive uses.

Parking would be provided within a parking garage of up to six-stories located along the easternmost portion of the site adjacent to the Great America Theme Park. Based on past noise measurements taken at a parking structure similar to the one proposed, maximum instantaneous noise levels measured approximately 75 feet from the facade of a typical garage at ground level ranged from 53 dBA to 70 dBA. Parking garage noise sources such as doors opening and closing, engines starting, and the use of horns are infrequent and would not be expected to cause an increase in ambient hourly average noise levels at the nearest commercial property line. The louder noises would be intermittently audible, but would generally be at levels below the sounds emanating from the theme park or generated when aircraft pass over the site. Parking garage sounds would not be discernible at nearby hotels located south of the site or at residences located over 2,000 feet away.

Impact NV-3: Noise levels generated by the operation of the project would not exceed the standards established in the Santa Clara Municipal Code. **(Less Than Significant Impact)**

3.4.2.5 *Construction Impacts*

Construction Noise

Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise sensitive receptors. Where noise from construction activities exceeds 70 dBA L_{eq} and the ambient noise environment by five dBA L_{eq} or more at nearby office and commercial land uses for a period of more than one construction season, the impact would be considered significant.

Construction activities generate considerable amounts of noise, especially during the demolition phase and the construction of project infrastructure when heavy equipment is used. Hourly average noise levels generated by demolition and construction are about 77 dBA to 89 dBA L_{eq} measured at a distance of 50 feet from the center of a busy construction site. During impact pile driving, hourly average noise levels could reach 94 dBA L_{eq} at 50 feet. Maximum noise levels generated during demolition would typically range from 85 to 105 dBA L_{max} assuming the operation of jackhammers, hoe rams, or impact pile drivers. Construction generated noise levels drop off at a rate of about six dBA per doubling of distance between the source and receptor. Shielding provided by barriers or structures can provide an additional five to ten dBA noise reduction at distant receivers.

The nearest office buildings north of the site are located approximately 100 feet from project site

areas where major construction activities would occur. Areas within the Great America Theme Park where visitors may congregate (public pathways/waiting areas for rides, etc.) and be aware of construction on the project site are located about 200 feet from proposed construction areas. Commercial office buildings are located approximately 275 feet west of the site and a hotel is located approximately 600 feet to the south.

Table 3.4-3 shows the range in hourly average noise levels expected at nearby office and commercial uses during construction of the proposed project. Noise from typical phases of construction (i.e., ground clearing, excavation, foundations, erection, and finishing) would range from 55-83 dBA L_{eq} at adjacent commercial and office uses when construction activities occur near the periphery of the site and would exceed 70 dBA L_{eq} when these phases of construction occur within about 450 feet of these receivers. Hourly average noise levels would reach 88 dBA L_{eq} at the nearest office building to the north when construction activities occur at the north end of the site. Pile driving noise levels would typically range from 72-82 dBA L_{eq} at the commercial uses to the east, south, and west when pile driving occurs near the periphery of the site. Hourly average noise levels would exceed 70 dBA L_{eq} when pile driving activities occur within about 800 feet of adjacent commercial uses. Construction noise levels would be less than 60 dBA L_{eq} at the nearest residential uses over 2,000 feet from the project site. Construction noise levels would at times be intrusive inside offices facing the project site and in exterior use areas at adjacent hotels and the theme park. Noise resulting from project construction activities would exceed 70 dBA L_{eq} and the ambient noise environment by more than five dBA L_{eq} for more than one construction season. Proposed construction activities would substantially increase ambient noise levels at nearby office buildings and the Great America Theme Park and resulting in a significant temporary noise impact.

Table 3.4-3
Range of Construction Noise Levels at Nearby Commercial Uses (dBA Leq)

Direction of Nearest Receivers	Distance from Areas Proposed for Construction	Land Use Type	Typical Construction Noise Level Range	Pile Driving Construction Noise Levels
North	100	Office	71-83	88
East	200	Theme Park	65-77	82
South	600	Hotel	55-67	72
West	275	Office	62-74	79

Impact NV-4: Noise generated by construction activities at the project site would exceed 70 dBA L_{eq} and the ambient noise environment by five dBA L_{eq} or more for a period exceeding one construction season. **(Significant Impact)**

Vibration Impacts

Demolition and construction activities proposed as part of the project may generate perceptible vibration levels when heavy equipment or impact tools (e.g. jackhammers, pile drivers, hoe rams) are

used in the vicinity of nearby commercial land uses. Distinctly perceptible groundborne vibration levels could be generated by heavy tracked vehicles (e.g., bulldozers or excavators) when these equipment operate within approximately 25 feet of sensitive land uses. Impact pile drivers can generate distinctly perceptible groundborne vibration levels at distances up to about 100 feet. The existing office building that may be demolished and the proposed office buildings and structured parking garage are a minimum distance of 150 feet from sensitive receiving areas at nearby commercial uses. Groundborne vibration levels generated by demolition or construction activities would not generally be perceptible at adjacent buildings or use areas. Anticipated vibration levels would not be expected to result in cosmetic or structural damage to adjacent buildings.

There are no other known sources of vibration that would affect the project site (e.g., railroad trains) or vicinity that are included as part of the project.

Impact NV-5: Vibration levels generated during demolition and construction activities would not generally be perceptible at neighboring land uses and would not be excessive or cause cosmetic or structural damage to adjacent buildings. **(Less Than Significant Impact)**

3.4.3 Mitigation Measures

As conditions of approval, the project applicant shall be responsible for the implementation of the following measures to reduce noise and vibration impacts:

MM NV-4.1: The applicant, in coordination with the Director of Planning & Inspection and adjacent land uses, shall implement a construction noise mitigation plan so that construction activities can be scheduled to minimize noise disturbance. The construction mitigation plan shall consider the following available controls to reduce construction noise levels as low as practical.

- Prohibit construction on weekends and holidays to minimize disturbance at the Great America Theme Park;
- Utilize ‘quiet’ models of air compressors and other stationary noise sources where technology exists;
- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment;
- Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from adjacent land uses;
- Locate staging areas and construction material areas as far away as possible from adjacent land uses;
- Prohibit all unnecessary idling of internal combustion engines;
- Notify all adjacent land uses of the construction schedule in writing;
- Designate a “disturbance coordinator” who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable

measures warranted to correct the problem be implemented; and

- Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

Noise reduction measures will be incorporated into the construction mitigation plan and implemented during all phases of construction activity to minimize the exposure of neighboring properties. This measure, in combination with the limitations on construction hours set forth in the Noise Ordinance, would reduce the temporary impact of construction noise to a less than significant level.

3.4.4 Conclusion

Impact NV-1: Standard office construction would provide sufficient noise reduction in interior spaces to comply with noise limits established in the CALGreen Code. **(Less Than Significant Impact)**

Impact NV-2: Traffic-generated noise levels would not be noticeably or measurably increased as a result of the project. **(Less Than Significant Impact)**

Impact NV-3: Noise levels generated by the operation of the project would not exceed the standards established in the Santa Clara Municipal Code. **(Less Than Significant Impact)**

Impact NV-4: Implementation of a construction noise mitigation plan, incorporating available noise reduction methods, would reduce the impacts of construction noise levels at adjacent commercial and office land uses to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact NV-5: Vibration levels generated during demolition and construction activities would not generally be perceptible at neighboring land uses and would not be excessive or cause cosmetic or structural damage to adjacent buildings. **(Less Than Significant Impact)**

3.5 GEOLOGY AND SOILS

The following discussion is based on a Geotechnical Feasibility Study prepared by *Cornerstone Earth Group* in January 2008. A copy of this study is included as Appendix D in this EIR.

3.5.1 Existing Setting

3.5.1.1 *Geology and Soils*

The site is located within the Santa Clara Valley, which is a broad alluvial plane between the Santa Cruz Mountains to the southwest and west, and the Diablo Range to the northeast. The San Andreas Fault system, including the Monte Vista-Shannon Fault, exists within the Santa Cruz Mountains and the Hayward and Calaveras Fault systems exist within the Diablo Range. Alluvial soil thicknesses in the areas of Santa Clara and North San José range from about 300 to greater than 700 feet.

The site is located at approximately 20 feet above mean sea level (MSL) and is relatively flat, but graded to drain to storm drainage facilities. The existing buildings are surrounded by asphalt concrete paved parking lots and associated landscaping areas. The site is located equidistant between San Tomas Aquino and Calabazas Creeks (approximately one-half mile to the east and west, respectively). The Guadalupe River is located approximately three miles to the northeast.

Subsurface conditions in the project area consist of a surficial layer of moderately to highly plastic clays overlying predominantly stiff to very stiff clays with interbedded seams/layers of medium dense to dense sands. This is common to the region where continuous and discontinuous sand seams and layers are present within the clay matrix. Based on testing of surface soil samples during previous investigations on and within the site vicinity, the soils on the project site have moderate expansion potential to wetting and drying cycles. The upper 20 to 30 feet of the soil profile is anticipated to consist of moderately compressible soils.

Groundwater was encountered in some of the previous explorations on site at depths ranging from approximately nine (9) to 13 feet below current grades. Historical high groundwater levels are reportedly between five (5) to 10 feet below grade (CGS, Milpitas Quadrangle, 2001).

Fluctuations in ground water levels occur due to many factors including seasonal fluctuations of two to five feet, underground drainage patterns, regional fluctuations over long time periods, and other factors.

3.5.1.2 *Seismicity and Seismic Hazards*

The San Francisco Bay Area is classified as Zone 4 for seismic activity, the most seismically active region in the United States. While seismologists cannot predict earthquake events, the U.S. Geological Survey's Working Group on California Earthquake Probabilities (2003) estimates there is a 62 percent chance of at least one magnitude 6.7 earthquake occurring in the Bay Area region between 2003 and 2032. Strong ground shaking can, therefore, be expected at the site during moderate to severe earthquakes in the region.

The faults considered capable of generating significant earthquakes are generally associated with the well-defined areas of crustal movement, which trend northwesterly. Active faults within the region are shown in Table 3.5-1. The project site is not located within a designated Alquist-Priolo Earthquake Fault Zone or Santa Clara County Fault Hazard Zone.

Table 3.5-1
Regional Faults

Fault Name	Distance (miles)
San Andreas	11.2
Monte Vista-Shannon	7.8
Hayward (Total Length)	8.9
Hayward (Southeast Extension)	6.5
Calaveras	10.5

Liquefaction

Liquefaction is the transformation of water saturated soil from a solid to a liquid state during ground shaking. Soils most susceptible to liquefaction are loose, non-cohesive soils that are saturated and are bedded with poor drainage. The site is within a State-designated Liquefaction Hazard Zone (CGS, Milpitas Quadrangle, 2001) as well as a Santa Clara County Liquefaction Hazard Zone (Santa Clara County, 2003).

On-site borings indicate that sand layers are likely to be present on the site between ten to 20 feet below grade. Ground rupture is not anticipated to occur on the site.

Lateral Spreading

Lateral spreading is horizontal/lateral ground movement of relatively flat-lying soil deposits towards a free face such as an excavation, channel, or open body of water. Typically, lateral spreading is associated with liquefaction of one or more subsurface layers near the bottom of the exposed slope. There are no creeks or open faces within 200 feet of the site where lateral spreading could occur; therefore, the potential for lateral spreading to affect the site is low.

3.5.1.3 *California Building Code*

The California Building Code is the California Code of Regulations (CCR), Title 24. The California Building Code is a compilation of three types of building standards from three different origins:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes;
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions; and
- Building standards, authorized by the California legislature, that constitute extensive additions not covered by the model codes that have been adopted to address particular California concerns.

The project shall be required to conform to the latest adopted California Building Code, as amended by the City of Santa Clara, in effect at the time of building permit approval.

3.5.2 Geology and Soils Impacts

3.5.2.1 *Thresholds of Significance*

For the purposes of this EIR, a geologic impact is considered significant if the project would:

- Expose people or structures to substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure (including liquefaction), landslides, or expansive soils;
- Cause substantial soil erosion or the loss of topsoil;
- Expose people or property to major geologic hazards that cannot be mitigated through the use of standard engineering design and seismic safety techniques;
- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state; or
- Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan.

There are no significant mineral resources present in the City of Santa Clara boundaries. In addition, there are no exploitable oil or gas resources within the City. For these reasons, the proposed project would not result in the loss of any mineral resources.

3.5.2.2 *Geologic Impacts*

Soil Conditions

The project would allow up to three new office buildings on the site for a total of six buildings. Structured parking would be located along the eastern side of the site. Depending on the final design of the project, static total and differential settlements could occur.

The project site contains soils that are moderately expansive. The proposed buildings will be designed to limit moisture changes in the surficial soils by using positive drainage away from buildings as well as limiting landscape watering adjacent to the buildings.

Shallow ground water has been measured during previous drilling at depths as shallow as approximately nine feet below the existing ground surface. Historic groundwater levels in the vicinity of the site were recorded at about five to ten feet. Shallow groundwater could impact grading and underground utility construction. These impacts typically consist of potentially wet and unstable foundation subgrade, difficulty achieving compaction, and difficult underground utility installation. Dewatering and shoring of utility trenches may be required in areas where deep utilities are planned.

Impacts from soil conditions on the site can be mitigated by utilizing standard engineering and construction techniques. With incorporation of these measures the project will not expose people or property to significant impacts associated with the geologic conditions of the site. Erosion or landslide related hazards will be minimal due to the flat topography of the site.

Seismic Hazards

The project site is located within a State- and County-designated Liquefaction Hazard Zone. Based on a review of the subsurface data previously collected on the site and in the site vicinity, there are likely some sand layers below the design groundwater level that could experience strength loss and liquefaction-induced settlement during strong seismic shaking. In this area of the Santa Clara Valley alluvial deposits are interbedded with discontinuous sand seams and layers. If liquefaction occurs within these variable layers, increased differential seismic settlement estimates can occur.

Loose unsaturated sandy soils can also settle during strong seismic shaking. As the unsaturated soils encountered above the water table at the site were predominantly stiff to very stiff clays, the potential for significant differential seismic settlement affecting the proposed buildings is low.

Seismic hazards in the project area will require that the proposed structures be designed and built in conformance with the requirements of the California Building Code.

Design-Level Geotechnical Investigation

Buildings will be designed and constructed in accordance with a design-level geotechnical investigation prepared for the site, which identifies specific design features that will be required for the project, including site preparation, compaction, trench excavations, foundation and subgrade design, drainage, and pavement design. Based on the preliminary geotechnical analysis, it is recommended that piles be used to support the proposed office buildings. The design-level geotechnical investigation shall be reviewed and approved by the City prior to issuance of a building permit for the project.

Impact GEO-1: The proposed project will be constructed in conformance with a design-level geotechnical investigation and the California Building Code. The proposed project, therefore, will not expose people or property to significant impacts associated with the geologic conditions of the site. **(Less Than Significant Impact)**

3.5.3 Mitigation Measures

There is no mitigation required or proposed.

3.5.4 Conclusion

Impact GEO-1: The proposed project will be constructed in conformance with a design-level geotechnical investigation and the California Building Code. The proposed project, therefore, will not expose people or property to significant impacts associated with the geologic conditions of the site. **(Less Than Significant Impact)**

3.6 HYDROLOGY AND WATER QUALITY

The following discussion is based in part on a Storm Drainage Hydrology Memo prepared by *Schaaf & Wheeler Consulting Civil Engineers* in December 2008. A copy of this report is included as Appendix E in this EIR.

3.6.1 Existing Setting

3.6.1.1 *Flooding*

Based on the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map, the project site is located within Zone AO.[14] Flood Zone AO is defined as an area determined to have flood depths of one to three feet during 100-year flood conditions.

The site is located within a dam failure inundation hazard area.[15] In the 1980s, the State Office of Emergency Services required that dam inundation maps be prepared for all dams in the state. The purpose of the maps is to provide information to local emergency service agencies that allows them to plan for a response in the event of a dam failure. Flood waters associated with a catastrophic dam failure at Lexington Reservoir would result in flooding at the site (as well as large portions of the Santa Clara Valley).

3.6.1.2 *Storm Drainage System*

The City of Santa Clara owns and maintains the municipal storm drainage system which serves the project site. Storm drains on-site connect to 12-inch to 66-inch lines in Great America Parkway and 30 to 33-inch lines in Mission College Boulevard. The lines serving the site drain to San Tomas Aquino Creek which flows north to Guadalupe Slough and into San Francisco Bay. San Tomas Aquino Creek is located approximately 1,800 feet east of the site.

3.6.1.3 *Stormwater Runoff*

Water Quality

The water quality of San Tomas Aquino Creek is directly affected by pollutants contained in stormwater runoff from a variety of urban and non-urban uses. Stormwater from urban uses contains metals, pesticides, herbicides, and other contaminants, including oil, grease, asbestos, lead, and animal wastes. Section 303(d) of the Federal Clean Water Act requires that each state develop a list of water bodies that do not meet water quality standards, establish priority rankings for waters on the

[14] Federal Emergency Management Agency. *Flood Insurance Rate Map, City of Santa Clara California Santa Clara County Community-Panel Number 06085C0063H*. May 18, 2009.
[15] Association of Bay Area Governments. *Dam Failure Inundation Hazard Map for Northwest San José/Milpitas/Santa Clara*. October 20, 2003. Map. Accessed February 4, 2013. http://www.abag.ca.gov/cgi-bin/pickdamx.pl; http://gis.abag.ca.gov

list, and develop action plans, called Total Maximum Daily Loads (TMDL)[16], to improve water quality. Currently, San Tomas Aquino Creek is not listed on the California 303(d) list as trash impaired.

Under existing conditions approximately 14.88 acres of the 18.5-acre project site is covered with impervious surfaces such as the existing buildings and paved parking lots. Runoff from the site likely contains sediments, debris, oils, metals, and other pollutants related to automobiles and the urban environment.

Nonpoint Source Pollution Program

In 1988 the State Water Resources Control Board (SWRCB) adopted the Nonpoint Source Management Plan in an effort to control nonpoint source pollution in California. In December 1999, the Plan was updated to comply with the requirements of Section 319 of the Federal Clean Water Act and Section 6217 of the Federal Coastal Zone Act Reauthorization Amendment (CZARA) of 1990. The Nonpoint Source Program requires individual permits to control discharge associated with construction activities. The Nonpoint Source Program is administered by the Regional Water Quality Control Board (RWQCB) under the National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities. Projects must comply with the requirements of the Nonpoint Source Program if:

- They disturb one acre or more of soil; or
- They disturb less than one acre of soil but are part of a larger development that, in total, disturbs one acre or more of soil.

The NPDES General Permit for Construction Activities requires the developer to submit a Notice of Intent (NOI) to the RWQCB and to develop a Stormwater Pollution Prevention Plan (SWPPP) to control discharge associated with construction activities.

Santa Clara Valley Urban Runoff Pollution Prevention Program

The Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) was developed by the RWQCB to assist co-permittees in implementing the provisions of the NPDES permit. This program was also designed to fulfill the requirements of Section 304(1) of the Federal Clean Water Act, which mandated that the Environmental Protection Agency develop NPDES application requirements for stormwater runoff. The Program's Municipal NPDES stormwater permit includes provisions requiring regulation of stormwater discharges associated with new development and development of an area-wide watershed management strategy. The permit also identifies recommended actions for the preservation, restoration, and enhancement of the San Francisco Bay Delta Estuary.

[16] A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. The TMDL high priority schedule denotes the most severely impaired water bodies on the 303(d) list.

Applicable projects consist of all new public and private projects that create 10,000 s.f. or more of impervious surface collectively over the entire project site and redevelopment projects that add or replace 10,000 s.f. or more of impervious surface area on the project site. Additional requirements must be met by large projects (formerly known as Group 1 projects) that create one-acre or more of impervious surfaces. These large projects must control increases in runoff peak flow, volume, and duration (referred to as Hydromodification) caused by the project if the increase in stormwater runoff has the potential to cause erosion or other adverse impacts to receiving streams.

Hydromodification

In addition to water quality controls, the Municipal Regional Stormwater NPDES permit requires all new and redevelopment projects that create or replace one-acre or more of impervious surface to manage development-related increases in peak runoff flow, volume, and duration, where such hydromodification is likely to cause increased erosion, silt pollutant generation or other impacts to beneficial uses of local rivers, streams, and creeks. Projects may be deemed exempt from the permit requirements if they do not meet the size threshold, drain into tidally influenced areas or directly into the Bay, drain into hardened channels, or are infill projects in subwatersheds or catchments areas that are greater than or equal to 65 percent impervious (per the Santa Clara Permittees Hydromodification Management Applicability Map).

Based on the SCVURPPP Watershed Map for the City of Santa Clara, the project site drains into a hardened channel. As a result, the project is not subject to the NPDES hydromodification requirements.[17]

3.6.1.4 *Groundwater*

Groundwater on the site has been encountered at depths ranging from nine to 13 feet below grade. Historical high groundwater levels in the project area are between five to ten feet below grade.[18]

3.6.2 Hydrology and Water Quality Impacts

3.6.2.1 *Thresholds of Significance*

For the purposes of this EIR, a hydrology and water quality impact is considered significant if the project would:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table (e.g., the production rate of preexisting nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);

[17] Santa Clara Valley Urban Runoff Pollution Prevention Program. *HMP Applicability Map City of Santa Clara*. November 2010. Accessed February 1, 2013. <http://www.scvurppp-w2k.com/hmp_maps.htm>

[18] Cornerstone Earth Group. *Geotechnical Feasibility Study Great America Commercial Development.* January 11, 2008.

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site;
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Otherwise substantially degrade water quality;
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows;
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam; or
- Be subject to inundation of the site by seiche, tsunami, or mudflow.

3.6.2.2 *Flooding Impacts*

The project site is located in the 100-year floodplain with average flood depths of one to three feet. Buildings proposed on the project site will be required to comply with the flood damage prevention requirements of the City's Municipal Code. The project will be required to elevate proposed structures on the site one-foot above the 100-year floodplain. The proposed project, therefore, would not expose persons and/or property to impacts from the 100-year flood.

As previously noted, the project site is located within the dam failure inundation area for Lexington Reservoir. The precise failure probabilities of dam failure have not been calculated but the probability is considered extremely remote. The SCVWD is mandated by the state to inspect and report on the condition of the dam on an annual basis.

Impact HYD-1: The proposed project would not expose persons or property to significant hazards due to flooding. **(Less Than Significant Impact)**

3.6.2.3 *Storm Drainage Impacts*

The proposed project would slightly increase the amount of impervious surface area on the project site. Existing impervious surfaces cover approximately 79 percent of the project site or 14.88 acres. The proposed project would allow for an increase in impervious surfaces on the project site, approximately one (1) percent, to 15.02 acres or 80 percent of the site. The existing storm drainage system has sufficient capacity to accommodate the existing runoff from the project site. Previous studies of storm drain capacity in the area assumed impervious surfaces of 80 percent and found adequate storm drain capacity was available. The existing storm drainage system, therefore, would have capacity to serve the proposed development.

Impact HYD-2: The proposed project would result in a negligible increase in impervious surfaces on the site and would not exceed the capacity of the existing storm drainage system. **(Less Than Significant Impact)**

3.6.2.4 *Water Quality Impacts*

Operational Impacts

Implementation of the proposed project could result in an incremental increase in stormwater pollutant loads due to an approximately one percent increase in impermeable surfaces. The proposed project will contribute the same types of stormwater runoff pollutants as the existing development on the site. Runoff from streets and parking areas often carries grease, oil, and trace amounts of heavy metals into drainages. Runoff from landscaping can carry pesticides, herbicides, and fertilizers. Although the amounts of these pollutants ultimately discharged into the waterways are unknown, over time they could accumulate and be substantial. Most of the proposed impervious surfaces will be buildings and parking areas. Having an increase in cars parked on-site each day will increase the amount of oils, grease, metals, and debris on-site which will increase the potential amount of pollution flowing into the storm drainage system.

In addition to the increased pollutant load in stormwater runoff, the proposed project will add or replace more than 10,000 s.f. of impervious surfaces and must conform to the requirements of the Municipal Regional Stormwater NPDES permit. A final Stormwater Control Plan at the Development Permit stage of this project will be required. Plans will be certified by engineers to ensure incorporation of appropriate and effective source control measures to meet Low Impact Development (LID) requirements to prevent discharge of pollutants, reduce impervious surfaces, retain a percentage of runoff on-site for percolation, and treatment control measures to remove pollutants from runoff entering the storm drainage system.

The proposed treatment facilities will have sufficient capacity to treat the stormwater runoff entering the storm drainage system. In addition, the project will be required to maintain all post-construction treatment control measures, as outlined below, throughout the life of the project.

The following measures, based on the RWQCB Best Management Practices (BMPs) and City requirements, are included in the proposed project to ensure compliance with NPDES permit requirements to reduce post-construction water quality impacts.

- When the construction phase is complete, a Notice of Termination (NOT) for the General Permit for Construction will be filed with the RWQCB and the City of Santa Clara. The NOT will document that all elements of the SWPPP have been executed, construction materials and waste have been properly disposed of, and a post-construction stormwater management plan is in place as described in the SWPPP for the project site.

- All post-construction Treatment Control Measures (TCMs) will be installed, operated, and maintained by qualified personnel. On-site inlets will be cleaned out at a minimum of once per year, prior to the wet season.

- The property owner/site manager will keep a maintenance and inspection schedule and record to ensure the TCMs continue to operate effectively for the life of the project. Copies of the schedule and record must be provided to the City upon request and must be made available for inspection on-site at all times.

With implementation of a Stormwater Control Plan, the project will not violate any adopted water quality standards or waste discharge requirements. Runoff will be routed directly from the treatment facilities to the storm drainage system and will not flow off-site. Installation and maintenance of the proposed stormwater treatment systems will result in a less than significant impact on water quality.

Impact HYD-3: The proposed project would implement stormwater treatment control measures to comply with the Municipal Regional Stormwater NPDES. **(Less Than Significant Impact)**

Construction Impacts

Construction of the proposed project, including grading, may result in temporary impacts to surface water quality. Construction of the project buildings and parking structure would result in the disturbance of underlying soils, thereby increasing the potential for sedimentation and erosion. When disturbance to underlying soils occurs, the surface runoff that flows across the site may contain sediments that are ultimately discharged into the storm drainage system. Construction of the project may require dewatering for trenching and the placement of piles.

Impact HYD-4: Construction of the proposed project could result in a significant temporary increase in the amount of contaminants in stormwater runoff during construction. **(Significant Impact)**

3.6.2.5 *Groundwater Impacts*

Groundwater in the project area is estimated at five to 13 feet below grade. The proposed project does not include any below grade structures that would impact the shallow groundwater aquifer.

The existing project site is approximately 21 percent permeable and does not contribute to recharging of the underground (i.e., is not a designated recharge area). The City of Santa Clara does rely on groundwater for a portion of its domestic water needs. With the implementation of the proposed project, the impermeable surface area on the project site would increase by approximately one percent. While the proposed project would result in an increase in impermeable surface area on the site, it is unlikely that this negligible increase would have a measureable effect on groundwater recharge and the groundwater supply.

Impact HYD-5: The proposed project would not substantially deplete or degrade groundwater supplies. **(Less Than Significant Impact)**

3.6.3 Mitigation Measures

As conditions of approval, the project applicant shall be responsible for the implementation of the following measures to reduce hydrology and water quality impacts:

MM HYD-4.1: The following RWQCB BMPs will be required to reduce construction-related water quality impacts. All mitigation will be implemented prior to the start of

earthmoving activities on-site and will continue until the construction is complete.

- Burlap bags filled with drain rock shall be installed around storm drains to route sediment and other debris away from the drains.
- Earthmoving or other dust-producing activities shall be suspended during periods of high winds.
- All exposed or disturbed soil surfaces shall be watered at least twice daily to control dust as necessary.
- Stockpiles of soil or other materials that can be blown by the wind shall be watered or covered.
- All trucks hauling soil, sand, and other loose materials shall be required to cover all trucks or maintain at least two feet of freeboard.
- All paved access roads, parking areas, and staging areas adjacent to the construction sites shall be swept daily (with water sweepers).
- Vegetation in disturbed areas shall be replanted as quickly as possible.
- All unpaved entrances to the site shall be filled with rock to knock mud from truck tires prior to entering City streets. A tire wash system may also be employed at the request of the City.
- A Stormwater Permit will be administered by the RWQCB. Prior to construction grading for the proposed land uses, the project proponent will file a "Notice of Intent" (NOI) to comply with the General Permit and prepare a SWPPP which addresses measures that would be included in the project to minimize and control construction and post-construction runoff. Measures will include, but are not limited to, the aforementioned RWQCB mitigation. Dewatering discharges will be filtered or treated using appropriate technologies to remove sediments prior to discharging to the City's storm drain system.
- The project proponent will submit a copy of the draft SWPPP to the City of Santa Clara for review and approval prior to start of construction on the project site. The certified SWPPP will be posted at the project site and will be updated to reflect current site conditions.
- When construction is complete, a NOT for the General Permit for Construction will be filed with the RWQCB and the City of Santa Clara. The NOT will document that all elements of the SWPPP have been executed, construction materials and waste have been properly disposed of, and a post-construction stormwater management plan is in place as described in the SWPPP for the site.

3.6.4 Conclusion

Impact HYD-1: The proposed project would not expose persons or property to significant hazards due to flooding. **(Less Than Significant Impact)**

Impact HYD-2: The proposed project would result in a negligible increase in impervious

surfaces on the site and would not exceed the capacity of the existing storm drainage system. **(Less Than Significant Impact)**

Impact HYD-3: The proposed project would implement stormwater treatment control measures to comply with the Municipal Regional Stormwater NPDES. **(Less Than Significant Impact)**

Impact HYD-4: Implementation of construction BMPs would reduce the temporary increase in the amount of contaminants in stormwater runoff to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact HYD-5: The proposed project would not substantially deplete or degrade groundwater supplies. **(Less Than Significant Impact)**

3.7 BIOLOGICAL RESOURCES

The following discussion is based in part on a Tree Inventory prepared by *McClenahan Consulting, LLC* in February 2013. A copy of this report is included as Appendix F in this EIR.

3.7.1 Existing Setting

The project site consists of three buildings surrounded by surface parking lots and landscaping, including mature trees. Habitats in developed urban areas are extremely low in species diversity. Species that use this habitat are predominantly urban adapted birds, such as rock dove, mourning dove, house sparrow, and starling.

3.7.1.1 *Special-Status Species*

Special status plant and wildlife species are not located on the highly urbanized project site, although raptor (birds of prey) could use the trees on the site for nesting and foraging habitat. Raptors are protected by the Federal Migratory Bird Treaty Act (MBTA) (16 U.S.C. Section 703, Supp. I., 1989).

3.7.1.2 *Mature Trees*

Mature trees are beneficial because they provide habitat for wildlife that can survive in an urban environment. The City also regulates removal of mature trees because their removal detracts from the scenic beauty of the City, causes erosion of topsoil, creates flood hazards, reduces property values, increases the cost of construction and maintenance of drainage systems through the increased flow and diversion of surface waters, and eliminates one of the prime oxygen producers and prime air purification systems in the area.

The tree survey completed in February 2013 found a total of 654 trees on the project site. There were 22 trees on the site greater than 18 inches in diameter. A summary of the trees found on the site is shown in Table 3.7-1. None of the trees on-site are native to this area of Santa Clara, although coast redwoods are native elsewhere in California. All trees measured during the survey and their locations on the project site are shown in Appendix F. A tree removal permit will be required prior to the removal of trees from the project site.

Table 3.7-1
Summary of Trees on Site

Tree Species	Diameter in Inches				
	1 to 6"	6 to 12"	12 to 18"	18+"	Total
American sweet gum	3	18	2	--	23
Aristocrat pear	10	69	49	8	136
Blackwood acacia	46	66	20	1	132
Bradford pear	2	8	--	--	10
Canary Island pine	--	5	--	--	5
Chinese hackberry	12	--	1	--	13
Chinese pistache	26	12	--	--	38
Coast redwood	20	69	34	3	126
Crape myrtle	7	1	--	--	8
Deodar cedar	34	--	1	--	35
Evergreen ash	3	--	7	3	13
Evergreen pear	4	24	4	--	32
Holly oak	7	--	--	--	7
Italian stone pine	--	--	--	3	3
Little leaf linden	--	1	4	--	5
London plane tree	--	23	18	--	41
Mexican fan palm	--	3	8	--	11
Zelkova	5	--	6	4	15
Total	**179**	**299**	**154**	**22**	**654**

3.7.2 Biological Resources Impacts

3.7.2.1 *Thresholds of Significance*

For the purposes of this EIR, a biological resources impact is considered significant if the project would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;

- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Conflict with any local ordinances protecting biological resources, such as a tree preservation ordinance; or
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

3.7.2.2 *Special-Status Species*

Due to the highly urbanized nature of the project site, the proposed development would not result in impacts to special-status plant and wildlife species, with the exception of raptors (birds of prey) that could use the trees on-site for nesting.

Nesting Raptors

Although the site is primarily used by species accustomed to developed areas, some nesting raptors (i.e., falcons, hawks, eagles, owls) may use the site and are protected under provisions of the Migratory Bird Treaty Act and the California Department of Fish and Wildlife (CDFW). The Federal Migratory Bird Treaty Act (MBTA; 16 U.S.C., §703, Supp. I, 1989) prohibits killing, possessing, or trading in migratory birds except in accordance with regulations prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of birds, and bird nests and eggs. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered a "take" by the CDFW.

Raptors (such as falcons, hawks, eagles, and owls) and other migratory birds may utilize the large trees on-site or adjacent to the site for foraging or nesting. The loss of mature landscape trees on-site could result in nesting raptors having to relocate to another site. Relocation of mature raptors or migratory birds would not, by itself, be significant. Construction disturbance on the site during the breeding season could result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment, a violation of the MBTA. Disturbance that causes abandonment and/or loss of reproductive effort is considered a taking by the CDFW. Any loss of fertile eggs, nesting raptors, or any activities resulting in nest abandonment would constitute a significant impact.

Impact BIO-1: The proposed development on a site with mature trees could result in direct impacts to nesting raptors. **(Significant Impact)**

3.7.2.3 *Mature Trees*

There are currently 654 trees located on the project site. The proposed PD zoning does not include a site plan detailing the specific locations of buildings, parking, and landscape areas. For the purposes of this analysis, trees are assumed to be remain in the landscaped areas around the existing buildings to be retained on the site. The project, therefore, is expected to result in the removal of approximately 519 trees from the site.

Under Policy 5.3.1-P10 in the Land Use section of the City's 2010-2035 General Plan, there is a requirement for new development to provide street trees and a minimum 2:1 on- or off-site replacement for trees removed. In accordance with City policy, the project will be required to replace the trees removed, per the conditions of approval of the tree removal permit.

Impact BIO-2: The proposed project will result in the removal of approximately 519 trees from the site. **(Significant Impact)**

3.7.3 Mitigation Measures

3.7.3 *Nesting Raptors*

The project applicant shall implement the following measure to reduce impacts to nesting raptors to a less than significant level:

MM BIO-1.1: Construction shall be scheduled to avoid the nesting season to the extent feasible. The nesting season for most birds, including most raptors, in the San Francisco Bay Area extends from February through August.

If it is not possible to schedule demolition and construction between September and January, then pre-construction surveys for nesting birds shall be completed by a qualified ornithologist to ensure that no nests will be disturbed during project implementation. This survey shall be completed no more than 14 days prior to the initiation of grading, tree removal, or other demolition or construction activities during the early part of the breeding season (February through April) and no more than 30 days prior to the initiation of these activities during the late part of the breeding season (May through August). During this survey, the ornithologist will inspect all trees and other possible nesting habitats immediately adjacent to the construction areas for nests. If an active nest is found sufficiently close to work areas to be disturbed by construction, the ornithologist, in consultation with CDFW, will determine the extent of a construction-free buffer zone to be established around the nest, typically 250 feet, to ensure that raptor or migratory bird nests will not be disturbed during project construction.

3.7.3.2 *Tree Replacement*

MM BIO-2.1: The project shall replace all trees removed from the site at a ratio of 2:1 in accordance with an approved landscape plan for the project.

MM BIO-2.2: In the event the redeveloped portion of the project site does not have sufficient area to accommodate the required tree mitigation, the project applicant will coordinate with the City Arborist to identify further opportunities within the City for the planting of replacement trees.

3.7.3.3 *Tree Preservation*

Trees proposed for retention on the site shall be protected under the following Tree Preservation Guidelines prepared by the project arborist and outlined below as avoidance measures (AM).

AM BIO-2.1: To minimize construction injuries, grading operations shall encroach no closer than five times the trunk diameter, (i.e. 30" diameter tree x 5=150" distance). At this distance, buttress/anchoring roots will be preserved and minimal injury to the functional root area will be anticipated. If encroachment within this area becomes necessary, hand digging will be mandatory.

AM BIO-2.2 Prior to initiation of construction activity, temporary barricades shall be installed around all trees in the construction area. Six-foot high, chain link fences are to be mounted on steel posts, driven two feet into the ground, at no more than ten-foot spacing. The fences shall enclose the entire area under the dripline of the trees or as close to the drip line area as practical. These barricades will be placed around individual trees and/or groups of trees as the existing environment dictates. The temporary barricades will serve to protect trunks, roots and branches from mechanical injuries, will inhibit stockpiling of construction materials or debris within the sensitive 'dripline' areas and will prevent soil compaction from increased vehicular/pedestrian traffic. No storage of material, topsoil, vehicles or equipment shall be permitted within the tree enclosure area. The ground around the tree canopy shall not be altered. These barricades should remain in place until final inspection of the building permit, except for work specifically required in the approved plans to be done under the trees to be protected. Designated areas beyond the driplines of any trees should be provided for construction materials and on-site parking.

AM BIO-2.3: During and upon completion of any trenching/grading operation within a tree's dripline, should any roots greater than one (1) inch in diameter be damaged, broken or severed, root pruning to include flush cutting and sealing of exposed roots should be accomplished under the supervision of a qualified arborist to minimize root deterioration beyond the soil line within twenty-four (24) hours.

AM BIO-2.4: Pruning of the foliar canopies, including removal of deadwood, shall be initiated prior to construction operations. Such pruning will provide any necessary construction clearance, will lessen the likelihood or potential for limb breakage, reduce 'windsail' effect and provide an environment suitable for healthy and vigorous growth.

AM BIO-2.5: A program of fertilization by means of deep root soil injection will be undertaken with applications in spring and summer for those trees to be impacted by construction. Such fertilization will serve to stimulate feeder root

SIGNIFICANT ENVIRONMENTAL IMPACTS	MITIGATION AND AVOIDANCE MEASURES
	sampling plan must be reviewed and approved by the Santa Clara Fire Chief prior to initiation of work. Once the soil sampling analysis is complete, a report of the findings will be provided to the Director of Planning and other applicable City staff for review. **MM HM-1.2:** Documentation of the results of the soil sampling shall be submitted to and reviewed by the City of Santa Clara prior to the issuance of a grading permit. Any soil with concentrations of pesticides above applicable environmental screening levels (ESLs) or hazardous waste limits would be characterized, removed, and disposed of off-site at an appropriate landfill according to all state and federal requirements. **MM HM-1.3:** If contaminated soils are found in concentrations above established thresholds a Site Management Plan (SMP) will be prepared and implemented (as outlined below) and any contaminated soils found in concentrations above established thresholds shall be removed and disposed of according to California Hazardous Waste Regulations. The contaminated soil removed from the site shall be hauled off-site and disposed of at a licensed hazardous materials disposal site. **MM HM-1.4:** A SMP will be prepared to establish management practices for handling impacted groundwater and/or soil material that may be encountered during site development and soil-disturbing activities. Components of the SMP will include: a detailed discussion of the site background; preparation of a Health and Safety Plan by an industrial hygienist; notification procedures if previously undiscovered significantly impacted soil or free fuel product is encountered during construction; on-site soil reuse guidelines based on the California RWQCB, San Francisco Bay Region's

SIGNIFICANT ENVIRONMENTAL IMPACTS	MITIGATION AND AVOIDANCE MEASURES
	reuse policy; sampling and laboratory analyses of excess soil requiring disposal at an appropriate off-site waste disposal facility; soil stockpiling protocols; and protocols to manage groundwater that may be encountered during trenching and/or subsurface excavation activities. Prior to issuance of grading permits, a copy of the SMP must be approved by the Santa Clara County Environmental Health Department, the City's Director of Planning and Inspection, and the Santa Clara Fire Chief. **(Less Than Significant Impact with Mitigation)**

Cumulative Impacts

The proposed project would not contribute to any significant cumulative impacts. Please see Section 5.0 of this EIR for a complete discussion of cumulative impacts.

Summary of Project Alternatives

CEQA requires that an EIR identify alternatives to a project as it is proposed. The CEQA Guidelines specify that the EIR should identify alternatives which "will feasibly attain most of the basic objectives of the project but will avoid or substantially lessen any of the significant effects of the project". The purpose of this section is to determine whether there are alternatives of design, scope or location which will substantially lessen the significant impacts, even if those alternatives "impede to some degree the attainment of the project objectives", or are more expensive. [§15126.6] Please refer to *Section 6.0 Alternatives to the Proposed Project* of this EIR for a complete discussion of these alternatives.

No Project Alternative

The CEQA Guidelines stipulate that an EIR specifically include a No Project Alternative, which should address both "the existing conditions, as well as what would be reasonably expected to occur in the foreseeable future if the project is not approved, based on current plans and consistent with available infrastructure and community services." Since the project site is currently developed with three office buildings, parking lots, and landscaping, the alternative to the City approving the currently proposed project would be to maintain the existing development on the site. Maintaining the current development on the project site would not result in any new significant environmental impacts.

The No Project Alternative would not meet any of the project objectives. The existing development would remain on site and the increased density of employment uses on the site would not occur. The

No Project Alternative would not strengthen the City's economy by providing additional high-tech office space. Although the No Project Alternative would not meet any of the project objectives, it would avoid all of the impacts of the proposed project. For this reason, the No Project Alternative is an environmentally superior alternative to the proposed project.

Reduced Scale Alternative

A Reduced Scale Alternative would be a lower density office development, representing a less intense use of the site. Reducing the size of the proposed project would lessen each of the environmental impacts of the project proportionally and would be less than significant with mitigation measures applied. Reducing the proposed office development to an additional 225,000 square feet of office space (resulting in a total of 643,000 s.f. on-site) would avoid the project's significant impacts to the Bowers Avenue and Augustine Drive intersection and 11 freeway segments in the project area. The Reduced Scale Alternative would also reduce the project's less than considerable contribution to cumulative traffic impacts.

Implementation of a Reduced Scale Alternative would result in substantially less office development on the site than currently proposed. The Reduced Scale Alternative would reduce all of the project's significant intersection and freeway segment impacts to a less than significant level. The amount of development allowed under this alternative, however, would not meet the project objectives to create a high intensity employment center by increasing the density of the site and redeveloping an underutilized site. The Reduced Scale Alternative may also not be financially viable due to the potential costs of redevelopment and the minimal increase in office space allowed under this alternative. Since this alternative would reduce the project's significant intersection and freeway impacts to a less than significant level, it is considered environmentally superior to the proposed project.

Environmentally Superior Alternative

The CEQA Guidelines state that an EIR shall identify an environmentally superior alternative. Based on the discussion above, the environmentally superior alternative is the Reduced Scale Alternative since it would reduce the significant intersection and cumulative impacts of the project to a less than significant level. The Reduced Scale Alternative would not, however, meet the project objectives. The amount of development allowed under this alternative may not be economically feasible.

SECTION 1.0 INTRODUCTION, BACKGROUND, AND PROJECT DESCRIPTION

1.1 INTRODUCTION

This project-specific EIR has been prepared in accordance with the requirements of CEQA and the regulations of the City of Santa Clara. The purpose of the EIR is to inform the public and various governmental agencies of the environmental effects of the proposed Great America Office Campus Expansion. The City of Santa Clara is the Lead Agency for the project, and *Sobrato Development Companies* is the project proponent.

1.2 PROJECT LOCATION

The proposed project is located at 4301, 4401, and 4551 Great America Parkway in Santa Clara, at the northeast corner of Mission College Boulevard and Great America Parkway. The project site includes two parcels, APNs 104-42-009 and -020, with a combined area of approximately 18.5 acres. Development in the project area includes the Great America Theme Park, office parks, hotels, and strip commercial centers.

Regional, vicinity, and aerial maps of the site are shown on Figures 1.2-1, 1.2-2, and 1.2-3, respectively.

1.3 BACKGROUND

The site is designated for *High Intensity Office/Research and Development* use in the City's 2010-2035 General Plan. Parcel 104-42-009 is zoned PD (MP) - Planned Development (Planned Industrial) and Parcel 104-42-020 is zoned MP - Planned Industrial.

The project site is currently developed with approximately 418,000 s.f. of office space in three buildings, surface parking lots, and landscaping. An existing 118,000 s.f., two-story office building is located at the north end of the site. Two 150,000 s.f., six-story office buildings, totaling 300,000 s.f. of gross floor area, are located at the corner of Mission College Boulevard and Great America Parkway.

1.4 PROJECT DESCRIPTION

The project proposes a Planned Development Zoning and Development Agreement with the City of Santa Clara to allow construction of an office campus development, which is described below.

1.4.1 <u>Proposed Uses</u>

The project proposes construction of 600,000 s.f. of net new office space, for a total of 1,018,000 s.f. of office space on the site. The Planned Development rezoning would allow the demolition of an existing 118,000 s.f. office building and new construction of up to approximately 718,000 s.f. of office/R&D uses, for a total of 1,018,000 s.f. of office development on the site (refer to Figure 1.4-1).

Up to three new buildings (for a total of six buildings) would be constructed on the site, not including parking structures. Development on the site would have a maximum floor area ratio (FAR) of 1.26. Maximum buildings heights would be up to 12 stories. Proposed office buildings would be set back a minimum of 30 feet from the property line along the street frontages of the project site. A minimum 10-foot setback would be provided from the side/east property line. The existing 300,000 s.f. of office space in the two buildings at the corner of Great America Parkway and Mission College Boulevard would remain on the site with the project.

1.4.2 Site Access and Parking

Vehicle access to the project site would be provided from two driveways on each of the roadway frontages of the site: Mission College Boulevard, Great America Parkway, and Patrick Henry Drive (refer to Figure 1.4-1). The project proposes structured parking up to six stories in height in one or multiple garage structures. No below grade parking is proposed. The project would provide a minimum of 3.3 parking spaces per 1,000 s.f. of office space on the site at buildout.

Pedestrian access would be provided by sidewalks along the roadways bordering the site and pathways through the site to the existing and proposed buildings.

1.4.3 Landscaping

Landscaping would be planted throughout the project site. Trees would provide a buffer between the project and adjacent land uses and the public roadways. Landscaping will comprise 20 percent of the site.

1.4.4 Construction Phasing

The project would be constructed in phases in response to market conditions and to ensure adequate parking is provided for the existing buildings on the site. The timing and duration of construction phases has not been determined at this time. Due to the height of the proposed buildings, project construction may require the use of pile driving.

1.5 PROJECT OBJECTIVES

Pursuant to CEQA Guidelines Section 15124 the Lead Agency must identify the purpose of the EIR and the discretionary actions required by the Lead Agency. The purpose of this EIR is stated in the project objectives below. The discretionary actions required are listed subsequently in *Section 1.6 Uses of the EIR*.

The project proponent, *Sobrato Development Companies*, has identified the following basic objectives for the proposed project:

- Redevelop an underutilized infill site with approximately 600,000 s.f. of net new space.
- Support the local high-tech economy by replacing obsolete buildings with buildings that are more attuned to the current and future needs of high-tech companies.
- Strengthen the City's economy by attracting new high-tech companies to the area and providing

additional office space to retain companies currently located within the boundaries of the City of Santa Clara.

- Increase the density of office development on the site to efficiently use land in an existing area of the City designated for office/R&D use.
- Provide office space in an area proximate to major transportation arterials, public transit, commercial services and workforce housing.
- Support existing businesses and economic development in the project area by providing additional jobs close to transit connections, retail uses, and various other tenant amenities.
- Support the City's role in the effort to balance regional land use by providing employment and economic development opportunities for residents of the city.

The City has identified the following basic objectives for the proposed project:

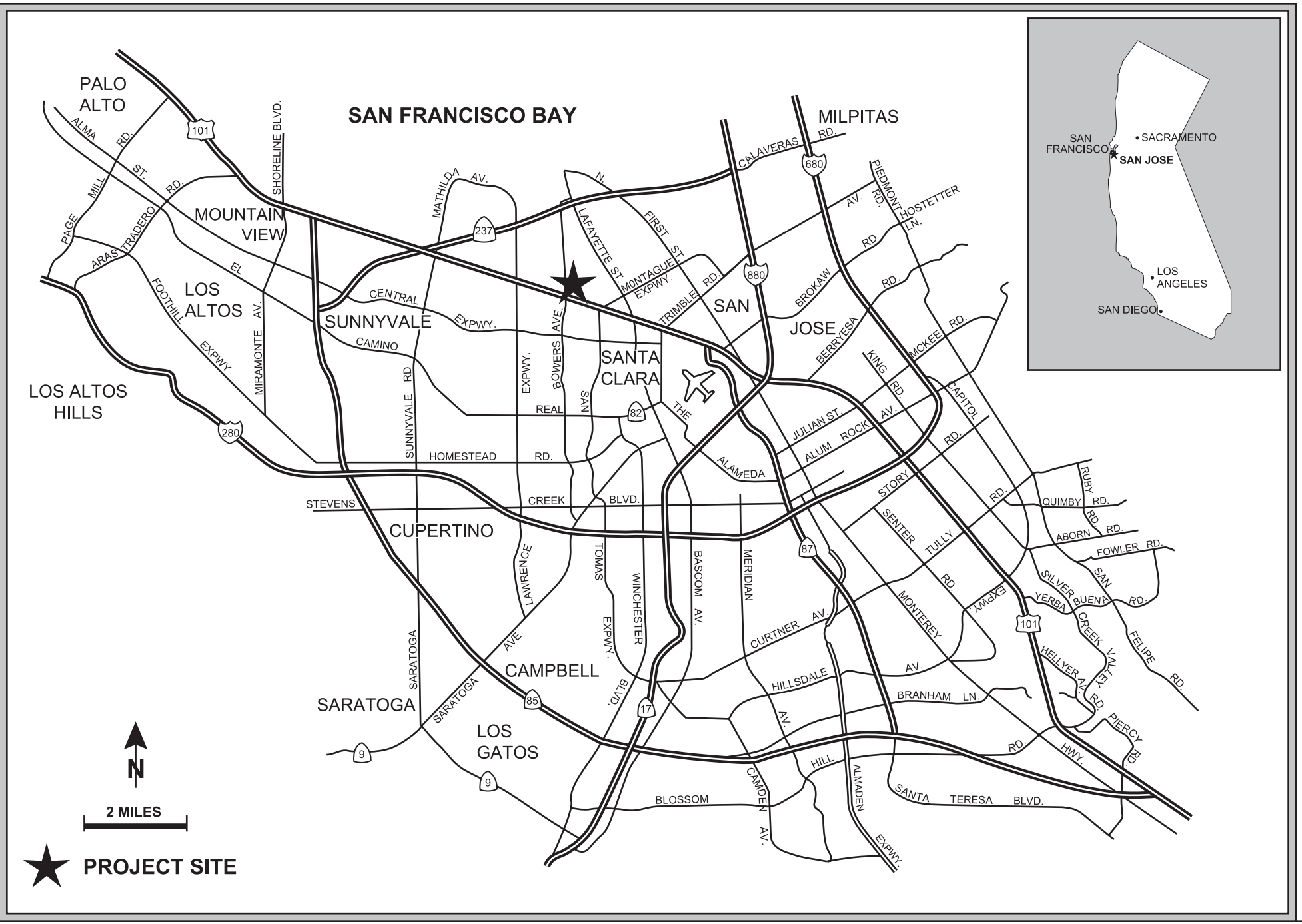
- Promote quality job growth within the City consistent with 2010-2035 General Plan Policy 5.3.5-G1.
- Support higher intensity employment centers that can take advantage of transit opportunities by concentrating jobs near existing transit facilities to reduce vehicle miles travelled consistent with 2010-2035 General Plan Policy 5.3.5-G2.
- Support development of significant employment projects on major local and regional transportation corridors in the City of Santa Clara to minimize traffic on local streets and to facilitate use of transit services consistent with 2010-2035 General Plan Policy 5.3.5-G3.

1.6 USES OF THE EIR

This EIR is intended to be an informational document and is subject to public review, agency review, and consideration by the City of Santa Clara. The purpose of this EIR is to identify potentially significant effects of the project on the physical environment, to determine the extent to which these effects could be reduced or avoided, and to identify feasible alternatives to the project. The EIR is an informational document and in itself does not determine whether a project should or will be approved.

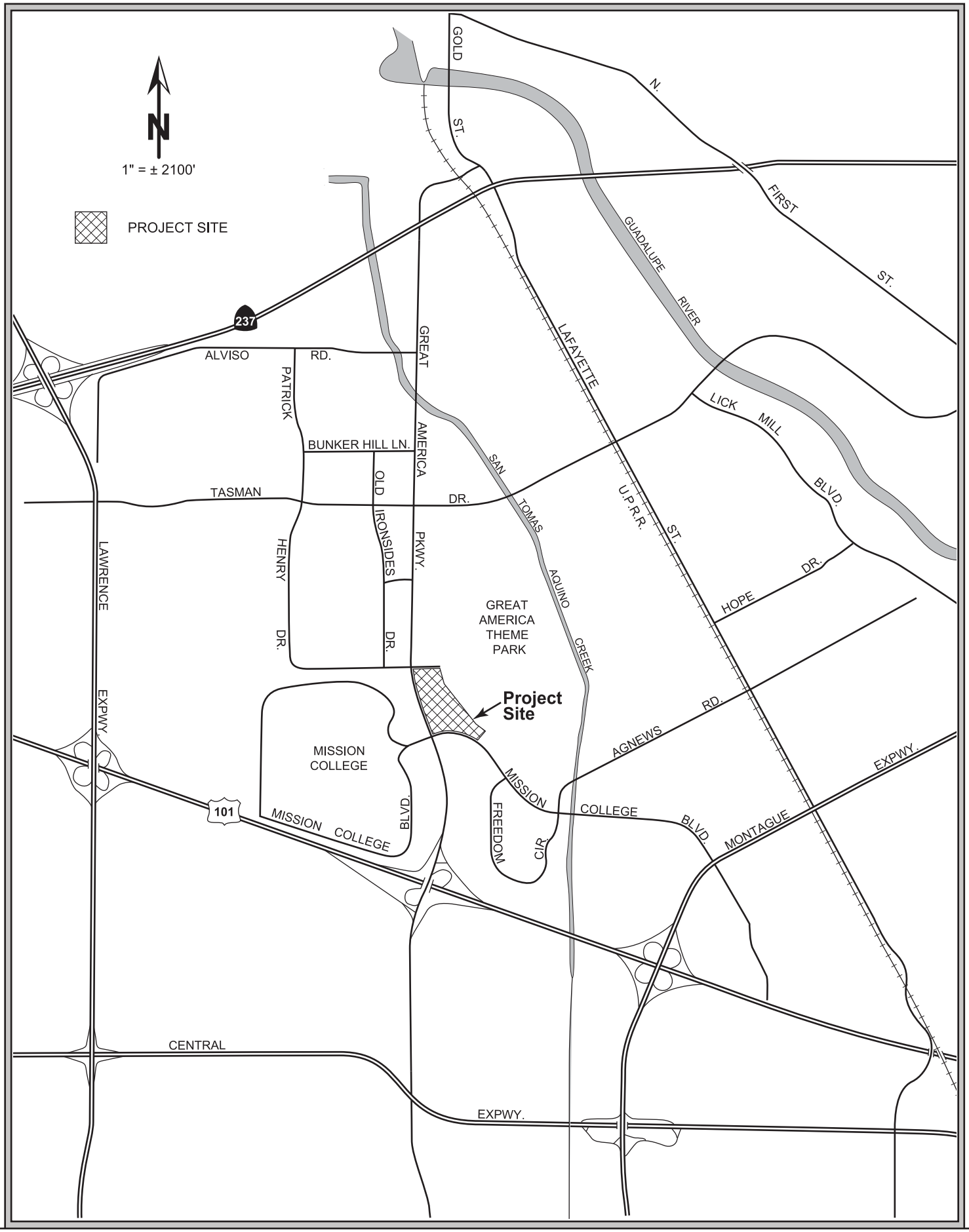
The project-specific discretionary approvals being requested by the project proponent which will be evaluated in the EIR include, but are not limited to, the following:

- Planned Development Zoning
- Tentative Parcel Map
- Site and Architectural Review
- Development Agreement
- Issuance of grading, building, and occupancy permits.

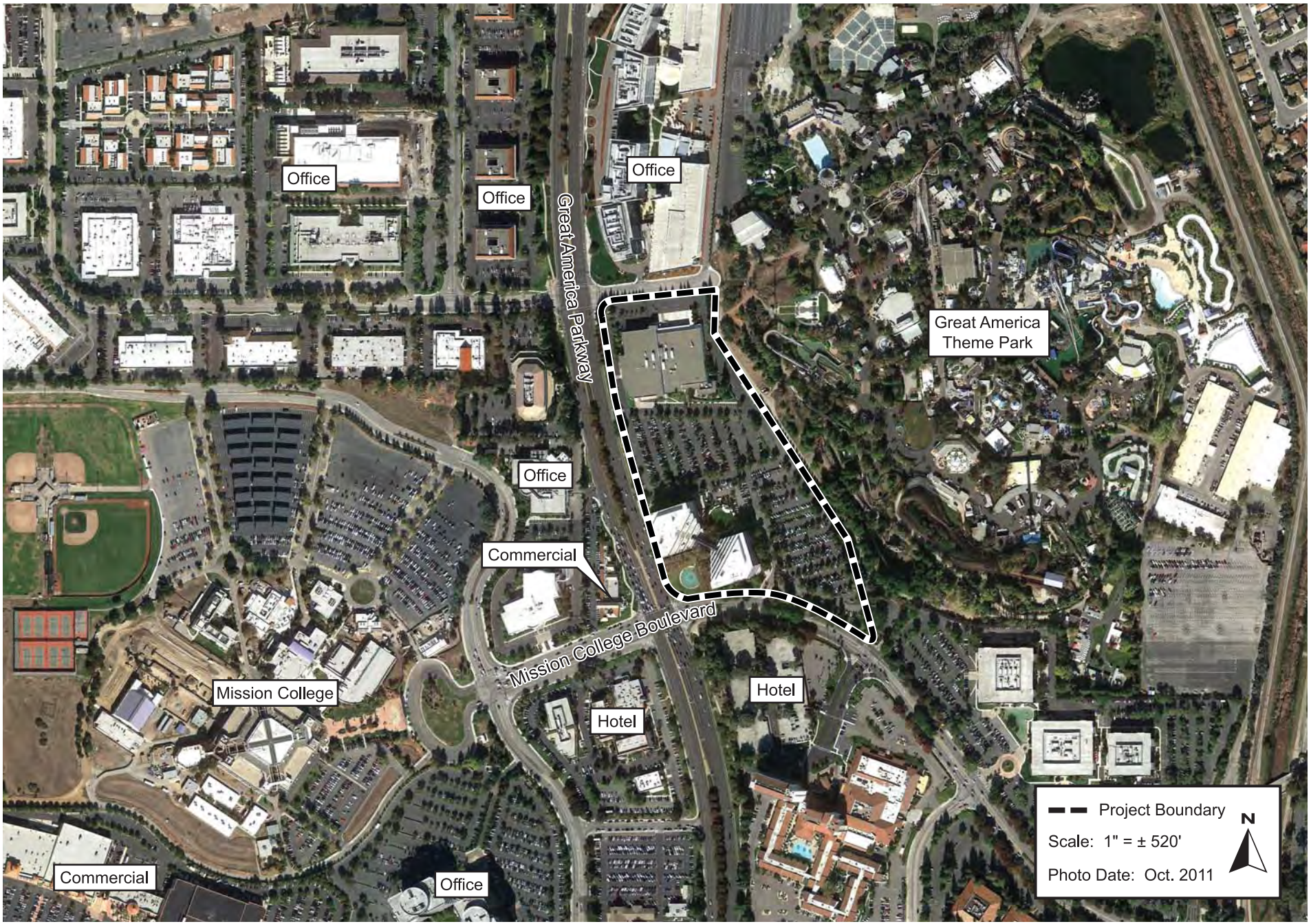


REGIONAL MAP

FIGURE 1.2-1



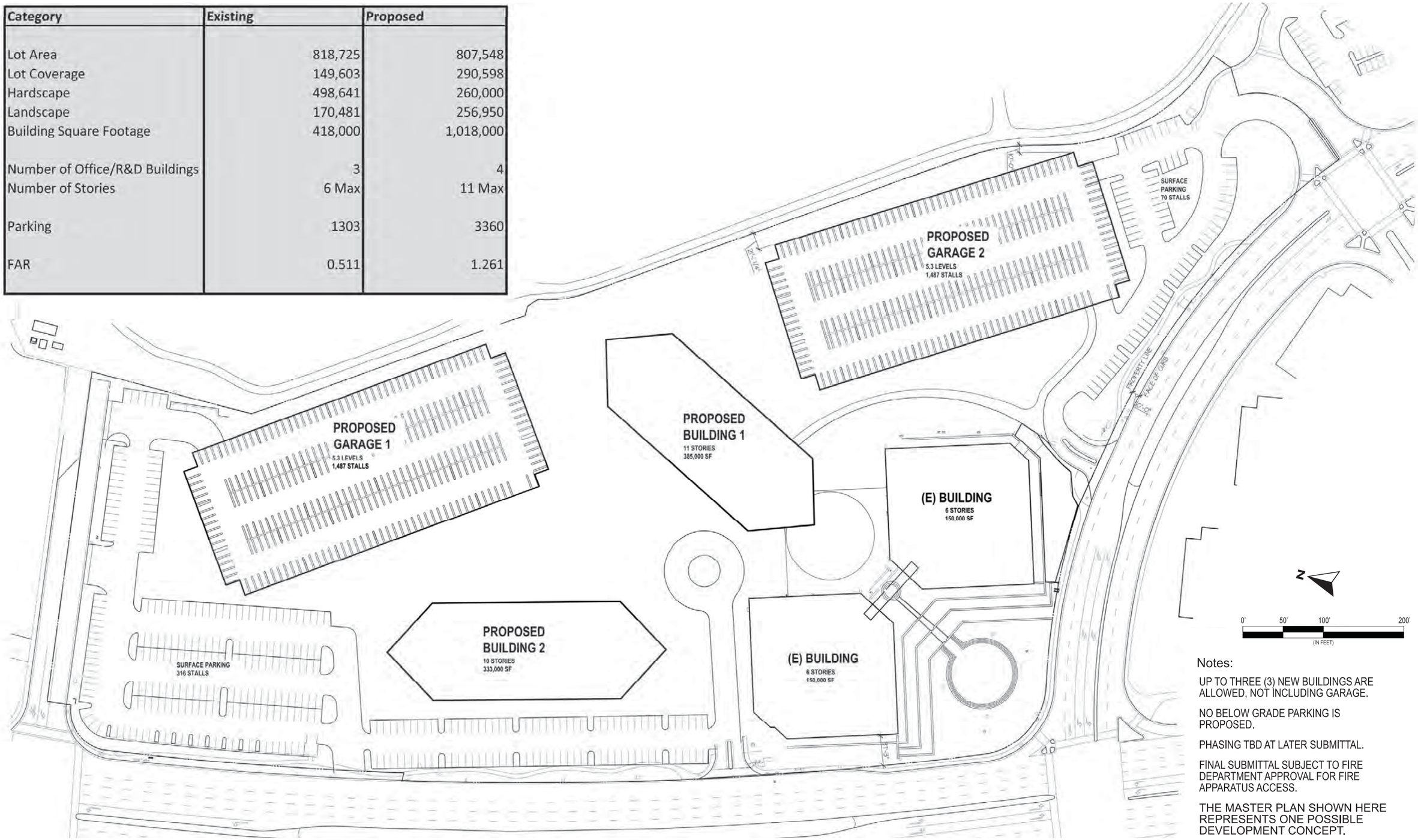
VICINITY MAP FIGURE 1.2-2



AERIAL PHOTOGRAPH AND SURROUNDING LAND USES

FIGURE 1.2-3

Category	Existing	Proposed
Lot Area	818,725	807,548
Lot Coverage	149,603	290,598
Hardscape	498,641	260,000
Landscape	170,481	256,950
Building Square Footage	418,000	1,018,000
Number of Office/R&D Buildings	3	4
Number of Stories	6 Max	11 Max
Parking	1303	3360
FAR	0.511	1.261



Notes:

UP TO THREE (3) NEW BUILDINGS ARE ALLOWED, NOT INCLUDING GARAGE.

NO BELOW GRADE PARKING IS PROPOSED.

PHASING TBD AT LATER SUBMITTAL.

FINAL SUBMITTAL SUBJECT TO FIRE DEPARTMENT APPROVAL FOR FIRE APPARATUS ACCESS.

THE MASTER PLAN SHOWN HERE REPRESENTS ONE POSSIBLE DEVELOPMENT CONCEPT.

CONCEPTUAL MASTER PLAN

FIGURE 1.4-1

SECTION 2.0 CONSISTENCY WITH RELEVANT PLANS AND POLICIES

In conformance with Section 15125(d) of the CEQA Guidelines, the following section discusses the consistency of the proposed project with relevant adopted plans and policies.

2.1 REGIONAL PLANS AND POLICIES

2.1.1 Bay Area 2010 Clean Air Plan

The Bay Area Air Quality Management District (BAAQMD), in cooperation with the Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG), prepared the Bay Area 2005 Ozone Strategy (Ozone Strategy). The Ozone Strategy served as a roadmap showing how the San Francisco Bay Area will achieve compliance with the State one-hour air quality standard for ozone (O_3) as expeditiously as practicable and how the region will reduce transport of O_3 and O_3 precursors to neighboring air basins. In 2010, BAAQMD adopted a new Clean Air Plan with the intent of updating the 2005 Ozone Strategy to comply with State air quality planning requirements as codified in the California Health and Safety Code.

The Bay Area 2010 Clean Air Plan (CAP) provides a comprehensive plan to improve Bay Area air quality and protect public health. The CAP defines a control strategy that the Air District and its partners will implement to: (1) reduce emissions and decrease ambient concentrations of harmful pollutants; (2) safeguard public health by reducing exposure to air pollutants that pose the greatest health risk, with an emphasis on protecting the communities most heavily impacted by air pollution; and (3) reduce greenhouse gas (GHG) emissions to protect the climate.

Consistency: The proposed project would result in an increase in employment on a site currently used and planned for employment use. The project as proposed would implement a Transportation Demand Management (TDM) Program (which is required as part of the CAP) that will reduce overall traffic trips by a minimum of five percent. The project, therefore, would be consistent with the CAP.

2.1.2 Santa Clara Valley Congestion Management Program

The Santa Clara Valley Transportation Authority (VTA) oversees the Santa Clara County Congestion Management Program (CMP). State legislation requires that all urbanized counties in California prepare a CMP in order to obtain each county's share of the increased gas tax revenues. The CMP legislation requires that each CMP contain the following five mandatory elements: 1) a system definition and traffic level of service standard element; 2) a transit service and standards element; 3) a trip reduction and transportation demand management element; 4) a land use impact analysis program element; and 5) a capital improvement element. The Santa Clara County CMP includes the five mandated elements and three additional elements, including: a County-wide transportation model and data base element, an annual monitoring and conformance element, and a deficiency plan element.

Consistency: As described in *Section 3.2, Transportation*, the proposed project would significantly impact two CMP intersections during the AM and/or PM weekday peak hour. The construction of high density office development on land proximate to existing transit and housing is generally consistent with the goals of the CMP. The project will also be conditioned to implement a TDM program that will reduce overall traffic trips by a minimum of five percent. The project, therefore, is consistent with the CMP.

2.1.3 State Water Quality Control Board National Pollutant Discharge Elimination System Permit

The Porter-Cologne Water Quality Control Act and Federal Clean Water Act require local municipalities to implement measures to control construction and post-construction pollution entering local storm drainage systems to the maximum extent practicable. To comply with the requirements of the Porter-Cologne Water Quality Control Act and Federal Clean Water Act, the State Water Resources Control Board (SWRCB) implemented a National Pollution Discharge Elimination System (NPDES) permit for the Santa Clara Valley. Subsequent to implementation of the permit, the San Francisco Regional Water Quality Control Board (RWQCB) issued a Municipal Storm Water NPDES Permit to 15 co-permittees. The 15 co-permittees are the City of Santa Clara, 12 other municipalities within the Santa Clara Basin watershed area, the County of Santa Clara, and the Santa Clara Valley Water District (SCVWD). Two programs, the Nonpoint Source Pollution Program and the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), have been implemented under the NPDES permit to control construction and post-construction runoff.

2.1.3.1 *Nonpoint Source Pollution Program*

In 1988 the SWRCB adopted the Nonpoint Source Management Plan in an effort to control nonpoint source pollution in California. In December 1999, the Plan was updated to comply with the requirements of Section 319 of the Federal Clean Water Act and Section 6217 of the Federal Coastal Zone Act Reauthorization Amendment (CZARA) of 1990. The Nonpoint Source Program requires individual permits to control discharge associated with construction activities. The Nonpoint Source Program is administered by the RWQCB under the NPDES General Permit for Construction Activities. Projects must comply with the requirements of the Nonpoint Source Program if:

- they disturb one acre or more of soil; or
- they disturb less than one acre of soil but are part of a larger development that, in total, disturbs once acre or more of soil.

The NPDES General Permit for Construction Activities requires the developer to submit a Notice of Intent (NOI) to the RWQCB and to develop a Stormwater Pollution Prevention Plan (SWPPP) to control discharge associated with construction activities.

Consistency: The proposed project would disturb more than one acre of soil and would require compliance with the Nonpoint Source Pollution Program. Implementation of the measures identified in *Section 3.6 Hydrology and Water Quality* would ensure the

project's consistency with the Nonpoint Source Pollution Program. Therefore, the proposed project is consistent with this plan.

2.1.3.2 *Santa Clara Valley Urban Runoff Pollution Prevention Program*

The SCVURPPP was developed by the RWQCB to assist co-permittees in implementing the provisions of the NPDES permit. This program was also designed to fulfill the requirements of Section 304(1) of the Federal Clean Water Act, which mandated that the U.S. Environmental Protection Agency develop NPDES application requirements for stormwater runoff. The Program's Municipal NPDES stormwater permit includes provisions requiring regulation of stormwater discharges associated with new development and development of an area-wide watershed management strategy. The permit also identifies recommended actions for the preservation, restoration, and enhancement of the San Francisco Bay Delta Estuary.

Applicable projects consist of all new public and private sector projects that create 10,000 s.f. or more of impervious surface collectively over the entire project site, and redevelopment projects that add or replace 10,000 s.f. or more of impervious surface area on the project site. Additional requirements must be met by large projects (formerly known as Group 1 projects) that create one acre or more of impervious surfaces. These large projects must control increases in runoff peak flow, volume, and duration (referred to as Hydromodification) caused by the project if the increase in stormwater runoff has the potential to cause erosion or other adverse impacts to receiving streams.

Consistency: As discussed in *Section 3.6 Hydrology and Water Quality*, the proposed project will include applicable Best Management Practices to ensure there is no increase in erosion or sedimentation that could impact local waterways and that stormwater runoff from the impervious surfaces on the site is treated and retained in accordance with the municipal regional permit. The implementation of erosion control and stormwater management practices during and after project construction would be in accordance with the Municipal Regional Stormwater NPDES permit requirements. The proposed project, therefore, would be consistent with the Municipal Regional Stormwater NPDES permit and Construction General NPDES permit.

2.1.4 <u>Comprehensive Land Use Plan (CLUP) for Norman Y. Mineta San José International Airport</u>

The CLUP for the Norman Y. Mineta San José International Airport was adopted on May 25, 2011. The CLUP includes land use compatibility policies and standards updated from the preceding land use policy plan, which previously covered activities around the airport. These policies and compatibility criteria form the basis for evaluating the land use compatibility of individual proposed projects. The CLUP is not intended to define allowable land use for a specific property, although the plan establishes development standards or restrictions that may limit certain types of uses and structures on a parcel. The CLUP is not retroactive with respect to existing incompatible land uses; it discusses actions to be taken when expansion, replacement or other significant changes are made to incompatible land uses.

Standards in the CLUP focus on the three areas of Airport Land Use Commission (ALUC) responsibility including aircraft noise, the control of objects in navigable airspace, and the safety of persons on the ground and in aircraft. The project site falls within the Airport Influence Area (AIA), which is a composite of the areas surrounding the Airport that are affected by noise, height, and safety considerations. The AIA is defined as a feature-based boundary around the Airport within which all actions, regulations and permits must be evaluated by local agencies to determine how the final draft CLUP policies may impact the proposed development.

Consistency: The project site is located within the referral boundary for the Norman Y. Mineta San José International Airport. The proposed project would be subject to review by the Federal Aviation Administration (FAA) and ALUC but is located outside the 65 dBA CNEL noise contour and appears to be consistent with the Land Use Plan and height restrictions of the FAA (refer to *Section 3.1 Land Use* and *Section 3.4 Noise and Vibration*).

2.2 LOCAL PLANS AND POLICIES

2.2.1 City of Santa Clara 2010-2035 General Plan

The City of Santa Clara's 2010-2035 General Plan is an adopted statement of goals and polices for the future character and quality of development in the community as a whole. The following is a summary of relevant sections of the 2010-2035 General Plan that would apply to the proposed project.

2.2.1.1 Land Use

Policy 5.3.1-P3: Support high quality design consistent with adopted design guidelines and the City's architectural review process.

Consistency: The final design of the proposed project will be subject to the City's architectural review process. Therefore, the project is consistent with Policy 5.3.1-P3.

Policy 5.3.1-P4: Encourage new development that meets the minimum intensities and densities specified in the land use classifications or as defined through applicable Focus Area, Neighborhood Compatibility or Historic Preservation policies of the General Plan.

Consistency: The project would be consistent with the current *High Intensity Office/R&D* land use designation. The proposed project would have a floor area ratio (FAR) of 1.26 which is within the range (up to 2.0 FAR) of allowable development density in the 2010-2035 General Plan for the proposed land use designation. Therefore, the proposed project is consistent with Policy 5.3.1-P4.

Policy 5.3.1-P5: Implement a range of development densities and intensities within General Plan land use classification requirements to provide diversity, use land efficiently and meet population and employment growth.

Consistency: The proposed project would construct up to six additional office buildings on an underutilized site and will increase employment opportunities in the City. Therefore, the proposed project is consistent with Policy 5.3.1-P5.

Policy 5.3.1-P8: Work with property owners to improve or redevelop underutilized and vacant properties.

Consistency: The proposed project is the redevelopment of an underutilized parcel. Therefore, the proposed project is consistent with Policy 5.3.1-P8.

Policy 5.3.1-P9: Require that new development provide adequate public services and facilities, infrastructure, and amenities to serve the new employment or residential growth.

Consistency: The proposed project would redevelop an underutilized site and would not exceed the capacity of existing infrastructure, with the exception of roadway facilities, and can be adequately served by existing public facilities and services. Therefore, the proposed project is partially consistent with Policy 5.3.1-P9.

Policy 5.3.1-P10: Provide opportunities for increased landscaping and trees in the community, including requirements for new development to provide street trees and a minimum 2:1 on- or off-site replacement for trees removed as part of the proposal.

Consistency: The proposed project will plant new trees on-site at a ratio greater than 2:1 to mitigate for the removal of existing trees. In the event the redeveloped portion of the project site does not have sufficient area to accommodate the required tree mitigation, replacement trees will be planted off-site as directed by the City Arborist. Therefore, the proposed project is consistent with Policy 5.3.1-P10.

Policy 5.3.1-P11: Encourage new developments proposed within a reasonable distance of an existing or proposed recycled water distribution system to utilize recycled water for landscape irrigation, industrial processes, cooling and other appropriate uses.

Consistency: Existing recycled water lines are present in Mission College Boulevard and will be utilized for landscape irrigation. Therefore, the proposed project is consistent with Policy 5.3.1-P11.

Policy 5.3.1-P14: Encourage Transportation Demand Management strategies and the provision of bicycle and pedestrian amenities in all new development in order to decrease use of the single-occupancy automobile and reduce vehicle miles traveled.

Consistency: As a Condition of Approval, the project will be required to implement a Transportation Demand Management (TDM) Program that will reduce overall traffic trips by a minimum of five percent. Therefore, the proposed project is consistent with Policy 5.3.1-P14.

2.2.1.2 Mobility and Transportation

Policy 5.8.1-P5: Work with local, regional, State and private agencies, as well as employers and residents, to encourage programs and services that reduce vehicle miles traveled.

Consistency: As a Condition of Approval, the project will be required to implement a TDM Program that will reduce overall traffic trips by a minimum of five percent. Therefore, the proposed project is consistent with Policy 5.8.1-P5.

Policy 5.8.3-P9: Require new development to incorporate reduced on-site parking and provide enhanced amenities, such as pedestrian links, benches and lighting, in order to encourage transit use and increase access to transit services.

Consistency: The project would provide on-site parking at a lower rate than required in the Municipal Code and would provide enhanced pedestrian amenities to encourage transit usage through a TDM Program. Therefore, the project is consistent with Policy 5.8.3-P9.

Policy 5.8.3-P10: Require new development to participate in public/private partnerships to provide new transit options between Santa Clara residences and businesses.

Consistency: The project is located in proximity to existing transit services that include VTA bus service, Caltrain and ACE shuttle service, and Light Rail Transit that provide connection from existing residential areas of the City to the project area. The project will be conditioned to provide a TDM Program and explore the feasibility of adding transportation services to link businesses with multi-modal transit in cooperation with the City, other public agencies, and other local business interests which could include new transit options. The project, therefore, is consistent with Policy 5.8.3-P10.

Policy 5.8.4-P10: Encourage safe, secure and convenient bicycle parking and end-of-trip, or bicycle "stop", facilities, such as showers or bicycle repair near destinations for all users, including commuters, residents, shoppers, students and other bicycle travelers.

Consistency: The TDM program implemented for the project would include bicycle parking as a condition of project approval in accordance with VTA Countywide Bicycle Plan Technical Guidelines. The provision of additional bicycle facilities such as shower and bicycle repair facilities that may be incorporated as part of the program; however, are currently unknown. The project, as conditioned, would be consistent with Policy 5.8.4-P10.

Policy 5.8.5-P1: Require new development to include transportation demand management site-design measures, including preferred carpool and vanpool parking, enhanced pedestrian access, bicycle storage and recreational facilities.

Consistency: As a Condition of Approval, the project will be required to implement a TDM Program that will reduce overall traffic trips by a minimum of five percent and will

include bicycle parking facilities. Therefore, the proposed project is consistent with Policy 5.8.5-P1.

Policy 5.8.5-P2: Require development to offer on-site services, such as ATMs, dry cleaning, exercise rooms, cafeterias and concierge services, to reduce daytime trips.

Consistency: The project may include amenity facilities within the proposed square footage for the project; however, amenities and on-site services will be determined by the TDM Program and needs of the future tenants. The proposed project, therefore, is not consistent with Policy 5.8.5-P2.

Policy 5.8.5-P4: Encourage new development to participate in shuttle programs to access local transit services within the City, including buses, light rail, Bay Area Rapid Transit, Caltrain, Altamont Commuter Express Yellow Shuttle and Lawrence Caltrain Bowers/Walsh Shuttle services.

Consistency: The proposed project is located adjacent to an existing bus stop on Great America Parkway. Shuttles for both Caltrain and ACE train stop at Mission College Boulevard and Great America Parkway. These transit stops will provide future employees access to local and regional transit systems. Therefore, the proposed project is consistent with Policy 5.8.5-P4.

Policy 5.8.5-P5: Encourage transportation demand management programs that provide incentives for the use of alternative travel modes to reduce the use of single-occupancy vehicles.

Consistency: As a Condition of Approval, the project will be required to implement a TDM Program that will reduce overall traffic trips by a minimum of five percent. Therefore, the proposed project is consistent with Policy 5.8.5-P5.

2.2.1.3 Environmental Quality

Policy 5.10.1-P4: Protect all healthy cedars, redwoods, oaks, olives, bay laurel and pepper trees of any size, and all other trees over 36 inches in circumference measured from 48 inches above-grade on private and public property as well as in the public right-of-way.

Consistency: The project would remove approximately 519 trees, many of which are protected as outlined in the City's 2010-2035 General Plan. Therefore, the proposed project is not consistent with Policy 5.10.1-P4. The project will be required to provide trees at a minimum 2:1 replacement ratio through architectural review of an approved landscape plan consistent with Policy 5.3.1-P10.

Policy 5.10.1-P6: Require adequate wastewater treatment and sewer conveyance capacity for all new development.

Consistency: The proposed project will not exceed the capacity of the wastewater treatment system or the sanitary sewer lines that serve the project site. Therefore, the project is consistent with Policy 5.10.1-P6.

Policy 5.10.2-P6: Require "Best Management Practices" for construction dust abatement.

Consistency: The proposed project will implement best management practices consistent with BAAQMD requirements for construction dust abatement. Therefore, the proposed project is consistent with Policy 5.10.2-P6.

Policy 5.10.3-P2: Encourage new development to incorporate sustainable building design, site planning and construction, including encouraging solar opportunities.

Consistency: The project would incorporate green building measures to achieve LEED Silver certification for the core and shell of the proposed buildings. Therefore, the proposed project is consistent with Policy 5.10.3-P2.

Policy 5.10.3-P3: Reduce energy consumption through sustainable construction practices, materials and recycling.

Consistency: The project will salvage or recycle discarded building materials (i.e., existing building and hardscape and remnant materials from construction) to reduce the amount of demolition and construction waste going to the landfill, in accordance with the City's construction and demolition ordinance. Therefore, the proposed project is consistent with Policy 5.10.3-P3.

Policy 5.10.4-P4: Require an adequate water supply and water quality for all new development.

Consistency: Based on the Water Supply Assessment (WSA) prepared for the project, the proposed project can be adequately served by the City's existing water supply. Therefore, the proposed project is consistent with Policy 5.10.4-P4.

Policy 5.10.4-P7: Require installation of native and low-water consumption plant species when landscaping new development and public spaces to reduce water usage.

Consistency: The project will be conditioned to meet LEED Silver Certification standards including measures to reduce water demand from the site. The exact methods used to meet these standards are not currently known. Therefore, the proposed project's consistency with Policy 5.10.4-P7 is unknown.

Policy 5.10.4-P8: Require all new development within a reasonable distance of existing or proposed recycled water distribution systems to connect to the system for landscape irrigation.

Consistency: Existing recycled water lines are present in Mission College Boulevard and will be utilized for landscape irrigation. Therefore, the proposed project is consistent with Policy 5.10.4-P8.

Policy 5.10.5-P5: Regulate development, including remodeling or structural rehabilitation, to ensure adequate mitigation of safety hazards, including flooding, seismic, erosion, liquefaction and subsidence dangers.

Consistency: The proposed project will be required to conform to the requirements of the California Building Code and the recommendations of a site specific geotechnical assessment. Therefore, the proposed project is consistent with Policy 5.10.5-P5.

Policy 5.10.5-P6: Require that new development is designed to meet current safety standards and implement appropriate buildings codes to reduce risks associated with geologic conditions.

Consistency: The proposed project will be required to conform to the requirements of the California Building Code and the recommendations of a site specific geotechnical assessment. Therefore, the proposed project is consistent with Policy 5.10.5-P6.

Policy 5.10.5-P15: Require new development to minimize paved and impervious surfaces and promote on-site Best Management Practices for infiltration and retention, including grassy swales, pervious pavement, covered retention areas, bioswales, and cisterns, to reduce urban water run-off.

Consistency: The project proposes to implement an operational stormwater management plan consistent with the requirements of the RWQCB that will provide treatment and filtration of stormwater prior to the water entering the storm drainage system. Therefore, the proposed project is consistent with Policy 5.10.5-P15.

Policy 5.10.5-P16: Require new development to implement erosion and sedimentation control measures to maintain an operational drainage system, preserve drainage capacity and protect water quality.

Consistency: The project proposes to implement a Stormwater Pollution Prevention Plan to control discharge associated with construction activities consistent with the requirements of the RWQCB. Therefore, the proposed project is consistent with Policy 5.10.5-P16.

Policy 5.10.5-P18: Implement the Santa Clara Valley Nonpoint Source Pollution Control Program, Santa Clara Valley Urban Runoff Pollution Prevention Program and the Urban Runoff Management Plan.

Consistency: The project will comply with the Santa Clara Valley Nonpoint Source Pollution Control Program, Santa Clara Valley Urban Runoff Pollution Prevention Program and the Urban Runoff Management Plan as discussed in Section 3.6, *Hydrology and Water Quality*. Therefore, the proposed project is consistent with Policy 5.10.5-P18.

Policy 5.10.5-P21: Require that storm drain infrastructure is adequate to serve all new development and is in place prior to occupancy.

Consistency: The proposed project will not exceed the capacity of the storm drain lines that serve the project site. Therefore, the project is consistent with Policy 5.10.5-P21.

Policy 5.10.5-P22: Regulate development on sites with known or suspected contamination of soil and/or groundwater to ensure that construction workers, the public, future occupants, and the environment are adequately protected from hazards associated with contamination, in accordance with applicable regulations.

Consistency: Implementation of the proposed project could expose construction workers to contaminated soil from historic agricultural activities. Mitigation measures are proposed to reduce potential impacts to a less than significant level. Therefore, the project is consistent with Policy 5.10.5-P22.

Policy 5.10.6-P1: Review all land use and development proposals for consistency with the General Plan compatibility standards and acceptable noise exposure levels defined on Table 5.10-1.

Consistency: Although noise levels on the project site exceed the acceptable noise exposure levels on Table 5.10-1, standard commercial construction techniques would ensure interior noise levels do not exceed 45 dBA L_{dn}. The project, therefore, is consistent with Policy 5.10.6-P1.

Policy 5.10.6-P2: Incorporate noise attenuation measures for all projects that have noise exposure levels greater than General Plan "normally acceptable" levels, as defined on Table 5.10-1.

Consistency: Commercial construction techniques would ensure the project meets acceptable levels for commercial use identified on Table 5.10-1. The project, therefore, is consistent with Policy 5.10.6-P2.

SECTION 3.0 ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION

3.1 LAND USE

3.1.1 Existing Setting

3.1.1.1 *Existing Land Use*

The approximately 18.5-acre project site is comprised of two parcels located on the east side of Great America Parkway, between Mission College Boulevard and Patrick Henry Drive, in the northern portion of the City of Santa Clara. The project site is located in an urban area developed with commercial and industrial uses. The project site has a 2010-2035 General Plan designation of *High Intensity Office/Research and Development* and is zoned *MP – Planned Industrial* and *PD(MP) – Planned Development (Planned Industrial)*.

The *High Intensity Office/Research and Development* land use designation is intended for high-rise or campus-like developments for corporate headquarters, R&D and supporting uses, with landscaped areas for employee activities. Permitted uses include offices and prototype R&D uses. Accessory, or secondary, small-scale supporting retail uses that serve local employees and visitors are also permitted. Parking is typically structured or below grade. The maximum FAR is 2.00, excluding any FAR devoted to supporting retail uses.

The *MP – Planned Industrial* zoning district is intended to provide an environment exclusively for and conducive to the development and protection of modern large-scale administrative facilities, research institutions, and specialized manufacturing organizations, all of a non-nuisance type. The district is to provide for an aesthetically attractive working environment with park-like grounds, attractive buildings, ample employee parking, and other amenities appropriate to an employee-oriented activity where problems of product handling, storage, advertising, and distribution are not of significant concern.

The *PD(MP) – Planned Development* zoning district is intended to accommodate development that is compatible with the existing community and that integrates uses that are not permitted to be combined in other zone districts or utilizes imaginative planning and design concepts that would be restricted in other zone districts.

The project site is currently developed with approximately 418,000 s.f. of office space in three buildings, surface parking lots, and landscaping. The entire site was previously leased by *Yahoo!* and is now partially occupied by Palo Alto Networks. The northern parcel on the project site is developed with an approximately 118,000 s.f., two-story, office building. The northern parcel has access from two driveways on Patrick Henry Drive and through the southern parcel of the project site from Great America Parkway. The southern parcel of the project site is developed with two, six-story buildings each with approximately 150,000 s.f. of office space.

3.1.1.2 *Surrounding Land Uses*

The project site is surrounded by properties designated for *Regional Commercial*, *High Intensity Office/Research and Development*, and *Light Industrial* land uses in the 2010-2035 General Plan. Existing development surrounding the project site includes office buildings to the north, office buildings and strip commercial development to the west, hotel and restaurant buildings to the south, and office buildings and the Great America Theme Park to the east. There are no properties in the vicinity of the project site that are now or have recently been farmed. The Norman Y. Mineta San Jose International Airport (San Jose International Airport) is located approximately 2.5 miles southeast of the project site. The site is located within the Airport Land Use Commission referral boundary for the San Jose International Airport.

3.1.2 Land Use Impacts

3.1.2.1 *Thresholds of Significance*

For the purposes of this EIR, a land use impact is considered significant if the project would:

- Physically divide an established community;
- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect;
- Conflict with any applicable habitat conservation plan (HCP) or natural community conservation plan (NCCP);
- Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping & Monitoring Program of the California Resources Agency, to non-agricultural use;
- Conflict with existing zoning for agricultural use, or a Williamson Act contract;
- Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use;
- Induce substantial population growth in an area, either directly or indirectly;
- Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere; or
- Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

The project site is developed and located within an urbanized commercial and industrial area. The site is designated *Urban and Built-Up Land* by the California Resources Agency and is not under a Williamson Act contract. There are no open space uses on or adjacent to the project site. The site is not within the boundaries of an HCP or NCCP. The project will not create a physical barrier within an established community. For these reasons, the proposed project would not result in the loss of farmland directly or indirectly, conflict with a conservation plan or land use plan, or divide an established community.

3.1.2.2 *Land Use Conflicts*

Land use conflicts can arise from two basic causes: 1) a new development or land use may cause impacts to persons or the physical environment in the vicinity of the project site or elsewhere; or 2) conditions on or near the project site may have impacts on the persons or development introduced onto the site by the new project. Both of these circumstances are aspects of land use compatibility. Potential incompatibility may arise from placing a particular development or land use at an inappropriate location, or from some aspect of the project's design or scope. Depending on the nature of the impact and its severity, land use compatibility conflicts can range from minor irritations and nuisance to potentially significant effects on human health and safety. The discussion below distinguishes between potential impacts from the proposed project upon persons and the physical environment, and potential impacts from the existing surroundings upon the project.

The project would allow demolition and replacement of an existing two-story office building and development of up to three new office buildings for a total of six office buildings on the site, along with structured parking. The project site is located in an area with office and commercial development. Development in the project area contains parking lots and landscaped areas along street frontages and buildings with substantial setbacks from adjacent roadways. All new buildings on the site would be set back 30 feet from adjacent roadways. The proposed setbacks are similar to the setbacks for existing buildings on the site at the corner of Great America Parkway and Mission College Boulevard that will remain with the proposed project. The proposed buildings would reach a maximum of 12 stories in height. The project proposes a 1.26 FAR which is consistent with the *High Intensity Office/Research and Development* land use designation. The project proposes a *PD – Planned Development* zoning for the entire site which would allow the proposed buildings to exceed the 70-foot height limitations of the existing zoning district and reduce on-site parking requirements to 3.3:1,000. The proposed buildings would expand the existing office campus development on the site which is compatible with the surrounding land uses.

Construction of the project may cause short-term impacts to adjacent uses from increased dust and noise. These short-term impacts from construction are discussed in more detail in *Section 3.3 Air Quality* and *Section 3.4 Noise and Vibration*.

The project site is located in a commercial and office/industrial area and the proposed development would increase office space on the site. The project would not be affected by incompatible land uses in the project area.

Impact LU-1: The proposed office buildings are compatible with the existing development on the site and in the project vicinity. **(Less Than Significant Impact)**

<u>Airport Land Use Compatibility</u>

Pending review by the Airport Land Use Commission (ALUC), the project appears to be consistent with the ALUC Land Use Plan, because it is located outside the Airport's projected 65 dBA CNEL contour. The impact of aircraft flyovers from the Norman Y. Mineta San José International Airport on ambient noise levels at the project site is discussed in *Section 3.4 Noise and Vibration*. The

proposed building heights would require review by the Federal Aviation Administration (FAA) to confirm consistency with Part 77 regarding objects within navigable airspace. The City of San José holds an existing avigation easement over the site which restricts building heights to 250 feet above existing grade. The proposed building heights would comply with the height restrictions of the existing avigation easement. The proposed project would not be subject to any other FAA surface restrictions.

Impact LU-2: The proposed project would be subject to review by the FAA and ALUC but appears to be consistent with the Land Use Plan and height restrictions of the FAA. **(Less than Significant Impact)**

3.1.2.3 *Population and Housing Impacts*

The City of Santa Clara has a total population of approximately 122,690 residents in 47,123 households.[1] Of the 122,690 residents, approximately 57,318 are employed residents and the City has approximately 108,905 jobs.[2] In 2035 it is estimated that the City will have approximately 154,825 residents, 60,435 households, 154,280 total jobs and 86,800 employed residents.[3]

The jobs/housing ratio quantifies the relationship between the number of housing units required as a result of local jobs and the number of residential units available in the City. When the ratio reaches 1.0 a balance is struck between the supply of local housing and jobs. The jobs/housing ratio is determined by dividing the number of local jobs by the number of employed residents that can be housed in local housing. This is an environmental issue because proximity between jobs and housing strongly influences driving patterns, air quality, and other environmental factors.

The City of Santa Clara had an estimated 1.90 jobs for every employed resident in 2008.[4] The recently adopted 2010-2035 General Plan focuses on increasing housing and the placement of housing near employment. As a result, the overall jobs/employed residents ratio is expected to decrease to 1.77 by 2035. Some employees who work within the City are, and still will be, required to seek housing outside the community with full implementation of the 2010-2035 General Plan. In 2005, the City of Santa Clara had an employment base with approximately 2.12 jobs per employed resident and, therefore, the overall trend in jobs per employed resident in the City is expected to continue to decrease with implementation of the 2010-2035 General Plan.[5]

The proposed project would result in approximately 1,980[6] additional jobs on the site which would increase jobs citywide. By locating additional jobs in the City, the project could incrementally increase the demand for housing in Santa Clara as employees seek residences near the project site. There is currently a shortage of available housing within the City of Santa Clara compared to the

[1] City of Santa Clara. *City of Santa Clara 2010-2035 General Plan.* 2010.
[2] The current number of total employed residents is based on the City's jobs to employed residents ratio which is 1.9 jobs per employed resident.
[3] City of Santa Clara. *City of Santa Clara 2010-2035 General Plan.* 2010.
[4] Ibid.
[5] Association of Bay Area Governments. *Projections 2007.* December 2006.
[6] Based on one employee per 303 square feet of office space.

number of jobs within the City. The increase in jobs will incrementally increase the overall jobs/housing imbalance within the City, but would not represent a substantial change.

Impact LU-3: The project will intensify employment on land already planned for job growth in the 2010-2035 General Plan. The project site is currently developed with office uses; therefore, the proposed project will not displace existing housing or people. Through implementation of the 2010-2035 General Plan, the City's job/housing imbalance will be reduced and, therefore, the incremental increase in the City's jobs/housing imbalance resulting from the proposed project will have a less than significant impact on population and housing in Santa Clara. **(Less Than Significant Impact)**

3.1.3 Mitigation and Avoidance Measures

No mitigation is required or proposed.

3.1.4 Conclusion

Impact LU-1: The proposed office buildings are compatible with the existing development on the site and in the project vicinity. **(Less Than Significant Impact)**

Impact LU-2: The proposed project would be subject to review by the FAA and ALUC but appears to be consistent with the Land Use Plan and height restrictions of the FAA. **(Less than Significant Impact)**

Impact LU-3: The project will redevelop land previously planned for job growth in the 2010-2035 General Plan. The project site is currently developed with office uses; therefore, the proposed project will not displace existing housing or people. Through implementation of the 2010-2035 General Plan the City's job/housing imbalance will be reduced and, therefore, the incremental increase in the City's jobs/housing imbalance within the City resulting from the proposed project will have a less than significant impact on population and housing in Santa Clara. **(Less Than Significant Impact)**

3.2 TRANSPORTATION

The discussion in this section is based on a Transportation Impact Analysis prepared by *Hexagon Transportation Consultants* in May 2013. A copy of this report is included as Appendix A in this EIR.

3.2.1 Existing Setting

The major roadways providing access to the project site are described below and shown graphically in Figure 3.2-1.

3.2.1.1 *Regional Access*

Regional access to the project site is provided via US 101 and State Route 237 (SR 237) as described below.

US 101 is an eight-lane freeway (three mixed-flow lanes and one high-occupancy vehicle (HOV) lane in each direction) in the vicinity of the site. It extends north through San Francisco and south through Gilroy. Regional access to the project site is provided via its interchange with San Tomas Expressway/Montague Expressway and with Great America Parkway/Bowers Avenue.

SR 237 is a six-lane freeway that extends in an east/west direction between Sunnyvale and Milpitas, providing access to I-880 and U.S. 101. Two of the six lanes (one in each direction) are designated as HOV lanes. Access to the project site is provided via its interchange with Great America Parkway.

3.2.1.2 *Local Access*

Local access to the site is provided by San Tomas Expressway, Montague Expressway, Great America Parkway, Bowers Avenue, Central Expressway, Scott Boulevard, Mission College Boulevard, and Patrick Henry Drive as described below.

San Tomas Expressway is a north-south expressway that begins at US 101 and extends southward through Santa Clara and San José and into Campbell, where it transitions into Camden Avenue at State Route 17 (SR 17). Full interchanges are located at US 101 and SR 17. In the north, San Tomas Expressway is an eight-lane roadway including HOV lanes. The HOV lane designation is in effect in both directions of travel during the AM and PM peak commute hours. During other times, the lane is open to all users. South of El Camino Real, San Tomas narrows to a 6-lane facility including HOV lanes. The HOV lane designation in this segment is in effect for only the peak direction of travel (northbound in the AM and southbound in the PM) during the peak commute hours. San Tomas Expressway provides access to and from the project site via its direct connection to Montague Expressway and Mission College Boulevard.

Montague Expressway is generally an east-west expressway that begins at US 101 and extends northward to Lafayette Street and then northeastward to Milpitas where it transitions into Landess Avenue at I-680. Full interchanges are located at I-680, I-880, and US 101. Montague Expressway

transitions to San Tomas Expressway at US 101. In the vicinity of the project site, Montague Expressway is a six-lane roadway. Approximately three miles to the northeast, Montague Expressway contains HOV lanes. The HOV lane designation is in effect in both directions of travel during both the AM and PM peak commute hours and is otherwise open to all users. Montague Expressway provides access to and from the project site via Mission College Boulevard.

Great America Parkway is a north-south thoroughfare that begins at US 101 and extends northward to SR 237. Full interchanges are located at both US 101 and SR 237. Great America Parkway is primarily a six-lane roadway, with an additional northbound lane between Tasman Drive and US 101. Great America Parkway provides access to and from the project site via Mission College Boulevard and Patrick Henry Drive with direct access via one right-turn only driveway.

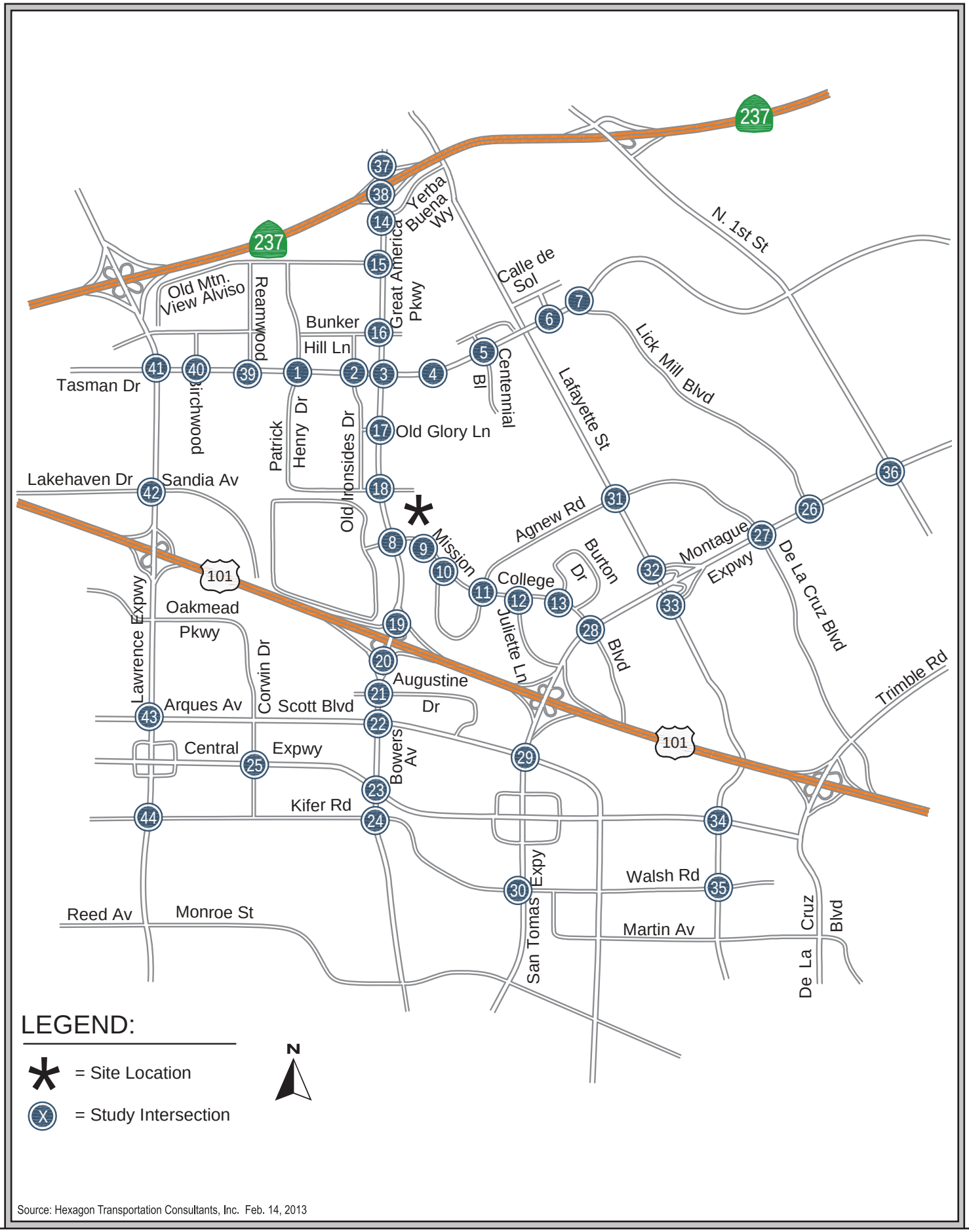
Bowers Avenue is the southern extension of Great America Parkway. It begins at US 101 as a six-lane roadway and extends southward to Kifer Road, where it transitions into a four-lane roadway with a divided median. At Chromite Drive to the south, Bowers Avenue becomes a four-lane road with no median divider. Bowers Avenue continues south to its intersection with El Camino Real (SR 82) where it transitions to Kiely Boulevard. A full interchange is located at US 101. Bowers Avenue provides access to and from the project site via Great America Parkway and Mission College Boulevard.

Central Expressway is a six-lane east-west expressway. Central Expressway begins at its junction with De la Cruz Boulevard and extends westward into Palo Alto, where it transitions into Alma Street at San Antonio Road. Central Expressway provides access to and from the project site via Bowers Avenue and San Tomas Expressway.

Scott Boulevard is a divided four-lane roadway that runs north-south from Saratoga Avenue to Space Park Drive in Santa Clara and east-west from Space Park Drive to Oakmead Parkway in Sunnyvale. Scott Boulevard provides access to the project site via Bowers Avenue and San Tomas Expressway.

Mission College Boulevard to the west of Great America Parkway is a loop road around Mission College and the Mercado Shopping Center. The eastern portion of Mission College Boulevard is a four-lane east-west thoroughfare, running between Great America Parkway and Montague Expressway. This segment of Mission College Boulevard provides access to numerous industrial and office uses, as well as some hotels. The eastern segment of Mission College Boulevard borders the south side of the project site and provides direct access to the project via the north leg of the Marriott Hotel entrance and Mission College Boulevard intersection. At the site location, Mission College Boulevard has a fixed median divider.

Patrick Henry Drive is a two-lane roadway with striped center median that runs between Great America Parkway and Old Mountain View-Alviso Road. Patrick Henry borders the northern side of the project site and provides direct access to the project via the east leg of its intersection with Great America Parkway.



Source: Hexagon Transportation Consultants, Inc. Feb. 14, 2013

ROADWAY NETWORK AND STUDY INTERSECTIONS FIGURE 3.2-1

3.2.1.3 *Existing Bicycle and Pedestrian Facilities*

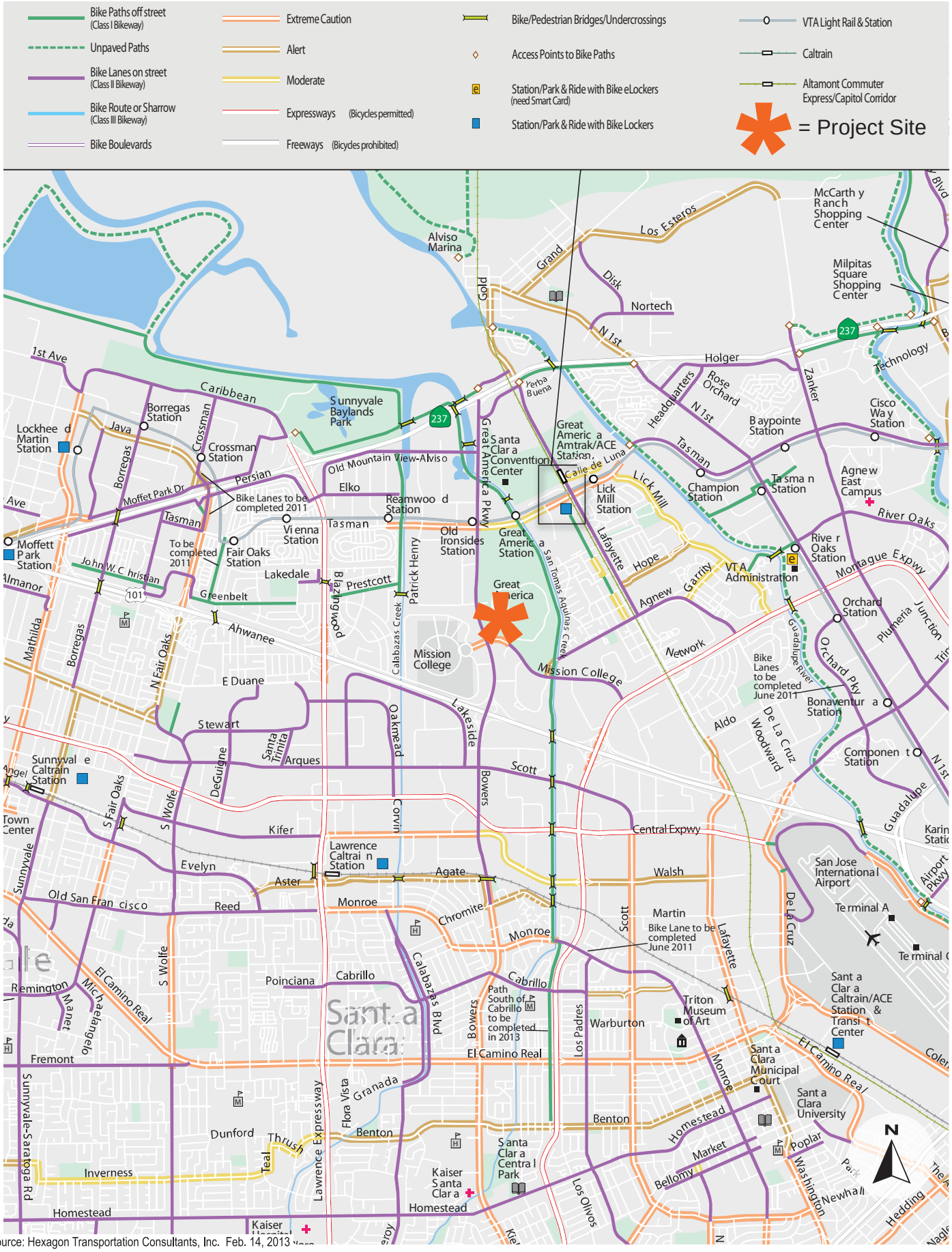
There are several bike lanes and bike paths in the vicinity of the project site. The San Tomas Aquino Creek trail runs from Benton Street to Sunnyvale Baylands Park with access to the bike path located at Mission College Boulevard and Agnew Road, east of the project site. Bike lanes in the vicinity of the site are listed below and shown on Figure 3.2-2:

- Bowers Avenue, from Chromite Drive extending onto Great America Parkway ;
- Great America Parkway, from US 101 to SR 237;
- Mission College Boulevard, from Montague Expressway to east of Great America Parkway;
- Agnew Road, from Mission College Boulevard onto Lick Mill Road to Montague Expressway;
- Scott Boulevard, from Central Expressway onto Arques Avenue to North Fair Oaks Avenue in Sunnyvale;
- Lakeside Drive; and
- Oakmead Parkway, from Central Expressway to Lawrence Expressway.

Bicycles are also permitted on San Tomas/Montague Expressway and Central Expressway.

Due to the project's proximate location to the freeway interchange with the County expressway, pedestrian facilities in the project area are limited. Mission College Boulevard has a continuous sidewalk on the south side of the street between Montague Expressway and Great America Parkway. The north side of Mission College Boulevard has continuous sidewalks from Montague Expressway to Agnew Road, east of the site, and intermittent sidewalks westward to Great America Parkway. Patrick Henry Drive has sidewalks on its north side only. Pedestrian crosswalks and signal heads with pushbutton actuators are present at all signalized intersections, including the Marriott Hotel Entrance and Mission College Boulevard and Patrick Henry Drive and Great America Parkway intersections. Some retail is present on the west side of the Mission College Boulevard and Great America Parkway intersection. Sidewalks, crosswalks, and pedestrian pushbuttons and signal heads are present to connect these retail properties to the project site for pedestrians.

Beyond the immediate project area, sidewalks are present on both sides of Great America Parkway north to Tasman Drive and on the south side of Tasman Drive west to the Old Ironsides Light Rail Station. Sidewalks continue on both sides of Great America Parkway south across the US 101 interchange through the Bowers Avenue and Central Expressway intersection. Sidewalks are present on both sides of Montague Expressway/San Tomas Expressway to the south of Mission College Boulevard, across the US 101 interchange to Scott Boulevard.



Source: Hexagon Transportation Consultants, Inc. Feb. 14, 2013

EXISTING BICYCLE FACILITIES

FIGURE 3.2-2

3.2.1.4 *Existing Transit Service*

Existing local transit service to the study area is provided by VTA bus service. Regional transit to the project area is provided by Caltrain and ACE, which have shuttle bus routes along Mission College Boulevard. Bus stops are located along Great America Parkway, at Patrick Henry Drive and Mission College Boulevard, and along Mission College Boulevard, at Freedom Circle, Agnew Road, and east of Great America Parkway to connect with both local and regional transit services. Additionally, the Old Ironsides Light Rail Station is located approximately two-thirds of a mile north of the project site, along Tasman Drive, serving the Mountain View-Winchester line. The transit service is described below and shown on Figure 3.2-3.

Local Route 57 operates on Great America Parkway in the study area. This route runs between West Valley College in Saratoga and Old Ironsides Drive at Tasman Drive (Great America) in Santa Clara. Route 57 runs between 5:45 AM and 11:00 PM with 30-minute headways during the AM and PM peak hours.

Local Route 60 operates on Great America Parkway and Mission College Boulevard in the study area. This route runs between the Winchester Transit Center in Campbell and Old Ironsides Drive at Tasman Drive (Great America) in Santa Clara. Route 60 runs between 5:30 AM and 11:00 PM with 15- to 30-minute headways during the AM and PM peak hours.

Express Bus Route 121 is an express bus (limited stops) with a scheduled stop at Old Ironsides Drive at Tasman Drive in the vicinity of the project. This route runs between the Gilroy Transit Center and the Lockheed Martin Transit Center in Mountain View. Express Route 121 provides service on weekdays only and runs in the northbound direction in the morning (between 4:30 and 8:45 AM) and in the southbound direction in the evening (between 3:00 and 7:30 PM) with 30- to 60-minute headways.

Express Bus Route 140 is an express bus (limited stops) with scheduled stops at Old Ironsides Drive at Tasman Drive and Mission College Boulevard and Montague Expressway in the vicinity of the project. It runs between the Fremont BART Station and Mission College/Montague Expressway. Express route 140 provides service on weekdays only with three runs in the southbound direction in the morning (between 7:12 and 9:39 AM) and three runs in the northbound direction in the evening (between 4:22 and 7:06 PM) with approximately 60-minute headways.

Limited Stop Route 321 operates on Great America Parkway, with a scheduled stop at Patrick Henry Drive and Tasman Drive, on its route between the Lockheed Martin Transit Center in Mountain View and the Great Mall Transit Center in Milpitas. It operates on weekdays only with one westbound run in the morning (between 8:10 and 8:44 AM) and one eastbound run in the evening (between 5:50 and 6:32 PM).

Limited Stop Route 330 operates on Great America Parkway and Mission College Boulevard, with scheduled stops at Old Ironsides Drive at Tasman Drive and Mission College Boulevard at Burton Drive in the vicinity of the project site, on its route between Almaden Expressway/Camden Avenue in San Jose and Alder Drive at Tasman Drive in Milpitas. It provides service on weekdays only with four runs in the northbound direction in the morning (between 6:45 and 9:21 AM) and 4 runs in the

southbound direction in the evening (between 4:20 and 7:19 PM) with approximately 30- to 60-minute headways.

ACE Yellow Shuttle (827) operates on Great America Parkway and Mission College Boulevard, with scheduled stops at Mission College Boulevard/Wyatt Drive and Great America Parkway/Mission College Boulevard, on its route between the Great America ACE Station and Scott Boulevard at San Tomas Expressway. It provides service on weekdays only with four runs in the southbound direction in the morning (between 6:16 and 9:47 AM) and four runs in the northbound direction in the evening (between 3:13 and 6:39 PM). The ACE Yellow Shuttle is a free service sponsored by the Bay Area Air Quality Management District.

Additionally, the Mission Area Caltrain Shuttle operates along Mission College Boulevard and has a nearby stop at Mission College Boulevard and Great America Parkway, adjacent to the project site. The Caltrain Shuttle also stops at the Intel facilities along Juliette Lane just south of the project site. The transit lines that operate within the study area are listed in Table 3.2-1.

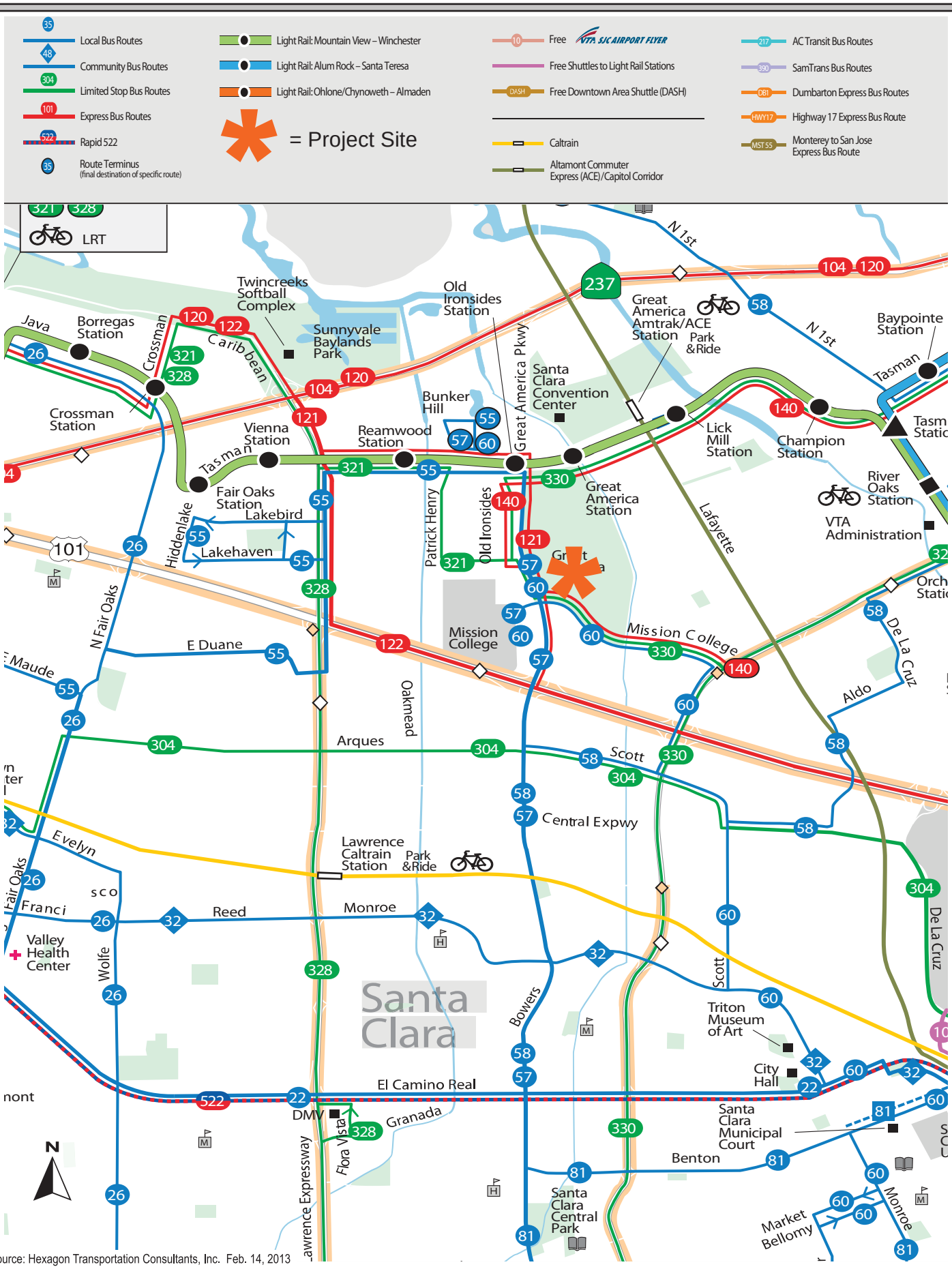
Table 3.2-1
Transit Service in the Study Area

Route	Route Description	Peak Hour Headways (minutes)
Local Route 57	West Valley College to Old Ironsides Drive/ Tasman Drive	30
Local Route 60	Winchester Transit Center to Old Ironsides Drive/Tasman Drive	15-30
Express Route 121[1]	Gilroy Transit Center to Lockheed Martin Transit Center	30-60
Express Route 140[1]	Fremont BART to Mission College Boulevard/Montague Expressway	60
Limited Stop Route 321[1]	Lockheed Martin Transit Center to Great Mall	--
Limited Stop Route 330[1]	Almaden Expressway/Camden Avenue to Alder Drive/Tasman Drive	30-60
ACE Yellow 827 Shuttle[1]	ACE Great America Station to Scott Boulevard /Walsh Avenue	60
Caltrain Shuttle[1]	Juliette Lane to Lawrence Caltrain Station	30

Notes: [1]Limited hours of operation.

3.2.1.5 *Level of Service Standards and Analysis Methodologies*

Traffic conditions at the study intersections were evaluated using level of service (LOS). *Level of Service* is a qualitative description of operating conditions ranging from LOS A, or free-flow conditions with little to no delay, to LOS F, or jammed conditions with excessive delays. Existing traffic conditions at the study intersections were evaluated using the LOS standards of the Cities of Santa Clara, San Jose, and Sunnyvale and the Santa Clara County Congestion Management Program (CMP), which is administered by VTA.



EXISTING TRANSIT FACILITIES

FIGURE 3.2-3

City of Santa Clara Signalized Intersections

Signalized study intersections that are not part of the CMP roadway network are subject to the local municipalities' LOS standards. The Cities of Santa Clara, San Jose, and Sunnyvale LOS methodology is TRAFFIX, which evaluates signalized intersection operations on the basis of average delay time for all vehicles at the intersection. Since TRAFFIX is also the CMP-designated intersection LOS methodology, each of the Cities' methodologies employs the CMP default values for the analysis parameters.

Each of the Cities' LOS standard for signalized intersections is LOS D or better. The correlation between average delay and LOS is shown in Table 3.2-2, on the following page.

CMP Intersections

Since TRAFFIX is the designated LOS methodology for both the CMP and the local municipalities, the CMP study intersections are not analyzed separately, but rather are among the local municipalities' signalized intersections analyzed using TRAFFIX. The only difference between the local municipalities' and CMP analyses is that the project impacts are determined on the basis of a different LOS standard – the CMP LOS standard for signalized intersections is LOS E or better, where the local municipalities' LOS standard for signalized intersections is LOS D or better.

Table 3.2-2
Signalized Intersection Level of Service Definitions

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Operations with very low delay occurring with favorable progression and/or short cycle lengths.	Up to 10.0
B	Operations with low delay occurring with good progression and/or short cycle lengths.	10.1 to 20.0
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	20.1 to 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 to 55.0
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences. This is considered to be the limit of acceptable delay.	55.1 to 80.0
F	Operation with delays unacceptable to most drivers occurring due to oversaturation, poor progression, or very long cycle lengths.	Greater than 80.0

Source: Transportation Research Board, 2*000 Highway Capacity Manual*, (Washington D.C. 2000)

Freeway Segments

As prescribed in the CMP technical guidelines, the LOS for freeway segments is estimated based on vehicle density. The vehicle density on a segment is correlated to LOS standards as shown in Table 3.2-3. The CMP defines an acceptable LOS for freeway segments as LOS E or better.

Table 3.2-3
Freeway Level of Service Definitions Based on Density

Level of Service	Description	Density (Vehicles/ Mile/Lane)
A	Average operating speeds at the free-flow speed generally prevail. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream.	0-11
B	Speeds at the free-flow speed are generally maintained. The ability to maneuver within the traffic stream is only slightly restricted, and the general level of physical and psychological comfort to drivers is still high.	>11-18
C	Speeds at or near the free-flow speed of the freeway prevail. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more vigilance on the part of the driver.	>18-26
D	Speeds begin to decline slightly with increased flows at this level. Freedom to maneuver within the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort levels.	>26-46
E	At this level, the freeway operates at or near capacity. Operations in this level are volatile, because there are virtually no usable gaps in the traffic stream, leaving little room to maneuver within the traffic stream.	>46-58
F	Vehicular flow breakdowns occur. Large queues form behind breakdown points.	>58

Source: Santa Clara County 2004 CMP (Based on the *Highway Capacity Manual* (2000, Washington, D.C.)

3.2.1.5 *Existing Conditions*

Existing Intersection Levels of Service

Existing peak-hour traffic volumes were obtained from new intersection turn movement counts (September 2012), previously completed traffic studies, and the CMP database. The existing peak-hour intersection volumes, traffic count data and peak hour intersection turning movement volumes for all intersections and study scenarios are included in Appendix A of this EIR.

The results of the LOS analysis under existing conditions are summarized in Table 3.2-4. The results show that, measured against the applicable level of service standards, all of the study intersections currently operate at an acceptable level of service under existing conditions.

Table 3.2-4
Existing and Background Intersection Levels of Service Summary

Intersection		Peak Hour	Existing		Background	
			Avg. Delay	LOS	Avg. Delay	LOS
1	Patrick Henry Drive and Tasman Drive	AM	17.5	B	23.0	C
		PM	15.6	B	29.3	C
2	Old Ironsides Drive and Tasman Drive	AM	10.8	B	20.3	C
		PM	11.5	B	26.1	C
3	Great America Parkway and Tasman Drive*	AM	28.2	C	30.0	C
		PM	28.6	C	36.5	D
4	Convention Circle and Tasman Drive	AM	9.4	A	9.6	A
		PM	9.9	A	10.0	A
5	Centennial Boulevard and Tasman Drive	AM	10.2	B	10.2	B
		PM	10.6	B	10.3	B
6	Calle del Sol and Tasman Drive	AM	16.3	B	16.9	B
		PM	13.5	B	14.7	B
7	Lick Mill Boulevard and Tasman Drive	AM	32.9	C	31.8	C
		PM	29.1	C	29.9	C
8	Great America Parkway and Mission College Boulevard*	AM	38.8	D	44.3	D
		PM	46.9	D	54.8	D
9	Marriott Hotel entrance and Mission College Boulevard	AM	12.0	B	13.8	B
		PM	10.2	B	12.1	B
10	Freedom Circle and Mission College Boulevard (West)	AM	10.8	B	10.6	B
		PM	18.7	B	19.0	B
11	Freedom Circle and Mission College Boulevard (East)	AM	16.5	B	16.0	B
		PM	19.3	B	19.0	B
12	Juliette Lane and Mission College Boulevard	AM	20.8	C	24.1	C
		PM	21.9	C	28.5	C
13	Burton Drive and Mission College Boulevard	AM	15.5	B	19.9	B
		PM	16.9	B	15.2	B
14	Great America Parkway and Yerba Buena Way	AM	13.7	B	21.6	C
		PM	18.2	B	31.6	C
15	Great America Parkway and Old Mountain View-Alviso Road	AM	9.7	A	12.1	B
		PM	14.2	B	19.8	B
16	Great America Parkway and Bunker Hill Lane	AM	12.6	B	11.7	B
		PM	14.5	B	13.3	B
17	Great America Parkway and Old Glory Lane	AM	12.8	B	16.2	B
		PM	11.7	B	22.3	C
18	Great America Parkway and Patrick Henry Drive	AM	19.6	B	25.1	C
		PM	24.9	C	26.2	C
19	Great America Parkway and Northbound US 101*	AM	14.6	B	22.1	C
		PM	9.1	A	16.4	B
20	Bowers Avenue and Southbound US 101*	AM	22.6	C	24.1	C
		PM	8.9	A	8.0	A
21	Bowers Avenue and Augustine Drive	AM	24.3	C	32.8	C
		PM	33.1	C	**73.0**	**E**
22	Bowers Avenue and Scott Boulevard*	AM	29.3	C	36.1	D
		PM	29.2	C	34.6	C
23	Bowers Avenue and Central Expressway*	AM	45.2	D	71.3	E
		PM	42.0	D	**97.0**	**F**

Table 3.2-4
Existing and Background Intersection Levels of Service Summary

Intersection		Peak Hour	Existing		Background	
			Avg. Delay	LOS	Avg. Delay	LOS
24	Bowers Avenue and Kifer Road/Walsh Avenue	AM	20.6	C	19.3	B
		PM	20.9	C	21.6	C
25	Corwin Drive and Central Expressway*	AM	21.1	C	28.2	C
		PM	22.5	C	30.2	C
26	Lick Mill Boulevard and Montague Expressway	AM	29.3	C	32.0	C
		PM	20.9	C	20.8	C
27	De La Cruz Boulevard and Montague Expressway*	AM	38.3	D	48.9	D
		PM	38.7	D	40.2	D
28	Montague Expressway and Mission College Boulevard*	AM	72.2	E	**111.2**	**F**
		PM	41.3	D	62.5	E
29	San Tomas Expressway and Scott Boulevard*	AM	31.0	C	41.4	D
		PM	43.9	D	77.8	E
30	San Tomas Expressway and Walsh Avenue	AM	23.5	C	44.1	D
		PM	30.8	C	68.3	E
31	Lafayette Street and Agnew Road	AM	34.5	C	33.0	C
		PM	38.2	D	39.0	D
32	Lafayette Street and Montague Expressway (North)	AM	29.9	C	32.4	C
		PM	26.1	C	27.5	C
33	Lafayette Street and Montague Expressway (South)	AM	14.7	B	13.6	B
		PM	11.5	B	11.6	B
34	Lafayette Street and Central Expressway*	AM	55.8	E	68.6	E
		PM	53.1	D	62.5	E
35	Lafayette Street and Walsh Avenue	AM	12.8	B	13.4	B
		PM	18.8	B	23.8	C
36	N. First Street and Montague Expressway*	AM	49.9	D	**121.1**	**F**
		PM	58.4	E	**132.1**	**F**
37	Great America Parkway (North) and SR 237*	AM	16.7	B	23.7	C
		PM	17.4	B	22.8	C
38	Great America Parkway (South) and SR 237*	AM	12.0	B	16.6	B
		PM	9.2	A	13.0	B
39	Reamwood Avenue and Tasman Drive	AM	6.2	A	7.8	A
		PM	9.9	A	38.1	D
40	Birchwood Avenue and Tasman Drive	AM	17.1	B	33.1	C
		PM	17.2	B	30.7	C
41	Lawrence Expressway and Tasman Drive*	AM	34.9	C	45.8	D
		PM	51.2	D	59.3	E
42	Lawrence Expressway and Lakehaven Drive/Sandia Avenue	AM	35.0	D	34.2	C
		PM	42.9	D	44.6	D
43	Lawrence Expressway and Scott Boulevard/Arques Avenue*	AM	25.9	C	29.0	C
		PM	56.1	E	**88.1**	**F**
44	Lawrence Expressway and Kifer Road	AM	28.0	C	27.4	C
		PM	58.9	E	**80.1**	**F**

*Denotes CMP intersection.
Bold indicates a substandard level of service.

Existing Freeway Levels of Service

Traffic volumes for the subject freeway segments were obtained from the *2011 CMP Annual Monitoring Report*. The results of the analysis are summarized in Table 3.2-5. The results show that the mixed-flow lanes on 24 of the 34 directional freeway segments analyzed currently operate at an unacceptable LOS F during at least one of the peak hours. The results also show that seven of the directional HOV lane segments analyzed currently operate at an unacceptable LOS F during at least one of the peak hours.

Table 3.2-5
Existing Freeway Segment Levels of Service

Freeway Segment		Peak Hour	Mixed-Flow Lanes		HOV Lanes	
			Density	LOS	Density	LOS
US 101 NB	I-880 to Old Bayshore Highway	AM	**121**	**F**	**92**	**F**
		PM	14	B	8	A
	Old Bayshore Highway to N. First Street	AM	**109**	**F**	**93**	**F**
		PM	18	B	12	B
	N. First Street to Guadalupe Parkway	AM	**83**	**F**	**81**	**F**
		PM	17	B	17	B
	Guadalupe Parkway to De La Cruz Boulevard	AM	**107**	**F**	**92**	**F**
		PM	24	C	15	B
	De La Cruz Boulevard to Montague Expressway	AM	54	E	44	D
		PM	32	D	13	B
	Montague Expressway to Great America Parkway	AM	52	E	29	D
		PM	30	D	13	B
	Great America Parkway to Lawrence Expressway	AM	**61**	**F**	30	D
		PM	33	D	11	A
	Lawrence Expressway to N. Fair Oaks Avenue	AM	**61**	**F**	32	D
		PM	28	D	13	B
	N. Fair Oaks Avenue to N. Mathilda Avenue	AM	**74**	**F**	30	D
		PM	26	C	10	A
	N. Mathilda Avenue to SR 237	AM	**71**	**F**	40	D
		PM	34	D	22	C
SR 237 EB	US 101 to N. Mathilda Avenue	AM	**74**	**F**	--	--
		PM	32	D	--	--
	N. Mathilda Avenue to N. Fair Oaks Avenue	AM	58	E	27	D
		PM	47	E	18	B
	N. Fair Oaks Avenue to Lawrence Expressway	AM	37	D	17	B
		PM	**87**	**F**	23	C
	Lawrence Expressway to Great America Parkway	AM	47	E	16	B
		PM	**100**	**F**	28	D
	Great America Parkway to N. First Street	AM	37	D	20	C
		PM	**87**	**F**	28	D
	N. First Street to Zanker Road	AM	42	D	15	B
		PM	**62**	**F**	27	D
	Zanker Road to McCarthy Boulevard	AM	29	D	7	A
		PM	47	E	23	C

Table 3.2-5
Existing Freeway Segment Levels of Service

Freeway Segment		Peak Hour	Mixed-Flow Lanes		HOV Lanes	
			Density	LOS	Density	LOS
US 101 SB	SR 237 to N. Mathilda Avenue	AM	26	C	27	D
		PM	25	C	30	D
	N. Mathilda Avenue to N. Fair Oaks Avenue	AM	27	D	20	C
		PM	32	D	14	B
	North Fair Oaks Avenue to Lawrence Expressway	AM	30	D	16	B
		PM	38	D	17	B
	Lawrence Expressway to Great America Parkway	AM	25	C	13	B
		PM	**106**	**F**	**64**	**F**
	Great America Parkway to Montague Expressway	AM	22	C	8	A
		PM	**100**	**F**	**64**	**F**
	Montague Expressway to De La Cruz Boulevard	AM	26	C	11	A
		PM	**96**	**F**	40	D
	De La Cruz Boulevard to Guadalupe Parkway	AM	23	C	7	A
		PM	50	E	31	D
	Guadalupe Parkway to N. First Street	AM	15	B	4	A
		PM	**69**	**F**	18	B
	N. First Street to Old Bayshore Highway	AM	21	C	8	A
		PM	**112**	**F**	36	D
	Old Bayshore Highway to I-880	AM	14	B	8	A
		PM	**123**	**F**	36	D
SR 237 WB	McCarthy Boulevard to Zanker Road	AM	**93**	**F**	**73**	**F**
		PM	45	D	13	B
	Zanker Road to N. First Street	AM	58	E	40	D
		PM	**61**	**F**	14	B
	N. First Street to Great America Parkway	AM	37	D	33	D
		PM	**82**	**F**	16	B
	Great America Parkway to Lawrence Expressway	AM	32	D	33	D
		PM	55	E	12	B
	Lawrence Expressway to N. Fair Oaks Avenue	AM	58	E	50	E
		PM	**75**	**F**	28	D
	N. Fair Oaks Avenue to N. Mathilda Avenue	AM	**86**	**F**	--	--
		PM	**100**	**F**	--	--
	N. Mathilda Avenue to US 101	AM	57	E	--	--
		PM	42	D	--	--

Source: Santa Clara Valley Transportation Authority Congestion Management Program Monitoring Study, 2011.
Notes: **Bold** indicates a substandard level of service.

3.2.1.6 *Background Conditions*

Background conditions are defined as conditions just prior to completion of the proposed project. Traffic volumes for background conditions comprise volumes from the existing traffic counts plus traffic generated by other approved developments in the vicinity of the site. This traffic scenario represents a more congested traffic condition than the existing conditions scenario, because it

includes traffic from approved projects. The background conditions analysis is consistent with City of Santa Clara policy for transportation analyses though it is not required under CEQA.

Background Roadway Network

Under background conditions, the transportation network is assumed to be the same as the existing transportation network, with the exception of the following improvements. These improvements were identified as mitigation measures to be completed by the City's Capital Improvement Program (CIP) or other approved development projects in the study area.

1. Great America Parkway and Mission College Boulevard – Addition of a third westbound left-turn lane, fourth southbound through lane, third northbound left-turn lane, and separate westbound right-turn lane. (CIP)
2. Old Ironsides Drive and Tasman Drive – Addition of a second northbound left-turn lane (Yahoo!)
3. Great America Parkway and Old Glory Lane – Addition of a second northbound left-turn lane (Yahoo!)
4. Great America Parkway and Patrick Henry Drive – Addition of a second northbound left-turn lane and eastbound free-right-turn lane. The eastbound right-turn lane includes the addition of a fourth southbound lane on Great America Parkway between Patrick Henry Drive and Mission College Boulevard. (Yahoo!)
5. Bowers Avenue and Augustine Drive – Addition of a second southbound left-turn lane, third eastbound left-turn lane, and second westbound right-turn lane (3333 Scott and EOP Office)

Background Traffic Volumes

Background peak-hour traffic volumes were estimated by adding to existing volumes the estimated traffic from approved, but not yet constructed, developments. The added traffic from approved but not yet constructed developments was provided by the City of Santa Clara's TRAFFIX network, which was updated with the current list of approved projects provided by City staff. Traffic generated by Phase 1 of the North San Jose Development Policy and approved projects within the City of Sunnyvale also were included in the background traffic volumes.

In addition, all existing buildings on the project site (a total of 418,000 s.f. office space) were vacant at the time traffic counts were collected at non-CMP intersections. Thus, traffic trips associated with the existing 418,000 s.f. of unoccupied office space at full occupancy were added to the background traffic volumes since those are trips already entitled to the site. These trips were estimated by applying the *Institute of Transportation Engineers'* (ITE) trip generation rate for general office space to the size of the vacant buildings.[7]

It should be noted that for CMP intersections, the available count data (obtained from the CMP) is from the year 2010. In 2010, two of the existing buildings on site (total of 300,000 s.f.) were still occupied. Therefore, at CMP intersections, trip credit was given only for the vacant office space at

[7] One of the buildings on-site has since been partially occupied.

the time the counts were conducted (118,000 s.f.). The list of approved but not yet constructed projects is included in Appendix A.

Background Intersection Levels of Service

The results of the intersection LOS analysis under existing and background conditions are summarized in Table 3.2-4. Measured against the applicable LOS standards, the results show that under background conditions, during at least one peak hour, the following six intersections would operate at unacceptable levels of service:

- No. 21 – Bowers Avenue and Augustine Drive (PM Peak Hour);
- No. 23 – Bowers Avenue and Central Expressway (PM Peak Hour);
- No. 28 – Mission College Boulevard and Montague Expressway (AM Peak Hour);
- No. 36 – North First Street and Montague Expressway (AM and PM Peak Hours);
- No. 43 – Lawrence Expressway and Scott Boulevard/Arques Avenue (PM Peak Hour); and
- No. 44 – Lawrence Expressway and Kifer Road (PM Peak Hour).

All the other study signalized intersections would operate at an acceptable level of service.

3.2.2 Transportation Impacts

3.2.2.1 *Thresholds of Significance*

For the purposes of this EIR, a near-term transportation impact is considered significant if the project would:

- Cause the level of service at any local signalized intersection to degrade from an acceptable LOS D or better under background conditions to an unacceptable LOS E or F under project conditions;
- Increase the average critical delay by four (4) seconds or more and the volume-to-capacity ratio (V/C) by 0.01 at any local intersections currently operating at LOS E or LOS F and at CMP intersections currently operating at LOS F under background conditions;
- Cause the level of service at a CMP signalized intersection to degrade from an acceptable LOS E or better under existing or background conditions to an unacceptable LOS F under baseline plus project or background plus project conditions;
- Increase the critical V/C value by 0.01 or more when the addition of project traffic reduces the amount of average delay for critical movements at non-CMP intersections currently operating at LOS E or LOS F and at CMP intersections currently operating at LOS F under existing or background conditions;
- Cause the LOS on a freeway segment to degrade from an acceptable LOS E or better under existing or background conditions to an unacceptable LOS F under project conditions;
- Contribute one percent of capacity on a freeway segment operating at an unacceptable LOS F under project conditions;
- Substantially impede the operation of a transit system as a result of congestion; or
- Create an operational safety hazard.

3.2.2.2 *Baseline Plus Project Conditions*

CEQA requires that project conditions be evaluated versus a "baseline" condition representing the environmental setting without the project, typically the existing condition. However, acknowledging that environmental conditions can vary over time, CEQA allows a lead agency the discretion to establish a baseline condition other than existing conditions, based on substantial evidence. This baseline condition can provide a more realistic condition against which the project's impacts will be measured than may be presented by existing conditions at the time the project is proposed. In the case of the subject project site, a baseline reflecting full occupancy of the three vacant buildings is appropriate given their history of full occupancy at various points in time over the past several decades and their suitability for continued use.

Traffic Estimates

The magnitude of traffic produced by a new development and the locations where that traffic would appear are estimated using a three-step process: (1) trip generation, (2) trip distribution, and (3) trip assignment. In determining project trip generation, the magnitude of traffic entering and exiting the site is estimated for the AM and PM peak hours. As part of the project trip distribution step, an estimate is made of the directions to and from which the project trips would travel. In the project trip assignment step, the project trips are assigned to specific streets and intersections in the study area.

Trip Generation

The traffic generated by the proposed project was estimated by applying the appropriate standard trip rates to the size of development. For most common land uses there are standard trip generation rates that can be applied to predict the future traffic increases that would result from a proposed development. Project trip estimates were based on trip generation rates obtained from ITE's *Trip Generation, Eighth Edition* (2008).

The City will require that the proposed project implement Transportation Demand Management (TDM) measures that would result in a reduction in vehicle trips by a minimum of five percent on the entire site (refer to Appendix A). Therefore, the project trip estimates include a five percent trip reduction for TDM. It is estimated that the proposed 600,000 s.f. of additional office space would generate an additional 6,046 daily trips, with 851 trips (749 inbound and 102 outbound) occurring during the AM peak hour and 818 trips (139 inbound and 679 outbound) occurring during the PM peak hour. The traffic that would be generated by the existing office space[8] on site (418,000 s.f.) was estimated in a similar manner and included within baseline conditions for this analysis. The trip generation estimates associated with the proposed project are presented in Table 3.2-6, below.

[8] As previously discussed, the three buildings on the site were vacant at the time non-CMP intersection counts were made. One of the on-site buildings is now partially occupied.

Table 3.2-6
Baseline Plus Project Trip Generation

Land Use	Size (s.f.)	Daily Trips	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
Existing Office	418,000	4,602	570	78	648	106	517	623
Proposed Office	1,018,000	11,208	1,389	189	1,578	258	1,259	1,517
Net Increase	600,000	6,606	818	112	930	152	742	894
5% TDM Red. Proposed		-330	-41	-6	-47	-8	-37	-45
5% TDM Red. Existing		-230	-29	-4	-32	-5	-26	-31
Net Project Trips		6,046	749	102	851	139	679	818

Notes: A TDM reduction was applied to the trip generation estimates per City requirement that the project achieve a minimum of 5% reduction in trips through implementation of a TDM program on the entire site.
Source: ITE *Trip Generation, Eighth Edition*, 2008. Land Use (710), General Office Building, average rate.

Trip Distribution and Trip Assignment

The trip distribution pattern for the proposed office development was estimated based on traffic patterns on the surrounding roadway system and on the locations of complementary land uses. The peak-hour trips associated with the proposed project were added to the transportation network in accordance with the distribution pattern.

Baseline Plus Project Traffic Volumes

The occupancy of the existing buildings on site has varied between 2010 and 2012, during which time the existing intersection traffic counts were collected. Therefore, to establish baseline conditions, the existing peak hour traffic volumes at each individual study intersections were adjusted to account for traffic associated with the existing 418,000 s.f. of office space on the project site since those are trips already entitled to the site and the existing office space could be occupied at any time.

All existing buildings on site (a total of 418,000 s.f. office space) were vacant at the time traffic counts were collected at non-CMP intersections. Thus, traffic associated with the existing 418,000 s.f. of unoccupied office space on the project site were added to the existing traffic volumes. It should be noted that for CMP intersections, the available count data (obtained from the CMP) is from the year 2010. In 2010, two of the existing buildings on site (total of 300,000 s.f.) were still occupied. Therefore, at CMP intersections, trip credit was given only for the vacant office space at the time the counts were conducted (118,000 s.f.).

Project trips associated with the proposed project (600,000 s.f. of office), as represented in the above project trip assignment, were added to the baseline traffic volumes to obtain baseline plus project traffic volumes.

Baseline Plus Project Intersection Level of Service

The results of the intersection LOS analysis under baseline plus project conditions are summarized in Table 3.2-7. The level of service results under baseline plus project conditions show that all of the signalized study intersections would continue to operate at acceptable levels of service.

Table 3.2-7
Baseline Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Baseline		Baseline Plus Project	
			Avg. Delay	LOS	Avg. Delay	LOS
1	Patrick Henry Drive and Tasman Drive	AM	17.5	B	17.5	B
		PM	15.7	B	15.8	B
2	Old Ironsides Drive and Tasman Drive	AM	10.7	B	10.7	B
		PM	11.5	B	11.5	B
3	Great America Parkway and Tasman Drive*	AM	28.1	C	28.1	C
		PM	28.6	C	28.8	C
4	Convention Circle and Tasman Drive	AM	9.3	A	9.3	A
		PM	9.9	A	9.9	A
5	Centennial Boulevard and Tasman Drive	AM	10.2	B	10.1	B
		PM	10.6	B	10.6	B
6	Calle del Sol and Tasman Drive	AM	16.1	B	15.9	B
		PM	13.4	B	13.3	B
7	Lick Mill Boulevard and Tasman Drive	AM	32.8	C	32.7	C
		PM	29.1	C	29.1	C
8	Great America Parkway and Mission College Boulevard*	AM	38.9	D	38.1	D
		PM	47.6	D	59.2	E
9	Marriott Hotel entrance and Mission College Boulevard	AM	14.9	B	18.5	B
		PM	13.3	B	18.5	B
10	Freedom Circle and Mission College Boulevard (West)	AM	10.6	B	10.6	B
		PM	18.6	B	18.7	B
11	Freedom Circle and Mission College Boulevard (East)	AM	16.4	B	16.5	B
		PM	19.0	B	18.7	B
12	Juliette Lane and Mission College Boulevard	AM	20.5	C	18.5	B
		PM	21.9	C	21.9	C
13	Burton Drive and Mission College Boulevard	AM	15.7	B	16.0	B
		PM	16.5	B	16.0	B
14	Great America Parkway and Yerba Buena Way	AM	13.6	B	13.5	B
		PM	17.8	B	17.4	B
15	Great America Parkway and Old Mountain View-Alviso Road	AM	9.6	A	9.5	A
		PM	14.7	B	15.7	B
16	Great America Parkway and Bunker Hill Lane	AM	13.3	B	12.9	B
		PM	14.6	B	15.1	B
17	Great America Parkway and Old Glory Lane	AM	12.5	B	12.2	B
		PM	12.0	B	12.2	B
18	Great America Parkway and Patrick Henry Drive	AM	21.3	B	25.3	C
		PM	25.1	C	25.4	C
19	Great America Parkway and Northbound US 101*	AM	14.5	B	14.0	B
		PM	9.1	A	8.8	A
20	Bowers Avenue and Southbound US 101*	AM	22.7	C	23.5	C
		PM	9.0	A	9.2	A
21	Bowers Avenue and Augustine Drive	AM	24.1	C	23.5	C
		PM	33.1	C	33.0	C
22	Bowers Avenue and Scott Boulevard*	AM	29.3	C	29.6	C
		PM	29.1	C	28.8	C
23	Bowers Avenue and Central Expressway*	AM	45.6	D	47.2	D
		PM	42.2	D	43.8	D

Table 3.2-7
Baseline Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Baseline		Baseline Plus Project	
			Avg. Delay	LOS	Avg. Delay	LOS
24	Bowers Avenue and Kifer Road/Walsh Avenue	AM	20.6	C	20.7	C
		PM	20.9	C	20.7	C
25	Corwin Drive and Central Expressway*	AM	21.1	C	21.1	C
		PM	22.6	C	22.7	C
26	Lick Mill Boulevard and Montague Expressway	AM	29.2	C	29.1	C
		PM	20.9	C	20.8	C
27	De La Cruz Boulevard and Montague Expressway*	AM	38.3	D	38.6	D
		PM	38.7	D	38.9	D
28	Montague Expressway and Mission College Boulevard*	AM	73.0	E	76.5	E
		PM	41.7	D	41.3	D
29	San Tomas Expressway and Scott Boulevard*	AM	31.0	C	30.9	C
		PM	43.9	D	44.0	D
30	San Tomas Expressway and Walsh Avenue	AM	23.5	C	23.4	C
		PM	30.8	C	30.8	C
31	Lafayette Street and Agnew Road	AM	34.5	C	34.7	C
		PM	38.2	D	38.5	D
32	Lafayette Street and Montague Expressway (North)	AM	29.7	C	29.4	C
		PM	26.1	C	26.1	C
33	Lafayette Street and Montague Expressway (South)	AM	14.4	B	13.9	B
		PM	11.8	B	12.1	B
34	Lafayette Street and Central Expressway*	AM	55.9	E	56.6	E
		PM	53.1	D	53.7	D
35	Lafayette Street and Walsh Avenue	AM	12.8	B	12.8	B
		PM	18.8	B	18.9	B
36	N. First Street and Montague Expressway*	AM	50.1	D	50.3	D
		PM	58.5	E	58.7	E
37	Great America Parkway (North) and SR 237*	AM	16.7	B	16.8	B
		PM	17.4	B	17.7	B
38	Great America Parkway (South) and SR 237*	AM	11.5	B	11.1	B
		PM	9.1	A	8.6	A
39	Reamwood Avenue and Tasman Drive	AM	6.2	A	6.1	A
		PM	9.9	A	9.9	A
40	Birchwood Avenue and Tasman Drive	AM	17.1	B	17.1	B
		PM	17.2	B	17.1	B
41	Lawrence Expressway and Tasman Drive*	AM	35.0	C	35.0	D
		PM	51.2	D	51.4	D
42	Lawrence Expressway and Lakehaven Drive/Sandia Avenue	AM	35.1	D	35.1	D
		PM	42.9	D	43.0	D
43	Lawrence Expressway and Scott Boulevard/Arques Avenue*	AM	26.0	C	26.2	C
		PM	56.1	E	56.6	E
44	Lawrence Expressway and Kifer Road	AM	28.0	C	28.0	C
		PM	59.1	E	59.8	E

*Denotes CMP intersection.

Impact TRANS-1: Implementation of the proposed project would have a less than significant impact on study intersections during both of the peak hours under baseline plus project conditions. **(Less Than Significant Impact)**

3.2.2.3 *Background Plus Project Conditions*

Traffic Estimates

As stated in 3.2.2.2 of this Chapter, the magnitude of traffic produced by a new development and the locations where that traffic would appear are estimated using a three-step process: (1) trip generation, (2) trip distribution, and (3) trip assignment. In determining project trip generation, the magnitude of traffic entering and exiting the site is estimated for the AM and PM peak hours. As part of the project trip distribution step, an estimate is made of the directions to and from which the project trips would travel. In the project trip assignment step, the project trips are assigned to specific streets and intersections in the study area.

Trip Generation

As stated in 3.2.2.2 of this Chapter, the traffic generated by the proposed project was estimated by applying the appropriate standard trip rates to the size of development. For most common land uses there are standard trip generation rates that can be applied to predict the future traffic increases that would result from a proposed development. Project trip estimates were based on trip generation rates obtained from ITE's *Trip Generation, Eighth Edition* (2008). Project trip estimates were generated for an additional 600,000 s.f. of office space on the site. The traffic that would be generated by the unoccupied office space on site (418,000 s.f.) at full occupancy was estimated and included in the background conditions.

The City will require that the proposed project implement TDM measures that would result in a reduction in vehicle trips by a minimum of five percent on the entire site. Therefore, the project trip estimates include a five percent trip reduction for TDM. It is estimated that the proposed construction of 600,000 s.f. of office space would generate an additional 6,046 daily trips, with 851 trips (749 inbound and 102 outbound) occurring during the AM peak hour and 818 trips (139 inbound and 679 outbound) occurring during the PM peak hour. The project trip generation estimates are presented in Table 3.2-8, below.

Table 3.2-8
Background Plus Project Trip Generation

Land Use	Size (s.f.)	Daily Trips	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Existing Office	418,000	4,602	570	78	648	106	517	623
Proposed Office	1,018,000	11,208	1,389	189	1,578	258	1,259	1,517
Total Net Increase	600,000	6,606	818	112	930	152	742	894
5% TDM Red. Proposed		-330	-41	-6	-47	-8	-37	-45
5% TDM Red. Existing		-230	-29	-4	-32	-5	-26	-31
Net Project Trips		6,046	749	102	851	139	679	818

Notes: A TDM reduction was applied to the trip generation estimates per City requirement that the project achieve a minimum of 5% reduction in trips through implementation of a TDM program on the entire site.
Source: ITE *Trip Generation, Eighth Edition*, 2008. Land Use (710), General Office Building, average rate.

Trip Distribution and Trip Assignment

The trip distribution pattern for the proposed office development was estimated based on traffic patterns on the surrounding roadway system and on the locations of complementary land uses. The peak-hour trips associated with the proposed project were added to the transportation network in accordance with the distribution pattern.

Background Plus Project Roadway Network

It is assumed in this analysis that the transportation network under background plus project conditions would be the same as described under background conditions.

Background Plus Project Traffic Volumes

Project trips, as described in the above project trip assignment, were added to the background traffic volumes to obtain background plus project traffic volumes.

Background Plus Project Intersection Level of Service

The results of the intersection LOS analysis under background plus project conditions are summarized in Table 3.2-9. Under background plus project conditions, the results show that six of the study intersection would operate at unacceptable levels of service, according to the applicable level of service standards.

Table 3.2-9
Background Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Background		Background Plus Project			
			Average Delay	LOS	Average Delay	LOS	Critical Delay Incr.	Critical V/C Incr.
1	Patrick Henry Drive and Tasman Drive	AM	23.0	C	23.3	C	0.2	0.004
		PM	29.3	C	30.4	C	2.0	0.011
2	Old Ironsides Drive and Tasman Drive	AM	20.3	C	20.3	C	0.0	0.003
		PM	26.1	C	26.2	C	0.1	0.001
3	Great America Parkway and Tasman Drive*	AM	30.0	C	30.9	C	1.6	0.050
		PM	36.5	D	37.7	D	1.8	0.013
4	Convention Circle and Tasman Drive	AM	9.6	A	9.6	A	0.1	0.011
		PM	10.0	A	10.0	B	0.1	0.010
5	Centennial Boulevard and Tasman Drive	AM	10.2	B	10.2	B	0.0	0.010
		PM	10.3	B	10.3	B	0.1	0.009
6	Calle del Sol and Tasman Drive	AM	16.9	B	16.7	B	-0.1	0.011
		PM	14.7	B	14.6	B	0.0	0.012
7	Lick Mill Boulevard and Tasman Drive	AM	31.8	C	31.7	C	0.0	0.001
		PM	29.9	C	30.0	C	0.1	0.009
8	Great America Parkway and Mission College Boulevard*	AM	44.3	D	48.4	D	7.6	0.048
		PM	54.8	D	71.6	E	25.5	0.075

Table 3.2-9
Background Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Background		Background Plus Project			
			Average Delay	LOS	Average Delay	LOS	Critical Delay Incr.	Critical V/C Incr.
9	Marriott Hotel entrance and Mission College Boulevard	AM	13.8	B	18.6	B	7.7	0.146
		PM	12.1	B	18.5	B	9.0	0.230
10	Freedom Circle and Mission College Boulevard (West)	AM	10.6	B	10.9	B	0.6	0.049
		PM	19.0	B	19.6	B	1.2	0.045
11	Freedom Circle and Mission College Boulevard (East)	AM	16.0	B	17.8	B	4.6	0.129
		PM	19.0	B	19.1	B	0.7	0.025
12	Juliette Lane and Mission College Boulevard	AM	24.1	C	24.3	C	0.0	0.000
		PM	28.5	C	29.7	C	1.7	0.025
13	Burton Drive and Mission College Boulevard	AM	19.9	B	21.5	C	2.1	0.038
		PM	15.2	B	15.2	B	0.1	0.023
14	Great America Parkway and Yerba Buena Way	AM	21.6	C	21.8	C	0.4	0.030
		PM	31.6	C	32.7	C	1.8	0.027
15	Great America Parkway and Old Mountain View-Alviso Road	AM	12.1	B	13.0	B	1.4	0.033
		PM	19.8	B	21.4	C	3.2	0.030
16	Great America Parkway and Bunker Hill Lane	AM	11.7	B	11.6	B	0.0	0.031
		PM	13.3	B	13.1	B	-0.1	0.028
17	Great America Parkway and Old Glory Lane	AM	16.2	B	17.1	B	1.4	0.046
		PM	22.3	C	22.7	C	1.1	0.009
18	Great America Parkway and Patrick Henry Drive	AM	25.1	C	29.5	C	0.7	0.027
		PM	26.1	C	27.9	C	2.7	0.067
19	Great America Parkway and Northbound US 101*	AM	22.1	C	23.5	C	2.1	0.045
		PM	16.4	B	21.9	C	7.2	0.040
20	Bowers Avenue and Southbound US 101*	AM	24.1	C	26.1	C	2.4	0.064
		PM	8.0	A	8.5	A	0.7	0.029
21	Bowers Avenue and Augustine Drive	AM	32.8	C	34.3	C	2.1	0.025
		PM	73.0	E	**78.8**	**E**	**8.9**	**0.023**
22	Bowers Avenue and Scott Boulevard*	AM	36.1	D	37.8	D	2.6	0.037
		PM	34.6	C	34.9	C	0.5	0.018
23	Bowers Avenue and Central Expressway*	AM	71.3	E	77.7	E	10.6	0.023
		PM	97.0	F	**104.7**	**F**	**6.9**	**0.018**
24	Bowers Avenue and Kifer Road/Walsh Avenue	AM	19.3	B	19.7	D	0.6	0.019
		PM	21.6	C	21.7	C	0.4	0.011
25	Corwin Drive and Central Expressway*	AM	28.2	C	28.3	C	0.2	0.002
		PM	30.2	C	30.8	C	0.5	0.002
26	Lick Mill Boulevard and Montague Expressway	AM	32.0	C	32.1	C	0.2	0.007
		PM	20.8	C	20.7	C	0.0	0.006
27	De La Cruz Boulevard and Montague Expressway*	AM	48.9	D	50.7	D	3.4	0.013
		PM	40.2	D	40.6	D	0.4	0.003
28	Montague Expressway and Mission College Boulevard*	AM	111.2	F	**115.4**	**F**	**7.9**	**0.017**
		PM	62.5	E	71.0	E	13.6	0.032
29	San Tomas Expressway and Scott Boulevard*	AM	41.4	D	41.4	D	0.0	0.005
		PM	77.8	E	79.1	E	2.4	0.005

Table 3.2-9
Background Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Background		Background Plus Project			
			Average Delay	LOS	Average Delay	LOS	Critical Delay Incr.	Critical V/C Incr.
30	San Tomas Expressway and Walsh Avenue	AM	44.1	D	44.5	D	0.7	0.006
		PM	68.3	E	69.4	E	1.8	0.005
31	Lafayette Street and Agnew Road	AM	33.0	C	33.2	C	0.4	0.004
		PM	39.0	D	39.3	D	0.4	0.007
32	Lafayette Street and Montague Expressway (North)	AM	32.4	C	32.2	C	0.0	0.000
		PM	27.5	C	27.5	C	0.0	0.000
33	Lafayette Street and Montague Expressway (South)	AM	13.6	B	13.5	B	-0.1	0.011
		PM	11.6	B	11.8	B	0.4	0.022
34	Lafayette Street and Central Expressway*	AM	68.6	E	70.6	E	-7.8	-0.047
		PM	62.5	E	64.1	E	2.9	0.010
35	Lafayette Street and Walsh Avenue	AM	13.4	B	13.4	B	0.1	0.011
		PM	23.8	C	24.1	C	0.5	0.010
36	N. First Street and Montague Expressway*	AM	121.1	F	122.1	F	1.4	0.003
		PM	132.1	F	132.8	F	1.4	0.003
37	Great America Parkway (North) and SR 237*	AM	23.7	C	26.8	C	4.5	0.039
		PM	22.8	C	23.4	C	0.7	0.019
38	Great America Parkway (South) and SR 237*	AM	16.6	B	17.3	B	1.2	0.034
		PM	13.0	B	13.3	B	0.6	0.033
39	Reamwood Avenue and Tasman Drive	AM	7.8	A	7.9	A	0.1	0.009
		PM	38.1	D	41.7	D	5.3	0.009
40	Birchwood Avenue and Tasman Drive	AM	33.1	C	36.2	D	4.3	0.010
		PM	30.7	C	32.9	C	3.4	0.009
41	Lawrence Expressway and Tasman Drive*	AM	45.8	D	46.8	D	2.7	0.016
		PM	59.3	E	60.0	E	1.4	0.006
42	Lawrence Expressway and Lakehaven Drive/Sandia Avenue	AM	34.2	C	34.2	C	0.0	0.001
		PM	44.6	D	44.7	D	0.1	0.002
43	Lawrence Expressway and Scott Boulevard/Arques Avenue*	AM	29.0	C	29.4	C	0.7	0.006
		PM	88.1	F	88.6	F	0.9	0.003
44	Lawrence Expressway and Kifer Road	AM	27.4	C	27.4	C	0.0	0.004
		PM	80.1	F	81.6	F	2.9	0.007

*Denotes CMP intersection.
Bold indicates a significant impact.

As shown above in Table 3.2-9, of the six intersections projected to operate at unacceptable levels of service, the following three intersections would be impacted by the proposed project during at least one of the peak hours:

- No. 21 – Bowers Avenue and Augustine Drive (PM Peak Hour);
- No. 23 – Bowers Avenue and Central Expressway (PM Peak Hour); and
- No. 28 – Mission College Boulevard and Montague Expressway (AM Peak Hour).

Impact TRANS-2: The Bowers Avenue and Augustine Drive intersection would operate at LOS E during the PM peak hour under background conditions. The addition of project traffic would cause the critical-movement delay at the intersection to increase by four or more seconds and the volume-to-capacity ratio (V/C) to increase by .01 or more during the PM peak hour under background plus project conditions. **(Significant Impact)**

Impact TRANS-3: The Bowers Avenue and Central Expressway intersection would operate at LOS F during the PM peak hour under background conditions. The addition of project traffic would cause the critical-movement delay at the intersection to increase by four or more seconds and the volume-to-capacity ratio (V/C) to increase by .01 or more during the PM peak hour under background plus project conditions. **(Significant Impact)**

Impact TRANS-4: The Mission College Boulevard and Montague Expressway intersection is expected to operate at LOS F during the AM peak hour under background conditions. The addition of project traffic would cause the critical-movement delay at the intersection to increase by four or more seconds and the volume-to-capacity ratio (V/C) to increase by .01 or more during the AM peak hour under background plus project conditions. **(Significant Impact)**

3.2.2.4 *Project Freeway Segment Analysis*

Traffic volumes on the study freeway segments under project conditions were estimated by adding the proposed net project trips to the existing volumes obtained from the *2011 CMP Annual Monitoring Report*. The results of the freeway analysis are summarized in Table 3.2-10, on the following page. The results show that the project would have a significant impact on 11 directional freeway segments:

- US 101 northbound from I-880 to Old Bayshore Highway (AM Peak Hour – Mixed-Flow & HOV);
- US 101 northbound from Old Bayshore Highway to North First Street (AM Peak Hour – Mixed-Flow & HOV);
- US 101 northbound from North First Street to Guadalupe Parkway (AM Peak Hour – Mixed-Flow & HOV);
- US 101 northbound from Guadalupe Parkway to De La Cruz Boulevard (AM Peak Hour – Mixed-Flow & HOV);
- SR 237 eastbound from Great America Parkway to North First Street (PM Peak Hour);
- SR 237 eastbound from North First Street to Zanker Road (PM Peak Hour);
- US 101 southbound from Great America Parkway to Montague Expressway (PM Peak Hour – Mixed-Flow & HOV);
- US 101 southbound from Montague Expressway to De La Cruz Boulevard (PM Peak Hour);
- US 101 southbound from Guadalupe Parkway to North First Street (PM Peak Hour);
- SR 237 westbound from McCarthy Boulevard to Zanker Road (AM Peak Hour – Mixed-Flow & HOV); and

- SR 237 westbound from Zanker Road to North First Street (AM Peak Hour).

The Valley Transportation Authority *Valley Transportation Plan* (*VTP 2030*) identifies improvements to regional facilities, including freeways, for which a regional funding plan could be used to fund the improvements. The following improvements to impacted freeway segments are identified in the VTP 2030:

- US 101 auxiliary lane widenings between Trimble Road and Montague Expressway;
- US 101 southbound auxiliary lane between Great America Parkway and Lawrence Expressway; and
- SR 237 westbound auxiliary lane between Coyote Creek Bridge and North First Street.

There is currently no mechanism in place to collect funds for these improvements.

Impact TRANS-5: The proposed project would contribute in excess of one percent of segment capacity to 11 directional freeway segments already operating at LOS F during either the AM or PM peak hour. **(Significant Impact)**

3.2.2.5 *Transit, Pedestrian and Bicycle Analysis*

Transit

Some quantity of future project trips may be made on buses and other transit service. Applying an average transit use rate of two percent yields an estimate of 19 and 18 additional transit trips during the AM and PM peak hours, respectively. The 57 and 60 bus lines directly serve the project site with a stop located along Great America Parkway. Given that there are also other bus routes within walking distance of the project site, the projected transit riders associated with the project could be accommodated by the existing service.

Pedestrian Facilities

There are existing sidewalks provided along the project's frontages on Mission College Boulevard, Great America Parkway, and Patrick Henry Drive. The existing sidewalks along the project's frontage on Great America Parkway and Mission College Boulevard provide the required pedestrian realm of 15 feet prescribed by the VTA's *Pedestrian Technical Guidelines*, October 2003 for urban roads.

Pedestrian crosswalks and signal heads with pushbuttons are present at all signalized intersections, including the Marriott Hotel entrance and Mission College Boulevard and Patrick Henry Drive and Great America Parkway intersections. Some retail is present at the southwest and northwest corners of Mission College Boulevard and Great America Parkway. Sidewalks, crosswalks, and pedestrian pushbuttons and signalheads are present to connect these retail properties to the project site for pedestrians. The existing network of sidewalks in Santa Clara would connect pedestrians to their destinations. The existing pedestrian facilities would be adequate to support pedestrians walking to and from the project site.

Table 3.2-10
Project Freeway Segment Levels of Service

Freeway	Segment	Peak Hour	Mixed-Flow Lanes				HOV Lanes			
			Capacity	LOS	Volume	% Capacity	Capacity	LOS	Volume	% Capacity
US 101 NB	I-880 to Old Bayshore Highway	AM	6,900	**F**	**81**	**1.2**	1,650	**F**	**36**	**2.2**
		PM	6,900	B	18	0.3	1,650	A	4	0.2
	Old Bayshore Highway to N. First Street	AM	6,900	**F**	**85**	**1.2**	1,650	**F**	**32**	**1.9**
		PM	6,900	B	18	0.3	1,650	B	4	0.3
	N. First Street to Guadalupe Parkway	AM	6,900	**F**	**87**	**1.3**	1,650	**F**	**30**	**1.8**
		PM	6,900	B	16	0.2	1,650	B	6	0.3
	Guadalupe Parkway to De La Cruz Boulevard	AM	6,900	**F**	**85**	**1.2**	1,650	**F**	**32**	**2.0**
		PM	6,900	C	18	0.3	1,650	B	4	0.2
	De La Cruz Boulevard to Montague Expressway	AM	6,900	E	86	1.2	1,650	D	31	1.9
		PM	6,900	D	19	0.3	1,650	B	3	0.2
	Montague Expressway to Great America Parkway	AM	6,900	E	90	1.3	1,650	D	27	1.6
		PM	6,900	D	19	0.3	1,650	B	3	0.2
	Great America Parkway to Lawrence Expressway	AM	6,900	B	13	0.2	1,650	D	4	0.3
		PM	6,900	D	99	1.4	1,650	A	12	0.7
	Lawrence Expressway to N. Fair Oaks Avenue	AM	6,900	F	13	0.2	1,650	D	4	0.3
		PM	6,900	D	95	1.4	1,650	B	16	1.0
	N. Fair Oaks Avenue to N. Mathilda Avenue	AM	6,900	F	12	0.2	1,650	D	4	0.3
		PM	6,900	C	93	1.4	1,650	A	13	0.8
	N. Mathilda Avenue to SR 237	AM	6,900	F	11	0.2	1,650	D	5	0.3
		PM	6,900	D	86	1.2	1,650	C	20	1.2
SR 237 EB	US 101 to N. Mathilda Avenue	AM	4,400	F	39	0.9	N/A	N/A	N/A	N/A
		PM	4,400	D	7	0.2	N/A	N/A	N/A	N/A
	N. Mathilda Avenue to N. Fair Oaks Avenue	AM	4,400	E	27	0.6	1,650	D	12	0.7
		PM	4,400	E	5	0.1	1,650	B	2	0.1
	N. Fair Oaks Avenue to Lawrence Expressway	AM	4,400	D	31	0.	1,650	B	8	0.5
		PM	4,400	F	5	0.1	1,650	C	2	0.1
	Lawrence Expressway to Great America Parkway	AM	4,400	E	31	0.7	1,650	B	8	0.5
		PM	4,400	F	4	0.1	1,650	D	3	0.2
	Great America Parkway to N. First Street	AM	4,400	D	12	0.3	1,650	C	4	0.2
		PM	4,400	**F**	**65**	**1.5**	1,650	D	41	2.5
	N. First Street to Zanker Road	AM	4,400	D	13	0.3	1,650	B	3	0.2
		PM	4,400	**F**	**72**	**1.6**	1,650	D	34	2.1
	Zanker Road to McCarthy Boulevard	AM	4,400	D	14	0.3	1,650	A	2	0.1
		PM	4,400	E	77	1.8	1,650	C	29	1.7

Table 3.2-10
Project Freeway Segment Levels of Service

Freeway	Segment	Peak Hour	Mixed-Flow Lanes				HOV Lanes			
			Capacity	LOS	Volume	% Capacity	Capacity	LOS	Volume	% Capacity
US 101 SB	SR 237 to N. Mathilda Avenue	AM	6,900	C	87	1.3	1,650	D	30	1.8
		PM	6,900	C	15	0.2	1,650	D	7	0.4
	N. Mathilda Avenue to N. Fair Oaks Avenue	AM	6,900	D	94	1.4	1,650	C	23	1.4
		PM	6,900	D	19	0.3	1,650	B	3	0.2
	North Fair Oaks Avenue to Lawrence Expressway	AM	6,900	D	104	1.5	1,650	B	19	1.2
		PM	6,900	D	19	0.3	1,650	B	4	0.2
	Lawrence Expressway to Great America Parkway	AM	6,900	C	104	1.5	1,650	B	19	1.1
		PM	6,900	F	15	0.2	1,650	F	8	0.5
	Great America Parkway to Montague Expressway	AM	6,900	C	14	0.2	1,650	A	2	0.1
		PM	6,900	**F**	**73**	**1.1**	1,650	**F**	**33**	**2.0**
	Montague Expressway to De La Cruz Boulevard	AM	6,900	C	14	0.2	1,650	A	2	0.1
		PM	6,900	**F**	**68**	**1.0**	1,650	D	38	2.3
	De La Cruz Boulevard to Guadalupe Parkway	AM	6,900	C	15	0.2	1,650	A	1	0.
		PM	6,900	E	79	1.1	1,650	D	27	1.6
	Guadalupe Parkway to N. First Street	AM	6,900	B	15	0.2	1,650	A	1	0.1
		PM	6,900	**F**	**87**	**1.3**	1,650	B	19	1.2
	N. First Street to Old Bayshore Highway	AM	6,900	C	14	0.2	1,650	A	2	0.1
		PM	6,900	F	63	0.9	1,650	D	43	2.6
	Old Bayshore Highway to I-880	AM	6,900	B	13	0.2	1,650	A	3	0.2
		PM	6,900	F	60	0.9	1,650	D	46	2.8
SR 237 WB	McCarthy Boulevard to Zanker Road	AM	5,280	**F**	**77**	**1.5**	1,650	**F**	**40**	**2.4**
		PM	5,280	D	19	0.4	1,650	B	3	0.2
	Zanker Road to N. First Street	AM	4,400	**F**	**76**	**1.7**	1,650	D	41	2.5
		PM	4,400	F	18	0.4	1,650	B	4	0.3
	N. First Street to Great America Parkway	AM	4,400	D	79	1.8	1,650	D	38	2.3
		PM	4,400	F	16	0.4	1,650	B	6	0.3
	Great America Parkway to Lawrence Expressway	AM	4,400	D	3	0.1	1,650	D	2	0.1
		PM	4,400	E	29	0.7	1,650	B	6	0.4
	Lawrence Expressway to N. Fair Oaks Avenue	AM	4,400	E	3	0.1	1,650	E	2	0.1
		PM	4,400	F	21	0.5	1,650	D	14	0.8
	N. Fair Oaks Avenue to N. Mathilda Avenue	AM	6,900	F	5	0.1	N/A	N/A	N/A	N/A
		PM	6,900	F	35	0.5	N/A	N/A	N/A	N/A
	N. Mathilda Avenue to US 101	AM	4,400	E	5	0.1	N/A	N/A	N/A	N/A
		PM	4,400	D	35	0.8	N/A	N/A	N/A	N/A

Source: Santa Clara Valley Transportation Authority Congestion Management Program Monitoring Study, 2011.
Notes: **Bold** text indicates a significant impact.

Bicycle Facilities

Bicycle trips are estimated at one percent of total project-generated trips. Therefore the project could be estimated to generate nine new bicycle trips. The existing bicycle facilities would be adequate to serve the anticipated demand. There are bike lanes provided on Great America Parkway along the project's frontage. The striping for bike lanes along Great America Parkway is discontinuous between the Mission College Boulevard intersection and the first project driveway, to allow for weaving of buses to the bus stop just north of the Mission College Boulevard intersection and right-turning vehicles from Mission College Boulevard. The lack of bike lane striping along this stretch of the project site would not result in a safety hazard due to the infrequency of buses stopping in this location and the presence of the stoplight and crosswalks at the Mission College Boulevard and Great America Parkway intersection which serve to slow vehicles and require greater driver awareness of pedestrians and cyclists in the area.

VTA recommends new developments provide bicycle parking, and provides recommended bicycle parking rates in their *VTA Countywide Bicycle Plan Technical Guidelines*, September 1999. Two types of bicycle parking are described by VTA: Class I and Class II. Class I bicycle parking include bicycle lockers, rooms with key access for regular bicycle commuters, guarded parking areas, and valet or check-in parking. Class II bicycle parking refers to a bicycle rack to which the frame and at least one wheel of the bicycle can be secured with a user-provided lock and cable. According to VTA's recommended rates, an office project (such as the proposed project) should provide one bicycle parking space for every 6,000 s.f. of proposed space. Class I and II should have 75 and 25 percent of the new parking spaces, respectively. According to the recommended rates, the proposed project should provide 75 Class I and 25 Class II bicycle parking spaces to serve the proposed office space. The City of Santa Clara, however, will condition the project to provide bicycle parking in excess of the VTA recommended rates. The City of Santa Clara will require that the project provide 128 Class I and 42 Class II bicycle parking spaces to serve the proposed office space.

Impact TRANS-6: The existing transit, pedestrian, and bicycle facilities in the project area are adequate to serve the proposed project. **(Less than Significant Impact)**

3.2.3 Mitigation Measures for Transportation Impacts

3.2.3.1 *Mitigation for Intersection LOS Impacts*

A significant impact is said to be satisfactorily mitigated when measures are implemented that would restore intersection LOS to an acceptable level or equivalent to background conditions. The following mitigation measures identify roadway improvements that could reduce impacts to the affected intersections. The feasibility of each mitigation measure is addressed below. Only those mitigation measures which are deemed feasible and/or the payment of impact fees (where applicable) are proposed as part of the project would reduce the identified traffic impact.

As a condition of approval, the City of Santa Clara will collect applicable local traffic fees. This is consistent with City policy to collect fees from projects that have a significant impact on local or

regional facilities. In addition, as a condition of approval, the project will pay a fair share contribution toward improvement programs currently approved by the County of Santa Clara. Identified improvements for intersections and/or roadway segments which are listed as possible mitigation and are not controlled by the City of Santa Clara, and are subject to financial contributions from Santa Clara, must complete the necessary environmental review and be certified by the Lead Agency with jurisdiction over the intersection/roadway in conformance with CEQA prior to the payment of fees toward those improvements.

MM TRANS-2: At the intersection of Bowers Avenue and Augustine Drive, improvements consisting of the addition of a second southbound left-turn lane, a separate westbound right-turn lane, and a third eastbound left-turn lane have been identified as part of other approved development in the project area. The intersection would, however, continue to operate at LOS E during the PM peak hour with the planned improvements with or without the proposed project. There are no further feasible improvements at the intersection due to right-of-way constraints. Therefore, the project impact is significant and unavoidable. **(Significant Unavoidable Impact)**

MM TRANS-3: The significant impact at the Bowers Avenue and Central Expressway intersection could be satisfactorily mitigated by adding third eastbound and southbound left-turn lanes. With these improvements, the intersection would continue to operate at LOS F during the PM peak hour. The average vehicular delay; however, would be less than that under background conditions; therefore, the impact would be considered mitigated. While the intersection is under the jurisdiction of the County and not the City of Santa Clara, the City has discussed this improvement with the County and they are conceptually in agreement with the identified improvements which can be constructed within the existing roadway right-of-way. The City intends to add these improvements to the Capital Improvement Plan (CIP) and program funds toward their construction. A previously approved project has already been conditioned to contribute toward a portion of these improvements. The project will pay a fair share contribution towards the improvements; thereby reducing the project's impact to a less than significant level. **(Less Than Significant Impact with Mitigation)**

MM TRANS-4: The Comprehensive County Expressway Planning Study identifies at-grade improvements at the Mission College Boulevard and Montague Expressway intersection as a Tier 1A priority along with the planned Tier 1B improvement of the US 101 and Montague Expressway partial cloverleaf interchange improvement project. The project will pay a fair share contribution toward these improvements. The effects of the planned improvements cannot be reflected in level of service calculations because the specific details of the interchange design are not available, but it is expected that the intersection would be improved to acceptable levels. **(Less Than Significant Impact with Mitigation)**

3.2.3.2 *Mitigation for Freeway LOS Impacts*

A significant freeway LOS impact is said to be satisfactorily mitigated when measures are implemented that would restore freeway conditions to better than background conditions.

MM TRANS-5: Full mitigation of significant project impacts on freeway segments would require roadway widening to construct additional through lanes, thereby increasing freeway capacity. Due to constraints in acquisition and cost of right-of-way, it is not feasible for an individual development project to bear responsibility for implementing such extensive transportation system improvements. No comprehensive project to add through lanes has been developed by Caltrans or VTA for individual projects to contribute to and, therefore, the significant impacts on the 11 directional freeway segments identified above are significant and unavoidable. **(Significant Unavoidable Impact)**

3.2.4 Conclusion

Impact TRANS-1: Implementation of the proposed project would have a less than significant impact on study intersections during both of the peak hours under baseline plus project conditions. **(Less Than Significant Impact)**

Impact TRANS-2: There are no further feasible improvements at the Bowers Avenue and Augustine Drive intersection due to right-of-way constraints. Therefore, the project impact is considered significant and unavoidable. **(Significant Unavoidable Impact)**

Impact TRANS-3: The City of Santa Clara will include the required improvements to the Bowers Avenue and Central Expressway intersection in the CIP and program funds toward their construction. The project will pay a fair share contribution towards the improvements; thereby reducing the project's impact to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact TRANS-4: The project will pay a fair share contribution toward improvements currently approved by the County of Santa Clara for the intersection of Mission College Boulevard and Montague Expressway. **(Less Than Significant Impact with Mitigation)**

Impact TRANS-5: The 11 freeway segment LOS impacts of the proposed project would remain significant and unavoidable due to the lack of feasible mitigation measures. **(Significant Unavoidable Impact)**

Impact TRANS-6: The existing transit, pedestrian, and bicycle facilities in the project area are adequate to serve the proposed project. **(Less than Significant Impact)**

3.3 AIR QUALITY

The following discussion is based on an Air Quality and Greenhouse Gas Emission Assessment prepared by *Illingworth & Rodkin, Inc.* in March 2013. A copy of this report is included as Appendix B in this EIR.

3.3.1 Existing Setting

3.3.1.1 *Air Pollution Climatology*

Air quality is determined by the concentration of various pollutants in the atmosphere. Units of concentration are expressed in parts per million (ppm) or micrograms per kilograms (μg/kg).

The amount of a given pollutant in the atmosphere is determined by the amount of pollutant released in an area, transport of pollutants to and from surrounding areas, local and regional meteorological conditions, and the surrounding topography of the air basin. The major determinants of transport and dilution are wind, atmospheric stability, terrain and for photochemical pollutants, sunshine.

Santa Clara is located in the southern portion of the San Francisco Bay Area Air Basin. The proximity of this location to both the Pacific Ocean and San Francisco Bay has a moderating influence on the climate. Northwest winds and northerly winds are most common in the project area, reflecting the orientation of the Bay and the San Francisco Peninsula. Winds from these directions carry pollutants released by autos and factories from upwind areas of the Peninsula toward Santa Clara, particularly during the summer months. Winds are lightest on the average in fall and winter. Every year in fall and winter there are periods of several days when winds are very light and local pollutants can build up.

Pollutants can be diluted by mixing in the atmosphere both vertically and horizontally. Vertical mixing and dilution of pollutants are often suppressed by inversion conditions, when a warm layer of air traps cooler air close to the surface. During the summer, inversions are generally elevated above ground level, but are present over 90 percent of the time in both the morning and afternoon. In winter, surface based inversions dominate in the morning hours, but frequently dissipate by afternoon.

Topography can restrict horizontal dilution and mixing of pollutants by creating a barrier to air movement. The South Bay has significant terrain features that affect air quality. The Santa Cruz Mountains and Diablo Range on either side of the South Bay restrict horizontal dilution, and this alignment of the terrain also channels winds from the north to south, carrying pollution from the northern Peninsula toward Santa Clara.

The combined effects of moderate ventilation, frequent inversions that restrict vertical dilution and terrain that restrict horizontal dilution give Santa Clara a relatively high atmospheric potential for pollution compared to other parts of the San Francisco Bay Air Basin and provide a high potential for transport of pollutants to the east and south.

3.3.1.2 *Overview of Regulatory Setting*

The Federal Clean Air Act governs air quality in the United States. In addition to being subject to federal requirements, air quality in California is also governed by more stringent regulations under the California Clean Air Act. At the federal level, the U.S. Environmental Protection Agency (EPA) administers the Federal Clean Air Act. The California Clean Air Act is administered by the California Air Resource Board (CARB) at the state level, and the Air Quality Management District (BAAQMD) regulates air quality at the regional level, which includes the nine-county Bay Area.

3.3.1.3 *Ambient Air Quality Standards*

National and State Standards

Both the EPA and CARB have established ambient air quality standards for common pollutants. The EPA is responsible for establishing the National Ambient Air Quality Standards (NAAQS) and the CARB is responsible for establishing the California Ambient Air Quality Standards (CAAQS). As required by the Federal Clean Air Act, the NAAQS have been established for six major air pollutants: carbon monoxide (CO), nitrogen oxides (NO_x), ozone (O_3), sulfur oxides (SO_x), respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$). Table 3.3-1 lists these pollutants, their sources and effects, and the related standards. Pursuant to the California Clean Air Act, the State of California has also established the CAAQS that are generally more stringent than the corresponding federal standards and incorporate additional standards for pollutants such as sulfates, hydrogen sulfide, vinyl chloride and visibility reducing particles. Because CAAQS are more stringent than NAAQS, CAAQS are used as the comparative standard in this analysis.

Table 3.3-1
Major Criteria Air Pollutants and Standards

	Pollutant					
	Ozone	**Carbon Monoxide**	**Nitrogen Dioxide**	**Sulfur Dioxide**	**PM_{10}**	**$PM_{2.5}$**
Health Effects	Eye irritation, respiratory function impairment	Aggravation of cardio-vascular disease, fatigue, headache, confusion, dizziness, can be fatal	Increased risk of acute and chronic respiratory disease	Aggravation of lung disease, increased risk of acute and chronic respiratory disease	Aggravation of chronic disease and heart/lung disease symptoms	Aggravation of chronic disease and heart/lung disease symptoms
Major Sources	Combustion sources, evaporation of solvents and fuels	Combustion of fuel, combustion of wood in stoves and fireplaces	Motor vehicle exhaust, industrial processes, fossil-fueled power plants	Diesel exhaust, oil power plants, industrial processes	Combustion, cars, field burning, factories, unpaved roads, construction	Combustion, cars, field burning, factories, unpaved roads, construction
Federal Standard	1-hr: n/a 8-hr: .075ppm	1-hr: 35ppm 8-hr: 9ppm	1-hr: .100 ppm AA: .053 ppm	1-hr: .075 ppm 24-hr: n/a	24-hr: 150 $\mu g/m^3$ AA: n/a	24-hr: 35 $\mu g/m^3$ AA: 15 $\mu g/m^3$
State Standard	1-hr: .09ppm 8-hr: .07ppm	1-hr: 20ppm 8-hr: 9ppm	1-hr: .18 ppm AA: .03 ppm	1-hr: .25ppm 24-hr:.04ppm	24-hr: 50 $\mu g/m^3$ AA: 20 $\mu g/m^3$	24-hr: n/a AA: 12 $\mu g/m^3$
Bay Area Attainment Status	federal – N state (8-hr) – N state (1-hr) – N	A	federal – A state (1-hr) – U state (AA) – A	A	federal – U state – N	federal (24-hr) – N federal (AA) -A state – N

Attainment Status: A = attainment N = nonattainment, U = Unclassified
PM_{10} = particulate matter, 10 microns in size $PM_{2.5}$ = particulate matter, 2.5 microns in size
ppm = parts per million $\mu G/m^3$ = micrograms per cubic meter
AA = annual average 1-hr = 1-hour average 8-hr = 8-hour average
24-hr = 24-hour average n/a = not applicable

Attainment Status

The Federal CAA and the California CAA of 1988 require that CARB, based on air quality monitoring data, designate portions of the state where federal or state ambient air quality standards are not met as "nonattainment areas". Because of the differences between the federal and state standards, the designation of "nonattainment area" is different under the federal and state legislation. The Bay Area is considered a non-attainment area for ground-level O_3 and fine particulate matter ($PM_{2.5}$) under both the Federal Clean Air Act and the California Clean Air Act. The area is also considered non-attainment for respirable particulates or particulate matter with a diameter of less

than 10 micrometers (PM_{10}) under the California Clean Air Act, but not the federal act. The area has attained both state and federal ambient air quality standards for carbon monoxide.

3.3.1.4 *Existing Air Quality Conditions*

Air quality studies generally focus on five criteria pollutants that are most commonly measured and regulated: CO, ground level O_3, N_2O, SO_2, and PM_{10} and $PM_{2.5}$. In Santa Clara County, O_3 and PM_{10} and $PM_{2.5}$ are the pollutants of greatest concern since measured air pollutant levels exceed the state and federal air quality standards concentrations at times.

Ozone

While O_3 serves a beneficial purpose in the upper atmosphere (stratosphere) by reducing ultraviolet radiation, when it reaches elevated concentrations in the lower atmosphere it can be harmful to the human respiratory system and to sensitive species of plants. O_3 concentrations build to peak levels during periods of light winds, bright sunshine, and high temperatures. Short-term O_3 exposure can reduce lung function in children, make persons susceptible to respiratory infection, and produce symptoms that cause people to seek medical treatment for respiratory distress. Long-term exposure can impair lung defense mechanisms and lead to emphysema and chronic bronchitis. Sensitivity to O_3 varies among individuals, but about 20 percent of the population is sensitive to O_3, with exercising children being particularly vulnerable. Ozone is formed in the atmosphere by a complex series of photochemical reactions that involve "ozone precursors" that are two families of pollutants: oxides of nitrogen (NOx) and reactive organic gases (ROG). NO_x and ROG are emitted from a variety of stationary and mobile sources. While N_2O is another criteria pollutant itself, ROGs are not in that category, but are included in this discussion as ozone precursors. The U.S. EPA recently established a new more stringent standard for O_3 of 0.75 ppm for 8-hour exposures, based on a review of the latest new scientific evidence.

Carbon Monoxide

CO, a colorless and odorless gas, interferes with the transfer of oxygen (O_2) to the brain. It can cause dizziness and fatigue, and can impair central nervous system functions. Highest CO concentrations measured in the South Bay Area have been well below the national and State ambient standards. Since the primary sources of CO are cars and trucks, highest concentrations would be found near congested roadways that carry large volumes of traffic. CO emitted from a vehicle is highest near the origin of a trip and considerably lower once the automobile is warmed up (usually five to ten minutes into a trip). This is different, however, for vehicles of different ages, where older cars require a longer warm up period.

Nitrogen Dioxide

N_2O, a reddish-brown gas, irritates the lungs. Exposure to N_2O can cause breathing difficulties at high concentrations. Clinical studies suggest that N_2O exposure to levels near the current standard may worsen the effect of allergens in allergic asthmatics, especially in children. Similar to O_3, N_2O is not directly emitted, but is formed through a reaction between nitric oxide (NO) and atmospheric O_2. NO and N_2O are collectively referred to as NO_x and are major contributors to ozone formation.

N_2O is emitted from combustion of fuels, with higher rates at higher combustion temperatures. Nitrogen dioxide also contributes to the formation of PM_{10} (see discussion of PM_{10} below). Monitored levels in the Bay Area are well below ambient air quality standards.

Sulfur Oxides

SO_x, primarily SO_2, are a product of high-sulfur fuel combustion. The main sources of SO_2 are coal and oil used in power stations, in industries, and for domestic heating. SO_x is an irritant gas that attacks the throat and lungs. It can cause acute respiratory symptoms and diminished breathing functions in children. Concentrations of SO_2 in the Bay Area are at levels well below the State and national standards, but further reductions in emissions are needed to attain compliance with standards for PM_{10}, to which SO_2 is a contributor.

PM_{10} and $PM_{2.5}$

Respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$) consist of particulate matter that is ten microns or less in diameter and 2.5 microns or less in diameter, respectively, and represent fractions of particulate matter that can be inhaled and cause adverse health effects. Both PM_{10} and $PM_{2.5}$ are health concerns, particularly at levels above the federal and state ambient air quality standards. Scientific studies have suggested links between fine particulate matter and numerous health problems including asthma, bronchitis, and acute and chronic respiratory symptoms such as shortness of breath and labored breathing. Children are more susceptible to the health risks of $PM_{2.5}$ because their immune and respiratory systems are still developing.

Both PM_{10} and $PM_{2.5}$ pose a greater health risk than larger particles because these tiny particles can penetrate the human respiratory system's natural defenses and damage the respiratory tract, increasing the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections. Whereas larger particles tend to collect in the upper portion of the respiratory system, $PM_{2.5}$ is miniscule and can penetrate deeper into the lungs and damage lung tissues. Suspended particulates also damage and discolor surfaces on which they settle, as well as produce haze and reduce regional visibility. Most stations in the Bay Area reported exceedances of the State standard on the same fall/winter days as reported in the South Bay. This indicates a regional air quality problem.

The primary sources of these pollutants are wood smoke and local traffic. Meteorological conditions that are common during this time of the year produce calm winds and strong surface-based inversions that trap pollutants near the surface. The high levels of PM_{l0} result in not only health effects, but also reduced visibility.

Ambient Air Quality

Air quality in the region is controlled by the rate of pollutant emissions and meteorological conditions. Meteorological conditions, such as wind speed, atmospheric stability, and mixing height may all affect the atmosphere's ability to mix and disperse pollutants. Long-term variations in air quality typically result from changes in air pollutant emissions, while frequent, short-term variations result from changes in atmospheric conditions. The San Francisco Bay Area is considered to be one

of the cleanest metropolitan areas in the country with respect to air quality. BAAQMD monitors air quality conditions at over 30 locations throughout the Bay Area. There are several BAAMQD monitoring stations near Santa Clara.

As shown in Table 3.3-2, violations of state and federal standards at the downtown San José monitoring station (the nearest monitoring station to the project site) during the 2009-2011 period (the most recent years for which data is available) include high levels of O_3 and $PM_{2.5}$. Violations of the CO standard have not been recorded since 1992.

Table 3.3-2
Number of Ambient Air Quality Standards Violations (2009-2011)

Pollutant	Standard	Days Exceeding Standard		
		2009	2010	2011
San Jose Central Station				
Ozone	state 1-hour	0	5	1
	state 8-hour	0	3	0
	federal 8-hour	0	3	0
Carbon Monoxide	federal 8-hour	0	0	0
	state 8-hour	0	0	0
Nitrogen Dioxide	state 1-hour	0	0	0
PM_{10}	federal 24-hour	0	0	0
	state 24-hour	0	0	0
$PM_{2.5}$	federal 24-hour	0	3	3

Source: Bay Area Air Quality Management District, Bay Area Air Pollution Summary.

3.3.1.5 *Toxic Air Contaminants*

In addition to the "criteria" air pollutants, there is another group of substances found in ambient air referred to as Hazardous Air Pollutants (HAPs) under the Federal Clean Air Act and Toxic Air Contaminants (TACs) under the California Clean Air Act. These contaminants tend to be localized and are found in relatively low concentrations in ambient air. However, they can result in adverse chronic health effects if exposure to low concentrations occurs for long periods. They are regulated at the local, state, and federal level.

Toxic air contaminants are a broad class of compounds known to cause morbidity or mortality (cancer risk). TACs are found in ambient air, especially in urban areas, and are caused by industry, agriculture, fuel combustion, and commercial operations (e.g., dry cleaners). TACs are typically found in low concentrations, even near their source (e.g., diesel particulate matter near a freeway). Chronic exposure to TACs can result in adverse health effects.

Particulate matter from diesel exhaust is the predominant TAC in urban air and was estimated to represent about three-quarters of the cancer risk from TACs (based on the Bay Area average).

According to CARB, diesel exhaust is a complex mixture of gases, vapors and fine particles. This complexity makes the evaluation of health effects of diesel exhaust a complex scientific issue. Some chemicals in diesel exhaust, such as benzene and formaldehyde, have been previously identified as TACs by CARB, and are listed as carcinogens either under State Proposition 65 or under the Federal Hazardous Air Pollutants programs.

CARB has adopted and implemented a number of regulations for stationary and mobile sources to reduce emissions of diesel particulate matter (DPM). Several of these regulatory programs affect medium and heavy duty diesel trucks that represent the bulk of DPM emissions from California highways. These regulations include the solid waste collection vehicle (SWCV) rule, in-use public and utility fleets, and the heavy-duty diesel truck and bus regulations. In 2008, CARB approved a new regulation to reduce emissions of DPM and NO_x from existing on-road heavy-duty diesel fueled vehicles. The regulation requires affected vehicles to meet specific performance requirements between 2011 and 2023, with all affected diesel vehicles required to have 2010 model-year engines or equivalent by 2023. These requirements are phased in over the compliance period and depend on the model year of the vehicle.

3.3.1.6 *Sensitive Receptors*

CARB has identified the following groups of people that are most likely to be affected by air pollution: children under 14; the elderly over 65; athletes; and people with cardiovascular and chronic respiratory diseases. These groups are classified as sensitive receptors. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, places of assembly and parks. The closest sensitive receptors to the site are located in the residential areas north of Agnew Road approximately 2,000 feet east of the project site. Great America Theme Park visitors are not considered sensitive receptors due to the limited duration and frequency of exposure to any given source of air pollution while attending the park.[9]

3.3.2 <u>Air Quality Impacts</u>

3.3.2.1 *Thresholds of Significance*

For the purposes of this EIR, an air quality impact is considered significant if the project would:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Violate an ambient air quality standard or contribute substantially to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative threshold for ozone precursors);
- Expose sensitive receptors to substantial levels of toxic air contaminants; or
- Create objectionable odors affecting a substantial number of people.

[9] Significance thresholds for health risk assessments are based on a 70-year exposure.

3.3.2.2 *CEQA Thresholds Used in the Analysis*

As discussed in CEQA Guidelines Section 15064(b), the determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the Lead Agency and must be based to the extent possible on scientific and factual data. The City of Santa Clara, and other jurisdictions in the San Francisco Bay Area Air Basin, often utilize the thresholds and methodology for assessing air emissions and/or health effects developed by the BAAQMD based upon the scientific and other factual data prepared by BAAQMD in developing those thresholds.

In December 2010, the California Building Industry Association (BIA) filed a lawsuit in Alameda County Superior Court challenging TACs and $PM_{2.5}$ thresholds adopted by BAAQMD in its 2010 CEQA Air Quality Guidelines (California Building Industry Association v. Bay Area Air Quality Management District, Alameda County Superior Court Case No. RG10548693). One of the identified concerns is inhibiting infill and smart growth in the urbanized Bay Area. On March 5, 2012, the Superior Court found that the adoption of thresholds by the BAAQMD in its CEQA Air Quality Guidelines is a CEQA project and BAAQMD is not to disseminate officially sanctioned air quality thresholds of significance until BAAQMD fully complies with CEQA. No further findings or rulings on the thresholds in the BAAQMD CEQA Air Quality Guidelines were made.

The City understands the effect of the lawsuit to be that BAAQMD may eventually prepare an environmental review document before BAAQMD adopts the same or revised thresholds. The ruling in the case; however, does not equate to a finding that the quantitative metrics in the BAAQMD thresholds are incorrect or unreliable for meeting goals in the Bay Area 2010 Clean Air Plan. Moreover, as noted above, the determination of whether a project may have a significant effect on the environment is subject to the discretion of each Lead Agency, based upon substantial evidence. Notwithstanding the BIA lawsuit, which has no binding or preclusive effect on the City of Santa Clara's discretion to decide on the appropriate thresholds to use for determining the significance of air quality impacts, the City has carefully considered the thresholds previously prepared by BAAQMD and regards the thresholds listed below to be based on the best information available for the San Francisco Bay Area Air Basin and conservative in terms of the assessment of health effects associated with TACs and $PM_{2.5}$. Evidence supporting these thresholds has been presented in the following documents:

- BAAQMD. *Thresholds Options and Justification Report*. 2009.
- BAAQMD. *CEQA Air Quality Guidelines.* May 2011. (Appendix D)
- California Air Pollution Control Officers Association (CAPCOA). *Health Risk Assessments for Proposed Land Use Projects*. 2009.
- California Environmental Protection Agency, California Air Resources Board (CARB). *Air Quality and Land Use Handbook: A Community Health Perspective*. 2005.

The analysis in this EIR is based upon the general methodologies in the most recent BAAQMD CEQA Air Quality Guidelines (May 2012) and numeric thresholds for the San Francisco Bay Basin, including the thresholds listed in Table 3.3-3.

Table 3.3-3
Thresholds of Significance Used in Air Quality Analyses

Pollutant	Construction	Operation-Related	
	Average Daily Emissions (pounds/day)	Average Daily Emissions (pounds/day)	Maximum Annual Emissions (tons/year)
ROG, NO_x	54	54	10
PM_{10}	82 (exhaust)	82	15
$PM_{2.5}$	54 (exhaust)	54	10
Fugitive Dust (PM_{10}/$PM_{2.5}$)	Best Management Practices	None	None
Risk and Hazards for New Sources and Receptors (Project)	Same as Operational Threshold	• Increased cancer risk of >10.0 in one million • Increased non-cancer risk of > 1.0 Hazard Index (chronic or acute) • Ambient $PM_{2.5}$ increase: > 0.3 μ/m^3 [Zone of influence: 1,000-foot radius from property line of source or receptor]	
Risk and Hazards for New Sources and Receptors (Cumulative)	Same as Operational Threshold	• Increased cancer risk of >100 in one million • Increased non-cancer risk of > 10.0 Hazard Index (chronic or acute) • Ambient $PM_{2.5}$ increase: > 0.8 μ/m^3 [Zone of influence: 1,000-foot radius from property line of source or receptor]	

Sources: *BAAQMD Thresholds Options and Justification Report (2009)* and *BAAQMD CEQA Air Quality Guidelines* (dated May 2011).

3.3.2.3 *Long-Term Air Quality Impacts*

2010 Clean Air Plan

The most recent regional clean air plan is the *Bay Area 2010 Clean Air Plan* (2010 CAP) that was adopted by BAAQMD in September 2010. This plan addresses air quality impacts with respect to obtaining ambient air quality standards for non-attainment pollutants (i.e., O_3, PM_{10} and $PM_{2.5}$), reducing exposure of sensitive receptors to TACs, and reducing greenhouse gas (GHG) emissions such that the region can meet AB 32 goals of reducing emissions to 1990 levels by 2020. The consistency of the proposed project with this regional plan is primarily a question of the consistency with the population/ employment assumptions utilized in developing the 2010 CAP, which were based on Association of Bay Area Governments (ABAG) Projections. While the proposed project would increase jobs, it would not affect population in the region and is consistent with the 2010 CAP.

The 2010 CAP includes about 55 control measures that are intended to reduce air pollutant emissions in the Bay Area either directly or indirectly. The control measures are divided into five categories that include:

- Measures to reduce stationary and area sources;
- Mobile source measures;
- Transportation control measures;
- Land use and local impact measures; and
- Energy and climate measures

The consistency of the proposed project was evaluated with respect to each set of control measures. The analysis found that because the project will be required to implement a TDM program, it is consistent with the CAP. The CAP includes transportation control measures (TCMs) that are strategies meant to reduce vehicle trips, vehicle use, vehicle miles traveled (VMT), vehicle idling, or traffic congestion for the purpose of reducing motor vehicle emissions. While most of the TCMs are implemented at the regional level [e.g., by the Metropolitan Transportation Commission (MTC) or Caltrans], there are measures that the CAP relies upon local communities to assist with implementation. The City's latest General Plan update includes measures to reduce vehicle travel that are consistent with the CAP TCMs. In addition, the 2010-2035 General Plan committed the City to developing and adopting a Climate Action Plan that would require additional TCMs consistent with CAP measures intended to reduce automobile use and to facilitate non-auto linkages through a network. Because the project will be required to implement a TDM program, it is considered to have a less than significant impact.

Impact AQ-1: The proposed project will implement a TDM program and will comply with the 2010 Clean Air Plan. **(Less Than Significant Impact)**

Impacts on Regional Air Quality

The Bay Area is considered a non-attainment area for ground-level O_3 and $PM_{2.5}$ under both the Federal Clean Air Act and the California Clean Air Act. The area is also considered non-attainment for respirable particulates or particulate matter with a diameter of less than 10 micrometers (PM_{10}) under the California Clean Air Act.

The CalEEMod model along with the project vehicle trip generation rates were used to analyze air pollutant emissions associated with operation of the proposed project. The model uses mobile emission factors from the CARB's EMFAC2007 model and adjusts these based on the effect of new regulations to reduce GHG emissions. These regulations include the Pavley Rule that increases fleet efficiency (reducing fuel consumption) and the low carbon fuel standard. This model is sensitive to the year selected, since vehicle emissions have and continue to be reduced due to more stringent exhaust controls, newer vehicle fleet, fuel efficiency standards and low carbon fuels.

The proposed development was assumed to be fully operational in 2017. The project trip generation rates were used to calculate vehicle emissions and incorporated a five percent trip reduction for the entire development based on the proposed TDM program. In addition to vehicle trips, the proposed 600,000 s.f. of new office space was assumed to be constructed with LEED Silver energy efficiency measures. The analysis also accounted for area source emissions associated with natural gas consumption (primarily space and water heating), use of landscape equipment, consumer products, and architectural coatings.

In summary, the project would expand the existing office space on the site by 600,000 s.f. The expanded office space and additional traffic trips were modeled for year 2017 (the earliest practical occupancy date). Estimated daily emissions are shown in Table 3.3-4 and compared against the applicable air quality thresholds.

Table 3.3-4
Project Regional Emissions in Pounds Per Day

	ROG	NO_x	PM_{10}	$PM_{2.5}$
Proposed Project 2017	93.2	59.5	54.6	4.9
Existing Use 2013	43.0	35.2	23.8	2.3
Net Emissions	50.2	24.3	30.8	2.6
Daily Emissions Threshold	54	54	82	54

The project would include diesel-powered emergency generators at each building. The specifications of these generators have not been identified at this time. Diesel generators would be a source of air pollutant emissions during routine testing which would occur monthly for 15 minutes to an hour. The primary emissions are NO_x and DPM. Since these generators are likely to exceed 50 horsepower, they would be subject to BAAQMD permitting requirements. The generator engines would be required to meet BAAQMD emission standards to ensure that health risks associated with DPM emissions would be acceptable. Sources of air pollutant emissions complying with all applicable BAAQMD regulations generally are not considered to have a significant air quality impact. No other stationary air pollutant sources have been identified. Stationary sources that are exempt from BAAQMD permit requirements due to low emission thresholds would not be considered to have a significant air quality impact.

Project development would increase emissions of ROG, NO_x and PM_{10}. As shown in Table 3.3-4, these emissions would not exceed the air quality significance thresholds.

Impact AQ-2: The proposed project would not result in significant regional air quality impacts associated with reactive organic gases (ROG), nitrogen oxides (NO_x), respirable particulates (PM_{10}), and fine particulate ($PM_{2.5}$) emissions. **(Less Than Significant Impact)**

Impacts on Local Air Quality

CO emissions from traffic generated by the project would be the greatest pollutant concern at the local level. Congested intersections with a large volume of traffic have the greatest potential to cause high-localized concentrations of CO. Measured CO levels have been at healthy levels (i.e., below state and federal standards) in the Bay Area since the early 1990s. As a result, the region has been designated as attainment for the standard. There is an ambient air quality monitoring station in central San José that measures CO concentrations. The highest measured level over any eight-hour

averaging period during the last three years is less than 3.0 parts per million (ppm) compared to the ambient air quality standard of 9.0 ppm.

The project screening guidance recommended by BAAQMD indicates that the project would not contribute significantly to CO levels if project traffic levels would not exceed 44,000 vehicles per hour at any affected intersection. The project would generate 6,046 net new daily trips and would not result in any of the affected study intersection exceeding 44,000 vehicles per hour.

Impact AQ-3: Vehicle emissions from project-generated traffic would not result in a significant increase in carbon monoxide levels at local intersections. **(Less Than Significant Impact)**

Community Risk Impacts

Local community risk and hazard impacts are associated with TACs and $PM_{2.5}$ because emissions of these pollutants can have significant health impacts at the local level. Although located near Great America Parkway and Mission College Boulevard, sources of TAC emissions from traffic, the project site does not include sensitive receptors. There are no sensitive receptors[10] located near the project site, therefore, emissions of TACs associated with construction and operation of the project would not impact sensitive receptors.

Impact AQ-4: The project does not include sensitive receptors and it would not generate TAC emissions in proximity to sensitive receptors and, therefore, would have a less than significant community risk impact. **(Less Than Significant Impact)**

3.3.2.4 *Short-Term Air Quality Impacts*

Construction Dust Emissions

Dust would be generated during demolition, grading and construction activities. Most of the dust would be generated during grading activities. The amount of dust generated would be highly variable and is dependent on the size of the area disturbed at any given time, amount of activity, soil conditions and meteorological conditions. Typical winds during late spring through summer are from the north. Nearby land uses include commercial space or offices, hotels, and the Great America theme park. These nearby active land uses could be adversely affected by dust generated during construction activities.

Impact AQ-5: Dust generated by grading and construction activities would result in a significant temporary impact. **(Significant Impact)**

[10] Great America Theme Park visitors are not considered sensitive receptors for air quality analysis due to the limited duration and frequency of visits to the park.

Construction Exhaust Emissions

Construction of the project is anticipated to begin in September of 2014 and last for approximately 30 months, ending in March of 2017. While it is not certain at this time if demolition of existing buildings will occur, demolition of an existing 118,000 s.f. building is possible and was included in the modeling to provide for a worst-case construction emissions scenario. Similarly, the construction of 718,000 s.f. of new office buildings was assumed for modeling, though as little as 600,000 s.f. of new office building construction may ultimately occur. The construction of new parking structure with up to 3,359 spaces was also included in the modeling. No import or export of fill material was assumed for construction given the limited grading necessary for project construction.
Table 3.3-5 summarizes the estimated average daily emissions from project construction. Average daily emissions were computed by dividing the total construction period emissions by the number of anticipated construction days. Much of the emissions were anticipated to occur over approximately 660 work days during the approximately 30-month construction period.

Construction exhaust emissions would be significant, since NO_x emissions are anticipated to exceed the significance threshold of 54 pounds per day, on an average daily basis. ROG emissions are just below the significance threshold. Construction BMPs are necessary during trenching and grading activities to avoid generation of dust that may affect nearby sensitive receptors. The implementation of BMPs would reduce exhaust emissions by approximately five percent. Additional mitigation measures would be needed to reduce exhaust emissions during construction.

Table 3.3-5
Construction Emissions

	ROG	NO_x	PM_{10}	$PM_{2.5}$
2014 Annual Emissions (tons)	0.31	2.44	0.11	0.11
2015 Annual Emissions (tons)	1.63	8.73	0.37	0.37
2014 Annual Emissions (tons)	1.48	7.75	0.33	0.33
2015 Annual Emissions (tons)	14.37	0.20	0.02	0.02
Average Daily Emissions (lbs/day)	53.9	57.9	2.5	2.5
Daily Emissions Threshold	54	54	82	54

Impact AQ-6: Project construction activities would emit significant levels of criteria air pollutants that would affect local and regional air quality. **(Significant Impact)**

Construction Community Risk Impacts

Construction activity would generate dust and equipment exhaust on a temporary basis that could affect nearby land uses. Construction activity is anticipated to include demolition of an existing building and associated paved areas, grading and excavation, building construction, paving, and application of architectural coatings. The closest residences or sensitive receptors are located greater

than 1,000 feet from the project site. According to BAAQMD screening guidance, project construction activities for 1,000,000 s.f office buildings would have less than significant health risk impacts at distances of 300 meters (~1,000 feet) from the edge of construction sites. Therefore, a health risk assessment is not necessary to conclude the project would have less than significant impacts on sensitive receptors due to TACs and $PM_{2.5}$ emissions from construction.

Impact AQ-7: The project is not located proximate to sensitive receptors that would be affected by construction TAC and $PM_{2.5}$ emissions. **(Less Than Significant Impact)**

3.3.2.5 *Odor Impacts*

The proposed office uses would not produce offensive odors. During construction, the various diesel powered vehicles and equipment in use on-site may create localized odors. These odors would be temporary and not likely to be noticeable for extended periods of time much beyond the boundaries of the project site. There are no sensitive receptors[11] adjacent to the site that would be adversely affected by construction-related odors. The project site is not affected by existing odor sources that would cause odor complaints.

Impact AQ-8: The proposed project would not result in significant localized or long-term odor. **(Less Than Significant Impact)**

3.3.3 Mitigation Measures

As conditions of approval, the project applicant shall be responsible for the implementation of the following measures to reduce construction air quality impacts:

MM AQ-5.1: During any construction ground disturbance, implement measures to control dust and exhaust. Implementation of the measures recommended by BAAQMD, and listed below, would reduce the air quality impacts associated with grading and new construction to a less than significant level. The contractor shall implement the following BMPs that are required of all development projects:

- All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
- All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 mph.
- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after

[11] Ibid.

grading unless seeding or soil binders are used.

- All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.
- Post a publicly visible sign with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

MM AQ-6.1: Consistent with guidance from the BAAQMD, the following additional actions shall be required of construction contracts and specifications for the project:

- Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to two minutes. Clear signage shall be provided for construction workers at all access points.
- The project shall develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used in the construction project (i.e., owned, leased, and subcontractor vehicles) would achieve a project wide fleet-average 20 percent NO_X reduction compared to the most recent Air Resources Board (ARB) fleet average. Acceptable options for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available.
- All construction equipment, diesel trucks, and generators shall be equipped with Best Available Control Technology for emission reductions of NO_X.
- All contractors shall use equipment that meets ARB's most recent certification standard for off-road heavy duty diesel engines.

After implementation of Mitigation Measure AQ-5.1 (estimated five percent reactive organic gases, NO_X and particulate matter reduction for off-road equipment exhaust emissions) and AQ-6.1 (estimated 20 percent NO_X reduction for off-road equipment), NO_X emissions are estimated to be 52.2 pounds per day, which is below the significance threshold of 54 pounds per day.

3.3.4 Conclusion

Impact AQ-1: The proposed project will implement a TDM program and will comply with the 2010 Clean Air Plan. **(Less Than Significant Impact)**

Impact AQ-2: The proposed would not result in significant regional air quality impacts associated with ROG, NOx, PM_{10}, and $PM_{2.5}$ emissions. **(Less Than Significant Impact)**

Impact AQ-3: Vehicle emissions from project-generated traffic would not result in a significant increase in CO levels at local intersections. **(Less Than Significant Impact)**

Impact AQ-4: The project does not include sensitive receptors and it would not generate TAC emissions in proximity to sensitive receptors and, therefore, would have a less than significant community risk impact. **(Less Than Significant Impact)**

Impact AQ-5: Implementation of the mitigation measure identified above would reduce dust generated by grading and construction activities to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact AQ-6: Implementation of the mitigation measures identified above would reduce levels of criteria air pollutants from dust and exhaust emissions generated during construction of the project to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact AQ-7: The project is not located proximate to sensitive receptors that would be affected by construction TAC and $PM_{2.5}$ emissions. **(Less Than Significant Impact)**

Impact AQ-8: The proposed project would not result in significant localized or long-term odor. **(Less Than Significant Impact)**

3.4 NOISE AND VIBRATION

The following discussion is based on an Environmental Noise Assessment prepared by *Illingworth & Rodkin, Inc.* in May 2013. A copy of this report is included as Appendix C in this EIR.

3.4.1 Existing Setting

3.4.1.1 *Fundamental Concepts of Environmental Noise and Vibration*

Environmental Noise

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB) with 0 dB corresponding roughly to the threshold of human hearing.

There are several methods of characterizing sound. The most common in California is the A-weighted sound level or dBA. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive.

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources, which create a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors, L_{01}, L_{10}, L_{50}, and L_{90}, are commonly used. They are the A-weighted noise levels equaled or exceeded during one percent, 10 percent, 50 percent, and 90 percent of a stated time period. A single number descriptor called the L_{eq} is also widely used. The L_{eq} is the average A-weighted noise level during a stated period of time. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

Sound level meters can accurately measure environmental noise levels to within plus or minus one dBA. Since the sensitivity to noise increases during the evening hours, 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Day/Night Average Sound Level, Ldn*, is the average A-weighted noise level during a 24-hour day, obtained after the addition of 10 dB to noise levels measured in the nighttime between 10:00 PM and 7:00 AM.

The most widespread and continual source of noise in Santa Clara is transportation and transportation-related facilities. Freeways, local arterials, the Norman Y. Mineta San Jose International Airport, railroads, and Light Rail Transit are all major contributors to noise in Santa Clara. The Great America Theme Park is located along the eastern property boundary of the project site. The park is open seven days a week during the summer months and on weekends during the spring and fall and would also be a source of noise in the project area during the months of the year the park is operational.

Groundborne Vibration

Several different methods are typically used to quantify groundborne vibration amplitude. One is the peak particle velocity (PPV) and another is the root mean square (RMS) velocity. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration. In this analysis, a PPV descriptor with units of millimeters per second (mm/sec.) or inches per second (in/sec.) is used to evaluate construction generated vibration for building damage and human complaints. The reactions of people and the effects on buildings that continuous vibration levels produce are shown in Table 3.4-1.

Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Table 3.4-1
Reaction of People and Damage to Buildings for Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe – Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation- and Construction-Induced Vibration Guidance Manual, California Department of Transportation, June 2004.

3.4.1.2 *Regulatory Background*

Environmental Noise

The State of California and the City of Santa Clara have established plans and policies designed to limit noise exposure at noise sensitive land uses. These plans and policies are contained in the following documents: (1) the State CEQA Guidelines, Appendix G, (2) the State of California Building Code, (3) the City of Santa Clara's Noise Element of the 2010-2035 General Plan, and (4) the City of Santa Clara Municipal Code.

State CEQA Guidelines

The California Environmental Quality Act (CEQA) contains guidelines to evaluate the significance of effects resulting from a proposed project. These guidelines have been used in this EIR as thresholds for establishing potentially significant noise and vibration impacts and are listed in *Section 3.4.2.1 Thresholds of Significance*.

CEQA does not define what noise level increase would be considered substantial. Typically, an increase in the L_{dn} noise level resulting from the project at noise sensitive land uses of three dBA L_{dn} or greater would be considered a significant impact when projected noise levels would exceed those considered acceptable for the affected land use (60 dBA L_{dn}). An increase of five dBA L_{dn} or greater would be considered a significant impact when projected noise levels would remain within those considered acceptable for the affected land use.

State of California Building Code (2010)

The Green Building Standards of the State of California Code of Regulations (CALGreen Code) establishes mandatory exterior sound transmission control standards for new non-residential buildings. Acoustical controls require that new construction employ building assemblies and components with Sound Transmission Class (STC) values determined in accordance with ASTM E90 and ASTM E413 or Outdoor-Indoor Sound Transmission Class (OITC) determined in accordance with ASTM E1332.

City of Santa Clara 2010-2035 General Plan

Based on the City's 2010-2035 General Plan Noise Element, Table 3.4-2 shows the noise levels considered compatible with specific land uses. Commercial land uses, including offices, are considered compatible with L_{dn} noise levels of up to 65 dBA and acceptable with design and insulation techniques in areas with L_{dn} noise levels up to 75 dBA.

Table 3.4-2
Noise and Land Use Compatibility (L_{dn} & CNEL)

Land Use	50	55	60	65	70	75	80	85
Residential								
Educational								
Recreational								
Commercial								
Industrial								
Open Space								

Compatible

Require Design and insulation to reduce noise levels

Incompatible. Avoid land use except when entirely indoors and an interior noise level of 45 Ldn can be maintained

Source: *City of Santa Clara 2010-2035 General Plan*

City of Santa Clara Municipal Code

The City's Municipal Code establishes noise level performance standards for fixed sources of noise. Noise levels generated on the project site would be limited to 65 dBA during daytime hours and 60 dBA at night at adjoining commercial land uses. Construction activities occurring during daytime hours are specifically exempted from these limits. Section 9.10.230 limits construction within 300 feet of any residentially zoned properties between the hours of 7:00 A.M. to 6:00 P.M. on weekdays other than holidays, and within the hours of 9:00 A.M. to 6:00 P.M. on Saturdays and is prohibited on Sundays and holidays.

Groundborne Vibration

City of Santa Clara Municipal Code

The City's Municipal Code qualitatively discusses vibration levels from fixed sources of vibration. Vibration resulting from construction activities is exempt from the Municipal Code standards provided that construction activities occur during allowable daytime hours, as stated above.

3.4.1.3 *Existing Noise Environment*

The project site is located northeast of the intersection of Great America Parkway and Mission College Boulevard. The site is bordered by commercial land uses including hotels, office buildings, and the Great America Theme Park. The nearest residential land uses are located approximately 2,000 feet east of the site, opposite the theme park.

An ambient noise monitoring survey was conducted on the afternoon of December 3, 2007 to quantify existing noise levels at the project site. The predominant sources of noise measured at the site included vehicular traffic along Great America Parkway and jet aircraft from the Norman Y. Mineta San José International Airport. Aside from the Santa Clara Stadium Project that is currently under construction, there have not been any other major developments in the project vicinity within the last five years that would substantially change existing ambient noise levels. The noise data collected at the site in 2007 are still considered representative of existing conditions, and are consistent with existing traffic noise levels modeled during the General Plan Update project in 2010.

Short-term noise measurement location ST-1 was approximately 150 feet from the center of Great America Parkway at the approximate 30-foot setback from the property line for allowed office buildings on the site. Noise levels were measured for a period of ten minutes beginning at 1:25 P.M. The average noise level measured at this location was 62 dBA L_{eq}. The short-term noise measurement was then compared to noise data collected over a 24-hour period in the project vicinity[12] to estimate the relationship between mid-day noise levels and daily average noise levels (L_{dn}). The L_{dn} noise levels at this location are estimated to be 64 dBA. A second short-term noise measurement was made at the site's easternmost property boundary, adjacent to the Great America Theme Park. The theme park was closed at the time. Ambient noise levels measured at this location were primarily the result of distant vehicular traffic and jet aircraft. The average noise level was 56 dBA L_{eq}. The L_{dn} at this location is estimated to be 60 dBA.

Noise attributable to operations at the Great America Theme Park has been estimated at the project site based on a review of a report prepared by *Wilson, Ihrig, and Associates, Inc*. in 2008 to identify noise levels from a proposed roller coaster. As part of the previous study, worst-case screaming noise levels were determined to reach 91 dBA L_{max}[13] at a distance of 50 feet. Shielding and directionality result in approximately two to four dBA of noise reduction and these noise levels attenuate at a rate of 4.5 to 6 dB per doubling of distance from the noise source. Based on the above data, noise levels resulting from riders' screams at the Great America Theme Park are estimated to be 77 to 82 dBA L_{max} at the eastern property line of the site.

3.4.2 Noise and Vibration Impacts

3.4.2.1 *Thresholds of Significance*

For the purposes of this EIR, a noise or vibration impact is considered significant if the project would:

- Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Expose persons to, or generate excessive groundborne vibration or groundborne noise levels;
- Create a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

[12] Illingworth & Rodkin, Inc. *49ers Stadium Project Environmental Noise Assessment*. February 24, 2009.
[13] L_{max} is the maximum A-weighted noise level reached during a given measurement period.

- Create a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;
- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels; or
- For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels.

A substantial permanent noise increase would occur if the noise level increase resulting from the project is three dBA L_{dn} or greater at noise-sensitive land uses, with a future noise level of 60 dBA L_{dn} or greater, or five dBA L_{dn} or more where future noise levels would remain below 60 dBA L_{dn}. A substantial temporary noise level increase would occur where noise from construction activities exceeds 70 dBA L_{eq} and the ambient noise environment by at least five dBA L_{eq} at adjacent land uses in the project vicinity for a period of one year or more.

3.4.2.2 *Noise Impacts to the Project*

Future Noise Levels

Office buildings proposed as part of the project would be set back a minimum of 30 feet from the property lines located on Patrick Henry Drive, Great America Parkway, and Mission College Boulevard. Future traffic noise levels are anticipated to increase by three dBA L_{dn} above existing conditions as a result of cumulative growth forecast in the 2010-2035 General Plan. Exterior noise levels would reach 70 dBA L_{dn} at the westernmost or southernmost facades of office buildings proposed along Great America Parkway and Mission College Boulevard. The exterior noise environment would exceed the City's 65 dBA L_{dn} compatibility threshold for proposed commercial land uses. Similarly, office buildings proposed within 200 feet of the center of Great America Parkway or 150 feet of Mission College Boulevard could be exposed to noise levels exceeding 65 dBA L_{dn}, triggering mandatory exterior sound transmission controls, as established by the CALGreen Building Code.

For office developments, the noise and land use compatibility guidelines are designed to screen projects and provide guidance in determining when special building sound insulation treatments may be necessary in order to adequately control the intrusion of environmental noise. The noise level goal for average noise levels inside offices varies depending upon the type of office space. Typically, traffic noise levels should be reduced to an hourly average noise level between 35 and 45 dBA L_{eq}. Standard office construction normally provides 30 dBA of noise reduction in interior spaces. An additional five dBA reduction in noise levels typically results due to room absorption and spreading losses as the noise propagates within the interior of the office. Predicted interior noise levels in proposed office buildings would be approximately 40 dBA L_{eq} assuming standard office construction. These interior noise levels would be compatible with the proposed use and would meet the 50 dBA L_{eq} noise limit established in the CALGreen Code.

Office buildings may be constructed as close as 10 feet from the easternmost boundary of the site, near the Great America Theme Park. At this location, intermittent peak noise levels resulting from amusement park-riders' screams are calculated to be 77 to 82 dBA L_{max} at the office building facade.

Assuming standard office construction methods, room absorption, and spreading losses, predicted interior noise levels resulting from amusement park-riders' screams would range from 42 to 47 dBA L_{max} which is still within the 50 dBA noise limit established in the CALGreen Code.

While it is not necessary as mitigation for a noise impact, additional noise control could be accomplished for private offices and conference rooms, as needed, through building design by selecting sound-rated windows (STC 35-40 or greater) for sensitive interior spaces along the westernmost or southernmost facades of the proposed buildings, adjacent to traffic noise sources, and along the facades of buildings oriented toward Great America Theme Park.

A review of the 65 dBA CNEL noise contour map in the adopted CLUP for the Norman Y. Mineta San José International Airport indicates that the project site is located outside of the future 65 dBA CNEL noise contour. Office land uses would be compatible in such an exterior noise environment and standard construction methods would adequately reduce aircraft noise levels indoors.

Impact NV-1: Standard office construction practices would provide sufficient noise reduction in interior spaces to comply with noise limits established in the CALGreen Code. **(Less Than Significant Impact)**

3.4.2.3 *Noise Impacts from the Project*

Project-Generated Traffic Noise

Project-generated traffic noise level increases along roadways in the project vicinity were calculated based on turning movement counts at 43 intersections for baseline conditions and baseline plus project conditions. Roadway link volumes (the total volume of traffic along a roadway segment) were calculated based on turning movement data and compared to existing conditions to calculate the anticipated noise level increase attributable to the project. Noise levels along roadways in the site vicinity will increase by less one dBA L_{dn} as a result of the project.

Impact NV-2: Traffic-generated noise levels would not be noticeably or measurably increased as a result of the project. **(Less Than Significant Impact)**

Operational Noise Sources

The operation of the project would introduce new sources of noise that may permanently increase noise levels at adjacent receivers. These sources of noise would be similar to current noise sources resulting from the existing land use including the operation of mechanical equipment and the operation of the proposed parking garage and surface parking areas.

Mechanical equipment associated with office buildings normally includes heating, ventilation, and air conditioning systems. Emergency generators are proposed to provide power to the office buildings in case of power outages. Specific details regarding the size, type, and locations of the generators are unknown at this time. This analysis assumes that the proposed generators would be located in acoustical enclosures, similar to existing emergency generators located on the site. The Municipal Code requires that noise from the operation of such equipment not exceed 65 dBA during

the day or 60 dBA at night at nearby commercial uses. Although detailed specifications regarding these systems are not available during this early phase of project planning, noise levels resulting from the operation of HVAC equipment or emergency generators is not anticipated to exceed 65 dBA during the day or 60 dBA at night at commercial uses in the project's vicinity or be audible above ambient conditions given the multitude of noise sources in the area. The operation of HVAC equipment or emergency generators would not be audible at nearby hotels located south of the site or at residences located over 2,000 feet away given the existing noise levels on the site, with buildings containing such equipment, and the distance to sensitive uses.

Parking would be provided within a parking garage of up to six-stories located along the easternmost portion of the site adjacent to the Great America Theme Park. Based on past noise measurements taken at a parking structure similar to the one proposed, maximum instantaneous noise levels measured approximately 75 feet from the facade of a typical garage at ground level ranged from 53 dBA to 70 dBA. Parking garage noise sources such as doors opening and closing, engines starting, and the use of horns are infrequent and would not be expected to cause an increase in ambient hourly average noise levels at the nearest commercial property line. The louder noises would be intermittently audible, but would generally be at levels below the sounds emanating from the theme park or generated when aircraft pass over the site. Parking garage sounds would not be discernible at nearby hotels located south of the site or at residences located over 2,000 feet away.

Impact NV-3: Noise levels generated by the operation of the project would not exceed the standards established in the Santa Clara Municipal Code. **(Less Than Significant Impact)**

3.4.2.5 *Construction Impacts*

Construction Noise

Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise sensitive receptors. Where noise from construction activities exceeds 70 dBA L_{eq} and the ambient noise environment by five dBA L_{eq} or more at nearby office and commercial land uses for a period of more than one construction season, the impact would be considered significant.

Construction activities generate considerable amounts of noise, especially during the demolition phase and the construction of project infrastructure when heavy equipment is used. Hourly average noise levels generated by demolition and construction are about 77 dBA to 89 dBA L_{eq} measured at a distance of 50 feet from the center of a busy construction site. During impact pile driving, hourly average noise levels could reach 94 dBA L_{eq} at 50 feet. Maximum noise levels generated during demolition would typically range from 85 to 105 dBA L_{max} assuming the operation of jackhammers, hoe rams, or impact pile drivers. Construction generated noise levels drop off at a rate of about six dBA per doubling of distance between the source and receptor. Shielding provided by barriers or structures can provide an additional five to ten dBA noise reduction at distant receivers.

The nearest office buildings north of the site are located approximately 100 feet from project site

areas where major construction activities would occur. Areas within the Great America Theme Park where visitors may congregate (public pathways/waiting areas for rides, etc.) and be aware of construction on the project site are located about 200 feet from proposed construction areas. Commercial office buildings are located approximately 275 feet west of the site and a hotel is located approximately 600 feet to the south.

Table 3.4-3 shows the range in hourly average noise levels expected at nearby office and commercial uses during construction of the proposed project. Noise from typical phases of construction (i.e., ground clearing, excavation, foundations, erection, and finishing) would range from 55-83 dBA L_{eq} at adjacent commercial and office uses when construction activities occur near the periphery of the site and would exceed 70 dBA L_{eq} when these phases of construction occur within about 450 feet of these receivers. Hourly average noise levels would reach 88 dBA L_{eq} at the nearest office building to the north when construction activities occur at the north end of the site. Pile driving noise levels would typically range from 72-82 dBA L_{eq} at the commercial uses to the east, south, and west when pile driving occurs near the periphery of the site. Hourly average noise levels would exceed 70 dBA L_{eq} when pile driving activities occur within about 800 feet of adjacent commercial uses. Construction noise levels would be less than 60 dBA L_{eq} at the nearest residential uses over 2,000 feet from the project site. Construction noise levels would at times be intrusive inside offices facing the project site and in exterior use areas at adjacent hotels and the theme park. Noise resulting from project construction activities would exceed 70 dBA L_{eq} and the ambient noise environment by more than five dBA L_{eq} for more than one construction season. Proposed construction activities would substantially increase ambient noise levels at nearby office buildings and the Great America Theme Park and resulting in a significant temporary noise impact.

Table 3.4-3
Range of Construction Noise Levels at Nearby Commercial Uses (dBA Leq)

Direction of Nearest Receivers	Distance from Areas Proposed for Construction	Land Use Type	Typical Construction Noise Level Range	Pile Driving Construction Noise Levels
North	100	Office	71-83	88
East	200	Theme Park	65-77	82
South	600	Hotel	55-67	72
West	275	Office	62-74	79

Impact NV-4: Noise generated by construction activities at the project site would exceed 70 dBA L_{eq} and the ambient noise environment by five dBA L_{eq} or more for a period exceeding one construction season. **(Significant Impact)**

Vibration Impacts

Demolition and construction activities proposed as part of the project may generate perceptible vibration levels when heavy equipment or impact tools (e.g. jackhammers, pile drivers, hoe rams) are

used in the vicinity of nearby commercial land uses. Distinctly perceptible groundborne vibration levels could be generated by heavy tracked vehicles (e.g., bulldozers or excavators) when these equipment operate within approximately 25 feet of sensitive land uses. Impact pile drivers can generate distinctly perceptible groundborne vibration levels at distances up to about 100 feet. The existing office building that may be demolished and the proposed office buildings and structured parking garage are a minimum distance of 150 feet from sensitive receiving areas at nearby commercial uses. Groundborne vibration levels generated by demolition or construction activities would not generally be perceptible at adjacent buildings or use areas. Anticipated vibration levels would not be expected to result in cosmetic or structural damage to adjacent buildings.

There are no other known sources of vibration that would affect the project site (e.g., railroad trains) or vicinity that are included as part of the project.

Impact NV-5: Vibration levels generated during demolition and construction activities would not generally be perceptible at neighboring land uses and would not be excessive or cause cosmetic or structural damage to adjacent buildings. **(Less Than Significant Impact)**

3.4.3 Mitigation Measures

As conditions of approval, the project applicant shall be responsible for the implementation of the following measures to reduce noise and vibration impacts:

MM NV-4.1: The applicant, in coordination with the Director of Planning & Inspection and adjacent land uses, shall implement a construction noise mitigation plan so that construction activities can be scheduled to minimize noise disturbance. The construction mitigation plan shall consider the following available controls to reduce construction noise levels as low as practical.

- Prohibit construction on weekends and holidays to minimize disturbance at the Great America Theme Park;
- Utilize ‘quiet’ models of air compressors and other stationary noise sources where technology exists;
- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment;
- Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from adjacent land uses;
- Locate staging areas and construction material areas as far away as possible from adjacent land uses;
- Prohibit all unnecessary idling of internal combustion engines;
- Notify all adjacent land uses of the construction schedule in writing;
- Designate a “disturbance coordinator” who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable

measures warranted to correct the problem be implemented; and

- Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

Noise reduction measures will be incorporated into the construction mitigation plan and implemented during all phases of construction activity to minimize the exposure of neighboring properties. This measure, in combination with the limitations on construction hours set forth in the Noise Ordinance, would reduce the temporary impact of construction noise to a less than significant level.

3.4.4 Conclusion

Impact NV-1: Standard office construction would provide sufficient noise reduction in interior spaces to comply with noise limits established in the CALGreen Code. **(Less Than Significant Impact)**

Impact NV-2: Traffic-generated noise levels would not be noticeably or measurably increased as a result of the project. **(Less Than Significant Impact)**

Impact NV-3: Noise levels generated by the operation of the project would not exceed the standards established in the Santa Clara Municipal Code. **(Less Than Significant Impact)**

Impact NV-4: Implementation of a construction noise mitigation plan, incorporating available noise reduction methods, would reduce the impacts of construction noise levels at adjacent commercial and office land uses to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact NV-5: Vibration levels generated during demolition and construction activities would not generally be perceptible at neighboring land uses and would not be excessive or cause cosmetic or structural damage to adjacent buildings. **(Less Than Significant Impact)**

3.5 GEOLOGY AND SOILS

The following discussion is based on a Geotechnical Feasibility Study prepared by *Cornerstone Earth Group* in January 2008. A copy of this study is included as Appendix D in this EIR.

3.5.1 Existing Setting

3.5.1.1 *Geology and Soils*

The site is located within the Santa Clara Valley, which is a broad alluvial plane between the Santa Cruz Mountains to the southwest and west, and the Diablo Range to the northeast. The San Andreas Fault system, including the Monte Vista-Shannon Fault, exists within the Santa Cruz Mountains and the Hayward and Calaveras Fault systems exist within the Diablo Range. Alluvial soil thicknesses in the areas of Santa Clara and North San José range from about 300 to greater than 700 feet.

The site is located at approximately 20 feet above mean sea level (MSL) and is relatively flat, but graded to drain to storm drainage facilities. The existing buildings are surrounded by asphalt concrete paved parking lots and associated landscaping areas. The site is located equidistant between San Tomas Aquino and Calabazas Creeks (approximately one-half mile to the east and west, respectively). The Guadalupe River is located approximately three miles to the northeast.

Subsurface conditions in the project area consist of a surficial layer of moderately to highly plastic clays overlying predominantly stiff to very stiff clays with interbedded seams/layers of medium dense to dense sands. This is common to the region where continuous and discontinuous sand seams and layers are present within the clay matrix. Based on testing of surface soil samples during previous investigations on and within the site vicinity, the soils on the project site have moderate expansion potential to wetting and drying cycles. The upper 20 to 30 feet of the soil profile is anticipated to consist of moderately compressible soils.

Groundwater was encountered in some of the previous explorations on site at depths ranging from approximately nine (9) to 13 feet below current grades. Historical high groundwater levels are reportedly between five (5) to 10 feet below grade (CGS, Milpitas Quadrangle, 2001).

Fluctuations in ground water levels occur due to many factors including seasonal fluctuations of two to five feet, underground drainage patterns, regional fluctuations over long time periods, and other factors.

3.5.1.2 *Seismicity and Seismic Hazards*

The San Francisco Bay Area is classified as Zone 4 for seismic activity, the most seismically active region in the United States. While seismologists cannot predict earthquake events, the U.S. Geological Survey's Working Group on California Earthquake Probabilities (2003) estimates there is a 62 percent chance of at least one magnitude 6.7 earthquake occurring in the Bay Area region between 2003 and 2032. Strong ground shaking can, therefore, be expected at the site during moderate to severe earthquakes in the region.

The faults considered capable of generating significant earthquakes are generally associated with the well-defined areas of crustal movement, which trend northwesterly. Active faults within the region are shown in Table 3.5-1. The project site is not located within a designated Alquist-Priolo Earthquake Fault Zone or Santa Clara County Fault Hazard Zone.

Table 3.5-1
Regional Faults

Fault Name	Distance (miles)
San Andreas	11.2
Monte Vista-Shannon	7.8
Hayward (Total Length)	8.9
Hayward (Southeast Extension)	6.5
Calaveras	10.5

Liquefaction

Liquefaction is the transformation of water saturated soil from a solid to a liquid state during ground shaking. Soils most susceptible to liquefaction are loose, non-cohesive soils that are saturated and are bedded with poor drainage. The site is within a State-designated Liquefaction Hazard Zone (CGS, Milpitas Quadrangle, 2001) as well as a Santa Clara County Liquefaction Hazard Zone (Santa Clara County, 2003).

On-site borings indicate that sand layers are likely to be present on the site between ten to 20 feet below grade. Ground rupture is not anticipated to occur on the site.

Lateral Spreading

Lateral spreading is horizontal/lateral ground movement of relatively flat-lying soil deposits towards a free face such as an excavation, channel, or open body of water. Typically, lateral spreading is associated with liquefaction of one or more subsurface layers near the bottom of the exposed slope. There are no creeks or open faces within 200 feet of the site where lateral spreading could occur; therefore, the potential for lateral spreading to affect the site is low.

3.5.1.3 *California Building Code*

The California Building Code is the California Code of Regulations (CCR), Title 24. The California Building Code is a compilation of three types of building standards from three different origins:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes;
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions; and
- Building standards, authorized by the California legislature, that constitute extensive additions not covered by the model codes that have been adopted to address particular California concerns.

The project shall be required to conform to the latest adopted California Building Code, as amended by the City of Santa Clara, in effect at the time of building permit approval.

3.5.2 Geology and Soils Impacts

3.5.2.1 *Thresholds of Significance*

For the purposes of this EIR, a geologic impact is considered significant if the project would:

- Expose people or structures to substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure (including liquefaction), landslides, or expansive soils;
- Cause substantial soil erosion or the loss of topsoil;
- Expose people or property to major geologic hazards that cannot be mitigated through the use of standard engineering design and seismic safety techniques;
- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state; or
- Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan.

There are no significant mineral resources present in the City of Santa Clara boundaries. In addition, there are no exploitable oil or gas resources within the City. For these reasons, the proposed project would not result in the loss of any mineral resources.

3.5.2.2 *Geologic Impacts*

Soil Conditions

The project would allow up to three new office buildings on the site for a total of six buildings. Structured parking would be located along the eastern side of the site. Depending on the final design of the project, static total and differential settlements could occur.

The project site contains soils that are moderately expansive. The proposed buildings will be designed to limit moisture changes in the surficial soils by using positive drainage away from buildings as well as limiting landscape watering adjacent to the buildings.

Shallow ground water has been measured during previous drilling at depths as shallow as approximately nine feet below the existing ground surface. Historic groundwater levels in the vicinity of the site were recorded at about five to ten feet. Shallow groundwater could impact grading and underground utility construction. These impacts typically consist of potentially wet and unstable foundation subgrade, difficulty achieving compaction, and difficult underground utility installation. Dewatering and shoring of utility trenches may be required in areas where deep utilities are planned.

Impacts from soil conditions on the site can be mitigated by utilizing standard engineering and construction techniques. With incorporation of these measures the project will not expose people or property to significant impacts associated with the geologic conditions of the site. Erosion or landslide related hazards will be minimal due to the flat topography of the site.

Seismic Hazards

The project site is located within a State- and County-designated Liquefaction Hazard Zone. Based on a review of the subsurface data previously collected on the site and in the site vicinity, there are likely some sand layers below the design groundwater level that could experience strength loss and liquefaction-induced settlement during strong seismic shaking. In this area of the Santa Clara Valley alluvial deposits are interbedded with discontinuous sand seams and layers. If liquefaction occurs within these variable layers, increased differential seismic settlement estimates can occur.

Loose unsaturated sandy soils can also settle during strong seismic shaking. As the unsaturated soils encountered above the water table at the site were predominantly stiff to very stiff clays, the potential for significant differential seismic settlement affecting the proposed buildings is low.

Seismic hazards in the project area will require that the proposed structures be designed and built in conformance with the requirements of the California Building Code.

Design-Level Geotechnical Investigation

Buildings will be designed and constructed in accordance with a design-level geotechnical investigation prepared for the site, which identifies specific design features that will be required for the project, including site preparation, compaction, trench excavations, foundation and subgrade design, drainage, and pavement design. Based on the preliminary geotechnical analysis, it is recommended that piles be used to support the proposed office buildings. The design-level geotechnical investigation shall be reviewed and approved by the City prior to issuance of a building permit for the project.

Impact GEO-1: The proposed project will be constructed in conformance with a design-level geotechnical investigation and the California Building Code. The proposed project, therefore, will not expose people or property to significant impacts associated with the geologic conditions of the site. **(Less Than Significant Impact)**

3.5.3 Mitigation Measures

There is no mitigation required or proposed.

3.5.4 Conclusion

Impact GEO-1: The proposed project will be constructed in conformance with a design-level geotechnical investigation and the California Building Code. The proposed project, therefore, will not expose people or property to significant impacts associated with the geologic conditions of the site. **(Less Than Significant Impact)**

3.6 HYDROLOGY AND WATER QUALITY

The following discussion is based in part on a Storm Drainage Hydrology Memo prepared by *Schaaf & Wheeler Consulting Civil Engineers* in December 2008. A copy of this report is included as Appendix E in this EIR.

3.6.1 Existing Setting

3.6.1.1 *Flooding*

Based on the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map, the project site is located within Zone AO.[14] Flood Zone AO is defined as an area determined to have flood depths of one to three feet during 100-year flood conditions.

The site is located within a dam failure inundation hazard area.[15] In the 1980s, the State Office of Emergency Services required that dam inundation maps be prepared for all dams in the state. The purpose of the maps is to provide information to local emergency service agencies that allows them to plan for a response in the event of a dam failure. Flood waters associated with a catastrophic dam failure at Lexington Reservoir would result in flooding at the site (as well as large portions of the Santa Clara Valley).

3.6.1.2 *Storm Drainage System*

The City of Santa Clara owns and maintains the municipal storm drainage system which serves the project site. Storm drains on-site connect to 12-inch to 66-inch lines in Great America Parkway and 30 to 33-inch lines in Mission College Boulevard. The lines serving the site drain to San Tomas Aquino Creek which flows north to Guadalupe Slough and into San Francisco Bay. San Tomas Aquino Creek is located approximately 1,800 feet east of the site.

3.6.1.3 *Stormwater Runoff*

Water Quality

The water quality of San Tomas Aquino Creek is directly affected by pollutants contained in stormwater runoff from a variety of urban and non-urban uses. Stormwater from urban uses contains metals, pesticides, herbicides, and other contaminants, including oil, grease, asbestos, lead, and animal wastes. Section 303(d) of the Federal Clean Water Act requires that each state develop a list of water bodies that do not meet water quality standards, establish priority rankings for waters on the

[14] Federal Emergency Management Agency. *Flood Insurance Rate Map, City of Santa Clara California Santa Clara County Community-Panel Number 06085C0063H*. May 18, 2009.
[15] Association of Bay Area Governments. *Dam Failure Inundation Hazard Map for Northwest San José/Milpitas/Santa Clara*. October 20, 2003. Map. Accessed February 4, 2013. http://www.abag.ca.gov/cgi-bin/pickdamx.pl; http://gis.abag.ca.gov

list, and develop action plans, called Total Maximum Daily Loads (TMDL)[16], to improve water quality. Currently, San Tomas Aquino Creek is not listed on the California 303(d) list as trash impaired.

Under existing conditions approximately 14.88 acres of the 18.5-acre project site is covered with impervious surfaces such as the existing buildings and paved parking lots. Runoff from the site likely contains sediments, debris, oils, metals, and other pollutants related to automobiles and the urban environment.

Nonpoint Source Pollution Program

In 1988 the State Water Resources Control Board (SWRCB) adopted the Nonpoint Source Management Plan in an effort to control nonpoint source pollution in California. In December 1999, the Plan was updated to comply with the requirements of Section 319 of the Federal Clean Water Act and Section 6217 of the Federal Coastal Zone Act Reauthorization Amendment (CZARA) of 1990. The Nonpoint Source Program requires individual permits to control discharge associated with construction activities. The Nonpoint Source Program is administered by the Regional Water Quality Control Board (RWQCB) under the National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities. Projects must comply with the requirements of the Nonpoint Source Program if:

- They disturb one acre or more of soil; or
- They disturb less than one acre of soil but are part of a larger development that, in total, disturbs one acre or more of soil.

The NPDES General Permit for Construction Activities requires the developer to submit a Notice of Intent (NOI) to the RWQCB and to develop a Stormwater Pollution Prevention Plan (SWPPP) to control discharge associated with construction activities.

Santa Clara Valley Urban Runoff Pollution Prevention Program

The Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) was developed by the RWQCB to assist co-permittees in implementing the provisions of the NPDES permit. This program was also designed to fulfill the requirements of Section 304(1) of the Federal Clean Water Act, which mandated that the Environmental Protection Agency develop NPDES application requirements for stormwater runoff. The Program's Municipal NPDES stormwater permit includes provisions requiring regulation of stormwater discharges associated with new development and development of an area-wide watershed management strategy. The permit also identifies recommended actions for the preservation, restoration, and enhancement of the San Francisco Bay Delta Estuary.

[16] A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. The TMDL high priority schedule denotes the most severely impaired water bodies on the 303(d) list.

Applicable projects consist of all new public and private projects that create 10,000 s.f. or more of impervious surface collectively over the entire project site and redevelopment projects that add or replace 10,000 s.f. or more of impervious surface area on the project site. Additional requirements must be met by large projects (formerly known as Group 1 projects) that create one-acre or more of impervious surfaces. These large projects must control increases in runoff peak flow, volume, and duration (referred to as Hydromodification) caused by the project if the increase in stormwater runoff has the potential to cause erosion or other adverse impacts to receiving streams.

Hydromodification

In addition to water quality controls, the Municipal Regional Stormwater NPDES permit requires all new and redevelopment projects that create or replace one-acre or more of impervious surface to manage development-related increases in peak runoff flow, volume, and duration, where such hydromodification is likely to cause increased erosion, silt pollutant generation or other impacts to beneficial uses of local rivers, streams, and creeks. Projects may be deemed exempt from the permit requirements if they do not meet the size threshold, drain into tidally influenced areas or directly into the Bay, drain into hardened channels, or are infill projects in subwatersheds or catchments areas that are greater than or equal to 65 percent impervious (per the Santa Clara Permittees Hydromodification Management Applicability Map).

Based on the SCVURPPP Watershed Map for the City of Santa Clara, the project site drains into a hardened channel. As a result, the project is not subject to the NPDES hydromodification requirements.[17]

3.6.1.4 *Groundwater*

Groundwater on the site has been encountered at depths ranging from nine to 13 feet below grade. Historical high groundwater levels in the project area are between five to ten feet below grade.[18]

3.6.2 Hydrology and Water Quality Impacts

3.6.2.1 *Thresholds of Significance*

For the purposes of this EIR, a hydrology and water quality impact is considered significant if the project would:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table (e.g., the production rate of preexisting nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);

[17] Santa Clara Valley Urban Runoff Pollution Prevention Program. *HMP Applicability Map City of Santa Clara*. November 2010. Accessed February 1, 2013. <http://www.scvurppp-w2k.com/hmp_maps.htm>

[18] Cornerstone Earth Group. *Geotechnical Feasibility Study Great America Commercial Development.* January 11, 2008.

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site;
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Otherwise substantially degrade water quality;
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows;
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam; or
- Be subject to inundation of the site by seiche, tsunami, or mudflow.

3.6.2.2 *Flooding Impacts*

The project site is located in the 100-year floodplain with average flood depths of one to three feet. Buildings proposed on the project site will be required to comply with the flood damage prevention requirements of the City's Municipal Code. The project will be required to elevate proposed structures on the site one-foot above the 100-year floodplain. The proposed project, therefore, would not expose persons and/or property to impacts from the 100-year flood.

As previously noted, the project site is located within the dam failure inundation area for Lexington Reservoir. The precise failure probabilities of dam failure have not been calculated but the probability is considered extremely remote. The SCVWD is mandated by the state to inspect and report on the condition of the dam on an annual basis.

Impact HYD-1: The proposed project would not expose persons or property to significant hazards due to flooding. **(Less Than Significant Impact)**

3.6.2.3 *Storm Drainage Impacts*

The proposed project would slightly increase the amount of impervious surface area on the project site. Existing impervious surfaces cover approximately 79 percent of the project site or 14.88 acres. The proposed project would allow for an increase in impervious surfaces on the project site, approximately one (1) percent, to 15.02 acres or 80 percent of the site. The existing storm drainage system has sufficient capacity to accommodate the existing runoff from the project site. Previous studies of storm drain capacity in the area assumed impervious surfaces of 80 percent and found adequate storm drain capacity was available. The existing storm drainage system, therefore, would have capacity to serve the proposed development.

Impact HYD-2: The proposed project would result in a negligible increase in impervious surfaces on the site and would not exceed the capacity of the existing storm drainage system. **(Less Than Significant Impact)**

3.6.2.4 *Water Quality Impacts*

Operational Impacts

Implementation of the proposed project could result in an incremental increase in stormwater pollutant loads due to an approximately one percent increase in impermeable surfaces. The proposed project will contribute the same types of stormwater runoff pollutants as the existing development on the site. Runoff from streets and parking areas often carries grease, oil, and trace amounts of heavy metals into drainages. Runoff from landscaping can carry pesticides, herbicides, and fertilizers. Although the amounts of these pollutants ultimately discharged into the waterways are unknown, over time they could accumulate and be substantial. Most of the proposed impervious surfaces will be buildings and parking areas. Having an increase in cars parked on-site each day will increase the amount of oils, grease, metals, and debris on-site which will increase the potential amount of pollution flowing into the storm drainage system.

In addition to the increased pollutant load in stormwater runoff, the proposed project will add or replace more than 10,000 s.f. of impervious surfaces and must conform to the requirements of the Municipal Regional Stormwater NPDES permit. A final Stormwater Control Plan at the Development Permit stage of this project will be required. Plans will be certified by engineers to ensure incorporation of appropriate and effective source control measures to meet Low Impact Development (LID) requirements to prevent discharge of pollutants, reduce impervious surfaces, retain a percentage of runoff on-site for percolation, and treatment control measures to remove pollutants from runoff entering the storm drainage system.

The proposed treatment facilities will have sufficient capacity to treat the stormwater runoff entering the storm drainage system. In addition, the project will be required to maintain all post-construction treatment control measures, as outlined below, throughout the life of the project.

The following measures, based on the RWQCB Best Management Practices (BMPs) and City requirements, are included in the proposed project to ensure compliance with NPDES permit requirements to reduce post-construction water quality impacts.

- When the construction phase is complete, a Notice of Termination (NOT) for the General Permit for Construction will be filed with the RWQCB and the City of Santa Clara. The NOT will document that all elements of the SWPPP have been executed, construction materials and waste have been properly disposed of, and a post-construction stormwater management plan is in place as described in the SWPPP for the project site.

- All post-construction Treatment Control Measures (TCMs) will be installed, operated, and maintained by qualified personnel. On-site inlets will be cleaned out at a minimum of once per year, prior to the wet season.

- The property owner/site manager will keep a maintenance and inspection schedule and record to ensure the TCMs continue to operate effectively for the life of the project. Copies of the schedule and record must be provided to the City upon request and must be made available for inspection on-site at all times.

With implementation of a Stormwater Control Plan, the project will not violate any adopted water quality standards or waste discharge requirements. Runoff will be routed directly from the treatment facilities to the storm drainage system and will not flow off-site. Installation and maintenance of the proposed stormwater treatment systems will result in a less than significant impact on water quality.

Impact HYD-3: The proposed project would implement stormwater treatment control measures to comply with the Municipal Regional Stormwater NPDES. **(Less Than Significant Impact)**

Construction Impacts

Construction of the proposed project, including grading, may result in temporary impacts to surface water quality. Construction of the project buildings and parking structure would result in the disturbance of underlying soils, thereby increasing the potential for sedimentation and erosion. When disturbance to underlying soils occurs, the surface runoff that flows across the site may contain sediments that are ultimately discharged into the storm drainage system. Construction of the project may require dewatering for trenching and the placement of piles.

Impact HYD-4: Construction of the proposed project could result in a significant temporary increase in the amount of contaminants in stormwater runoff during construction. **(Significant Impact)**

3.6.2.5 *Groundwater Impacts*

Groundwater in the project area is estimated at five to 13 feet below grade. The proposed project does not include any below grade structures that would impact the shallow groundwater aquifer.

The existing project site is approximately 21 percent permeable and does not contribute to recharging of the underground (i.e., is not a designated recharge area). The City of Santa Clara does rely on groundwater for a portion of its domestic water needs. With the implementation of the proposed project, the impermeable surface area on the project site would increase by approximately one percent. While the proposed project would result in an increase in impermeable surface area on the site, it is unlikely that this negligible increase would have a measureable effect on groundwater recharge and the groundwater supply.

Impact HYD-5: The proposed project would not substantially deplete or degrade groundwater supplies. **(Less Than Significant Impact)**

3.6.3 Mitigation Measures

As conditions of approval, the project applicant shall be responsible for the implementation of the following measures to reduce hydrology and water quality impacts:

MM HYD-4.1: The following RWQCB BMPs will be required to reduce construction-related water quality impacts. All mitigation will be implemented prior to the start of

earthmoving activities on-site and will continue until the construction is complete.

- Burlap bags filled with drain rock shall be installed around storm drains to route sediment and other debris away from the drains.
- Earthmoving or other dust-producing activities shall be suspended during periods of high winds.
- All exposed or disturbed soil surfaces shall be watered at least twice daily to control dust as necessary.
- Stockpiles of soil or other materials that can be blown by the wind shall be watered or covered.
- All trucks hauling soil, sand, and other loose materials shall be required to cover all trucks or maintain at least two feet of freeboard.
- All paved access roads, parking areas, and staging areas adjacent to the construction sites shall be swept daily (with water sweepers).
- Vegetation in disturbed areas shall be replanted as quickly as possible.
- All unpaved entrances to the site shall be filled with rock to knock mud from truck tires prior to entering City streets. A tire wash system may also be employed at the request of the City.
- A Stormwater Permit will be administered by the RWQCB. Prior to construction grading for the proposed land uses, the project proponent will file a "Notice of Intent" (NOI) to comply with the General Permit and prepare a SWPPP which addresses measures that would be included in the project to minimize and control construction and post-construction runoff. Measures will include, but are not limited to, the aforementioned RWQCB mitigation. Dewatering discharges will be filtered or treated using appropriate technologies to remove sediments prior to discharging to the City's storm drain system.
- The project proponent will submit a copy of the draft SWPPP to the City of Santa Clara for review and approval prior to start of construction on the project site. The certified SWPPP will be posted at the project site and will be updated to reflect current site conditions.
- When construction is complete, a NOT for the General Permit for Construction will be filed with the RWQCB and the City of Santa Clara. The NOT will document that all elements of the SWPPP have been executed, construction materials and waste have been properly disposed of, and a post-construction stormwater management plan is in place as described in the SWPPP for the site.

3.6.4 Conclusion

Impact HYD-1: The proposed project would not expose persons or property to significant hazards due to flooding. **(Less Than Significant Impact)**

Impact HYD-2: The proposed project would result in a negligible increase in impervious

surfaces on the site and would not exceed the capacity of the existing storm drainage system. **(Less Than Significant Impact)**

Impact HYD-3: The proposed project would implement stormwater treatment control measures to comply with the Municipal Regional Stormwater NPDES. **(Less Than Significant Impact)**

Impact HYD-4: Implementation of construction BMPs would reduce the temporary increase in the amount of contaminants in stormwater runoff to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact HYD-5: The proposed project would not substantially deplete or degrade groundwater supplies. **(Less Than Significant Impact)**

3.7 BIOLOGICAL RESOURCES

The following discussion is based in part on a Tree Inventory prepared by *McClenahan Consulting, LLC* in February 2013. A copy of this report is included as Appendix F in this EIR.

3.7.1 Existing Setting

The project site consists of three buildings surrounded by surface parking lots and landscaping, including mature trees. Habitats in developed urban areas are extremely low in species diversity. Species that use this habitat are predominantly urban adapted birds, such as rock dove, mourning dove, house sparrow, and starling.

3.7.1.1 *Special-Status Species*

Special status plant and wildlife species are not located on the highly urbanized project site, although raptor (birds of prey) could use the trees on the site for nesting and foraging habitat. Raptors are protected by the Federal Migratory Bird Treaty Act (MBTA) (16 U.S.C. Section 703, Supp. I., 1989).

3.7.1.2 *Mature Trees*

Mature trees are beneficial because they provide habitat for wildlife that can survive in an urban environment. The City also regulates removal of mature trees because their removal detracts from the scenic beauty of the City, causes erosion of topsoil, creates flood hazards, reduces property values, increases the cost of construction and maintenance of drainage systems through the increased flow and diversion of surface waters, and eliminates one of the prime oxygen producers and prime air purification systems in the area.

The tree survey completed in February 2013 found a total of 654 trees on the project site. There were 22 trees on the site greater than 18 inches in diameter. A summary of the trees found on the site is shown in Table 3.7-1. None of the trees on-site are native to this area of Santa Clara, although coast redwoods are native elsewhere in California. All trees measured during the survey and their locations on the project site are shown in Appendix F. A tree removal permit will be required prior to the removal of trees from the project site.

Table 3.7-1
Summary of Trees on Site

Tree Species	Diameter in Inches				
	1 to 6"	6 to 12"	12 to 18"	18+"	Total
American sweet gum	3	18	2	--	23
Aristocrat pear	10	69	49	8	136
Blackwood acacia	46	66	20	1	132
Bradford pear	2	8	--	--	10
Canary Island pine	--	5	--	--	5
Chinese hackberry	12	--	1	--	13
Chinese pistache	26	12	--	--	38
Coast redwood	20	69	34	3	126
Crape myrtle	7	1	--	--	8
Deodar cedar	34	--	1	--	35
Evergreen ash	3	--	7	3	13
Evergreen pear	4	24	4	--	32
Holly oak	7	--	--	--	7
Italian stone pine	--	--	--	3	3
Little leaf linden	--	1	4	--	5
London plane tree	--	23	18	--	41
Mexican fan palm	--	3	8	--	11
Zelkova	5	--	6	4	15
Total	**179**	**299**	**154**	**22**	**654**

3.7.2 Biological Resources Impacts

3.7.2.1 *Thresholds of Significance*

For the purposes of this EIR, a biological resources impact is considered significant if the project would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;

- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Conflict with any local ordinances protecting biological resources, such as a tree preservation ordinance; or
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

3.7.2.2 *Special-Status Species*

Due to the highly urbanized nature of the project site, the proposed development would not result in impacts to special-status plant and wildlife species, with the exception of raptors (birds of prey) that could use the trees on-site for nesting.

Nesting Raptors

Although the site is primarily used by species accustomed to developed areas, some nesting raptors (i.e., falcons, hawks, eagles, owls) may use the site and are protected under provisions of the Migratory Bird Treaty Act and the California Department of Fish and Wildlife (CDFW). The Federal Migratory Bird Treaty Act (MBTA; 16 U.S.C., §703, Supp. I, 1989) prohibits killing, possessing, or trading in migratory birds except in accordance with regulations prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of birds, and bird nests and eggs. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered a "take" by the CDFW.

Raptors (such as falcons, hawks, eagles, and owls) and other migratory birds may utilize the large trees on-site or adjacent to the site for foraging or nesting. The loss of mature landscape trees on-site could result in nesting raptors having to relocate to another site. Relocation of mature raptors or migratory birds would not, by itself, be significant. Construction disturbance on the site during the breeding season could result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment, a violation of the MBTA. Disturbance that causes abandonment and/or loss of reproductive effort is considered a taking by the CDFW. Any loss of fertile eggs, nesting raptors, or any activities resulting in nest abandonment would constitute a significant impact.

Impact BIO-1: The proposed development on a site with mature trees could result in direct impacts to nesting raptors. **(Significant Impact)**

3.7.2.3 *Mature Trees*

There are currently 654 trees located on the project site. The proposed PD zoning does not include a site plan detailing the specific locations of buildings, parking, and landscape areas. For the purposes of this analysis, trees are assumed to be remain in the landscaped areas around the existing buildings to be retained on the site. The project, therefore, is expected to result in the removal of approximately 519 trees from the site.

Under Policy 5.3.1-P10 in the Land Use section of the City's 2010-2035 General Plan, there is a requirement for new development to provide street trees and a minimum 2:1 on- or off-site replacement for trees removed. In accordance with City policy, the project will be required to replace the trees removed, per the conditions of approval of the tree removal permit.

Impact BIO-2: The proposed project will result in the removal of approximately 519 trees from the site. **(Significant Impact)**

3.7.3 Mitigation Measures

3.7.3 *Nesting Raptors*

The project applicant shall implement the following measure to reduce impacts to nesting raptors to a less than significant level:

MM BIO-1.1: Construction shall be scheduled to avoid the nesting season to the extent feasible. The nesting season for most birds, including most raptors, in the San Francisco Bay Area extends from February through August.

If it is not possible to schedule demolition and construction between September and January, then pre-construction surveys for nesting birds shall be completed by a qualified ornithologist to ensure that no nests will be disturbed during project implementation. This survey shall be completed no more than 14 days prior to the initiation of grading, tree removal, or other demolition or construction activities during the early part of the breeding season (February through April) and no more than 30 days prior to the initiation of these activities during the late part of the breeding season (May through August). During this survey, the ornithologist will inspect all trees and other possible nesting habitats immediately adjacent to the construction areas for nests. If an active nest is found sufficiently close to work areas to be disturbed by construction, the ornithologist, in consultation with CDFW, will determine the extent of a construction-free buffer zone to be established around the nest, typically 250 feet, to ensure that raptor or migratory bird nests will not be disturbed during project construction.

3.7.3.2 *Tree Replacement*

MM BIO-2.1: The project shall replace all trees removed from the site at a ratio of 2:1 in accordance with an approved landscape plan for the project.

MM BIO-2.2: In the event the redeveloped portion of the project site does not have sufficient area to accommodate the required tree mitigation, the project applicant will coordinate with the City Arborist to identify further opportunities within the City for the planting of replacement trees.

3.7.3.3 *Tree Preservation*

Trees proposed for retention on the site shall be protected under the following Tree Preservation Guidelines prepared by the project arborist and outlined below as avoidance measures (AM).

AM BIO-2.1: To minimize construction injuries, grading operations shall encroach no closer than five times the trunk diameter, (i.e. 30" diameter tree x 5=150" distance). At this distance, buttress/anchoring roots will be preserved and minimal injury to the functional root area will be anticipated. If encroachment within this area becomes necessary, hand digging will be mandatory.

AM BIO-2.2 Prior to initiation of construction activity, temporary barricades shall be installed around all trees in the construction area. Six-foot high, chain link fences are to be mounted on steel posts, driven two feet into the ground, at no more than ten-foot spacing. The fences shall enclose the entire area under the dripline of the trees or as close to the drip line area as practical. These barricades will be placed around individual trees and/or groups of trees as the existing environment dictates. The temporary barricades will serve to protect trunks, roots and branches from mechanical injuries, will inhibit stockpiling of construction materials or debris within the sensitive 'dripline' areas and will prevent soil compaction from increased vehicular/pedestrian traffic. No storage of material, topsoil, vehicles or equipment shall be permitted within the tree enclosure area. The ground around the tree canopy shall not be altered. These barricades should remain in place until final inspection of the building permit, except for work specifically required in the approved plans to be done under the trees to be protected. Designated areas beyond the driplines of any trees should be provided for construction materials and on-site parking.

AM BIO-2.3: During and upon completion of any trenching/grading operation within a tree's dripline, should any roots greater than one (1) inch in diameter be damaged, broken or severed, root pruning to include flush cutting and sealing of exposed roots should be accomplished under the supervision of a qualified arborist to minimize root deterioration beyond the soil line within twenty-four (24) hours.

AM BIO-2.4: Pruning of the foliar canopies, including removal of deadwood, shall be initiated prior to construction operations. Such pruning will provide any necessary construction clearance, will lessen the likelihood or potential for limb breakage, reduce 'windsail' effect and provide an environment suitable for healthy and vigorous growth.

AM BIO-2.5: A program of fertilization by means of deep root soil injection will be undertaken with applications in spring and summer for those trees to be impacted by construction. Such fertilization will serve to stimulate feeder root

development, offset shock/stress as related to construction and/or environmental factors, encourage vigor, alleviate soil compaction and compensate for any encroachment of natural feeding root areas. Inception of this fertilizing program is recommended prior to the initiation of construction activity.

AM BIO-2.6: A supplemental irrigation program for all trees shall be accomplished at regular three to four week intervals during the period of May 1st through October 31st. Irrigation is to be applied at or about the 'dripline' in an amount sufficient to supply approximately 15 gallons of water for each inch in trunk diameter. Irrigation can be provided by means of a soil needle, 'soaker' or permeable hose. When using 'soaker' or permeable hoses, water is to be run at low pressure, avoiding runoff/puddling, allowing the needed moisture to penetrate the soil to feeder root depths.

AM BIO-2.7: Mulching with wood chips (maximum depth three inches) within tree environments (outer foliar perimeter) shall be used, as appropriate, to lessen moisture evaporation from soil, protect and encourage adventitious roots and minimize possible soil compaction.

AM BIO-2.8: Periodic inspections by the project arborist shall be completed during construction activities, particularly as trees are impacted by trenching/grading operations. Inspections at approximate four week intervals would be sufficient to assess and monitor the effectiveness of the Tree Preservation Plan and to provide recommendations for any additional care or treatment.

3.7.4 Conclusion

Impact BIO-1: Implementation of the required mitigation measure would reduce impacts to nesting raptors to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact BIO-2: Implementation of the required tree preservation and replacement measures will reduce impacts to mature trees on the site to a less than significant level. **(Less Than Significant Impact with Mitigation)**

3.8 VISUAL AND AESTHETIC RESOURCES

3.8.1 Existing Setting

3.8.1.1 *Visual Character of the Project Site*

The approximately 18.8-acre site is located in an urban commercial and industrial area adjacent to Great America Parkway and north of US 101. The project site is bounded by Patrick Henry Drive to the north, the Great America Theme Park and an office building and parking lot to the east, Mission College Boulevard, a four-lane roadway, to the south, and Great America Parkway, a seven-lane roadway, to the west. Offices, hotels, and commercial development exists on the opposite sides of the streets to the south and west of the project.

The northern parcel of the project site is developed with a two-story office building surrounded by paved parking lots and landscaping (refer to Photos 1 and 2). The building facade is comprised of glass and stucco which is typical of surrounding office development. Mature trees are located along the parcel's street frontages and in landscape areas around the existing building.

The southern parcel of the project site is developed with two, six-story buildings located directly northeast of the Great America Parkway and Mission College Boulevard intersection (refer to Photos 3 and 4). A grassy area and fountain are located adjacent to the intersection with mature trees shielding views of the buildings' ground floors. The two office buildings on the site were constructed in 1983 and include terraced floors from the second through sixth floors. The building facades are comprised of glass and stucco. The buildings are connected by an enclosed glass walkway on the third floor. Mature trees are located in landscaped berms along the parcel's street frontages and in landscape areas around the buildings. Large surface parking lots are located to the north and east of the buildings with trees scattered throughout the parking areas. The eastern parcel boundary is lined with a row of Coast redwood trees.

3.8.1.2 *Visual Character of the Project Area*

Surrounding development in the project area is primarily modern commercial and office uses. Building heights in the area vary and include single-story strip commercial development, six-story office buildings, and a 14-story hotel (refer to Photos 5-7). North of the project site is a six-story office building with an associated five-story parking garage that was constructed within the last 10 years (refer to Photo 5). Three- to four-story office buildings typical of 1980s-2000 are located west of Great America Parkway with landscape buffers along the street frontage and large parking areas. A single-story strip commercial retail development is also located west of Great America Parkway at its intersection with Mission College Boulevard (refer to Photo 6). A large Marriot hotel complex is located south of Mission College Boulevard and contains two hotel towers, two- and three-story hotel buildings, and ancillary facilities (refer to Photo 7). A two-story office building is located east of the project site and is separated from the site by a large surface parking lot. The Great America Theme Park is also located east of the site with some park attractions visible from the site. Large mature trees on the theme park property provide a visual buffer between the site and adjacent park attractions. Segments of Great America Parkway and Mission College Boulevard contain landscaped medians in the project area.

Photo 1 - View of the northernmost building on the project site looking southeast from the intersection of Great America Parkway and Patrick Henry Drive.

Photo 2 - View of the northernmost building on the site looking east from Great America Parkway.

PHOTOS 1 AND 2

Photo 3 - View of 4401 Great America Parkway looking northeast from Great America Parkway.

Photo 4 - View of 4301 Great America Parkway looking northeast from Mission College Boulevard.

PHOTOS 3 AND 4

Photo 5 - View of the office building north of the project site looking east from the intersection of Great America Parkway and Patrick Henry Drive.

Photo 6 - View of the strip commercial development on Great America Parkway looking west from the project site.

PHOTOS 5 AND 6

Photo 7 - View of the Marriot Hotel complex looking south from the signalized entrance to the site on Mission College Boulevard.

PHOTO 7

3.8.1.3 *Scenic Views and Resources*

The project site and the surrounding area are relatively flat and, therefore, the site is only visible from the immediate area. The project area is not located within a designated scenic area based on the City of Santa Clara 2010-2035 General Plan. There are no scenic views within the project area.

3.8.1.4 *Light and Glare*

Sources of light and glare are abundant in the urban environment of the project area, including but not limited to street lights, parking lot lights, security lights, vehicular headlights, internal buildings lights, and reflective building surfaces and windows.

3.8.2 Visual and Aesthetic Resources Impacts

3.8.2.1 *Thresholds of Significance*

For the purposes of this EIR, a visual and aesthetic impact is considered significant if the project would:

- Substantially degrade the existing visual character or quality of the site and its surroundings;
- Have a substantial adverse effect on a scenic vista;
- Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway; or
- Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

3.8.2.2 *Change in Visual Character*

The proposed project would allow up to three new office buildings for a total of six office buildings and an associated parking garage on the site with a maximum FAR of 1.26. Buildings on the site would be up to 12-stories in height. Structured parking would be allowed on the interior of the site and largely shielded from view by the proposed office buildings, and would be subordinate in height to the new office buildings. Although the proposed office building heights would be substantially taller than the office buildings proposed to remain on the site, buildings of similar height and mass are present in the vicinity, south of Mission College Boulevard and near US 101. The proposed buildings would maintain similar setbacks from adjacent roadways as the current buildings on the site. Proposed building setbacks of 30 feet would continue to allow for a landscaped buffer along the project's street frontages.

Views of the site from Great America Parkway and Patrick Henry Drive will be altered from the potential replacement of the two-story office building with taller office buildings and a parking structure. The proposed buildings would be visually compatible with the surrounding commercial and industrial development.

The design details of the new office buildings are not yet available. The proposed buildings would be reviewed through the City's Site and Architectural Review Committee prior to issuance of building permits.

Impact VIS-1: The proposed project would not substantially degrade the visual character or quality of the site or project area. **(Less Than Significant Impact)**

3.8.2.3 *Effect on Scenic Views*

The project site and surrounding area is flat and not located within a scenic corridor or area of the City. No scenic views or resources would be impacted by the proposed project. Mature trees on the site would be removed to accommodate the proposed buildings and parking structure; however, these trees would be replaced in coordination with the City Arborist (refer to *Section 3.7 Biological Resources*). The development of the proposed project would reduce the visibility of the adjacent Great America Theme Park from Great America Parkway. The theme park, however, is not considered a visual resource by the City and the project's impact, therefore, is less than significant.

Impact VIS-2: The proposed buildings would not block any designated scenic views in the project area or impact any scenic resources. **(Less Than Significant Impact)**

3.8.2.4 *Light and Glare*

Additional development on the site would include outdoor security lighting along walkways, driveways, building entrances, and within the structured parking area and surface lots. Outdoor lighting on the site would be directed away from public streets to comply with the City's lighting requirements (Municipal Code Section 18.46.140) and be comparable in brightness to the nighttime lighting in the project area. Increased lighting on the site, relative to the existing outdoor lighting, would increase the level of illumination in the area. Compliance with the City's lighting requirements would ensure less than significant lighting impacts from the project.

Similar to the existing development in the project area, new buildings on the site may include reflective surfaces such as window panes and trim. The sun reflecting off these surfaces would create glare. Compared to the existing sources of glare on and in the vicinity of the project site, the glare created by new buildings on the site would not be substantial. The proposed building materials and design would be subject to the City's Site and Architectural Review Committee which would ensure glare resulting from the proposed building materials would comply with all local standards.

Impact VIS-3: The proposed buildings would not result in a substantial source of light and glare that would impact views in the project area. **(Less Than Significant Impact)**

3.8.3 <u>Mitigation Measures</u>

No mitigation is required or proposed.

3.8.4 Conclusion

Impact VIS-1: The proposed project would not substantially degrade the visual character or quality of the site or project area. **(Less Than Significant Impact)**

Impact VIS-2: The proposed buildings would not block any designated scenic views in the project area or impact any scenic resources. **(Less Than Significant Impact)**

Impact VIS-3: The proposed buildings would not result in a substantial source of light and glare that would impact views in the project area. **(Less Than Significant Impact)**

3.9 CULTURAL RESOURCES

The following discussion is based on a Cultural Resources Assessment previously prepared for the site by *Basin Research Associates* in October 1998 and a Cultural Resources Sensitivity Study prepared by Albion Environmental, Inc. in May 2010. Because these reports may discuss the location of specific archaeological sites, they are considered administratively confidential and are not included in this EIR. Qualified personnel may request a copy from the City's Department of Planning and Inspection located at 1500 Warburton Avenue, during normal business hours.

3.9.1 Regulatory Setting

3.9.1.1 *California Public Resources Code*

California Public Resources Code, Sections 21083.2 and 21084.1 defines archaeological and historical resources, respectively. These include resources listed on or eligible for the California Register of Historical Resources (CRHR) or the National Register of Historic Places and those resources listed on a local register. Public Resources Code, Sections 5020.1 through 5024.6 creates the California Register of Historical Resources (CRHR) and sets forth requirements for protection of historic cultural resources.

3.9.2 Existing Setting

3.9.2.1 *Archaeological Resources*

No known archaeological sites or other reported cultural resource locations have been recorded on or adjacent to the project site. The site is, however, located in a moderate to highly sensitive archaeological area due to its proximity to San Tomas Aquino and Calabazas Creeks. Numerous small and large size sites, including major villages occupied during the last 5,000 years are present within a quarter to several miles of the project site, indicating a high archaeological sensitivity for the general area.

3.9.2.2 *Historic Resources*

During the Hispanic Period (ca.1804-1818) the project site was situated in ungranted lands and as a result, no adobe dwellings are situated on or within the vicinity of the project site. The project area was probably used for grazing cattle to make tallow and hides.

No notable American Period buildings or features were present in or adjacent to the project site. In the late 1800s, the project site was part of a 165-acre parcel owned by J.W. Haskell whose residence was situated east of the site near San Tomas Aquino Creek. A structure was located just north of the site in 1895 but was removed by 1897. By 1939 two structures were situated near the intersection of what is now Great America Parkway and Mission College Boulevard but were removed by 1980 when these two roadways were built. The project area was primarily occupied by orchards until at least 1973.

3.9.2.3 *Other Resources*

No other local, state or federal historically significant structures, landmarks or points of interest are located in or adjacent to the project site.

3.9.3 Cultural Resource Impacts

3.9.3.1 *Thresholds of Significance*

For the purpose of this EIR, a cultural resources impact is considered significant if the project would:

- Cause a substantial adverse change in the significance of a historical resource;
- Cause a substantial adverse change in the significance of an archaeological resource;
- Directly or indirectly destroy a unique paleontological resource or site or unique geological feature; or
- Disturb any human remains, including those interred outside of formal cemeteries.

3.9.3.2 *Impacts to Archaeological Resources*

No known archaeological resources are present on the project site. The project site is, however, situated within an area identified as moderate to highly sensitive for prehistoric and historic cultural resources. The project site appears to have been occupied by orchards until at least 1973 and is currently occupied by office buildings and parking areas. Due to the location of the project within a moderate to highly sensitive area for cultural resources, the project may result in impacts to buried archaeological resources.

Impact CUL-1: The proposed project may disturb previously unidentified buried archaeological resources. **(Significant Impact)**

3.9.3.3 *Impacts to Historic Buildings*

The six-story buildings located on the northeast corner of Mission College Boulevard and Great America Parkway were constructed in 1983. The two-story building located on the southeast corner of Patrick Henry Drive and Great America Parkway was constructed in 1992. The existing buildings on the site were constructed in the late twentieth century and are, therefore, not considered historic.

Impact CUL-2: The proposed project will not result in impacts to any historic buildings on the site. **(No Impact)**

3.9.4 Mitigation Measures

As conditions of project approval, the project proponent shall implement the following mitigation measures to reduce the impacts of the project to archaeological resources to a less than significant level:

MM CUL-1.1: A qualified archaeologist will be on-site to monitor earth-moving activities during grading on the project site. After monitoring the initial excavation, the archaeologist will make recommendations for further monitoring if it is determined that the site has cultural resources. If the archaeologist determines that no resources are likely to be found on-site, no additional monitoring will be required.

MM CUL-1.2: In the event that prehistoric or historic resources are encountered during excavation and/or grading of the site, all activity within a 50-foot radius of the find will be stopped, the Director of Planning and Inspection will be notified, and the archaeologist will examine the find and make appropriate recommendations prior to issuance of building permits. Recommendations could include collection, recordation, and analysis of any significant cultural materials. A report of findings documenting any data recovery during monitoring would be submitted to the Director of Planning and Inspection.

MM CUL-1.3: In the event that human remains are discovered during excavation and/or grading of the site, all activity within a 50-foot radius of the find will be stopped. The Santa Clara County Coroner will be notified and shall make a determination as to whether the remains are of Native American origin or whether an investigation into the cause of death is required. If the remains are determined to be Native American, the Coroner will notify the Native American Heritage Commission (NAHC) immediately. Once NAHC identifies the most likely descendants, the descendants will make recommendations regarding proper burial, which will be implemented in accordance with Section 15064.5(e) of the CEQA Guidelines.

3.9.5 Conclusion

Impact CUL-1: Implementation of the identified mitigation measures will reduce project impacts to archaeological resources to a less than significant level. **(Less Than Significant Impact with Mitigation)**

Impact CUL-2: The proposed project will not result in impacts to any historic buildings on the site. **(No Impact)**

3.10 HAZARDS AND HAZARDOUS MATERIALS

The following discussion is based on a Summary of Environmental Evaluation prepared by *PES Environmental, Inc*. in February 2013. A copy of this report is included as Appendix G in this EIR.

3.10.1 Existing Setting

The proposed project would expand the amount of office development on an existing office park site. The project site is located in an area with a mix of office and commercial uses.

Hazardous materials are commonly used by large institutions, commercial, and industrial businesses. Hazardous materials include a broad range of common substances such as motor oil and fuel, pesticides, detergents, paint, and solvents. A substance may be considered hazardous if, due to its chemical and/or physical properties, it poses a substantial hazard when it is improperly treated, stored, transported, disposed of, or released into the atmosphere in the event of an accident.

3.10.1.1 *On-Site Hazardous Materials Use*

4301 and 4401 Great America Parkway

Phase I Environmental Site Assessments (ESAs) were prepared for the project site in 1988 and 1998. Additionally, PES performed an environmental evaluation of the subject property in 2007. Prior to construction of the existing buildings at 4301 and 4401 Great America Parkway in 1983, the project site contained farm buildings and was historically planted with row crops and pear orchards. Herbicide and pesticide residues may be present in shallow soil at the site; however, during previous development of the site these residual herbicides and pesticides would have been removed from the site or mixed with other soils.

The on-site buildings have been occupied by various companies, none of which has used significant quantities of hazardous materials. Bay Networks occupied the site when the 1998 Phase I ESA was completed. The building at 4401 Great America Parkway is listed on one hazardous materials database for facilities disposing of various hazardous wastes, including organic solids and liquids, laboratory waste chemicals, waste solvents and outdated chemicals. The Santa Clara Fire Department did not list any current or historical hazardous materials use from these buildings; therefore, the one database listing for the site is likely attributed to a nearby facility historically occupied by Bay Networks which did use hazardous materials.

The buildings each have two emergency generators. A 25-gallon aboveground storage tank (AST) is located on the rooftop of 4301 Great America Parkway and a 140-gallon AST is located in a gated enclosure on the ground floor. A 25-gallon AST and a 50-gallon AST are located on the rooftop of 4401 Great America Parkway. No staining or evidence of leakage was found on, or in the vicinity of, the emergency generators.

Based on the construction date of these buildings and the identification of suspected asbestos containing materials (ACMs), components of these buildings may contain asbestos.

4551 Great America Parkway

A Phase I Environmental Site Assessment was prepared for the building at 4551 Great America Parkway in 1998. This portion of the project site was also previously used for agriculture and was vacant agricultural land prior to the construction of the existing building in 1992. Companies occupying the building on-site did not use significant quantities of hazardous materials.

A pad-mounted emergency generator was observed adjacent to the building in 1998 with no staining or evidence of leakage found on, or in the vicinity of, the emergency generator. Based on site inspections in February 2013, this emergency generator appears to have been removed by the previous tenant. No staining or other evidence of leakage was observed on the pad formerly occupied by the emergency generator.

Although it is not known whether ACMs are present in this building, an asbestos survey will be required prior to demolition of the building.

3.10.1.2 *Off-site Hazardous Materials Use*

A regulatory agency database report was reviewed for sites located within a one-mile radius of the project site to identify off-site sources of hazardous materials with the potential to impact the site. None of the identified sources of hazardous materials in the vicinity of the project site were likely to affect the site because the sites have received regulatory case closure, are located crossgradient or downgradient of the site, the hazardous materials were localized in soils, and/or are located at too great a distance to affect the project site.

3.10.1.3 *Other Hazards*

The project site is located within the land use referral boundary of the Norman Y. Mineta San José International Airport. The project site is subject to building height restrictions under Federal Aviation Regulations, Part 77, which is administered by the Federal Aviation Administration (FAA) is incorporated into Santa Clara County Airport Land Use Commission policy. The City of San José holds an existing avigation easement over the site which restricts building heights on the project site to 250 feet above existing grade. The proposed building heights would comply with the height restrictions of the existing avigation easement. The proposed project would not be subject to any other FAA surface restrictions.

3.10.2 <u>Hazards and Hazardous Materials Impacts</u>

3.10.2.1 *Thresholds of Significance*

For the purposes of this EIR, a hazardous materials impact is considered significant if the project would:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;

- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school;
- Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment;
- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area;
- For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area;
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; or
- Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

3.10.2.2 *Impacts from On-Site Hazardous Materials*

The project proposes an additional 600,000 s.f. of office space on the site. The existing six-story buildings at the corner of Great America Parkway and Mission College Boulevard would remain on the site. The 118,000 s.f. building at 4551 Great America Parkway could be demolished or remain on the site. As discussed above, buildings on the project site were developed in 1983 and 1992 and, based on regulatory agency databases, no significant hazardous materials use, spills, or leaks have occurred on the site since the buildings were constructed.

The project does not propose any on-site use of hazardous materials other than small amounts of herbicides and pesticides for landscaping maintenance, and cleaning materials. Limited quantities of diesel fuel are expected with redevelopment of the site for use in the existing and anticipated emergency back generators. No future tenant of the site has been identified, and it is possible that future occupants of the buildings may use and store additional hazardous materials beyond those listed above. This usage would be regulated by federal, state and local laws and policies. The storage and use of these materials in conformance with existing regulations would not result in significant hazardous material impacts.

The site would be covered by buildings or other impervious surfaces, and landscaping following construction of the proposed buildings. Since the site was originally used for agriculture residual agricultural contamination may still be present on the site, and may be disturbed during grading and construction.

Impact HM-1: Workers on site could be exposed to residual agricultural chemicals during grading and construction on the site. **(Significant Impact)**

3.10.2.3 *Asbestos-Containing Materials (ACMs)*

Buildings on the project site may have been constructed using materials containing asbestos such as mastics in flooring and roofing materials. The building proposed for demolition as part of the project located at 4551 Great America Parkway has not been surveyed for ACMs.

Demolition of the existing structure on the project site could expose construction workers or residents in the vicinity of the project site to harmful levels of ACMs or lead.

The project is required to conform to the following regulatory programs and to implement the following measures to reduce impacts due to the presence of ACMs and/or lead-based paint:

- In conformance with State and local laws, a visual inspection/pre-demolition survey, and possible sampling, shall be conducted prior to the demolition of on-site buildings to determine the presence of asbestos-containing materials.

- All potentially friable ACMs shall be removed in accordance with National Emission Standards for Hazardous Air Pollutants (NESHAP) guidelines prior to any building demolition or renovation that may disturb the materials. All demolition activities will be undertaken in accordance with Cal/OSHA standards contained in Title 8 of CCR, Section 1529, to protect workers from exposure to asbestos.

- A registered asbestos abatement contractor shall be retained to remove and dispose of ACMs identified in the asbestos survey performed for the site in accordance with the standards stated above.

- Materials containing more than one percent asbestos are also subject to Bay Area Air Quality Management District (BAAQMD) regulations. Removal of materials containing more than one percent asbestos shall be completed in accordance with BAAQMD requirements.

Impact HM-2: The existing building proposed for demolition as part of the project may have been constructed using ACMs. Any ACMs found to be present in the building will be removed in accordance with uniformly applied federal, state, and local regulations to ensure worker safety. **(Less Than Significant Impact)**

3.10.2.4 *Airport Safety Hazards*

The project site is located within the Airport Land Use Commission's (ALUC) land use referral boundary for the Norman Y. Mineta San José International Airport. The City of San José holds an existing avigation easement over the site which restricts building heights on the project site to 250 feet above existing grade. The proposed building heights would comply with the height restrictions of the existing avigation easement. The proposed project would not be subject to any other FAA surface restrictions.

Impact HM-3: The proposed project would be subject to review by the FAA and ALUC but appears to be consistent with the Comprehensive Land Use Plan adopted by the ALUC and height restrictions of the FAA and would not result in significant hazards to employees on the site, aircraft, or the Norman Y. Mineta San José International Airport operations. **(Less than Significant Impact)**

3.10.3 Mitigation Measures

As a condition of approval, the project proponent shall implement the following mitigation measures to reduce impacts from hazardous materials to a less than significant level:

MM HM-1.1: Prior to the issuance of grading permits, shallow soil samples shall be taken to determine any location of contaminated soils on the site with concentrations above established construction/trench worker thresholds. The soil sampling plan must be reviewed and approved by the Santa Clara Fire Chief prior to initiation of work. Once the soil sampling analysis is complete, a report of the findings will be provided to the Director of Planning and other applicable City staff for review.

MM HM-1.2: Documentation of the results of the soil sampling shall be submitted to and reviewed by the City of Santa Clara prior to the issuance of a grading permit. Any soil with concentrations of pesticides above applicable ESLs or hazardous waste limits would be characterized, removed, and disposed of off-site at an appropriate landfill according to all state and federal requirements.

MM HM-1.3: If contaminated soils are found in concentrations above established thresholds a Site Management Plan (SMP) will be prepared and implemented (as outlined below) and any contaminated soils found in concentrations above established thresholds shall be removed and disposed of according to California Hazardous Waste Regulations. The contaminated soil removed from the site shall be hauled off-site and disposed of at a licensed hazardous materials disposal site.

MM HM-1.4: A SMP will be prepared to establish management practices for handling impacted groundwater and/or soil material that may be encountered during site development and soil-disturbing activities. Components of the SMP will include: a detailed discussion of the site background; preparation of a Health and Safety Plan by an industrial hygienist; notification procedures if previously undiscovered significantly impacted soil or free fuel product is encountered during construction; on-site soil reuse guidelines based on the California RWQCB, San Francisco Bay Region's reuse policy; sampling and laboratory analyses of excess soil requiring disposal at an appropriate off-site waste disposal facility; soil stockpiling protocols; and protocols to manage groundwater that may be encountered during trenching and/or subsurface excavation activities. Prior to issuance of grading permits, a copy of the SMP

must be approved by the Santa Clara County Environmental Health Department, the City's Director of Planning and Inspection, and the Santa Clara Fire Chief.

3.10.4 Conclusion

Impact HM-1: Soil sampling, implementation of appropriate worker health and safety practices, and appropriate disposal of any contaminated soil will reduce the impact of hazardous materials for workers on the site during grading and utility trenching on the site. **(Less Than Significant Impact with Mitigation)**

Impact HM-2: The existing building proposed for demolition as part of the project may have been constructed using ACMs. Any ACMs found to be present in the building will be removed in accordance with uniformly applied federal, state, and local regulations to ensure worker safety. **(Less Than Significant Impact)**

Impact HM-3: The proposed project would be subject to review by the FAA and ALUC but appears to be consistent with the Comprehensive Land Use Plan adopted by the ALUC and height restrictions of the FAA and would not result in significant hazards to employees on the site, aircraft, or the Norman Y. Mineta San José International Airport operations. **(Less than Significant Impact)**

3.11 UTILITIES AND SERVICE SYSTEMS

The following discussion is based in part on a Water Supply Assessment prepared by the City of Santa Clara and approved by the City Council in December 2012. A copy of this report is included as Appendix H in this EIR.

3.11.1 Existing Setting

3.11.1.1 *Water Service*

Potable Water

Water service to the site is provided by the City of Santa Clara Water Utility. The water system consists of more than 315 miles of water mains, 27 wells and seven storage tanks with more than 27 million gallons of water capacity.[19] Drinking water is provided by an extensive underground aquifer (accessed by the City's wells) and by two wholesale water importers: the Santa Clara Valley Water District (SCVWD) (imported from the Sacramento-San Joaquin Delta) and the San Francisco Public Utilities Commission (SFPUC) Hetch-Hetchy System. About 25 percent of the City's water comes from these imported treated water supplies. The remaining 62 percent is pumped from the City's system of 27 deep wells.[20] The three sources are used interchangeably or are blended together. A water recharge program administered by SCVWD from local reservoirs and imported water enhances the dependability of the underground aquifer.

There is an existing eight-inch water line along the eastern property line and existing 12-inch water lines in Great America Parkway, Mission College Boulevard, Patrick Henry Drive, and traversing the center of the site. Based on the City's Water Supply Assessment (WSA), the potable water use on-site is approximately 1.5 acre-feet (488,777 gallons) per year when the buildings are fully occupied.

Recycled Water

The South Bay Water Recycling Program was initiated to reduce the amount of effluent entering San Francisco Bay from the San José/Santa Clara Water Pollution Control Plant. The City of Santa Clara recycles approximately 13 percent of its water through non-potable uses by businesses, industries, parks, and schools along pipeline routes.[21] Recycled water is currently available to the project site from existing lines in Mission College Boulevard. Based on the City's Water Supply Assessment (WSA), the current potable water use on-site is approximately 0.4 acre-feet (130,341 gallons) per year.

3.11.1.2 *Sewer Services*

Wastewater from the City of Santa Clara is treated at the San Jose/Santa Clara Water Pollution

[19] City of Santa Clara. "Water Utility". Accessed March 28, 2013. <http://santaclaraca.gov/index.aspx?page=1043>
[20] Ibid.
[21] Ibid.

Control Plant (WPCP), located near Alviso in North San Jose. The WPCP is a regional wastewater treatment facility serving eight tributary sewage collection agencies and is administered and operated by the City of San Jose's Department of Environmental Services. The WPCP provides primary, secondary, and tertiary treatment of wastewater and has the capacity to treat 167 million gallons of wastewater per day (mgd).[22] The City of Santa Clara currently has rights to 22.585 mgd of the total treatment capacity at the plant.[23]

The WPCP is currently operating under a 120 mgd dry weather effluent flow constraint. This requirement is based upon the State Water Resources Control Board and the Regional Water Quality Control Board concerns over the effects of additional freshwater discharges from the WPCP on saltwater marsh habitat, as well as pollutant loading to the Bay from the WPCP. Approximately 10 percent of the plant's effluent is recycled for non-potable uses and the remainder flows into San Francisco Bay. The plant currently treats an average of 110 mgd of wastewater.[24]

Sanitary sewer lines that serve the project site are maintained by the City of Santa Clara Sewer Utility. Sanitary sewer lines serving the project site include an 18-inch line in Patrick Henry Drive, a 12-inch line near the eastern property boundary, a 33-inch line in Great America Parkway, and a 12-inch line in Mission College Boulevard. Based on completion of the recent Walsh Avenue Sewer Project no deficiencies are expected to exist within the Great America Parkway trunk line.[25] Based on the wastewater flow factors contained in the Sanitary Sewer Hydraulic Modeling for the 2010-2035 General Plan Update, the existing development on the site generates approximately 62,700[26] gallons of wastewater per day when the buildings are fully occupied.

3.11.1.3 *Storm Drainage*

The City of Santa Clara owns and maintains the municipal storm drainage system which serves the project site. Storm drains on-site connect to 12-inch to 66-inch lines in Great America Parkway and 30 to 33-inch lines in Mission College Boulevard. The lines serving the site drain to San Tomas Aquino Creek which flows north to Guadalupe Slough and into San Francisco Bay. San Tomas Aquino Creek is located approximately 1,800 feet east of the site.

3.11.1.4 *Solid Waste*

Solid waste collection in the City of Santa Clara is provided by Mission Trail Waste System through a contract with the City. Mission Trail Waste System also has a contract to implement the Clean Green portion of the City's recycling plan by collecting yard waste. All other recycling services are provided through Stevens Creek Disposal and Recycling. The City has an arrangement with the owners of the Newby Island Landfill, located in San José, to provide disposal capacity for the City of

[22] City of San José, Environmental Services Department. "Water Pollution Control Plant". Available at: <http://www.sanjoseca.gov/?nid=1663> Accessed: March 27, 2013.
[23] City of Santa Clara. *City of Santa Clara 2010-2035 General Plan.* 2010.
[24] City of San José, Environmental Services Department. "Water Pollution Control Plant.". Available at: <http://www.sanjoseca.gov/?nid=1663> Accessed: March 27, 2013.
[25] RMC Water and Environment. *City of Santa Clara Sanitary Sewer Hydraulic Modeling Support for General Plan Update.* September 2009. Page 2.
[26] Based on sanitary sewer flows of 0.15 gpd/s.f. for Office/R&D use (418,000 s.f.)

Santa Clara through 2024. There is sufficient capacity at this facility to serve existing and planned development under the 2010-2035 General Plan through 2024.[27] Beyond 2024, the City would need to contract with another landfill operator which would be subject to environmental review.

The California Integrated Waste Management Board (CIWMB) established a diversion requirement of 50 percent beginning in 2000. Based on the CIWMB 2008 Annual Report Summary, the City of Santa Clara has exceeded its diversion goal. In addition to the CIWMB requirements, the City of Santa Clara has a construction debris diversion ordinance which requires all projects over 5,000 s.f. to divert a minimum 50 percent of construction and demolition debris from landfills.

3.11.2 Utility and Service System Impacts

3.11.2.1 *Thresholds of Significance*

For the purposes of this EIR, a utility and service impact is considered significant if the project would:

- Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board;
- Require or result in the construction of new/expanded water or wastewater treatment facilities, the construction of which could cause significant environmental effects;
- Require or result in the construction of new stormwater or wastewater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;
- Not have sufficient water supplies available to serve the project from existing entitlements and resources, and would require new or expanded entitlements;
- Result in a determination by the wastewater treatment provider which serves or may serve the project that it does not have adequate capacity to serve the project's projected demand in addition to the provider's existing commitments;
- Be served by a landfill without sufficient permitted capacity to accommodate the project's solid waste disposal needs; or
- Be inconsistent with federal, state or local statutes and regulations related to solid waste.

3.11.2.2 *Water Service and Supply Impacts*

Based on the WSA completed for the project, the proposed office development would use approximately 352.5 acre feet (or 314,694 gallons per day) of water per year. This represents an increase in water demand of 350.6 acre-feet per year (AFY) over the historic water demand at the site.

The City has determined (based on the WSA) that the level of development proposed on the project site and the projected increase in water demand is consistent with the growth projections and future water demand assumed in the City's 2010 *Urban Water Management Plan* (UWMP) and that sufficient water supplies are available to meet the projected demands.

[27] City of Santa Clara. *City of Santa Clara 2010-2035 General Plan.* 2010.

Impact UTIL-1: The proposed project would not exceed projected water supplies identified in the City's 2010 Urban Water Management Plan and, therefore, the City will have sufficient water supplies to serve the project. **(Less Than Significant Impact)**

3.11.2.3 *Sanitary Sewer/Wastewater Impacts*

The sanitary sewer hydraulic modeling completed for the 2010-2035 General Plan Update in 2009 concluded that with implementation of the Walsh Avenue Sanitary Sewer Improvement Project, no deficiencies in the Great America Parkway trunk line would occur with projected development under the current 2010-2035 General Plan. Based on the model results, downstream trunk lines would not surcharge under peak wet weather flows.

According to the 2010-2035 General Plan FEIR, the City of Santa Clara generated 13.3 million gallons per day (gpd) of wastewater in 2009. Based on the sanitary sewer flow rates used for the 2010-2035 General Plan hydraulic analysis, the proposed project would generate approximately 152,700 gallons of wastewater per day. The proposed project, therefore, would result in a net increase in wastewater of 90,000 gpd.

The City's current capacity allocation at the WPCP is 22.585 million gpd. Even with full build out of the 2010-2035 General Plan, total wastewater generated by the City would be below the existing capacity allocation by 2.485 million gpd. Because the proposed project is consistent with the 2010-2035 General Plan, the City has sufficient capacity allocation at the WPCP to support the proposed project.

Impact UTIL-2: The proposed project would not exceed the capacity of the sanitary sewer system or wastewater treatment facilities serving the project site. **(Less Than Significant Impact)**

3.11.2.4 *Storm Drainage Impacts*

The proposed project would slightly increase the amount of impervious surface area on the project site. Existing impervious surfaces cover approximately 79 percent of the project site or 14.88 acres. The proposed project would allow for an increase in impervious surfaces on the project site, approximately one (1) percent, to 15.02 acres or 80 percent of the site. The existing storm drainage system has sufficient capacity to accommodate the existing runoff from the project site. Previous studies of storm drain capacity in the area assumed impervious surfaces of 80 percent and found adequate storm drain capacity was available. The existing storm drainage system, therefore, would have capacity to serve the proposed development.

Impact UTIL-3: The proposed project would result in a negligible increase in impervious surfaces on the site and would not exceed the capacity of the existing storm drainage system. **(Less Than Significant Impact)**

3.11.2.5 *Solid Waste Impacts*

Implementation of the proposed project will result in construction waste as well as an ongoing net increase in solid waste and recyclable materials generated within the City of Santa Clara of approximately 599 tons per year.[28] The Newby Island Landfill, located in San Jose, has an agreement with the City to provide disposal capacity through 2024. There is sufficient capacity at Newby Island Landfill to serve existing and planned development under the 2010-2035 General Plan through 2024.[29] The project will comply with the requirements of the Santa Clara Business/Commercial Recycling Program to assist the City in meeting its waste diversion goal of 50 percent.

Impact UTIL-4: The proposed development is consistent with the 2010-2035 General Plan and new landfill facilities will not need to be contracted with or constructed to service the proposed project. The project will comply with City efforts to reduce solid waste. **(Less Than Significant Impact)**

3.11.3 Mitigation and Avoidance Measures

No mitigation is required or proposed.

3.11.4 Conclusion

Impact UTIL-1: The proposed project would not exceed projected water supplies identified in the City's 2010 Urban Water Management Plan and, therefore, the City will have sufficient water supplies to serve the project. **(Less Than Significant Impact)**

Impact UTIL-2: The proposed project would not exceed the capacity of the sanitary sewer system or wastewater treatment facilities serving the project site. **(Less Than Significant Impact)**

Impact UTIL-3: The proposed project would result in a negligible increase in impervious surfaces on the site and would not exceed the capacity of the existing storm drainage system. **(Less Than Significant Impact)**

Impact UTIL-4: The proposed development is consistent with the 2010-2035 General Plan and new landfill facilities will not need to be contracted with or constructed to service the proposed project. The project will comply with City efforts to reduce solid waste. **(Less Than Significant Impact)**

[28] CalRecycle. *Waste Disposal and Diversion Findings for Selected Industry Groups.* June 2006. Table 2. Available at: <http://www.calrecycle.ca.gov/Publications/Detail.aspx?PublicationID=1184>
[29] City of Santa Clara. *City of Santa Clara 2010-2035 General Plan.* 2010.

3.12 ENERGY

This section was prepared pursuant to CEQA Guidelines Section 15126.4(a)(1)(C) and Appendix F (Energy Conservation of the Guidelines), which require that EIRs include a discussion of the potential energy impacts of proposed projects with particular emphasis on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy.

3.12.1 Introduction

Energy consumption is analyzed in an EIR because of the environmental impacts associated with its production and usage. Such impacts include the depletion of nonrenewable resources (e.g., oil, natural gas, coal, etc.) and emissions of pollutants during both the production and consumption phases.

Energy usage is typically quantified using the British Thermal Unit (BTU). As points of reference, the approximate amount of energy contained in a gallon of gasoline, a cubic foot of natural gas, and a kilowatt hour (kWh) of electricity are 123,000 BTUs, 1,000 BTUs, and 3,400 BTUs, respectively.

Many federal, state, and local statutes and policies address energy conservation. At the federal level, energy standards apply to numerous products (e.g., the EnergyStar™ program) and transportation (fuel efficiency standards). At the state level, Title 24 of the California Administrative Code sets forth energy standards for buildings, the CALGreen Code establishes mandatory green building standards, rebates/tax credits are provided for installation of renewable energy systems, and the *Flex Your Power* program promotes conservation in multiple areas.

3.12.2 Existing Setting

Total energy usage in California was approximately 7,826 trillion BTUs in the year 2010 (the most recent year for which this specific data was available).[30] The breakdown by sector was approximately 19 percent (1,463 trillion BTUs) for residential uses, 19 percent (1,501 trillion BTUs) for commercial uses, 23 percent (1,765 trillion BTUs) for industrial uses, and 40 percent (3,097 trillion BTUs) for transportation.[31] This energy is primarily supplied in the form of natural gas, petroleum, nuclear electric power, and renewable energy power.

Given the nature of the proposed project, the remainder of this discussion will focus on the three most relevant sources of energy: electricity for office uses, natural gas for office uses, and gasoline for vehicle trips associated with office uses.

[30] United States Energy Information Administration, "Table C1. Energy Consumption Overview: Estimates by Energy Source and End-Use Sector, 2010" Available at: <http://www.eia.gov/state/seds/sep_sum/html/pdf/sum_btu_1.pdf> Accessed March 21, 2013.
[31] Ibid.

3.12.2.1 *Electricity*

Electricity is provided in Santa Clara by the City's own public utility, Silicon Valley Power (SVP). The State of California currently requires that energy saving measures be applied to new construction through the California Building Standards Code (Title 24, Part 6). The State of California Green Building Standard Code or CALGreen (Title 24, Part 11) also requires mandatory green building standards for all buildings in California. CALGreen covers five categories: planning and design, energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and indoor environmental quality.

Electricity supply in California involves a complex grid of power plants and transmission lines located in the Western United States, Canada, and Mexico. The electricity is produced from power plants fueled by natural gas (36 percent), nuclear (15 percent), renewable energy (14 percent), hydroelectric (13 percent), coal (8 percent), and other unspecified sources (14 percent).[32]

Electricity consumption in California increased less than one percent annually from 261,381 gigawatt hours (GWh) in 2000 to 273,103 GWh in 2010.[33] By 2022, electricity demand is expected to reach between 308,677 GWh to 333,838 GWh which reflects annual growth of 1.03 and 1.69 percent, respectively.[34]

Electricity in project area is provided by SVP, which is the public electric utility of the City of Santa Clara. Santa Clara currently has ownership interest, or has purchase agreements for 821.53 MW of electricity. [35] Approximately 25 percent of that generation is eligible as renewable (as defined by the CEC) and an additional 22.8 percent is otherwise a non-greenhouse gas emitting resource (i.e. large-hydroelectric).[36] This capacity far exceeds City of Santa Clara's current peak electricity demand of approximately 471 MW.[37] The City of Santa Clara seeks to meet its Renewable Portfolio Standard (RPS) through the addition of new renewable resources. In order to meet anticipated increases in energy needs (as separate from peak generation capacity requirements) the City of Santa Clara has contracted for additional wind energy including the Big Horn II Wind Project that will provide the City of Santa Clara up to an additional 17.5MW of GHG-emission-free electricity.

Electricity use at the project site is from the existing office buildings, which are estimated to use approximately 8,238 MWh of electricity per year when the buildings are fully occupied.[38]

---

[32] California Energy Commission. *Energy Almanac, Total Electricity System Power*. Available at: <http://www.energyalmanac.ca.gov/electricity/total_system_power.html> Accessed March 22, 2013.
[33] California Energy Commission, *2012 Integrated Energy Policy Report Update* (CEC-100-2012-001-CMF), 2013. Page 14. <http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf> Accessed March 22, 2013.
[34] California Energy Commission, *2012 Integrated Energy Policy Report Update* (CEC-100-2012-001-CMF), 2013. Page 15. <http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf> Accessed March 22, 2013.
[35] Kathleen Hughes, Silicon Valley Power, City of Santa Clara, April 26, 2012.
[36] Silicon Valley Power. "Power Content Label". Accessed March 22, 2013. Available at: <https://siliconvalleypower.com/index.aspx?page=2022>.
[37] Orville Plum, Acting Sr. Electric Division Manager, Silicon Valley Power, City of San Clara. April 25, 2012.
[38] Calculation based upon BAAQMD BGM Model output for general office uses (Appendix B).

3.12.2.2 *Natural Gas*

Natural gas is provided in Santa Clara by the Pacific Gas & Electric (PG&E). Natural gas provides almost one-third of California's total energy requirements. Approximately 12 percent of natural gas used in California is generated within the state while the remaining 88 percent comes from other states and Canada.[39] Natural gas from out-of-state producers is delivered into California via five major interstate natural gas pipelines. Most of the natural gas used in California (98 percent) is distributed by three major utility companies including Southern California Gas Company, SDG&E, and PG&E. The remaining two percent is distributed by municipalities and smaller companies.[40]

There has been increasing production of natural gas in the United States since 2005 with the development of shale formations which contain vast quantities of natural gas. In 2000, shale formations contributed approximately two percent to total natural gas production in the lower 48 states. By 2010, the contribution exceeded 23 percent. At current rates of consumption, the natural gas reserves life index is approximately 115 years.[41]

Natural gas consumption in California decreased approximately one percent annually from 13,913 million (MM) therms in 2000 to 12,774 MMtherms in 2010.[42] In 2010, natural gas was used in California to produce electricity (42 percent), in industrial uses (29 percent), in commercial uses (8 percent), in residential uses (20 percent), and for transportation (approximately one percent).[43] By 2022, natural gas demand is expected to reach between 13,688 MMtherms to 14,075 MMtherms which reflects annual growth of 0.58 and 0.81 percent, respectively.[44]

Natural gas usage in California for differing land uses varies substantially by the type of uses in a building, type of construction materials used in a building, and the efficiency of all gas-consuming devices within a building. The existing office building on the project site uses natural gas for space and water heating. The existing office development on the site uses approximately 7,197 million BTUs of natural gas per year when the buildings are fully occupied.[45]

---

[39] California Energy Commission, *2012 Integrated Energy Policy Report Update* (CEC-100-2012-001-CMF), 2013. Page 18. <http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf> Accessed March 22, 2013.

[40] California Energy Commission, Energy Almanac. Overview of Natural Gas in California. N.d. Available at: <http://www.energyalmanac.ca.gov/naturalgas/overview.html> Accessed: March 22, 2013.

[41] California Energy Commission. *Current Trends: Natural Gas Supply.* Staff Workshop 2011 Integrated Energy Policy Report. April 19, 2011. <http://www.energy.ca.gov/2011_energypolicy/documents/2011-04-19_workshop/presentations/Current_Trends_Natural_Gas_Supply.pdf> Accessed March 22, 2013.

[42] California Energy Commission, *2012 Integrated Energy Policy Report Update* (CEC-100-2012-001-CMF), 2013. Page 14. <http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf> Accessed March 22, 2013.

[43] California Energy Commission, *2012 Integrated Energy Policy Report Update* (CEC-100-2012-001-CMF), 2013. Page 18. <http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf> Accessed March 22, 2013.

[44] California Energy Commission, *2012 Integrated Energy Policy Report Update* (CEC-100-2012-001-CMF), 2013. Page 15. <http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf> Accessed March 22, 2013.

[45] Calculation based upon BAAQMD BGM Model output for general office uses (Appendix B).

3.12.2.3 *Gasoline for Motor Vehicle Use*

California is the third highest producer of transportation fuels in the nation, with a crude oil distillation capacity of more than 2.0 million barrels per day.[46] In 2009, approximately 38 percent of crude oil used in California was produced in-state, while 14 percent came from Alaska and 48 percent from foreign sources.[47] Californians were using roughly 49.5 million gallons of gasoline and diesel each day in 2009. California oil production has fallen 47.2 percent since 1985, and it is estimated that future declines will range from 2.2 to 3.1 percent per year. The State's 20 oil refineries, which processed more than 1.7 million barrels of crude oil per day in 2010, continue to rely on crude oil imports from Alaska and a variety of foreign sources. Crude oil imports are expected to rise by between 22 million and 104 million barrels per year by 2030, compared to 2010 levels.[48]

According to the California Energy Commission's *2011 Integrated Energy Policy Report*, Californians consumed 21.5 billion gallons of gasoline, diesel, and jet fuel in 2010, which represents a 7.2 percent decline from 2006 levels. Data for the first seven months of 2011 indicate that gasoline and diesel consumption were down approximately two percent from 2010 levels. This decline is due to a combination of sustained high fuel costs, low economic growth, declines in the value of real estate and equities, continued high unemployment, and the improved fuel efficiency of standard vehicles and hybrid vehicles.

The average fuel economy for the fleet of light-duty vehicles (autos, pickups, vans, and SUVs) steadily increased from about 13.1 miles-per-gallon (mpg) in the mid-1970s to approximately 23.8 mpg in 2012.[49] In August 2012, the U.S. Environmental Protection Agency (U.S. EPA) and National Highway Transportation Safety Administration finalized rules to increase the national fuel economy standard to 54.5 miles per gallon by 2025.

There is no direct use of gasoline on the project site. Indirectly, gasoline is consumed by uses at the project site through vehicle trips generated by workers at the existing office building. The existing office building generates approximately 4,602 trips per day,[50] resulting in annual vehicle miles travelled (VMT) of 8.3 million.[51] Based upon the U.S. EPA average fuel economy rate of 23.8

---

[46] United States Energy Information Administration, "California State Energy Profile." June, 2011. <http://www.eia.gov/dnav/pet/pet_pnp_cap1_a_(na)_8D0_BpCD_a.htm>. Accessed March 22, 2013.
[47] California Energy Commission. *2009 Integrated Energy Policy Report* (CEC-100-2009-003-CMF), 2009. Page 148.
[48] California Energy Commission. *2011 Integrated Energy Policy Report* (CEC-100-2011-001-CMF), 2012. Page 6. <http://www.energy.ca.gov/2011publications/CEC-100-2011-001/CEC-100-2011-001-CMF.pdf> Accessed March 22, 2013.
[49] United States Environmental Protection Agency. *Light Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 through 2012*. Available at: <http://www.epa.gov/oms/fetrends.htm> Accessed March 22, 2013.
[50] Hexagon Transportation Consultants. *Great America Parkway Office Campus Development Traffic Impact Analysis.* February 14, 2013.
[51] VMT was calculated by CalEEMod using the standard default vehicle fleet mix for the land use.

mpg,[52] the existing office building workforce results in gasoline use of approximately 350,160 gallons of fuel per year for worker travel to and from the site when the buildings are fully occupied.

3.12.3 Energy Impacts

3.12.3.1 *Thresholds of Significance*

For the purposes of this EIR, an energy impact is considered significant if the project would:

- Use fuel or energy in a wasteful manner;
- Result in a substantial increase in demand upon energy resources in relation to projected supplies; or
- Result in longer overall distances between jobs and housing.

3.12.3.2 *Energy Efficiency and Use*

The proposed project would be constructed to meet the requirements of Title 24, as it pertains to energy efficiency and green building. The project proposes development of an additional 600,000 s.f. of building space on the site. The estimated net increase in annual energy use resulting from the proposed project is shown in Table 3.12-1.

Table 3.12-1
Annual Energy Use from the Project

Type of Energy	Existing Energy Use at Site	Project Energy Use	Net Project Energy Use*	Net Project Energy Use in BTUs
Electricity	8,238 MWh	19,351 MWh	11,113 MWh	37,910 million BTUs
Natural Gas	7,197 million BTUs	16,499 million BTUs	9,302 million BTUs	9,302 million BTUs
Gasoline	350,160 gallons of fuel	810,143 gallons of fuel	459,983 gallons of fuel	57,498[1] million BTUs
TOTAL				104,710 million BTUs

Notes: [1]U.S. EPA, Unit Conversions, Emissions Factors, and Other Reference Data, November 2004.

Indirect Impacts of the Proposed Project

As shown in Table 3.12-1 above, energy used from the burning of gasoline from vehicles going to and from the site would result in a net increase of approximately 459,983 gallons of fuel used per year (57,498 million BTUs) over existing conditions.

[52] United States Environmental Protection Agency, *Light Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 through 2012*. Available at: <http://www.epa.gov/oms/fetrends.htm> Accessed March 22, 2013.

The project is an infill development and would create jobs in an area that is already served by commercial services, public transportation, and the project location is proximate to existing housing in Santa Clara which would avoid long overall distances between jobs and housing. In addition, the project will be required as a condition of project approval to implement a TDM program to reduce daily traffic trips by a minimum of five percent.

Impact ENER-1: The location of the project and implementation of a TDM program will reduce vehicle trips to and from the project site and, therefore, the project would not result in the wasteful use of fuel. **(Less Than Significant Impact)**

Operational Impacts of the Proposed Project

As shown in Table 3.12-1 above, the project would result in a net increase in energy use at the site of 1,113 MWh (37,910 million BTUs) of electricity, and 9,302 million BTUs of natural gas per year.

The City of Santa Clara encourages the use of building materials that include recycled materials and makes information available on those building materials to developers. New buildings are required to be built to current codes, which require insulation and design to minimize wasteful energy consumption. The proposed office development will be required by the City, as a Condition of Approval, to obtain LEED Silver certification for the core and shell of the buildings, as a result, the buildings would use less energy for heat and light and less water than a standard design office building simply meeting Title 24 requirements.

Impact ENER-2: Implementation of the proposed green building measures would result in efficient energy use at the project site. The project would not result in a substantial increase in demand upon energy resources in relation to projected supplies, and the project would not result in the wasteful use of energy. **(Less Than Significant Impact)**

3.12.3 Mitigation and Avoidance Measures

As conditions of project approval, the following avoidance measures will be implemented by the project to reduce energy use from the proposed buildings:

AM ENER-1.1: The project shall include measures to sufficiently reduce energy and water use on the site to achieve, at a minimum, LEED Silver Certification for the core and shell of the building.

AM ENER-1.2: The project shall comply with the City's construction and demolition ordinance which requires diversion of 50 percent of waste generated from development of the site.

AM ENER-1.3: The project shall implement a Transportation Demand Management Program to reduce vehicle trips to the project site by a minimum of five percent.

3.12.4 Conclusion

Impact ENER-1: The location of the project and implementation of a TDM program will reduce vehicle trips to and from the project site and, therefore, the project would not result in the wasteful use of fuel. **(Less Than Significant Impact)**

Impact ENER-2: Implementation of the proposed green building measures would result in efficient energy use at the project site. The project would not result in a substantial increase in demand upon energy resources in relation to projected supplies and, therefore, the project would not result in the wasteful use of energy. **(Less Than Significant Impact)**

3.13 GREENHOUSE GAS EMISSIONS

The following discussion is based, in part, on an Air Quality and Greenhouse Gas Emission Assessment prepared by Illingworth & Rodkin, Inc. in March 2013. A copy of this report is included as Appendix B.

3.13.1 Background Information

This section provides a general discussion of global climate change and focuses on emissions from human activities that alter the chemical composition of the atmosphere. The discussion on global climate change and greenhouse gas (GHG) emissions is based upon the California Global Warming Solutions Act of 2006 (Assembly Bill [AB] 32), the 2006 and 2009 Climate Action Team (CAT) reports to former Governor Schwarzenegger and the Legislature, and research, information, and analysis completed by the International Panel on Climate Change (IPPC), the United States Environmental Protection Agency (U.S. EPA), and the California Air Resources Board (CARB).

Global climate change refers to changes in weather including temperature, precipitation, and wind patterns. Global temperatures are modulated by naturally occurring and anthropogenic (generated by mankind) atmospheric gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).[53] These gases allow sunlight into the Earth's atmosphere but prevent heat from radiating back out into outer space and escaping from the earth's atmosphere, thus altering the Earth's energy balance. This phenomenon is known as the greenhouse effect.

California produced 474 million gross metric tons (MMT) of CO_2 equivalent (CO_2e) averaged over the period from 2002-2004. CO_2e is a measurement used to account for the fact that different GHGs have different potentials to retain infrared radiation in the atmosphere and contribute to the GHG effect. This potential, known as the global warming potential (GWP) of a GHG, is dependent on the lifetime, or persistence, of the gas molecule in the atmosphere. For example, one ton of CH_4 has the same contribution to the GHG effect as approximately 23 tons of CO_2. Therefore, CH_4 is a much more potent GHG than CO_2. Expressing emissions in CO_2e takes the contributions of all GHG emissions to the GHG effect and converts them to a single unit equivalent to the effect that would occur if only CO_2 were being emitted.[54]

Naturally occurring GHGs include but are not limited to: CO_2. CH_4, N_2O, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride.[55] Several classes of halogenated substances that contain fluorine, chlorine, or bromine are also GHGs, but are for the most part solely a product of industrial activities.

---

[53] IPCC, 2007, *Summary for Policymakers*, In "Climate Change 2007: The Physical Science Bases. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change" [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: http://ipcc.ch/

[54] BAAQMD. Updated *CEQA Guidelines*. May 2011. < http://www.baaqmd.gov/Divisions/Planning-and-Research/CEQA-GUIDELINES/Updated-CEQA-Guidelines.aspx>

[55] Greenhouse gases as defined by the adopted 2010 CEQA Guidelines.

Impacts to California from climate change include shifting precipitation patterns, increasing temperatures, increasing severity and duration of wildfires, earlier melting of snow pack and effects on habitats and biodiversity. Sea levels along the California coast have risen up to seven inches over the last century, and average annual temperatures have been increasing. These and other effects will likely intensify in the coming decades and significantly impact the State's public health, natural and manmade infrastructure, and ecosystems.[56]

Agencies at the international, national, state, and local levels are considering strategies to control emissions of gases that contribute to global warming. There is no comprehensive strategy that is being implemented on a global scale that addresses climate change; however, in California a multi-agency "Climate Action Team," has identified a range of strategies and CARB, under AB 32, has approved the *Climate Change Scoping Plan* (Scoping Plan). AB 32 requires achievement by 2020 of a statewide GHG emissions limit equivalent to 1990 emission levels, and the adoption of rules and regulations to achieve the maximum technologically feasible and cost-effective GHG emissions reductions. The CARB and other State agencies are currently working on regulations and other initiatives to implement the Scoping Plan. By 2050, the State plans to reduce emissions to 80 percent below 1990 levels.

3.13.1.1 *Existing Conditions*

The project site is developed with 418,000 s.f. of office space which are currently unoccupied. The existing development on the site, when fully occupied, would generate approximately 4,602 daily traffic trips and operation of the office buildings use electricity and water which results in the emission of GHGs from the site.

3.13.2 Greenhouse Gas Emissions Impacts

3.13.2.1 *Thresholds of Significance*

For the purposes of this EIR, a greenhouse gas emissions impact is considered significant if the project would:

- Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment; or
- Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

As discussed in CEQA Guidelines Section 15064(b), the determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the Lead Agency and must be based to the extent possible on scientific and factual data. As described previously, in Section 3.3, *Air Quality*, the City of Santa Clara considers the Bay Area Air Quality Management District (BAAQMD) thresholds to be based on the best information available for the

[56] California Energy Commission. *2009 California Climate Adaptation Strategy Discussion Draft. Frequently Asked Questions.* August 3, 2009. <www.climatechange.ca.gov/adaptation/documents/2009-07-31_Discussion_Draft-Adaptation_FAQs.pdf>

San Francisco Bay Area Air Basin. Therefore, the BAAQMD thresholds have been used in this analysis to determine the project's impact on GHG emissions.

GHG emissions from the proposed project would include:

- Construction emissions;
- Emissions from the manufacture and transport of building materials;
- Mobile emissions (e.g., emissions from combustion of fossil fuels for vehicle trips to and from the site); and
- Emissions from the generation of electricity to operate lighting, appliances, and HVAC on the site, and to convey water to the site.

3.13.2.2 *Operational Greenhouse Gas Emissions (Long Term Emissions)*

The proposed project is anticipated to be in full operation by the year 2017. The proposed project would exceed Title 24 standards and would be certified LEED Silver. In addition, the project would have a minimum waste diversion rate of 50 percent as required by the City and consistent with the rate currently met in Santa Clara County, and the project would be served by Silicon Valley Power which has a lower-than-average emission rate due to a renewable portfolio of 25 percent renewable sources with a planned increase in renewable energy sources to 33 percent between 2018 to 2020.

The project would result in a net increase in GHG emissions of approximately 8,254 MT CO_2e/year and would exceed the 1,100 MT CO_2e/year significance threshold. The project would serve approximately 1,980 new employees (assuming 3.3 employees per 1,000 s.f.), which would result in the emission of approximately 4.2 MT CO_2e/year per service population which is below the efficiency significance threshold of 4.6 CO_2e/year per service population.[57]

Impact GHG-1: The project would not exceed the 4.6 MT CO_2e/year per service population "efficiency" threshold and, therefore, would not have a significant operational GHG impact. **(Less Than Significant Impact)**

3.13.2.3 *Construction Greenhouse Gas Emissions (Short Term Emissions)*

GHG emissions would occur during demolition of an existing building and hardscape, excavation and grading of the site, and construction of the project. Construction of the project would involve emissions associated with equipment and vehicles used to construct the project, as well as emissions associated with manufacturing materials used to construct the project.

The project would salvage or recycle discarded building materials (i.e., existing building and hardscape and remnant materials from construction) in order to reduce the amount of demolition and construction waste going to the landfill. The project site is an infill site located in an urbanized location with readily available construction supplies and equipment. These project features would help to minimize GHG emissions generated from transport of construction materials and waste

[57] Assumes implementation of a TDM program that reduces vehicle trips by five percent.

associated with the project. There is no reliable method to estimate construction-related emissions associated with the manufacturing of project materials.

Neither the City of Santa Clara nor BAAQMD have quantified thresholds for construction activities. CalEEMod was used to calculate CO_2 emissions generated from construction of the proposed project over a 30-month starting in 2014 and ending in 2017. It was estimated that construction of the project would emit 271, 2,348, 2,281, and 45 MT of CO_2e from 2014 through 2017.

BAAQMD encourages the incorporation of BMPs to reduce GHG emissions during construction where feasible and applicable. BMPs may include but are not limited to using alternative fueled (e.g., biodiesel, electric) construction vehicles/equipment for at least 15 percent of the fleet; using at least 10 percent local building materials; and recycling or reusing at least 50 percent of construction waste or demolition materials. Construction emissions resulting from the project would be reduced through incorporation of BAAQMD's recommended measures.

Impact GHG-2: Given that the emissions would be temporary and that the project is in an urban setting close to construction supplies and equipment, that discarded materials will be salvaged or recycled, and that the project will implement the best management practices outlined in Section 3.3, *Air Quality*, construction of the project would not contribute substantially to cumulative GHG emissions. **(Less than Significant Impact)**

3.13.2.4 *Consistency with Adopted Plans to Reduce GHG Emissions*

The project would be subject to new requirements under rule making developed at the state and local level regarding GHG emissions and be subject to local policies that may affect emissions of GHG. The City is currently developing a Climate Action Plan that would include policies and implementation measures that would apply to future development.

Impact GHG-3: The project will not conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHG and has incorporated applicable measures (i.e. BMPs, TDM, LEED certification) to reduce GHG emissions. **(Less Than Significant Impact)**

3.13.3 <u>Conclusion</u>

Impact GHG-1: The project would not exceed the 4.6 MT CO_2e/year per service population "efficiency" threshold and, therefore, would not have a significant operational GHG impact. **(Less Than Significant Impact)**

Impact GHG-2: Given that the emissions would be temporary and that the project is in an urban setting close to construction supplies and equipment, that discarded materials will be salvaged or recycled, and that the project will implement the best management practices outlined in Section 3.3, *Air Quality*, construction of the project would not contribute substantially to cumulative GHG emissions. **(Less than Significant Impact)**

Impact GHG-3: The project will not conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHG and has incorporated applicable measures (i.e. BMPs, TDM, LEED certification) to reduce GHG emissions. **(Less Than Significant Impact)**

SECTION 4.0 PUBLIC FACILITIES AND SERVICES

Unlike utility services, public facility services are provided to the community as a whole, usually from a central location or from a defined set of nodes. The resource base for delivery of the services, including the physical service delivery mechanisms, is financed on a community-wide basis, usually from a unified or integrated financial system. The service delivery agency can be a city, county, service or other special district. Usually, new development will create an incremental increase in the demand for these services; the amount of demand will vary widely, depending on both the nature of the development (residential vs. commercial, for instance) and the type of services, as well as on the specific characteristics of the development (such as senior housing vs. family housing).

The impact of a particular project on public facilities services is generally a fiscal impact. By increasing the demand for a type of service, a project could cause an eventual increase in the cost of providing the service (more personnel hours to patrol an area, additional fire equipment needed to service a tall building, etc.). That is a fiscal impact, however, not an environmental one.

CEQA does not require an analysis of fiscal impacts. CEQA analysis is required if the increased demand triggers the need for a new facility (such as a school or fire station), since the new facility would have a physical impact on the environment. CEQA requires that an EIR then identify and evaluate the physical impacts on the environment from the new or physically altered facility. To reiterate, the impact that must be analyzed in an EIR is the impact that would result from constructing a new public facility (should one be required), not the fiscal impact of a development on the capacity of a public service system.

For the purposes of the EIR, a public facilities and services impact is considered significant if the project would result in substantial adverse physical impacts associated with the provision or need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for fire protection, police protection, schools, parks, or other public facilities. Given the commercial use of the site, no new students or library patrons would be directly generated by the project and such facilities would have capacity to serve any minor increases in users that may result from the project.

4.1 Police Services

Police protection services are provided by the City of Santa Clara Police Department (SCPD). The SCPD has approximately 147 sworn officers, 30 reserve offices, and 74 support personnel.[58] Police headquarters is located southeast of the project site at 601 El Camino Real.

The proposed office development would increase the total population of Santa Clara during standard business hours, but would not permanently increase the population because no housing is proposed as part of the project. The project would be constructed in conformance with current codes and the project design will be reviewed by the City of Santa Clara Police Department to ensure that it incorporates appropriate safety features to minimize criminal activity.

[58] City of Santa Clara Website: http://santaclaraca.gov/police/pol_index.html

New police facilities would not be required in order to provide service to the project site.

Impact PF-1: The proposed project would not result in impacts to the physical environment related to the construction of new police facilities. **(Less Than Significant Impact)**

4.2 Fire Protection Service

Fire protection services are provided to the project site by the City of Santa Clara Fire Department (SCFD). The SCFD is comprised of 180 fire service personnel and over 60 volunteers. The SCFD responds annually to over 7,000 received emergency calls for fires, medical emergencies and rescues, and hazardous materials.[59] The goal of the SCFD is to maintain a force sufficiently staffed and deployed to sustain a three-minute response time to initial calls 90 percent of the time.[60]

The SCFD consists of ten stations distributed throughout the City. The closest station to the project site is Station 8, located at 2400 Agnew Road, which is approximately 0.6 miles east of the project site.

The project site is currently developed with office buildings that are partially occupied and create a demand for fire services. The proposed project would result in a net increase in the total square footage of office space on the site, resulting in an increase in demand for fire protection services. The proposed project would be built to current building and fire codes, including features that would reduce potential fire hazards such as sprinklers. Access to the site for emergency vehicles would be provided from project driveways built to SCFD specifications.

Although the project would incrementally increase demand for fire response and related emergency services, it would not require the construction of new fire service facilities.

Impact PF-2: The proposed project would not result in impacts to the physical environment related to the construction of additional fire protection service facilities. **(Less Than Significant Impact)**

4.3 Parks

The City of Santa Clara 2010-2035 General Plan states that it's the City's goal to provide ample facilities for physical activities that promote community health. The City currently maintains 40 municipal parks and facilities, including a wildlife and natural vegetation park, a dog park, and a skate park. Neighborhood parks typically range in size from one-acre to ten acres. The City's recreational system is augmented by local school facilities, which are available to the general public after normal school hours.

[59] City of Santa Clara. "Fire". Accessed: March 15, 2013 <http://santaclaraca.gov/index.aspx?page=119>
[60] City of Santa Clara. *City of Santa Clara 2010-2035 General Plan*. 2010.

The nearest City park to the project site is the Mission College and Sports Complex located at 3300 Mission College Boulevard, approximately 2,100 feet west of the project site. This park contains three softball and one baseball field.

The proposed project would increase the amount of office space on the project site and does not include any residential uses. An increase in the daily employee population in the City would not result in substantial increase in the usage of local recreational facilities. In addition, the proposed project would include approximately 3.75 acres of landscaping and passive open space for users of the site.

Impact PF-3: The proposed project would not result in impacts to the physical environment because it would not require the construction of additional park and recreational space. **(Less Than Significant Impact)**

4.4 Mitigation and Avoidance Measures

No mitigation is required or proposed.

4.5 Conclusion

Impact PF-1: The proposed project would not result in impacts to the physical environment because it will not require the construction of new police facilities. **(Less Than Significant Impact)**

Impact PF-2: The proposed project would not result in impacts to the physical environment because it would not require the construction of additional fire service facilities. **(Less Than Significant Impact)**

Impact PF-3: The proposed project would not result in impacts to the physical environment because it would not require the construction of additional park and recreational space. **(Less Than Significant Impact)**

SECTION 5.0 CUMULATIVE IMPACTS

5.1 INTRODUCTION

Cumulative impacts, as defined by CEQA, consist of two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts. Cumulative impacts may result from individually minor, but collectively significant projects taking place over a period of time. Section 15130 of the *CEQA Guidelines* states that an EIR should discuss cumulative impacts "when the project's incremental effect is cumulatively considerable, as defined in section 15065(a)(3)." The discussion does not need to be as detailed as is necessary for project impacts, but is to be "guided by the standards of practicality and reasonableness". The purpose of the cumulative analysis is to allow decision-makers to better understand the potential impacts that might result from approval of past, present, and reasonably foreseeable future projects, in conjunction with the proposed project.

The CEQA Guidelines advise that a discussion of cumulative impacts should reflect both their severity and the likelihood of their occurrence. To accomplish these two objectives, the analysis should include either a list of past, present and probable future projects or a summary of projections from an adopted General Plan or similar document. The effects of past projects are generally reflected in the existing conditions described in the specific sections of this EIR. For instance, the traffic from recently-approved projects is reflected in the Background Conditions described in *Section 3.2, Transportation.* Therefore, CEQA requires that the impacts of implementing the proposed Great America Office Campus Expansion project be analyzed in conjunction with other related past, current, and probable future projects whose impacts might compound or interrelate with those of the project.

The discussion below addresses two aspects of cumulative impacts: (1) would the effects of all of the pending development listed result in a cumulatively significant impact on the resources in question and, if that cumulative impact is likely to be significant, (2) would the contributions to that impact from the project which is the subject of this EIR be cumulatively considerable.

5.2 LIST OF CUMULATIVE PROJECTS

The projects included in the cumulative analysis for the proposed project are shown in Appendix A of this EIR. The projects included in the cumulative analysis include both approved and pending projects in the City of Santa Clara and the neighboring cities of San Jose and Sunnyvale.

Based on the analysis in this EIR, development of the proposed project would result in less than significant impacts to visual and aesthetics, air quality, greenhouse gas emissions, geology and soils, utilities and service systems, energy, and public services. The degree to which the proposed project would add to existing or probable future impacts on existing land uses and/or resources would be negligible. As a result, the project's contribution to a cumulatively significant impact in any of these resource areas would not be considerable.

The proposed project would result in significant impacts to biological resources, construction air quality, construction noise, hydrology and water quality, hazards and hazardous materials, and

cultural resources. These impacts are temporary and will be reduced to a less than significant level with implementation of the proposed mitigation measures. Because of the temporary nature of these impacts and the fact that the impacts will be mitigated, there would be no long term cumulative effect. As a result, the project's contribution to a cumulatively significant impact in any of these resource areas would not be considerable.

The proposed project would contribute to and, therefore, it is possible that in combination with past, present, and reasonably foreseeable future projects, the project may have cumulatively significant impacts in the areas of land use, transportation, and noise.

5.3 ANALYSIS OF CUMULATIVE IMPACTS

5.3.1 Cumulative Land Use

As discussed in Section 3.1.2.3, the City of Santa Clara has a strong employment base with approximately 1.9 jobs per employed resident in 2008.[61] The proposed project would construct a net increase of approximately 600,000 s.f. of office space. The cumulative projects would create additional job opportunities within the City and increase the jobs/housing imbalance in the City. The project proposes a lower density of development than envisioned for the site in the 2010-2035 General Plan (1.26 FAR vs. 2.0 FAR). The project, therefore, reduces the employment-generating capacity of the site, as compared to full development under the 2010-2035 General Plan. The 2010-2035 General Plan includes additional housing development throughout the City to offset the intensification of employment areas. Implementation of the 2010-2035 General Plan would result in a reduction in the current jobs to employed resident ratio by the year 2035 with the phased addition of housing development sites. Because Santa Clara already has a strong employment base that substantially exceeds the current housing stock, new workers would either have to commute from housing in other areas of Santa Clara County or from outside the County. Although the cumulative projects would cumulatively induce housing growth outside the City, the development of the project site at a lower density than previous planned would not make a considerable contribution to this impact.

Impact C-LU-1: Although the cumulative projects would significantly worsen the City's jobs/housing imbalance, increase the number of workers commuting from outside the City, and induce housing growth throughout the region, the project would not make a considerable contribution to this impact. **(Less Than Significant Cumulative Impact)**

5.3.2 Cumulative Traffic Impacts

Cumulative conditions represent future traffic volumes on the future transportation network. Cumulative conditions include traffic growth projected to occur due to past projects already either on the street or reflected as approved development in background conditions, the proposed project, other proposed but not yet approved (pending) development projects and general background traffic increases.

[61] City of Santa Clara. *City of Santa Clara 2010-2035 General Plan.* 2010.

Traffic volumes under cumulative conditions were estimated by adding the trips from approved developments, estimated project trips, and trips from proposed but not yet approved (pending) development projects within each of the municipalities where intersections were analyzed. A list of the cumulative projects is shown in Appendix A. In addition, the cumulative conditions include trips generated by both Phase 1 and 2 of the approved North San Jose Development Policy.

5.3.2.1 *Cumulative Roadway Network*

The intersection lane configurations under cumulative conditions were assumed to be the same as described under background conditions.

5.3.2.2 *Cumulative Intersection Levels of Service*

A cumulative impact on traffic conditions at a signalized intersection is determined by application of the local municipal level of service policies. A significant cumulative traffic impact would, therefore, occur if the cumulative projects were to:

- Cause the level of service at any local signalized intersection to degrade from an acceptable LOS D or better under background conditions to an unacceptable LOS E or F under cumulative conditions; or
- Increase the average critical delay by four (4) seconds or more and the volume-to-capacity ratio (V/C) by 0.01 at any local intersections currently operating at LOS E or LOS F and at CMP intersections currently operating at LOS F under background conditions; or
- Cause the level of service at a CMP signalized intersection to degrade from an acceptable LOS E or better under background conditions to an unacceptable LOS F under cumulative conditions; or
- Increase the critical V/C value by 0.01 or more when the addition of cumulative traffic reduces the amount of average delay for critical movements at non-CMP intersections currently operating at LOS E or LOS F and at CMP intersections currently operating at LOS F under background conditions.

The LOS results under cumulative conditions are summarized in Table 5.3-1, below. The results show that measured against applicable level of service standards, nine study intersections are projected to operate at an unacceptable LOS E or F during at least one of the peak hours under cumulative conditions. The project's contribution to each of the cumulative intersection impacts is noted for each impacted peak hour.

- No. 8 – Great America Parkway and Mission College Boulevard (PM – 10%)
- No. 21 – Bowers Avenue and Augustine Drive (PM – 4%)
- No. 23 – Bowers Avenue and Central Expressway (AM – 4% and PM – 4%)
- No. 27 – De La Cruz Boulevard and Montague Expressway (AM – 2%)
- No. 28 – Mission College Boulevard and Montague Expressway (AM – 4% and PM – 3%)
- No. 29 – San Tomas Expressway and Scott Boulevard (PM – 1%)
- No. 36 – First Street and Montague Expressway (AM – 1% and PM – 1%)
- No. 43 – Lawrence Expressway and Scott Boulevard/Arques Avenue (PM – 1%)
- No. 44 – Lawrence Expressway and Kifer Road (PM – 2%)

All the other study signalized intersections would operate at an acceptable level of service.

Table 5.3-1
Cumulative Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Background		Cumulative Plus Project			
			Average Delay	LOS	Average Delay	LOS	Critical Delay Incr.	Critical V/C Incr.
1	Patrick Henry Drive and Tasman Drive	AM	23.0	C	24.8	C	3.5	0.039
		PM	29.3	C	32.5	C	6.1	0.030
2	Old Ironsides Drive and Tasman Drive	AM	20.3	C	20.5	C	-0.1	0.036
		PM	26.1	C	26.6	C	0.9	0.007
3	Great America Parkway and Tasman Drive*	AM	30.0	C	32.3	C	4.2	0.099
		PM	36.5	D	41.1	D	9.8	0.052
4	Convention Circle and Tasman Drive	AM	9.6	A	9.9	A	0.0	0.007
		PM	10.0	A	10.0	B	0.2	0.016
5	Centennial Boulevard and Tasman Drive	AM	10.2	B	10.5	B	0.0	0.007
		PM	10.3	B	10.2	B	0.1	0.015
6	Calle del Sol and Tasman Drive	AM	16.9	B	17.6	B	0.9	0.025
		PM	14.7	B	14.8	B	0.3	0.024
7	Lick Mill Boulevard and Tasman Drive	AM	31.8	C	31.4	C	-0.6	0.036
		PM	29.9	C	30.8	C	2.0	0.036
8	Great America Parkway and Mission College Boulevard*	AM	44.3	D	52.8	D	15.7	0.080
		PM	54.8	D	81.8	F	40.9	0.115
9	Marriott Hotel entrance and Mission College Boulevard	AM	13.8	B	19.1	B	8.5	0.171
		PM	12.1	B	18.6	B	9.6	0.265
10	Freedom Circle and Mission College Boulevard (W)	AM	10.6	B	11.1	B	1.0	0.076
		PM	19.0	B	19.7	B	1.5	0.051
11	Freedom Circle and Mission College Boulevard (E)	AM	16.0	B	17.8	B	4.8	0.154
		PM	19.0	B	19.5	B	1.2	0.061
12	Juliette Lane and Mission College Boulevard	AM	24.1	C	24.7	C	-9.5	-0.066
		PM	28.5	C	31.3	C	3.9	0.049
13	Burton Drive and Mission College Boulevard	AM	19.9	B	27.1	C	9.4	0.104
		PM	15.2	B	15.1	B	0.2	0.044
14	Great America Parkway and Yerba Buena Way	AM	21.6	C	22.1	C	0.8	0.052
		PM	31.6	C	32.9	C	2.2	0.033
15	Great America Parkway and Old Mountain View-Alviso Road	AM	12.1	B	14.2	B	3.1	0.057
		PM	19.8	B	22.1	C	4.1	0.036
16	Great America Parkway and Bunker Hill Lane	AM	11.7	B	11.6	B	0.1	0.053
		PM	13.3	B	13.0	B	-0.1	0.034
17	Great America Parkway and Old Glory Lane	AM	16.2	B	17.6	B	2.5	0.068
		PM	22.3	C	25.5	C	5.6	0.035
18	Great America Parkway and Patrick Henry Drive	AM	25.1	C	30.3	C	2.2	0.047
		PM	26.1	C	32.3	C	9.7	0.091
19	Great America Parkway and Northbound US 101*	AM	22.1	C	27.9	C	7.7	0.095
		PM	16.4	B	30.4	C	18.0	0.078
20	Bowers Avenue and Southbound US 101*	AM	24.1	C	26.6	C	3.3	0.090
		PM	8.0	A	8.7	A	0.9	0.061

Table 5.3-1
Cumulative Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Background		Cumulative Plus Project			
			Average Delay	LOS	Average Delay	LOS	Critical Delay Incr.	Critical V/C Incr.
21	Bowers Avenue and Augustine Drive	AM	32.8	C	35.0	C	4.1	0.042
		PM	73.0	E	86.2	F	21.4	0.054
22	Bowers Avenue and Scott Boulevard*	AM	36.1	D	407	D	8.3	0.084
		PM	34.6	C	37.7	D	2.8	0.060
23	Bowers Avenue and Central Expressway*	AM	71.3	E	84.2	F	22.1	0.054
		PM	97.0	F	114.9	F	5.9	0.033
24	Bowers Avenue and Kifer Road/Walsh Avenue	AM	19.3	B	20.8	C	1.8	0.051
		PM	21.6	C	25.3	C	7.5	0.085
25	Corwin Drive and Central Expressway*	AM	28.2	C	30.5	C	2.2	0.019
		PM	30.2	C	35.1	D	4.5	0.017
26	Lick Mill Boulevard and Montague Expressway	AM	32.0	C	38.2	D	10.6	0.111
		PM	20.8	C	22.8	C	22.8	0.116
27	De La Cruz Boulevard and Montague Expressway*	AM	48.9	D	81.5	F	55.1	0.155
		PM	40.2	D	50.5	D	7.4	0.117
28	Montague Expressway and Mission College Boulevard*	AM	111.2	F	130.4	F	33.1	0.144
		PM	62.5	E	106.8	F	68.2	0.162
29	San Tomas Expressway and Scott Boulevard*	AM	41.4	D	43.9	D	3.8	0.054
		PM	77.8	E	90.7	F	20.2	0.057
30	San Tomas Expressway and Walsh Avenue	AM	44.1	D	52.5	D	12.4	0.049
		PM	68.3	E	75.0	E	10.8	0.030
31	Lafayette Street and Agnew Road	AM	33.0	C	32.9	C	-0.6	0.056
		PM	39.0	D	40.2	D	3.1	0.032
32	Lafayette Street and Montague Expressway (North)	AM	32.4	C	33.8	C	0.8	0.020
		PM	27.5	C	28.5	C	1.1	0.044
33	Lafayette Street and Montague Expressway (South)	AM	13.6	B	14.3	B	1.1	-0.088
		PM	11.6	B	10.5	B	-2.6	0.039
34	Lafayette Street and Central Expressway*	AM	68.6	E	74.6	E	0.1	-0.018
		PM	62.5	E	69.1	E	12.0	0.038
35	Lafayette Street and Walsh Avenue	AM	13.4	B	13.4	B	0.2	0.028
		PM	23.8	C	26.3	C	3.3	0.049
36	N. First Street and Montague Expressway*	AM	121.1	F	147.8	F	46.9	0.112
		PM	132.1	F	177.3	F	62.4	0.139
37	Great America Parkway (North) and SR 237*	AM	23.7	C	27.3	C	5.5	0.044
		PM	22.8	C	23.7	C	1.1	0.028
38	Great America Parkway (South) and SR 237*	AM	16.6	B	17.5	B	1.6	0.041
		PM	13.0	B	13.5	B	0.8	0.038
39	Reamwood Avenue and Tasman Drive	AM	7.8	A	8.0	A	0.3	0.028
		PM	38.1	D	47.5	D	14.0	0.024
40	Birchwood Avenue and Tasman Drive	AM	33.1	C	44.0	D	14.8	0.030
		PM	30.7	C	36.7	D	9.3	0.023
41	Lawrence Expressway and Tasman Drive*	AM	45.8	D	50.6	D	10.7	0.051
		PM	59.3	E	62.1	E	4.5	0.030

Table 5.3-1
Cumulative Plus Project Intersection Levels of Service Summary

Intersection		Peak Hour	Background		Cumulative Plus Project			
			Average Delay	LOS	Average Delay	LOS	Critical Delay Incr.	Critical V/C Incr.
42	Lawrence Expressway and Lakehaven Drive/Sandia Avenue	AM	34.2	C	34.0	C	-0.2	0.010
		PM	44.6	D	44.7	D	0.8	0.012
43	Lawrence Expressway and Scott Boulevard/Arques Avenue*	AM	29.0	C	32.3	C	3.9	0.052
		PM	88.1	F	103.9	F	27.3	0.069
44	Lawrence Expressway and Kifer Road	AM	27.4	C	28.0	C	0.4	0.041
		PM	80.1	F	91.0	F	20.5	0.052

*Denotes CMP intersection.
Bold text indicates a significant cumulative impact.

Impact C-TRANS-1: The proposed project's contribution to each of the significantly impacted intersections under cumulative conditions is below the level the City of Santa Clara considers to be cumulatively considerable. Therefore, the project would not result in a cumulatively considerable contribution to a significant cumulative impact. **(Less Than Significant Cumulative Impact)**

5.3.3 Cumulative Noise Impacts

Cumulative traffic noise levels are calculated to increase substantially along roadways serving the project site because of cumulative growth forecast in the 2010-2035 General Plan. The project would result in a significant cumulative traffic noise impact if noise levels at existing sensitive receivers would be substantially increased (three dBA L_{dn} or more above existing traffic noise levels without the project) and if the project would make a cumulatively considerable contribution to the overall traffic noise level increase. A cumulatively considerable contribution is defined as an increase of one dBA L_{dn} or more attributable solely to the proposed project.

Cumulative traffic noise levels are anticipated to increase by up to four dBA L_{dn} along most roadway segments and by up to six to seven dBA L_{dn} in some instances. The project's contribution to the overall cumulative traffic noise increases would be less than one dBA L_{dn} on all off-site roadway segments analyzed in the traffic report. The project's contribution to overall cumulative traffic noise increases would not be cumulatively considerable.

Impact C-NV-1: Cumulative traffic conditions would substantially increase traffic noise levels along area roadways, but the project would not make a cumulatively considerable contribution (one dBA L_{dn} or more) to the cumulative noise increase. **(Less Than Significant Cumulative Impact)**

SECTION 6.0 ALTERNATIVES TO THE PROPOSED PROJECT

6.1 INTRODUCTION

The CEQA Guidelines, Section 15126.6 gives extensive direction for identifying and evaluating alternatives to a proposed project in an EIR. The purpose of having alternatives in an EIR is to identify ways to substantially lessen or avoid the significant effects that a proposed project may have on the environment. The range of alternatives selected for analysis is governed by the "rule of reason," which requires the EIR to discuss only those alternatives necessary to permit a reasoned choice. Although the alternatives do not have to meet every goal and objective set for the proposed project, they should "feasibly attain most of the basic objectives of the project."

CEQA does not require that all possible alternatives be evaluated, only that "a range of feasible alternatives" be discussed to encourage both meaningful public participation and informed decision making. The three critical factors to consider in selecting and evaluating alternatives are: (1) the project's objectives, (2) the significant impacts from the proposed project which could be reduced or avoided by an alternative, and (3) the feasibility of the alternatives available.

6.1.1 Objectives of the Project

While CEQA does not require that alternatives must be capable of meeting all the project objectives, their ability to meet most of the objectives is relevant to their consideration. As described in *Section 1.5,* the project proponent, *Sobrato Development Companies*, has identified the following basic objectives for the proposed project:

- Redevelop an underutilized infill site with approximately 600,000 s.f. of net new space.
- Support the local high-tech economy by replacing obsolete buildings with buildings that are more attuned to the current and future needs of high-tech companies.
- Strengthen the City's economy by attracting new high-tech companies to the area and providing additional office space to retain companies currently located within the boundaries of the City of Santa Clara.
- Increase the density of office development on the site to efficiently use land in an existing area of the City designated for office/R&D use.
- Provide office space in an area proximate to major transportation arterials, public transit, commercial services and workforce housing.
- Support existing businesses and economic development in the project area by providing additional jobs close to transit connections, retail uses, and various other tenant amenities.
- Support the City's role in the effort to balance regional land use by providing employment and economic development opportunities for residents of the city.

The City has identified the following basic objectives for the proposed project:

- Promote quality job growth within the City consistent with 2010-2035 General Plan Policy 5.3.5-G1.

- Support higher intensity employment centers that can take advantage of transit opportunities by concentrating jobs near existing transit facilities to reduce vehicle miles travelled consistent with 2010-2035 General Plan Policy 5.3.5-G2.

- Support development of significant employment projects on major local and regional transportation corridors in the City of Santa Clara to minimize traffic on local streets and to facilitate use of transit services consistent with 2010-2035 General Plan Policy 5.3.5-G3.

6.1.2 Significant Unavoidable Impacts of the Project

As mentioned, the CEQA Guidelines advise that the alternatives analysis in an EIR should be limited to alternatives that would avoid or substantially lessen any of the significant effects of the project and would achieve most of the project objectives. The significant unavoidable impacts identified in this EIR that would result from approval of the proposed project include the following:

- The project traffic would contribute to an operational deficiency at the Bowers Avenue and Augustine Drive intersection during the PM peak hour.

- The project traffic would significantly impact freeway segments due to a contribution in excess of one percent of segment capacity to 11 directional freeway segments already operating at LOS F during either the AM or PM peak hour.

6.1.3 Feasibility of Alternatives

CEQA, the CEQA Guidelines, and the case law on the subject have found that feasibility can be based on a wide range of factors and influences. The Guidelines advise that such factors *can* include (but are not necessarily limited to) the suitability of an alternate site, economic viability, availability of infrastructure, consistency with a General Plan or with other plans or regulatory limitations, jurisdictional boundaries, and whether the project proponent can "reasonably acquire, control or otherwise have access to the alternative site." [Section 15126.6(f)(1)]

6.1.4 Selection of Alternatives

An EIR is required to include a "No Project" alternative that "compares the impacts of approving the proposed project with the impacts of not approving the proposed project."[62] The project's primary impacts result from trip generation related to the size and type of use proposed. In addition to the No Project Alternative, a Reduced Scale Alternative is analyzed to address the potential for a smaller development on the site to reduce the project's impacts. As described below, due to the nature of the

[62] CEQA Guidelines Section 15126.6(e)(1)

project's impacts and the general location of the project, no Location Alternative is included in this analysis.

There is no rule requiring an EIR to explore off-site project alternatives in every case. As stated in the Guidelines: "An EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project, but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives." (Guidelines, § 15126.6, subd. (a), italics added.) As this implies, "an agency may evaluate on-site alternatives, off-site alternatives, or both." (*Mira Mar, supra*, 119 Cal.App.4th at p. 491.) The Guidelines thus do not require analysis of off-site alternatives in every case. Nor does any statutory provision in CEQA "expressly require a discussion of alternative project locations." (119 Cal.App.4th at p. 491 citing §§ 21001, subd. (g), 21002.1, subd. (a), 21061.)

In considering an alternative location in an EIR, the CEQA Guidelines advise that the key question is "whether any of the significant effects of the project would be avoided or substantially lessened by putting the project in another location".[63] The proposed project is the redevelopment and intensification of an existing parcel in an established office/commercial zone near bus transit, major roadways, and US 101. Other than relocating vehicle trips to another intersection and thereby reducing their use of the impacted intersection along Bowers Avenue, it is unlikely that an alternative location within this general area of the City would substantially lessen the project's contribution to local intersection impacts. Employees of the project would likely be traveling from the same residential locations and the traffic trips would generally use the same roadways and freeway segments to access another office development site in the area. There are no other impacts of the project that are specifically related to the proposed location. For these reasons, an alternative location was not analyzed.

6.2 NO PROJECT ALTERNATIVE

The CEQA Guidelines stipulate that an EIR specifically include a No Project Alternative, which should address both "the existing conditions, as well as what would be reasonably expected to occur in the foreseeable future if the project is not approved, based on current plans and consistent with available infrastructure and community services." Since the project site is currently developed with three office buildings, parking lots, and landscaping, the alternative to the City approving the currently proposed project would be to maintain the existing development on the site. Maintaining the current development on the project site would not result in any new significant environmental impacts.

The No Project Alternative would not meet any of the project objectives. The existing development would remain on site and the increased density of employment uses on the site would not occur. The No Project Alternative would not strengthen the City's economy by providing additional high-tech office space.

[63] CEQA Guidelines Section 15126.6(f)(2)(A)

6.2.1 Conclusion

The No Project Alternative would not meet any of the project objectives but would avoid all of the impacts of the proposed project. For this reason, the No Project Alternative is an environmentally superior alternative to the proposed project.

6.3 REDUCED SCALE ALTERNATIVE

A Reduced Scale Alternative would be a lower density office development, representing a less intense use of the site. Reducing the size of the proposed project would lessen each of the environmental impacts of the project proportionally and would be less than significant with mitigation applied.

Based on LOS calculations by *Hexagon Transportation Consultants,* reducing the proposed office development to an additional 225,000 s.f. of office space (resulting in a total of 643,000 s.f. on-site) would avoid the project's significant impacts to the Bowers Avenue and Augustine Drive intersection and 11 freeway segments in the project area. The Reduced Scale Alternative would also reduce the project's less than considerable contribution to cumulative traffic impacts.

Although this alternative would contribute to an increase in the jobs/housing imbalance it would not be to a level that is significant given the reduced number of additional employees that could be accommodated on the site.

6.3.1 Conclusion

Implementation of a Reduced Scale Alternative would result in substantially less office development on the site than currently proposed. The Reduced Scale Alternative would reduce all of the project's significant intersection and freeway segment impacts to a less than significant level. The amount of development allowed under this alternative, however, would not meet the project objectives to create a high intensity employment center by increasing the density of the site and redeveloping an underutilized site. The Reduced Scale Alternative may also not be financially viable due to the potential costs of redevelopment and the minimal increase in office space allowed under this alternative. Since this alternative would reduce the project's significant intersection and freeway impacts to a less than significant level, it is considered environmentally superior to the proposed project.

6.4 ENVIRONMENTALLY SUPPERIOR ALTERNATIVE

The CEQA Guidelines state that an EIR shall identify an environmentally superior alternative. Based on the discussion above, the environmentally superior alternative is the Reduced Scale Alternative since it would reduce the significant intersection and freeway impacts of the project to a less than significant level. The Reduced Scale Alternative would not, however, meet the project objectives. The amount of development allowed under this alternative may not be economically feasible.

SECTION 7.0 SIGNIFICANT UNAVOIDABLE IMPACTS

A significant unavoidable impact is an impact that cannot be mitigated to a less than significant level if the project is implemented as it is proposed. The following significant unavoidable impacts have been identified to result from the proposed project:

Impact TRANS-2: There are no further feasible improvements possible at the Bowers Avenue and Augustine Drive intersection due to right-of-way constraints. Therefore, the project impact is considered significant and unavoidable. **(Significant Unavoidable Impact)**

Impact TRANS-5: The 11 freeway segment LOS impacts of the proposed project would remain significant and unavoidable due to the lack of feasible mitigation measures. **(Significant Unavoidable Impact)**

All other significant impacts of the proposed project would be reduced to a less than significant level with the implementation of the mitigation measures identified in this EIR.

SECTION 8.0 GROWTH-INDUCING IMPACTS

For the purposes of this EIR, a growth inducing impact is considered significant if the project would:

- Cumulatively exceed official regional or local population projections;
- Directly induce substantial growth or concentration of population. The determination of significance shall consider the following factors: the degree to which the project would cause growth (i.e., new housing or employment generators) or accelerate development in an undeveloped area that exceeds planned levels in local land use plans; or
- Indirectly induce substantial growth or concentration of population (i.e., introduction of an unplanned infrastructure project or expansion of a critical public facility such as a road or sewer line necessitated by new development, either of which could result in the potential for new development not accounted for in local general plans).

The proposed project would expand the square footage of office use on an existing office development site. The site is surrounded by existing infrastructure and urban development. Development of the proposed project would be required to make a fair share contribution toward improvements to two CMP intersections currently operating at LOS E or better (refer to *Section 3.2 Transportation*). The project would not require upgrades to any other infrastructure and would not include any significant expansion of infrastructure that would facilitate growth in other areas of the City.

The proposed project would create a greater density of employment uses on a site currently developed with offices uses. The proposed project would be compatible with surrounding land uses and would not pressure adjacent properties to redevelop with new or different land uses. The project would be developed at a lower density than envisioned for the site in the 2010-2035 General Plan (1.26 FAR vs. 2.0 FAR). The project, therefore, reduces the employment-generating capacity of the site, as compared to full development under the 2010-2035 General Plan. Implementation of the 2010-2035 General Plan would result in a reduction in the current jobs to employed resident ratio by the year 2035 with the phased addition of housing development sites. The project, therefore, would not indirectly induce greater employment or residential development than was otherwise considered in the City's 2010-2035 General Plan.

SECTION 9.0 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES

CEQA and the CEQA Guidelines require that an EIR address "significant irreversible environmental changes which would be involved in the proposed project, should it be implemented." [§15126.2(c)] Significant irreversible changes include the use of nonrenewable resources, the commitment of future generations to similar use, and irreversible damage resulting from environmental accidents associated with the project.

9.1 USE OF NONRENEWABLE RESOURCES

If the proposed project is implemented, development of this site would involve the use of non-renewable resources both during the construction phase and future operations/use of the site. Construction would include the use of building materials, including materials such as petroleum-based products and metals that cannot be regenerated over time.

Construction also involves significant consumption of energy, usually petroleum-based fuels that deplete supplies of non-renewable resources. The operational phase of the project would consume energy for multiple purposes including, building heating and cooling, lighting, appliances, electronics, and commercial machinery. The project will be conditioned to meet LEED Silver certification standards for the core and shell which would reduce the energy consumption of the proposed buildings. Energy in the form of fossil fuels would be used to fuel vehicles traveling to and from the site. The proposed project is located near existing transit service and will be conditioned to implement a TDM program which will reduce the vehicle miles traveled by employees on the project site by at least five percent.

9.2 COMMITMENT OF FUTURE GENERATIONS TO SIMILAR USE

The site is an infill location and is currently served by public transportation. The site provides an expansion of job opportunities on a site proximate to existing housing in Santa Clara and adjacent communities. The proposed project will, therefore, facilitate a more efficient use of resources over the long term.

9.3 IRREVERSIBLE DAMAGE RESULTING FROM ENVIRONMENTAL ACCIDENTS ASSOCIATED WITH THE PROJECT

The project does not propose any new or uniquely hazardous uses and its operation would not be expected to cause environmental accidents that would impact other development in the vicinity of the site. The project site is located within a seismically active region and would be exposed to ground shaking during a seismic event. Conformance with the standard engineering practices in the California Building Code and implementation of the recommendations in the design-level geotechnical report for the project would not result in significant geology and soils impacts (refer to *Section 3.5 Geology and Soils*).

SECTION 10.0 REFERENCES

Association of Bay Area Governments. *Dam Failure Inundation Hazard Map for Northwest San José/Milpitas/Santa Clara*. October 20, 2003. Map. Accessed February 4, 2013. http://www.abag.ca.gov/cgi-bin/pickdamx.pl; http://gis.abag.ca.gov

Association of Bay Area Governments. *Projections 2007*. December 2006.

Bay Area Air Quality Management District. *Thresholds Options and Justification Report*. 2009.

Bay Area Air Quality Management District. *CEQA Air Quality Guidelines.* May 2011.

California Air Pollution Control Officers Association (CAPCOA). *Health Risk Assessments for Proposed Land Use Projects*. 2009.

California Department of Conservation. *Santa Clara County Important Farmland 2010.* Map.

California Energy Commission. *2009 California Climate Adaptation Strategy Discussion Draft. Frequently Asked Questions*. August 3, 2009. <www.climatechange.ca.gov/adaptation/documents/2009-07-31_Discussion_Draft-Adaptation_FAQs.pdf >

California Energy Commission. *2009 Integrated Energy Policy Report (CEC-100-2009-003-CMF).* 2009. Page 148.

California Energy Commission. *2011 Integrated Energy Policy Report (CEC-100-2011-001-CMF)*. 2012. Page 6. <http://www.energy.ca.gov/2011publications/CEC-100-2011-001/CEC-100-2011-001-CMF.pdf>

California Energy Commission. *2012 Integrated Energy Policy Report Update (CEC-100-2012-001-CMF)*. 2013. Pages 14 - 18. <http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf>

California Energy Commission. "Current Trends: Natural Gas Supply. Staff Workshop 2011 Integrated Energy Policy Report". April 19, 2011. Accessed March 22, 2013. <http://www.energy.ca.gov/2011_energypolicy/documents/2011-04-19_workshop/presentations/Current_Trends_Natural_Gas_Supply.pdf>

California Energy Commission, Energy Almanac. "Total Electricity System Power". Available at: <http://www.energyalmanac.ca.gov/electricity/total_system_power.html>

California Energy Commission, Energy Almanac. "Overview of Natural Gas in California". Accessed: March 22, 2013. <http://www.energyalmanac.ca.gov/naturalgas/overview.html>

California Environmental Protection Agency, California Air Resources Board (CARB). *Air Quality and Land Use Handbook: A Community Health Perspective*. 2005.

CalRecycle. *Waste Disposal and Diversion Findings for Selected Industry Groups.* June 2006. Available at: <http://www.calrecycle.ca.gov/Publications/Detail.aspx?PublicationID=1184>

City of San José, Environmental Services Department. "Water Pollution Control Plant". Accessed: March 27, 2013. <http://www.sanjoseca.gov/?nid=1663>

City of Santa Clara. "Fire". Accessed: March 15, 2013. <http://santaclaraca.gov/index.aspx?page=119>

City of Santa Clara. *City of Santa Clara 2010-2035 General Plan*. 2010.

City of Santa Clara. *Municipal Code.*

City of Santa Clara, Water and Sewer Utilities. *4301, 4401, 4551 Great America Parkway Development Application Water Supply Assessment.* November 26, 2012.

City of Santa Clara. "Water Utility". Accessed March 28, 2013. <http://santaclaraca.gov/index.aspx?page=1043>

Cornerstone Earth Group. *Geotechnical Feasibility Study Great America Commercial Development*. January 11, 2008.

Federal Emergency Management Agency. *Flood Insurance Rate Map, City of Santa Clara California Santa Clara County Community-Panel Number 06085C0063H*. May 18, 2009.

Hexagon Transportation Consultants. *Great America Parkway Office Campus Development Project Transportation Impact Analysis.* May 28, 2013.

Illingworth & Rodkin, Inc. *Great America Campus Environmental Noise Assessment.* May 14, 2013.

Illingworth & Rodkin, Inc. *Great America Office Campus Expansion Project Air Quality and Greenhouse Gas Assessment.* March 15, 2013.

McClenahan Consulting, LLC. *Tree Inventory Sobrato Development Companies Mission College Boulevard.* February 15, 2013.

PES Environmental, Inc. *Summary of Environmental Evaluation*. February 27, 2013.

RMC Water and Environment. *City of Santa Clara Sanitary Sewer Hydraulic Modeling Support for General Plan Update.* September 2009.

Santa Clara County Airport Land Use Commission. *Comprehensive Land Use Plan Santa Clara County*. May 25, 2011.

Santa Clara Valley Urban Runoff Pollution Prevention Program. *HMP Applicability Map City of Santa Clara*. November 2010. Accessed February 1, 2013. <http://www.scvurppp-w2k.com/hmp_maps.htm>

Schaaf & Wheeler Consulting Civil Engineers. *Sobrato Site Storm Drainage Hydrology Memo.* December 5, 2008.

Silicon Valley Power. "Power Content Label". Accessed March 22, 2013. <https://siliconvalleypower.com/index.aspx?page=2022>

United States Energy Information Administration. "Table C1. Energy Consumption Overview: Estimates by Energy Source and End-Use Sector, 2010". Available at: <http://www.eia.gov/state/seds/sep_sum/html/pdf/sum_btu_1.pdf>

United States Energy Information Administration. "California State Energy Profile". June 2011. <http://www.eia.gov/dnav/pet/pet_pnp_cap1_a_(na)_8D0_BpCD_a.htm>.

United States Environmental Protection Agency. "Light Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 through 2012". Available at: <http://www.epa.gov/oms/fetrends.htm>

SECTION 11.0 LEAD AGENCY AND CONSULTANTS

Lead Agency

City of Santa Clara
Planning and Inspection Department
Kevin Riley, Director
Debby Fernandez, Associate Planner

Consultant

David J. Powers & Associates, Inc.
Environmental Consultants & Planners
Judy Shanley, Principal
Will Burns, Project Manager
Zach Dill, Graphic Artist

Cornerstone Earth Group
Laura C. Knutson, P.E., G.E., Principal Engineer
John R. Dye, P.E., G.E., Principal Engineer

Hexagon Transportation Consultants
Robert Del Rio, Principal Associate

Illingworth & Rodkin, Inc.
James Reyff, Project Scientist
Joshua Carman, Acoustical Consultant
Michael S. Thill, Senior Consultant

McClenahan Consulting, LLC
John H. McClenahan, Arborist

PES Environmental, Inc.
William F. Frizzell, P.E., Principal Engineer
Julie L. Turnross, Senior Hydrogeologist

Schaaf & Wheeler Consulting Civil Engineers
Kirk Wheeler, PE, Principal

Jack Barnwell
jbarnwell@tahoedailytribune.com

November 23, 2015

Lake Tahoe-Truckee transit future full of hope; big money needed

A BlueGo bus waits for passengers at the South Lake Tahoe "Y" Transit Center on Friday, Nov. 20.

SOUTH LAKE TAHOE, Calif. — Dreams of an integrated, seamless transit system in the Lake Tahoe Basin are still on the drawing board, but the green vision lacks cash to completely fuel it.

That was one takeaway from a Wednesday, Nov. 18, panel discussion on the future of transit on Lake Tahoe's North and South Shore.

Panelists included George Fink from Tahoe Transportation District, Heavenly Mountain Resort base operations director Tom Fortune, Jaime Wright with Truckee North Tahoe Transportation Management Association, and Sandy Evans Hall from North Lake Tahoe Resort Association.

All four local experts highlighted current goals and challenges occurring with the transit system, including a rise in summer tourism.

"I think that we can all agree anecdotally that we've had a lot more tourists this last summer than in previous years, and that presents some unique challenges for us," Fink said.

Fink said South Shore transit goals would eventually include adding service to Meyers and into local neighborhoods, as well as improving bus frequencies.

BlueGo Bus Company, which serves South Lake Tahoe and Stateline, currently operates on an hourly schedule.

Fortune, from Heavenly, said the resort already provides free shuttle service on six routes for its employees and skiers during winter operations.

In the future, Heavenly will consider using the 1,200 parking spots at the resort's California Lodge as a free park-and-ride during the summer season. Shuttles would take visitors to the gondola at Heavenly Village, transporting them to the resort's rope courses and other summer facilities.

ON THE NORTH SHORE

North Tahoe accomplished a seamless ridership to some extent between Truckee and the North Shore, according to Evans Hall and Wright.

Truckee and North Tahoe transit services recently combined resources, calling itself Truckee Tahoe Area Regional Transit.

A grant from Tahoe Truckee Airport District will provide year-round service on Highway 267 between Truckee and Kings Beach for three years.

North Tahoe agencies are also working on the Resort Triangle Transit Vision, a plan that would eliminate fees, increase service frequency to 30-minute rides, and add year-round evening service between Truckee, the North Shore and West Shore.

"We would essentially double our ridership if we did that," said Evans Hall, noting it would boost ridership from 400,000 people a year to nearly a million.

According to Fink, one of the top future priorities includes a basin-wide transit service.

"Tahoe Transportation District is working with its North Shore partners to establish a year-round transit system that is seamless to the rider," Fink said.

He added that this could be accomplished without creating a massive transit entity.

Joanne Marchetta, executive director of Tahoe Regional Planning Agency, noted that there would be some challenges in accomplishing that goal, especially when there are multiple agencies involved.

FUNDING FUTURE GOALS

For some initiatives, like increasing service around the Lake Tahoe Basin, a lack of money remains a very real obstacle.

Implementing the Resort Triangle Transit Vision in Truckee and North Tahoe, for example, would cost $7.2 million a year. The North Shore transit service currently operates on a $4.5 million budget.

However, Evans-Hall said consultants are optimistic that the program would pay for itself in the first year. The goal is to implement the plan within five years.

She added that Lake Tahoe Basin agencies should stop looking at public transportation in a conventional way, especially if it wants to accomplish goals similar to Park City, Utah, or Vail, Colo.

“As a resort community, you have to start thinking of transportation as an amenity,” Evans-Hall said. “A fare system can be a barrier to transit use, especially for visitors.”

She explained that places like Park City pay for free transit with various taxes and fees.

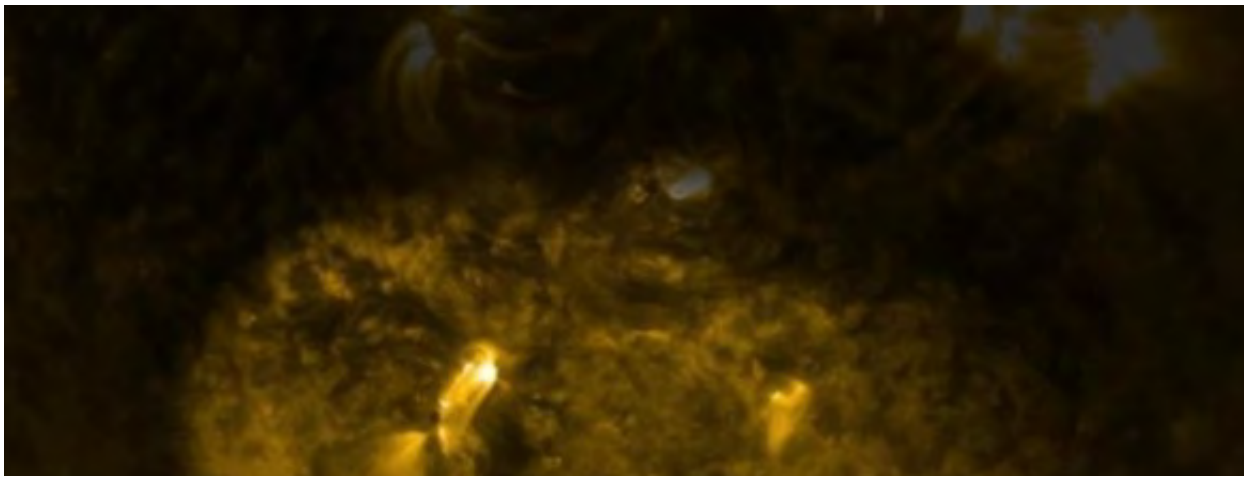
Placer County may consider placing a sales- or bed-tax increase on the ballot in 2016.

Fink said that while it appears that the federal government will approve a six-year transportation bill soon, it won’t provide all the necessary funding for future goals.

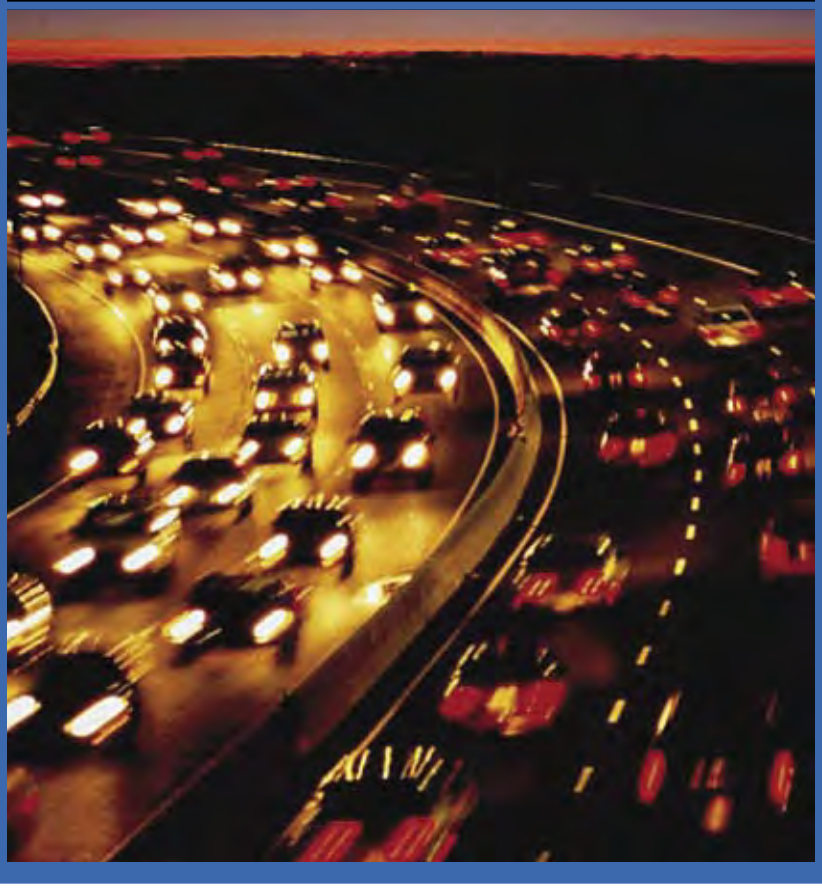
“We have to realize that funding for the goals we want to do won’t come from the federal government, but from locals,” he said.

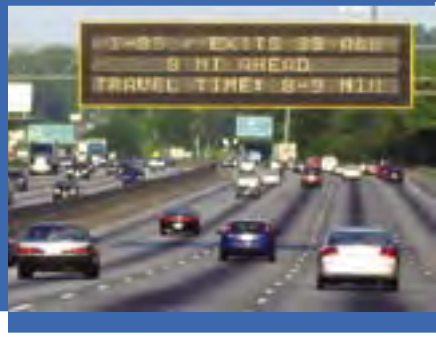
Top Video Headlines

of 3

- 

©2016 - 2016 Swift Communications, Inc.





MITIGATING **TRAFFIC CONGESTION**

THE ROLE OF DEMAND-SIDE STRATEGIES

U.S. Department of Transportation
Federal Highway Administration

MITIGATING **TRAFFIC CONGESTION**

THE ROLE OF DEMAND-SIDE STRATEGIES

BY

The Association for Commuter Transportation

WITH

URBAN**TRANS** CONSULTANTS

AND

PARSONS BRINCKERHOFF

ESTC

IN PARTNERSHIP WITH:

U.S. Department of Transportation
Federal Highway Administration

OCTOBER 2004

ACKNOWLEDGEMENTS

PRINCIPLE AUTHORS

Kevin Luten
UrbanTrans Consultants
Katherine Binning
Parsons Brinckerhoff
Deborah Driver
UrbanTrans Consultants
Tanisha Hall
UrbanTrans Consultants
Eric Schreffler
ESTC

WITH CONTRIBUTIONS FROM

Stuart Anderson, *UrbanTrans Consultants*
Fox Chung, *UrbanTrans Consultants*
Joddie Gray, *UrbanTrans Consultants*
Justin Schor, *UrbanTrans Consultants*
David Ungemah, *UrbanTrans Consultants*
Tad Widby, *Parsons Brinckerhoff*
Tammy Wisco, *Parsons Brinckerhoff*

FOR ADDITIONAL INFORMATION:

Association for Commuter Transportation
PO Box 15542
Washington, DC 20003-0542
202.393.3497 • 678.244.4151 (fax)
act@act-hq.com
www.actweb.org

FORWARD

Note From the Director
Office of Transportation Management, Office of Operations
Federal Highway Administration

As we advance further into the 21st Century, strategies to manage demand will be more critical to better transportation operations and system performance than strategies to increase capacity (supply) of facilities. The inability to easily and quickly add new infrastructure, coupled with the growth in passenger and freight travel, have led to the need for transportation system managers and operators to pay more attention to managing demand.

The original concepts of demand management took root in the 1970s and 1980s from legitimate desires to provide alternatives to single occupancy commuter travel – to save energy, improve air quality, and reduce peak-period congestion. Today, the need to manage travel demand has broadened to encompass the desire to optimize transportation system performance for both commute and non-commute types of trips, and during both recurring as well as non-recurring events.

Growth in population, number of vehicles and the number of travelers, freight, and development has affected travel demand and re-shaped travel patterns. Managing travel demand now occurs at shopping malls, tourist sites, employment areas, or special events, such as the Olympics. The need to manage demand can occur in the middle of the day, during weekends, or evenings. Demand–side approaches are needed to help address transportation issues created by growth and the variability in demand for use of the system.

In this light, the Federal Highway Administration's Office of Transportation Management is pleased to present this new report on demand-side strategies and the important role that it plays in 21st Century transportation operations. This report builds upon previous work done on travel demand management in the early 1990's to present a newer, more contemporary, perspective on what managing demand in the 21st Century really means.

Given the greater need to manage demand under a broader set of situations and conditions, as well as the influence of information and the technologies to deliver it, the concept of demand management in the 21st Century takes on a broader and more relevant meaning. Managing demand in the 21st Century goes beyond just encouraging travelers to change their travel mode from driving alone to a carpool, vanpool, public transit vehicle, or other alternative. Managing travel demand today is about providing travelers, regardless of whether they drive alone or not, with informed choices of travel route, time, and location – not just travel mode.

Information and the technology to deliver it to travelers are beginning to have a significant impact on managing demand for both commute and non-commute situations. Real-time information systems can now let travelers make better decisions about how they travel (mode), when they travel (time), which route they travel (route), and whether they travel at

all. Real-time traveler information systems are also critical to managing significant shifts in demand that occur as a result of special events, tourist activity, incidents and emergencies, schools, shopping centers, recreation areas, medical facilities, weather problems, and reconstruction projects. In the 21st Century, the need to deliver information to help manage transportation demand will grow and be further supported by intelligent transportation systems (ITS) technologies.

The FHWA Office of Operations has a two-pronged action agenda of awareness and guidance to evolve the thinking of managing demand to a more 21st Century perspective. This report is a significant step in that direction.

To learn more, visit our website at: www.ops.fhwa.dot.gov

We look forward to working with organizations, public agencies, and interest groups to advance the ideas presented in this publication.

Jeffrey Lindley
Director
Office of Transportation Management, FHWA

TABLE OF CONTENTS

Acknowledgements 4
Forward 5
Introduction 9

The Demand-Side Framework 13
Demand-Side Strategies 13
General Strategies 16
Targeted Strategies 26

Travel Choices 33
Mode Choices 33
Departure-Time Choices 36
Route Choices 37
Trip Reduction Choices 38
Origin/Destination Location Choices 39

Applications 40
Schools & Universities 40
Special Events 41
Recreation & Tourism 41
Transportation Corridor Planning & Construction Mitigation 42
Employer-Based Commuter Programs 43
Airports 44
Incidents and Emergencies 44
Freight Transportation 45

Summary of Case Study Experience 46
What Works Best? A Review of International Experience 47
Lessons Learned from the Case Studies 49
Conclusions & Future Developments 51
Additional Resources & Citations 52

The Case Studies 59

Schools & Universities
- University of Washington - Seattle, WA 61
- Contra Costa County SchoolPool - CA 63

Special Events
- Summerfest and Concert Tour - WI 65
- Seahawks Stadium (Qwest Field) - Seattle, WA 67
- PacBell (SBC) Park - San Francisco, CA 69

TABLE OF CONTENTS

Recreation & Tourism Destinations
- Zion National Park - UT 71
- City of Aspen - CO 73
- Lake Tahoe Basin - CA 75

Transportation Corridor Planning and Construction Mitigation
- I-15 Reconstruction - Salt Lake City, UT 77
- I-25 & I-225 Reconstruction - Denver, CO 79
- Springfield Interchange - VA 81

Employer-Based Commute Programs
- Bal Harbour Village - FL 83
- CALIBRE - Alexandria, VA 85
- CH2M HILL - Denver, CO 87
- Georgia Power Company - Atlanta, GA 89
- Hennepin County - MN 91
- Johns Manville - Denver, CO 93
- Nike - Beaverton, OR 95
- Overlake Christian Church - Redmond, VA 97
- Simmons College - Boston, MA 99
- Swedish Medical Center - Seattle, WA 101
- Texas Children's Hospital - Houston, TX 103

Location / Design Strategies
- Metropolitan Seattle Transit-Oriented Development and Flexcar - Seattle, WA. 105
- Orenco Station Mixed-Use Development - Hillsboro, OR 107

Variable Pricing
- Lee County Variable Bridge Tolls - Lee County, FL 109

Advanced Traveler Information
- Commuter Link - Salt Lake City, UT 111

INTRODUCTION

Traffic congestion is slowing America down. In cities large and small, from the east coast to the west coast, traffic congestion is steadily getting worse each year. A larger percentage of the nation's roadway network is congested, more severely and for longer portions of each day, than ever before. In 1982, the average person living in one of the country's 75 largest cities faced seven hours of travel delay per year. By 2001, that figure had shot to 26 hours of delay per year, and the most severely congested periods of the day – once known as the "rush hour" – stretched to cover nearly six hours of each day. By 2001, the severity of peak-period congestion also intensified, with the average "rush hour" trip taking nearly 40% longer than the same trip at other times of the day (TTI, 2003).

The impacts of traffic congestion are far-reaching – impacting individuals, families, businesses and communities. The Texas Transportation Institute (TTI), at Texas A&M University, calculates that the country's "congestion invoice" amounted to nearly $70 billion in 2001 – the byproduct of 3.5 billion hours of delay and 5.7 billion gallons of excess fuel consumed in congestion-related delays. These costs directly affect individuals and families, as people spend more time and money stuck in traffic. For most American households, transportation costs now account for 18% of total household expenditures. Only shelter represents a larger portion of expenditures, at 19%. The impacts on lower-income families are even more severe. For households earning between $12,000 and $23,000 per year, transportation expenses consume one in every four dollars spent (STPP, 2000).

Recognizing the growing burden of traffic congestion and the importance of efficient access and mobility, community leaders and transportation planners are actively working on transportation improvements to alleviate traffic congestion. Much needed roadway, bridge, and transit infrastructure projects – considered transportation "supply" or "capacity" enhancements – are underway across the country to mitigate travel delays and accommodate future growth needs.

As urban areas mature, however, opportunities for further investments in transportation infrastructure are often limited. Urban transportation corridors increasingly lack the physical space to accommodate more lanes. In some areas, communities voice concerns that impacts to private rights-of-way or sensitive environments outweigh the potential benefits of expanding facilities. Many areas simply lack the funds needed to pay for major roadway or transit projects. Competition for limited federal and state funds is intense, and even where needed infrastructure projects are in the planning or construction stages, project completion can still be years away.

Effectively tackling traffic congestion increasingly means employing all available strategies. New infrastructure projects – from roads to bridges to transit facilities – remain a core element of comprehensive transportation improvement programs.

Supplementing these "supply-side" investments are a broad array of "demand-side" strategies intended to make existing transportation facilities work better. Demand-side strategies are designed to better balance people's need to travel a particular route at a particular time with the capacity of available facilities to efficiently handle this demand. Many people have attended a sporting event or a concert where everyone tries to leave the same place at the same time. While in the extreme, this is a perfect example of where travel demand exceeds available supply – and severe traffic congestion often results. The focus of demand-side strategies is to provide people with enhanced travel choices – from choices in travel mode (such as driving, using transit or bicycling), to choices in travel route and trip departure-time – and to provide incentives and information for people to make informed travel choices. For example, many sports and concert venues provide incentives for people to arrive a little early or stay a little late, essentially spreading the "peak" of the demand to travel to/from the building, reducing traffic congestion, and improving the visitor's overall experience.

This contemporary understanding of demand-side strategies is broader in scope than prior, more traditional views of transportation demand management – or TDM. To some, the realm of demand management applications is limited primarily to encouraging alternatives to single-occupant vehicle travel for the commute to work. In practice, however, this narrow view is no longer consistent with the broad applications of demand-side strategies currently underway across the country. Today's applications are not only limited to facilitating shifts in travel mode – they also address shifts in travel routes and travel departure-times (for all travelers, including single-occupant vehicle drivers). Today's applications also extend beyond a focus on commute trips. At national parks, sports stadiums, university campuses, and other diverse destinations, transportation and facility managers are implementing demand-side strategies as part of coordinated efforts to reduce congestion. On bridges, and along corridors undergoing roadway reconstruction programs, demand-side strategies are helping travelers avoid congestion by utilizing alternative travel routes, travel times and/or travel modes – or by reducing the need for some trips altogether by facilitating work from home options a few days a month.

LAKE TAHOE, CALIFORNIA/NEVADA

Mitigating Traffic Congestion: The Role of Demand-Side Strategies articulates a framework for understanding contemporary efforts to manage demand and improve the performance and efficiency of transportation systems. The document provides extensive examples of programs already underway in a variety of application settings, including over 25 in-depth case studies from across the country.

The in-depth case studies illustrate a handful of the many applications of demand-side strategies in place today. The case studies attempt to highlight the diversity of programs, with an effort to find examples that also provided one or more measures of program effectiveness. A few highlights from the case studies include:

- **SBC Park** (formerly Pac Bell Park) in San Francisco – a 41,000 seat baseball stadium – forged an access plan that integrated excellent access to existing transportation facilities (roadways, bus and rail transit, ferry services, and an extensive sidewalk network) and a comprehensive transportation management plan. With only 5,000 dedicated parking spaces available, demand-side strategies to promote a variety of mode and route travel options, along with advanced transit ticket sales and an aggressive marketing program, were key to the stadium's success. The year the park opened, approximately 50% of baseball fans arrived in non-auto modes, over 100,000 advance-purchase transit tickets were sold, and the limited number of parking spaces were rarely full.

SBC PARK, SAN FRANCISCO

- **CH2M Hill** in Denver implemented a transportation program to improve the commute and enhance their employee recruitment and retention abilities. They designed an aggressive telework program with full-time and part-time telework options, and instituted a flextime program to better support a variety of commute options. CH2M Hill also designed the "Look Before You Leave" program, which encouraged all employees to check traffic conditions on a company intranet that centralized a variety of resources for current traffic conditions, roadway construction updates, etc. This resource encouraged employees to avoid the most congested travel routes and travel times whenever feasible. At this suburban work location, 17% of CH2M Hill employees use transit, carpool, bicycle, or telework. In 2002, the program reduced the number of miles driven by employees by over 115,000, and saved nearly 3,700 staff hours.

- **Lee County Bridges** crossing the Caloosahatchee River in southwest Florida are a major source of congestion and travel delay for the region. In 1997, County leaders implemented a variable pricing system for the bridge tolls which incorporated a discount for travelers crossing the bridges just before and just after the peak-periods (when using the electronic toll collection system). A 1999 survey found that this demand-side pricing system encouraged 7% of users to shift their travel patterns to cross the bridges during the discounted, non-peak hours of the day.

LEE COUNTY TOLL BRIDGES, FLORIDA

A full understanding of demand-side strategies must recognize the reasonable limits of these applications. Demand-side strategies should not be considered total solutions to regional traffic congestion problems. Rather, they should more often be implemented as part of an integrated set of solutions that balance supply-side infrastructure investments and demand-side strategies. Demand-side strategies can be relatively easy to implement in a shorter timeframe, within a more constrained budget, than capital improvements. As such, supply-side and demand-side approaches can prove complementary – with demand-side efforts taking on an asset management role by maximizing the performance and extending the life of existing roadways. Successful demand management programs often leverage the synergistic results of many demand-side strategies working together – essentially producing the cumulative results of a number of small percentage improvements.

Demand-side strategies are ultimately about choice and balance. Expanding the array of mode, route and departure-time choices available – supported by robust real-time traveler information, incentives, and other resources – allows each person to choose the options that work best for them regarding when they travel, the mode and route they use to get there, or whether they travel at all.

What's Inside?

Mitigating Traffic Congestion outlines a framework for understanding the full scope of demand-side strategies, and provides a wealth of case studies, both brief and in-depth, that illustrate where and how these strategies are already underway. The document is organized around these primary five sections:

The Demand-Side Framework – The broad framework for understanding demand-side strategies, their impact on traveler choices, and the varied settings where they are applied.

Summary of Case Study Experience – A review of the case studies collected and key lessons learned from the case study exploration.

Conclusions & Future Developments – A summary of concluding thoughts from the publication as a whole and highlights of important future developments.

Additional Resources & References – A collection of organizations, publications and internet resources, along with citations from this publication.

The Case Studies – In-depth case studies of over 25 examples of demand-side programs underway across the country.

THE DEMAND-SIDE FRAMEWORK

this section outlines a framework for understanding demand-side strategies, their impact on traveler choices, and the varied settings where they are applied

In order to better understand the scope of demand-side strategies, the following section presents a framework outlining three primary areas for discussion of demand-side strategies: the variety of available action strategies, the realm of targeted traveler choices, and the variety of program applications.

The basic framework for how these concepts work together is presented in Figure 1. Essentially, in considering demand management programs:

> *A variety of **demand-side strategies** are implemented in order to impact the **travel choices** of individuals and organizations, in the context of a wide array of **application settings**.*

Further detail on each of these three areas is provided below, and illustrated in Figure 2 on the following page.

Demand-Side Strategies. These are the actual strategies designed and implemented by organizations with a role to play in mitigating traffic congestion, including state/regional/local governments, employers, special event managers, and many others. Organizations frequently tailor packages of both general strategies and targeted strategies to facilitate the most appropriate blend of efficient traveler choices.

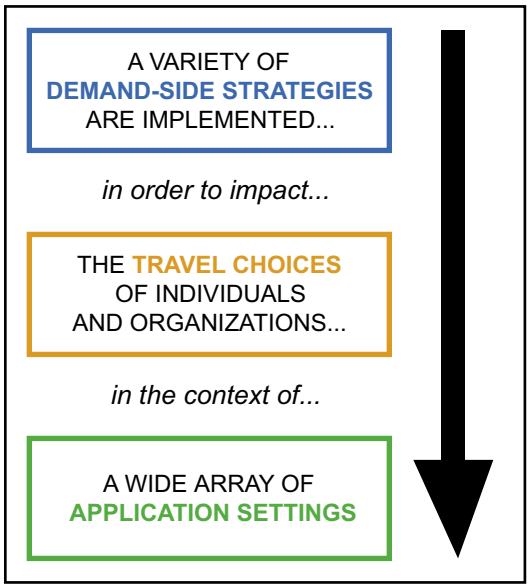


FIGURE 1: THE THREE CORE ELEMENTS OF DEMAND-SIDE STRATEGIES

Traveler Choices. These are the key travel choices made by individuals and organizations that collectively impact the efficiency and performance of the transportation system. Elements include both day-to-day choices about travel mode, departure-time, and travel route, as well trip reduction choices (i.e., telework) and more fundamental residential and business location choices.

Application Settings. Demand-side strategies impacting traveler choices are tailored for a wide range of different application settings, each addressing different trip types or travel market segments. Examples are shown in Figure 2, along with some of the case studies included in this document.

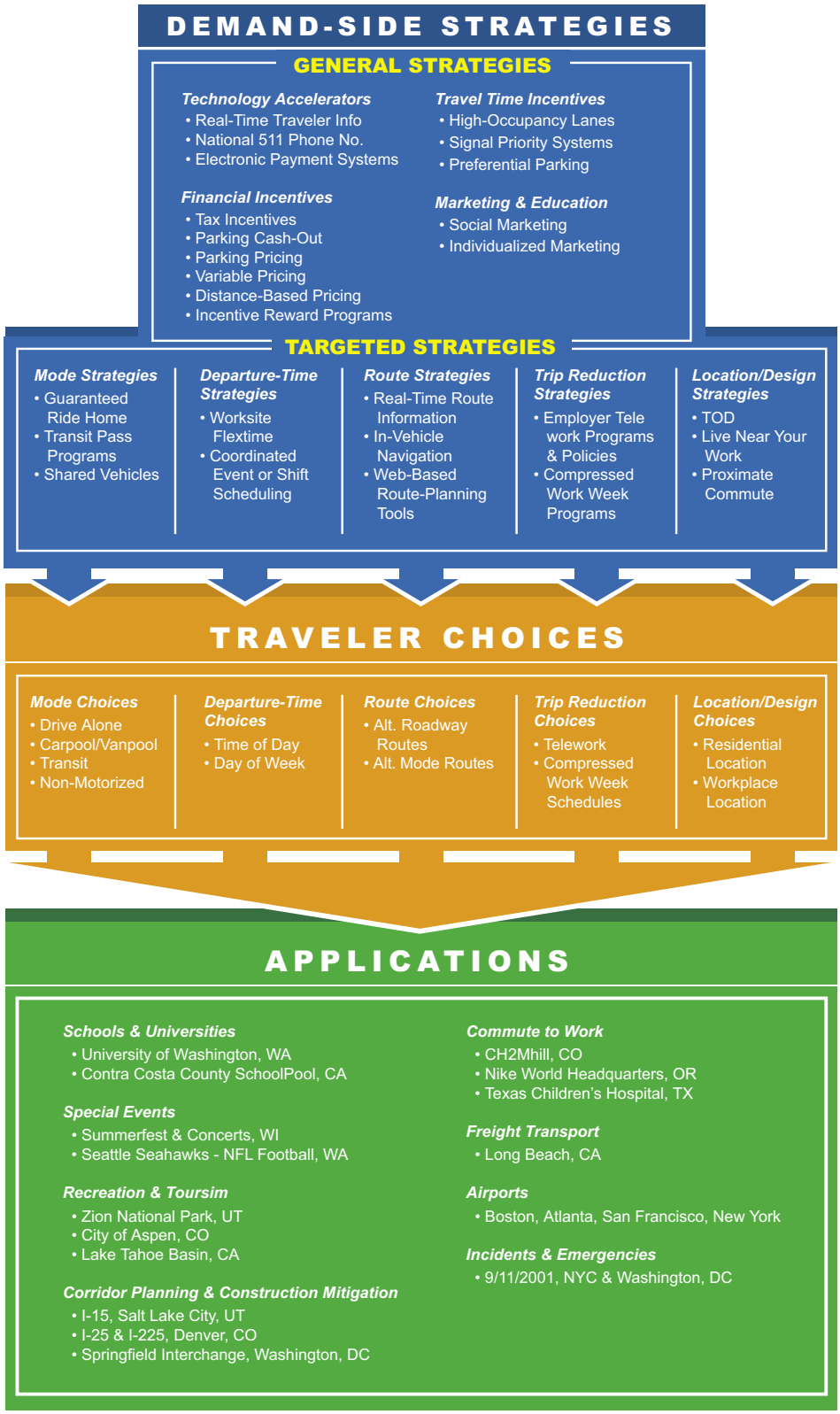


FIGURE 2: THE THREE CORE ELEMENTS OF DEMAND-SIDE STRATEGIES

DEMAND-SIDE STRATEGIES

this section describes the scope of programs and policies implemented by organizations to impact the demand for travel

These are the on-the-ground strategies designed and implemented by organizations with a role to play in mitigating traffic congestion, including state/regional/local governments, transportation management associations, non-profit transportation services providers, transit agencies, employers, special event managers, property managers, and many others. Action strategies can include "general" strategies that have a broad impact on a variety of travel choices. For example, financial incentives can be used to impact travel choices in a variety of ways. In addition to the general strategies available, there are also many "targeted" strategies that focus on a specific travel choice. For example, implementation of workplace "flextime" policies is a demand-side strategy specifically targeting travel departure-time choices. Organizations designing and implementing demand-side strategies frequently tailor appropriate packages of both general and targeted action strategies to facilitate the most appropriate blend of traveler choices.

General Strategies

"General" demand-side strategies impact the full range of traveler choices – from mode choices to departure-time choices and route choices. Ranging from infrastructure investments like high-occupancy vehicle lanes and preferential parking spaces, to more programmatic investments like tax-based incentives, these broad-based, general strategies often work in conjunction with the targeted strategies described below. The full range of general demand-side strategies are described in greater detail in the sections below, and are organized in four primary categories:

- **Technology Accelerators**
- **Travel Time Incentives**
- **Financial Incentives**
- **Marketing & Education**

Targeted Strategies

Often complementing the more broad-based, general demand-side strategies, an array of demand-side strategies are targeted to specific traveler choices – such as choices regarding travel mode or trip departure time. These targeted strategies are described in detail in the sections below, and are organized around the five primary categories of choices that affect overall transportation demand:

- **Mode Strategies**
- **Departure-Time Strategies**
- **Location/Design Strategies**
- **Route Strategies**
- **Trip Reduction Strategies**

General Strategies

General demand-side strategies impact the full range of traveler choices – from mode choices to departure-time choices and route choices.

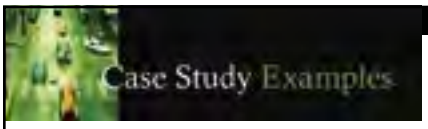
Technology Accelerators

Advances in technology are quickly accelerating the ability of transportation organizations to implement effective demand-side strategies. Significant investments in intelligent transportation system (ITS) infrastructure throughout the country are yielding increasingly precise, real-time information about transportation conditions (i.e., current traffic congestion, transit vehicle locations and wait times, etc.), and increasingly user-friendly and robust pre-trip travel planning tools – all of which are making it easier for travelers to make smart transportation mode, route, and departure-time choices. Additionally, rapid advancements in broadband and wireless internet connectivity are making trip reduction strategies, like telework and e-commerce, viable for larger segments of society. While ITS hardware and software technologies will continue to improve – demand-side strategies play a critical role ensuring that advances in transportation information technology translate into more efficient mode, route, and departure-time choices by the users of the transportation system. By developing partnerships with employers, property developers and managers, residential districts, transportation providers and others, organizations that design demand-side programs can ensure full integration of technology accelerators and other complementary demand-side strategies (i.e., financial incentives, travel-time incentives, etc.). Specific technology applications accelerating the scope of demand-side strategies include:

- **Real-Time Traveler Information**
  The expanded deployment of intelligent transportation system infrastructure and networks, such as road sensors and video cameras, means that accurate, real-time information about traffic congestion, parking availability, transit arrival times, and more are now available to more and more travelers around the country. Real-time traveler information can be provided through a wide variety of communications mediums, including: (1) websites, (2) telephone systems, (3) wireless devices (cell phones, pagers, PDAs, etc.), (4) information kiosks, (5) variable message signs on roadways, at transit stops, and in parking lots, and (6) in-vehicle navigation systems. In order to reach more people before they make travel decisions, transportation organizations are working with a variety of partners to integrate such real-time traveler information resources into corporate intranets at the workplace, building lobbies and elevators, and residential developments through "internet communities."

By providing better information about current travel conditions, transportation agencies and their partners allow people to make travel mode, route and time choices that best match their individual travel needs. Real-time travel information evaluations show that – armed with real-time travel information – a significant number of travelers alter their original route, departure-time, and even mode choices, reducing the demand for already congested facilities and maximizing the use of underutilized alternatives.

FAST FACTS: According to a 2001-2002 survey of real-time travel information users, 68% of users in Pittsburgh and 86% of users in Philadelphia changed their original travel route, while 47% of users in Pittsburgh and 66% of users in Philadelphia changed their original time of travel as a result of the traffic information. The effect on mode choice was less noticeable, 6% in Pittsburgh and 2% in Philadelphia changed their mode of transportation based on the information provided. (Fekpe, 2003)



REAL-TIME TRANSIT INFORMATION – REHOBOTH BEACH, DE. Summertime parking and traffic problems in the beach town area around Rehoboth Beach, Delaware, are addressed with seasonal bus services including a park-and-ride Beach Bus. Electronic signs placed at the Rehoboth Park-n-Ride, the Rehoboth Boardwalk, and Dewey Beach's Ruddertown complex, provide both scrolling text messages and AVL-based bus arrival time predictions (NextBus, 2002). In the season following installation, "ridership increased over 13 percent from the year before. No additional service hours or miles were operated…" (Hickox, 2002). This notable response pertains to a recreation and tourist oriented rider clientele, and the electronic sign placement may have had an advertising as well as informational effect. (TCRP, 2003)

REAL-TIME TRANSIT & PARKING INFORMATION – ACADIA NATIONAL PARK, ME. The Acadia National Park, in Maine, is visited by an increasing number of people each year, exceeding 2.5 million annually in 2002. In 2001-2002, a partnership between the U.S. Departments of Transportation and Interior, Acadia National Park, and the State of Maine, implemented several real-time traveler information systems to provide more timely and accurate information to visitors regarding the Acadia's Island Explorer free shuttle bus service and on-site parking availability. Components included (1) real-time bus departure electronic message signs, (2) automated on-board "next-stop" announcements on each Island Explorer bus, and (3) real-time parking information made available by website, telephone, and parking status signs.

A visitor survey, conducted near the end of 2002, revealed the following shifts in transportation choices and preferences among park visitors:

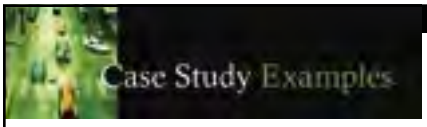
- Real-time parking information impacted decisions visitors made about travel in the park. Of visitors using the parking information, 43% changed the time they visited a destination and 38% changed destinations based on the information.
- Visitors strongly believed in the benefits of the Island Explorer's real-time bus departure signs and the on-board bus announcements. Over 80% found that these technologies made it easier to get around and 69-80% visitors believed they helped to save time.
- Visitors using the electronic bus departure signs and on-board announcements reported that the technologies helped them decide to use the Island Explorer bus (80% and 67%, respectively). 44% of the users of the real time parking information said it helped them decide to use the Island Explorer bus.

(Battelle, 2003)

- **National 511 Phone Number**
  During the 1990s, a variety of organizations established hundreds of travel information telephone numbers across the country to provide real-time and other transportation information. In 1999, the U.S. Department of Transportation petitioned the Federal Communications Commission for a three-digit dialing code to make it easier for consumers to access these travel information services – using the same, simple phone number nationwide. The FCC assigned the "511" number on July 21, 2000. In early 2004, 511 was available in over 20 states/regions, providing users access to advanced traveler information services.

  DID YOU KNOW? By January 2004, the 511 system was available to almost 57 million Americans (19.4%), in over 20 states/regions. In January 2004, 1.8 million calls were placed to the 511 system, with an average length of 1 minute and 46 seconds (for a total of over 3.2 million minutes of call time in the month). (Resource511, 2004)

- **Integrated Electronic Payment Systems**
  Electronic Payment Systems (EPS) allow travelers to pay for transportation services electronically. The advancement of EPS technologies is allowing more widespread – and more integrated – application of electronic payment options for transit, parking, roadway tolls, and other fee-based transportation services. Integrated EPS technologies – from the "smart card" fare payment systems with imbedded microprocessors in each card to the Radio Frequency Identification (RFID) systems at many toll plazas – are quickly reducing many of the barriers to seamless transportation across travel modes and between different transportation providers. EPS technology can allow for seamless payment, with a single fare payment media, across a variety of modes (bus, rail, ferry, etc.), and on a variety of transportation service providers within the same region. Transit agencies and other providers are also exploring adding retail purchase options to fare payment smart cards, allowing transit users convenient purchase of retail goods and services in and around transit stations and stops. In each case, technological advances are enabling more efficient and convenient travel choices.



INTEGRATED ELECTRONIC FARE PAYMENT – WASHINGTON, DC. The Washington Metropolitan Transportation Authority's (WMATA) SmarTrip program was the first public transportation system in the U.S. to adopt smart cards, launching a pilot program in 1999. In June, 2002, WMATA sold its 250,000th SmarTrip permanent rechargeable plastic smart card which holds up to $200.00 in fare value. One third of WMATA Metrorail riders use SmarTrip cards regularly. SmarTrip will be expanded to parking, bus transit, and other regional rail service over a total of 17 transit systems. (APTA, 2003)

DID YOU KNOW? Smart card electronic fare payment systems are now in use by transit agencies in over ten regions of the U.S., including Washington, DC; Atlanta, GA Los Angeles, CA; San Francisco, CA; Orlando, FL; Minneapolis, MN; and others. (APTA).

Financial Measures

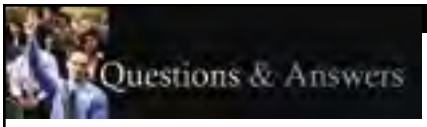
Transportation expenses are a major factor in the travel choices people make everyday. In fact, for the average American household, transportation costs represent 18 percent of total household expenditures (STPP, 2000). As such, a wide range of demand-side strategies are oriented around using financial incentives and targeted pricing systems to encourage efficient travel choices.

- **Tax Incentives**
  The Federal tax code allows employers to provide tax-free transit, vanpool, and parking benefits to their employees. The employer and employee save on taxes, since neither pays federal income or payroll taxes on these benefits. Called "qualified transportation fringe" benefits in the Internal Revenue Code, Section 132(f), these tax incentives are often referred to as "Commuter Choice tax benefits" or simply "commuter benefits." For tax year 2004, transit and vanpool expenses up to $100 per month ($1,200 per year) and qualified parking expenses up to $195 per month ($2,340 per year) are tax-free. The monthly tax-free limits are subject to annual adjustments, indexed to inflation (see www.commuterchoice.com for continually up-to-date information). Providing commuter tax benefits to employees can save payroll taxes for employers. Because the value of the benefit paid to employees is considered a tax-free transportation fringe benefit and not wage or salary compensation, the cost of the benefit is eligible as a business expense and payroll taxes do not apply. There are three primary ways employers can structure the benefit:

  Employer-Paid Transportation Benefits. Employers can pay for their employees to commute by transit or vanpool, up to a limit of $100/month (subject to annual change). With this arrangement, employees get up to $100 in a tax-free transportation benefit. Employers get a tax deduction for the expense and enjoy savings on payroll-related taxes. Employers have found that providing transportation benefits offers significant savings over offering the equivalent dollar value to employees in the form of a salary increase. Employers can also pay for the cost of parking for employees, up to a limit of $195/month (this limit is subject to annual change).

  Employee-Paid, Pre-Tax Transportation Benefits. Employers can allow employees to set aside up to $100/month of pre-tax income to pay for transit or vanpooling (subject to annual change). Employers save money overall since the amount set aside is not subject to payroll taxes. Employees save money, too, since the amount of an employee's salary set aside for transportation benefits is not subject to income or payroll taxes, up to the specified monthly limits.

  Shared-Cost Transportation Benefits. Employers can share the cost of transit or vanpool costs with employees—and everyone can receive valuable tax savings. With this approach, employers can provide a portion of the cost of taking transit or vanpooling as a tax-free benefit and allow the employee to set aside pre-tax income to pay for the remaining amount of the benefit (up to the specified limits).



Q. Are additional tax incentive programs available to employers at the state level?

A. Yes, several states have tax incentive programs to encourage employer participation in providing commuter benefits to their employees. For example, the Maryland Commuter Tax credit provides a 50 percent tax credit, up to $30 per employee per month, for provision of transit passes, vanpool benefits, and reimbursement for carpooling expenses. Other states offering tax incentives to employers include: Georgia, Minnesota, Delaware, Connecticut, Oregon, New Jersey. See the following U.S. EPA document for more information: www.bwc.gov/pdf/fedtax.pdf

FAST FACTS: Although 86 percent of American workers feel that commuter assistance benefits — such as discount transit passes, ride sharing boards, or parking benefits — are beneficial and useful, only 17 percent have access to such assistance through their employers. Eighty-six percent of employees who do not have commuter assistance typically drive alone to work, compared with only 71 percent who do have access to commuter assistance. Surveyed employees who have commuter assistance are almost eight times more likely to use public transportation such as the train, subway or bus than those employees who do not have assistance (15 percent versus 2 percent). (Xylo, 2001)

- **Parking Cash-Out**
  Employers can offer their employees the option to "cash out" of their existing parking space. For example, if Company A subsidizes parking for their employees at $60/month, a parking cash-out program would allow employees to choose from the following options: (1) keep the parking space worth $60/month, (2) give up the parking space and receive $60 extra each month in taxable salary, or (3) receive $60/month in tax-free transportation benefits to pay for transit or vanpooling. Cash-out programs often work best for employers that pay separately for parking and for organizations with parking shortages or demands to expand parking facilities.

FAST FACTS: A 1997 study of eight parking cash out programs in California found that total vehicle trips declined by 17% after a parking cash out option was introduced at various urban and suburban worksites, as shown in Figure 3 below. (Shoup, 1997)

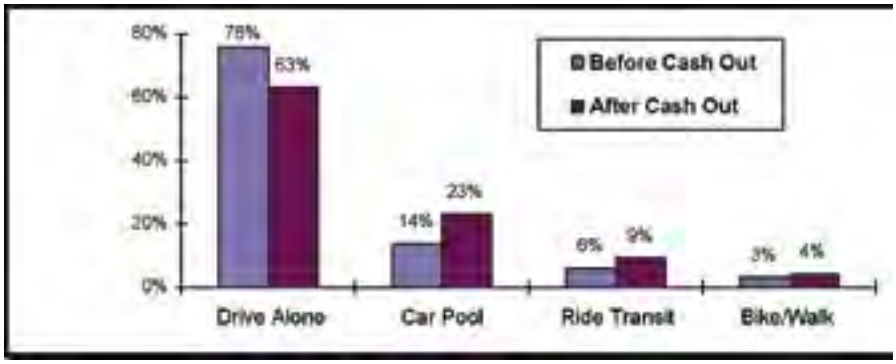
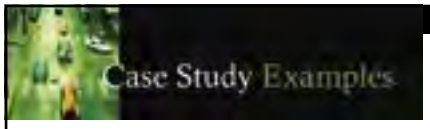


FIGURE 3: CASHING OUT IMPACTS ON COMMUTE MODE (SHOUP, 1997)

- **Parking Pricing**
  Parking pricing entails charging vehicles directly for use of a parking space, and is among the most powerful demand-side strategies. There is a cost (whether in land value, construction cost, maintenance cost, etc.) for all parking spaces. The question is whether these costs are subsidized by developers, property owners, property managers, or others – or whether, and how, these costs are charged directly, in full or in part, to those using the spaces. Well-crafted parking pricing strategies can impact the use of alternative travel modes, in particular where high-quality transit services are available. Variable parking pricing programs (see below for more detail on variable pricing), where parking prices are higher during more congested hours of the day or along more congested routes, assist in managing demand and encouraged the use of less-congested travel times and travel routes. Within particular parking lots, parking managers can discount certain parking spaces (preferably in priority locations, such as next to a building entrance) for use by those arriving in multi-occupant vehicles.

  FAST FACTS: Over 95 percent of commuters park for free at work in the US, and almost all of them drive alone (91 percent of total commuters). For 2002, this yielded an estimated commuter parking subsidy for off-street parking paid by the employer and/or developer of $36 billion. (Shoup, 2003)

- **Variable Pricing**
  Variable pricing changes the price structure of toll roads, bridges, parking lots, and other congested transportation facilities in order to provide incentives for using the facilities in uncongested times or by different modes. On variable priced toll roads, toll rates are structured such that higher prices are assessed based upon time of day concurrent with typical or even actual periods of congestion. Despite the nature of the program, tollway users will experience higher charges during the peak periods and lesser charges during off-peak or shoulder periods. The effect of variable pricing on toll facilities is to: 1) help divert some traffic from the peak period to the shoulders of the peak period, and, 2) provide a cost-based encouragement for the use of transportation options (such as transit and ridesharing). Shifts to either off-peak periods or other transportation options will likely reduce the overall congestion on the facility, and, reduce the need for additional capacity on the toll facilities.



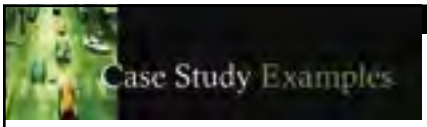
VARIABLE-PRICED TOLLS – LEE COUNTY, FL. Lee County is using variable-priced tolls to mitigate congestion on two county bridges by spreading traffic away from the peak period "rush hour." In the "shoulders of the peak period" (6:30 – 7:00 am, 9:00 – 11:00 am, 2:00 – 4:00 pm, and 6:30 – 7:00 pm), patrons received a 50% discount on the bridge toll if they utilize the bridge's electronic toll collection system. According to a 1999 telephone survey, half of respondents indicated they always or sometimes considered the toll discounts prior to making a trip across the bridges. As a result of the program, use of the bridges increased in the off-peak times and decreased during the peak periods. Analysis indicated that the travelers who modified their travel plans were more likely to be retired or working part-time. The survey results indicated that commuters were less likely to modify their schedules as a result of variable pricing, and that the program appears to have a greater impact on shopping trips. (Burris, 2000)

FAST FACTS: Over forty-five projects in fifteen states have investigated and, in some cases, begun implementation of pricing programs. In Hudson County, NY, variable pricing on existing toll bridges increased transit usage and reduced peak-period traffic by 7 percent. On the New Jersey Turnpike, up to 15 percent of peak-period traffic was reduced by variable pricing. Variable tolls on the State Route 91 facility has increased three-or-more person carpools. (FHWA, 2004)

- **Distance-Based Pricing**
  Distance-based pricing involves shifting automobile expenses that are often fixed monthly or annual costs, such as automobile insurance or vehicle registration, to expenses that vary according to how much the vehicle is driven. Distance-based pricing strategies are designed to directly tie more types of automobile expenses (i.e., in addition to fuel expenses) to the number of miles driven. Distance-based pricing programs may include (1) pay-as-you-drive automobile insurance, (2) mileage-based vehicle registration fees, and (3) mileage-based vehicle purchase taxes.

DID YOU KNOW? Progressive Insurance became the first insurance company in the United States to offer mileage-based vehicle insurance when it initiated service in Texas in 1999. Not only does Progressive charge per mile, but the company also uses a Global Positioning Satellite (GPS) system to charge motorists more when they drive under higher risk conditions. In 2004, GMAC Insurance and OnStar teamed up to offer mileage-based insurance discounts to OnStar subscribers in four states. Under the new program, vehicle owners with active OnStar accounts may be able to save from 5 to 40 percent on their car insurance, depending upon where they fall within seven mileage categories. (OnStar, 2004)

- **Incentive Rewards Programs**
  Reward-based incentive programs use financial and recognition rewards to encourage travelers to try and to maintain efficient transportation choices. There a wide variety of ways incentive reward programs are structured: (1) direct cash or gift certificate rewards offered to travelers for efficient travel choices, either on a regular basis or through periodic prize giveaways, (2) points-based systems for use of efficient travel choices, much like airline frequent flier programs, (3) extra time off of work, or similar workplace-based rewards, and (4) recognition of travelers or sponsoring organizations in newspaper ads, award ceremonies, etc. Reward-based incentive programs are sponsored by organizations at many different levels, from single-site employers to federal agencies. For example, the Best Workplaces for Commuters℠ program, established by the U.S. Environ-



INCENTIVE PROGRAMS – NIKE. Nike, a footwear manufacturer headquartered in suburban Portland, has an extensive commuting program that includes two types of carpooling incentives. First, carpools have reserved parking areas until 10 AM. Second, carpoolers are eligible, along with all other non-single occupant vehicle commuters, for monthly and quarterly prize drawings. Prizes range from gift certificates in increments of $25, $50, of $100 for company store or local retailers to $400 for mountain bike purchase or "getaway" weekends. Nike's SOV rate in 1992 was 98%. Since moving WHQ and implementing the Nike Buck and TRAC programs, Nike's SOV rate has reduced to 78%. 10% of employees carpool, 2% bike, 5% use bus and rail and 5% use flextime.

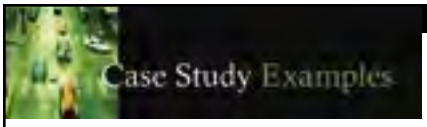
mental Protection Agency (EPA) and the U.S. Department of Transportation (DOT), publicly recognizes employers whose commuter benefits reach a National Standard of Excellence. EPA and DOT also recognize entities other than employers, such as business parks, downtown districts, or shopping malls, which provide and administer to each of the district's employees a commuter benefits program that meets the National Standard of Excellence. For more information, visit: www.bwc.gov.

Travel Time Incentives

Increases in congestion levels around the country are creating longer and longer travel times. The average driver in the country's 75 largest cities experienced about 26 hours of travel delay due to congested driving conditions in 2001. In addition to an overall increase in average travel times, travel time "reliability" has also decreased, with crashes, vehicle breakdowns, weather, special events, construction and maintenance accounting for about 50 percent of all delay on the roads in 2001 (TTI, 2003). As such, a variety of demand-side strategies are oriented around providing travel time incentives to encourage efficient travel choices. These demand-side travel time incentives address both overall travel time savings and improved travel time reliability.

- **High-Occupancy Vehicle (HOV) Lanes**
  HOV lanes are exclusive roadways or lanes designated for high-occupancy vehicles, such as buses, vanpools, and carpools. The facilities may operate as HOV lanes full time or only during the peak periods. HOV lanes typically require minimum vehicle occupancy of two or more persons. However, in some locations, occupancy requirements have been increased to prevent congestion on the HOV lane. Support facilities, such as park and ride lots and transit centers with direct access to the HOV lane, are important system elements to increase facility use. HOV lanes may also be used to provide bypass lanes on entrance ramps with ramp meter signals. Keys to the success of lanes include location (areas of high congestion do better); enforcement; interagency coordination; synergy with parking policy, trip reduction ordinances, and transit and ridesharing programs; public and policy-maker support; and education and marketing. A related concept, high-occupancy toll lanes, or HOT lanes, allow single-occupant vehicles to utilize HOV lanes for a fee. HOT lanes can expand the range of travel choices available to all users and even help articulate the perceived "value" of HOV lanes to transit, vanpool, or carpool travelers able to use the same lanes at free or reduced rates. Revenues generated through fees paid by single-occupant vehicles on HOT lanes can also bolster ongoing funding for transit and ridesharing services along a HOT/HOV route.

FAST FACTS: There are more than 2,500 lane-miles of HOV facilities in the U.S. and Canada. This is expected to double within the next 25 years. One of the first HOV lanes, the I-10 HOV lane in southern California, known as the "El Monte Busway", was opened in 1973 as a dedicated busway and later opened to carpools of three or more people. In 2002, the single El Monte HOV lane carried more people than three regular general purpose lanes during peak periods, and, saved users an average of 20 minutes over the eleven mile distance. On average in southern California, HOV lane users saved more than half a minute per mile compared to the general purpose lanes. (CA DOT - District 7, 2003)



BUS SIGNAL PRIORITY SYSTEMS – INTERNATIONAL EXPERIENCE. "Transit signal priority (TSP) installations in England and France have shown a 6 to 42% reduction in transit travel time, with only 0.3 to 2.5% increases in auto travel time. In North America, Toronto, Edmonton, Charlotte, Portland, Chicago, and Los Angeles, among others, have installations in place. In Toronto, for example, average transit signal delay reductions of between 15 and 49% using TSP has justified expansion to over 300 signalized intersections (15% of total) along four bus and five streetcar routes, all in mixed traffic. Other TSP deployments include a 2-mile stretch in Cicero, IL on Cermak Road that is the site of an Illinois Department of Transportation demonstration using wire loops at 10 signalized intersections. Chicago Transit Authority and suburban PACE buses, using transponders and absolute TSP, realized an 8-minute trip time versus 12 minutes before TSP (a 33% reduction). In Los Angeles, two projects demonstrated application of TSP in conjunction with service restructuring (Metro Rapid) at approximately 100 signals along of each corridor (14-16 miles). Results indicated an average 8% decrease in overall bus running time, and a 35% reduction in bus delay at signalized intersections." (ITS America, 2002)

- **Transit / HOV Signal Priority Systems & Queue Jumps**
  Queues at either arterial intersections and/or ramp meters (signals that manage access to freeways from arterials) can significantly lengthen travel times for all travelers. When compounded with the need to make stops, signal delays often result in unacceptably long travel times for potential bus riders, carpools, and vanpools. Many metropolitan areas have implemented signal priority systems and queue jumps as one means of addressing signal delay for multi-occupancy vehicles, providing a significant improvement to travel time and/or travel time reliability for transit users, vanpoolers, or carpoolers. These demand-side strategies provide a travel time incentive for the use of high-occupancy travel modes – or the use of underutilized travel routes/times.

  FAST FACTS: The Minnesota Department of Transportation conducted a study to evaluate the effectiveness of its extensive ramp metering system, including shutting the system down. The study showed that ramp metering decreased total travel time by 24% in heavy congestion and 46% in typical traffic. Without HOV bypass lanes, ramp metering imposes a delay on buses and carpools. With HOV bypass lanes, overall travel time delay can be reduced by up to 62% in heavy congestion due to 1) reduction of freeway traffic due to ramp metering, and, 2) no travel time delay on the ramps. (MN DOT, 2002)

- **Preferential Parking**
  This strategy reserves priority parking spaces within a parking lot for those arriving by carpool or vanpool, or even those arriving during less-congested times of the day. "Preferred" parking could include (1) covered parking that protects people and cars from the weather, (2) an assigned parking space near the building entrance, (3) a level-one spot in a multistory parking garage, or (4) priority position on a parking space waiting list. Although designating preferred parking areas is most effective where parking demand meets or exceeds supply, many travelers with abundant parking still enjoy parking closer to the building or in a designated parking space.

FAST FACTS: The City of Aspen, Colorado, provides a variety of demand-side transportation strategies to preserve the physical environment and to control future traffic impacts on the community. In order to encourage carpooling, vehicles with more than three people entering the downtown area can stop at a kiosk and receive a Carpool Parking Permit that allows that vehicle to park in a designated area free of charge all day. In 2001, approximately 16,000 daily permits were issued. Coupled with the high-occupancy vehicle lanes, the distribution of these permits is one of the most successful incentives to rideshare.

Marketing & Education

A critical element of successful demand-side strategies is often a well-designed and executed marketing and education program. Even in communities where high-quality transportation mode, route and time choices are currently available, travelers who remain unaware that these choices exist, or unconvinced that these choices are viable and/or reliable, even modest shifts in travel behavior and transportation efficiency are unlikely. Transportation marketing programs, at their most basic level, are designed to do one of three things: (1) increase awareness of available transportation choices, (2) encourage travelers to try new, more efficient travel choices for the first time, or (3) increase or maintain the frequency that people utilize more efficient travel modes, routes or times. Educational programs are designed to make travelers more aware of available transportation choices, and more aware of the specific facts related to travel choices – such as travel costs for different travel modes, travel times at different departure times, etc. Several specific strategies are emerging at the forefront of demand-side marketing and education strategies:

- **Social Marketing**
  Social marketing campaigns are increasingly being used by organizations around the country to encourage voluntary, socially-beneficial behavior change. "Social marketing is the use of marketing principles and techniques to influence a target audience to voluntarily accept, reject, modify, or abandon a behavior for the benefit of individuals, groups, or society as a whole" (Kotler, 2002). Using techniques similar to marketing commercial goods and services, various organizations have used social marketing techniques to encourage environmentally-friendly landscaping techniques, increase the use of seat belts and child safety seats, promote safe bicycling and the use of bike helmets, and champion enhanced exercise and physical activity. Similar approaches are increasingly being used to encourage voluntary changes in travel behavior, from reducing the number of trips made by single-occupant automobile to encouraging travel at off-peak travel times.

FAST FACTS: In 1993, North Carolina launched the "Click It or Ticket" campaign to increase seat belt use throughout the state. A social marketing campaign touted the benefits of seat belt use in conjunction with communicating a $25 fine for violations (fine revenues went to local schools). Before the campaign, only 65% of North Carolinians used seat belts. By 2000, seat belt use had jumped to 84%, among the highest rates in the nation. Highway fatalities and injuries were cut by 14%, and statewide, auto insurance rates fell. The U.S. Department of Transportation called the campaign a "model for the nation," and it has since been replicated by states across the country. (Kotler, 2002)

- **Individualized Marketing**
  Individualized marketing – sometimes referred to as dialogue marketing – focuses marketing efforts and financial resources on a targeted group of individuals or households, working on a one-to-one level to provide tailored information about available transportation choices and small incentives to encourage individuals to try new options. In April 2004, the Federal Transit Administration (FTA) selected four communities for a pilot individualized transit marketing project: Bellingham, WA; Cleveland, OH; Sacramento, CA; Triangle Park, NC. "The FTA's pilot project is based on personalized, individual marketing of potential commuters who might consider using public transit, but need more information. Transit agencies in the pilot communities first identify a neighborhood (approximately 600 households) with existing transit service and those residents are contacted in writing to determine if they are interested in learning more about travel options. Interested residents are then contacted by phone to determine if they would like information on transit, bicycling or walking. The outreach continues until residents have enough information to ensure their comfort level with trying different modes of transportation. In a few cases, bus operators make 'home visits' to personally discuss public transportation routes and options with residents." (FTA, 2004)

> FAST FACTS: A UITP (International Public Transportation Association) project conducted in Europe, as well as larger scale individualized marketing programs in Australia, resulted in significant increases in transit ridership. The pilot project in Europe resulted in a 10 percent reduction in car usage in the targeted area, while the large-scale individualized marketing efforts in Australia yielded up to 14 percent reductions. The first U.S. pilot project in Portland, Oregon, reduced car travel by 8 percent in the first area selected for the pilot, and resulted in a 27 percent increase in travel by carpool, vanpool, transit, bicycling and walking in that same area. (FTA, 2004; Australian TravelSmart, www.dpi.wa.gov.au/travelsmart/)

Targeted Strategies

Often complementing the more broad-based, general demand-side strategies, an array of demand-side strategies are targeted to specific traveler choices – such as choices regarding travel mode or trip departure time. These targeted strategies are described in detail in the section below, and are organized around the five primary categories of choices that affect overall transportation demand.

- **Mode Strategies**
- **Departure-Time Strategies**
- **Location / Design Strategies**
- **Route Strategies**
- **Trip-Reduction Strategies**

Mode Strategies

The following demand-side strategies specifically target the choices of travel mode, from driving alone to bicycling to using transit:

- **Guaranteed Ride Home**
  Guaranteed Ride Home (GRH) programs, sometimes called emergency ride home programs, provide those who do not drive into work, or other supported destination, with

a free ride home in cases of emergencies, unplanned overtime, or other unexpected issues. Rides are often provided by taxi, but GRH can also be supported through rental cars, company fleet vehicles, or other alternatives. Often sponsored by local/regional governments, or by employers, GRH programs provide a back-up travel option to prevent travelers using alternative travel modes from being stranded at their destination.

> FAST FACTS: In a 2003, survey the Artery Business Committee Transportation Management Association in Boston found that seven percent of commuters who used to drive alone switched to transit once they found out that there was a GRH service available. Metropolitan Washington's Council of Governments (MWCOG) GRH program is listed as a transportation control measure in the area's state implementation plan (SIP). MWCOG estimates that by 2005, its GRH program will eliminate 0.76 tons per day of NOX, at a cost of $8,800 per ton of NOX reduced. (Todreas, 2004)

- **Transit Pass Programs**
  Transit pass programs provide subsidized or free passes to travelers for the use on community transit and/or regional rail, bus, ferry or shuttle transit services. Free transit passes provide an incentive for "first time" users to try using transit and simplify the fare payment process..

> FAST FACTS: When employees in downtown Ann Arbor, Michigan were provided a discounted or free transit pass (depending on the level of employer involvement), the estimated effect was a 9.2% increase in daily bus trips and a 3.5% daily decrease in the number of private vehicles coming into downtown between 2000 and 2001. (White, 2002)

- **Shared Vehicles**
  Shared vehicles provide a flexible option to travelers who rely primarily on non-motorized and public transit travel, yet at times require a vehicle for special trips, such as grocery shopping or trips to rural areas, or to get from the transit station to their final destination. Shared vehicle concepts include:

  - Car Sharing: Member based programs offer 24 hour access to a fleet of vehicles (cars, vans, trucks) within a city or neighborhood. Vehicles are reserved and used for just a few hours or up to a week. Most programs offer vehicles at an hourly and mileage based rate, with prices including gas, insurance, parking and maintenance. Several vehicles are generally located at convenient locations throughout the city
  - Station Cars: Similar to the car sharing concept; small, low emission vehicles are available at transit stations, helping people get from the train to their final destination, used daily for the commute or on an as needed basis.

> FAST FACTS: According to researchers at the University of California at Berkeley tracking City CarShare, a San Francisco Bay area car-sharing organization, 30 percent of users have sold one or more of their privately owned vehicles and City CarShare is saving 13,000 miles of vehicle travel, 720 gallons of gasoline, and 20,000 pounds of carbon dioxide emissions in the Bay area. (City CarShare, 2004)

Departure-Time Strategies

The following demand-side strategies specifically target trip departure-time choices:

- **Worksite Flextime**
  Worksite flextime allows employees to set their own arrival and departure time to/from work – within established time boundaries agreed to by their employer. This strategy can influence travel in several ways. In congested areas, it may encourage employees to avoid the most congested travel times, reducing the demand on roadway and/or transit systems during peak-demand periods. Furthermore, flextime programs often provide employees with the schedule flexibility sometimes needed to coordinate carpools and vanpools.

  FAST FACTS: From a Federal Transit Administration report on the potential impacts of flextime programs on peak-period traffic demand: "At Bishop Ranch in California, flextime policies [were] successful in shifting employee arrival times to earlier periods. A survey of 14,800 employees between 1988 and 1990 showed the percent of employees starting work before 7:00 a.m. increased from eight to 17 percent, and the percent starting work after 9:00 a.m. increased from one to 9 percent. Departure peaking also has been reduced. The percentage of workers leaving before 4:00 p.m. increased from 12 to 17 percent. The employer flextime programs were instituted as part of a broad demand management program for the area, as well as a local trip reduction ordinance encouraging reduction of peak hour vehicle trips." (FTA, 1992)

- **Coordinated Event or Shift Scheduling**
  Scheduling the coordination and staggering of traffic to reduce the number of vehicles arriving and leaving a site at one time. This can apply to event venues, specific worksites or office parks with severe traffic congestion.

  FAST FACTS: Near downtown Milwaukee, Summerfest, an annual, eleven-day outdoor music festival, attracts approximately 100,000 patrons per day and over 1 million annually. Since parking on-site is limited near the venue, alternative means of providing transportation and informing festival visitors with traffic, alternative route and parking information were essential. Local ridership data for Year 2000 showed that approximately 25% of the total attendance used bus transportation.

Route Strategies

Travelers making day-to-day decisions regarding available travel routes generally use a combination of information resources to determine the quickest, or most reliable, route option. Many commuters listen to television and radio reports of traffic conditions. Others explore real-time, web-based travel-speed maps. Some simply pursue alternate routes when their normal route is unusually congested. The role of demand-side route strategies is to get the most accurate, timely information on travel conditions to people before they end up on congested facilities – allowing them to select less-congested routes and avoid "adding to the problem" by using already congested routes. Demand-side route strategies can apply to roadway, transit and other travel route alternatives.

- **Real-Time Travel Route Information**
  More and more areas around the country are launching real-time travel route information resources for area travelers. Using web-based maps, en route variable message signs, wireless updates to mobile devices, and other communications mediums – travelers are better able to make the most efficient route choice, and better able to make that choice before they end on a congested roadway or transit facility. Real-time, web-based traffic maps, like the Georgia Navigator system shown in Figure 4, often use a color-coded system to display travel speeds, warning indicators to show current incident locations, and hotlinks to connect users to live camera images of existing traffic conditions (where available). Organizations implementing comprehensive demand-side strategies are working with employers, property developers and managers, and others to integrate these real-time tools into corporate intranets, lobby kiosks, and others medium – in order to ensure that people can access this information conveniently.

FIGURE 4: GEORGIA NAVIGATOR REAL-TIME TRAFFIC MAP. www.georgia-navigator.com

DID YOU KNOW? The Utah Department of Transportation's CommuterLink, a real-time, web-based traveler information system that was operational for the 2002 Salt Lake Winter Olympics, is based on the Georgia Department of Transportation's Navigator system – which was used during the 1996 Summer Olympic Games.

- **In-Vehicle Navigation Systems**
  In-vehicle navigation systems are currently available in a variety of automobiles currently on the market for sale, lease and rent. These systems generally provide drivers with route guidance, vehicle position, and regional points of interest information. Historically, in-vehicle systems have relied on static data about travel times for each road segment to calculate the shortest travel time from where the vehicle is located to a point the driver inputs as the destination. As the collection and dissemination of real-time travel information – and the availability and affordability of regional broadband wireless networks – both improve, in-vehicle navigation systems will be able to provide drivers of private automobiles and transit vehicles real-time route guidance. Such guidance will encourage travelers to take advantage of underutilized travel routes and avoid non-recurring congestion caused by incidents and other emergencies.

FAST FACTS: Telecommunications companies are launching region-wide, broadband wireless services in cities around the country. The expansion of region-wide broadband wireless will expand the capacity to deliver real-time traffic data and other information to vehicles moving throughout a region. Telecommunications companies initiated service in Washington, DC, and San Diego, CA, in 2003. Service will expand to other major metropolitan areas throughout 2004 and 2005. (Baig, 2004)

- **Web-Based Route-Planning Tools**
  A variety of companies provide web-based travel route planning tools for roadway trips, and an increasing number of transit agencies are offering similar services for transit riders. These tools allow users to enter trip start and end locations (along with desired departure times or en route services, in some instances), and process recommended travel routes and forecast travel times. As these tools evolve, multi-modal travel route planning and the capacity for using real-time travel information to suggest less-congested alternate routes or modes is likely to emerge.

Trip Reduction Strategies

The following demand-side strategies are designed to reduce the need for some trips altogether:

- **Employer Telework Programs & Policies**
  Employers establish telework programs and policies at the worksite in a wide variety of ways – from structured, formally-implemented telework programs and policies to more informal telework arrangements established between individual employees and their direct supervisors. In many areas, transportation organizations – from metropolitan planning organizations to transportation management associations – have well-established telework support programs to assist employers in setting up appropriate telework systems and policies.

FAST FACTS: In a 2001-2002 employee survey, AT&T found that "AT&T teleworkers again reported that they gain about an extra hour of productive time each day at home, adding up to at least an estimated $65M in business benefit each year... Teleworkers appear to get more accomplished not only because of time saved by not commuting - that is, increased productivity on a per teleworker or per workday basis - but also because of increased productivity per unit hour. The ability to focus and manage time is critical for knowledge workers, and little distractions in the office add up to big costs in productive time." (Roitz, 2002)

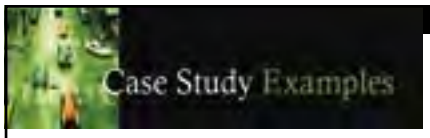
- **Employer Compressed Work Week Programs & Policies**
  Employers in a variety of setting establish compressed work week programs, offering employees the option to work the same number of work hours in fewer days per week, or per pay period. Development of compressed work week programs and policies involves a variety of partners, including company management and human resources staff, employee labor unions, and regional transportation organizations.

FAST FACTS: A 1991 study of compressed work week programs in Ventura County, CA, reports that the program was associated with a decline in single-occupant vehicle trips to work, from 82 percent to 77 percent. (Freas, 1991)

Location / Design Strategies

The location of land uses in a community – from homes, to businesses, to retail establishments –directly impacts transportation demand. Over time, as cities evolve, changes in land use development patterns lead to changes in trip-making patterns. In some areas, urban growth has led to increases in trip lengths and growth in the average number of vehicle trips per day. In other areas, a variety of land use location and design strategies have led to reductions in trip lengths and vehicle trip generation – contributing to congestion mitigation advances (R.H. Pratt Consultant, 2003). Communities, businesses, and individuals make land use location and design decisions based on a wide range of economic, social, environmental, and other factors. Transportation accessibility is also a factor in many of these decisions, and a variety of location/design demand-side strategies are available. Several specific programs are described below. A more extensive discussion of the impacts of land use and site design strategies on travel patterns is available from the Transportation Research Board: Traveler Response to Transportation System Changes: Chapter 15 Land Use and Site Design (R.H. Pratt Consultant, 2003).

- **Live Near Transit Mortgage Incentives**
  Live near transit programs offer mortgage incentives to encourage residential location near transit facilities. The programs recognize that household transportation expenses can be lower for residences well served by public transportation, and allow homebuyers to use these transportation savings as additional borrower income in qualifying for a home mortgage. For example, Fannie Mae sponsors the Smart Commute InitiativeTM in pilot cities across the country. In several of the pilot cities, the Smart Commute Initiative involves partnerships with regional planning organizations, transit agencies, and private companies to provide complementary services supporting the use of public transportation (i.e., discounted transit passes, shared-car membership programs, etc.). Fannie Mae also supports the Location Efficient Mortgage® program in four pilot cities nationally.



WASHINGTON REGIONAL SMART COMMUTE INITIATIVE. In Washington, DC, the Smart Commute Initiative offers mortgage incentives to households locating within one-quarter mile of a public bus stop or one-half mile of a public rail station. Through the program, participating lenders will add a portion of the potential transportation savings to borrowers' qualifying income - an addition of $200 per month for one wage-earner households and $250 per month for two wage-earner households (a potential increase in home-buying power for a typical purchaser of a median-priced home of approximately $10,000). Participants also receive discounts on transit passes and lifetime membership in the Flexcar shared-car program. (www.mwcog.org/planning/smart_commute/index.html)

- **Live Near Work Incentive Programs**
  Live near work programs provide incentives for employees to live near their place of employment. Examples include down payment assistance, location efficient mortgages and rent subsidies. By providing housing close to employment, this program can lower the costs of commuting, lessen the pressure on infrastructure, and generate more pedestrian traffic in business districts.

DID YOU KNOW? In 1997 Maryland's General Assembly adopted a series of growth management programs, one of which was the Live Near Your Work Program. The City of Baltimore pioneered the program and continues to partner with area "Live Near Your Work Employers" to provide $2,000 cash grants to home buyers for down payment and/or settlement expenses. (www.livebaltimore.com/homebuy/lnyw.html)

- **Proximate Commute**
  This program involves voluntary, coordinated relocation of eligible employees who work for multi-site employers to the work branch locations closest to their home, reducing commute distances. Rather than having employees commute to distant locations, their employers help them arrange job swaps and transfers to company sites closer to home. In the mid-1990s, the Washington State Department of Transportation worked with Key Bank on a proximate commute demonstration project. A total of 500 Key Bank employees – from 30 individual branches in three counties – were found to be eligible for the program. An initial review found that 83% of the employees lived closer to an average of 10 different branches than the branch where they were presently employed. 85 of the 500 employees enrolled in the program. The result was a 65% reduction in miles traveled. (Giery, 2003)

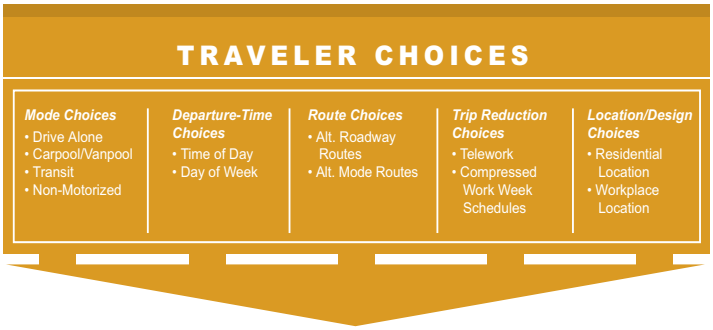
FAST FACTS: In 2002, Boeing undertook a pilot project to itemize the jobs and home addresses of 10,000 of its non-union workers to determine if some could transfer to a plant closer to home. Preliminary research showed that 53 percent, or 42,475, of its workers share a job description with a plant that is closer to their residence. Boeing found that if those employees could be moved, it would reduce commute-related travel by 168 million miles annually, equating to 8 million gallons of gas and 5,000 tons of emissions each year. (Seattle Post-Intelligencer, 2002)

- **Transit-Oriented & Pedestrian-Oriented Design, Mixed-Use**
  A wide range of urban form and design strategies can enhance opportunities for the use of public transit, ridesharing, bicycling, and walking. Focusing a mix of land uses – such as employment, housing, restaurants, services (banking, day care, etc.), retail, and more – in well-designed, pedestrian-friendly developments and/or near transit connections can reduce the demand for vehicle travel and reduce trip distances. A 2002 study in California demonstrated that transit-oriented developments (TODs) can yield 20 to 40 percent higher ridership at an individual transit station for both work and non-work trips, and can increase overall regional transit ridership by up to 5 percent. (Parsons Brinckerhoff).

FAST FACTS: An assessment of the impact of different degrees of land use mix on travel patterns in 57 suburban activity centers found that centers with some on-site housing had 3 to 5% more transit, bike and walk commute trips. Additionally, for each additional 10% of commercial/retail floor space in the activity center, transit and ridesharing increased by 3%.

TRAVELER CHOICES

an outline of the range of traveler choices impacted by demand-side strategies



Traveler Choices

Strategies implemented as part of a demand-side program are designed to facilitate efficient traveler choices.

Individual travelers, families, and businesses all make important decisions that collectively impact traffic congestion. These decisions include day-to-day travel choices, such as travel mode, departure-time, and travel route. They also include decisions to eliminate some travel altogether – for example, by working from home a few days a month or by using internet-based technologies to preclude the need to physically travel to a store, library, or other destination. Finally, individuals and organizations make important decisions about the location of their residence or business – often factoring in transportation-related considerations such as commute to work travel times or ease of access to public transportation services.

This section provides additional detail on five primary traveler choices:

1. **Mode Choices**
2. **Departure-Time Choices**
3. **Route Choices**
4. **Trip Reduction Choices**
5. **Origin / Destination Location Choices**

Mode Choices… "What travel mode will I use for my trip?"

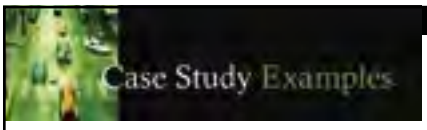
Demand-side strategies target improvements to the availability and viability of real transportation mode alternatives for a full range of travelers, from school-age children through seniors, and for a full range of trip types, from the trip to work to the trip to the corner store. By enhancing the availability of a range of travel mode choices, travelers can select the most appropriate or efficient option for each trip. In many situations, the flexibility and convenience of the single-occupant automobile is the best option. However, for many trips, other mode choices can prove less expensive, less stressful or more predictable.

The Range of Mode Choices:

- **Single-Occupant Vehicle (SOV)**
  A single individual driving an automobile or motorized cycle with no other passengers.

> FAST FACTS: The country's share of commuters driving alone increased by just over 3% from 1990 to 2000 (from 73.19% to 76.31%). From the 2000 U.S. Census, the District of Columbia (40%), New York (56%), Hawaii (67%), and Alaska (69%) remain the four jurisdictions with the lowest drive alone rates. Alabama (85%), Michigan (84%), and Ohio (84%) have the highest drive alone rates. (2000 U.S. Census)

- **Carpool**
  Two or more people sharing a ride in a private vehicle. Carpooling is the most common and flexible way for travelers to share a ride, and often occurs between family members, friends, or co-workers. More informal than a vanpool and more flexible than public transit, carpools generally have two or more passengers who live in the same neighborhood, or along the same route, using a private vehicle to travel to common or nearby destinations. Carpooling often appeals most to people traveling at least ten miles or whose trip takes over 20-30 minutes.

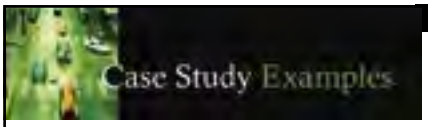


VANPOOLING - PUGET SOUND, WA. Six large, medium and small transit agencies in the Puget Sound region include vanpool service as an integral part of their total service package. In January 2004, King County Metro operated 663 vanpool and 60 vanshare vans, Community Transit ran 210 , Pierce Transit ran 228 , Kitsap Transit ran 89, Intercity Transit ran 77, and Island Transit ran 43. In the Puget Sound area, vanpooling has achieved a 2% market share of the overall commuter market. Among commuters who travel 20+ miles each way, vanpooling has reached a 7% market share. King County Metro's VanShare program provides service to bridge the gap between the commuter and a public transportation hub or terminal (rail station, Park & Ride lot and ferry dock). The agencies specifically look to vanpooling to meet demand in hard-to-serve suburban markets. For more information on vanpooling in the Puget Sound region, contact Syd Pawlowski at King County Metro, 206-684-1535, syd.pawlowski@metrokc.gov.

- **Vanpool**
  A group of seven or more people sharing a ride in a prearranged vehicle. With one or two vanpool participants typically serving as regular drivers, vanpools provide non-stop, point-to-point service. The van's ownership and operating costs are usually paid for by the van riders on a monthly basis. Vanpools typically serve trips of 15 miles or more. Many transportation agencies complement fixed-route bus and rail transit with vanpool services to provide attractive door-to-door travel options for otherwise difficult to serve trips (i.e., suburb-to-suburb trips, trips to low-density office markets, and trips to/from smaller towns or outlying communities).

> FAST FACTS: While the average fare paid by bus passengers in 2001 was $0.74 per unlinked trip, vanpool passengers paid an average of $2.06. As a result, transit operators in the Puget Sound region achieve an 85% farebox recovery of capital and operating costs for their vanpool programs. In 39 cities reporting data on more than one mode to the National Transit Database (NTD) in 2001, vanpools had the lowest cost-per-passenger and cost-per-revenue-mile expense to transportation agencies. (APTA, NTD)

- **Public Transportation**
  Rail, bus, shuttle or ferry transportation services provided to the general public, utilizing a paid driver and administered by public transportation agencies or private-sector companies. Services may operate along a fixed-route on a set schedule, or may utilize more flexible routing and scheduling options. Public transportation services provide critical, high-capacity access to dense-urban areas (allowing for intensified land use development without increased congestion), offer needed transportation services to those without access or unable to drive (including child and the elderly populations), and are increasingly vital to the success of special events (from major events like the Olympic Games, to recurring events like baseball games or concerts). In an effort to preserve high-value environments and enhance visitors experience, public transportation is now a key element of overall mobility and access planning at many of the nation's parks, including Acadia and Zion National Parks.



CHICAGO, IL. The City of Chicago has joined forces with the Chicagoland Bicycle Federation to teach motorists and bicyclists to better share city streets. Along with an ad campaign to show motorists how to share the road, they'll send bicycling ambassadors out to the streets to speak face-to-face with members of the public.
www.biketraffic.org/

USA. In 2003, 500,000 students, parents and community leaders in cities across America joined millions of walkers worldwide to participate in International Walk to School Day.
www.iwalktoschool.org/

FAST FACTS: Public transportation ridership has increased over 21 percent in the last six years (1998-2003), faster than highway or air travel. Every $1 invested in public transportation projects generates $6 in local economic activity, and supports approximately 47,500 jobs. Public transportation is a $32 billion industry that employs more than 350,000 people. (APTA, 2004)

- **Non-Motorized (Walk, Bike, Skate)**
  Includes walking, bicycling, skating or any other mode of non-motorized travel. Often complements other modes of travel. For example, most public transportation trips begin or end with a walking trip, and many users bicycle to/from transit stops. A safe and convenient environment for pedestrians can dramatically increase the number of people walking to offices, stores, or schools during the day. Walking then enables sharing a ride or taking the bus as a realistic travel alternatives.

DID YOU KNOW? In 2000, the bicycle industry generated $5.89 billion in sales. Each year, nearly one billion trips are made by bicycle, and over 40 million American adults ride a bike at least once a month. Bicycling and walking represent 7% of all trips made nationally, yet accounts for 13% of all traffic-related fatalities in the country. (America Bikes, 2003). More than half of the American public (55%) says it would like to walk more throughout the day either for exercise or to get to specific places. When thinking about deciding where to live, having sidewalks and places to take walks for exercise or fun is important to nearly eight in ten Americans (79%), and "very" important to four in ten (44%). Having areas to walk in the neighborhood rates third on a list of seven items asked in the survey, behind feeling safe from crime and the quality of the public schools. (STPP, 2001)

Departure-Time Choices… "What time-of-day or day-of-week will I depart for my trip?"

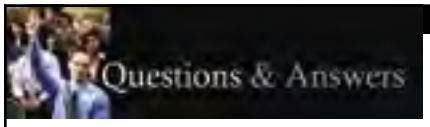
Beyond day-to-day choices about travel mode, travelers also make regular decisions about the time of day, or even day of week, to depart on their trip. Travelers often adjust their travel schedules to avoid rush-hour traffic congestion, to work around childcare or school schedules, or to take advantage of reduced roadway, bridge or transit off-peak pricing discounts. Demand-side strategies use a variety of approaches to facilitate utilization of less-congested travel times, mitigating the length and duration of congested peak periods ("spreading the peak"). The enhanced use of real-time travel information increasingly allows travelers to avoid non-recurring traffic incidents by shifting trips to an earlier or later time.

The Range of Departure-Time Choices:

- **Time of Day**
  Shifting trip departure-times away from congested times of day, to avoid non-recurring traffic congestion resulting from a traffic incident, to avoid traffic congestion caused by weather, or for individual scheduling needs.

  FAST FACTS: The extra time needed for rush hour travel has tripled over two decades. According to the Texas Transportation Institute's (TTI) 2003 Urban Mobility Report, the national average Travel Time Index for 2001 was 1.39 (meaning a rush hour trip took 39 percent longer than a non-rush hour trip). The national average in 1982 was only 1.13, a 26% increase in travel time for a rush hour trip versus a non-rush hour trip. This increasing "rush hour penalty" creates a growing incentive for travelers to take advantage of less congested travel times. (TTI, 2003)

- **Day of Week**
  Shifting trips to less-congested days of the week. In addition to more common "rush hour" times of the day in many urban areas, congested travel conditions in some communities are more frequently linked to certain days of the week. For example, travel to recreation or tourism destinations can be plagued with peak-direction congestion on Friday afternoons and Saturday mornings, followed by congestion in the reverse direction on Sunday afternoons. US 50 over the Chesapeake Bay Bridge, Highway 99 to the Whistler Blackcomb ski area, Route 6 to the Cape Cod National Seashore, and I-70 to Colorado's many ski areas all exhibit this day-of-week congestion.



Q. Do demand-side operations programs require people to change their travel patterns?

A. Absolutely not. These programs simply aim to provide travelers with the broadest range of efficient travel choices, the best information on the choices available and how to use them, and balanced financial incentives for the most efficient alternatives.

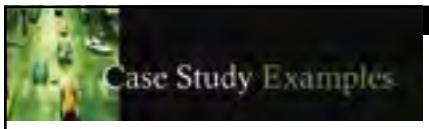
Route Choices… "Which route will I use for the trip?"

Many travelers have several routes available to travel between Point A and Point B. Travelers wisely choose routes that get them where they need to go (including en route stops) based on experience over time that informs them of the most efficient route choices. Some travelers choose the fastest routes, while others choose routes with less-hectic or safer travel conditions. Other travelers alter travel routes from day-to-day as the result of changing travel needs (i.e., trip chaining) or as the result of non-recurring travel delays caused by traffic incidents, roadway construction, or even weather. The collective route choices made by travelers in a region affect the performance of the transportation network ("too many people using the same route at the same time"). Demand-side programs provide travelers with advanced, real-time transportation information in a variety of formats, facilitating traveler utilization of excess roadway capacity on less-congested travel routes, and limiting the magnitude and duration of both recurring and non-recurring travel delays. These strategies can also focus on shifting travel away from residential or other sensitive routes, and can shift demand away from routes with construction related delays.

The Range of Route Choices:

- **Alternative Roadway Routes**
  Shifting the roadway route utilized to travel between destinations, in order to avoid congested facilities and travel on routes with available capacity. Travelers may utilize a variety of traveler information tools – such as real-time traffic information available on websites or en route variable message signs – to determine the best available routes.

- **Alternative Mode Routes**
  Shifting the transit routes utilized in order to avoid system delays or other issues, or shifting the travel mode used (into transit, bike, walk, etc.) in response to delays on roadway systems.



ROUTE CHOICES – CAPE COD NATIONAL SEASHORE. Of the five million annual visitors to the Cape Cod National Seashore today, one-half arrive during a ten-week period in the months of June-August. The type and duration of tourist visits has changed over the past forty years. The two-week to a full month stay that was usual in the 1960s and 1970s has been replaced by shorter trips, usually a two to three day weekend. In order to address the long-range transportation needs of the area, planners developed the Long-Range 25-Year Plan for Alternative Transportation Systems – including transit enhancements and development of intelligent transportation systems to provide both pre-trip and en route travel information services. From the plan: "Pre-trip information can assist a driver map a route, gather information on current roadway conditions, and identify detours around planned construction. Transit users can identify transit routes, schedules, fares, and connections… En-Route Driver Information systems provide real-time information to travelers who have commenced a trip. Information on delays, accidents, weather conditions, and emergency situations can be communicated to the traveling public. Route guidance systems can identify alternative routes that are available to by-pass delays." (Volpe, 2003)

Trip Reduction Choices… "What are my options to reduce the need for some trips?"

The demand for travel is based on the need of customers to move between two points for some purpose, whether to get to work or to the store. "Trip reduction" choices explore alternative ways to "connect" origins and destinations, using technology and other advancements to eliminate the original need for some trips altogether. As an example, "teleworking" connects people to their jobs through the information superhighway, rather than the local interstate highway.

The Range of Trip Reduction Choices:

- **Telework**
  Simply defined, teleworking is working at home or another off-site location, full- or part-time. While employees may be hooked up to the main office via a sophisticated computer network, it's possible to telework with as little as a pen, paper and phone. Jobs are more portable than they once were. Teleworking is increasingly used by employers to reduce the demand for office space and parking space. Additionally, teleworking is often used as a recruiting and retention tool. Across the country, part-time teleworking is on the rise, while trends suggest a gradual decline in the number of people working full-time from home. A 2003 survey by The Dieringer Research Group reported that 23.5 million Americans telework at least one day per month, a growth of 40 percent since 2001. The report found that 42 percent of these employee teleworkers work from home at least one day per week, and 22 percent of the employees work at home daily or nearly every day. (Dieringer, 2003)

  FAST FACTS: 21% of working Americans teleworked in 2001. 58.8% of teleworkers say they work longer hours because they work at home. (ITAC, 2001)

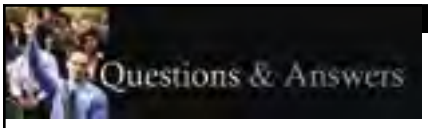
- **Compressed Work-Week Schedules**
  In a compressed work week, employees complete their required number of work hours in fewer-than-normal days per week (or per pay period). This arrangement allows employees to have one day off each week or one day off every other week, depending upon which type of compressed work week program preferred. The two most popular compressed work week schedules are the 4/40 and 9/80 programs, although other variations also exist. These options are described below:

  - 4/40 Program. Employees work four 10-hour days each week, with the fifth day off. To ensure five-day coverage, some employers have half the company take Mondays off and half take Fridays off.
  - 9/80 Program. Employees work 80 hours in nine days, with the 10th day off. This schedule usually translates to eight 9-hour days and one 8-hour day (this shorter day is often the Friday that the employee works). In a company with two major work groups, each group might take off alternating Fridays.

FAST FACTS: A 1995 study of 2,600 Southern California employees, conducted for the California Air Resources Board, found that "employees on compressed work week reduced their net number of trips by an average of 0.5 per week… The respondents using a 9/80 schedule drove an average of 13 fewer miles per week; those using a 4/40 schedule drove an average of 20 fewer miles per week." (Holmes, 1995)

Origin / Destination Location Choices… "How do residential, business, shopping and other location choices impact my travel choices?"

While travel choices cover the range of alternatives about how and when to travel between an origin and destination (decisions that people make every day), individuals and businesses also make more fundamental choices about the actual location of these origins and destinations - and these "location choices" have a significant impact on the demand for transportation. People looking for a new home often consider the length and difficulty of their commute to work in their residential location choice. Companies often consider maximizing access to employee labor markets, or to central freight shipment locations, when making business location choices. Retail establishments often assess area consumer markets and ease of access to their retail location. Additionally, community land use design decisions can integrate a mix of land uses in one area, making it easier for people to access multiple destinations (work, shopping, day care, etc.) in a centralized area. All of these locations choices can have a significant impact on the number of trips people make, the length of these trips, and the viability of making these trips by a variety of travel modes (driving, transit, walking, etc.).



Q. Do these travel choices, such as using transit or adjusting travel times, really work for everyone?

A. No, but even shifting 5-10% of travelers to a different mode or time can have a significant impact on peak period congestion in certain locations. Many travelers in urban areas note that congestion is less severe when area schools are not in session – a prime example of how small shifts in travel patterns can affect overall congestion levels and delay.

The Range of Origin / Destination Location Choices:

- **Residential Location**
  Decisions about residential location, with consideration given to ease of access to adjacent transportation facilities (roadways, transit stations/stops, bike paths, etc.) or to travel distances to key destinations (work, shopping, schools, etc.).

- **Business Location**
  Decisions about business location, with consideration given to ease of access to adjacent transportation facilities, proximity of employee residential locations and commute distances, ease and manner of access to potential customer markets, etc.

FAST FACTS: Quantitative assessments of jobs/housing balance at the sub-regional level have shown that a good balance of jobs and housing can be associated with average commuter trip lengths lower by seven to almost 30 percent, compared to where jobs and housing are out of balance (R.H. Pratt Consultant, 2003).

APPLICATIONS

the application settings for demand-side strategies

Demand-side strategies facilitating efficient traveler choices are tailored for a wide range of different program applications, each addressing different trip types of travel market segments.

1. **Schools & Universities**
2. **Special Events**
3. **Recreation & Tourism Destinations**
4. **Transportation Corridor Planning & Construction Mitigation**
5. **Employer-Based Commute Programs**
6. **Airports**
7. **Incidents & Emergencies**
8. **Freight Transportation**

Schools & Universities

Throughout the United States, driving children to school is as routine as the commute to work. While school bus systems exist for many school districts (particularly rural), they do not always fit student schedules (due to after school activities, etc.) or they are not even offered in some urban districts. Neighbors may form carpools for their children, however, without outside support or guidance, the reach of these carpools may be limited to groups of friends or neighbors that already know each other and that have children in the same school. "School Pool" programs are administered in many communities to share information with parents and assist in the connection of interested parties for sharing a ride. Not only do school pools reduce overall vehicle miles traveled, they also decrease congestion around the schools, which enhances safety and fosters an improved environment for children walking or bicycling to school. Often referred to "safe

routes to school," these programs are underway across the country, in cities of all sizes. The California Safe Routes to School Clearinghouse offers a range of resources and contacts for these efforts: www.4saferoutes.org.

In university or college settings, the physical space for parking and transportation infrastructure is often limited. By making transportation opportunities abundant and flexible in nature, students, faculty, and staff are encouraged to try and eventually rely on alternatives to single occupancy vehicles. Other programs may integrate on-campus housing as part of an integrated transportation and land use strategy designed to reduce travel distances or eliminate the need for some trips altogether. Disincentives, such as an aggressive parking fee structure, often play an integral role in encouraging more efficient travel choices.

Case Study Examples

CONTRA COSTA COUNTY, CA. The county-wide SchoolPool program has providing rideshare assistance and bus passes on local transit for five years.

UNIVERSITY OF WASHINGTON. The University created the "Universal Pass" which provides transportation options for a quarterly fee to faculty/staff.

Special Events

Many communities recognize sizeable special events produce significant impacts to the transportation system. In order to curtail traffic disruptions and congestion related to events – whether they are summer festivals, sporting events or conventions – agency collaborations on traffic management plans are using available assets, including local transit and ITS infrastructure, to better manage demand. FHWA has developed a technical reference entitled *Managing Travel for Planned Special Events.* The reference is intended to serve as a stand-alone tool for transportation practitioners and includes successful case studies for a range of special event types.

King County, in Seattle, developed an internet-based resource for offering ridematching and other services for regional events. The website provides an updated list of upcoming special events, and facilitates ridesharing to the event locations. More information is available: www.rideshareonline.com/eventmatching/logonframepubevent.asp

Case Study Examples

SUMMERFEST, WI. The Wisconsin Department of Transportation demonstrated the effectiveness of "pre-planning" for large events, such as the Summerfest concert festival, attended by over one million people annually.

SEATTLE SEAHAWKS, WA. As a condition of project approval, the transportation management plan for Seahawks Stadium established goals to reduce personal vehicle trips. Based on 2002 results, mode split goals set forth in the plan have been surpassed.

Recreation & Tourism

Unique circumstances can lead to successful implementation of demand-side strategies at recreation and tourism destinations. Typical of the resort areas researched for this guide, maintaining environmental, natural, and aesthetic features of

Case Study Examples

ZION NATIONAL PARK, UT. In order to preserve the unique resources and recreational opportunities of Zion Canyon, the Park instituted a mandatory shuttle system during peak visitation. 75% of Zion's annual visitors utilize the shuttle system.

ASPEN, CO. In this city, the revenue generated from the paid parking program is directly reinvested into demand-side programs and allocated for future transit investments.

the community are of necessary importance for the economic vitality of the area. As part of this guide, information has been collected on strategies to manage traffic that have been implemented in recreational and destination communities. Demand-side strategies typically focus on targeted travelers (i.e. employees, visitors, etc.) to reduce trips during congested travel times. Often demand-side programs are geared towards home-based work trips. However in an area where tourism and seasonal services occur, demand-side strategies might be particularly effective if targeted towards seasonal employees often priced out of living close to their employment center or visitors who are accustomed to paying for services and already expect a unique experience from visiting the area. The case studies highlighted in this guide describe a collection of programs undertaken by various sponsors (i.e. local jurisdictions, transit authority, non-profit organizations) as part of a collective effort for their community.

Transportation Corridor Planning & Construction Mitigation

Planning and preliminary engineering of major corridor investment projects presents significant opportunities for the coordinated integration of demand-side programs. In more and more projects around the country, these programs are being developed as an integrated component of each "build" alternative assessed in the corridor planning process. There are three prime opportunities for integration of demand-side programs into the corridor planning and construction process:

1. **Project Phasing.** In corridors where major capital investments are selected as part of the "preferred alternative," the final implementation of these investments is often 5-10 years down the road. Demand-side programs often take much less time and money to implement, and can provide valuable transportation services in the early years of implementation. Systems management strategies can achieve near-term, incremental improvements to traffic flow. Demand-side measures can enhance available travel choices and establish key partnerships with corridor businesses.

2. **Construction Mitigation.** The (re)construction of major corridor infrastructure projects often takes many years to complete. During this time period, transportation capacity in the corridor is often degraded and access to businesses limited. Demand-side programs provide critical mitigation strategies to reduce the negative impacts of construction, including:
   - Providing traveler information regarding construction activities like ramp closures, and offering details and assistance on alternative travel modes, travel routes and travel times.
   - Working with corridor employers and other businesses to provide traveler information and to develop access alternatives, such as transit, vanpooling, flexible work hours or telework.
   - Working with transportation agencies to adjust existing transportation facilities and services, such as adding temporary HOV lanes or adding additional transit services.

3. **Complementing Build Alternatives.** Demand-side programs often play an important role as a complement to a build alternative, in two key ways:

   A. Maximizing the utilization of build alternatives.Strategies implemented vary, based on the nature of the build alternative. For example:
      - For corridors adding HOV lanes, appropriate strategies might include partnerships with employers for promotion of transit and ridesharing, development of incentives, education and marketing of associated travel time and travel cost savings for HOV lane use, information on lane access times and locations, etc.
      - For corridors adding transit systems, appropriate strategies might include working with employers to improve connections to the transit stops/stations, development of transit pass programs, marketing and education of transit routes, stops and schedules, real-time transit schedule information, etc.

ATLANTA, GEORGIA

   B. Providing enhanced travel choices for trip patterns not well served by the major investment. For example, construction of new general purpose lanes and a rail transit line along a north-south corridor may not provide significant benefits for east-west travel patterns in the area. Transportation management strategies can augment the major north-south investment with systems management strategies to improve traffic flow and demand-side programs to provide enhanced travel choices for east-west trips. These same programs also enhance access to major north-south investments.

Employer-Based Commute Programs

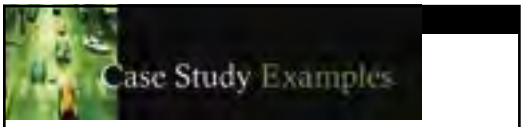
As a travel market, work-related trips tend to reflect the highest percentage of peak-period trips made within a region. Typically, commute trips occur regularly and are sometimes easier to arrange for a consistent alternative to driving alone than other trip types. For this reason, many demand-side strategies are implemented through employer-based and work site specific programs that encourage employees to switch from driving alone to carpooling, vanpooling, or using some other alternate means of travel. Often programs deployed at a work site level encourage employees to ad-

Case Study Examples

T-REX – DENVER, CO. For the Transportation Expansion Project (T-REX) in metropolitan Denver, Colorado, project sponsors have dedicated $3 million to the TransOptions program, a TDM-based construction mitigation program. (www.trexproject.com)

US 101 – SAN LUIS OBISPO, CA. As part of the reconstruction of US 101 in the Cuesta Grade in central California, the San Luis Obispo Council of Governments developed an integrated set of demand-side strategies to enhance mobility during the reconstruction period. The program included increased commuter bus service, special vanpool promotion and subsidies, and carpool incentives. An evaluation of the demand-side programs showed a reduction of about 300 cars per day from the highway, eliminating about 8,000 miles of daily vehicle travel. Average auto occupancy on the highway rose from 1.206 to 1.266. The evaluation showed that the carpool incentives were the most cost effective means among the three programs for removing cars from the highway.

just work schedules or even reevaluate the need to travel (i.e. telecommute). Regional demand-side programs also focus on commute trip reduction strategies that complement local transportation programs and facilities such as light rail, regional bus service, and rideshare programs. As an incentive, employers are typically eligible for tax benefits by providing certain qualifying transportation benefits.



LONDON HEATHROW. On a large scale, BAA's London Heathrow has invested in a sustainable future for public transport involving an integrated system of rail, transit, and managing and monitoring traffic demand.

JFK, NY. In addition to improving access to the John F. Kennedy Airport (JFK) in New York City, the $1.9 billion JFK AirTrain investment provides access for passengers traveling between terminals and other ground facilities.

Airports

In recent years, increased attention has been given to transportation systems supporting airports both locally as well as internationally. Airports are vital to local economies and therefore should be given due diligence for continued and orderly expansion. Transportation management efforts, whether or not expansion is on the horizon, include internal circulation plans, overall master planning efforts, and regional transportation infrastructure investments. Planning efforts should take a critical look at airfield capacity, terminal and parking space and access issues. Besides encouraging travelers to use alternative means to travel to, from and within airport property, successful planning efforts have incorporated transportation options for airport employees. Since the terrorist events on September 11, 2001, transportation infrastructure as it relates to maintaining airport security has also been taken to a level of elevated importance and scrutiny.

Incidents & Emergencies

Strategies to improve traveler awareness of an unplanned event and to expedite the response to incidents on the roadway network are essential for maintaining freeway operations. Traffic incidents are a significant cause of freeway congestion. When an incident occurs, roadway capacity is typically reduced by blocking a lane or introducing a distraction in the traveling environment that causes motorists to reduce travel speed. Considerable documentation is already available on incident and emergency management programs throughout the country. FHWA has numerous publications, including the Benefits Brochures series, highlighting technology for incident and emergency response. AASHTO has published the Connecticut Department of Transportation (CONNDOT) Incident Management System (IMS) as one of their highlighted Success Stories. CONNDOTs IMS, like many throughout the country, monitors traffic operations at a traffic operations center, dispatches and coordinates interagency emergency response, adjusts traffic signal systems to manage flow, and supports highway service patrols. Transportation management plans are also critical to emergency preparedness planning efforts for natural disasters and other major, unexpected occurrences

Freight Transportation

Considering that commercial vehicle traffic typically comprises a steady percentage of daily traffic on state highways and the interstate system, further research on non-commute demand-side strategies would benefit from a more detailed discussion of freight management and commercial transportation. As a function of their size, freight trucks have been attributed with adding to congestion, road surface degradation and traffic accident severity. Commercial vehicle travel reductions can provide benefit to both the highway system and local roads utilized for delivery. There are a number of programs around the country that have been implemented to streamline commercial vehicle operations. FHWA has also documented the benefits of commercial vehicle electronic screening in their Benefits Brochures series. Besides streamlining operations, perhaps the most effective way to manage commercial vehicle travel is to encourage off-peak travel or alternative routes. Improving scheduling and truck routing processes can contribute to a reduction in freight vehicle mileage.

Case Study Examples

DEMAND-SIDE FREIGHT STRATEGIES – LONG BEACH, CA. The Los Angeles region has 16 million residents, 9 million jobs, and one of the busiest freight ports in the world. In the Los Angeles area, the Long Beach port moves close to 13,000 20-foot long containers each day. To better manage this high level of goods movement, Intelligent Transportation Systems can be used as a tool to implement Transportation Demand Management concepts traditionally seen in personal commuting. TDM concepts in goods movement include better scheduling, better routing and reduction of bottlenecks at check points.

On December 10th, 2003, the Marine Terminal Operators (MTO) introduced a new truck identification technology that has potential to reduce air pollution and relieve truck congestion around the port. The two tracking devices currently being considered are radio frequency identification tags (RFID) and Real-Time Locating System tags (RTLS). Both systems are similar to electronic toll collection devices currently used in private automobiles across the country. At the MTO's expense, these devices will be installed in over 30,000 trucks that use the Long Beach terminal.

The new technologies will help reduce congestion in several ways. First, it allows the MTO to identify and register trucks without the need for them to stop at port entrances. Electronic identification also will reduce the entrance gate personnel requirements for the MTO, making off-hour deliveries less expensive and more realistic. Increasing off-hour deliveries has the potential to shift delivery schedules to times of the day that experience less commuter congestion. Thirdly, the new technologies could locate lost truck drivers and facilitate route finding back to the terminal. Finally, electronic identification provides an excellent tool to gather data on truck contributions to local highway congestion.

The Vice Mayor and City Councilman of Long Beach, Frank Colonna is excited about the potential to reduce the impacts of truck congestion on neighboring communities. Mr. Colonna has said, "I like the initiative. It will provide a pathway to better manage truck traffic, minimize congestion, [and] reduce air pollution..." The MTO intends to have the system up and running by March 2004. For more information contact: Port of Long Beach, (562) 437-0041, info@pobl.com.

SUMMARY OF CASE STUDY EXPERIENCE

this section reviews the case studies collected and key lessons learned from the case study exploration

Mitigating Traffic Congestion provides over 25 in-depth case examples of demand-side programs implemented in a rich and varied range of locations, including the following (with corresponding page numbers):

Schools & Universities
- University of Washington - Seattle, WA 61
- Contra Costa County SchoolPool - CA 63

Special Events
- Summerfest and Concert Tour - WI 65
- Seahawks Stadium (Qwest Field) - Seattle, WA 67
- PacBell (SBC) Park - San Francisco, CA 69

Recreation & Tourism Destinations
- Zion National Park - UT 71
- City of Aspen - CO 73
- Lake Tahoe Basin - CA 75

Transportation Corridor Planning and Construction Mitigation
- I-15 Reconstruction - Salt Lake City, UT 77
- I-25 & I-225 Reconstruction - Denver, CO 79
- Springfield Interchange - VA 81

Employer-Based Commute Programs
- Bal Harbour Village - FL 83
- CALIBRE - Alexandria, VA 85
- CH2M HILL - Denver, CO 87
- Georgia Power Company - Atlanta, GA 89
- Hennepin County - MN 91
- Johns Manville - Denver, CO 93
- Nike - Beaverton, OR 95
- Overlake Christian Church - Redmond, VA 97
- Simmons College - Boston, MA 99
- Swedish Medical Center - Seattle, WA 101
- Texas Children's Hospital - Houston, TX 103

Location / Design Strategies
- Metropolitan Seattle Transit-Oriented Development and Flexcar - Seattle, WA. 105
- Orenco Station Mixed-Use Development - Hillsboro, OR 107

Variable Pricing
- Lee County Variable Bridge Tolls - Lee County, FL 109

Advanced Traveler Information
- Commuter Link - Salt Lake City, UT 111

Demand-side programs have also been applied to major employment centers, new development sites, airports, freight movement, and to entire regions (via road pricing and travel reduction regulations).

This shows the diversity of applications for demand-side strategies, some focused on the traditional commuter market and others applied to school, recreation, and other types of travel. The common theme is the desire to reduce peak period travel by managing demand and removing cars from the most congested places (parking lots, roads, highways) and the most congested times. This is accomplished by facilitating efficient traveler choices of the mode of travel used, the time of departure, the route used, and by reducing the need for some trips altogether.

Another commonality is the use of demand-side strategies to address very specific problems, such as:

- Inadequate parking or road space for employees, visitors, fans, customers, etc.
- Harmful effects from automobile emissions.
- Employee tardiness or absence due to travel delays or lack of travel options.
- Recruitment and retention of skilled workers with minimal stress from commuting.

The more targeted the problem and travel market, the better chance that demand-side programs can provide an effective solution or be part of a package of solutions.

All of these problems impose a tangible cost on travelers, on business, on government, and on society as a whole. The benefit-to-cost ratio of many demand-side programs is quite high, as is discussed below.

What Works Best? A Review of International Experience

Several seminal research projects and guidance reports have been produced since the 1993 FHWA report "Implementing Effective TDM Measures" (COMSIS, 1993). This body of knowledge includes studies performed at the regional, state, national and international levels. Considerable research has been performed in U.S. regions that require employer trip reduction programs (e.g., WA and AZ); in states that embrace TDM (e.g., Florida); among research organizations (e.g., TRB and TCRP); and federal agencies (FHWA, FTA, EPA). Among the more important recent references is the TCRP Report 95, the "Traveler Response to Transportation System Changes," which documents the impacts of various demand management strategies in chapters covering: HOV facilities, vanpools, pricing, parking management, and employer TDM (R.H. Pratt Consultant, 2003).

An example of this research comes from another TCRP project, B-4, "Cost Effectiveness of TDM Programs," that evaluated some 50 employer-based demand management programs in the U.S., but provides insight into demand management effectiveness in both commute and non-commute applications. The study estimated that the average reduction in vehicle trips among all these "successful" programs was 15.3% (at a cost of about $0.75 per trip reduced). However, programs that focused on information/promotion alone exhibited no measurable decrease in trips. Programs that provided enhanced alternatives, such as vanpools or shuttle buses, realized a 8.5% reduction in trips. Programs that focused on financial incentives and disincentives realized a 16.4% reduction of trips and

programs that combined enhanced alternatives with incentives/disincentives for their use, realized a 24.5% reduction in vehicle trips. (COMSIS, 1994).

Evidence also suggests that the number of strategies implemented, or the size of the budget, does not positively correlate with higher effectiveness. Some of the simplest, albeit politically controversial, measures involve pricing of automobile travel and subsidies for high occupancy modes. So, one researcher concluded: "It's more what you do to influence commute behavior (the strategies/incentive utilized), more than how you market the program or how much you spend" (ESTC, 1998).

Another important study, the Congressionally-mandated review of the Congestion Mitigation Air Quality (CMAQ) federal funding program performed by the Transportation Research Board, revealed that four of the five most cost-effective strategies (measured as the cost per pound of emissions reduced) funded by CMAQ were demand-side strategies, including: regional rideshare programs, charges and fees for drivers, vanpool programs, and "miscellaneous TDM" programs, (TRB 2002).

Many other recent research projects have documented the effectiveness of TDM strategies to reduce automobile travel for school trips, recreation and special event trips. This was accomplished by increasing auto occupancy (which is already higher than work travel) and providing quality shuttle service and traveler information.

The scope of demand-side strategies has evolved over the past 30 years in the U.S. However, these measures (referred to as Mobility Management in Europe and some other regions of the world) are a growing phenomenon in other countries and are even integrated into national policy in places like:

- **Sweden.** Where a region must consider demand management solutions before considered new road capacity.
- **The Netherlands.** Where travel reduction goals have been set and TDM is an integral part of the program to meet these goals.
- **United Kingdom.** Where all regions are required to have "green travel plan" capabilities and integrate TDM into land development approvals (AMOR, 2003).

Many other innovative applications of demand-side strategies have been tested, evaluated, and documented in Europe, Australia, Canada, etc. In Europe especially, demand-side strategies are being applied to non-commute travel markets (tourists, schools, special events) in a conscious effort to address the growth in automobile use that is affecting most countries of the world. The E.U.–funded project MOST (MObility STrategies for the next decades) provides comprehensive findings from over 30 pilot projects (AMOR 2003). A recent study by the Organization of Economic Cooperation and Development (OECD), "Road Travel Demand: Meeting the Challenge," documents world-wide experience with demand management strategies (OECD, 2002). The resource section of this report provides references and links to related websites.

LESSONS LEARNED FROM THE CASE STUDIES

all the research on, and experience with, demand-side programs and strategies cannot possibly be summarized in 10 brief points. However, a few common findings and lessons can be offered here

1. Demand-Side Strategies Are About Choices – As the term implies, demand-side strategies intend to modulate the demand for travel in a way that is based on choices (mode, time, route, etc.), and incentives for using alternatives to driving alone and avoiding the most congested conditions. A good example of this is the I-15 FasTrak program in San Diego, which allows solo drivers to pay to use the HOV lanes and allows those sharing a ride to use the lanes for free, but does not force a fee on any driver or require anyone to use a particular facility (OECD, 2002).

2. Time and Financial Incentives Are Most Effective – Time savings for alternative mode users (such as HOV lanes), financial incentives (such as vanpool subsidies or tax incentives) and financial disincentives (such as parking or road pricing) are consistently cited as the most effective demand-side strategies. These intervening influences help to balance out the perceived convenience and speed of driving alone (ITE, forthcoming).

3. Incentives and Disincentives Require Good Alternatives – Time and financial incentives and disincentives are most effective when they support good travel alternatives, such as transit service, vanpool formation, carpool matching, bicycle facilities, etc. The TCRP B-4 study, cited earlier, provides tangible evidence of this symbiosis by showing that the most effective programs combined financial incentives (such as transit subsidies) with improved alternatives (such as more frequent and convenient bus service (COMSIS, 1994).

4. Managing Demand Can Be a Cost-Effective Tool – Many studies that have compared mobility and air quality strategies have concluded that demand management strategies are among the most cost-effective in that they can reduce a trip, mile of travel or ton of emissions for a relatively modest amount of money. Demand-side strategies may not be the primary solution to these problems, but if they are applied in the right situation, they can help address traffic and air pollution problems in modest, yet very affordable ways (TRB, 2002).

5. Information Technology Enhances Demand-Side Programs – While incentives and disincentives are perhaps the key to effectiveness, much of managing demand relies on good information about travel conditions and alternatives. Advances in information technology make managing demand more effective by providing real-time, accurate information on travel options, traffic conditions, alternative routes, and even dynamic matching of travelers into shared ride arrangements.

6. The Implementing Organization Should Match the Scope of the Strategies – The organizational home for demand-side programs should match the scope of the application. For example, strategies to reduce congestion around employment centers or in corridors might be managed by Transportation Management Associations, whereas regional traveler information and ridematching services might better be implemented by regional agencies with access to appropriate resources and information. Multiple organizations are often involved in a given urban area, calling for coordination and cooperation to maximize impacts

7. Packaging Demand-Side Strategies Can Create Synergies – Research indicates that the greatest potential for demand management lies in strategic grouping of measures into "programs" of reinforcing actions. For example, limiting parking in a high-density commercial development served by convenient, reliable transit can do more to reduce vehicle trips than can solely limiting parking supply (ITE, forthcoming). One study concluded that "packaged, complementary solutions are usually more effective than a single measure" (OECD, 2002).

8. Expectations Need to Be Realistic – Demand-side programs are not a panacea for all social ills or a cure-all for traffic congestion problems. However, they can have a significant impact on travel. If the correct incentives and disincentives are used to facilitate shifts to alternative modes, demand-side strategies can reduce vehicle trips and VMT 10%-20%. Most decision-makers, however, are reluctant to adopt certain disincentives (such as parking pricing) to change travel behavior in a significant way. In the absence of these strategies, most demand management programs should only be expected to reduce travel by 0% - 5% (COMSIS, 1993). At the same time, it is important to recognize that the goals for demand-side programs often extend beyond reducing VMT to include mobility, accessibility, environmental, and other outcomes.

9. Plans for Managing Demand Should Be Integrated into Overall Transportation Plans – Demand-side strategies should be considered a set of measures to better manage existing infrastructure, but they still need to be well-planned. Demand management actions should be considered simultaneously with related transit, traffic engineering, and land use plans (ITE, forthcoming). Since many metropolitan planning organizations and regional councils now fund and oversee demand management efforts, it is important to integrate demand-side strategies into long-range plans, as well as shorter-term management and operations actions. It is also important to evaluate the impacts of actual demand-side measures, as implemented, to better inform future decision-making.

10. Demand-Side Strategies Are Practical – Demand-side strategies are compatible with sustainability, transportation-land use interaction, and other longer-term goals. Yet, it is most applicable to managing demand for finite travel markets, to solve real problem that provide tangible benefits to users and implementers. Travels are smart consumers and, when faced with tangible changes in out-of-pocket costs and travel time, will change their travel behavior in immediate and significant ways (ESTC, 2003).

CONCLUSIONS & FUTURE DEVELOPMENTS

a summary of concluding thoughts from the publication and highlights of important future developments

This report offers a new, broader perspective on demand-side strategies. These programs can be a critical component of a comprehensive transportation improvement program to improve the efficiency of the current transportation system, and they can also be an integral part of longer-term transportation and land use plans in order to change the fundamental influences on demand for the single occupant vehicle traveling at peak periods on congested roads. Ultimately, demand-side programs can be a critical factor in "decoupling" the link between economic growth and transportation growth. Economic growth creates new demands for travel and not all of this new demand can be accommodated on current or future roads (OECD, 2002).

Demand-side programs, in their traditional form of commute trip reduction, were born from energy crises of the 1970s as a response to fuel shortages. In the new millennium, managing demand extends to all types of travel, be it parents walking a group of kids to school in a "walking bus," visitors to a National Park leaving their cars off-site and using clean shuttles, new residents opting to live in "transit-oriented developments" to avoid the need for an extra car, or shippers coordinating deliveries to avoid congested roads and clogged city streets.

This is all demand management. Many of the tools used today by transportation planners, traffic engineers, and traffic operations managers are designed to modulate the demand for travel (by mode, route, location or time) rather than provide more capacity in the system to accommodate more trips. This new perspective on demand-side programs can still benefit from some of the findings from the 1993 FHWA report, "Implementing Effective TDM Measures." That report discussed the "economics of TDM" by estimating that the average cost to society to accommodate a one-way daily solo commute trip was $6.75, whereas the cost to employers to reduce a commute trip was $1.33. Carpooling cost commuters $1.92 per trip, whereas driving alone cost $4.81. (COMSIS 1993) These economics are as compelling today and they were ten years ago. Perhaps as the "demand for TDM" grows and is applied to other travel markets, the economics are even more compelling.

MEMPHIS, TENNESSEE

In the future, the role of demand-side programs in solving specific problems and contributing to larger goals will be even greater as our inability to squeeze more cars into a limited road system compels us to look for ways to do things "smarter" and to focus on moving people, goods, and information rather than cars and other vehicles.

ADDITIONAL RESOURCES & CITATIONS

a collection of organizations, publications and internet resources, along with citations from this publication

GENERAL RESOURCES

Association for Commuter Transportation – www.actweb.org

America Bikes – www.americabikes.org

American Planning Association – www.planning.org

American Public Transportation Association:
Homepage – www.apta.com
APTA Transit Resource Guides – www.apta.com/research/info/briefings/

Best Workplaces for Commuters[SM] – www.bwc.gov

Better Environmentally Sound Transportation (BEST) – www.sustainability.com/best

Commuter Choice – www.commuterchoice.com

Institute of Transportation Engineers – www.ite.org

International Telework Association & Council – www.telecommute.org

National TDM and Telework Clearinghouse, National Center for Transit Research – www.nctr.usf.edu/clearinghouse

Northwest TDM Resource Center – www.wsdot.wa.gov/Mobility/TDM/default.htm

Organization for Economic Co-operation and Development – www.oecd.org

Pedestrian & Bicycle Information Center – www.bicyclinginfo.org, www.walkinginfo.org/

Promotional Materials Clearing House at F.S.U.'s The Marketing Institute – http://nctr.cob.fsu.edu/

Smart Card Alliance – www.smartcardalliance.org

Surface Transportation Policy Project – www.transact.org

Victoria Transport Policy Institute, Online TDM Encyclopedia – www.vtpi.org

U.S. Department of Transportation (DOT):
ITS/Operations Resource Guide – www.its.dot.gov/guide.html
ITS Benefits & Costs Database – www.benefitcost.its.dot.gov/
FHWA Office of Operations – www.ops.fhwa.dot.gov

U.S. DOT 511 Resources – www.itsdocs.fhwa.dot.gov/511/511.htm, www.deploy511.org/

International Experience

Association for Commuter Transport (United Kingdom) – www.act-uk.com

Australian TravelSmart Program – www.dpi.wa.gov.au/travelsmart/

European Union, MOST, Mobility Management Strategies for the Next Decade – http://mo.st

European Commission, PORTAL (Promotion Of Results in Transport Research And Learning) – www.eu-portal.net

European Platform on Mobility Management – www.epomm.org

International Association of Public Transport – http://www.uitp.com

National Travelwise Association (United Kingdom) – www.ntwa.org.uk/

VM2, Vereniging Mobiliteitsmanagement (The Netherlands) – www.vm2.nl

World Bank, Transport – www.worldbank.org/transport/

REFERENCES

America Bikes, *America Bikes, America Benefits.* Spring 2003. www.americabikes.org

American Public Transportation Association. *2004 Public Transportation Fact Book.* 2004. www.apta.com

American Public Transportation Association. *Online Transit Resource Guide: Smart Cards and U.S. Public Transportation.* Number 6 - Revised October 2003. www.apta.com/search/info/briefings/

Austrian Mobility Research (AMOR). *MOST Final Report D9*. Prepared for European Commission, March 2003. http://mo.st

Baig, Edward C. "Verizon hooks up Wi-Fi alternative; BroadbandAccess zippier than its predecessor." *USA Today.* Mar 25, 2004. p. B3.

Battelle. *Evaluation of the Acadia National Park ITS Field Operational Test: Final Report.* Prepared for the U.S. Department of Transportation, ITS Joint Programs Office. June 2003. www.benefitcost.its.dot.gov/

Beers, Thomas M. "Flexible schedules and shift work: replacing the '9-to-5' workday? *Monthly Labor Review.* Bureau of Labor Statistics. June 2000. p.33. www.bls.gov

Burris, Mark, Ashley Yelds. *Using ETC to Provide Variable Tolling: Some Real-World Results.* Paper presented at the ITS America 2000 Annual Meeting. Boston, MA. May 1-4, 2000.

California Department of Transportation, District 7. *2002 HOV Annual Report.* 2003. www.dot.ca.gov/dist07/aboutdist7/pubs/hov_annual/2002/2002_HOV_annual.pdf

Charles River Associates Incorporated. *Building Transit Ridership: An Exploration of Transit's Market Share and the Public Policies That Influence It.* Transit Cooperative Research Program, Report 27. National Academy Press. 1997.

COMSIS Corporation. *Implementing Effective Travel Demand Management Measures: Inventory of Measures and Synthesis of Experience.* Prepared for FHWA, Report DOT-T-94-02, September 1993.

COMSIS Corporation, "Cost Effectiveness of TDM Programs," Transit Cooperative Research Program Project B-4, unpublished Working Paper #2, 1994.

Cura, Fredrico. "Transit Agencies Seeing Increased Interest in Transit-Oriented and Joint Development." *APTA Passenger Transport.* April 18, 2003: Volume 61, No. 33.

Davis, Donald D., Ph.D. and Karen A. Polonko, Ph.D. *Telework America 2001 Summary.* Old Dominion University, October 2001.

Dieringer Research Group. "Home-Based Telework by U.S. Employees Grows Nearly 40% Since 2001." The American Interactive Consumer Survey. A press release from the International Telework Association & Council: September 4, 2003.

ESTC, "Overview of TDM in the United States: What Makes for Successful TDM Programs," paper presented at ACT UK Conference, London, November 1998.

ESTC. *Commuter Choice Primer: An Employer's Guide to Implementing Effective Commuter Choice Programs.* Prepared with SAIC for FHWA, FTA and EPA, Report FHWA-OP-03-007, 2003.

Federal Highway Administration. *Value Pricing Project Quarterly Reports.* Office of Transportation Policy Studies, Value Pricing Pilot Program. 2004. www.fhwa.dot.gov/policy/otps/valuepricing.htm

Federal Transit Administration. "FTA Selects Four Communities For Pilot Program To Boost Public Transportation Ridership." FTA Press Release. April 2, 2004.

Federal Transit Administration. *TDM Status Report Variable Work Hours.* U.S. Department of Transportation. August 1992. (Available on www.cutr.usf.edu).

Fekpe, Edward, Shawna Collins. *Evaluation of Intelligent Transportation Infrastructure Program (ITIP) in Pittsburgh and Philadelphia, Pennsylvania.* U.S. Department of Transportation. March 2003. www.itsdocs.fhwa.dot.gov

Freas, Alyssa, Stuart Anderson. *The Effects of Variable Work Hour Programs on Ridesharing and Organizational Effectiveness, A Case Study: The County of Ventura.* A paper before the Transportation Research Board. January 1991.

Giery, Margaret, Martin Catala, Philip L. Winters. *Proximate Commuting: Potential Benefits and Obstacles.* Center for Urban Transportation Research. National TDM and Telework Clearinghouse. July 2003. www.nctr.usf.edu/clearinghouse/

Holmes, John R. *Effects of Compressed Work Week on Employee Travel.* California Environmental Protection Agency – Air Resources Board. June 1995.

ICF Consulting. *Strategies for Increasing the Effectiveness of Commuter Benefits Programs.* Transit Cooperative Research Program, Report 87. National Academy Press. 2003.

Institute of Transportation Engineers, *Information Report on TDM in Highway Reconstruction*, prepared by PBQ&D, publication pending, 2004. www.ite.org

Intelligent Transportation Society of America (ITS America). *An Overview of Transit Signal Priority.* July 2002. www.itsa.org

Intelligent Transportation Society of America (ITS America). *Delivering the Future of Transportation: The national intelligent transportation systems program plan: a ten-year vision.* January 2002. www.itsa.org

Kotler, Philip, Ned Roberto and Nancy Lee. *Social Marketing: Improving the Quality of Life.* Sage Publications. 2002.

Lewis, Mike. "Boeing Will Study Moving The Jobs Of Its Workers Closer To Their Homes." *Seattle Post-Intelligencer.* Thursday, March 21, 2002. http://Seattlepi.Nwsource.Com

Live Baltimore Home Center. *Live Near Your Work.* www.livebaltimore.com/homebuy/lnyw.html

Minnesota Department of Transportation. *Twin Cities Metro Area Ramp Meter Study Final Report.* Office of Communications and Public Relations. May 2002. www.dot.state.mn.us/rampmeterstudy/reports.html#finalreport

OnStar. "GMAC Insurance and OnStar Create Innovative Insurance Products." OnStar Press Release. January 28, 2004.

Organization of Economic Co-operation and Development. *Road Travel Demand: Meeting the Challenge.* 2002. www.oecd.org

Organization of Economic Co-operation and Development. *Communicating Environmentally Sustainable Transport The Role of Soft Measures.* 2004. www.oecd.org

Parsons Brinckerhoff. *Statewide TOD Study: Factors For Success In California.* California Department of Transportation. 2002. www.dot.ca.gov/hq/MassTrans/

R.H Pratt Consultant, Inc., et al. *Traveler Response to Transportation Systems Changes, Transit Cooperative Research Program Report 95.* 2003 – 2004. (Selected chapters available at www.trb.org/trb/bookstore/)

Roitz, Joseph, Dr. Brad Allenby, Dr. Robert Atkyns. "AT&T 2001/2002 Employee Survey Results - Telework, Business Benefit and the Decentralized Enterprise." 2002. www.att.com/telework/article_library/survey_results_2002.html

Rosenbloom, Sandra. *Transit Markets of the Future: The Challenge of Change.* Transit Cooperative Research Program, Report 28. National Academy Press. 1998.

Schrank, David, Tim Lomax. *The 2003 Annual Urban Mobility Report.* Texas Transportation Institute, The Texas A&M University System. September 2003. http://mobility.tamu.edu

Shoup, Donald. "Evaluating the Effects of California's Parking Cash-out Law: Eight Case Studies," *Transport Policy*, Vol. 4, No. 4, 1997, pp. 201-216.

Shoup, Donald. *The High Cost of Parking.* Presentation to the International Symposium on Road Pricing. November 2003. www.trb.org/Conferences/RoadPricing/Presentations/Shoup.ppt

Social Marketing Institute. Success Stories: Florida Truth Campaign. 2004. www.social-marketing.org

Surface Transportation Policy Project. *Americans' Attitudes Toward Walking and Creating Better Walking Communities.* April 2003. www.transact.org/report.asp

Surface Transportation Policy Project and Center for Neighborhood Technology. *Driven to Spend.* March 2000. www.transact.org/report.asp

Todreas, Ian L. "My Kingdom for a Horse: All About Emergency Rides Home for the Rest of Us." TDM Review, Association for Commuter Transportation. Issue 1, 2004. www.actweb.org

Transport. *TravelSmart: A 10-Year Plan.* September 1999. www.travelsmart.transport.wa.gov.au

Transportation Research Board, *The Congestion Mitigation Air Quality Improvement Program: Assessing Ten Years of Experience, TRB Special Report 264.* National Academies. 2002.

U.S. Department of Labor. *Current Population Survey.* May 1997. www.dol.gov

Volpe National Transportation Systems Center. *Cape Cod National Seashore Alternative Transportation Systems Long-Range Planning Study: Final Report.* National Park Service. May 2003.

Wachs, Martin, "Regulation XV in Southern California: Success or Failure?" *TDM Review*, Association for Commuter Transportation, Winter 1996. www.actweb.org

White, Christopher, Jonathan Levine and Moira Zellner. *Impacts Of An Employer-Based Transit Pass Program: The Go! Pass In Ann Arbor, Michigan.* APTA, 2002. www.apta.com/research/info/briefings/documents/white.pdf

Xylo, Inc. "Commuter Assistance Benefits in the Workplace," Xylo Report, April 2001. www.xylo.com/press/pr042501.htm

MITIGATING **TRAFFIC CONGESTION**

THE ROLE OF DEMAND-SIDE STRATEGIES

CASE STUDIES

University of Washington - Seattle, WA

FAST FACTS ABOUT: Univ. of Washington - Seattle, WA

Types of TDM: Mode Choice
Keywords: U-PASS, university transportation, parking disincentive, flexible parking, transit service
Area Demographics: UW-Seattle is the City's second largest employment and activity center outside of the central business district. In 2002, enrollment topped 39,000 students.
Program: One pass, the U-PASS, provides an array of transportation options including transit service, preferential parking, consumer discounts, and rideshare matching.
Results: Due to its success, other campuses have developed their own programs using U-PASS as an example. U-PASS has saved UW-Seattle capital investment costs associated with traditional parking expansion projects. U-PASS has eliminated 91 million trips since 1991.
Cost of Program: $11.3 million for the 2002/2003 school year.
Staff: Unavailable
Contact: Peter Dewey, US-Seattle Transportation Office, www.washington.edu/upass

Large University Grapples with Growth

The University of Washington's (UW) Seattle campus of 643 acres is the heart of the University District, the City's second largest employment and activity center outside of the central business district. In Fall 2002, student enrollment was over 39,000 and faculty and staff nearly reached 22,000. According to 2002 Campus Master Plan efforts currently underway, the Seattle campus is projected to grow by 1,000 students and 2,000 additional faculty and staff by 2012 triggering significant development and transportation demands.

The "Universal" Solution: U-PASS

The current Transportation Management Plan (TMP), U-PASS, demonstrates a strong, collaborative partnership between the University, the City of Seattle and transit providers, King County Metro (Metro), Snohomish County's Community Transit (CT) and the regional transit authority Sound Transit. In the late 1970's, University transportation goals were conceived and then formalized in 1983 as part of the City-University Agreement. Specific goals included maintaining 1983 traffic volumes traveling to or from campus during peak periods and limiting UW parking supply to 12,300 while making certain that additional spill-over parking would not occur within the surrounding neighborhoods.

As part of the 1989 General Physical Development Plan (GPDP) for the campus, it became clear that forecasted population growth and development would trigger a significant increase in vehicle trips and a loss of approximately 1,700 surface lot parking spaces to new construction. As part of the GPDP planning process, a task force was formed to develop, guide and oversee the implementation of a new TMP. The task force recognized the importance of transportation incentives as well as complementary disincentives (i.e. parking rate increases).

Removing the volume discount provided by a quarterly parking pass, the variable rate method favors infrequent users. In other words, the more you park, the higher the fee.

In 1990, the task force pitched the U-PASS as a "universal pass" providing card holders with a range of transportation options and incentives with one pass, the U-PASS. The U-PASS Program began as a three-year pilot program in 1991 with a budget of $17.4 million. In 2002, the U-PASS annual budget was approximately $11.3 million. Since its inception, the most significant cost of the U-PASS Program is related to transit service. Currently, user fees cover 50 percent of the Program costs while the remaining revenue is generated from parking fines, fees and other UW sources.

Today, U-PASS provides an array of transportation options for a quarterly fee to eligible students ($35 in 2003) as well as faculty and staff ($48.96 in 2003). Record sales in Fall 2002 indicated that nearly eight-six percent of the total student population participated. Transportation alternatives and programs included with a U-PASS include the following:

- Full fare coverage on Metro Transit, Sound Transit, CT and Sounder commuter train service,
- Free carpool and vanpool parking,
- Vanpool subsidies,
- Discounted "occasional" parking permits,
- Local merchant discounts,
- Ridematching services,
- Reimbursed rides home for faculty and staff, and
- Evening neighborhood shuttle service.

Considering all the transportation options U-PASS provides, it is most frequently used for transit service on Metro Transit, Sound Transit and CT. Transit agencies have preserved and stimulated ridership by increasing capacity and introducing new routes as user needs change. Today's U-PASS is less than half the price of the traditional bus pass of 1990. Since 1991, 91 million vehicle trips to or from campus have been eliminated by U-PASS transit riders.

Managing traffic demand through pricing has been documented as a key component of U-PASS Program success. Besides quarterly and daily parking rate increases, UW has developed a number of flexible parking features to compliment other U-PASS program components and alternatives to single-occupancy vehicle (SOV) travel including the Pay Per Use Parking (PPUP) program. Basically, PPUP participants are tracked each time they use the West Campus Garage and are subject to a variable parking rate structure. Removing the volume discount provided by a quarterly parking pass, the variable rate method favors infrequent users. In other words, the more you park, the higher the fee.

Today's U-PASS is less than half the price of the traditional bus pass of 1990. Since 1991, 91 million vehicle trips to or from campus have been eliminated by U-PASS transit riders.

U-PASS Success Leads the Way

Immediately after implementation, U-Pass was a success in reducing vehicle trips and parking lot occupancy on campus. The Program is continually monitored and evaluated through a series of surveys, traffic counts, parking utilization studies, and individual U-PASS component monitoring. As a result, comprehensive measures of effectiveness are available. As reported in the 2001-2002 U-PASS Annual Report produced by the UW Transportation Office, U-PASS has been attributed with the following:

- Prevented the need to build 3,600 new parking spaces saving considerable capital cost,
- Reported 86% U-PASS user satisfaction, a 13% increase over Year 1992, and
- Reduction of 33% in parking permit purchases since October 1990 indicating that users are finding another way to school or work.

In addition, 2002 traffic counts indicate that morning peak period traffic was 18 percent below the 1983 traffic levels, a goal set forth in the City-University Agreement.

As a result of the success of the U-PASS Program on UW's Seattle campus, similar but fiscally-separate programs have been implemented at UW Bothell, UW Tacoma, and Harborview Medical Center. In addition, Metro has developed FLEXPASS for metropolitan Seattle employers and commuters using the U-PASS as a model. As a tribute to U-PASS success, the Program has been heavily awarded both locally and nationally.

Contra Costa County SchoolPool - CA

FAST FACTS ABOUT: Contra Costa SchoolPool

Types of TDM: Mode Choice
Keywords: school pool, rideshare, transit, students
Area Demographics: Contra Costa County, one of the nine counties in the San Francisco – Oakland Bay Area.
Program: Rideshare matching service offered to parents to encourage consolidating school trips. Additional incentives to ride local transit are also provided.
Results: In 2002, 536 families joined a carpool and 27 % of carpools formed in 2001 continued carpooling in 2002. The program has also been credited with an annual vehicle trip reduction of 1.1 million and a vehicle miles traveled (VMT) reduction of nearly 4 million.
Cost of Program: $95,000 for the 2002/2003 school year.
Staff: SchoolPool requires a full time employee for 6 months or a half-time employee on an annual basis.
Contact: Lynn Osborn, CCCAN Program Manager, www.cccan.org

Identifying the Problem – Outside of the Classroom

The SchoolPool program serves western, central, and eastern Contra Costa County, in the northern California Bay Area. Very few schools in Contra Costa County offer bus service for their students. As a result, traffic congestion within the communities surrounding the schools presents a significant mobility challenge. The average one-way trip length to or from school within Contra Costa County is about 4.3 miles. Similar to other parts of the country, crowded classrooms are forcing students to attend a school "across town" instead of in their own neighborhood.

Offering Options for School Trips

The SchoolPool program is administered by staff at the Contra Costa Commute Alternative Network (CC CAN) and has been in operation for 5 years. The goal of the SchoolPool program is to provide parents with information on neighboring students who are interested in carpooling to and from school, and to encourage the parents to establish a carpool. Carpooling is voluntary and no financial incentive is offered to the parents. Carpool ridematch lists are provided to parents with students attending the same school(s) to encourage carpooling. It is promoted among residents who have children in all public and private schools throughout the County (kindergarten through college).

For the 2002 school year (July 2002 – June 2003), carpool ridematch forms were sent directly to 150 participating schools and in turn were distributed in Fall registration packets to over 157,000 school children. Additional program outreach efforts included presentations to Parent Teacher Associations (PTAs) and school administration.

As ridematch applications are received, rideshare matches within the same district are found and sent within three days to the applicant. For the 2002 school year, approximately four ridematch lists were sent to each parent during the course of the first three months of the school year. Additional ridematch lists were sent throughout the year as new parents moved into the school area, or as parents' commute patterns changed.

Parents who were unable to find a carpool partner were encouraged to have their children try transit instead of driving. To encourage participation, a $20 bus pass was provided for the student's use. CC CAN Staff worked with County bus operators to develop bus schedule brochures for each school district. In turn the brochures were distributed with free tickets so that parents could see and experience which routes and schedules serviced their schools.

SchoolPool requires a full time employee for 6 months or a half-time employee on an annual basis. The most intense time is between April and October when registration forms are generated and distributed and most of the outreach occurs. The total program cost for SchoolPool during the 2002 school year (July 2002 to June 2003) was $95,000.

Setting a Good Example

For the 2002 school year, 710 individual ridematch requests were received from parents. Of these, 174 included siblings (essentially duplicate requests) who were also riding in the carpool, which resulted in a total of 536 unique ridematch requests. In general, parents must make two round trips to the school (one each morning, and one each afternoon) to pick up their children. These two round trips equate to four one-way trips. Allowing for 25% of the trips to be drop-offs on the way to work, it is estimated that three one-way trips are saved for each non-sibling, which in this case is a reduction of 1608 one-way trips per day.

A follow-up survey was conducted to determine the usage and satisfaction of program participants from SchoolPool 2001/2002. Of the participants who were contacted, 27% indicated that they have continued to carpool resulting in continued reduction of 816 one-way trips per day.

In addition to the carpool riders, another 1,932 students received bus passes in 2002. These passes were given to students whose parents indicated that they usually drive the student to school. Nearly 2,000 bus riders equates to a reduction of around 4,000 one-way trips per day.

Collectively, the three groups discussed above, new carpools, 2001 carpools still ridesharing, and bus riders have contributed to an annual one-way trip reduction of 1.13 million trips and a vehicle miles traveled (VMT) reduction of 3.96 million.

In addition, due to additional school bus cutbacks in the summer of 2003, the SchoolPool Program had over 3,000 bus riding participants. The construction of a new school without bus service (even public bus service) has resulted in additional rideshare requests topping the 2002 totals.

Summerfest and Concert Tour - WI

FAST FACTS ABOUT: Summerfest and Concert Tour - WI

Types of TDM: Mode Choice, Route Choice
Keywords: Special events, ITS, concert, multi-jurisdictional coordination, transit advantage, enforcement, park and ride, Freeway Flyer
Area Demographics: Two venues featured, both in southeastern Wisconsin attracting between 35,000 and 1 million visitors per multi-day event.
Program: Coordinated, pre-emptive special events planning which offers public information and transportation alternatives to event attendees.
Results: Event planning Severity Level Matrix, County ordinance adopted which provides fiscal reimbursement for extra government services required as the result of a special event. Increased transit usage (25% of total attendance).
Cost of Program: Not available; numerous agencies and departments cover resource needs.
Staff: Not available; numerous agencies and departments cover resource needs.
Contact: Scott Silverston, Wisconsin Department of Transportation, scott.silverson@dot.state.wi.us

Recurring Event Traffic Management

Southeastern Wisconsin is host to various special events throughout the year ranging from sporting events to rock concerts, all attracting a large number of visitors from around the region. In particular this case study will focus on two events, both being music festivals/concerts. Summerfest is an annual music festival that takes place at the Henry W. Maier Lakefront Festival Grounds near downtown Milwaukee and within a close proximity of several major freeways. The second highlighted event is the Grateful Dead Tour that took place at the Alpine Valley Music Theatre in the rural Wisconsin city of East Troy in Walworth County.

Combining Resources and Integrating Technology

In 1995, a number of key components added to the local transportation system as part of an Intelligent Transportation System (ITS) early deployment package, MONITOR, set the stage for special events planning and traffic management in the future. Also in 1995, the Traffic Incident Management Enhancement Program (TIME) was conceived consisting of four inter-related components: 1) special events and construction, 2) emergency response, 3) corridor traffic management, and 4) public information. TIME has been the catalyst of multi-jurisdictional coordination and collaboration regarding regional transportation issues.

The importance of special event transportation planning was recognized through a review of incident management procedures and programs. Wisconsin DOT (WisDOT) and planning partners began to collaborate on traffic issues related to recurring events such as Summerfest (attracting 1 million people over the course of eleven days), the State Fair and professional sporting events. Planned special events have tangible elements of time, location and content that lend themselves to early coordination unlike unpredictable, unplanned incidents such as a major traffic accident.

Throughout the process, additional challenges have been recognized such as the compounding effect of numerous events, even if they are small in scope, occurring at the same time

Summerfest

Summerfest is an annual, eleven-day outdoor music festival that starts during the last week of June and lasts through the Fourth of July weekend. Summerfest attracts approximately 100,000 patrons per day and over 1 million annually. It's been estimated that approximately 45% of all attendees are out of town travelers.

Since parking on-site is limited near the venue, alternative means of providing transportation and informing festival visitors with traffic, alternative route and parking information were essential. In order to manage the steady influx and departure of Summerfest attendees, several Wisconsin DOT field components and other regional resources were utilized. Managing traffic for Summerfest requires high level interagency coordination on the part of WisDOT, Milwaukee County Sheriff's Department, City of Milwaukee Public Works and Police departments, MCTS, and Summerfest Staff. A scenario based Traffic Management Plan was in place to inform travelers of traffic conditions and detour information.

For Summerfest, several transit enhancements were deployed including expanded transit and shuttle bus service. Temporary access improvements including bus only access to closed freeway ramps as well as bus only lanes and one way traffic patterns increased transit effectiveness and reliability during the event. Other operational measures such as providing round trip fares and separate staging areas for expanded shuttle service expedited passenger loading.

Grateful Dead Tour

The Grateful Dead Tour in 1989 held at the Alpine Valley Music Theatre in East Troy, Wisconsin was attended by nearly six times as many people as expected (200,000 instead of 35,000). At the time, a coordinated Traffic Management Plan was not in place. Attendees arrived earlier and stayed later than the venue itself and damages to personal property, severe congestion on local roads, and inadequate emergency access were consequences of the 1989 Tour.

Thirteen years later, local law enforcement officials requested the assistance of the Wisconsin DOT to create a Traffic Management Plan that would reduce or possibly eliminate the congestion and problems experienced in 1989. On June 26, 2002, a Concert Management Plan was created after approximately 5 weeks of planning time consisting of four sub-plans, 1) Traffic Management, 2) emergency government, 3) weapons of mass destruction, and 4) emergency medical.

The plan implemented several traffic control measures to guide and control traffic including portable VMS, type 3 barricades and traffic cones, portable lighting units, ATV/bicycle/equestrian patrols, HAR, and a significant law enforcement presence. In addition, a nearby permanent WisDOT Rest Area was temporarily utilized as a remote command center for Walworth County Sheriff Department and a WisDOT remote TOC.

Indicators of Successful Event Planning

Special events planning in southeastern Wisconsin has lead to the development of a number of tools including the Severity Level Matrix. Developed in coordination with local law enforcement and event sponsors, the Excel-based Matrix indicates anticipated level of response based on event criteria such as predicted attendance and road closures.

WisDOT continues to work with local agencies and event planners on special event transportation planning. While mitigating traffic congestion for special events is often limited by transportation facilities or time of day, agencies continue to give due diligence to safe, efficient, and informed traffic management. Throughout the process, additional challenges have been recognized such as the compounding effect of numerous events, even if they are small in scope, occurring at the same time.

Summerfest

Quantitative effectiveness data for the Summerfest Traffic Management Plan is limited. However, MCTS ridership data for Year 2000 listed below provides an indication of success:

- Approximately 25% of the total attendance utilized bus transportation.
- The Downtown Shuttle provided 100,000 rides.
- 300,000 riders utilized the Freeway Flyer service from 13 park-and-ride lots.

Grateful Dead Tour

The two-day Grateful Dead reunion took place on August 3-4, 2002 without serious incident. Approximately 37,000 people attended the reunion, not the expected 100,000. Attendees and residents followed the traffic guidance. During the entire two-day event, 123 citations were issued for various charges and 15 arrests were made, which is a significant decrease compared to 1989. Public information campaigns, "If you don't have a ticket, don't come" and national media attention were successful in detouring impromptu concert goers without tickets from loitering the venue.

As a result, Walworth County adopted an ordinance (Ordinance No. 232-11/02 Sec. 10-28 a) stating that an event licensee is responsible for reimbursing the County for the cost of providing extraordinary governmental services required as a result of an event. Grateful Dead Tour promoters were required to pay the County $15,000 in additional fees.

Seahawks Stadium (Qwest Field) - Seattle, WA

FAST FACTS ABOUT: Seahawks Stadium (Qwest Field)

Types of TDM: Mode Choice
Keywords: Special events, multi-jurisdictional coordination, neighborhood impacts, stadium construction, parking reduction goals
Area Demographics: Professional sports stadium and adjacent exhibition center proximate to other regional venues and I-15. Seahawks Stadium is situated on the former Kingdome site surrounded by residential land uses.
Program: Transportation Management Program (TMP) was a condition of project (i.e. Stadium) approval. TMP implementation roles and responsibilities are clearly defined.
Results: Coordinated approach to demand management for special events. In the first year of the program, mode split goals were surpassed.
Contact: David Markley, Transportation Solutions, Inc.

A New Stadium for Seattle

In the late 1990s, as plans for a new football and soccer stadium began to take form, public agencies and the private sector acknowledged the importance of a balanced Transportation Management Program (TMP). The TMP needed to be consistent with the region's approach on engaging stakeholder involvement and preserving the quality of life and the natural environment.

In 1998, Washington voters approved Referendum 48 allowing the use of public funds to build the stadium, an adjacent exhibition center and a parking structure. The referendum also created the Public Stadium Authority (PSA) to provide public representation as part owner. The new Seahawk Stadium is west of I-5 and north of Seattle Mariner's Safeco Field. The site is where the former Kingdome stood within Seattle's Pioneer Square neighborhood. In 2000, the Kingdome was imploded and construction began. Two years later, the facility was completed within the $430-million budget and ahead of schedule. Seahawk Stadium was designed to host professional football and soccer games with a seating capacity of 67,000. The adjacent exhibition center typically hosts non-sporting events with up to 15,000 attendees.

The TMP is explicit regarding roles and responsibilities for TMP planning and implementation by assigning responsibility in one of four ways: exclusive, lead/ coordination, partner, or advocate.

TMP Sets the Stage

As transportation and parking mitigation for the Environmental Impact Statement (EIS) prepared for the project, the Transportation Management Program (TMP) was born. The Seattle Department of Construction and Land Use (DCLU) required that the conceptual TMP contained in the Final EIS be further developed and committed to as a condition of project approval. The TMP has built on the success of other local projects including the TMPs for prior Kingdome Stadium, the new Safeco Field, and the Seahawk's temporary use of the University of Washington's Husky Stadium during construction. The TMP was designed to minimize personal vehicle use to and from the site by supporting other transportation modes thereby minimizing negative transportation-related impacts to visitors as well as the immediate neighborhood. A number of goals were set as guiding principals for the TMP concerning area residents and businesses. Specific goals included minimizing the impact of event parking on adjacent neighborhoods as well as minimizing access delay and confusion for neighboring residents and businesses prior to, during, and following events. The TMP is flexible in nature with the ability to adapt to tenant changes, travel pattern variations, and transportation improvements as they occur in the vicinity.

The development of the TMP was a collaborative process engaging key stakeholders through a series of meetings including the re-establishment of the Parking and Access Review Committee (PARC), a group previously organized to address transportation and parking issues associated with construction of nearby Safeco Field.

Input on the TMP was obtained from all affected agencies including King County METRO, the Seattle Department of Transportation, the Seattle Police Department, the Washington State Department of Transportation, and the Port of Seattle. The TMP was subsequently approved by the stakeholder groups and forwarded to the DCLU for final approval, which was granted in early 2002 allowing enough time for implementation prior to the stadium opening in August 2002.

The TMP is organized into four strategic program groups, which include: 1) Traffic and Parking Demand Reduction, 2) Management of Resultant Vehicle and Pedestrian Demand, 3) Event Management and Public Information, and 4) Implementation and Monitoring. The TMP is explicit regarding roles and responsibilities for TMP planning and implementation by assigning responsibility in one of four ways: exclusive, lead/coordination, partner, or advocate.

Transportation options for Seahawk Stadium include, but are not limited to, regular Metro transit service, Metro Express Bus Service from Park and Ride lots, charter buses, Sounder train service, and Event Match ridematching service.

Settling the Score

In order to evaluate the effectiveness of the TMP, it was important to have measurable criteria. Recognizing that personal vehicle use and parking have a significant impact on area traffic circulation and congestion, an index was developed to measure the reduction in personal vehicles traveling to and from events. The index has been defined as the number of personal vehicles per 1,000 persons attending an event.

The index is directly affected by the use of transit and other alternative modes of travel and average vehicle occupancy for the personal vehicles that do travel to the event. Based on historical travel data for the Kingdome and applying performance assumptions for each program contained in the TMP, an estimated mode split was derived that was then used as the basis for performance goals for the new stadium in terms of cars per 1000 attendees. The index-based approach has proven to be well-suited as an evaluation tool since it allows for varying degrees of attendance and time of day. The table below indicates performance goals (less than or equal to) for a single event occurring at any given time.

Single Event Performance Goals

	Vehicles per 1,000 Attendees			
Event Type and Timing	**Kingdome Baseline (1998 and 1999)**	**2002**	**2003**	**2004+**
Stadium Weekend	**340**	**319**	**298**	**277**
Stadium Weeknight	**370**	**349**	**328**	**307**

Although scheduled events at Safeco Field, Seahawks Stadium and the exposition center were never to occur concurrently or even within four hours of one another, an additional set of goals were established for dual events. Prior to the City of Seattle's approval, a "Dual Event Agreement" was established eliminating the possibility of having two events with a combined attendance of over 58,000 occurring within 4 hours of each other without a special TMP.

An initial review of 2002 results indicate that mode split goals have been surpassed. The non-auto mode split was surveyed at between 25% and 30% which exceeded initial projections of 20%. Success can not be directly attributed to any single mode of travel, but is reflective of the range of options available including Park and Ride facilities, transit service, ferry and rail services as well as bicycling and walking.

Pac Bell (SBC) Park - San Francisco, CA

FAST FACTS ABOUT: Pac Bell (SBC) Park

Types of TDM: Transit service improvements, information and incentives, and parking management
Keywords: Special events, multi-jurisdictional coordination, transportation management plan, neighborhood impacts, parking pricing
Area Demographics: Professional sports stadium in rehabilitated warehouse district proximate to regional commuter rail and light rail service. PacBell Park (now SBC Park) is situated in South or Market district adjacent to San Francisco Bay.
Program: Transportation Management Program (TMP) was a required by City. Ballpark Transportation Coordinating Committee appointed to develop TMP among stakeholders.
Results: Achieve objective of 50% of fans arriving by non-auto modes. Parking lots never full to capacity.
Cost of Program: $1.5 million spent on transportation facility improvements and information campaign.
Contact: Gerald Robbins, City and County of San Francisco Planning Department

A New Downtown Ballpark for the SF Giants

Pacific Bell Park, the San Francisco Giants 41,000-seat "downtown ballpark," opened in March 2000. The ballpark is located alongside San Francisco Bay, approximately one mile (1.6 km) south of the center of downtown San Francisco. The ballpark is located in the South of Market Area (SOMA) of San Francisco, a former warehouse district that in recent years has become a popular location for new technology firms and high-density residential development. The ballpark site is relatively small and is bounded by water on two sides. Unlike most sports stadia, PacBell park and its parking lots were constructed almost entirely with private funds. As a result, very little funding (about $1.5 million) was available for off-site transportation improvements, such as improved roadway, transit or pedestrian facilities. However, the Giants promoted the downtown site, in part, because of its proximity to regional transit and existing commuter-oriented parking supply. Additionally, the ballpark planners also hoped that many downtown workers would walk or ride bicycles to PacBell park on weekdays. Traffic concerns included the fact that weekday afternoon ball games would be over within close proximity to the start of the evening rush hour.

The Giants and regional transportation agencies educated fans on the potential traffic and parking problems and the range of convenient and affordable transit options.

TMP Required by City

Due in part to concerns of local residents and businesses about traffic congestion, particularly for weekday afternoon games, the City and County of San Francisco required a Transportation Management Plan (TMP) be developed and approved to assure efficient transportation operations and minimal impacts to the surrounding neighborhoods. A Ballpark Transportation Coordinating Committee (BTCC) was appointed to develop the TMP and garner buy-in from affected parties. One key objective of the TMP was to maximize the use of non-auto modes by baseball fans, particularly public transit.

The TMP included the promotion of existing and new transit services:

- Caltrain commuter rail service terminus adjacent to the ballpark.
- A new LRT line from Caltrain to BART Embarcadero station.
- Nearby BART regional rail under Market Street.
- New ferry service to the adjacent China Basin Ferry Terminal.
- Various SF Muni bus lines and regional bus service to the Transbay Terminal.

PacBell has 5,000 dedicated parking spaces in lots located across Mission Creek. New residential area parking restrictions were imposed and several streets and lanes closed during games (including access routes to the parking lots and regional transit service).

Finally, a set of transit promotional activities and incentives were part of a comprehensive marketing campaign called "Your Ticket Home" and were funded by the Giants, the Metropolitan Transportation Commission, and several corporate sponsors. The campaign was designed to entice first time user to try transit and included the following components:

- A pocket-size pocket information guide for fans and all season ticket holders.
- A transit information hotline answered by the regional ridesharing organization.
- The opportunity to purchase transit tickets by mail (resulting in over $100,000 in advanced fares purchases).
- An incentive program that rewarded Giants fans points toward their fan appreciation program for purchasing transit tickets.
- Promotion of the Your Ticket Home campaign on Bay Area trains and buses serving the ballpark.
- The deployment of "Transit Ambassadors" to answer questions and guide new riders through transfers and fare collection particulars.

Better than Expected Results

The primary measures of success were the proportion of fans arriving by transit and the severity of traffic and parking congestion. During the first year in PacBell Park (renamed SBC Park in 2004), the ballpark and its TMP achieved a 50% non-auto mode split and the dedicated parking lots never reached capacity.

Half of Giants fans arrived by non-auto modes and parking lots were never full to capacity due to the effectiveness of the TMP.

Part of the evaluation of the TMP's effectiveness was a comparison of the first year operation of PacBell Park with 3Com (formerly Candlestick Park). Some key comparisons are provided below and bear witness to the success of the TMP:

	3Com Park	PacBell Park
Seats	58,000	41,000
Dedicated Parking Spaces	8,800	5,000
Parking Fee	$6	$15-20
Other Nearby Parking Spaces	10,000	2,000-3,000
Percent on Transit	3-4%	34-41%
Percent Walking	0%	5-8%
Percent in Autos	96%	48-58%
Average Auto Occupancy	2.5 fans per car	2.8 fans per car

What do the Giants and City of San Francisco attribute the high transit usage and lack of parking and severe traffic problems? First, pre-opening public information not only educated fans as to the lack of parking and congested downtown streets, but one the range of affordable transit options. Pre-paid transit ticket opportunities and a high proportion of advance payment season ticket holders provided fans with ample time to plan their trip to the ballpark and reduce spur of the moment travel (more commonly made by car). A significant percentage of fans at weekday (32%) and weeknight (28%) games came to the ballpark directly from work.

The high level of transit use at PacBell can be attributed to the following factors: 1) availability of reliable, efficient, and affordable mass transit; 2) commitment to quality transit service by regional providers and the Giants made possible by predictable ridership; 3) high parking costs and limited availability; 4) close proximity to a large downtown population base; a well developed and executed transportation management plan; and 5) public expectations as to the severity of traffic and parking problems.

Zion National Park - UT

FAST FACTS ABOUT: Zion National Park - UT

Types of TDM: Mode Choice
Keywords: national park, shuttle system, sustainable practices, parking restriction, road closure, alternative fuel vehicles
Area Demographics: Utah's first national park, annual visitation of 2.61 million in 2002.
Program: Mandatory summer shuttle system since 2000 serving Zion Canyon and Springdale. Parking is restricted on Scenic Drive.
Results: 75% of Zion's annual visitors use the system. In 2000, the shuttle system reportedly reduced nearly 1,200 vehicle trips per day and almost 11,000 vehicle miles traveled per day.
Cost of Program: $12 million for the initial capital investment and approximately $2.5 million in annual operating costs.
Contact: Ron Terry, Zion National Park

Protecting Assets

Zion National Park, located in southwest Utah, was designated as the state's first national park in 1919. The Park, associated with deep canyons, dramatic cliffs and the Virgin River, is nearly 230 square miles although most of the visitation in focused on Zion Canyon. The Park is accessible from the south, west and east with the southern access through the town of Springdale. The usual approach to the southern access is from the west via State Route 9.

In the early 1990s an escalated number of visitors to the Zion Canyon made it increasingly difficult for visitors to find parking along the Zion Canyon Scenic Drive. In 1999, the annual visitation was 2.4 million. Increased visitation resulted in traffic congestion, inadequate parking, destruction of natural resources and a diminished visitor experience in the 6-mile upper portion of the Zion Canyon. On an average day during the peak season up to 5,000 cars including tour buses were using the Scenic Drive. Only 400 parking spots were available along the scenic roadway and as a consequence visitors typically double and triple parked destroying vegetation.

Bold Idea for Zion

Several alternatives were considered by Park officials prior to implementing the existing shuttle program. Alternatives considered but rejected included increasing parking in the Canyon, closing the scenic drive once the parking filled, and providing a voluntary shuttle system. The selected alternative included the implementation of a mandatory shuttle system using propane-powered vehicles during the peak tourist season.

The shuttle system began operation on May 26, 2000 allowing only the Park's shuttle busses to operate north of the Zion Canyon Visitor Center during the peak summer season. An exception has been given to allow employees and guests of the Upper Lodge to continue using the Scenic Road although they are encouraged to use the shuttle system once their vehicle is parked. Parks Transportation, Inc. currently operates 30 NPS-owned propane-powered shuttle buses. Approximately 20 of these buses operate exclusively within the park with attached trailers capable of holding a total of around 66 passengers each. The shuttles have operated daily from the beginning of April though the end of October since 2000. Personal vehicle access is only permitted from November to late March on the Scenic Drive except for Upper Lodge employees and guests.

The shuttle system operates in two loops. One route makes six stops within the town of Springdale and the other has eight stops along the Scenic Drive. The Visitor Center is the central transfer point for both the Zion Canyon route and the Springdale Loop. Although parking is permitted at the Visitor Center, it is typically full by late morning during the peak season. Parking at the Visitor Center is equivalent to the 400 spaces that used to be available to visitors on the Scenic Road prior to implementation. Some of the Scenic Road parking has been converted to bus stops, but most of the spaces remain providing general parking during the off-peak season when the road is again accessible to all.

Visitors are encouraged to park in Springdale and use the shuttle system to access the Park free of charge. Springdale has provided approximately 1000 parking spaces for Park visitors. Shuttles operate within the Canyon at 6 minute headways during the middle of the day and approximately every 10 to 15 minutes in the morning and evening. Between 6:30 - 7:30 AM and 9:00 – 11PM frequency is reduced to every 30 minutes. Each full shuttle bus, which has a capacity of 66 people has the potential to replace 25 cars.

The shuttle system is an integral component and was the catalyst of a large-scale improvement project including the construction of a new Visitor Center and a bus maintenance facility, as well as a 3-mile pedestrian path, the Pa'rus Trail. Additional streetscape and safety improvements near shuttle stops were also included in the project. The Visitor Center showcases award-winning energy efficient design and sustainable development practices. Like a number of other National Parks, Zion is also testing alternative fuel vehicles to assess environmental impacts. Zion has two electric trams each holding up to 36 passengers.

The town of Springdale has directly benefited from their Partnership with the Park on the shuttle system. Today, over half of the system operates within Springdale thereby providing free transit service to the residents.

The total cost of the improvement project was $27.4 million, including $9.4 million for shuttle buses and trailers. The bus maintenance facility cost an additional $2.6 million. Annual operating costs of the shuttle system are estimated to be $2.5 million, or about one dollar per visitor. The street, landscaping, and sidewalk improvements surrounding the Springdale shuttle stops were financed by federal enhancement funds secured by the Utah Department of Transportation.

Benefits Started on Day One

The shuttle system has had a significant impact on traffic operations and the natural environment within the Canyon. The 2000 operational period lasted from the 26th of May until the 29th of October, during which more than 1.5 million passengers utilized the system. The effectiveness data below indicates the marked success of the system during its' first year of operation.

Year 2000 Shuttle System Effectiveness	
Shuttle Passenger / Day	**2,994**
Reduction in Vehicle Trips / Day	**1,183**
Reduction in Vehicle Miles Traveled / Day	**10,877**

Source: 2001 Draft Report on Air Emissions Inventory for Zion National Park

Current estimates indicated that about 75 percent of the 2.5 million annual visitors ride the Zion Canyon shuttle. In the programs second year, 2002, annual shuttle boardings (2.35 million) almost equaled park visitation (2.61 million).

The shuttle system has been attributed with eliminating much of the vehicle congestion, parking conflicts, and aesthetic and noise related issues associated with vehicle use in the Park. Research is underway to quantify the effect that propane-powered shuttle buses have had on reducing noise levels. Prior to implementing the system, a noise impact assessment concluded that a considerable portion of the Canyon noise was a result of commercial tour bus traffic which is now prohibited north of the Visitor Center.

The town of Springdale has directly benefited from their Partnership with the Park on the shuttle system. Today, over half of the system operates within Springdale thereby providing free transit service to the residents. Likewise, the Park has also benefited from collaborating with Springdale. Without the partnership, the Park would have had to invest in additional roadway and parking infrastructure to support the shuttle system. The partnership has been attributed with reducing Park roadway construction needs by 40% and parking development by 54%. Aside from providing a transportation alternative for Park visitors and staff as well as Springdale residents, the shuttle system has indirectly promoted the local economy. Springdale experienced a 5 percent increase in retail sails during the first year of shuttle operation

City of Aspen - CO

FAST FACTS ABOUT: City of Aspen - CO

Types of TDM: Mode Choice
Keywords: tourism, shuttle service, paid parking, marketing, ridesharing, recreation, HOV
Area Demographics: Premier winter sports and recreation destination in west-central Colorado. Peak season visitor population nearly matches resident population.
Program: Various programs including, carpool parking incentives, mandatory shuttle service, paid parking programs, and aggressive marketing.
Results: Money generated from the paid parking program directly benefits demand-side strategies. Traffic volumes have not exceeded 1993 volumes. Parking occupancy reduction of 10%.
Cost of Program: Unavailable; numerous departments cover resource needs. As an indication, the City's marketing budget (including printing costs) for 2003 was approximately $50,000.
Staff: The City of Aspen has one full-time individual dedicated to demand-side strategies.
Contact: Lynn Bader, City of Aspen, www.aspenpitkin.com

Aspen at the Top

Aspen, Colorado is recognized as a premier recreational and resort destination in the western United States. Located approximately 220 miles west of Denver, Aspen is home to less than 15,000 permanent residents. Visitors push the seasonal population to 25,000 during the winter peak ski season. Aspen is home to the Aspen Skiing Company (ASC) which operates two luxury hotels and 15 restaurants. At the peak winter season, ASC employs 3400 people, and is the largest employer in the Valley.

Aspen is accessible via Colorado Highway 82 (CO 82), which is currently under construction. The C0 82 project is a 40-mile corridor improvement from Glenwood Springs, Colorado at I-70 to Aspen. A key project component includes the installation of high occupancy vehicle (HOV) lanes. When completed, the HOV facility will stretch 16 miles from Basalt to Aspen. The HOV lane has also served as a construction traffic impact mitigation tool, reducing the number of vehicle trips passing through the construction zones along CO 82. By using temporary signing and striping during construction, the Colorado Department of Transportation (CDOT) was able to start providing a time-saving advantage to HOVs.

Aspen has implemented transportation goals to preserve the physical environment and control future traffic impacts on the community. The 1993 Aspen Area Community Plan adopted a transportation goal to limit the traffic entering Aspen to 1993 volumes. Traffic volume counts are taken continuously at Castle Creek Bridge and are summarized monthly to ensure that the goal is being met. The goal has been met every year since. The City of Aspen has adopted several transportation goals besides limiting traffic volumes such as reducing parking occupancy rates downtown and offering viable alternatives to driving alone.

Program Description - Complementing Strategies

Aspen exemplifies the cohesion of a range of demand-side strategies, in most cases implemented by a number of different organizations (local transit agency, non-profit, local jurisdiction, etc.), successfully contributing to vehicle trip reduction. The section below highlights a few of the Aspen's programs although success is difficult to attribute to only one or two strategies.

Area-wide Rideshare - The City of Aspen coordinates the local rideshare arrangements. The distribution of daily Carpool Parking Permits provides an indication of the success of their ridesharing program. To encourage carpooling, vehicles with more than 3 people entering the downtown area can stop at a kiosk and receive a Carpool Parking Permit that allows that vehicle to park in a designated area free of charge all day. Approximately 16,000 daily permits

are issued annually. Coupled with the high-occupancy vehicle lanes and transit signal priority, the distribution of these permits is one of the most successful incentives to rideshare.

Transit Service - The Roaring Fork Transportation Authority (RFTA) provides daily fixed route and demand response transit services. RFTA operates partially on a local sales tax. The local jurisdictions including Aspen and Glendale contribute proportionately to the transit service they receive. During the summer, RFTA operated the Maroon Bells shuttle service to the Maroon Bells National Recreation Area. Personal vehicle traffic is restricted between 9:00 AM and 5:00 PM daily allowing access only to shuttles and those with special needs. The combined June and July 2003 ridership was over 40,000 passengers.

Park and Ride Lots - Highway 82, the main north-south roadway has eight P&R lots available to commuters. The lots range in size between 10 and 150 spaces. The neighboring Town of Snowmass hosts an aggressive intercept parking program in which perimeter parking lots are available to leave vehicles and use transit. The alternative to intercept parking in Snowmass is to buy a parking permit to park in the core area.

Employer-based Support Programs - The Transportation Options Program (TOP) is comprised of 32 businesses and over 6000 employees. Participating employers provide an employee transportation coordinator (ETC), nick-named TOP Dogs, to attend meetings and disseminate information to employees. TOP has also negotiated the creation of the Zone Pass with Roaring Fork Transit Association (RFTA), which enables individualized transit options to encourage employers to purchase transit passes for their employees. Other TOP incentives include schedule display boards, email traffic alerts, and monthly newsletters. TOP is operated on funds from the paid parking program. All TOP services are free.

Parking Incentive Programs -The paid parking program, Pay and Display, has been implemented with the highest rates charged downtown. One Pay and Display ticket covers the entire block with a maximum of two hour parking. Aspen also has traditional parking meters. Money generated from Aspen parking programs is applied directly towards other transportation management programs.

Marketing - Find Another Way Day is an annual marketing campaign to encourage commuters to try another mode of travel. For the last 7 years, the City of Aspen has sponsored this event to encourage people to leave their car at home and use another means to get around town or commute to work. Find Another Way Day events include entertainment, food, prizes and free bicycle safety checks. In 2001, a Customer Appreciation event was also added to Find Another Way Day to enable citizen's not living and working near the downtown core area to participate. In 2003, the event became Find Another Way Week with daily events happening throughout the Valley. In 2002, the City implemented "Carpool Patrol" in cooperation with local radio stations by interviewing and giving prizes to carpoolers who stopped at the kiosk.

A Decade of Success

The City of Aspen has designated one full-time individual to demand-side programs. The program is evaluated yearly and considers a documented goal and outcome plan. Aspen has found it fruitful to track quantifiable measures of effectiveness such as the number of transit passed sold, Carpool Parking Permits distributed and traffic volumes as well as performing annual reviews with their employer participants to ensure that their needs are being met. Each year, specific goals are outlined and later the outcome is documented.

The programs highlighted above have collectively but not exclusively contributed to achieving transportation goals. As of 2003, revenue generated from the paid parking program generated $600,000 for program support and $300,000 for future transit investment. This program is also attributed with reducing parking occupancy downtown by 10%. The City has also displayed flexibility with their programs to ensure that goals are met. For example, in 2003, parking rates were increased to cover higher transit costs as well as to preserve the parking occupancy rates downtown. In 2003, the City of Aspen became the first and only city in the nation to be awarded best workplace for commuter status by the US EPA. The City's program also received the 2003 Outstanding Service Award from the Association for Commuter Transportation.

Lake Tahoe Basin - CA

FAST FACTS ABOUT: Lake Tahoe Basin - CA

Types of TDM: Mode Choice, Route Choice
Keywords: tourism, trolley service, private shuttle service, gondola, transportation management association, recreation
Area Demographics: Mountain communities surrounding Lake Tahoe, an attractive year-round recreation and vacation destination. Historically, a peak Friday in August experiences the highest annual daily traffic volumes. About 56,000 live in the Tahoe Basin year-round.
Program: Various programs including two summer trolley services and private shuttle services catering primarily to Basin visitors. Private investments such as the Heavenly gondola.
Results: 20% of Heavenly's visitors arrive via the gondola. In 2001, the combined trolley service ridership was nearly 90,000 passengers during a limited summer operational season.
Cost of Programs: Limited information available. In 2001, Nifty 50 operated on a budget of $200,000 which included 5 vehicles. During the same year, the TNT / TMA operated with a budget of about $160,000.
Staff: Limited information available. South Shore TMA has one full-time person. TNT / TMA utilizes one full time director and one part-time employee.
Contact: Dick Powers, South Shore TMA and Jennifer Merchant, TNT / TMA

Area Characteristics

The Lake Tahoe Basin incorporates two states and five counties between the Sierra Nevada and Carson mountain ranges. Approximately two-thirds of the Basin is in California and one-third in Nevada. The area can be characterized as mountainous with limited areas of level terrain. Lake Tahoe itself is twenty-two miles long and 12-miles wide with 72-miles of shoreline.

The population of the Lake Tahoe Basin consists of residents and visitors. The Basin economy is significantly dependent on resort, recreational, and gaming industries. The resident population lives and works in the basin, and the influx of visitors arrive during the winter ski season (December through March), and the summer seasons (June through August). However, the month of August has the highest travel demand in terms of peak hour traffic volumes on the roadways. Currently (according to 2000 census data) about 56,000 people reside year-round in the Basin. Population growth through 2010 is expected to be modest in contrast to the rest of the four counties of which the Tahoe Basin is a part. The land use restrictions and the physical carrying capacity of the Basin will tend to maintain steady linear trends in population growth.

The roadway network within the Basin consists essentially of a "ring road" with a handful of regional access points. Most of the roadway network supporting the Basin can be classified as 2-lane highway and local collectors and arterials. Traffic entering the Basin has access from several points. The most direct access route to the City of South Lake Tahoe from points west and east is U.S. 50. State Route (S.R.) 89 and S.R. 267 provide access from Truckee and the I-80 corridor on the north. S.R. 89 through Tahoe City consistently maintains the highest traffic volumes entering the Basin both during the peak month and yearly. Except for U.S. 50 from the east, all the access routes are two-lane highways.

In response to the TRPA air quality threshold standards, the 1992 Regional Transportation Plan (RTP) established a VMT threshold standard to reduce vehicle miles of travel (VMT) by 10 percent of the 1981 base values. A number of demand-side programs have been implemented in an effort to obtain the VMT threshold.

Public and Private Transportation Investments

The Tahoe Basin is served by two publicly operated transit systems, tourist oriented trolley services, and a number of privately operated shuttle systems. Demand response service is offered by many agencies, and subsidized taxi services are also available. Basin agencies have realized investment in existing infrastructure

with comprehensive studies concluding with detailed recommendation for pedestrian and bicycle facilities as well as enhancements to the existing ITS initiatives. Highlighted below are a few of the innovative programs and TDM measures that the Basin has successfully implemented in recent years.

Visitor-based Trolley Service - In addition to the two established local transit agencies operating in the Basin, there are two successful summer trolley systems operated by the local Transportation Management Associations. The north shore service, Tahoe Trolley, is free at night but requires a minimal fare during the day. Service is available for approximately 60 days during the summer. In 2001, 18,000 riders used the service despite a 25% service cutback due to the limited availability of drivers. The south shore of Lake Tahoe supports a separate trolley system called Nifty 50. As a tourist-focused system, Nifty 50 operates approximately 80 days during the summer months from 10AM to 10PM. In 2001, 70,000 passengers used the service.

Privately Operated Shuttle Service - Several privately operated shuttle services also operate in the Basin. Casinos and hotels offer daily shuttle services while the major ski areas offer shuttle services either on a contract basis or privately during winter months. Services are available on both the north and south shore areas. As documented, the casino shuttles offer a significant service providing nearly 500,000 one-way passenger-trips per year. North shore ski areas to the south shore also provide service. Coordination of services between the public transit system on the south shore and the ski shuttles is afforded by use of common bus stops. The Tahoe Queen operating out of the Ski Run Marina also provides a waterborne ski shuttle service between the north and south shore areas.

Heavenly Ski Resort Gondola - In 2000, Heavenly Ski Resort installed a gondola providing direct access from the hotels, casinos and center of South Lake Tahoe to the resort. The gondola affords mountain views covering 2.4 miles for the 17-minute scenic ride. The new gondola recently won the Silver Eagle Award from the National Ski Areas Association, recognizing the improvement the gondola has made to the resort and community in reducing vehicle trips while minimizing visual impacts and environmental disturbances. Heavenly reports that 20% of their winter visitors access the ski resort via the gondola, which has helped reduce traffic congestion in South Lake Tahoe.

Transportation Management Associations - Over the last ten years, a number of measures have been implemented in the Basin through two community-based transportation management associations (TMAs).

The Truckee/North Tahoe TMA (TNT/TMA) has been a local leader in addressing transportation issues as well as disseminating information and providing transportation alternatives. One of their most successful programs is the Tahoe Trolley, which provides a summer season service (approximately 60 days) in and around north shore communities, resort areas, and to Emerald Bay providing a link to the south shore transit options. In addition, the TNT/TMA has taken the lead in coordinating expanded winter transit service for the north shore. Currently, one full-time and one part-time employee operate the TMA with an annual budget of about $160,000. 44% of the required revenue is generated from member contributors including local jurisdictions and area resorts.

Serving South Lake Tahoe, the South Shore TMA has focused primarily on appealing to the visitor market of the Basin. Formed in 1994, the TMA initiated the successful summer trolley program, Nifty 50 Trolley. The TMA is responsible for maintenance, drivers and securing funding as well as all other logistical matters related to the service. The South Shore TMA is actively involved with local planning efforts and is leading the effort to institute the coordinated transit system (CTS), which would combine both public and private transit services of the south shore. The South Shore TMA and NDOT are also working on securing funding to expand the existing seasonal shuttle service and to provide service to employees commuting between the Tahoe Basin and the Carson Valley.

Measures of Effectiveness

Programs highlighted above contribute positively to the overall transportation and visitor experience within the Tahoe Basin. Summarized below are indicators of program performance provided by project sponsors:

- Seasonal Trolley Service Ridership (Summer of 2001):
  - 18,000 passengers on Tahoe Trolley, north shore.
  - 70,000 passengers on Nifty 50, south shore.
- 500,000 one-way passenger trips per year provided by private casino shuttles.
- 20% visitor using the gondola to access Heavenly from South Lake Tahoe versus arriving by vehicle.

I-15 Reconstruction - Salt Lake City, UT

FAST FACTS ABOUT: I-15 Reconstruction

Types of TDM: Mode Choice, Route Choice, Time Choice, Trip Substitution Choice
Keywords: ATMS, design-build, special events, Olympics, 511, light rail, capacity enhancement, TOC
Area Demographics: Salt Lake City metropolitan area. Recent 7-year design-build reconstruction project of I-15 including significant investment in ATMS technology. The project was complete prior to the 2002 Winter Olympic Games.
Program: CommuterLink (TOC, control and field equipment), marketing and outreach during reconstruction, coordinated special events planning for the 2002 Winter Olympic Games.
Results: Commuter Link is expected to save Utah more than $100 million annually.
Cost of Programs: Reconstruction = $1.52 billion, Initial ATMS investment = $70 million.
Contact: Lawrence Jesse Glazer, FHWA, Jesse.Glazer@fhwa.dot.gov

Area Characteristics

The Utah Department of Transportation (UDOT) completed the 17 mile reconstruction of I-15 in July 2001. The project was completed in four and a half years at a cost of about $1.52 billion. Instead of rehabilitating segments of the highway, UDOT decided to rebuild the entire corridor. To meet an aggressive schedule and, in particular, aiming to finish construction before the 2002 Olympic Games, UDOT completed the project using a design/build approach.

The original I-15 infrastructure, built in the 1960's, was designed to support half the traffic capacity it served in 1997. This capacity-enhancing project included adding two general purpose lanes, two high occupancy vehicle (HOV) lanes and auxiliary lanes between interchanges. Project components also improved access to downtown Salt Lake City, provided railroad grade-separations, replaced deficient bridges and utilized single-point interchange design. The project mitigated conflicting merging traffic movements and significant traffic congestion.

Program Description

UDOT recognized that the project would have significant consequences to traffic circulation and operations during all project stages. The contractor was required to maintain two lanes of traffic in each direction during peak commute periods as well as preserve critical freeway-to-freeway movements and access to downtown at all times. When interchanges and cross streets were closed, no two adjacent interchanges were inaccessible at the same time. Incident Management programs were expanded and supplemented by contractor-required courtesy patrols. As part of the reconstruction, emergency pullout locations were constructed along the corridor since limited shoulders were provided for disabled vehicles.

UDOT used a combination of demand-side strategies to maintain traffic during reconstruction. The ITS system (CommuterLink) was installed in three major pieces: 1) the Traffic Operations Center (TOC) including the physical building and internal networking equipment, 2) the control software, and 3) field equipment including VMS signs, cameras, and signal controllers. The comprehensive system includes a 511 Traveler Information Line, coordinated signals, ramp meters as well as speed, volume, weather and pavement sensors. UDOT installed the bulk of the $70 million worth of ATMS equipment using a design-build procurement method. CommuterLink was funded mostly by state funds ($52 million) with local ($1 million) and federal ($17 million) contributions.

ATMS technology enabled jurisdictions to monitor construction impacts, respond to traffic accidents faster, and communicate with the motoring public. The UDOT TOC is directly linked to both the Salt Lake City and Salt Lake County Traffic Control Centers and the Utah Transit Authority (UTA) Radio Center to provide seamless communication between jurisdictions.

UDOT also undertook a marketing campaign recognizing that one of the best ways to minimize traffic conflicts and delays on the interstate during reconstruction was to reduce the number of vehicles on the road. Employers and employees were encouraged to participate in ridesharing opportunities provided by UTA and commuter transit services, the Telecommuting Directive, and the Corridor Business Program. Informational services included the use of the internet, highway advisory radio, media outlets, signing, seminars and open houses. The importance of ridesharing and trip reduction was reiterated and promoted by such programs as Skip-a-Trip.

Evaluation of the 2002 Winter Olympic Games

The ATMS was put to the test for the 2002 Winter Olympic Games which was the largest Winter Games held to date. In total, the Games utilized twelve venues across the region. With 1.5 million tickets purchased, the travel needs were unprecedented. After the conclusion of the Games, an assessment was made on program components.

A number of goals and programs were established specifically for the Games TDM Plan depending on the venue and transportation user group. The two primary user groups considered were spectators and residents. For example, a specific TDM Plan goal was established to reduce background traffic by at least 20%. The strategies implemented to achieve this goal included transit, carpools, shifting work hours and travel routes and times. A follow-up survey with residents concluded that approximately one-fifth of residents changed travel patterns during the Games. Most residents offered that the change was related to an adjustment in daily work hours as opposed to a change in mode or route. In addition, a reduction in day-time truck traffic reduction between 30 -45% indicated by limited date from UDOT's Automated Traffic Recorder (ATR) system also contributed to reducing background traffic. The Olympic Spectator Transportation System (OSTS) was developed to address the transportation needs of the spectator population and included 19 park and ride lots served by shuttle buses, the TRAX light rail system with overflow parking lots and publicly - subsidized shuttle services to mountain venues.

Athlete and media transportation needs were also identified and addressed. A shuttle service was created exclusively for 11,000 members of the media, which operated on fixed routes 24 hours a day. The Athlete Transportation System served 3,300 athletes and officials housed in Olympic Village. The System included over 500 passenger vans, 50 cargo vans, 44 coach buses which operated 24 hours a day. Both media and athlete services were encouraged to use alternate routes.

Measures of Effectiveness

CommuterLink has already demonstrated its effectiveness. During its first years of operation, CommuterLink has been attributed with the following successes:

- Increased peak hour freeway speeds by 20%,
- Decreased freeway delay by 36%,
- Decreased traffic signal stops by 15%, and
- Decreased Intersection delay by 27%.

Considering the efficiency measures above, CommuterLink is projected to save Utah more than $100 million annually.

An evaluation of the ATMS and TDM Plan components specifically for the Winter Games provide the following results:

- 80,000 unique visitors visited the CommuterLink web site during the Games,
- 511 Traveler Information line daily usage peaked near 4000 calls. By comparison, 511 usage on a typical day in 2002 was around 300 calls.
- Over 2.5 million passenger-trips were recorded on public transit during the Games.
- Park and ride shuttle buses carried one-third of the transit passenger trips.

I-25 & I-225 Reconstruction - Denver, CO

FAST FACTS ABOUT: 1-25 & I-225 Reconstruction

Types of TDM: Mode Choice, Route Choice
Keywords: design-build, corridor reconstruction, construction mitigation, rideshare, transit subsidies
Area Demographics: Metropolitan Denver, T-REX includes both light rail construction and highway capacity and safety improvements to I-25 and I-225.
Program: TransOptions offers transit and vanpool subsidies, community outreach and education on construction and transportation options.
Results: Transit and vanpool subsidies account for a daily VMT reduction of 74,800. Refer to the case study for additional results.
Cost of Program: $3 million allocated to TransOptions.
Contact: Allison Hodge, Director of TransOptions, HodgeAM@trexproject.com

Area Characteristics

The I-25 corridor in metropolitan Denver is one of the most overburdened sections of roadway in Colorado. Over the past twenty years the region has experienced intense residential and employment growth leading to increased travel demand and congestion along the I-25 corridor.

In an effort to confront congestion along I-25, the Colorado Department of Transportation (CDOT) and the Regional Transportation District (RTD) initiated a multi-modal design-build project known as the Transportation Expansion Project, or T-REX. The design-build approach compliments T-REX project goals, which are:

- Minimize inconvenience to the public,
- To stay within the $1.67 billion project budget,
- To provide a quality product, and
- Complete the project on time (2008).

The project is ahead of schedule and is estimated for completion in 2006.

The T-REX project includes both light rail construction and highway capacity and safety improvements. T-REX, a design-build project, will add many new elements to the transportation system including 19 miles of double track light rail, 13 light rail stations (all but one with park & Ride lots), 34 additional fleet vehicles, and a new maintenance facility. The project will also provide additional lanes on both I-25 and I-225 within project limits as well as other safety improvements associated with save ingress and egress.

Program Description

T-REX owners recognized the potential impact that the large-scale project could have on the motoring public and took steps to minimize inconvenience associated with the reconstruction project. The TransOptions program was formulated in consultation with key community stakeholders as a construction mitigation program designed to assist employers and commuters in dealing with the challenges of traveling to, from and through the corridor during construction. CDOT and RTD dedicated $3 million to the TransOptions program, which included transit and vanpool subsidies, community outreach and education as well as maintaining a project website. The project is now in it's fourth construction season (2004). TransOptions has been recognized as a key element of construction mitigation by providing commuters and employers with incentives to use alternative modes to, from and through the corridor. TransOptions builds on the success of the TMAs and TMOs and established demand-side programs implemented by local jurisdictions including the Denver Regional Council of Government's (DRCOG) RideArrangers.

Facilitative leadership has helped avoid roles and responsibilities pitfalls. For continued success, it will be important to communicate the role of agency partners to ensure focused but collaborative efforts through established and new partnerships.

Due to the fluid nature of a design-build project and the foresight of those involved, a number of recent project features have been deployed to manage travel demand during construction. In November 2002, T-REX opened a temporary bus/HOV lane on I-25 to promote the benefit of higher occupancy modes. In May of 2003, T-REX launched a real-time instant email alert system utilizing project ITS components as they became operational. In May of 2003, TransOptions was honored with a TDM Award presented by the Southeast Business Partnership for it's continued commitment to and success with construction related transportation management to date.

Measures of Effectiveness

Recently, the T-REX TransOptions program has undergone an evaluation of it's first two years (2001 and 2002) utilizing a variety of measures including documentation review, stakeholder interviews, e-mail surveys, and quantitative analyses of program data. The evaluation identifies strengths and weaknesses of the TransOptions program, as well as opportunities and threats for the future of the program.

By reducing daily vehicle miles traveled (VMT) along the T-REX corridor, the TransOptions program is contributing to T-REX's goal of minimizing inconvenience along the corridor. As part of recent analysis conducted by UrbanTrans Consultants, Inc., TransOptions contributed to VMT reduction was measured. Collectively, transit and vanpool subsidies provided by TransOptions have reduced daily VMT by 74,800. The following successes have been cited as contributors of VMT reduction based on analysis completed to date:

- 14 employers purchased Eco Pass which resulted in over 1,200 employee Eco Pass holders,
- 66 commuters purchased ValuPass,
- 318 commuters purchased subsidized transit pass products at 4 Sales Pass Outlets established with T-REX support,
- 80 commuters utilized Commuter Checks to purchase transit products,
- 179 Vanpool riders received T-REX TransOptions subsidies, and
- 9 Vanpools were formed.

A number of TransOptions strengths were documented as part of the evaluation and are seemingly applicable to all highway reconstruction projects. Collaborative, responsive leadership of the TransOptions staff is imperative for the continued interest of project team members including the TMA/TMOs, DRCOG, RTD and the TransOptions TDM Committee. Facilitative leadership has helped avoid roles and responsibilities pitfalls. For continued success, it will be important to communicate the role of agency partners to ensure focused but collaborative efforts through established and new partnerships. Program credibility continues to be strengthened by the presence of a public relations firm on the TransOptions team. Marketing and public relations outreach of the TransOptions program resulted in increased employer and employee awareness of transit, vanpool and carpool. Success is evident measured by the implementation of over 300 events, attended by more than 20,000 persons by the end of 2002. In addition, just as important as providing employers and commuters with subsidized transit and vanpool products, it was necessary to enable the TMA/TMOs and DRCOG the tools to effectively provide those products. TransOptions is flexible in nature, adjusting to user needs.

Springfield Interchange - VA

FAST FACTS ABOUT: Springfield Interchange - VA

Types of TDM: Mode Choice, Route Choice, Trip Substitution Choice
Keywords: reconstruction, HOV, retail information center, park and ride, commuter rail
Program: TDM Program as part of Congestion Management Plan for the Springfield Interchange Improvement Project.
Cost of Program: $10 million for TDM program over 8 years
Contact: Valerie Pardo, Virginia Department of Transportation

Area Characteristics

The Springfield Interchange Improvement Project, a major reconstruction project sponsored by the Virginia Department of Transportation (VDOT), is currently mid-way through construction. The multi-phased, $350 million project began in March of 1999 and is scheduled for completion in 2007. The pre-project interchange, where I-95, I-395 and I-495 met, was nearly a mile long linking the three major interstates and serving nearly 400,000 vehicles a day. The original interchange was constructed in the 1960's and was not equipped to handle current or future transportation needs. Traffic forecasts projected volumes to double by 2020. Project improvements include building more than 50 bridges and flyovers, 30 ramps, and installing nearly 200 guide signs and 20 electronic message signs. Among a number of goals, VDOT undertook the Project to improve safety and access while increasing throughput capacity. A main project feature is to barrier-separate HOV lanes, through lanes and local lanes on I-95 to reduce weaving conflicts.

Program Description

VDOT has worked with federal and local agencies to create a comprehensive Congestion Management Plan ($28 million) including incident management, traffic operations, and demand management. The program allocation is $10 million over 8 years. Specific Plan goals were established to reduce 1,000 vehicles per peak hour and 2,500 vehicles per peak period.

Incident management components include the use of an on-site mobile command vehicle, equipment to respond to hazardous waste spills and traffic incidents of all degrees as well as increased patrols by the police and safety service units. Operational improvements include the installation of cameras to monitor traffic flow proximate to the interchange, a coordinated construction phasing plan, and information dissemination regarding alternate routes and emergency routes. In addition, signal timing adjustments and spot intersection improvements (installing or lengthening turn pockets) were also made. Infrastructure improvements also included capacity enhancements at intersections along parallel routes to accommodate diverted trips. Other specific TDM investments included a 10% increase in Park & Ride spaces, expanded commuter rail service, OmniRide bus enhancements, telework centers, fare discounts for both bus and rail service, and the promotion of vanpools, carpools, and private buspools of more than 30 passengers.

The region has numerous transportation management associations (TMA)s and ridesharing organizations available to users. Currently, bus service proximate to Springfield is free of charge thanks to a state-funded program conceived by the Northern Virginia Transportation Commission, Fairfax County, and the Washington Metropolitan Area Transit Authority (WMATA).

The Project maintains a project website, an information line and utilizes media for public outreach. Commuters or other travelers are encouraged to stay informed about project conditions. VDOT has enhanced information dissemination to the public by opening the nation's first formalized retail Information Center (IC), which is located in the Springfield Mall to help disseminate project information. The storefront station is equipped with monitoring cameras and can provide rideshare assistance and transit information and passes. Additional project elements promoting TDM include High Occupancy Vehicle (HOV) lanes, including the two-lane reversible facility running north to south and roadway operational improvements.

Measures of Effectiveness

The use of transit, carpooling, and vanpooling in the I-405 corridor has been consistently high due in large part to the success of the HOV lanes and Metrorail line. The challenge of the Congestion Management Plan was to provide additional services that would encourage drivers to change their behaviors. An early survey of single occupant drivers determined the most effective improvements to entice people out of their cars. Demand-side strategies were formulated based on these improvements. With HOV lanes already in place, VDOT was able to offer a time-savings advantage. The public outreach component is proving to be a success. As of May 2003, over 230,000 motorists had visited the Information Center in the Springfield Mall.

The Springfield Interchange Improvement Project is currently in Phase 4 and 5 and continues to operate the Congestion Management Plan established for the Project. As of June 2002, the Congestion Management Plan had been through three evaluation processes and has not been substantially modified. Minor shifts in programmed funds have occurred, but the majority of demand-side strategies are performing at or above their anticipated goals. Even during reconstruction, the original number of through travel lanes is maintained during peak hours.

Bal Harbour Village - FL

FAST FACTS ABOUT: BAl Harbour Village - FL

Types of TDM: Modal Shift
Keywords: Vanpool Subsidy
Employer Demographics: The Village of Bal Harbour is a small community located south of Miami Beach. Traffic congestion is not a problem in Bal Harbour, but traffic around the Bal Harbour area is challenging.
Results: 48% drive alone, 12% vanpool, 2% telework, 38% flextime (police officers)
Cost: $7,440: 93% = Vanpool subsidies, 7% = staff/management
Staff: Minimal staff time and staff costs once program was set up.
Contact: Alfred Treppeda, manager@balharbourflorida.com

Vanpooling: A New Idea Presents Itself

Bal Harbour Village is a small, upscale resort town located in South Florida. With a population of 3,309, the Village has implemented strict growth management policies since its incorporation in 1946. Today, the Bal Harbour Village Manager seeks out ways to sustain Bal Harbour's appeal to both Village employees and in turn to visitors. Despite good bus service, Bal Harbour Village employees are not avid bus riders. The presence of free parking for employees may be one explanation for low bus usage. Residential location may be a second explanation. Most of Bal Harbour Village's employees commute from outside the town limits and prior to August 2001, a great majority of them drove alone.

In August 2001, the Village Manager received a flyer advertising the South Florida Commuter Services (SFCS) vanpool services. SFCS works with the South Florida Vanpool Program (SFVP) to provide vanpool services and programs. SFVP works directly with employers to design a vanpool program, present vanpooling options to employees and manage the program from the start-up through implementation. The Village Manager's interest was peaked and he scheduled an employee vanpool presentation.

In just 2 years, 12% of Bal Harbour Village's employees are vanpooling.

Immediate Vanpool Formation

The presentation concluded with high employee interest in starting a vanpool. Immediately, eight Bal Harbour employees signed up to form a vanpool. In addition to presenting the Vanpool program to employees, the Village Manager began researching subsidies and payment options for employees. In order to tap into employee motivation, the Village Manager leveraged a subsidy paid by Miami-Dade County with funds from the Village of Bal Harbour to establish the first vanpool. The employee and Village divided the remaining vanpool costs.

Employees that participated in the first vanpool began to report reduced commuting costs and influenced other employees to consider vanpooling. Not long after the first van formed, the Village Manager acquired enough employees to sponsor a second vanpool. In just 2 years, 12% of Bal Harbour Village's employees are vanpooling. Due to the vanpool popularity, the Miami-Dade County subsidy and new transportation tax proceeds, the Village of Bal Harbour is able to pay 100% of the vanpool costs. Thus, as of Summer 2003, employees pay only the cost of gas to vanpool. All vanpoolers are eligible to participate in the County's Guaranteed Ride Home program.

Results

The Village Manager's interest in promoting alternative mode choices to employees has resulted in the formation of a strong vanpooling program. Today, Bal Harbour's mode split reflects the high interest in vanpooling. 12% of employees vanpool, 2% telework and 48% drive alone. The remaining 38% are police officers that work irregular shifts.

Calibre - Alexandria, VA

FAST FACTS ABOUT: Calibre - Alexandria, VA

Types of TDM: Modal Shift, Location Shift
Keywords: Transit Subsidy, Parking Management, Shuttle, Relocation, Parking Cash Out, Telework, Lease Negotiation
Employer Demographics: Located in Alexandria, VA near Washington, DC in an area well served by subway, commuter train and bus
Program: $65 transit, bike or walk subsidy, $65 parking cash out, carpool subsidy, telecommute
Cost of Program: $99,000 - $30,000- transit subsidies, $5,500 Telecommute program administration, $64,000 TeleworkVA! subsidy
Staff: 2 (Benefits Coordinator and HR Director)
Results: 2% carpool, 12% transit, 5% telework
Contact: Michelle Voisinet Caylor, Benefits Coordinator
mcaylor@calibresys.com

Company on the Move

CALIBRE is an employee-owned government information technology and management services firm headquartered in Alexandria, Virginia. CALIBRE's transportation program is a reflection of company objectives to "Take Care of Our People", "Manage Our Company" and "Be Good Citizens". CALIBRE opened its Falls Church, Virginia office with 44 employees in 1989. Over the next seven years, the company added two offices in the Virginia area. By May of 2001, company management recognized the benefits of consolidating Metro Washington, DC area staff into one office and began searching for appropriately sized office space. To assist the company in selecting a highly accessible location, the company looked at where employees lived and estimated employee commute times. The company found that relocating corporate headquarters to the Alexandria/Springfield, Virginia area would equalize commute time.

In addition to equalizing commute time, the company wanted to relocate to an area better served by a variety of transit modes. The Metro Park area of Alexandria provides access to the Franconia-Springfield station, which serves both the DC Metrorail and Virginia Railway Express (VRE). The new facilities accommodated staff from the three Virginia offices and provided ample room for predicted growth.

In an attempt to pro-actively address future parking demand issues, management began encouraging alternative mode usage immediately.

The Springfield office lease included an allotment of parking spaces based on the amount of square footage leased. Although the parking allotment fully meets and exceeds CALIBRE's present needs, the company's continued growth will someday out pace the allocated number of parking spaces. In an attempt to pro-actively address future parking demand issues, management began encouraging alternative mode usage immediately. Through the development and implementation of an aggressive transportation benefits program, CALIBRE hopes to avoid the high cost of increased parking in the future. As a first step towards this goal, CALIBRE negotiated, in its lease, a shuttle to the Metro station that allowed for free transportation to and from the Franconia-Springfield Metro station and the office. The Washington Metro Area Transit Authority (WMATA), under contract to the Transportation Association of Greater Springfield (TAGS), operates the shuttle.

Pulling the Pieces Together

Prior to relocating to the Alexandria/Springfield Area, a landlord-operated shuttle to and from the Pentagon, a major CALIBRE client, was the extent of the transportation benefits program. Today, CALIBRE's transportation benefits program is flexible towards a variety of transportation modes. All CALIBRE employees in the National Capital Area are eligible to receive subsidized parking or participate in the Metrochek program. CALIBRE's corporate headquarters employees may also receive parking cash out benefits. Metrochek, a transit program sponsored by WMATA, provides employees with vouchers from $65-$100 for approved transit costs. The

voucher can be applied to most forms of public transportation. The parking cash out program provides employees who opt out of their parking space and do not utilize transit, a subsidy of $65.00 a month. Cyclists and walkers can utilize the subsidy to defray the costs of commuting on bike or foot. CALIBRE employees who choose to carpool receive parking cash out of $32.50 a month. Additionally, employees outside the Metropolitan Washington Area may identify local transit programs for consideration in the Commuter Transit Benefit program.

CALIBRE recognized that employees did not need to work from the office to be productive.

In addition to transit, bike and walk subsidies and the parking cash out program, CALIBRE supports both flextime and telecommuting. As a high tech company, CALIBRE recognized that employees did not need to work from the office to be productive. In June of 2002, CALIBRE began a pilot program with TeleworkVA! a public and private partnership that promotes telecommunting. TeleworkVA! assisted CALIBRE by mapping out a telework policy plan highlighting how best to work with employees that telework. CALIBRE's telework plan requires employees interested in telework to first gain support from their supervisor and then together, submit a telework application. Employees are required to set up a home office, send in a photo of the office, pass a safety check and attend telework training with their supervisor. The training focuses on communication expectations, offers suggestions on supervising from a distance, and provides tips on avoiding telecommuting pitfalls. To provide seamless phone access, CALIBRE upgraded their phone system to allow for a telework employee's home phone to ring when their office number is dialed. The company reimburses employee expenses incurred from telecommuting and requires the employee to come into the office at least twice a week. Although supportive of the telework concept, the inter-connectedness and teamwork qualities of the CALIBRE culture necessitate the presence of employees at least twice a week.

Marketing the Program

Prior to hiring employees, CALIBRE invites the potential hire to an offer interview at which, a Vice President explains the CALIBRE culture and employee benefits, including telework, parking cash out and subsidized transit passes. Because of the offer interview, employees are aware of the transportation benefits before they accept the job. Once at CALIBRE, employees attend a new hire orientation where the transportation benefits program is reintroduced. In addition, information on the program is always available via the company's intranet. This has proven to be an effective marketing and outreach strategy as more new employees take advantage of the program than existing employees.

The Benefits Coordinator at CALIBRE includes the transportation program and any upcoming regional events in the monthly employee newsletter. She works with the local rideshare agency to host transportation and telecommuting fairs at the office. The Benefits Coordinator has recognized that the motivation to try transit stems primarily from an employee's experience and frustration with a long commute. Employees who first choose parking often decide commuting via Metro and commuter rail may be more time efficient and cost effective. Therefore, the program allows employees to switch from parking to subsidized transit at any time.

Results

CALIBRE evaluates the success of their program in a simple yet effective manner. As long as the number of transit users grows, the program is deemed successful. Upper management is concerned with stalling the parking demand issue as far into the future as possible. Continued growth in the transit pass and parking cash out programs assists CALIBRE in meeting this goal. If participation in the transportation benefits program decreases, management will re-evaluate the program's effectiveness. At that time, a new program or a more aggressive parking management program may emerge.

After 2 years of program implementation, 2% of CALIBRE's employee's carpool, 12% utilize transit (bus, rail, subway) and 5% participate in the telework program. Although 81% of CALIBRE employees continue to drive alone, many of them utilize the nearby Metro to travel to and from work-related meetings and trips during the week.

CH2M Hill - Denver, CO

FAST FACTS ABOUT: CH2M Hill - Denver, CO

Types of TDM: Time Shift, Location Shift
Keywords: Telework, Intranet, Technology, Flextime, Relocation
Employer Demographics: Located in a suburban business park, little bus service, ample parking, adjacent to a large corridor construction project.
Program: Corporate Telework and Flextime policies, "Look Before You Leave" Intranet travel site, relocation based on commute time analysis, accessibility to roadways and future alternative mode infrastructure.
Results: *17% mode shift*
8% Telework and Flextime 3% transit 5% Carpool .5% bike
Cost of Program: $60,000 includes 40 hours a month of staff time, Intranet upkeep and marketing costs.
Staff: 1 FTE with limited transportation related responsibilities.
Contact: Michele Wagner, michele.wagner@ch2m.com

Strategic Relocation

CH2M HILL is an employee owned, engineering, construction, and operations firm serving a variety of public and private clients throughout the world. CH2M HILL's mission states, "We are a global project delivery company making technology work to help our clients build a better world." Fulfilling this mission begins with CH2M HILL's commitment to fostering healthy employees and leaving as light an environmental footprint as possible. An example of this commitment to the environment and employees is reflected in the firm's transportation benefits program.

CH2M HILL has 165 offices throughout the world with both corporate headquarters and regional operations located in Denver, CO. Prior to 2002, CH2M HILL's corporate and regional employees were scattered in four locations throughout Denver. CH2M HILL's executive leadership team decided to relocate employees to one campus-style office park. Prior to choosing the location of the new corporate and regional Denver offices, the leadership team plotted where employees lived and made relocation decisions based upon accessibility. After careful consideration, CH2M HILL chose an area south of Denver, along the I-25 corridor. The Meridian International Business Center, located less than 20 miles south of Denver and 30 miles north of Colorado Springs, boasts easy access to multiple east-west and north-south highways. The campus is in a traditional suburban business park setting featuring ample parking and sparse bus service.

Roadway convenience and employee residential locations were not the only factors driving CH2M HILL to relocate to Meridian. In 2001, the Colorado Department of Transportation and the local Regional Transportation District (RTD) began to move forward with plans for a massive corridor-wide roadway expansion and light rail project. The corridor construction project, entitled Transportation Expansion or T-REX, included plans for a Denver light rail system with a station near CH2M HILL's then-anticipated campus. The Leadership Team was keenly aware of the positive opportunities for increased mass transit use by the firm's employees as a result of this new transportation infrastructure.

Corporate TDM: Telework and Flextime

At a corporate level CH2M HILL has established an aggressive Telework and Flextime program. CH2M HILL's Telework Program Policy views telework as a "mutually beneficial work arrangement designed to attract and retain employees and reduce company costs." Participation in the company's telework program is based on job suitability, suitability of the employee's skill sets, job performance and suitability of home work site. Employees must obtain supervisory approval to participate in the firm's Telework Program. Once approved, employees are required to complete a two-hour telework training that covers IT and ergonomic aspects of teleworking. The teleworker is responsible for defining a safe and appropriate workplace using the tools provided by the company. CH2M HILL provides specific equipment and software tools and reimburses employees for appropriate office supplies and voice and data connectivity charges. While CH2M HILL is supportive of both full-time and part-time/ occasional telework arrangements, only full-time teleworkers receive financial support. The company provides

in-house "hoteled offices" or carrels within the CH2M HILL office, which come equipped with phones, networking capabilities and office supplies. Employees who telework on a full-time basis can utilize these workstations if and when they are required to work from the office. CH2M HILL also recognizes the need to provide employees with work hour options.

Regional Denver Office TDM: "Look Before You Leave"

Because the culture within CH2M HILL leans toward decentralized decision-making, there is no corporate mandate to offer transportation benefits. There are offices, (such as the Seattle, Washington office), which are required by the state to provide transportation benefits. Despite the lack of such a mandate in Colorado, CH2M HILL's Denver office initiated an innovative TDM program. As the company moved forward with office relocation plans, recruitment and retention were forefront in managers' minds. Management recognized commute times would increase for a number of employees either by virtue of the office relocation or by the up-coming T-REX project. Either way, they did not want highly valued employees dissatisfied with working at CH2M HILL due to the impending traffic, congestion and construction. To complicate matters, transit service to the new campus was severely limited as was bike accessibility.

With support from management, an employee in the Denver office asked other co-workers to volunteer their time to assist CH2M HILL in addressing transportation related concerns. Soon the T-REX Tamers Transportation Team was formed with the intent of helping managers create new services and programs aimed at improving accessibility and mobility to, from and around office locations all of which were in the direct path of the T-REX project. Utilizing employee survey results, the T-REX Tamers were able to focus efforts down to the types of information and programs that employees would respond to the most. First, they chose a TDM program theme: "Look Before You Leave" which encourages employees to look at traffic conditions before leaving home and/or work. As employees began to "look before they left" they were presented with the information they needed to make intelligent transportation decisions, including the decision to not drive at that specific time.

The central feature of the program is a transportation Intranet featuring current traffic updates, planned closures, T-REX project information (closures, construction updates), links to Denver International Airport, subscription service to a traffic alert service provided by MyTrafficNews.com and driving directions using popular websites. Employees can also access links to Denver Metro's transit provider (RTD), carpool and vanpool information and rideshare matching services, bike to work information and links to company telework and flextime policies. The Intranet also provides links to local businesses that provide pickup and delivery of dry cleaning, meal delivery and car maintenance services. Finally, the site offers information on learning and professional development opportunities. Employees faced with a congestion-filled commute can opt to stay and earn CH2M HILL professional development credits. A transportation fair was held to heighten awareness of the T-REX project and introduce the new tools and alternatives available to employees

Results

CH2M HILL evaluates success through two main efforts. First, periodic surveys are provided to employees to learn more about travel modes and commuting concerns. Second, alternative mode users are encouraged to register with Teletrips, a web-based alternative mode data gathering resource. Employees who register with Teletrips receive a weekly e-mail survey requesting information about their commute and in return receive a aggregate report on the amount of pollution they reduced, number of drive-miles avoided and an estimate of time saved by teleworking, using the bus, carpooling or vanpooling. Additionally, CH2M HILL receives a company-wide profile, which generates air pollution credits through the e-Commute program. In 2002 alone, 81 Denver campus employees reported the following results: 115,130 miles saved, 3,689 hours saved, 61,325 lbs. of carbon dioxide saved and 3,497 lbs. of carbon monoxide not created.

CH2M HILL has been successful at getting 17% of its employees out of single occupant vehicles. A little more than 8% of employees take advantage of CH2M HILL's Telework and Flextime programs; 5% carpool; 3% take transit and .5% bike commute. Given CH2M HILL's remote location, lack of bus service and the on-going construction project, a 17% mode shift is a solid start. Furthermore, the light rail segment of the T-REX project includes a stop near the Meridian International Business Center. CH2M HILL provides solid stepping-stones to assist in further employee transit usage.

Georgia Power Company - Atlanta, GA

FAST FACTS ABOUT: GEOrgia Power Company - Atlanta, GA

Types of TDM: Modal shift, Location shift
Keywords: Company sponsored vanpools, Fleet vehicles, transit subsidy, telework, intranet
Employer Demographics:
Program: Smart Ride commuter options program. Offers a variety of commuter options to employees
Results: 15% Compressed/flex time, 13% Vanpool/Carpool, 5% Telework
Cost of Program:
Staff: 3 FTE. 1 Project Coordinator, 2 Corporate Facilities Analysts
Contact: Jane Franklin, Project Coordinator 404-506-1967

Summer Olympics + Increased Parking Demand + Poor Air Quality = New Commuter Benefits

Georgia Power, an investor owned utility that serves customers across the state, boasts office locations throughout the State of Georgia. 5,500 of the approximately 8,800 Georgia power employees are located in the greater Atlanta metro region. Executives at Georgia Power were concerned that there was not enough parking at the downtown Atlanta Georgia Power Headquarters location. As such, in 1994 they decided to provide the commuter benefits to downtown employees. The commute options program, titled SmartRide, included subsidizes for Metropolitan Atlanta Rapid Transit Authority (MARTA) transit tokens. Initially, the SmartRide program was only available at the downtown Georgia Power facility but eventually expanded to other regional offices.

With the upcoming 1996 summer Centennial Olympic Games in Atlanta, employers throughout the greater Atlanta region were concerned with the impact the Games would have on traffic congestion and employee accessibility to the workplace. Additionally, in 1996 Georgia Power was consolidating two downtown offices into one building. Given these two pressures, executives at Georgia Power opted to increase the types of transportation programs offered. Unfortunately, in 1997 the consolidated downtown building experienced serious parking problems. Georgia Power also responded to pressure from the 1998 Voluntary Ozone Action Program, which encouraged state agencies and major corporations to reduce vehicle miles traveled by 20%. To reduce demand for employee parking and assist in reducing Atlanta's worsening traffic congestion and air pollution, Georgia Power redesigned their SmartRide program.

Vanpool Becomes Mode of Choice

In 1998 Georgia Power extended their SmartRide program from a downtown focused transit subsidy program to an extensive regional commute options program. The program featured company sponsored vanpools, fleet vehicles, free MARTA passes, telework, flextime, alternative work locations, free and preferential parking for vanpools and first come first serve preferential parking for carpools. Of the commute options benefits offered, the company sponsored vanpool is the most popular among employees.

Fleet vehicles are available to employees who use alternative transportation to get to work. This is an important transportation strategy the company offers because employees do not feel "trapped" in the office once they carpool, vanpool or use transit.

As of summer 2003, approximately Georgia Power supports over 50 vanpools involving over 500 employees. Fifty percent of vanpools travel to the downtown headquarters office and fifty percent travel to regional offices. The vanpool program is offered to all employees, including temporary contract employees. Currently, the longest vanpool trip documented is 160 miles round trip from Rome, Georgia to a North Atlanta metro regional office.

Additional Program Details

Fleet vehicles are available to employees who use alternative transportation to get to work. This is an important transportation strategy the company offers because employees do not feel "trapped" in the office once they carpool, vanpool or use transit. Employees are allowed use of a fleet vehicle to run errands or go to meetings during the work day. Keeping with its desire to be good environmental citizens, the Georgia Power vehicles are either powered by electricity or ethanol.

To keep track of employee usage of transportation options, an internal alternative mode tracking system was developed for Georgia Power. Also called SmartRide, the software provides employees with a web-based reporting portal that offers a user friendly way to track carpool, vanpool and transit use. Separate internal timekeeping software is used to report when employees telework, work at an alternative location, or work an alternate schedule.

Georgia Power participates in the Guaranteed Ride Home (GRH) funded by Commute Connections, the regional rideshare agency. Employees who use alternative transportation have access to a free ride home in case of an emergency or unplanned overtimes. If there are any overages in the program, Georgia Power supplements the program.

In previous years, the program was highly marketed through e-mail, and messages on televisions monitors around the downtown campus. Employees received information from management and letters from the CEO that encouraged individual travel behavior changes. Additional program marketing and outreach was done in conjunction with the smog alerts season which initially lasted from May to October but eventually became a year round event. Given budget cuts, Georgia Power currently markets the transportation program through human resource orientations, word of mouth and occasional e-mail messaging. Georgia Power attempts to increase awareness of the transportation benefits program during smog alert season but to a much more limited extent.

Measuring Success

The main goal of the commuter options program is to get as many cars off the roads as possible. Georgia Power has been successful in accomplishing this goal as the company boasts over 1.2 million VMT reduced each month. Even with a downturn in staff, participation in the programs has been steady with 13% of employees carpooling or vanpooling, 15% working compressed or flex time schedules, 5% using transit while another 5% telework.

The success of this program is also measured by employee reaction. Employees recognize this as a good benefit and management sees it as a recruitment and retention tool. Georgia Power's efforts have been recognized with a host of awards from local, regional and national organizations since 1997. As recipients of the 2001 Clean Air Campaign's HOVie Award, Georgia Power's program was acknowledged for encouraging the use of HOV lanes through carpooling, vanpooling and/or alternative fuel vehicles. The company has also been honored as a designated US EPA Best Workplace for Commuters, and was awarded the 1999 Outstanding in the Field Award from the Southeastern Association for Commuter Transportation.

Hennepin County - MN

FAST FACTS ABOUT: Hennepin County - MN

Types of TDM: Modal Shift, Location Shift
Keywords: Transit subsidy, Pre-Tax benefits, Legislation
Employer Demographics: Hennepin County, Minnesota, has 130 offices and facilities dispersed throughout the county with differing levels of transit service at each site. About 10,000 County employees are located in downtown Minneapolis and are well served by transit.
Results: Estimated 60% drive alone, 15% carpool, 2% vanpool, 15% bus, 3% telework, 5% flextime
Cost: $559,000 bus subsidy + $14,000 vanpool, parking and administration costs = $573,000 - $109,000 FICA Savings = Total Cost: $464,000.
Staff: Minimal staff time and staff costs once program was set up.
Contact: Mike Bastyr, Sr. Human Resources Representative, 612-348-4640

Local and Federal Legislation and Policy Impacts

Since 1960 the City of Minneapolis's growth management policies concentrated office and retail use in a downtown core and limited parking to areas just outside the core. These policies have resulted in high bus service and ridership in the downtown core, where most of Hennepin County's employees work.

Like many other US cities, Minneapolis is recently experiencing a resurgence in downtown growth and development. As Minneapolis's downtown core continues to grow, city and county officials have become concerned about increasing congestion and decreasing air quality.

In 1999 Minneapolis expanded the smart growth policy in their City Comprehensive Plan to include more emphasis on transit. Per the plan, "Minneapolis will follow a policy of 'Transit First' in order to build a more balanced transportation system than the current one."

In addition to the local "Transit First" policy, federal legislation passed in 1999 encouraged employers throughout the United States to reevaluate their transportation benefits programs. Internal Revenue Code Section 132 (f), allows employees to exclude certain transportation fringe benefits from gross income. In 1998, these pre-tax fringe benefits were limited to $65.00/month for transit or vanpool and $175.00/month for qualified parking. In 2000, the benefit limits were increased to $100/month for transit or vanpool and $195.00/month for qualified parking.

The convergence of local policy and federal legislation provided the impetus for Hennepin County to reevaluate its 20-year old bus pass program.

The convergence of local policy and federal legislation provided the impetus for Hennepin County to reevaluate its 20-year old transportation program. During the 1980's and 1990's Hennepin County's transportation program consisted of a pay-roll deducted bus pass. Convenience and a 5% discount from the local transit authority, MetroTransit, motivated employee bus pass purchases. In 1999, spurred by new federal transportation benefit regulations, Hennepin County introduced a pre-tax employee transportation program that covered bus and parking costs (in 2000).

Pre-Tax and Creative Use of Savings

Hennepin County's pre-tax transit pass program, available to all 13,000 employees, immediately increased transit usage by 400-500 employees spread throughout the County's dispersed offices.

Soon after Hennepin County's introduction of the pre-tax transit program, MetroTransit, introduced a metro pass. Although employees voiced interest in the metro pass, the cost was too high for Hennepin County. Instead, in 2000, the County enhanced the transit pass program by providing a 40% discount on transit pass purchases. The combined subsidy and pre-tax status of the transit pass reduced costs for the employee. Transit purchases increased to over 1,900 by January 2003.

As an employer, the pre-tax bus and parking program saved the County money on FICA payments. The County decided to filter the FICA savings back to offset the subsidy program. Doing so defrays 30% of the cost to provide the subsidy. From June 2000 through January 2003, the subsidy, less the FICA savings, totaled $666,464.

One Year Example of FICA Savings

Item	Annual Cost	% of Total Budget
Transit Subsidy	$559,000	98%
Other (Vanpool Parking)	$14,000	2%
Total	$573,000	100%
FICA Savings	$109,000	
Total Budget	$464,000	

Results and Challenges

Due to the high level of bus service in the downtown core, Hennepin County's marketing and outreach is focused on encouraging bus ridership. The combination of subsidies and pre-tax incentives captured the attention of employees and increased bus ridership by almost 900 employees in one year. Success for Hennepin County is measured by increased participation in the transit subsidy program. Since the changes in the program, SOV rate has reduced to approximately 60% with an estimated 15% of employees carpooling, 2% vanpooling, 3% teleworking, 5% using flextime and 15% utilizing transit.

Despite the initial success of the transit subsidy/pre-tax incentive program, employees complained about the confusing pre-tax parking process. As the pre-tax parking benefits operate differently than the popular and familiar flexible spending accounts, employees became frustrated.

Hennepin County's Benefits Unit kept an open-door policy and sought and responded to feedback on a regular basis. County newsletter articles and e-mail announcements were used to both inform and clarify the program to employees.

One employee responded to a newsletter article with an e-mail stating, "Pre-tax parking is confusing and stupid." That quote was used as the title for an employee mailing that explained changes that made the program easier for employees to use. Feedback loops and consistent updates increase the appeal to employees, and therefore participation.

The local MetroTransit group recognized Hennepin County's innovative funding model with a transportation benefits program award.

Johns Manville - Denver, CO

FAST FACTS ABOUT: Johns Manville - Denver, CO

Types of TDM: Modal Shift
Keywords: Transit subsidy, parking management, pre-tax benefits
Employer Demographics: Corporate office located in downtown Denver near ample bus and light rail service, limited parking. Although Johns Manville has multiple offices around the country, the program is offered to Denver employees only
Program: 100% transit subsidy, GRH, free-parking vouchers and parking subsidy
Results: 55% drive alone, .5% vanpool, 44% bus/rail, .5% walk, carpool not tracked
Cost of Program:.$372,129 includes parking charges, EcoPass and parking validation stamps.
Staff: 1 FTE, Risk Management Coordinator dedicates 20 hours a month to transportation benefits.
Contact: Pam Linam, LinamP@JM.com

1987-1990s: The Early Years of the Transportation Program

In 1987 Johns Manville, a leading manufacturer and marketer of premium-quality building and specialty products, moved from a spacious location in the Foothills outside of Denver, Colorado to a transit-convenient location in downtown Denver. Despite the expense, management guaranteed employees free parking for the first five years at the new location. For employees that did not want to drive, the company paid all but the taxes on either a monthly transit pass or up to four coupon books of transit tickets. Employees opting for the monthly pass could choose between purchasing a subsidized Local, Regional and Express bus pass. The individual employee's commute lengths determined the type of pass they preferred.

Johns Manville extended their parking subsidy after five years and continued to pay 100% of parking costs for employees until 1998. On October 1, 1998, Johns Manville capped the employer paid parking expense at $110 per month. Employees had the option of parking on the roof for no extra expense or parking under cover for an additional $15.00 per month. For those who chose covered parking, the additional $15.00per month was deducted through payroll at $7.50 per pay period. Both rooftop and covered parking costs increased through the next four years. Effective March 1, 2002, roof top parking increased to $131.30 and covered to $146.40. Current lease requirements include a 1% increase in parking costs per year, which Johns Manville passes down to employees. Currently, Johns Manville continues to subsidize all parking at $110.00 a month.

Pre-Tax Benefits and Light Rail

A provision amended by the Transportation Equity Act for the 21st Century increased the limits for public transit to $65 dollars per month (Federal, tax free) in January of 2000. The allowed pre-tax amount exceeded the cost to ride the bus and therefore, the employee was no longer taxed as part of the program. This legislation encouraged Johns Manville to reevaluate their transportation benefits program. Cost-effectiveness and bottom line good business sense became the main motivations for Johns Manville.

It became cost effective for Johns Manville to purchase the local annual employee bus pass, the Eco Pass, when over 30% of employees started riding light rail and transit.

In 1994, Denver welcomed its first light rail line which included a stop in front of Johns Manville's Denver office. The opening of the rail line attracted additional employees to transit. It became cost effective for Johns Manville to purchase the local annual employee bus pass, the Eco Pass, when over 30% of employees started riding rail and transit and the cost for the monthly pass increased. Purchasing individual monthly

passes for 30% of employees became far more expensive than purchasing the Eco Pass for all employees. Additionally, upper management recognized the financial benefits of providing an Eco Pass program for employees as annual parking costs were significantly reduced as the number of employees choosing light rail and transit increased.

In 2000, Johns Manville worked with the local transit district, RTD, to provide the Eco Pass to all employees. The company received a variety of incentives and "first-time-Eco Pass" subsidies that further convinced upper management to expand the transit program. Despite the short-term incentives, the company recognizes the need to provide choices to employs and is committed to providing the Eco Pass as long as the benefit is cost-effective when compared to parking. Johns Manville pays 100% of the Eco Pass cost.

Employee Choice

Due to the fact that Johns Manville subsidizes each parking space they require employees to choose between a parking space and the Eco Pass, employees cannot have both. Given the "either-or" policy, Johns Manville recognized the need to provide flexibility within the program. Therefore, employees are free to try one form of commuting for a short term in order to make the best decision between driving and utilizing transit. Additionally, all employees that chose an Eco Pass are eligible to participate in the Guaranteed Ride Home Program and can receive up to 12 free parking days a year. Finally, Johns Manville's transportation program also provides $110/month in vanpool subsidies for interested employees. Given the close proximity to transit and rail, only two employees currently participate in a vanpool program.

Results

Since 2000, when the Eco Pass program started, Johns Manville's transportation benefits program has resulted in the following mode split: 55% drive alone, 44% bus/rail, .5% vanpool, .5% walk.

Nike - Beaverton, OR

FAST FACTS ABOUT: Nike - Beaverton, OR

Types of TDM: Time Shift, Modal Shift
Keywords: Internal Rideshare Technology, Incentives, Flextime, Relocation, Transit Subsidy, Bike Commute
Employer Demographics: Located in a suburban business park, bus and light rail service, ample parking. 5,000 employees at world headquarters.
Program: Evolution of incentive based program from Nike Buck giveaway to TRAC program featuring prize incentives, transit and rail subsidy, preferential parking, shuttle, service amenities and flextime.
Results: 78% SOV, 10% carpool, 5% bus/rail, 5% flextime, 2% bike
Cost of Program:.$302,000 annually plus staff time. 43% of expenditures go to shuttle operations, 34% to transit subsidies, 6% to incentives, 1% to marketing, remainder to other expenses.
Staff: 1 FTE , Transportation Specialist dedicates 150 hours a month to the TRAC program.
Contact: Linda Bainbridge, Linda.Bainbridge@nike.com

Nike Bucks

The Nike Corporation has a history of supporting alternative mode usage through the creation of aggressive employee transportation benefits. In 1991, when upper management decided to relocate Nike's World Headquarters (WHQ) to a suburb outside of Portland, Oregon, they recognized the opportunity to save money by building fewer parking spaces and promoting carpool, vanpool and the overall use of alternative modes. In 1992 when Nike moved its WHQ to Beaverton, Oregon they introduced the incentive based Nike Bucks program. Alternative mode users could choose between receiving $1.00 a day in a Nike Buck voucher or a $21.00 bus pass subsidy. The Nike Buck vouchers could be used at on-site cafeterias, shops and Nike stores. The Nike Bucks program was initially only available to employees housed at the new WHQ, but due to its popularity, the program was expanded to include Nike's Portland area retail stores and Portland's Niketown. Ensuring employees outside the WHQ were indeed utilizing alternative modes became more and more difficult. By 1996, management began to question the overall effectiveness of the program as it became more difficult to manage and monitor.

1996: Mandates, Economics and Reevaluating Programs

At the same time Nike management began to reevaluate the Nike Bucks program, the State of Oregon's Department of Environmental Quality (DEQ) established a commute trip reduction mandate (titled the Employee Commute Options program or ECO) aimed at employers in the Portland area with more than 50 employees reporting to a single work site. Beginning in 1996, affected employers were required to provide incentives and programs for employee use of alternative commute options. Employers were now required to reduce single-occupancy vehicle commuting by 10 percent over three years. As 5,000 employees reported daily to Nike's WHQ in Beaverton, Nike was affected by the new mandate. By the time the mandate became law, Nike had been working on reducing SOV commuting for three years. After consultation with the DEQ, Nike was given permission to utilize their 1992 levels of SOV usage for base line data purposes.

Layered upon the growing difficulty of monitoring the Nike Buck program and the new local mandate was the 1996 Asian economic downturn's impact on Nike. The Asian economic downturn resulted in huge layoffs at Nike as well as a corporate-wide reevaluation of every Nike program. As such, management questioned whether or not the hard to track $250,000 a year Nike Buck price tag was the best way to encourage alternative mode usage.

A New Program

With upper management's support, Nike's Employee Transportation Coordinator (ETC) gathered employees from various departments to create a new, cost-effective and easy to manage transportation benefits program. With management's support, they decided to retain an incentive based program but to alter the incentive to a

large quarterly drawing with smaller monthly drawing. At first employees that participated in the Nike Bucks program were resistant to changes and the alternative mode usage decreased when the new prize-oriented program was implemented. The ETC marketed the program through a transportation fair, newsletters, flyers and posters and soon, interest in the prizes and utilizing alternative modes increased. The ETC and employee planning group named the new program TRAC.

To encourage rail usage, Nike sponsors a shuttle to transport employees to and from the light rail station, which is located about 1/2 mile from the World Headquarters campus.

In addition to the prize incentives, Nike also developed transit subsidies and carpool incentives. Since 1996, all WHQ employees have been eligible to receive a transit pass for the local bus and light rail system. Nike subsidizes the cost of an annual bus/rail pass by 72% and the WHQ are well served by both bus and light rail service. To encourage rail usage, Nike sponsors a shuttle to transport employees to and from the light rail station, which is located about 1/2 mile from the WHQ campus. All bus pass holders are eligible to participate in the Guaranteed Ride Home (GRH) program, which is administered by the local transit authority, TriMet. The ETC promotes carpooling through the use of an in-house rideshare matching list and the presence of preferential carpool parking. Nike also supports a flextime policy allowing employees to work with their supervisors to determine the best schedule most appropriate for them and their workload.

Commuting by Bike and Building Amenities

Nike's ETC provides a variety of services for bike commuters, and interested bike commuters. Upon request, the ETC will work with employees to map out the safest bike route, provide regional and local bike resources and information to assist with their commutes, and promote bike specific events to all employees. Nike has two fitness centers for employee use and bike commuters can easily access the showers and locker room. Nike also provides bike racks scattered around the campus and bike cages in the fitness center area. Furthermore, employees are allowed to bring bikes into the building and store them in their offices. Bike commuters are eligible to participate in the monthly and quarterly drawings.

In addition to the two fitness centers, Nike's WHQ features a variety of on-site amenities designed to limit SOV and vehicle usage during the workday. Nike employees can access quality childcare at one of the two on-campus childcare centers. Employees that need childcare for only a short time can utilize the Nike Tykes drop off program when regular care is unavailable. Nike's WHQ campus also features two sundry stores, dry cleaning service, beauty salon, an ATM and on-site movie ticket sales.

Goals and Evaluation

Nike's extensive transportation benefits program and the presence of a variety of on-site building amenities stems from the company's commitment to environmental leadership and sustainable practices. Although Nike is affected by local commute mandates, their commitment to promoting alternative mode usage existed prior to the mandates. Today, Nike's goals revolve around the ECO mandate, which includes reporting progress towards meeting the specific mandate goals every two years. Additionally, Nike tracks awareness of and participation in the TRAC program through a newly developed in-house technology. This new technology allows alternative mode users to report their commute mode on a weekly basis. The ETC can utilize information garnered from the employees for both evaluation and targeted marketing. Additionally, the employees are automatically entered into drawings each time they register their commute modes.

Results

Nike's SOV rate in 1992 was 98%. Since moving the WHQ's and implementing the Nike Buck and TRAC programs, Nike's SOV rate has reduced to 78%. 10% of employees carpool, 2% bike, 5% use bus and rail and 5% use flextime. Employees provide the ETC with feedback and ideas for program improvement and the ETC is given flexibility from upper management to make appropriate changes when necessary. Nike's ETC is actively involved with the local TMA and is on the MPOs TDM subcommittee. Nike's transportation programs have resulted in numerous recognitions and awards including recognition as a "Best Workplace for Commuters" by the EPA.

Overlake Christian Church - Redmond, WA

FAST FACTS ABOUT: Overlake Christian Church

Types of TDM: Modal Shift
Keywords: Suburban Location, Carpool, Incentives
Employer Demographics: Located in the City of Redmond, WA, Overlake Christian Church has ample free parking and receives minimal bus service.
Program: The transportation benefits program provides up to 16 hours of paid time off per year to employees utilizing other forms of alternative transportation and $20 a month financial subsidy for public transportation.
Results: 52% drive alone, 1% bus, 26% carpool, 12% Flextime/ compressed work week
Cost of Program: $4,000
Staff: 1 FT with other various responsibilities including transportation program and 1 FT Director with only oversight of program.
Contacts: Nancy Thorgeson, Director of Human Resources, nancyt@occ.org; Barbara Graef, Human Resources Administrative Assistant, barbg@occ.org

Community Driven

The Overlake Christian Church broke ground in 1968 with a handful of members and even fewer employees. By the mid-1990's, its growth resulted in the need for a new, larger church. Church leaders selected a 27-acre site in Redmond, Washington and oversaw the construction of the 250,000 sq. ft. campus located minutes from Microsoft. The Overlake Christian Church (OCC) development included the construction of a parking lot necessary to accommodate the 2,000 plus vehicles for attendees and employees. In November 1996, OCC opened the doors to its new campus for 3,500 plus attendees and 109 employees.

OCC was driven to provide commute benefits to employees by the desire to set an example to other employers and the opportunity to be a role model in the community.

With assistance from the Greater Redmond Transportation Management Association (GRTMA), the OCC chose to voluntarily comply with Washington State's Commute Trip Reduction (CTR) law. The CTR law requires that all employers with more than 100 employees traveling to work during peak morning times provide commute alternative programs. These programs must reduce the number of single-occupancy-vehicles (SOV) on the roadway during the busy morning commute. Though over 100 employees worked at OCC, not all traveled to and from work during the peak morning commute times. Nonetheless, OCC was driven to provide commute benefits to employees by the desire to set an example to other employers and the opportunity to be a role model in the community.

Carpool and Take Time Off

OCC is located in an area of Redmond that receives minimal transit service. This, combined with the availability of ample free parking, led OCC to develop a carpool-oriented transportation program. Upper management supported the program by providing opportunities for creativity and innovation. They also set aside funds and assigned transportation benefits program management responsibilities to a staff member. As such, the Human Resource Director and the Employee Transportation Coordinator (ETC) developed an incentive based program.

In 2001, OCC unveiled its unique and award-wining transportation benefits program. Utilizing the GRTMAs rideshare matching software, OCC provides internal rideshare matching services to connect employees with one another. Employees that choose to carpool on a regular basis can earn up to 16 hours of paid time off

a year for carpooling. Time is earned on a quarterly basis and is based on the number of days per week an employee commutes using an alternative commute mode. As a further benefit, carpoolers receive the best parking spaces at OCC.

Recognizing carpooling isn't for everyone, the program also provides a $20.00 a month transit and ferry pass incentive. OCC has set up a telework program, supports flextime and alternative work schedules and provides bike racks, showers and covered bike parking for cyclists.

Despite the presence of free and ample parking and the low level of bus service, Overlake Christian Church has created a successful model transportation benefits program.

Marketing, Partners and Results

The ETC utilized a thorough marketing campaign to educate employees about the new program. Presentations to new and existing employees throughout the year, as well as a transportation benefits program piece on the OCC Intranet ensure all employees are informed of the program. The transportation program is also shared at OCC's regular chapel meetings and all-staff lunches and via email notification.

OCC partners with the GRTMA to leverage marketing and outreach materials produced by them for employers throughout the Redmond area. GRTMA also sponsors multiple regional events throughout the year, including Bike to Work day and other alternative commuting campaigns. The ETC works diligently to ensure OCC's employees are aware of and involved in the various local, regional and state campaigns, events and activities.

Despite the presence of free and ample parking and the low level of bus service, Overlake Christian Church has created a successful model transportation benefits program. From 2001-2003, Overlake Christian Church's program has reduced SOV travel by employees from 84% to 52%. 31% of employees participate in the program, 26% carpool, 12% utilize flextime, 8% telework, 1% use transit and 1% bike to work.

Overlake Christian Church has won numerous awards including the Diamond Award from *Commuter Challenge* (the local employer commute assistance program), the City of Redmond's Commute Trip Reduction Program Award and recently the Washington State Governor's *Commute Smart Award*.

Simmons College - Boston, MA

FAST FACTS ABOUT: Simmons College - Boston, MA

Types of TDM: Modal shift
Keywords: Transit subsidy, Parking Management, Incentives, Disincentives, Shuttle
Employer Demographics: Located in a dense, area of Boston, MA that is well served by transit.
Program: $65 T-Pass subsidy, increased parking costs
Cost of Program: ESTIMATED COST?
Staff: 1 (Director of Auxiliary Services), contributes approximately 20 hours a month to transportation program and has assistance from other staff.
Results: 27% transit usage, 41% SOV, 32% carpool, bike, walk
Contact: Roy Schifilitti, roy.schifilitti@simmons.edu

Student Meetings at the Parking Garage

Simmons College is a small, nationally recognized, private university located in the Longwood/Fenway neighborhood of Boston. Surrounded by a variety of universities, cultural institutions and medical facilities, Simmons College is well served by the Massachusetts Bay Transportation Authority's (MBTA) transit and subway service, otherwise known as "the T". Though parking is limited in the area, Simmons College attempted to stand by a "low-cost-parking-for-all-faculty-and-staff" policy.

Most of Simmons' 740 faculty and staff prefer to drive to work, park in the Simmons owned lot and come and go at their leisure. In an effort to maintain popular parking benefits, Simmons College provided faculty and staff a parking spot on request. A year of parking cost employees a mere $200, far below the cost of utilizing transit or the nearby subway. As parking demand grew, the College recognized the need to change their parking policy. Yet, limiting parking or raising rates were not options under consideration.

By raising the cost of parking while simultaneously increasing the attractiveness of transit, travel behavior could be changed and the parking crises could be quelled.

In 1998, as parking demand increased, the parking situation became critical. Staff and faculty often waited in the parking garage entrance for a half hour before getting a space. Faculty began scheduling student meetings in the garage while they waited. Others used cell phones and laptops to remotely work from their vehicles. Frustration escalated and college leadership began to fear losing employees. As the situation worsened, the Director of Auxiliary Services researched similar problems and uncovered possible solutions. The research pointed to the economic reality that given a fixed supply of parking, demand could be influenced by changing price. By raising the cost of parking while simultaneously increasing the attractiveness of transit, travel behavior could be changed and the parking crises could be quelled. Yet, upper management remained opposed to increasing parking costs.

Incentives and Disincentives

In 1998 leadership at the college changed and support for a parking management program grew. The Director of Auxiliary Services met with the new Executive Management staff and demonstrated that the parking crisis could not be solved without raising rates and supporting alternative modes. The College began to slowly increase the cost to park and also introduced a 25% transit subsidy, or T-Pass. Unfortunately, these techniques did not change travel behavior. The transit subsidy appealed to existing transit users and the parking increase was not enough to discourage parking. Over the next five years the College continued to both increase parking costs and transit subsidies. Eventually they got to a price point where transit was more appealing. Today, faculty and staff are eligible for a 60% T-subsidy (up to $65.00 a month) and parking has increased from $200 a year to $1200 a year.

Program Goals:

Two main goals drive the Simmons College transportation benefits program. First, Simmons leadership is committed to reducing vehicle miles traveled. Few parking structures exist in the Longwood/Fenway neighborhood and the large medical center presence results in the need for ample patient and visitor parking. Furthermore, the City of Boston's strict parking development requirements inhibit future growth in parking. Therefore, Simmons College and other nearby institutions have made a community commitment to each do their part in reducing vehicle miles traveled and manage parking well.

Second, Simmons College strives to be a good employer by providing a wide array of employee benefits. The transportation benefits program compliments other employee benefits and promotes the College's commitment to employees. All new employees are introduced to the employee transportation benefits and the transportation coordinator sends out newsletters and bulletins reminding employees of their transportation options. Employees can opt for the T-subsidy at anytime.

Program Details:

Faculty and staff of Simmons College must choose between paying for a parking space or receiving the T-Pass. Simmons College provides a 60% Subsidy for all MBTA transit passes, with a limit of $65.00 a month. This provides plenty of support for most of MBTA's pass programs and only those with commutes from New Hampshire accrue out of pocket costs. If faculty and staff opt to drive to work, they can pay $1200/year for a parking space in the faculty/staff parking garage.

All T-pass holders, carpoolers and cyclists are eligible to participate in one of two Guaranteed Ride Home programs. As part of the transportation benefits program, Simmons created their own Guaranteed Ride Home (GRH) program. The Simmons program is open to any employee in need of an emergency ride home. Additionally, due to a partnership with the local transportation organization, MASCO Commuter Works, a second GRH program is included in the benefits program. Though rarely utilized, the MASCO Commute Works GRH provides an added resource to commuters. In addition to the GRH programs, Simmons College provides 15 free-park day vouchers for T-Pass holders. Many faculty and staff take advantage of educational benefits and/or teach night classes. The vouchers allow employees to drive on those days, park and get home safely.

Additionally, as a member of the local TMA, MASCO Commute Works, Simmons College faculty, staff and students can utilize Commute Works' shuttle system. The shuttle system features six shuttles serving the Longwood/Fenway area, Cambridge, Chestnut Hill, University of Massachusetts and other destinations. Simmons College pays 60% of the shuttle pass for staff and faculty. Two shuttles transport commuters to and from the Ruggles and JFK T-stops. These shuttles are fully supported by MASCO Commute Works and are free to all riders.

The hiring of a professional parking management company rounds out Simmons College transportation program. During the first week of classes, on graduation day and on other days throughout the school year, Simmons College experiences peak period parking issues. The parking management company manages parking during these peak periods by providing valet parking and other parking services. Additionally, the company limited parking in the parking garage to faculty and staff. The surface parking lots became student parking lots. Frequent in and out student trips are easier to manage on a surface lot. The parking management company works closely with Simmons College and neighboring institutions to minimize parking problems.

Results

Simmons College utilizes two tools to evaluate the success of their program. As the transportation coordinator works with the parking management company to track the parking demand. The ability to manage the lot and keep up with demand is a key indicator of success. To date, they have had far fewer parking problems and the demand has reduced by 20% over the last five years. The transportation coordinator also includes a few parking and transportation related question in the annual employee satisfaction survey. Negative comments regarding the T-Pass program rarely appear on the surveys, implying the program is working. The coordinator is open to feedback and constructive criticism about the T-Pass program. The transportation benefits program has significantly reduced drive-alone parkers at Simmons College. Today, 41% of faculty and staff park on campus, 27% use transit and the remainder carpool, walk or ride their bike to work. Although no one currently uses vanpool, the transportation coordinator is open to supporting any non-single occupancy vehicle mode usage with the 60% subsidy (up to $65.00 a month).

Swedish Medical Center - Seattle, WA

FAST FACTS ABOUT: Swedish Medical Center

Types of TDM: Modal Shift
Keywords: Transit Subsidy, Ferry Subsidy, Parking Management, Preferential Parking, Vanpool and Carpool subsidy, State and Local Mandates
Employer Demographics: Swedish has three campuses dispersed throughout the greater Seattle area: First Hill in a downtown, dense, area well served by transit and Ballard and Providence, less dense and less transit service.
Program: Carpool promotion program expanded to include transit, vanpool and parking benefits. Program is flexible given different shifts and campuses.
Results: Varies with each campus, see table at end of case study.
Cost of Program: $1.6 million for Flexpass, Puget Pass and Washington State Ferry Pass
Staff: 1 FTE, Parking Manager/Employee Transportation Coordinator dedicates 80 hours a month to transportation benefits program.
Contact: Karen Lee Kimber, Parking Manager/Employee Transportation Coordinator, Karen.Kimber@swedish.org.

Benefits Before and After State Mandate

Swedish Medical Center, in Seattle, WA, is comprised of three separate campuses spread throughout the greater Seattle area. Swedish's 7,000 employees and 2,000 physicians are accustomed to the irregular work shifts and on-call realities of hospital work. Despite the challenges inherent in scheduling and transportation, Swedish has supported transportation benefits since the 1980's. Carpools with three or more Swedish staff received free parking at the Swedish campus and those with two or more received a 50% parking subsidy. Employees were also eligible for a 25% transit pass subsidy. In 1986, Swedish Hospital's growth resulted in the need for a new building. At the time, the City of Seattle began to require all new construction and development plans whose fulfillment would result in adverse effects on traffic and mobility to include a transportation management program (TMP). The TMP included traffic and mobility mitigation plans as well as reporting requirements and schedules. In 1986, Swedish chose to focus their TMP and therefore, transportation benefits, on carpool and transit benefits. Swedish continued to provide free parking for vanpools, subsidized carpool parking and they extended the transit subsidy to 50%.

In 1991, Washington State passed the Commute Trip Reduction (CTR) law. The CTR law requires employers with more than 100 employees traveling to work during peak morning times to provide commute alternative programs. These programs must reduce the number of single-occupancy-vehicles (SOV) on the roadway during morning commute times. Thus, since 1991, Swedish has been required to develop programs that encourage employees to utilize alternative, non-SOV modes of transportation for their commutes.

Swedish Medical Center strives to be a best work-place, recruit and retain high quality nurses, doctors and hospital staff and abide by the local and state mandates.

Motivation and Program Details

In addition to adherence to the CTR law, Swedish views their transportation benefits program as a recruitment and retention tool. Hospitals all over the country are experiencing nursing shortages and Swedish strives to be an employer of choice. Given these motivations, Swedish worked with the local rideshare and transit organization, to develop and implement a variety of incentives and disincentives to driving alone. Through the leadership of Swedish's Employer Transportation Coordinator (ETC), Swedish expanded the initial program to one that provides extensive transit, ferry and rail subsidies, preferential parking and vanpool subsidies.

Swedish tailors its transportation benefits for each of the three campuses and for night and day shift employees. All day and evening shift employees at each campus are eligible to receive a fully subsidized area transit and rail pass, called a Flexpass, or a Washington State Ferry pass. The Flexpass can be used on each of three adjoining county transit systems, the regional transit system, regional commuter rail and the soon-to-be-built monorail.

All employees with a Flexpass are eligible to participate in a county-sponsored vanpool program. Each of the three adjoining counties, King, Pierce and Snohomish, operates an extensive vanpool program. Swedish provides a $63.00 a month vanpool subsidy for all employees. Given that most vanpools do not exceed a cost of $63.00 a month, the vanpool subsidy is often 100% for employees. All alternative mode users who receive their Flexpass are eligible for the Guaranteed Ride Home (GRH) program that includes 16 free taxi-rides home a year. Additionally, all Swedish employees that work a 12-hour shift are eligible to participate in a unique taxi service Swedish provides. Every weekday between 6:00-7:00pm, employees with a Flexpass can take a taxi to specific park-&-ride. The taxi service is an extra bonus designed to assist employees achieve a quick and easy commute home after a long, over-time shift.

Parking

Bus service and parking availability is different at each of the three campuses. The First Hill campus features fewer parking spaces and higher levels of transit service than either the Ballard or Providence location. Thus, the First Hill campus has limited all day shift SOV parking to upper management since July 1990. SOV parking costs $70/month; carpool parking is $12.50 per person per month and vanpools park free. Both carpools and vanpools receive access to the best parking spaces at the First Hill campus. Given the need for flexibility and the on-call realities of hospital work, carpool and vanpool passengers receive four free SOV parking days a month. Night shift employees at First Hill receive free parking but are not eligible for a Flexpass. Instead, night shift employees are eligible to receive a WA State Ferry pass and/or a dollar value Puget Pass that covers their specific commute. The Puget Pass can be used on all local and regional transit but is not valid for use on the ferries.

Neither the Providence nor Ballard campuses receive high levels of bus service. Additionally, parking is more plentiful at each campus. Therefore, Swedish charges SOV's $60 a month and carpools $12.50 per person per month to park at the Providence Campus. Parking at the Ballard campus, the smallest of the three campuses, is $30 a month for SOV parking and free for carpoolers.

Role Modeling and Marketing

When the ETC was asked to take on full-time transportation benefits and CTR reporting responsibilities, she responded by relinquishing her SOV commute. Since then, she has tried most of the commute alternatives Swedish provides and is able to use her own experience and understanding of the process of commuting via vanpool, carpool and/or transit to encourage employees to at least give it a try. To market the program, the ETC sends out a fact sheet with bus route information, parking requirements and costs, and Flexpass, carpool and vanpool benefits to each employee when they are hired. This fact sheet is delivered to the employee's home along with two free transit passes to encourage transit usage on their first day of work. Additionally, the ETC utilizes the intranet, employee newsletters and new employee orientations to market the various program elements. Swedish's intranet includes information about local merchant discounts for Flexpass holders, all transit, rail and ferry schedules and services, adverse weather notices, links to the regional Rideshare organization and parking pricing information.

Results

Swedish Medical Center strives to be a best workplace, recruit and retain high quality nurses, doctors and hospital staff and abide by the local and state mandates. Their efforts have resulted in the following modal splits:

Mode	Providence	First Hill	Ballard
Drive Alone	50%	34%	55%
Carpool	19%	23%	14%
Vanpool	4%	3%	0%
Bus/Rail	22%	32%	15%
Bicycle	1%	1%	6%
Walk	3%	5%	8%
Other (flextime, compressed work week)	1%	2%	2%

Texas Children's Hospital - Houston, TX

FAST FACTS ABOUT: Texas Children's Hospital

Types of TDM: Modal Shift
Keywords: Transit subsidies, Vanpool Subsidies, Carpool allowances, Recruitment and retention, Home/Life balance
Employer Demographics: Located within the largest medical center in the world, TCH is the largest pediatric hospital in the United States.
Results: 20% mode shift, 10% carpool/vanpool, 10% transit
Cost of Program: checking on that figure
Staff: 1 FTE for seven sites
Contact: Patsi Davis, Transportation Specialist, 832-824-2070

Recruitment and Retention

Located just southwest of Houston, Texas in the Texas Medical Center, Texas Children's Hospital (TCH) is the largest pediatric hospital in the United States. A full-care pediatric hospital, the hospital's medical staff consists of more than 1,580 primary-care physicians, pediatric subspecialists, pediatric surgical subspecialists and dentists. In addition, Texas Children's boasts a nursing and support staff of more than 6,000. TCH's mission "to create a community of healthy children" is leveraged by the CEO's commitment to assist employees balance work and home life. Given the nursing shortage and limited supply of high quality doctors, recruiting and retaining top notch employees became difficult for TCH. Therefore, in an effort to increase TCH's recruitment and retention, the CEO convened a focus group in 2001. Vice Presidents and Directors of various departments participated in a brainstorming session and discussed ideas on how TCH can continue to function as a "world class" facility and attract and keep top notch employees.
Brainstormed ideas included providing free uniforms to staff, offering $2,500 per year tuition subsidy, and instituting free parking, bus passes and carpool allowances. All of the ideas were implemented at the cost of $5.7 million for the first year. Highlighted among the benefits was the flexible employee transportation benefits program.

Flexibility is Key

Recognizing the changing needs and schedules of hospital employees, TCH's upper management is committed to providing flexible employee transportation benefits. Among the many benefits Texas Children's offers are transit subsidies, rideshare matching, vanpool subsidies, parking management programs, pre-tax benefits, bike/walk incentives, a telework program, flexible work schedules, a Guaranteed Ride Home program, and shuttle service. Most of the programs are flexible from month to month and all employees are eligible to participate. Due to the CEO's emphasis on home and work life, he wanted to make sure the program maintained an "ease of use" with the program. Employees feel like they own the program because they can pick and chose which options are best for them at different times. For example, in the summer months, more employees use alternative transportation modes. These employees are eligible to receive transportation benefits strictly for the summer months.

Incentives for Options

Management believed the presence of a subsidy would increase participation in the transportation benefits program.

Previous to the 2001 brainstorming session, the hospital subsidized transit subsidies at less than 15%. After the brainstorming session, both the number of transportation options supported by TCH and the amount of subsidies provided increased. Management believed the presence of a subsidy would increase participation in the transportation benefits program. The table below summarizes TCH's program options and corresponding subsidies. Subsidy ranges shown are based on employee commute distance and cover 100% of vanpool and METRO transit costs.

Commute Option	Subsidy Offered by TCH
Vanpool	$40 - $170/ month
METRO Vouchers	$35 - $110/ month
Woodlands Express Pass	$165/ month
Remote Parking	100% cost (increases 10% each year. Currently $53/ contract)
Carpool Allowance	$20/ month

"Free Rides"

While not heavily marketed, when the commute options program is advertised the messages are simple, "Free Rides" or "Manage your home and work life". Information about the program is given to new hires during orientation along with free one-day passes from METRO. Enrollment forms and information about the programs can be found on TCH's intranet. Additional commuter option information is published in the company newsletters and are placed on bulletin boards in general employee areas. TCH also works with Commute Solutions, the regional commute alternatives program, to help get the word out to employees. Commute Solutions offers brochures, training and a telework program to TCH employees.

TCH has been challenged by the "it's too good to be true" employee mentality. Often, employees do not believe that these programs are free. They are looking for a catch or think this is a one time only subsidy. Once TCH management is able to clearly explain the transportation benefits program, employees are hooked.

Make the Employees Happy

The program at TCH does not have set quantifiable goals to measure success. Success of this program is based on employee reaction. Management does not "worry" about the program unless there are negative reactions to it, which has not occurred to date. TCH management strives to ensure employees are provided with as many available commuter options and that the program remains flexible and open ended. Surveys about the TCH benefits package are performed regularly. The results of the survey are compiled and given to the Vice President of the institution on a monthly basis.

Currently, survey results show 20% of TCH employees participate in the commute options program. Of that population, approximately 10% carpool or vanpool, and 10% ride transit.

In addition to changing employee travel behavior, the employee benefits program has contributed to improving TCH's recruitment and retention numbers. Before program implementation, the population at TCH was 3,700. After implementation, with the addition of 1.2 million square feet to the facility, an additional 1,800 persons were hired. TCH's management praises the transportation benefits program and the other employee benefits (free uniforms, tuition) as an important recruitment and retention tool.

Metropolitan Seattle Transit-Oriented Development and Flexcar - Seattle, WA

FAST FACTS ABOUT: Seattle Transit Development And Flexcar

Types of TDM: Mode Shift, Origin/ Destination Location Choice, Trip Substitution Choice
Keywords: park and ride, transit oriented development, parking variance, car sharing
Area Demographics: Metropolitan Seattle, project locations are varied
Program: Transit-oriented development at existing park and ride facilities, car sharing program.
Results: New multi-family construction parking variance. Flexcar operates over 100 vehicles in more than a dozen Seattle area neighborhoods.
Cost of Program: $1 million appropriation for staffing, consulting fees, and project development for TOD Program. Additional private development costs.The County contributes up to $200,000 per year for member incentives and staff support.
Staff: Three project managers oversee the TOD Program.
Contact: Flexcar – Christine Anderson, Flexcar Program Manager, King County Department of Transportation, cristine.anderson@metrokc.gov
TOD - Ron Posthuma, King County Department of Transportation, TOD Program Manager, ron.posthuma@metokc.gov.

Area Characteristics

The City of Seattle, King County, Sound Transit, University of Washington, surrounding jurisdictions and private developers have committed to trip reduction by introducing a number of complementary programs and projects throughout the region. This case study will focus specifically on public-private partnerships that foster a complementary relationship between land use, transit, parking availability, and transportation demand. The success of transit oriented development (TOD) projects and Flexcar, the County's car sharing program, is due in large part to the willingness of program sponsors and participants to try something different. In addition to the programs highlighted below, three other case studies within this report are from the Seattle metropolitan region, the University of U-PASS Program, the Swedish Medical Center, and Seattle Seahawks Stadium.

Program Description

King County Transit Oriented Development (TOD) Program
Developed in 1998, TOD efforts began by assessing established park-and-ride sites for development potential. Following a series of analysis efforts, a number of TOD projects have been completed, are under construction or are currently under study. Each success has led to a continued investment in infill development, affordable development and design practices that maximize the viability of alternate modes of travel besides single occupancy vehicles. Since 1999, the Program has received an annual $1million appropriation for staffing, consulting fees, and project development. Summarized below are three completed TOD projects developed at park-and-ride lots throughout metropolitan Seattle.

The Village at Overlake Station, Redmond, WA - As the first suburban "pilot" program, the Overlake project includes 308 apartments, a daycare facility and a shared parking structure open to park-and-ride users with spaces reserved for Flexcar. As a condition, the developer was required to provide one bus pass per apartment.

Northgate North, Seattle, WA - Northgate North opened in October 2000 as a four story retail project requiring a new access road which resulted in a loss of a portion of the park-and-ride lot. As a condition, the developer was required to provide replacement parking in its parking structure. In March 2002, the County purchased additional adjacent land to provide an additional 500 parking stalls. Negotiations continue regarding the ultimate outcome of the site which is only partially developed.

Each success has led to a continued investment in infill development, affordable development and design practices that maximize the viability of alternate modes of travel besides single occupancy vehicles.

Renton Transit Center, Renton, WA – The Renton site is home to 90 apartments and a new parking structure with 150 new park-and ride stalls. The apartments have all been rented and staff research indicates one third of the tenants travel by transit.

As the TOD programs continue to grow, a number of lessons learned have emerged. Although it might be challenging to agree on terms of shared parking arrangements, it introduces a substantial benefit to the viability of the site as both a TOD and park-and-ride facility. It has also been beneficial to evaluate existing park-and-ride demand and suggest consolidations where appropriate.

Flexcar

In 1998, King County Metro, the County's transit provider, initiated efforts to make the case for car sharing as a viable alternative to personal vehicle ownership. A number of successive events occurred leading up to the actual implementation of the program including the development of Business and Marketing Plan, the Request for Proposals to secure a vendor, and the explicit identification of roles and responsibilities among jurisdictional participants. From the onset, a number of distinguishing features were recognized as contributors to the program's success including the expectation of rapid growth, utilizing a multi-market approach, and the presence of political support.

In January 2000, Flexcar was implemented in Capitol Hill, Seattle's highest density neighborhood with four vehicles. According to 1990 Census data, Capitol Hill was home to 16,250 residents of which 37% did not own a personal vehicle. Within the first year, Flexcar grew to over 900 members with 19 vehicles with presence in five neighborhoods. Today, Flexcar operates more than 100 vehicles in over twenty neighborhoods. As a company, Flexcar continues to expand with operations in sic metropolitan areas throughout the U.S. (Seattle, Portland, Washington D.C., Los Angeles, San Diego, and Denver). In a report summarizing the first six months of Flexcar based on 146 responses to a new member survey it was determined that the majority of the members work in a managerial or professional occupation and 79% were college graduates. 55% of members indicated that they lived in a rental property.

Like other car sharing programs, Flexcar participants pay an annual fee and select a rate plan that suits their needs. Rate plans are offered hourly or monthly and fees are incurred based on time and distance driven. In return, user costs such as vehicle maintenance, gasoline, and insurance are paid for through the rate plans. Vehicles are parked within a reasonable distance from residential and employment centers. Reservations are made by phone or on-line.

Measures of Effectiveness

As an indicator of TOD and Flexcar success, both programs have received awards and recognition as innovative strategies with a positive impact on regional travel. It's also evident that the two programs complement each other as car sharing has been included in development plans, including some King County TOD projects.

By requiring developers to provide bus passes and making transit and light rail highly accessible to tenants, the TOD program has been able to obtain a variance in the parking requirements for new multi-family construction. Instead of requiring 2.5 parking stalls per apartment, the ratio has been dropped to 1 stall per apartment as is the case at Overlake. Since tenants are required to register their car for the site, the actual stall usage per apartment ratio was able to be measured. On average, .6 of a stall is being utilized per apartment. It's also been inferred that a third of the tenants use transit, which is three times greater than a typical suburban multi-family apartment complex.

Currently, Flexcar program effectiveness is being analyzed by the University of Washington.

Orenco Station Mixed-Use Development - Hillsboro, OR

FAST FACTS ABOUT: Orenco Station - Hillsboro, OR

Types of TDM: Mode Choice, Location Choice
Keywords: light rail, transit-oriented design, housing, zoning, community design
Area Demographics: Master-planned community at Orenco Station proximate to Tri-Met Westside MAX light rail within metropolitan Portland, Oregon.
Program: Transit-oriented development featuring a varied housing selection and pedestrian-friendly amenities. Free transit passes are offered to all new tenants for one year.
Results: 53% increase in transit usage after Westside light rail opened. Reduced need to travel outside of immediate community for discretionary trips.
Contact: www.orencostation.com

Area Characteristics

The developers of Orenco Station call it America's most awarded new community. As the winner of the National Association of Homebuilders Master Planned Community of the Year (1999), there are many good reasons why. The 206-acre, transit-oriented development has many planning and design features that make it one of the most livable new communities in the U.S. Located on the Westside Light Rail line outside of Portland, Oregon, Orenco Station is a pedestrian-friendly, mixed-use development with all the fundamental features of a successful neo-traditional community including a menu of housing choices, a town center with a main street corridor, ample park and recreation amenities and a variety of transportation options including light rail.

Although the Orenco Station site was originally zoned for industrial use and later for subdivision housing, the site was ultimately designated as a "town center" in the Portland Metro Area 2040 Plan. The Plan specifies legally binding requirements for all Westside station areas, and mandates features such a minimum densities and residential density targets at varying distances from light-rail stops, mixed-use development in station areas, pedestrian oriented buildings, prohibitions on auto-oriented land uses, and reduced parking. A special zoning ordinance was customized for Orenco Station establishing design guidelines to allow for and ensure an urban mix of housing types and land uses not typically found in the suburbs.

Demand Management by Community Design

One of the benefits of being a transit-oriented development is the provision of transportation alternatives. The community was designed to be a "complete community", meaning residents could work, shop, recreate and live within it, thereby reducing the need for travel outside of it. Orenco residents are located within a quarter mile radius of groceries, restaurants, and professional services.

The other defining transportation feature is the development of pedestrian pathways, and open space that all culminate at the Orenco Station stop of the Tri-Met Westside MAX light-rail line. This region-wide light rail system is one of the key features of the Portland region's livability. Orenco residents may walk to the station and have access via light rail to downtown Portland, the Portland International Airport, Hillsboro's high technology industrial center and other parts of the metropolitan region. The development team consciously biased towards pedestrians to encourage walking to transit and local commercial development and to encourage a more community-oriented life style.

The community was designed to be a "complete community," meaning residents could work, shop, recreate and live within it, thereby reducing the need to travel outside of it.

The town center is situated near Cornell Road, an existing major arterial road a quarter mile north of the station that bisects the entire development. The town center buildings provide for neighborhood retail and offices uses with

generous adjacent pedestrian facilities. In addition, a new grocery store and retail kitchen store will be opening in the fall of 2003. Housing units are also located above the retail spaces.

Several design features were employed in the residential areas to reinforce the pedestrian- and community-orientation of Orenco Station. Residential streets within Orenco generally allow for parking on one side with widths held to 25 feet. To further reduce the impact of automobiles, Orenco's site design provides alley-accessed parking, thereby eliminating front garages, curb cuts, and driveways.

The community was designed to provide a variety of housing options, all of which are made for compact development: single-family homes, townhouses, accessory units, loft units, and apartments. The single family detached units are relatively small, ranging from 1,400 to 1,700 square feet; but all units have a dedicated home-office space and features to reduce the amount of commuting in the community. Unlike more traditional subdivisions, the three- and four-unit townhouse structures are integrated with single-family detached housing. The loft units have many of the architectural features of single family homes. Apartments and lower price condominiums are also available in the development to offer more affordable options. All residential unit sales have been strong since the beginning.

At Orenco, all new tenants are provided free transit passes for one year with other tenant marketing materials. Intel and other large employers adjacent to Orenco provide transit passes through an arrangement with Tri-Met.

A special zoning ordinance was customized for Orenco Station establishing design guidelines to allow for and ensure an urban mix of housing types and land uses not typically found in the suburbs.

Measures of Effectiveness

The planning and design of Orenco have been noticed by community residents and is reflected in their attitudes and behaviors. A Pilot TOD Pass Program was implemented in September 1998 to test the effectiveness of transit pass incentives. Under the program, new tenants were provided free transit passes with other tenant marketing materials. Some key findings include:

- Whereas only 30% of respondents reported using transit prior to the Westside MAX opening, 83% reported that they used transit in May 1999 (after the opening).
- From September 1998 to May 1999, transit use for commuting purposes increased 22%.

Although the Pilot program has expired, all new residents continue to receive free 1-year passes.

According to a recent Lewis and Clark College study, transportation practices were also affected by the design and planning of the Orenco community. The study suggests:

- 70% of those surveyed shop in the Town Center at least once a week.
- 85% of respondents stated that the close proximity of neighborhood businesses and amenities has reduced the need to drive elsewhere to purchase necessities or for entertainment.

Lee County Variable Bridge Tolls - Lee County, FL

FAST FACTS ABOUT: Lee County Variable Bridge Tolls

Types of TDM: Value Pricing, Off-peak Travel Time Shift
Keywords: Value pricing, variable pricing, electronic tolling, flexible work arrangements, off-peak travel time shift, discounts, incentives
Area Demographics: Lee County, Florida (Cape Coral and Fort Myers); 400,000 residents
Program: 50 cent discounts on tolls for use of off-peak travel times on two principal bridges accompanied action to raise overall bridge tolls to $1 (from 75 cents)
Cost of Program: $9.7 million grant awarded by Federal Highway Administration for technology installation, demonstration, implementation, and evaluation; additional $7.0 million set aside as "emergency revenue reserve"
Implementer: Lee County Public Works
Results: 5% shift from peak to off-peak travel
Contact: Chris Swenson, CRSPE, Inc., crs@crspe.com

Providing Choice in Tolling

Lee County, Florida, is a pioneer in using variable tolls as a way to manage congestion, provide traveler choice, and spread traffic away from the peak period. The principle behind this objective is that commuters will make rational choices if those decisions are based on balanced cost incentives. The Leeway project provides another measure of choice – price choice – to the mix of Transportation Demand Management (TDM) strategies.

Background

Lee County is located in southwest Florida. Approximately half a million people live in the metropolitan area comprised of Ft. Myers and Cape Coral, with an additional 1.7 million tourists visiting per year. The Caloosahatchee River separates these two cities, and the County provides only three bridge crossings. Two of these crossings, the Cape Coral Bridge and the Midpoint Bridge, are the most relevant to commuter traffic, and were the focus of the Variable Pricing Program.

A toll of $1.00 was levied on both bridges in 1997. In order to convince the public to accept the higher $1.00 toll, over a previous $0.75 toll, Lee County Commissioners endorsed an innovative concept of varying the level of the toll based upon the time of day. In the "shoulders of the peak period" (6:30 – 7:00 am, 9:00 – 11:00 am, 2:00 – 4:00 pm, and 6:30 – 7:00 pm), patrons received a 50 percent discount on the toll if they utilize the bridge's electronic toll collection (ETC) system. Due to a popular "frequent user" program, this discount varies in value from either $0.25 to $0.50 each trip.

The objectives of the variable pricing program were to provide travelers with:

- an incentive to shift from peak periods
- an opportunity to lower out-of-pocket costs
- a reason to use ETC (which provides for better traffic management at toll plazas)

Challenges

There are a variety of challenges involved with the variable pricing program. The two principal concerns were:

- marketing the benefits of variable pricing in an area with relatively low levels of congestion, and,
- ensuring sufficient funds are generated to repay bonds and cover operating/maintenance costs

Lee County does not experience significant levels of congestion. In fact, most of the main arterials and highways operate at free-flow even in the peak hour. The challenge to Lee County officials was how to market the new off-peak travel discounts, when shifting travel was not likely to significantly short the likely travel time. Lee County responded to this challenge by marketing the convenience of electronic tolling and the cost savings provided by using off-peak periods. A variety of media was used to market the service, with multiple points of presence throughout the County. Media coverage of the concept also was high, since there is appeal in the innovation of variable pricing. Within a year, the project had over 40 articles in print media and 150 news stories in televised media.

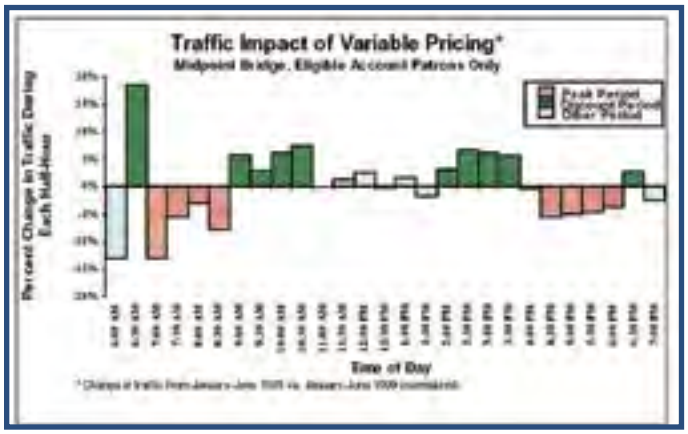
In addition to convincing travelers to use the program, Lee County also needed to convince employers to offer employees flexible scheduling and variable work hours. Without the ability to shift the commuter's travel time, the off-peak discount program would not be successful. In order to accomplish this, the County conducted outreach to medium and large size businesses in Ft. Myers (the principal employment node).

The issue of ensuring sufficient funds was critical to implementing the program. In 1996, Lee County applied for, and received, a grant from the Federal Highway Administration's Value Pricing Pilot Program. The $20 Million grant provided a $7 Million set-aside to compensate for lost tolls under the variable pricing program. The set-aside was necessary to alleviate concerns about the potential loss of revenue.

Results

The variable pricing program has been successful in meeting the program's objectives. Approximately 7 percent of all eligible participants indicate the variable pricing program causes them to alter their tripmaking behavior. According to a telephone survey of eligible drivers in late 1999, half of respondents indicated they always or sometimes considered the discounts prior to making a trip across the bridges. Finally, the variable pricing program is well known in Lee County, with over 90 percent of travelers familiar with the program. Altogether, these show that travelers are aware of and consider the option provided to them from the variable pricing program.

In three years of the implemented project, as reported by Mark Burris at the Center for Urban Transportation Research ("Lee County Variable Pricing Project: Evaluation Report", January 2001), use of the bridges increased in the off-peak times and decreased during the peak periods. Traffic data near the bridges indicate that variable pricing had caused no measurable change in vehicle speeds, queue lengths at toll plazas, average vehicle occupancy, transit ridership, or accidents.



Over time, more and more travelers have utilized the electronic toll collection technologies, reducing the average cost per transaction. Lowered transaction costs on the bridges have partially offset the loss of revenue from the toll discount, as has the natural increase in daily traffic. It should be noted that the program continues to this day (September 2003), well after the expiration of the Federally funded toll revenue guarantee.

Evidence for this case study has been provided by numerous evaluation reports conducted by Mark Burris (Center for Urban Transportation Research) and Chris Swenson (CRSPE, Inc.).

Commuter Link - Salt Lake City, UT

FAST FACTS ABOUT: Commuter Link - Salt Lake City, UT

Types of TDM: Advanced Traveler Information Systems
Keywords: Real-time communication, multi-jurisdictional coordination, technology, individualized demand management.
Area Demographics:
Salt Lake Area: 913,000 residents
Program: Technology allows SOV drivers to make better choices by managing their own demand with real time travel information.
Cost of Program: In 2004 the reduced cost of server technology makes this a much less expensive endeavor. Instead of requiring nearly a dozen Unix Servers to capture/generate images and nearly 40 Intel web severs to operate CommuterLink, TOC employees intend to operate all it with 3 or 4 more powerful Intel servers at an approximate cost of $60,000.
Implementer (s): Utah Department of Transportation (UDOT) in partnership with Utah Transit Authority (UTA), Salt Lake City, Salt Lake County, Wasatch Front Regional Council, Mountainland, Utah Department of Public Safety (DPS), Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Federal Railroad Administration (FRA), Salt Lake City Airport, ITS Rocky Mountain, ITA America, and Georgia Navigator.
Contact: Troy Hyer –UDOT, Paul Jencks–UDOT, Brian Chamberlain–UDOT.

Background Information

The CommuterLink system design was based on Navigator, the Georgia Department of Transportation's Intelligent Transportation System, which was used for the 1996 Summer Olympics in Atlanta. With a deadline to have the system operational by the 2002 Salt Lake City Winter Olympics, UDOT staff felt it was better to go with an older model that had been tested than to trouble shoot newer technology and deliver less than adequate service to travelers during the Olympics. UDOT employees customized Georgia's software to address their needs and added the feature that automatically disseminates alerts via email.

Advanced Traveler Information System Issues

Timing- Traffic reports on commercial radio stations are provided at specified intervals of time. Most often, traffic reports are not broadcast more frequently than every 10 minutes during peak rush hour. If an incident is reported one minute after the last traffic report is given on that station, it will be 9 minutes before commuters hear about it in the next report. That interval of time is often when commuters initiate their trip and make their decisions on which routes to take. Thousands of commuters may have made different travel choices had they heard the information. Instead they are choosing a route that will take them to and contribute to worsening delays at the incident. Receiving the traffic report as soon as the incident is reported gives commuters more opportunity to avoid it and lessen impacts of it.

Simplicity- Radio stations often have to cater to their regional audience, and therefore provide traffic reports on all of the roads in the region. This is often rushed and confusing to listen to. If for some reason you were distracted when they said something about your route, it will be ten minutes before you can hear it again.

Solutions

UDOT recognized that in order to effectively manage traffic it is as important to allow travelers to manage their own demand. This can be done by providing travelers with information when and where they need it. UDOT in partnership with numerous other organizations developed CommuterLink as a centralized system to manage travel in the region.

Description of CommuterLink Website

In addition to traffic monitoring and incident detection, CommuterLink also provides a user friendly format to relay the information detected and monitored to the traveling public. This is done through the CommuterLink Website. The CommuterLink Website (CLW) is operated by UDOT, on computer servers located at the TOC. CLW provides a map of the freeway system and the major surface streets, where most of the surveillance equipment is installed. CLW offers three primary types of information to the traveler:

1. Traffic conditions (speeds, incidents)
2. Roadway closures and construction
3. Weather (including pavement conditions)

Traffic information is presented in a number of ways. To display congestion conditions, the speed on each freeway segment (about one-half mile long) is shown as color-coded band (red = 0-30 mph, yellow = 31-50 mph, and green = 51 mph and above). Incidents are denoted with a red triangle; if the user clicks on that symbol, further information about that incident is displayed on a small portion of the screen, in the lower left corner. Visitors to CLW can also view video footage of real-time traffic conditions by clicking on the cameras located on the map.

Roadway construction and closures are displayed as a color-coded triangle, near the location involved. Yellow triangles denote current construction and/or closures; blue triangles identify future construction or closures.

Weather conditions are displayed as a cloud near the roadway where road conditions are provided.

Alert System

The CLW also enables individual users to subscribe to an "Alert" system, which automatically sends an email message in the event of an incident that falls within user-specified parameters (time of day, day of week, severity of incident). CommuterLink provides information only about the routes with a traffic impact level that concerns the subscriber at a time when it concerns them. The criteria for which an individual can subscribe can be seen at right.

When an "Alert Subscriber" presses the "Create Profile" button they are added to the CommuterLink database. Every half hour subscribers who checked that "Notification Timeframe" box are activated. Within that half hour, CommuterLink captures information about travel speed on regional roadways every 20 seconds. If travel speed on any of those roadways indicates an incident, CommuterLink sends an email is sent to the subscriber. A sample message would be, "Crash I-15 at 1500N SPGVL on right shld."

A variation on receiving this information is an email account allows users to receive this information on their cell phone or pager using text messaging. This provides them with the information they need, when they need it, wherever they may be.

By receiving emails at work before they leave to get in their car, commuters can make a decision to delay their departure until incident is cleared or plan an alternative route to avoid the incident. In either case the traveler is not adding to the problem created by the incident and able to use their time more productively. Similarly, by having the information sent to their pager or cell phone, commuters can receive information about an incident before they leave the office or while they are on the road. If they receive it early enough they can receive the same benefits listed above.

Quick Facts*

- CommuterLink initiated email subscriptions in late 2000.
- In March 2004, CommuterLink had 6,652 commuters subscribing for traffic incident information to be sent to their email account.
- CommuterLink had 121,117 visitor sessions during March of 2004. Averaging 3,907 sessions per day.
- 83% of the sessions occur during the week with Monday and Wednesday being the busiest days
- CommuterLink receives its most visitor sessions between 7:00 am and 6:00 pm. Peak usage is between at 4:00 pm and 5:00 pm for commuters to plan their trip home.

*Detailed usage statistics for the CommuterLink Website are maintained by the website host (UDOT), using the "Webtrends" tracking software package. All usage data reported in this section are based upon the information reported by that system.

U.S. Department of Transportation
Federal Highway Administration

Federal Highway Administration
US Department of Transportation
400 7th Street, S.W. (HOP)
Washington, DC 20590

To order a copy of this document contact the
ITS Toll-Free “Help Line” 866-367-7487
www.ops.fhwa.dot.gov

Publication Number: FHWA-HOP-05-001
Electronic Document Library (EDL) Number: 13668

www.vtpi.org

Info@vtpi.org

250-360-1560

First Resort

Resort Community Transportation Demand Management

18 February, 2011

Todd Litman
Victoria Transport Policy Institute

Abstract

Transportation demand management (TDM) includes a variety of strategies to encourage more efficient use of existing transportation facilities. This paper describes how TDM strategies are being used to address transportation problems in resort communities. Such communities tend to be particularly appropriate for TDM because they have predictable travel patterns, significantly increased demand during peak periods (which are frequently a few hours a week, or a few weeks of the year, and so increasing capacity to satisfy peak demand is unjustified), and high environmental amenity values that can be degraded by expanding road and parking capacity. If carefully planned and implemented, TDM strategies can provide Win-Win solutions to resort community transportation problems, by providing visitors more travel choices and an improved experience, while avoiding road and parking construction projects that are financially expensive and degrade local environmental quality. This paper describes TDM strategies suitable for application in resort communities, and discusses TDM planning and implementation.

Todd Litman © 1997-2011
You are welcome and encouraged to copy, distribute, share and excerpt this document and its ideas, provided the author is given attribution. Please send you corrections, comments and suggestions for improvement.

Introduction

Many resorts are too successful for their own good. They attract so many people – visitors, residents and employees – that their unique amenities and environments are threatened. Usually, it is motor vehicle traffic, not people themselves, that imposes environmental risks.

Resort communities must make difficult tradeoffs in their transportation planning decisions. On one hand, most depend on motor vehicles to bring visitors, staff and essential products. On the other hand, motor vehicle traffic can degrade the very aesthetic amenities that attracts visitors.

Constraints on motor vehicle traffic are often critical in retaining what makes a resort community special. For example, Venice, Italy is famous for its canals. Although the millions of tourists who visit that city could get around more quickly if the canals were filled, paved, and turned into modern roadways, doing so would destroy the very features that attract them in the first place. Most other resort communities, whether they be large, internationally famous destinations, or smaller, less well known resorts, must control motor vehicle traffic if they are to retain their unique ambiance.

This tension between traffic and the environment exists in most communities, but is particularly intense in resort communities where environmental amenities often have tremendous value. As a result, resort communities are often justified in taking greater measures to limit traffic and encourage alternative travel options than otherwise comparable communities.

Although resort communities vary tremendously, they often have common traits that must be taken into account when planning transportation. These include:

- High environmental and experiential values
- Geographic isolation.
- A large volume of visitors and staff.
- Distinct and predictable types of trips.
- Concentrated activities.
- Visitors accustomed to paying for transport services, such as parking, trams, shuttle buses, bicycle rentals, etc.

This paper describes how the concepts of transportation demand management (or TDM) can be applied in resort communities, taking into account these unique traits. It describes the process that can be used to identify a range of possible strategies and measures for a community to choose from.

TDM Principles

Transportation Demand Management involves a wide range of strategies and measures that encourage more efficient travel behavior.[1] Although individual TDM measures have been widely used for decades (such as transit promotion and parking restrictions), it is only recently that the overall concept has been widely accepted by transportation professionals.

Although transportation demand management is often implemented as a "last resort" to address urban traffic congestion, it provides a wide range of benefits, some of which are often overlooked.[2] These include economic savings (such as reduced roadway and parking costs), safety, environmental protection, and increased travel choices for non-drivers. These benefits are often significant in resort communities where environmental amenities are highly valued and travel choice is important. Although TDM has usually been targeted at commute trips, it has much broader applications.

There are three principles that form the foundation for effective transportation demand management planning:

1. *Choice*
A community should provide a range of travel choices that individuals can choose from. For example, this may include private automobile, taxi and transit services.

2. *Incentives*
There should be incentives that encourage individuals to choose the "best" travel choice for each particular trip. For example, because transit services impose the least traffic impacts per passenger trip (since transit vehicles can typically carry 5 to 50 passengers), transit should be comfortable, efficient, fast and inexpensive.

3. *Equity*
There are often a number of equity issues implicit in resort transportation decisions. In particular, visitors and clients tend to have more wealth than staff or residents. Yet, resort communities often provide premium transportation services to visitors in order to help attract them and satisfy their wants. Equity issues should be considered explicitly in transportation planning.

---

[1] Todd Litman, *Potential Travel Demand Management Options*, VTPI (www.vtpi.org) 1998; Reid Ewing, *Transportation and Land Use Innovations; When You Can't Build Your Way Out of Congestion*, Planners Press (Chicago; www.planning.com), 1997.
[2] Todd Litman, *Guide to Calculating TDM Benefits*, VTPI (Victoria; www.vtpi.org), 1998.

Travel Choices

Some examples of efficient travel choices are described in this section.

1. Transit
Many people assume that North Americans will not willingly ride public transit, particularly buses, if they can drive. But wait. What happens when visitors arrive at a Disneyland? They park their car, and hop on a cute little *bus*. Tourists at theme parks are happy to ride a bus. They just need assurance that it is part of the fun.

There are a number of factors that can help make transit attractive at resorts. It must be convenient, comfortable and attractive. Schedules and fares must be easy to understand. If possible, it should be free or payments should be convenient. For example, it could be funded as part of an accommodation tax, or some type of unlimited-rides-for-one-fee that visitors pay when they arrive.

New Legislation Could Bring Transit Service to National Parks
Legislation introduced by Senator Paul Sarbanes (D-Md.) on 3/23 would bring transit to an unprecedented number of national parks. In an effort to curb congestion and pollution in parks and nearby gateway communities, the Transit in Parks Act would provide the Department of the Interior's land management agencies with $50 million annually over the next five years to develop clean bus and rail networks, pedestrian and bike paths, and watercraft access within national park lands.

The possibility of improving transit services in national parks is strongly supported by Americans, according to a survey by Colorado State University. Conducted for the National Parks and Conservation Association, the 1998 survey found that 92 % of respondents were willing to use shuttle buses to reduce traffic congestion and help protect park resources. With 270 million people visiting America's national parks each year, the introduction of transit services in popular national parks may help visitors become more familiar with the benefits of transportation choices.

There are many types of public transit. Which is most appropriate in a particular situation depends on ridership needs and travel conditions. A rail system may be justified along corridors with heavy use. Rail is often more comfortable, easier to understand, and tends to attract more ridership than buses. If rail is impractical, large buses may be justified on busy routes. Smaller buses or vans are often preferred because the are less intrusive.

Parks agencies can establish transit services, bicycle rentals and guided tours, or help private companies provide suitable services.[3] If possible, transit vehicles should be particularly comfortable, with padded seats and other amenities. This is especially important for longer rides. Coffee (or rather, *espresso*, we're talking upscale here) and snacks sold at stations or served on transit vehicles may be appropriate. Some

[3] Cambridge Systematics, *Federal Lands Alternative Transportation Systems Study*, Federal Highway Administration and Federal Transit Administration (www.fhwa.dot.gov), 2001.

communities use theme vehicles, such as historic style trolleys mounted on a conventional bus chassis, or double-decker buses.

It is important that transit vehicles accommodate baggage, including skies, bicycles, surfboards and big dirty backpacks, or whatever else visitors are likely to carry. This can be accomplished with special racks, or by replacing one or more seats with a luggage bin.

Demand response transit, in which vehicles are routed to specific destinations, may be appropriate, either in addition to or instead of fixed route transit. Demand response is often the only way to provide transit services in lower density, suburban or rural areas.

Conventional taxi service is an important form of mobility in many resorts. It is important that taxi services be included in transportation planning and information. Although taxis do not directly reduce automobile travel, they provide a mobility option for people who do not have an automobile. Inadequate or overly expensive taxi services will encourage visitors to arrive by, or rent, an automobile.

Many hotels already provide shuttle bus or van services to pick up their guests from airports or other terminals, and for trips to common destinations. It may be possible to expand and coordinate such services so they carry an increasing portion of total trips.

Buses, particularly large buses, impose a number of environmental impacts, including air pollution, noise and parking space requirements. Newer buses tend to have lower emissions than older diesel vehicles. Alternative fuels, such as CNG may be appropriate in some cases, although diesel engines themselves are getting much cleaner. Noise pollution can be reduced through design improvements and driving practices. In some cases, smaller buses may be justified to minimize this impact.

2. Ridesharing
Ridesharing is particularly appropriate for resort community employees. Ridesharing can be encouraged by offering ridematching services, by promoting it at businesses, and by providing incentives to reduce automobile use, as described below.

3. Bicycling
Bicycling is an important travel alternative in many communities, but it could be used much more if given appropriate support.[4] Bicycling minimizes environmental impacts compared with other travel modes,[5] and is a fun and healthy activity.[6] It may be the best way for visitors to experience a resort that has moderately dispersed attractions (1 to 10 miles in area).

---

[4] National Bicycling and Walking Study reports #1, 3 and 4, USDOT, FHWA (Washington DC), 1992.
[5] Charles Komanoff and Cora Roelofs, *The Environmental Benefits of Bicycling and Walking*, National Bicycling and Walking Study Case Study No. 15, USDOT, January 1993, FHWA-PD-93-015.
[6] Ian Roberts, Harry Owen, Peter Lumb, Colin MacDougall, *Pedalling Health—Health Benefits of a Modal Transport Shift*, Bicycle Institute of South Australia (Sydney; www.science.adelaide.edu.au), 1996.

Bicycling requires adequate facilities.[7] Many riders prefer paths that are completely separated from the roadway, although on-road riding is acceptable if there is a wide bikelane or where traffic is light or slow (such as in a downtown area). It is not usually enough to establish just one or two paths. It is often important to develop a comprehensive bicycle plan that identifies routes, parking requirements, and any bottlenecks to riding. Because of new standards in bicycle facility design it is important to obtain up to date information in bicycle plan development.

It is also important that visitors be able to easily rent bicycles. Some hotels offer bicycles to their guests, and many communities have businesses that rent bicycles. These options should be expanded and promoted as much as possible.

4. Walking

Walking is an important transportation option, and supports travel options (since transit riders rely on walking once they arrive at their destinations). It is also an enjoyable activity in most resort communities. An attractive pedestrian environment is an important attraction to many resort communities, and is a critical component of successful transportation demand management programs.

There are many design details that can enhance the pedestrian environment. Pedestrian facilities include sidewalks, paths, crosswalks, and pedestrian bridges. It is important to identify barriers and inadequacies that limit pedestrian travel. A pedestrian-friendly streetscape includes appropriate scale lighting and street furniture, and storefronts that are welcoming to pedestrians. A well-connected street system minimizes travel distances, which is particularly important for pedestrian travel.[8] Traffic calming (described later) can greatly improve the pedestrian environment by reducing motor vehicle traffic speeds.

5. Land Use Coordination

Land use patterns have a significant impact on local transportation needs.[9] In general, if most attractions are in a central, walkable area there is less need for driving than if attractions are dispersed. Attractions sprawled for miles along a highway typically require the greatest amount of driving.

What do we mean by attractions? Any destinations that either visitors or residents may need. Hotels, restaurants, recreation and entertainment centers, stores or any other place that attracts people. The attractions that are most popular are the ones that deserve the most careful land use coordination.

---

[7] American Association of State Highway and Transportation Officials, *Guide to the Development of Bicycle Facilities*, 1991; John Forester, *Effective Cycling*, MIT Press, Cambridge, 1984.
[8] Michael Aaron Berman, "The Transportation Effects of Neo-Traditional Development," *Journal of Planning Literature*, Vol. 10, No. 4, May 1996, pp. 347-363.
[9] Terry Moore and Paul Throsnes, *The Transportation/Land Use Connection*, American Planning Asso., Planning Advisory Service, Report 448/449 (Chicago; www.planning.org), 1994; Eric Damian Kelly, "The Transportation Land-Use Link," *Journal of Planning Literature*, Vol. 9, No. 2, Nov. 1994, pp. 128-145.

6. Establish Transportation Management Associations (TMAs) and coordinators.
TMAs coordinate transport activities at worksite, neighborhood or municipal levels, which is more effective than smaller, individual programs managed by individual employers.[10] Such programs distribute information, organize transportation fairs, perform ride matching, manage parking, sponsor guaranteed ride home services, and help plan transit, bicycle and pedestrian improvements, site amenities, etc.[11] One TMA will typically serve a small resort community, or a particular section if the community is large and dispersed.

7. Transportation Management for Special Events and Activities
TDM can be especially appropriate for special events, such as fairs, sports competitions, etc. that attract large crowds. [12] This can include special transit services, road use restrictions and parking provisions that encourage alternatives to automobile travel. Event organizers can be required to provide a TDM plan, and to include information on travel alternatives in their publicity. For example, the state of Maine promotes "Car(e)-Free" vacations, providing support to the travel industry to develop vacation packages that reduce automobile use.

8. Freight Delivery Coordination
Specific measures may be used to coordinate and consolidate deliveries to minimize the number of freight vehicles needed, particularly during peak periods.[13]

---

[10] Erik Ferguson, Catherine Ross and Michael Meyer, "Transportation Management Associations: Organization, Implementation, and Evaluation," *Transportation Research Record 1346*, 1992, pp. 36-43; Lori Diggins and Eric Schreffler, "Status Report on Transportation Management Association Development in California," *Transportation Research Record 1346*, 1992, pp. 53-61.
[11] For resources contact the Association for Commuter Transportation (http://tmi.cob.fsu.edu/act/act.htm).
[12] Nada D. Trout and Gerald L. Ullman, "A Special Event Park-and-Ride Shuttle Bus Success Story," *ITE Journal*, December 1997, pp. 38-43.
[13] Hitoshi Ieda, "Potential of Regional Goods Transport Collaboration Toward Sustainable Urban Development," *IATSS Research*, Vol. 19, No. 2, Sept. 1995, pp. 79-87.

Incentives

1. Information
One of the most important components of any TDM program is the distribution of information about travel options. Resort visitors, employees and residents need information on automobile use (such as the availability and cost of parking, road conditions, etc.) and the availability of travel alternatives. Public relations campaigns can also encourage the use of alternative travel modes. This information must be timely, widely available, and easy to understand. Special brochures, newsletters, signs and hotlines are all appropriate, as well as information integrated into general visitor information.

2. Parking Management
Experience indicates that parking management is often one of the most effective ways to manage transportation.[14] There are many specific parking management strategies.[15] The following strategies are appropriate for application in resort communities:

- Reduced parking requirements. Current North American zoning law parking requirements often result in oversupply.[16] A number of strategies can be used to encourage more efficient use of parking, allowing requirements to be reduced.[17]

- Limited, relatively expensive parking facilities in central areas, with more abundant, cheaper parking at the community edge.

- Cashing out free employee parking.[18] This means that employees who receive free parking are also offered its cash equivalent if they use alternative travel modes.

- Providing transit subsidies in place of parking subsidies. It is common for communities to offer subsidized parking as an enticement to visitors. At a minimum, transit subsidies should be offered *in addition to* free or underpriced parking. Even better is to offer transit service *instead of* parking subsidies.

---

[14] Todd Litman, *Pavement Busters Guide*, VTPI (www.vtpi.org) 1998; Donald Shoup, "The High Cost of Tree Parking," *Access*, No. 10 UCTC (http://socrates.berkeley.edu/~uctc), Spring 1997.
[15] K.T. Analytics, *Parking Management Strategies: A Handbook For Implementation*, Regional Transportation Authority (Chicago), May 1995.
[16] Richard Willson, "Suburban Parking Requirements: A Tacit Policy for Automobile Use and Sprawl," *Journal of the American Planning Association*, Vol. 61, No. 1, Winter 1995.
[17] Donald Shoup, "An Opportunity to Reduce Minimum Parking Requirements," *Journal of the American Planning Association*, Vol. 61, No. 1, Winter 1995, pp. 14-28; Patrick Hare, *Planning, Transportation, and the Home Economics of Reduced Car Ownership*, Hare Planning (Washington DC), 1995.
[18] Donald Shoup, "Cashing Out Employer-Paid Parking: An Opportunity to Reduce Minimum Parking Requirements," *Journal of the American Planning Association*, Vol. 61, No. 1, Jan. 1995, pp. 14-28.

A number of new technologies make it much easier to charge users for parking.[19] For example, conventional parking meters require drivers to predict how long they will park and carry the right type of change. New charging systems allow drivers to pay by debit or credit card, and to pay only for the amount of time their vehicle is actually parked.

3. Automobile Restrictions

There are many different types of restrictions on automobile use that may be appropriate at resort communities. These include:

- Total or partial prohibitions on driving in certain areas. Automobile use is severely limited in some resorts due to their isolation or extreme environments. In others, driving is restricted to protect their environment or maintain special amenities.

- Restrictions on when certain types of vehicle may use certain roads. For example, private automobile travel is allowed during certain hours into the center of some cities, but is prohibited during busier times. In other areas, freight delivery may be restricted to off-peak time periods.

- Limiting certain lanes or roads to high occupancy vehicles. This allows buses and car pools to bypass congested areas. This is a more efficient use of congested road space and provides an incentive to use these modes.

- Limitations on the number of vehicles allowed (either by metering or simply by letting congestion become self-limiting). In many resort communities this occurs naturally because it is not financially possible or environmentally acceptable to build enough road capacity to accommodate the maximum automobile travel demand during peak periods. Although this is often considered a problem initially, it is actually a blessing if congestion becomes a constraint on automobile traffic and a catalyst for developing a more balanced transportation system.

- Road pricing.[20] A charge may be levied for driving on certain roads or into an area. This can be used to discourage automobile travel.

- Traffic calming strategies, which limit traffic speeds and volumes, particularly around pedestrian area.[21] This provides a number of benefits to visitors and communities.

Many people wonder if visitors, accustomed to unrestricted driving in their own communities, will be willing to accept such limitations when they visit a resort. The

[19] James Luk, *Technologies for On-Street Paid Parking*, Australian Road Research Board, 1995.
[20] Committee for Study on Urban Transportation Congestion Pricing, *Curbing Gridlock*, Transportation Research Board, National Academy Press (Washington DC), 1994.
[21] Ian Lockwood, "ITE Traffic Calming Definition, *ITE Journal*, Vol. 67, No. 7, July 1997, pp. 22-25. Carmen Hass-Klau, Inge Nold, Geert Bocker, Graham Crampton, *Civilized Streets; A Guide to Traffic Calming*, Environmental & Transport Planning (Brighton, UK), 1992.

answer is yes. Many of the world's most popular resorts have severe restrictions on private automobile use. However, such restrictions must be predictable, understandable, and people must have attractive alternatives to driving.

Visitor information can include statements such as, "During the summer [winter] season, local roads tend to be congested. Visitors are encouraged to use our community's high quality transit service, which bypasses major roadway bottlenecks. An unlimited daily pass costs $5.00 for adults and $2.50 for children under 12."

4. Commute Trip Management

A number of TDM programs are specifically targeted at employees.[22] These tend to be particularly effective because commute trips are predictable and frequent. This typically involves coordinated policies between employers, transit agencies, and local governments to increase travel choices, remove barriers to their use, and provide incentives to employees to use commute alternatives. To be effective, such programs require consideration of social issues, including equity, status and comfort.[23] Special measures may be appropriate to address the travel needs of working parents who have children in daycare or school.[24]

[22] Cambridge Systematics, *The Effects of Land Use and Travel Demand Management Strategies on Commuting Behavior*, USDOT, DOT-T-95-06, November 1996; Deborah Dagang, "Transportation Demand Management Cost-Effectiveness Model for Suburban Employers," *Transportation Research Record #1404*, July 1993, pp. 64-72

[23] Craig Jesus Poulenez-Donovan and Cy Ulberg, Seeing the Trees and Missing the Forest: Qualitative Versus Quantitative Research Findings in a Model Transportation Demand Management Program Evaluation, *Transportation Research Record #1459*, 1995, pp. 1-6.

[24] Sandra Rosenbloom and Elizabeth Burns, "Why Working Women Drive Alone: Implications for Travel Reduction Programs," *Transportation Research Record #1459*, 1995, pp. 39-45.

Addressing Equity Concerns

Transportation demand management often raises equity issues since it affects the distribution of costs and benefits. For example, increasing parking prices is often considered unfair to lower income people. This may be particularly noticeable in resort communities where staff and residents are often less wealthy than visitors. However, TDM can also provide equity benefits by increasing travel choices for non-drivers and reducing subsidies to automobile users. Concerns about inequity can be addressed through good planning that results in policies that benefit all groups.

Equity concerns can be addressed in pricing structures. For example, transit agencies can offer deeply discounted long-term passes that make transit service affordable to staff and residents. Employees can be encouraged or required to cash out free parking or to subsidize travel alternatives such as transit.

Coordinating TDM

It is important that TDM measures be coordinated to create a system. To be effective, there must be both alternatives to automobile travel and appropriate incentives to use those alternatives.

It is not enough that these travel options and incentives exist. It is equally important that they be publicized so the appropriate people know about them. Since resort communities constantly have new visitors it is essential that information about travel options (including prices and other incentives) be widely available. Distributing information is often one of the major responsibilities of the TDM agency.

An objective of the TDM program may be to assure potential visitors that they don't need an automobile because there are adequate mobility options. If visitors are to arrive by public transit they must know that their mobility needs within the resort community will be fully met. Shuttle buses, taxis, bike rentals and pedestrian paths can all help reduce the number of automobile trips *to* the community as well as *within* it.

Many TDM measures require local coordination. Some municipal governments incorporate TDM management into their existing transportation planning activities. Others create a TDM management position or office. In other communities, independent TDM agencies are established, either fully tax funded, a public/private partnership with local businesses, or sometimes fully supported by a chamber of commerce or a group of businesses.[25] TDM programs have also been successfully managed by university campus administrations.[26]

---

[25] Erik Ferguson, Catherine Ross and Michael Meyer, "Transportation Management Associations," *Transportation Quarterly*, Vol. 47, No. 2, April 1993, pp. 207-219.
[26] Michael Williams and Kathleen Petrait, "U-PASS: A Model Transportation Management Program that Works," *Transportation Research Record 1404*, 1993, pp. 73-81.

Planning Exercise

Here is an exercise that can help develop an appropriate TDM program.

First, identify various types of trips, including those made by residents, visitors, employees, and service vehicles. For each type of trip identify:

- Number of such trips (per day, week, year, etc.), or the portion of total trips they constitute.
- Who makes this trip.
- What are the baggage requirements.
- What is the "conventional" mode (such as automobile).
- What are alternative (non-automobile) options for that trip.
- What supports and incentives are needed to accommodate and encourage the alternative mode for that trip.

Develop a table that summarizes this information, such as the one below:

Table 1 **Transportation Demand Management Analysis Example**

Trip Type	Number/ Portion	Who	Baggage	Conven-tional	Alterna-tives	Support/Incentives
Arrival at hotels	10,000/yr 2% of total	Visitors	Large	Private or rented automobile	Intercity bus, rail, airporter	Improved bus/rail services. Discounts to bus tours. Promote bus travel options.
Hotels to ski slopes	100,000/yr 20% of total	Visitors	Medium	Private or rented automobile	Shuttle buses and vans	Parking charges at ski slopes. Improved bus and van services. Discounts to bus users. Promotion of bus use.
Hotels to shops and restaurants	100,000/yr 20% of total	Visitors	Medium	Private or rented automobile	Shuttle buses and vans	Parking charges. Improved bus and van services. Discounts to bus users. Promotion of bus and van use.
Hotels to hiking trails	10,000/yr 2% of total	Visitors	Medium to large	Private or rented automobile	Shuttle buses, vans, bicycles	Special bus and van services Bicycle rentals. Promotion of bus, van and bike use.
Resort Staff commuting	100,000/yr 20% of total	Resort Staff	Small	Private automobile	Pub. Transit, shuttle buses or vans, car pooling, bicycling.	Employee parking charges. Special bus and van services. Bicycle parking and showers. Promote bus, van and bike use.
Deliveries	5,000/yr 1% of total	Delivery Vehicles	Very Large	Individual delivery trucks	Coordinate d delivery trucks	Coordinate shippers. Provide local delivery services. Require or provide financial incentives to consolidate shipping.
Local errands	50,000/yr 10% of total	Resi-dents'	Small to large	Private automobile	Transit, car sharing, bicycling	Parking charges. Improved transit. Ridesharing information. Bicycle and walking encouragement.
Others	-	-	-	-	-	-

Now you can identify which support resources and incentives can provide the most benefit to the community in terms of reduced traffic impacts at the least cost. This does not mean that only strategies that affect a large portion of total trips should be considered, since some strategies that have relatively small direct impacts may have minimal cost, and therefore a high benefit/cost ratio. In most cases a TDM program will include a package of several measures. It may be appropriate to develop a phased plan, particularly since some measures are most appropriate after a certain foundation is developed. For example, it is often important to establish a TDM program and have increased travel choices before raising prices for automobile use. In other cases, certain measures may be held in reserve to be implemented if others fail, or after a certain threshold is reached.

Case Studies

1. The Austrian Model Project "Sustainable Mobility – Car free Tourism"

The project was initiated by the Ministry for the Environment and is carried out together with two other Ministries, the Ministry for Transport and Science and the Ministry for Economic Affairs, as well as two model communities and the Province of Salzburg. Two communities were selected for the project: Bad Hofgastein and Werfenweng, both situated in the Province of Salzburg.

The project was initiated in recognition that a sound and clean environment is essential to attract visitors to a tourist resort. But tourism, particularly motorized transport, has negative impacts on the environment, including air pollution, noise and land use. Tourism is inherently linked to transport. Visitors travel to their holiday destinations and back home, and make local trips during their stay at a resort. The impacts of motorized transport affects the region's ecosystems and diminishes its recreational value.

The five year project started in 1998. It has an advisory board consisting of all project partners, which has the task of coordination and financing. Local coordinators supervise the implementation of the measures in the communities. Public-private-partnerships are established in the field of transport services, electric vehicle manufacturers, logistic and telematic enterprises, energy industry as well as tourism organisations and travel agencies. The implementation of all measures of the model project will afford financing funds of about 110 million ATS (more than 8 million ECU).

Bad Hofgastein

Bad Hofgastein has 6,000 inhabitants and is situated 850 m above sea level in the spacious Gastein valley, which is surrounded by mountains up to 3,000 m high. The settlement was founded in the end of the 9th century, but only became famous in the beginning of the 19th century when its thermal springs became popular. Today, with about 8,000 beds and 1 million overnight stays per year Bad Hofgastein is among the ten most tourism-intensive communities in Austria. Two thirds of overnight stays go to the winter season. About 90% of the visitors are German and Austrian.

Car-free travel to Bad Hofgastein is easy because the community is situated on the Tauern railway, the main connection between Munich and the South. The only problem is that the railway station lies 2 km off the city center. This affords a change to bus or taxi. A private bus service therefore connects the railway station with the city centre.
The city centre has been redesigned during the last years. A pedestrian zone was implemented and only few vehicles like the city bus are allowed to enter it. Delivery of goods is allowed between 7:30 and 10:30 a.m.

Traffic management has been implemented in the residential and hotel area around the pedestrian zone. This helps to avoid through-traffic in those areas. Each point in Bad Hofgastein now can be reached only from one of the three entrances to the city. The number of parking spaces in the streets is very low, since parking is provided at the edge of the city and in an underground car park. Two free bus lines serve the city center. In winter, ski-buses connect the city with the stations of the ski lifts.

Werfenweng

Werfenweng is situated about 45 km south of the city of Salzburg on a plateau above the Salzach valley. It lies 1,000 m above sea level and has 650 inhabitants. The settlement consists of scattered groups of houses. 1,800 beds are offered and about half of the 190,000 overnight stays per year are counted during the winter season. 70% of the visitors are German, 15% Austrian, 8% from the Benelux-countries.

As Werfenweng has not got a railway station of its own, the community is implementing several measures to improve its connection to the railway stop in Bischofshofen, which is in 14 km distance from Werfenweng. A dial-a-taxi-service has been realised, called Werfenweng-Shuttle, and a concept for luggage logistics will be realised soon. In 1997 two electric vehicles were bought and now are offered in a local public car-sharing project. The cars can also be rented by visitors who arrived without their own car.

Project components

The following measures will be implemented as part of the project:

- The establishment of a mobility management centre is a cornerstone of the project. It will promote integration between various means of transport, and travel information, and provide transport services including demand-oriented dial-a-bus-systems, booking and coordination for the car-sharing programme, and rental of bicycles and sports equipment.
- Streets will be redesigned to be more pedestrian- and cycle-friendly. This will allow visitors and inhabitants to walk unimpededly everywhere in the communities. Pedestrians are given priority to cyclists and motorized vehicles. The speed of motorized traffic will be adjusted to that of pedestrians. Cycling will be an important means of travel for visitors and inhabitants. It will be possible to rent bicycles e.g. from hotels or at public service points like the tourist information or the railway station. Public transport services will also transport bicycles. A network of cycling routes is prepared and information material on it will be provided.
- Information packages on car-free travel, and attractive car-free travel services will be provided. To relieve the visitors from their heavy load, a concept of door-to-door luggage logistics is implemented. Sports equipment will be offered for rent.
- Regional public transport is being improved, including railway, buses, taxis, lifts and the electric-car-rental. Information about regional carfree mobility will be provided, including an information map and suggestions for excursions using public transport.

- To allow environmentally sound freight delivery, a freight logistic concept is elaborated and a freight delivery center will be built on the edge of Bad Hofgastein.
- Conventional cars will be replaced by zero-emission-vehicles as far as possible. The aim is to finance the additional costs (compared to the costs of conventional vehicles) of 100 zero-emission-vehicles. It is also planned to replace the two now diesel-powered city buses in Bad Hofgastein by electric buses.
- An integrated travel information and booking system will be created. Upon entering a home address and an address for the desired destination, a user of the travel information system will be able to retrieve information about all options for carfree travel to the desired holiday destination. The travel information system may also serve as a regional information system, and can be used to inform visitors about the best transport for excursions or about the availability of car-sharing. This travel information system will be simple and easy to use.
- The number of parking spaces in the streets will be reduced.
- Legal changes will be made as required.
- A new quality product ”carfree tourism”, including “all-inclusive-packages” with transfer to and from train stations and door-to-door luggage services will be developed.
- The effects of the project will be evaluated in economic and social terms as well as in terms of air pollution and noise.

For more information on this project contact:
Austrian Federal Ministry for Environment, Youth and Family
Dept. I/5
Stubenbastei 5, A-1010 Wien, Austria
Tel. ++43-1-51522-1208, Fax ++43-1-51522-7208

2. Ski Resort Mobility and Parking Management

Most destination ski resorts provide various travel services and incentives to reduce vehicle traffic and address parking problems. Examples are described below.

Aspen/Snowmass, Colorado (www.snowmass.com)

- The Town of Snowmass Village provides free shuttle service to most locations in the Village.
- Twice-hourly bus service from the airport. Free to Aspen (always) and to Snowmass during ski season, and $3 to Snowmass at other times.
- Parking Plaza offers convenient 24 hours a day covered parking. Rates are US$0.75 per hour or US$7.50 per day.
- Residential parking in neighborhoods is restricted to a maximum of two hours from 8:00 am to 6:00 pm Monday through Friday.
- Parking in the commercial core of downtown Aspen is priced at $0.50 per half hour, maximum of two hours.

Banff/Lake Louise (www.banfflakelouise.com)

- Daily bus service between the Fairmont Banff Springs Hotel, town centre, Tunnel Mountain hotels (to the campground in summer) and along Banff Avenue, hours vary seasonally, cost $1.
- Free parking on ski hill, and free parking in downtown with 3-hour and 12-hour time limits, depending on location.

Jackson Hole (www.jacksonhole.net)

- Free shuttle bus operates every half-hour.
- Parking is $5 per day at the edge of the village and $10 per day in the village.

Mount Hood, Oregon (www.skihood.com)

- State Sno-Park Permits costing US$4 per day or US$17 per season are required November 15 - April 30 to park in Oregon Department of Transportation maintained parking areas, including the Mt. Hood Meadows parking lots.
- Park & ride transportation packages are promoted for day skiers. A $50 ticket includes bus service from downtown Portland and a lift ticket, compared with $44 for a standard adult lift ticket.
- A rideshare promotion provides ride matching for skiers.

Mount Washington

- One bus per day from Courtney.
- Free day parking, $10 per day for parking overnight.

Park City, Utah (www.parkcitytownhome.com)

- Free shuttle bus with service as frequently as every 10-minutes during the winter season.
- Some on-street parking within the town is free but has a one- to three-hour limit, some is priced at US$1.00 per hour, some off-street parking is free, and there are private, off-street parkades.

Stevens Pass (www.stevenspass.com)

- Stevens Pass has more than 2,700 parking spaces in eight lots at the base of the mountain, plus parking facilities at Yodelin and the Stevens Pass Nordic Center. Parking is free except at the two summit lots, where $10 daily fees are charged on weekends and holidays. Carpools with 4 or more people pay only $5. VIP reserved parking at the most convenient lots is available for $40 per day during season weekends and holidays.
- An electronic sign is set up on the summit during peak times to indicate where parking is currently available. If the summit lots fill, there are two satellite parking facilities, with free shuttle services. The shuttle runs on continuous basis from when the satellite parking lots are open until 10:30 PM.
- Shuttle bus services are provided every 20 minutes from the nearby town of Sultan, and daily from Leavenworth, on weekdays and weekends during the peak season. A roundtrip is $5, or $25 for ten rides.

Steamboat Springs (www.steamboat.com)

- Steamboat Springs offers a comprehensive system of free transportation between the ski area, downtown and most hotel, condominium, restaurant, grocery and entertainment locations. The ski area is located 3 miles southeast of downtown Steamboat Springs. Buses continuously from 7:00am til 1:45am daily, stopping at each location every 20 minutes.
- Most parking is free. More convenient, underground parking is US$10 per day.

Sun Valley, Idaho

- Free city bus service.
- $8.00 per day parking at base of mountain.

Vail, Colorado (http://vvctb.ecomshare.com)

- 2,500 parking spaces are free during the off-season and priced at US$13 per day from mid-November through mid-April. When the parking structures fill, additional free

parking is available at various lots nearby. All outlying parking spaces are free and within close proximity to existing bus stops.

- The Town of Vail offers the largest free transportation service in the nation. Summer bus service is increased during the ski season.
- Beaver Creek offers year-round free parking just 10 minutes from the ski mountain. A free shuttle bus takes passengers from the free lots to the base of the mountain from 6:30 a.m. until 2:00 a.m., seven days a week. In addition, Village Transportation, a complimentary shuttle service, transports guests to any location within the resort.

Winter Park, Colorado (winterparkguide.com)

- Free shuttle buses operate every hour on weekdays and every half-hour on Fridays, weekends and holidays.
- Free parking is available outside of town. Parking in close lots is $10 per weekday and $15 per weekend day.

3. Greater Sedona Transportation[27]

Sedona/Red Rock region in northern Arizona is a popular destination for tourists who are attracted by its spectacular Red Rock cliffs, expanses of forest and grasslands, rushing rivers and striking canyons. The area has approximately 14,000 residents and 4-5 million annual visitors driving 2.5 million cars through Oak Creek Canyon each year, with a doubling of visitors projected in the next two decades. Currently, the only viable way for most people to get to or around Sedona is by car.

The conventional response to growing traffic is build a new road or widen streets. This is not an option within the narrow confines of Oak Creek Canyon. The community is challenging conventional practices and assumptions, such as:

- Additional road and highway investments are the only way to assure mobility for a growing population.
- Transit incentives, land use and other public policies cannot significantly reduce the number or length of trips made by automobile.
- Public transportation requires massive and continuing public subsidies.

The City of Sedona, Yavapai and Coconino Counties, the Coconino National Forest, the Northern Arizona Council of Governments (NACOG) and the Arizona Department of Transportation (ADOT), with technical assistance from the Community Transportation Association of America, are exploring innovative and cost effective ways to manage transportation to enhance the region's livability and preserve its cultural and

[27] David Raphael and Charles Rutkowski, *Enhancing Public and Visitor Transportation in the Greater Sedona Area: A Strategic Partnership Between the City of Sedona, Arizona and the Coconino National Forest*, Community Transportation Association of America (www.ctaa.org), presented at the Transportation Research Board Annual Meeting, #1024, January 2000.

environmental assets. These efforts will control automobile access to scenic sights and areas within the Coconino National Forest, promoting a balanced choice of transportation options for residents and visitors, including limited highway and parking facilities, establishing a convenient public shuttle system, and pedestrian improvements.

The transportation plan is designed to increase travel choices and enhance visitors' experience. Most in town restaurants and businesses will be accessible by shuttle. Hotels and resorts would serve as staging areas for trips to scenic sights or up the Canyon. A network of gateway centers coupled with a downtown transit hub will serve as collection points for people heading for recreation spots, state parks, trailheads, shopping excursions and other outings. Visitors who arrive by air or shuttle bus would be able to get around without the need of rental cars. Many visitors to Red Rock country pass through Sedona on chartered tours. While these "package" visitors currently depend upon tour operators or jeep companies to get around locally, the availability of a low-cost public shuttle, with proper marketing and promotion, is expected to entice many independent travelers to remain a day or two in the area. The scenic shuttle system will provide the transportation link between many major visitor destinations in the area

The following actions are being planned or implemented to support this plan:

- *Public Shuttle System*: The City will take the lead role in jointly developing a community shuttle system—the centerpiece of the strategy for increasing mobility and access to the region's most important attractions while reducing reliance on the automobile. The shuttle system will be designed to provide frequent, convenient and accessible service within Sedona, between the Village of Oak Creek and the Uptown area, including key attractions within the Red Rock area, and throughout Oak Creek Canyon.
- *Shuttle Stops*: In-town shuttle stops will be designated adjacent to core commercial areas, major motels and resorts, municipal offices, medical offices and parks. Passenger shelters, benches and other "street furniture" would be constructed, adding to the transit system's convenience and attractiveness to both passengers and non-passengers.
- *Street Configuration*: The City will enhance auto, bicycle and pedestrian access to the shuttle system. The street system needs to be interconnected and provide alternate routes between core business areas and surrounding neighborhoods without requiring use of major highways.
- *Bicycle/Pedestrian Connections*: Travel by foot or bicycle will need to be facilitated for shuttle passengers at either end of their trip. A key element of a successful transit system will be a convenient network of sidewalks, jogging paths and bike pathways serving shuttle stops.
- *Transit-Oriented Development*: Transit-oriented development and transit-friendly land use would be promoted through a mix of housing densities and higher intensity development in locations easily served by transit.
- *Parking*: City officials will need to manage parking to reduce congestion and promote transit ridership, including limiting right-of-way parking, create a central parking district, and encourage visitors' to leave their cars at park-and-ride lots and resorts. Forest officials are prepared to limit parking in a number of scenic areas within the national forest. Limits would be placed on roadside parking along two highways that run through Oak Creek Canyon and the Red Rocks scenic area. These limits will serve as an incentive for the shuttle system and will help address safety, water quality and other resource issues. A coordinated plan for

shuttle and controlled parking will be developed to ensure sufficient access to trailheads, residences, businesses, and developed recreation areas, with the intent of providing strong incentives for forest visitors to leave their private vehicles behind and use a shuttle service.

- *Permit System*: The Forest Service is considering implementing a "parking pass" or "passport" for drivers accessing the public lands. Studies indicate that this system could provide significant revenue to support the infrastructure of a shuttle system. At the same time, these methods can be used to encourage visitors to use a shuttle system rather than paying for parking. Subsidized seasonal or annual passes would be available for Sedona area residents.
- *Enhancements*: Shuttle stops will be designated at one mile or less intervals within the Canyon and at vista points elsewhere. Appropriate vehicle turnouts, parking and loading areas, passenger shelters and information kiosks at each stop will also have to be constructed.
- *Pathways*: It is also contemplated that shuttle stops would be connected by pathways, allowing people the convenience of taking the shuttle, bicycling or walking to various destinations along the way within the recreation areas.
- *Gateways*: The partnership between jurisdictions will also allow the development of a network of "gateway" centers and "orientation" sites to serve visitors entering the area. At least four gateways are contemplated. Each would serve as possible "orientation sites", and serve as visitor information centers, day and long-term parking facilities, and transfer points to access the shuttle.

Various funding strategies are being considered for this program. Daily charges could be applied for parking on road right-of-ways. Visitors would be encouraged to leave their cars in motel and Inn parking lots, while free or reduced priced parking also would be available at Gateway Centers and other designed areas. Shuttle passes would be available for sale on a daily, seasonal or annual basis. The following rate schedule has been proposed for shuttle bus service:

- $2.50 Daily Visitor Pass
- $10 Monthly Resident Pass
- $1 Trip Ticket

An alternative is to fund the shuttle system with a national forest entrance fee. Visitors could either purchase a lower-price pass that would allow travel through the area, or visitor "Passport" that would allow entry to the forest, scenic attractions, and recreational facilities, and unlimited use of the shuttle system. Local residents could obtain free or subsidized passes to ride the shuttle.

4. South Beach, Florida

South Beach comprises the southern third of the city of Miami Beach, located on an Atlantic barrier island separated from the mainland by Biscayne Bay. It has a population of about 100,000 in an urban region with a total population of about 4 million residents. In addition to being a bedroom community it is a national tourist destination, with a core business and entertainment district that is on the National Register of Historic Places.

In order to deal with growing traffic congestion and parking problems the community established the SoBe TMA to coordinate transportation management activities. Specific projects include:

- Establish a shuttle bus system with 5-10 minute headways to link fringe parking with the Historic District.
- Implement parking management, such as park-and-ride lots, improved signage, and pricing.
- Develop a marketing and promotion program, including a Miami Beach Mobility Map that will show municipal parking areas, bikeways, water taxis, and transit routes between common destinations in the region.
- Pedestrian and bicycle facility improvements.

References and Information Resources

Christoper M. Anderson, Chhandita Das and Timothy J. Tyrrell (2006), "Parking Preferences Among Tourists In Newport, Rhode Island," *Transportation Research A*, Vol. 40, Issue 4 (www.elsevier.com/locate/tra) May 2006, pp. 334-353.

Susanne Bohler, Sylvie Grischkat, Sonja Haustein and Marcel Hunecke (2006), "Encouraging Environmentally Sustainable Holiday Travel," *Transportation Research A*, Vol. 40, Issue 8 (www.elsevier.com/locate/tra), Oct. 2006, pp. 652-670.

William Byrne and Jonathan Upchurch (2011), "Reducing Congestion at Grand Canyon's South Rim," *ITE Journal* (www.ite.org), Vol. 81, No. 1, January, pp. 50-55.

Cambridge Systematics (2001), *Federal Lands Alternative Transportation Systems Study*, Federal Highway Administration and Federal Transit Administration (www.fhwa.dot.gov).

Cambridge Systematics (2002), *Small Communities Benefits: Innovative Traffic Management Practices in Small Communities*, Federal Highway Administration (www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//13612.html).

Matt Craig (2011), "TransLink and the 2010 Olympic Winter Games," *ITE Journal* (www.ite.org), Vol. 81, No. 1, January, pp. 56-60.

Rosaleen Duffy (2002), *A Trip Too Far: Ecotourism, Politics And Exploitation*, Earthscan Publication (www.earthscan.co.uk).

Anne E. Dunning (2005), *Inputs Of Transit Service Planning For National Parks And Gateway Communities*, Transportation Research Board Annual Meeting (www.trb.org), 2005; at http://smartech.gatech.edu/dspace/bitstream/1853/10859/1/E-20-H83_751430.pdf.

Reid Ewing (1997), *Transportation and Land Use Innovations; When You Can't Build Your Way Out of Congestion*, Planners Press (www.planning.com).

ETC (2002), *Tourism and Transport - The Issues and Solutions*', English Tourism Council (www.culture.gov.uk).

Lesley France (1997), *The Earthscan Reader in Sustainable Tourism*, Earthscan (www.earthscan.co.uk).

Robert N. Giordano (2002), *Exploring Visitor Experiences on Going-To-The-Sun Road in Glacier National Park*, Forestry Department, University of Montana (www.forestry.umt.edu/research/MFCES/programs/itrr/research/giordano_thesis.pdf).

Green Tourism Association (www.greentourism.on.ca) is a nonprofit organization dedicated to promoting environmentally- and socially-responsible tourism.

Brian Grover (2001), *BC Car-Free; Exploring Southwestern British Columbia Without a Car*, Whisky Jack Publishing (www.whisky-jack.com).

James Higham and Anna Carr (2001), *Ecotourism Bibliography*, University of Otago, New Zealand (http://divcom.otago.ac.nz/tourism/research/electronicpubs/EcotourismBibliography.pdf).

IFN (2002), *Clever Travelling*, International Friends of Nature (www.nfi.at). This brochure provides information on sustainable tourist activities, and links to related organizations.

ISHTAR (www.ishtar-fp5-eu.com) is a project is to build an advanced software suite for the analysis of the effects of short term actions and long term policies to improve the quality of the environment, citizens health, conservation of monuments.

ITS (2003), *ITS Deployment Tracking: Tourist Cities; ITS Operations Resource Guide*, USDOT Intelligent Transportation Systems (www.itsdocs.fhwa.dot.gov//JPODOCS/catalog/frame_sec2.htm).

Journal of Ecotourism (www.multilingual-matters.com/multi/journals_eco.asp) edited by David Fennell of Brock University, Vol. 1. 2002 (ISSN 1472-4049).

Journal of Sustainable Tourism (www.multilingual-matters.com/multi/journals_jost.asp) edited by Bill Bramwell of Sheffield Hallam University and Bernard Lane of the University of Bristol, (ISSN 0966-9582).

Martin Lanzendorf (2000), "Social Change & Leisure Mobility," *World Transport Policy & Practice*, Vol. 6, No. 3, (www.ecoplan.org/wtpp), Autumn 2000, pp. 21-25.

Linx (www.yellowstonebusiness.org/transportation/linx) integrates transportation service providers across 27 counties in Idaho, Wyoming and Montana to improve access within the Greater Yellowstone region. It provides trip planning and ticketing; improved marketing of existing and emerging services; coordination of route schedules and transfer points; innovative technology applications that benefit both transportation operators and their riders; and a centralized location for information on all modes of mobility.

Todd Litman (1999), *First Resort; Resort Community Transportation Management*, VTPI (www.vtpi.org); at www.vtpi.org/resort.pdf.

MOST, "Mobility Management for Tourism," *Mobility Management Strategies*, European Union (http://mo.st).

Network for Soft Mobility in European Tourism (www.soft-mobility.com) is a cooperative partnership between tourism, transport and environmental organizations.

Online Resource Guide for Exploring Ecotourism in the Americas (www.planeta.com/ecotravel/etour.html)

Stephen J. Page (1999), *Transport and Tourism*, Longman (www.ablongman.com).

Lisa Petraglia and Glen Weisbrod (2004), *Integrating Tourism and Recreation Travel with Transportation Planning and Project Delivery*, NCHRP Synthesis 329 (http://trb.org/publications/nchrp/nchrp_syn_329.pdf), Transportation Research Board (www.trb.org).

Skyline Bus (www.skylinebus.com), is a public transit system that serves Montana's Big Sky mountain resort area.

T.J. Steiner and A.L. Bristow (2000), "Road Pricing in National Parks: A Case Study in the Yorkshire Dales National Park," *Transport Policy*, Vol. 7, No. 2, April 2000, pp. 93-103.

TRB (2004), "Transportation Innovations in the Parks," special issue of *TR News*, Number 233, Transportation Research Board (www.trb.org), July-August 2004.

Nada D. Trout and Gerald L. Ullman (1997), "A Special Event Park-and-Ride Shuttle Bus Success Story," *ITE Journal*, December 1997, pp. 38-43.

Katherine F. Turnbull (2003), "Transports to Nature: Transportation Strategies Enhancing Visitor Experience of National Parks," *TR News* (www.trb.org), January-February, 2003, pp. 15-21.

UITP (2003), *Leisure And Tourism: An Opportunity For Public Transport*, International Association of Public Transport (UITP) (www.uitp.com).

Megan Wood (2002), *Ecotourism: Principles, Practices and Policies for Sustainability*, UNEP and International Ecotourism Society (www.uneptie.org/pc/tourism/library/ecotourism.htm).

www.vtpi.org/resort.pdf

TDM Marketing

Information and Encouragement Programs

~~~~~~~~~~~~~~

TDM Encyclopedia

Victoria Transport Policy Institute

~~~~~~~~~~~~~~~~~~~~

Updated 21 December 2015

This chapter describes TDM marke ng programs and strategies, which inves gate the types of transporta on services people want, iden fy barriers to alterna ve modes, and promote use of efficient transport op ons.

“Informaěon is as powerful as infrastructure.”

Description

Marke ng involves determining consumer needs and preferences, creaěng appropriate products, providing useful informaěon about products to consumers, and promoěng their use. Public knowledge and aħ tudes have a major effect on travel behavior, so markeěng is an important component of TDM implementaěon.

Markeěng is more than simply adverěsing to promote a product or acěvity. It is an ongoing dialogue between producers and consumers. It involves Change Management, that is an effort to change the way problems are defined and soluěons evaluated. The most effecěve TDM Markeěng programs involve a variety of partners within a community, including public officials, community organizaěons and individuals who support transportaěon alternaěves.

Below are specific TDM markeěng acěviěes:

- Survey users and poteněal users of alternaěve modes to determine preferences, knowledge, barriers and opportuniěes for changing travel behavior and providing TDM services.
- Targeted, personalized markeěng campaigns, which ideněfy consumers who are most able and willing to change their travel paĥerns and providing them with suitable inceněves to try alternaěves.
- Programs oriented at households that are making home locaěon decisions, that promote the personal and social benefits of choosing homes in more accessible, mulě-modal, Locaěon Efficient neighborhoods. Residents of such neighborhoods tend to own fewer motor vehicles, drive less, and rely more on resource-efficient modes, and as a result, save money and ěme, and reduce external impacts.
- Educate public officials, businesses about TDM strategies they can implement.
- Promote benefits and changing public aħ tudes about alternaěve modes. For example, promote alternaěves modes as enjoyable, Healthy and Presěgious.
- Produce a Mulě-Modal Access Guide that provides concise informaěon on how to access a parěcular desěnaěon by alternaěve modes.
- Improve wayfinding (guidance for navigaěng around an area and through a transportaěon system), parěcularly for use of alternaěve modes (Gibson 2009).
- Make alternaěve modes more Affordable, with appropriate Prices and discounts.
- Ideněfy and overcoming barriers to the use of alternaěve modes.
- Encourage Transit ridership by making transit service convenient and aĥracěve.
- Provide travel training, which help people with disabiliěes and special needs learn to use public transportaěon services (Wolf-Branigin and Wolf-Branigin 2008).

- Provide informaěon that encourages people to compete to achieve travel change objecěves, such as contests between individuals, businesses and communiěes (Cialdini 2001).

Given adequate resources, markeěng programs can significantly increase use of alternaěve modes and reduce automobile travel, although there are limits to what markeěng can accomplish by itself. Markeěng cannot change every person or every trip, and can be counterproducěve if alternaěve modes are inadequate. For example, adverěsing that encourages motorists to try transit will fail if transit service is inconvenient and unpleasant to use; travelers who try it will have a bad experience, give up, and tell their friends. Similarly, a commuter who tries cycling for the first ěme, but has no support, will be discouraged if they find it difficult and frightening, or have an accident or mechanical problems.

Effecěve markeěng often requires delivering different messages to different types of people, with special emphasis on people who are most ready to change. For example, poteněal transit markets can be divided into people who wouldn't use it, might use it, someěmes use it, and often use it. It is generally unrealisěc to shift somebody from the "wouldn't" into the "often" category, but a transit markeěng campaign can provide messages and inceněves to shift travelers one category at a ěme, so for example, people who currently would not ride transit are encouraged to consider it; people who are already considering it are given opportuniěes and inceněves to try it occasionally; and people who currently use it occasionally are encouraged to use it more often.

Wouldn't => Might => Sometimes => Often

Travel paĥerns tend to experience regular turnover (also called churning) as people change income, jobs, homes, abiliěes, responsibiliěes and preferences. For example, during a parěcular year a poreon of residents may naturally shift from automobile to public transit commuěng, while others shift from public transit to driving, due to changes in their life condiěons. Markeěng programs should therefore target people when they are ready to change their travel paĥerns.

In most communiěes a poreon of trips are responsive to TDM markeěng. Consumer surveys indicates that a significant poreon of travel is non-esseněal, and that a significant poreon (typically 25-50%) of travelers would consider using travel alternaěves and are interested in obtaining informaěon about them. One survey found that out of 43 respondents, 19 report that they drive more than they need, and 34 report that they drive more than they want (Handy, Weston and Mokhtarian, 2005). Mustel (2004) surveyed Vancouver, BC motorists to determine the types of travel changes they consider most feasible, and the factors that would moěvate travel shifts. Given the right combinaěon of informaěon, services and encouragement, a poreon of automobile trips can be shifted.

Cialdini (2001) ideněfies several factors that can be used to support behavior change:

- Commitment and Consistency - If people commit, orally or in wriěng, to an idea or goal, they are more likely to honor that commitment. Even if the original inceněve or moěvaěon is removed after they have already agreed, they will coněnue to honor the agreement.
- Social Proof - People will do things that they see other people are doing. For example, in one experiment, one or more confederates would look up into the sky; bystanders would then look up into the sky to see what they were seeing.
- Authority - People will tend to obey authority figures, even if they are asked to perform objecěonable acts.
- Liking - People are easily persuaded by other people that they like.
- Reciproca on - People tend to return a favor.

TDM Markeěng programs should generally be ongoing so they provide coněnual support and encouragement, and respond to future opportuniěes and changes in individual's travel needs and preferences. Travel paĥerns tend to reflect churning (coněnual turnover and change, someěmes in response to specific events such as changes in employment or home locaěons); for example, during a given year some people naturally shift from automobile to public transit, while others shift from public transit to automobile due to changes in their circumstances and preference. TDM Programs should take these natural changes into account, providing ongoing encouragement for shifts toward more efficient travel paĥerns.

Direct markeĕng programs, such as TravelSmart, are effecĕve because they focus on the people who are ready to consider changing their travel habits, but need informaĕon and encouragement. People tend to develop established travel habits. As described by Goodwin (1997), "The traveller does not carefully and deliberately calculate anew each morning whether to go to work by car or by bus. Such deliberaĕon is likely to occur only occasionally." TDM markeĕng programs can help overcome this inerĕa in travel habits. Programs that present alternaĕves in a posiĕve way and convince people to try them may result in long-term changes.

Positive Statements

As much as possible, TDM Markeĕng should emphasize the poteněal benefits from more efficient transportaĕon systems. For example, reduced driving and shifts to alternaĕve modes can provide vehicle cost savings, reduced crash risk, and reduced stress to users. More walking and cycling provides health benefits. They also provide community benefits, such as reduced traffic congesĕon, increased safety, road and parking facility costs, and reduced polluĕon.

Transportaĕon Demand Management is not a very good markeĕng term, parĕcularly since the acronym (TDM) sounds like tedium. It reflects a planning and economic analysis perspecĕve, but is not well understood by the general public. So what should we call what we do? The term Mobility Management is used in some regions, parĕcularly in Europe, but for markeĕng purposes it is often best to emphasize the posiĕve objecĕves, such as Travel Op ons, Mobility Choices and Transporta on Efficiency.

People naturally tend to raĕonalize their current aħ tudes and behavior (Gilbert 2006); TDM Markeĕng requires that alternaĕves be presented as aĥracĕve and desirable, at least compared with alternaĕves. TDM Markeĕng should offer motorists many opportuniĕes to try alternaĕve modes, without requiring a major commitment. For example, a program might provide transit route informaĕon and a free transit pass to people who currently commute by automobile. Walking and cycling Encouragement programs often start with a short-term event, such as bike-to-work week. Once people try alternaĕve modes and use them occasionally, markeĕng can encourage them to increase their use incrementally, for example, by Ridesharing twice a week, or using a bicycle for commuĕng and errands for a greater porĕon of the year.

Market research is an important part of effecĕve markeĕng. This means using surveys and other market data to beĥer understand consumer knowledge, needs, preferences, barriers and opportuniĕes to change travel behavior (Cao and Mokhtarian, 2005). For example, Table 1 shows results from a survey of poteněal rideshare users (employees with regular commute schedules who currently drive more than 5 miles to work), indicĕng which inceněves are most likely to cause them to shift to alternaĕve modes. Such surveys need to be preformed for specific demographic groups and geographic locaĕons.

Table 1 Market Survey (proprietary source)

What Would Help Entice You To Rideshare?	Portion of Respondents
Personalized help finding bus ĕmes and routes	2.9%
Bike parking	3.3%
On-site food or kitchen	4.1%
Lockers/showers	5.9%
More info about alternaĕves	5.9%
Personalized help forming ridesharing	6.1%
Priority parking for rideshare	6.2%
On-site services	8.1%
Payment in lieu of parking	15.6%
Other	16.3%
Transportaĕon during breaks/lunch	16.3%
Employer provided car	17.9%
More frequent bus service at site	18.4%
Flexible work schedule to meet alternaĕve schedule	20.2%
Guaranteed Ride Home	33.3%
Financial inceněve	39.1%

Markeěng tends to be most effecěve when it emphasizes posiěve benefits to parěcipants from using alternaěve modes, including stress reducěons and financial savings from reduced driving, and increased enjoyment and Health from acěve travel modes such as walking and cycling. Some studies show that many workers place a high value on having commute alternaěves (Novaco and Collier, 1994).

Social Marketing

Social marke ng refers to community-based programs to encourage more socially desirable behavior. Social markeěng is effecěve at achieving behavior changes that people generally support but find difficult to make, such as acěons that increase personal health or benefits neighbors. It helps people reconcile their acěons with their beliefs, providing integrity and pride, as well as helping to solve specific personal and community problems.

There are many successful examples of social markeěng, including increased use of seatbelts and child restraints, reduced excessive drinking, more balanced diets and reduced tobacco consumpěon. These involved a combinaěon of educaěon, persuasion and policy interveněons that have changed the way people act.

Social markeěng consists of these steps:

1. Ideněfy market to focus on, which may be everybody in an area, or a parěcular segment of the populaěon that is parěcularly significant or likely to change.
2. Ideněfy barriers to the desired behavior.
3. Develop mulě-faceĥed strategy.
4. Develop a pilot project to test the strategy.
5. Based on results of the pilot, implement a full-scale program.
6. Evaluate and improve the program.

Successful social markeěng requires listening carefully to the audience through focus groups and surveys in order to understand their real aħ tudes and concerns. It ideněfies the costs of inacěon and the benefits of change from users' perspecěve, and helps people overcome barriers to desirable change.

A typical social markeěng campaign to support TDM might include the following acěons:

- Ideněfy travelers who are most likely to change. For example, a campaign might focus on commuters in a parěcular demographic and income category who work in a parěcular area.
- Inveseěgate consumer travel aħ tudes and preferences, poteněal benefits from alternaěve travel opěons (financial savings, reduced stress, sociability and fun, healthy exercise, community benefits such as reduced air polluěon), and barriers to change.
- Based on market surveys, develop programs that improve Transportaěon Opěons (such as beĥer transit services, Rideshare services, improved walking condiěons), provide inceněves to users (such as Commuter Financial Inceněves), and overcome barriers as perceived by users (such as sěgma associated with the use of alternaěve modes).
- Ideněfy key aħ tudes, such as interest in fitness or pride in helping others that can be highlighted. For example, if personal health and fitness is a key consumer aħ tude, a campaign might emphasize the health problems that result if people coněnue their sedentary travel habits, and the user benefits from more physically-acěve travel modes.
- Develop mulě-faceted promoěonal materials, which may include press materials, media adverěsing, brochures, flyers, posters, and other strategies to convey messages. This can include informaěon on:
    - What is available (walk, cycle, rideshare, transit, etc.).
    - Why alternaěves are desirable (benefits to users and communiěes)
    - How to use alternaěves (how to cycle, rideshare or ride transit).
    - Encouragement to try alternaěves ("Try using transit tomorrow.").
    - How to obtain support and addiěonal informaěon (websites, telephone numbers, etc.).
    - Reinforcement and validaěon to users ("When you ride transit, you help make our community a beĥer place to live.").
- Start with a small pilot, improve it based on experience and feedback from users, and then expand the program.

- Coněnually update the program based on parěcipant feedback, and to keep it fresh, ěmely and interesěng. Try new messages and promoěonal materials.

Resources:
Novar s Founda on Social Marke ng (www.foundaěon.novarěs.com/social_markeěng.htm)
Social Marke ng.Com (www.social-markeěng.com)
Social Marke ng Ins tute (www.social-markeěng.org)
Social Marke ng Network (www.hc-sc.gc.ca/hppb/socialmarkeěng)

How it is Implemented

TDM markeěng is usually implemented by government agencies or non-profit organizaěons as part of a comprehensive TDM Program or Commute Trip Reducěon program. The Way-to-Go, Seaĥle! program's Replicability Package (2003) provides detailed informaěon on how to create and evaluate a program that encourages residents to reduce their automobile travel and use alternaěve modes.

Travel Impacts

Markeěng can improve the effecěveness of most individual TDM programs and strategies. A survey of commuters found that exposure to commute trip reducěon program informaěon was the single most important factor contribuěng to mode shifting (Weber, Nice, Lovrich, 2000). Hendricks and Joshi (2004) ideněfied specific factors that affect CTR program effecěveness. They found that the degree of management support and the presence of an Employee Transportaěon Coordinator is important if a worksite is located outside a major business district, but are less criěcal in a CBC. Given adequate resources, markeěng programs can often increase use of alternaěve modes by 10-25% and reduce automobile use by 5-15% (see examples described later in this chapter). One study esěmates that markeěng increases the effecěveness of other TDM strategies by up to 3% (Shadoff, 1996). Modarres (1993) found that the provision of informaěon on alternaěve travel modes by employers was one of the most important factors contribuěng to mode shifting.

Based on a detailed review of research, Spears, Boarnet and Handy (2011) conclude that well-managed voluntary travel behavior change programs typically reduce parěcipant's vehicle travel by 5% to 8%. Their effecěveness a city- or region-wide level is dependent on parěcipaěon levels and spillover effects. Spillover may occur when non-parěcipants learn of programs through media coverage or contact with parěcipants.

The most effecěve markeěng programs promote a variety of travel opěons rather than just one mode (such as ridesharing or public transit), since this allows consumers to choose the opěon that best suits their needs. For example, about half of the trips reduced by the TravelSmart programs shifted to walking, with smaller shifts to cycling, ridesharing and public transit (www.travelsmart.vic.gov.au). Individual mode shifts appear small, typically consisěng of just few percentage points, but their total impacts are significant. The TravelSmart program found that markeěng programs can reduce automobile travel by 6-14%, which is comparable in magnitude to much more expensive infrastructure improvement programs to encourage use of alternaěve modes. Fujii and Taniguchi (2006) found even larger travel reducěons from "travel feedback programs" in Japan, with 50% increases in transit travel and 18% reducěons in automobile travel among affected populaěons. Taylor (2007) discusses ways to evaluate travel behavior change programs, including used of instruments to track travel acěvity and model impacts.

Table 2 Travel Impact Summary

Objec ve	Ra ng	Comments
Reduces total traffic.	2	Tends to increase TDM effecěveness.
Reduces peak period traffic.	2	"
Shifts peak to off-peak periods.	2	"
Shifts automobile travel to alternaěve modes.	2	"
Improves access, reduces the need for travel.	2	"
Increased ridesharing.	2	"
Increased public transit.	2	"
Increased cycling.	2	"
Increased walking.	2	"
Increased Telework.	2	"

Reduced freight traffic.	2	"

Raěng from 3 (very beneficial) to –3 (very harmful). A 0 indicates no impact or mixed impacts.

Benefits And Costs

Markeěng provides a foundaěon for specific TDM policies, programs and strategies. Benefits include increased understanding and appreciaěon of TDM, increased public support for TDM strategies, and increased effecěveness of TDM efforts. Costs are primarily associated with program expenses. Actual benefits, costs and effecěveness vary depending on circumstances, program design and its effecěveness. A study by Ker (2003) found that markeěng programs typically provide financial paybacks of 1.0 years or less (plus addiěonal benefits to society), indicaěng an excellent return on investment.

Table 3 Benefit Summary

Objec ve	Ra ng	Comments
Congesěon Reducěon	2	Tends to increase TDM effecěveness.
Road & Parking Savings	2	"
Consumer Savings	2	"
Transport Choice	2	"
Road Safety	2	"
Environmental Protecěon	2	"
Efficient Land Use	2	"
Community Livability	2	"

Raěng from 3 (very beneficial) to –3 (very harmful). A 0 indicates no impact or mixed impacts.

Equity Impacts

TDM markeěng can help increase equity by increasing public knowledge and acceptance of transportaěon alternaěves, and creaěng more effecěve TDM programs. This tends to benefit lower-income and transportaěon disadvantaged people by improving their mobility opěons, increasing access for non-drivers, and reducing the sěgma often associated with alternaěve modes. Actual equity impacts vary depending on circumstances and program design.

Table 4 Equity Summary

Criteria	Ra ng	Comments
Treats everybody equally.	1	Generally benefits all groups.
Individuals bear the costs they impose.	-1	Requires subsidy.
Progressive with respect to income.	2	Can improve travel choice and reduce sěgma associated with alternaěve modes.
Benefits transportaěon disadvantaged.	2	Can improve travel choice and reduce sěgma associated with alternaěve modes.
Improves basic mobility.	0	No significant impact.

Raěng from 3 (very beneficial) to –3 (very harmful). A 0 indicates no impact or mixed impacts.

Applications

Can be implemented as part of any TDM program.

Table 5 Application Summary

Geographic	Ra ng	Organiza on	Ra ng
Large urban region.	3	Federal government.	2
High-density, urban.	3	State/provincial government.	2
Medium-density, urban/suburban.	3	Regional government.	3
Town.	3	Municipal/local government.	3
Low-density, rural.	2	Business Associaěons/TMA.	3
Commercial center.	3	Individual business.	3
Resideněal neighborhood.	2	Developer.	2
Resort/recreaěon area.	3	Neighborhood associaěon.	2
		Campus.	3

Raěngs range from 0 (not appropriate) to 3 (very appropriate).

Category
TDM Program Support

Relationships With Other TDM Strategies
Effecĕve markeĕng can increase the acceptability and effecĕveness of most TDM strategies. It is often a component of TDM Programs, Commute Trip Reducĕon, Transportaĕon Management Associaĕons, Tourist Transport Management, Campus Transport Management and Mulĕ-Modal Access Guides. It is important to incorporate Evaluaĕon into markeĕng efforts.

Wit and Humor
A farmer siĥ ng on his front porch paĕently watches a city slicker driving his sports car down the dirt road, throwing up a tail of dust. A liĥle laĥer he watches the same car zoom pass the other direcĕon, and later sĕll the car passes by again, then screeches to a stop, engulfing car, yard and porch in a dust cloud. The driver, clearly exasperated at being lost, rolls down his window and yells to the farmer, "How do I get to Midville?"

The farmer thinks it over, and after the dust begins to seĥle finally replies, "I'm afraid ya can't get there from here."

Stakeholders
Virtually all stakeholders can have a role in markeĕng, including federal, state, provincial, regional and local agencies, Transportaĕon Management Associaĕons and business associaĕons, individual businesses, and non-governmental organizaĕons.

Barriers To Implementation
Markeĕng programs depend primarily on support and funding from agencies or businesses.

Best Practices
References and organizaĕons listed below provide specific informaĕon on how to develop successful TDM markeĕng programs. IOLT, 2001 provides recommendaĕons for providing transportaĕon informaĕon through the Internet. Below are some general suggesĕons.

- Markeĕng programs should be developed in cooperaĕon with all major stakeholders, including government agencies, business organizaĕons, non-profit organizaĕons, and parĕcipant groups.
- Markeĕng should provide a clear and consistent message.
- Markeĕng should emphasize posiĕve benefits to parĕcipants, including increased enjoyment and health.
- Give people many chances to try alternaĕve modes. For example, a markeĕng program may offer a free transit pass and appropriate route informaĕon to commuters who currently drive, so they have an opportunity to try transit.
- Markeĕng should offer useful informaĕon and resources (i.e., contacts for transit, rideshare, and carshare services, cycling safety ĕps, etc.).
- Focus on achievable, incremental changes. For example, rather than expecĕng commuters to shift completely from driving to alternaĕve modes, encourage them to use alternaĕve modes one or two days a week, and then to increase this over ĕme.
- Markeĕng should only be implemented after TDM programs and services are operaĕng effecĕvely (it is counterproducĕve to promote TDM programs that give consumers an unsaĕsfactory experience, such as ineffecĕve rideshare matching services).
- Poteneal users should be surveyed regularly to ideneĕfy their needs and preferences, to evaluate the acceptance and effecĕveness of markeĕng efforts, and to ideneĕfy ways to improve markeĕng.

- All markeĕng materials should be reviewed by markeĕng specialists.
- Program Evaluaĕon should be incorporated into markeĕng efforts.

Marke ng Public Transit - Peter Everehĥ, Professor, Penn State University
Marketers of public transit have made heroic efforts to stem ridership loss. Surprisingly, among all the markeĕng variables tried, the one least used is the market posiĕon of "status". Yet clear posiĕoning is one of the prime ways a product or service can disĕnguish itself from the compeĕĕon and moĕvate purchases.

Transit Suffers Poor Market Posi on. In the western world, much consumpĕon is driven by status. Consumers commonly choose travel modes not only for funcĕon, but also for status. Yet since the 1960s, public transit has lost its posiĕon as a status mode of travel. Most of the failed ahĥempts to recoup ridership on transit result from the confused and rejected market posiĕon into which public transit evolved over the past thirty years: transit in the U.S. today is a mode primarily for the transportaĕon disadvantaged.

Reposi oning Strategy. Efforts to reposiĕon transit on the status coněnuum should be devoted to first ahĥracĕng riders from social classes that others would like to emulate. This will require targeĕng the upscale suburban commuter, and providing premium and premium plus services.

With so many market segments in modern western cultures, reposiĕoning efforts may ulĕmately entail mulĕple services, to give each segment status on parameters they feel appropriate, But two major points sĕll stand:
* it is often not possible to mix services for different market segments (e.g., the transportaĕon disadvantaged and the upscale commuter)
* status must be gleaned by consumers of a travel mode

Consumer Research Required. While the above points remain only premises and hypotheses, they adhere to respected psychological and markeĕng theory and pracĕce. The first component of a real effort to reposiĕon public transit would be consumer research. The second phase would be to radically redesign services on a route or segment of a selected city according to suggesĕons elicited from the consumer research.

There Are Many Barriers To These Reposi oning Effort. They include: being labeled "eliĕst"; the economic and ĕme commitments required to reposiĕon transit; and the sheer dominance of the private automobile and plethora of low cost services provided for it.

Examples and Case Studies

DfT (2007) provides a comprehensive review of Personal Travel Planning case studies.

TravelWise Website (www.rmoc.on.ca/travelwise)

The Ohĥawa-Carleton Region established the TravelWise website to provide a one-stop, on-line source for complete informaĕon about walking, cycling, carpooling, public transit and more. TravelWise is home base for the Region's transportaĕon demand management (TDM) program. The site will have an online Cycling Map on-line, informaĕon to help drivers reduce their costs and environmental impacts, a "TravelWise at Work" secĕon will focus on workplace commuĕng, and "TravelWise at School" will be a local resource for Internaĕonal Walk to School Day. The TravelWise web site was produced by the Mobility Management Branch of the Region's Environment and Transportaĕon Department.

TravelSmart, Perth (www.dpi.wa.gov.au/travelsmart)

TravelSmart is a community-based program that encourages people to use alternaĕves to travelling in their private car. It provides informaĕon, moĕvaĕon and skills to help people choose alternaĕves to driving for personal travel. This is done through a programme called Individualised Markeĕng that reaches households through schools, businesses, local government and major desĕnaĕons that run their own TravelSmart programs. TravelSmart also forms partnerships with environmental, health, cycling organizaĕons and other organizaĕons that have an interest in supporĕng travel alternaĕves.

The Perth Metropolitan Transport Strategy targets a 35% reducĕon in single-occupant-vehicle trips over the next 30 years. TravelSmart is a significant part of that strategy. TravelSmart research indicates that travellers have alternaĕves to driving for about 45% of all personal trips. Increasing the porĕon of these trips made by environmentally-friendly modes (walking, cycling, transit and tele-access) from 10% to 25% would achieve the Transport Strategy targets.

The Individualised Markeĕng program started with a pilot project in South Perth in 1997. The pilot project achieved a 10% reducĕon in car travel, a 16% increase in walking, a 21% increase in public transit use, and a 91% increase in cycling. These changes in travel behaviour were found to coněnue when measured one and two years later. Large-scale applicaĕon of the program to the whole City of South Perth populaĕon (15,300 households) achieved a 14% reducĕon in car travel, 35% increase in walking, a 17% increase in transit use, and a 61% increase in cycling. Analysis of transit (bus) boardings for routes through the area showed a 21% increase in patronage.

This project was funded from capital funds under the concept of a "non-built" soluĕon, based on Least Cost planning principles. It achieves an equal or beĥer transportaĕon benefits as an investment in physical infrastructure improvements. The Western Australian Department of Transport plans to expand the program to the eněre city of Perth. If the objecĕves are realized, a 7% reducĕon in car travel across the whole region will be achieved at the cost of 2% of new main road construcĕon for the same period. The project is esĕmated to have a benefit/cost raĕo exceeding 13.

INSIDE TRACK; How to think people out of their vehicles
When 8,000 Perth households were helped to analyze their journeys, car use fell by 14 per cent with a shi to public transport and cycling.
Julieĥe Jowit, Financial Times, Sep 11, 2001; (www.travelsmart.transport.wa.gov.au)

It sounds like a transport dream. A cheap and effecĕve scheme that could cut traffic by 10 per cent or more within months. But in Australia it is reality. And the idea is now on trial in 15 European countries.

The concept, called "individualised markeĕng", is simple. Households are contacted and offered advice about the journeys they make. If they are interested, they can get informaĕon and personalised ĕmetables by post or a telephone hotline, or a home visit from a consultant who analyses the trips they make and suggests alternaĕves to the car.

Socialdata (www.socialdata.de), a German-based consultancy, claims to have developed the idea and spent 10 years looking for a guinea-pig before the government of Western Australia agreed to try it in Perth. An iniĕal trial in 1997 of more than 800 households in South Perth showed a 10% drop in car journeys and vehicle miles, with a significant shift to public transport and cycling. Surveys a year later, and again 18 months after that, showed those gains were sustained.

Last year, Western Australia's Department for Planning and Infrastructure extended the project to 8,000 households in South Perth, with even beĥer results. Car journeys and mileage fell 14 per cent and walking, cycling and use of public transport rose again. Use of local shops and services increased, air polluĕon fell and bus companies collected enough extra fares to recoup the cost within three years.

The south Perth trial cost AUS$1.3m - including new bus stops in the suburbs, printed material and surveys - and took three months. That compares with the UK government's 10-year transport plan, published last summer, which promised that in return for Pounds 180bn of private and public money, traffic would rise by 17% (admiĥedly, that is 5% less than what has been forecast without the plan.) Werner Brog, Social-data's founder and managing director, explained the theory behind the individualised markeĕng project.

Socialdata found that only 20% of journeys in Perth were by "green modes" - public transport, walking and cycling. However, in poteněally 60% of journeys, people either did not need their cars or had an adequate alternaĕve. Then Socialdata asked why people did not leave their cars behind more often and found a big gap between percepĕon and the reality of public transport, walking and cycling. Typically, people thought their journey would take twice as long as it did and would cost a third more than the real fare. Half of motorists with a viable alternaĕve did not know about the individualised markeĕng service.

"There's an alternaěve there," says Mr. Brog, poiněng outside to buses, cycle lanes and Tube staěons, "but not there," he says, jabbing at his head. "Transport planners want to fix that (poiněng out of the window again) but we'd say it's much easier to fix the head."

It sounds almost too good to be true, which raises the quesěon of why more towns, ciěes and regions are not pursuing the idea. As it stands, Western Australia plans to extend the scheme to all 600,000 residents of Perth, while elsewhere in the country, Brisbane is running a trial. Transport operators in Europe are talking to Socialdata about city-wide iniěaěves, says Mr. Brog. Socialdata is also exploring how individualised markeěng can be used for energy, water, waste disposal and other applicaěons.

However, before the transport scheme can spread, deep-rooted cultural and pracěcal barriers will need to be overcome in many countries. Perhaps the biggest perceived threat, especially among poliěcians being asked to fund such projects, is a backlash from motorists who may see the scheme as "aně-car".

But in Australia, the Department for Planning and Infrastructure collected seven files of posiěve feedback and not one leĥer of complaint, insists Bruce James, the department's execuěve director metropolitan. The reason is that the approach is "not Stalinist" says Mr. Brog. People are not stopped from making journeys; they are never told to stop using their cars; and the project stresses how even ěny changes - say, one journey a week - can make a big difference.

"As soon as people hear what I do at a party they start saying 'Do you know how far I have to travel to work? Do you know I have to make interchange four ěmes?' and so on," says Mr. Brog. "I say, if that's the case, use your car. But let's look at where else you can use public transport."

More subtly, another barrier is the long-standing assumpěon by transport engineers and planners that puħ ng on more services and building new infrastructure is the soluěon to all problems. And the "boys with toys" approach has always chimed with the poliěcal aĥracěon of opening new railways and roads. Individualised markeěng can be complementary to invesěng in infrastructure, says Mr. Brog. But he hopes that, as more successful trials roll in, the balance will shift. Individualised markeěng is more cost-effecěve, he believes. "We can beĥer them hands down every ěme," he insists.

Doubters should know that Perth - designed for cars and a massive 100km by 80km in size - was a highly tesěng trial area, says Mr. Brog. "The saying is if it works in Perth it works everywhere in the world," he says.

Brisbane Individualised Marketing Trial Gets Ten Percent Mode Shift

A Brisbane trial of the individualised markeěng approach to promoěon of walking, cycling and public transport has achieved a 10 percent reducěon in private vehicle use with an approximate benefit to cost raěo of 20:1. The pilot used the IndiMark technique which has also been successfully applied in Perth both as a pilot and on a larger scale. There are five key phases in the IndiMark process: contact and segmentaěon, moěvaěon, informaěon, convincing and system experience and evaluaěon.

The Brisbane pilot was applied in the Grange District a group of suburbs in the north of the city with a populaěon of around 26,000 (10,000 households). The suburbs are relaěvely well serviced by public transport with four rail stops on one line and 17 bus services spread over three main routes.

Following compleěon of a Before Travel Survey (including a survey of a control group), 412 households were contacted and asked if they would like to find out more informaěon on how they could meet some of their travel needs via sustainable modes. Of those contacted 29 percent were uninterested, 47 percent were interested, 16 percent already used sustainable modes but were interested in receiving more informaěon and 8 percent were exisěng users and were uninterested in further informaěon.

The moěvaěon phase involved detailed discussions with those who requested further informaěon to ideněfy problems they had and their travel needs. A service sheet allowed householders to select the exact informaěon they wanted to receive.

In the informaěon phase only the material specifically ordered was provided and all material was hand delivered. No general informaěon, markeěng or media campaigns on sustainable modes or their benefits were carried out in the pilot area at the same ěme as the trial was running.

The convincing phase involved home visits to discuss in detail the possible mode changes with those who had indicated the need for this level of support. In addiĕon, a small number of households who were interested in swapping to a sustainable mode and did not already use public transport were given a one month system experience ĕcket for bus or rail.

The final phase, evaluaĕon, involved another travel survey, again including the control group. The results indicated there had been a 10 percent reducĕon in vehicle trips, which roughly equates to one return trip per week per person by either public transport, walking or cycling.

The approximate benefit to cost raĕo of 20:1 covered the benefits of reduced road congesĕon and car operaĕng costs and, to a lesser extent, environmental externaliĕes and public transport revenue. A number of other benefits would be parĕcularly noĕceable if IndiMark was implemented on a larger scale. A 10 percent reducĕon in congesĕon would reduce travel ĕmes by greater than 10 percent during peak ĕmes. There would be a reduced need for capital and maintenance expenditure on new and widened road corridors, as well as reduced private expenditure on fuel. Socially, a 10 percent reducĕon in crash rates and improvements in health and fitness due to exercise could be expected. Finally, environmentally, the reduced travel demand and consequent reducĕon in fuel use and exhaust pollutants would lead to improvements in local and regional air quality and reducĕons in greenhouse gas emissions and noise.

Sustainable Travel Towns (Sloman, et al., 2010)

Darlington, Peterborough and Worcester are typical medium-sized English towns. Following a compeĕĕon, they were designated Sustainable Travel Towns, and so were able to invest £15 million in measures to reduce car use from 2004 to 2009. Baseline surveys in 2004 showed strong public support for more sustainable transport policies. Each town developed its own programme, including personal travel plans, walking and cycling promoĕon, public transport markeĕng, plus workplace and school travel plans.

Detailed travel surveys were performed in 2004 and 2008 and compared with data from comparable size towns from the Naĕonal Travel Survey (NTS) and traffic counts from the Naĕonal Road Traffic Esĕmates (NRTE). The analyses gave the following results:

- Car use: Car driver trips declined 9% per person, and car driver distance by 5%~7% for the three towns. This compares with a decline of about 1% in other medium-sized urban areas over the same period.
- Bus use: Bus trips per person grew substanĕally, by 10%~22%, compared with a naĕonal fall of 0.5% in medium-sized towns. The bus growth primarily occurred in Peterborough and Worcester, with a less posiĕve trend in Darlington (in part due to the nature of compeĕĕon between two operators in that town).
- Cycling: The number of cycle trips per person grew substanĕally in all three towns, by 26%~30%. Darlington (which was also a Cycling Demonstraĕon Town) showed the greatest growth. Meanwhile, cycle trips declined in medium-sized towns elsewhere.
- Walking: The number of walking trips per person grew substanĕally, by 10%~13%, compared to a naĕonal decline in similar towns.
- While the reducĕon in the number of car trips per head was proporĕonately greatest for short trips, the biggest reducĕon in car distance travelled (hence traffic) was from medium-length and longer trips.
- There were indicaĕons of complex behaviour change, involving transfers between modes, changes of desĕnaĕons and changes in trip numbers, not all of which can be fully analysed with the available data.
- The biggest reducĕon in car driver distance came from changes to leisure trips, then shopping and work-related business. This paĥern was consistent with the relaĕvely low emphasis on work-trips in the interveněons chosen.
- The biggest falls in car driver mode share appear to have been among groups either at a point of change in their lives (at college, looking for work, or recently reĕred) or on a reduced income. There was a smaller per head reducĕon in car trips by those in full-ĕme work, though this sĕll consĕtuted 40% of the total reducĕon.

Assessment of Success

Overall, the Smarter Choice Programmes in the towns contributed posiĕvely to objecĕves of supporĕng economic growth, reducing carbon emissions, increasing health, promoĕng equality of opportunity, and improving quality of life.

The programme costs averaged £11 annually per person per year or about 4 pence per car kilometre removed. Considering just congesĕon reducĕon benefits, this indicates a 4.5 benefit/cost raĕo. Including environmental, consumer-benefit and health effects using Department for Transport values would approximately double this benefit value. This provides sufficient evidence to jusĕfy substanĕal expansion of Smarter Choice Programmes.

Green Marketing (www.green-engage.co.uk/PaintingtheTownGreen.pdf)
Markeĕng expert Stephen Hounsham offers the following recommendaĕons for beĥer markeĕng environmental acĕons to the general public.

- Present environment as important not just for environment's sake but also for people's sake. We should market the environment not just as a home for nice animals and plants but as the life support system that we all rely on, directly or indirectly, for food, water, air and shelter. Like a life support system in a hospital, the whole system is complex but fragile and vulnerable. It could break down if we don't keep the machinery in good running order. In other words, if we don't start looking after the environment, it might stop providing what we need. American President JF Kennedy's famous words "Ask not what America can do for you but what you can do for America", now need to be turned around to give: "Ask not what you are doing for the environment but what the environment is already doing for you." It's an approach that's esseněally selfish but human beings are esseněally selfish.

- Move away from exhorta on and a pedestal 'I know best' a tude to create real dialogue. We should aim to take people on a shared journey on equal terms where both sides can learn.

- Move from a modus operandi of informa on provision and ra onal argument to methods aimed at touching emo ons, s mula ng resonance, inspiring and crea ng desire. In other words, we should move from a head-focused approach to one that's heart-focused. We need to recognize the poteněal of peripheral processing and hidden messages and focus on strong, visual images.

- Aim to dispel the green image of nega vity and doom and instead focus on posi vity, op mism and human ingenuity. We have to stop using shock or guilt tacĕcs and avoid the temptaĕon to exaggerate or go beyond science. The presumpĕon must be that we will get through all this, that there is light at the end of the tunnel and that it is daylight, rather than the train hurtling towards us... Our moĥo should be to reassure and offer a way through.

- Agree a vision of the future within the movement and make sure it isn't hopelessly unobtainable. This has to be presented as an exciĕng new way of looking at things and marketed as something beĥer. We should turn from defence to aĥack by moving away from 'defending' the environment through the reducĕon of damage and exploitaĕon to 'aĥacking' on its behalf through promoĕng a posiĕve vision of a beĥer way of doing things. In this way we can be associated with soluĕons rather than problems. Our message must be: "Something beĥer is on the way..."

- Look for tangible, personal, close-to-home benefits from environmental ac ons for individuals. Every environmental acĕon should carry a personal inceněve or reward and we should press for non-sustainable behaviours to carry price penalĕes or other disinceněves. Create agency, the ability for people to understand a problem in their own way, decide for themselves to do something about it, make a real difference that's noĕceable to them, and receive recogniĕon for having done the right thing.

- Create a sense of every li le bit counts and deal convincingly with the "I can't do everything, so I'll do nothing" reac on by presen ng a 'green on balance' framework for personal living. Similarly we shouldn't chasĕse people for slipping into binges of 'bad ways' now and again.

- Aim to develop brands – packages of environmentally friendly behaviours – that people will iden fy with, find a rac ve, see as a must-have, and above all like, just as they iden fy with a favourite brand in a supermarket.

- Focus campaigns and calls for behaviour change on what works for the people to be targeted. This means recognising that different types of people have different values and moĕvaĕons. We should therefore present environmentally friendly behaviours in ways that resonate with different personality groups. A campaign using the words 'green living' runs the risk of failing with some types of people. Following the principles of one model explaining human behaviour and moĕvaĕons, we could present green behaviours as part of an Ethical Living tag to inner-directed, seeker-type personaliĕes; as Smart Living to outer-directed, esteem-driven personaliĕes; and as Safe Living to security-driven, home valuesbased personaliĕes. We would need to

take people as they are and on their own terms. In parĕcular this might need a ban on all green language when communicaĕng the need for Smart Living to esteem-driven people and use of only that green language that can be brought down to a local level when persuading security-driven people to adopt Safe Living.

- Stop pretending environment is the only issue that should ma er to people. There are countless others too, many of them appearing to be more urgent and immediate to people. We need to work towards legiĕmising and broadening the appeal of green behaviours by wrapping up environment with the other four main families of visionary causes: prosperous, comfortable lives; peaceful, safe communiĕes; social jusĕce; and physical, mental and spiritual well being. Calls for Ethical Living, Smart Living and Safe Living could, in this way, ring mulĕple bells in people's minds rather than just one and end up being inarguable.

- Work towards providing 'green living on a plate', as easy as booking a holiday: the equivalent of just making a phone call, handing over a credit card number and turning up on the day. Every local authority should work towards providing a green demonstraĕon house, in which green consumer choices are demonstrated in a pracĕcal, construcĕve and non-confrontaĕonal way with friendly staff on hand to offer commentary. A naĕonal one-stop telephone advisory service should be set up offering clear, easy-to-obtain pracĕcal advice on the best things to do for the environment and how to do them. Government should facilitate and encourage the establishment of 'green make-over' businesses and other private providers of, and crucially maintenance services for, green technology. There should be massive public investment in infrastructure and faciliĕes for green living.

- Similarly introduce 'green starter kit' advice by star ng people off with easy ac ons with obvious paybacks or pleasant effects that fit into exis ng rou nes, before building up to the more difficult ones. For example, this could begin with wildlife gardens, acĕon on liĥer and planĕng or tending trees in the neighbourhood.

- Aim to create 'bandwagon environmentalism' with a sense of joining in, or missing out if you don't. This is esseněal if niche is to become mainstream and if we are to overcome the bystander effect where people don't act because they don't see others acĕng.

- Court influen al role models by building bridges with people who strike a chord with the public and working with them to demonstrate green values. Similarly we should put forward 'green leaders' that people can look up to, ideněfy with and more than anything like.

- Make more effort to get environment into popular culture and probe opportuni es for so messaging. In parĕcular, build bridges with television execuĕves responsible for drama, soaps, gameshows, comedy, reality TV and so on.

- Widen the green movement further to embrace sociologists, anthropologists and psychologists who understand why people act and don't act. We should draw in too adverĕsing creaĕves able to 'sell' green as brands that work for people. The green movement relies too much on campaigners and not enough on people with these skills and knowledge areas.

- Build bridges with faiths, focusing on shared principles and values, and 'sign up' religious leaders as public campaigners. It is sobering for environmentalists used to communicaĕng with limited audiences in limited ways with limited budgets to think that 1.7 million people parĕcipate in a Church of England service each month, that 1 million children are educated in Church of England schools and that the number of Church of England ministers is as high as 27,000. What could Friends of the Earth do with 27,000 dedicated campaigners?

- Spend more me achieving change by working within and with established and realis c poli cal processes, rather than outside and against. This could mean more inside-track lobbying of decision makers rather than outside-track campaigns to harass them. Taken one step further, some might argue that relying on a separate poliĕcal party to promote primarily green values may not be as effecĕve as poliĕcians with a strong green conscience moving into the mainstream parĕes and changing them from within.

Fremantle Travel Smart Program (www.dpi.wa.gov.au/travelsmart)

As a result of parĕcipaĕng in the Western Australia Travel Smart program, Fremantle residents have reduced the number of car trips by 12% and the number of kilometres by 14%. They also increased the number of walking trips by 25%, cycling trips by 38%, and public transit trips by 13%.

TravelSmart, Portland (www.portlandonline.com/transportation/index.cfm?c=36370)

The City of Portland and TriMet have partnered to test a social markeěng program to encourage the use of environmentally friendly travel modes. The TravelSmart program ideněfies individuals who want to change the way they travel, moěvates them to think about their travel opěons and provides them with informaěon about how to use transit, bike, walk or carpool for some of their trips. This approach has proven effecěve in many ciěes in Europe, Australia, and now in North America. The program was parěcularly successful with off-peak, discreěonary trips. TravelSmart Portland was launched September 2002.

The before travel survey provided detailed informaěon about travel behavior in the pilot area. There was a 65% response rate to a mail-back travel diary sent to 1,200 randomly selected households. The survey found that 64% of the trips in the target area are by people driving alone in their cars, 10% are walking, 5% are public transit, and 1% are bike trips. The remaining 19% are trips by passengers in cars. Many people are surprised that work trips make up such a small percentage of overall trips. Work trips and work related trips make up only 25% of all trips on the test pilot area. The large majority of people's trips are for shopping or for leisure acěviěes-56%. This is a large number of trips that allow some flexibility in choosing to walk, bike or use transit.

Most interesěng is trip distance. Of all trips from Multnomah Hillsdale, 12% are less than a half mile and 22% are less than one mile. Almost half of all trips (46%) are less than 3 miles. Car trips account for 39% of all trips under 3 miles and 15% under one mile. Most people are willing to walk a half-mile and many are willing to walk a mile. There is clearly a poteněal for shifting some of these car trips to walking or cycling.

The first 600 households responding to the baseline travel survey were included in the next phase, Individualized Markeěng. These households were segmented based upon their responses. About 41% of SW Portlanders were interested in finding out more about transportaěon opěons. They received the informaěon they needed, either by mail, telephone, or personal at-home visits. People already using environmentally friendly modes (26%) were given a small reward. The remaining 33% who didn't want to parěcipate weren't contacted again. The segmentaěon closely matches that of households in the Perth project.

Table 6 Survey Results

	Households Total	Percentages
"Interested"	246	41%
"Already Using Alternaěves"	156	26%
"Not Interested"	198	33%
HH Total	600	100%

This program resulted in 9% less car travel and an 8% increase in walking, cycling, and public transit. These figures represent a 12% reducěon in vehicle miles traveled. Residents' changes in travel behavior have been shown to be sustained one year after the iniěal markeěng efforts. Furthermore the data indicated that these results were achieved without affecěng people's overall mobility in terms of their acěviěes outside the home, travel ěme and number of trips per day.

When compared to other pilot projects using individualized markeěng techniques in Europe and Australia, Portland has the highest percentage of trips by car. Despite the high rate of car travel in the Portland pilot, the reducěon in car travel achieved is very similar to the other projects. The results support the use of TravelSmart, or individualized markeěng, as an effecěve strategy to increase environmentally friendly modes of travel and reduce car travel.

Car Smart Communities (www.cityofseattle.net/carsmart)

Car Smart Communiěes encourages neighborhood projects that help residents use cars less often for errands and other personal and family trips. The program provides a variety of resources and inceněves to encourage less automobile-dependent communiěes and lifestyles.

Seattle Way-To-Go Household Car Reduction Program (www.cityofseattle.net/waytogo)

Way to Go, Sea le is a new iniěaěve to show people they can save money and make their communiěes more livable by making more conscious transportaěon choices, just as they do now with recycling and water conservaěon.

During summer 2001, 23 Seaĥle families completed a Way to Go pilot program to see if people could get along without their extra car for six weeks. The results are impressive. At least four families liked it so much that they're selling the car. Some families didn't need to parěcipate in the program to be convinced. By determining the cost of owning their car on the City's website, they sold their extra car without evening parěcipaěng in the program!

"We can all take small steps to improve our transportaĕon system," said Mayor Paul Schell. "These families have proven that we can make choices about how to get around and enjoy spending less ĕme in our cars."

All the families in the study saved money, and most saved about $64 per week. The all found they could get around on transit, walking, bicycling and taking taxis when needed for about $21 a week, far less than the $85 per week cost of an average second car. Most families tell us they will coněnue to take the bus or ride their bike, and think about whether they need to drive to where they want to go.

"We hope more people will see they don't need that extra car," said Jamae Hoffman, project manager. "Families making smart decisions about transportaĕon can cut down on vehicle trips, congesĕon, gasoline use and, of course, air polluĕon."

The best experience for Richard Kielbowitz and Linda Lawson of the Hawthorne Hills neighborhood was "watching the price of gas rise for other people". "When we heard reports of traffic jams, we counted our blessings that we were not caught up in them," they said. After parĕcipaĕng in the program, Kielbowitz and Lawson sold their second car.

"Before I would have driven north for movies and shopping. Now, I head downtown on the bus," said Lori Goodwin of the Queen Anne neighborhood. "It was a fun experience. Same movies, same shopping, but it was wonderful not to have to deal with a huge parking lot."

Seaĥle's Strategic Planning Office paid the parĕcipaĕng families $85 per week for keeping a daily dairy of their transportaĕon acĕviĕes and expenses during the six weeks they did not use their extra cars. Families were able to use the $85, the naĕonal average cost of owning and operaĕng a second car, for bus fares, joining a Carsharing service, or taxi when needed. Most families spent only about $21 geĥ ng around without a car, saving an average of $49 per week. As a result the 23 families made nearly 200 fewer car weekly trips totaling 1,260 miles of travel avoided.

The One-Less-Car Study was conducted in three rounds during 2000, 2001, and 2002, and engaged a total of 86 Seaĥle households in living with 'one-less-car' for either six or nine weeks while keeping detailed trip diaries showing their changing travel choices. During just these few short weeks of having 'one-less-car' to use, parĕcipant households made 8,003 fewer car trips which resulted in 41,463 fewer miles of neighborhood traffic and 30,198 pounds less of carbon dioxide emiĥed in our atmosphere. The families demonstrated that every type of household (such as those with and without children, etc.) in a variety of Seaĥle's neighborhoods can get where they need to go with 'one-less-car' while saving money and reducing stress.

The One-Less-Car Demonstraĕon Study online Replicability Package (www.seaĥle.gov/waytogo/replicabilitypackage.htm) has all that is needed to conduct a study and start realizing the benefits of smarter transportaĕon choices. The package contains the reports and products that will allow you to understand the raĕonale, methods, and outcomes of the "One-Less-Car" Project, including data analysis reports, all the worksheets and forms, and the Final Report with a step-by-step narraĕve of how Seaĥle did it. Over twenty ciĕes and organizaĕons have requested informaĕon on the study and how to start their own version.

The One-Less-Car Demonstraĕon Study is part of the Way to Go, Seaĥle! family of programs aimed at helping Seaĥle to make the most of its transportaĕon system and provide more transportaĕon choices. It was designed to show people that they could save money and make their communiĕes more livable by making more conscious transportaĕon choices. Way to Go, Seaĥle! strives to find creaĕve and innovaĕve ways to reduce demand on the transportaĕon network, a pracĕce commonly referred to as Transportaĕon Demand Management.

Commuter Choice Marketing Program (www.commuterchoice.com)

Commuter Choice is a U.S. program that encourage employers to offer Commute Trip Reducĕon programs and Inceněves. It emphasizes the benefits of such programs to employers, employees and communiĕes, and provides a variety of resources and support services. Like any other product, Commuter Choice relies on markeĕng iniĕaĕves to successfully reach its audience, including employers, commuters and others. The Coopera ve Commuter Choice Marke ng Ini a ve has developed a variety of materials and model adverĕsements to promote transportaĕon alternaĕves.

- Community-wide markeĕng & educaĕon campaigns.
- Employer materials promoĕng commuĕng choices and benefits.
- Educaĕonal materials relaĕng to the costs and benefits of commuĕng choices.
- Promoĕonal events or programs to try commuĕng choices.
- Tesĕmonials from saĕsfied customers.

Go For Green (www.goforgreen.ca/home_e.html)

Go for Green is a naĕonal non-profit, charitable organizaĕon encouraging Canadians to pursue healthy, outdoor physical acĕviĕes while being good environmental ciĕzens. It encourages acĕve transportaĕon (walking and cycling). It sponsors the Commuter Challenge (see below) and school transport management programs. Go For Green provides informaĕon and materials, including newsleĥers, report, case studies and merchandize (logo shirts and hats).

Commuter Challenge (www.commuterchallenge.ca)

The Commuter Challenge is a week-long, friendly compeĕĕon between Canadian ciĕes to see which can cut its air polluĕon the most by using acĕve and/or sustainable modes of transport. Parĕcipants commitment to walk, jog, cycle or in-line skate (acĕve transportaĕon) and/or bus, carpool or telework during Environment Week (June 2-8, 2002). With this informaĕon, the Commuter Challenge team determines the amount of air polluĕon each parĕcipant reduced using an Environment Canada polluĕon model that calculates the number of kilograms of polluĕon produced by automobile commuĕng. The program emphasizes the following benefits of sustainable transportaĕon.

- For Exercise! When you commute using acĕve transportaĕon, such as walking or cycling, you incorporate regular exercise into your daily life.
- For Your Health! Walking, in-line skaĕng, jogging, and cycling exposes you to less polluĕon than the average car driver. Since drivers sit in traffic and are closer to car exhaust fumes, they are exposed to 10x more air polluĕon than the average pedestrian or cyclist.
- For Your Wallet! The Canadian Automobile Associaĕon reports that the average yearly cost to operate a car is over $6,000! A bus pass for a year, however, costs about $700, and a brand new bicycle may cost as liĥle as $200.
- For the Environment! The average car produces about 4 tonnes of air polluĕon each year. It takes about 130 trees to produce the amount of oxygen needed to combat the polluĕon that one car produces. Carbon dioxide is the single biggest pollutant that comes from automobiles, and carbon dioxide makes up the majority of greenhouse gases. Using fewer cars conserves our natural habitat and decreases the demand for new roads and parking lots.
- For Your Community! Using acĕve and sustainable transportaĕon makes your community safer, especially for children, youth, and seniors, by reducing the risk of vehicle-pedestrian accidents. People who use acĕve and sustainable transportaĕon also tend to support local businesses by shopping locally.
- To Reduce the Effects of Climate Change! Greenhouse gases, like carbon dioxide, get trapped in the planet's atmosphere, causing the Earth's temperature to rise. When you reduce greenhouse gas emissions by using acĕve and sustainable transportaĕon, you reduce the effects of climate change.

Green Travel Incentives (www.travelsmart.vic.gov.au)

The City of Darebin, Australia achieved a 17 percentage point increase in the number of staff sharing the drive to work over a three year period due to an inceněve program. A 2004 survey found that 67% drove alone, compared to 84% in 2001. Staff have the opportunity to win a $100 gift voucher to selected local businesses by logging their green travel trips to/from work on the Council's intranet site. To receive the voucher, staff must ensure that at least 20% of their travel to or from work is classified as green travel. Since its introducĕon in late August 2003, the number of staff registered for the inceněves has grown steadily. As of March 2004 the 130 registered staff had logged 6,278 trips which equated to 61,838 kilometres of green travel.

In addiĕon, there have already been twenty six $100 gift vouchers awarded to staff who have reached their points tally. Of those staff registered, 40% previously came to work in a single occupant vehicle all of the ĕme. This proporĕon of parĕcipants have since completed 900 green travel trips and travelled 9,981 kilometres. Aĥached to the software that administers the inceněve program is a car pool component where registered parĕcipants can search for travel partners in their nearby area. Staff not registered on the system can sĕll view the carpool map to see who lives around their area and perhaps approach them informally.

Individualized Marketing in U.S.Cities (www.fta.dot.gov/initiatives_tech_assistance/technology/15791_ENG_HTML.htm)

The US Federal Transit Administraĕon commissioned individualized markeĕng pilot projects in four US ciĕes (Bellingham, Washington State; Sacramento city, California; Durham, North Carolina and Cleveland, Ohio) to test the effecĕveness of individualised markeĕng in increasing public transport use. These ciĕes were chosen because each exhibited different socio-demographic and cultural profiles, urban densiĕes, populaĕon sizes, and public transport patronage trends. Public transport use within targeted communiĕes increased between 14% to 43%. The number of walking and cycling trips also rose across each of the four target communiĕes. When averaged across the four pilots, parĕcipants drove 4.5% less leading to an average 6.75% reducĕon in vehicle miles travelled. All results are based on comparison with a control populaĕon.

Table 7 Travel Changes From Marketing Program in U.S. Cities (FTA, 2006)

	Bellingham	Sacramento	Durham	Cleveland
Car (as driver)	-8%	-2%	-7%	-4%

Car (as passenger)	10%	1%	7%	5%
Walking	35%	15%	15%	13%
Cycling	13%	30%	25%	22%
Public Transit	14%	43%	35%	26%
Vehicle miles reduced	4%	4%	11%	8%

Washington State's Oil-Smart Campaign (www.wsdot.wa.gov/smartmoves)

The Smart Moves campaign is an annual event during the Month of April to promote alternaĕve transportaĕon in the Puget Sound region. It was iniĕated as Oil Smart in 1990, by a group of concerned ciĕzens in the greater Seaĥle area.
Smart Moves has grown over the years to include a variety of community organizaĕons and public agencies across Washington state. These groups join forces each year to create a new campaign theme, materials, and acĕviĕes, all targeted to reduce single occupant vehicle travel by promoĕng the use of commute alternaĕves, like walking, bicycling, sharing a ride with other, riding the bus or working from home.

Marketing Effective Speed (Tranter and May, 2005)

Researchers Tranter and May (2005) examine the poteněal use of the effecĕve speed concept to sĕmulate travel behaviour change. Effec ve speed reflects the total ĕme devoted to a parĕcular form of transport, including ĕme actually devoted to travel and ĕme devoted to earning money to pay for it. Effecĕve speed analysis recognizes that faster but more costly modes, such as driving, are someĕmes less ĕme efficient overall. Effecĕve speed could have useful applicaĕons in mobility management markeĕng to help people to reconsider the perceived advantages of automobile travel over slower but lower cost modes.

Table 8 indicates the esĕmated effecĕve speed of various vehicles. This analysis indicates that public transit and cycling often have higher effecĕve speeds than driving, parĕcularly for more costly automobiles. Of course, actual costs will vary depending on individual factors, including actual income, costs, travel speeds and annual mileage.

Table 8 Effective Speed (Tranter and May 2005)

	Luxury Car	Sport Utility Vehicle	Average Car	Economy Car	Public Transit	Bicycle
Annualized costs (Aus$)	$14,161	$17,367	$9,753	$5,857	$966	$500
Hours worked to pay costs*	644	790	444	266	44	23
Average travel speed (km/hr)	45	45	45	45	2	20
Hours of travel ĕme	333	333	333	333	600	750
Support acĕvity ĕme (walking to vehicle, maintenance, etc.)	51	51	50	51	60	55
Total ĕme	1,028	1,174	827	650	704	828
Effec ve speed (km/hr)	14.6	12.8	18.1	23.1	21.3	18.1

This table compares the es mated effec ve speed of various vehicles. Lower-speed modes, such as public transit and cycling, o en have higher effec ve speeds than driving.
* Assumes $40,100 annual income.

A coordinated and integrated communicaĕons campaign could opĕmise the promoĕon of the effecĕve speed idea. This would involve in part, an extended media program over a period of several years in order to achieve changes in people's percepĕons. Such a campaign would be part of a package encompassing social markeĕng and the expansion of travel behaviour change programs, leadership from poliĕcians, and the presence of appropriate price signals.

Personal Travel Planning (ITP 2007)

Personal Travel Planning (PTP) is an approach to delivering targeted informaĕon directly to travellers, to help them make sustainable travel choices. It seeks to overcome habitual use of the car, enabling more journeys to be made on foot, bike, bus, train or in shared cars. It can also seek to discourage unnecessary travel, through the provision of local or site-specific informaĕon. Within the UK, PTP is reported to reduce car driver trips by 11% (amongst the targeted populaĕon) and reduce the distance travelled by car by 12%. In terms of mode share, this represents a decrease in car driver trips of 4 percentage points, with walking the main beneficiary, having, on average, a reported increase of 3 percentage points. Follow-on benefits from these impacts can be expected in terms of wider

community benefits, including the improved health of parĕcipants, a greater propensity to use local services, and improved local air quality

Vanpool Marketing Plan (York and David Fabricatore, 2003)

The Puget Sound region has some of the most successful vanpool programs in North America. Vanpooling represents about 2% of total commute trips and 7% of commute trips over 20 miles in length. Several factors contribute to this success: a Commute Trip Reducĕon law requires large employers in the region to help employees use alternaĕve modes, vanpooling services are provided by transit agencies which insures quality and integrated services; and HOV Priority provides travel ĕme savings for vanpools on some routes. Market research by York and Fabricatore (2001) indicates that this ridership could double or triple if supported by a variety of improvements and inceněves:

- Increased flexibility, for example,
  - allow commuters to vanpool two or three days a week, rather than every day
  - allow unscheduled use as long as a van has extra space, such as a commuter who misses their regular 5:30 van may ride in a later van.
- Empty seat subsidies (temporarily paying a share of costs if a vanpool has less than six riders).
- Fare subsidies by employers or transit agencies (currently, transit commuĕng is often subsidized, but similar trips by vanpools are not).
- Targeted, direct Markeĕng, for example, calling households in a parĕcular suburb with an offer of one month's free vanpooling to encourage area commuters to try the service.
- HOV Priority measures, such as HOV lanes and preferred parking spaces.
- Premium service opĕons, such as extra high-quality vans with bucket seats, workstaĕons (fold-down tables with electric power so vanpoolers can work while commuĕng), and complementary newspapers and drinks for vanpoolers who pay an extra fee.
- Pay-As-You-Drive Vehicle Insurance, Parking Cash Out and Road Pricing, which give financial rewards to commuters who shift to ridesharing.
- Vanpools scheduled to transfer to transit service or other vanpools.
- Rent cars for carpools the same as vans are rented for vanpool use. This provides an opĕon for groups of two to five who want to rideshare if none have a suitable vehicle, including vanpools that lose members.

Young People Less Interested in Driving

There is evidence that young urban people place less importance on personal vehicle ownership and use than in the past, and so may be more amenable to mobility management markeĕng programs. Computers and mobile telephones may be displacing automobiles as objects of status, entertainment and social interacĕon.

According to the Wall Street Journal (29 February 2008), 2007 survey of 1,700 young Japanese by the Nihon Keizai Shimbun, Japan's biggest business newspaper found that only 25% of Japanese men in their 20s wanted a car, down from 48% in 2000 (hĥp://s.wsj.net/arĕcle/SB120422248421700325.html). The Japanese automobile manufacturers' associaĕon found that men 29 years old and younger made up 11% of Japanese drivers in 2005, roughly half the size of that group in 1993.

According to an arĕcle in the Sacramento Bee (4 March 2008), the porĕon of California 16-year-olds who obtained a drivers license declined form 22% in 1996 to 14% in 2006, and for 17-year-olds the rate declined from 40% to 33% during this period, and by age 18, almost half sĕll had no license in 2006 (www.sacbee.com/101/story/757826.html). Similar trends are occurring naĕonwide.

Cycling Survey (Gaterslbgen and Appleton, 2007)

A survey of Briĕsh adults different stages in people's willingness to cycle for transportaĕon, including precontemplaĕon (they wound not consider it), contemplaĕon (they would consider it, but do not current do it), prepared for acĕon (they occasionally do it), acĕon (they frequently do it) and maintenance (the always do it). This study suggests that different markeĕng strategies are suitable for different audiences: some people should be encouraged to consider cycling, while others should be encouraged to actually do it, or do

it more frequently. The study indicates that is it important to portray cycling as a normal acĕvity for all types of people (not just fit young men). It also recommends the expansion of school cycling programs to encourage children to develop the habit of cycling for transportaĕon.

TravelSMART Communities Program (Ampt 2003)

A program in Melbourne, Australia, TravelSMART Communiĕes, illustrates how the community development model and other principles of behavior change were implemented to offer individuals mulĕple tools to change their travel behavior.
The program involves the following acĕviĕes:

- Project team gets to know the area – meeĕng people, understanding local demographics, personalized interacĕons with householders.
- Engaging households through direct contact, always a conversaĕon to establish level of frustraĕon with the car.
- Travel Blending – computer analyzed 7-day travel diary highlighĕng efficient travel and giving customized suggesĕons to achieve personal goals (save money, ĕme, environment).
- Journey Plans – personalized plans for individuals who wanted to try a new mode but didn't know how (bike and walking paths, bus schedules and far informaĕon, etc.).
- Local Acĕvity Guide – info on area acĕviĕes.
- General informaĕon packet – leaflet for each of the main reasons people want to change.
- Loan a Bike – borrow a bike fore 2 weeks to determine if they wanted to buy a bike.
- Children's acĕvity pages – makes travel behavior a topic of conversaĕon.
- Ideas tool – talking through new scenarios and geĥ ng commitment to try something new.
- Congratulaĕons – some people thought they already traveled efficiently so all the general informaĕon leaflets were sent to them to pass out to friends and neighbors.

Travel Market Segmentation (PRR 2004)

A Portland, Oregon study examined real and perceived barriers and benefits to changing travel behavior for all types of trips. The focus groups reported that ĕme and ability to trip-chain influence travel mode choice; people will use transit of it is safe, fast reliable and cheap; alternaĕve modes are seen as less comfortable and less safe, but some think it's worth it. The survey results indicated an emphasis on three general types of moĕvators: cost, convenience, and social. The survey ideneĕfied 26 poteneĕal moĕvators. Responses were categorized by market segment, e.g. financial inceneĕves appear to be most effecĕvely targeted to younger, less-affluent people including students. Survey respondents ranked moĕvators that iniĕally caused them to use alternaĕve modes. Fifty percent or more of respondents listed the following moĕvators:

- Employer or school provided financial inceneĕve for using alternaĕve travel modes.
- Ability to work at home one day per week.
- Guaranteed ride home from work in emergencies.
- Transit passes sold at a reduced rate, such as $50 per year.
- More express buses.
- Shelters at bus stops.
- Ability to use transit passes for discounts at local shops.

Specifically, moĕvators to use alternaĕve travel modes or use them more often included:

- Parking price and convenience.
- Higher gas prices
- Traffic congesĕon.
- Reduced stress from not driving alone.
- Enjoyment of traveling with others.

Reducing Car Use by Morning Commuters (Pinnacle Research, 2004)

A research programme invesĕgated factors that can influence commuĕng paĥerns to work or schools, including chauffeuring children to school. Our work on the laĥer led to a separate research programme trialing Walking School Bus networks in four schools. The trial resulted in over 10% of the schools' populaĕon becoming involved in walking school buses and generated significant interest in the concept of networks in New Zealand. There are now walking school bus networks in at least ten ciĕes throughout New Zealand and the Energy Efficiency and Conservaĕon Authority has released a "Walking School Bus Kit" based on the guidelines developed by Pinnacle Research.

This programme also designed and administered a sophisĕcated stated preference quesĕonnaire to car drivers in Auckland and Wellington and Christchurch. We analysed the resultant database using standard staĕsĕcal methods along with mulĕnomial logit analysis. Recognising that each of these regions (Auckland, Wellington and Christchurch) is different, we have analysed each region separately, as well as developing a naĕonal model. We have esĕmated the marginal effect of these policy tools, both "carrots" and "sĕcks", on an individual's decision to travel by car:

- Implemeněng a $5 or $10 toll ($2.50 and $5 in Christchurch).
- Implemeněng a 10¢ or 30¢ per kilometre vehicle registraĕon surcharge.
- a $5 or $10 surcharge on public car parking buildings ($2.50 and $5 in Christchurch)
- Implemeněng short term (P<120) on-street parking within .5 or 1.5 kilometres of the work place.
- Increasing on-street parking charges to $2.50 or $5 per hour ($1.25 and $2.50 per hour in Christchurch).
- Improved frequency of passenger transport services, either in the "peak" periods or "off-peak".
- Improved / shortened trip ĕmes for passenger transport and high-occupancy vehicles.
- Reduced passenger transport fares by 25% or 50%.
- Improved rouĕng of passenger transport services.
- Improved cycle lane availability along 50% or 100% of the route to work / place of study.

From the above informaĕon and the contextual data we collected, we have developed "profiles" of different mode users, ideněfying the characterisĕcs of those car drivers most likely to switch to using passenger transport, being car passengers, car pooling or other modes (e.g. walking or cycling). We have also ideněfied perceptual barriers to using passenger transport in parĕcular and "concrete" barriers to mode switching generally. We also collected data on peoples' aħ tudes and ability to work a "compressed" work week and to "telecommute" (work from home) one or more days per week. We found 23% of respondents were recepĕve to these concepts. Our survey also gathered informaĕon about car drivers' aħ tudes towards their cars, passenger transport, ride sharing (car pooling), and cycling.

Building Community Support For Public Transit

The report, Understanding How to Mo vate Communi es to Support and Ride Public Transporta on (TRB, 2008) ideněfies ways to enhance the public image and increase community support for public transportaĕon. It examines the percepĕons, mispercepĕons, and use of public transit, and the extent to which these affect support. It ideněfies methods used by other industries (comparable to public transportaĕon) to enhance their public image and to moĕvate support for their products and services. It recommends appropriate communicaĕon strategies, campaigns, and plaĔorms for moĕvaĕng individuals to acĕon in support of public transportaĕon, as well as ways to execute those communicaĕon strategies, campaigns, and plaĔorms.

Whatcom Smart Trips (www.whatcomsmarttrips.org)

Whatcom Smart Trips is a partnership between local government, public agencies, employers, and schools to promote walking, bicycling, ridesharing and public transport that subsĕtutes for automobile travel. The organizaĕon provides informaĕon and support services, such as a Guaranteed Ride Home. Parĕcipants record their "smart trips" at the organizaĕon website, which qualifies them for discount cards and prizes.

Smart Home Location Choice Project (Fenton and Jensen 2006)

The Home Loca on Choice Project used Google adverĕzing to direct people searching for homes in Townsville, Australia to a special website (www.movetotownsville.com) which offered inceněves to parĕcipate in the research program. Parĕcipants received $25 for parĕcipaĕng in the iniĕal survey and another $25 if they completed a second survey.

Parĕcipants were randomly assigned to either a control group (68 parĕcipants), which were simply surveyed before and after they moved to Townsville, and an interveněon group (65 parĕcipants) which were given detailed informaĕon about the financial, environmental and health costs of living in different Townsville neighborhoods. This travel cost informaĕon was also integrated into several email messages sent to the parĕcipants which emphasised the savings and benefits that result from a more accessible home locaĕon. These messages provided guidance to addiĕonal maps and other travel cost informaĕon, plus opportuniĕes for parĕcipants to directly phone or email the project administrator for addiĕonal informaĕon about living in Townsville.

Three weeks after their intended arrival date all parĕcipants completed a telephone interview which collected informaĕon on their current home locaĕon; household composiĕon and travel behaviours including travel desĕnaĕons, trips per week and mode of transport. Interviewers were unaware of which individuals had been assigned to the control and interveněon condiĕons.

Results indicate that households in the experimental group choose more accessible, mulĕ-modal locaĕons and as a result drive about 15% less or about 900 fewer annual motor vehicle kilometers. Households that intend to stay longer (more than 3 years) in their new home tended to reduce their mileage more than households that expected to stay a shorter period. The researchers conclude that informaĕon programs of this type can be a cost effecĕve way to sĕmulate demand for more accessible, mulĕ-modal locaĕons.

Environment Canada's Clean Air Day

Clean Air Day (CAD) was proclaimed by the Government of Canada to increase public awareness and acĕon on two key environmental prioriĕes, clean air and climate change. It is part of Canadian Environment Week which was created to promote and to celebrate acĕviĕes that care and nurture our environmental legacy.

Clean Air Day builds on a tradiĕon of community acĕviĕes that target environment, health and transportaĕon issues during the months of May and June. In fact, the Day was declared by the Government of Canada in response to a request made by several of these community organizaĕons. Clean Air Day, as part of Environment Week, is very much a grassroots event relying on strong partnerships with all sectors of society. Clean Air Day and Environment Week are about all of us, as individuals and as members of our communiĕes, making choices that help create a cleaner, safer world for ourselves, our families and the next generaĕon.

Vancouver TravelSmart Program (www.tc.gc.ca/Programs/Environment/utsp/travelsmart.htm)

TravelSmart is an innovaĕve personal transportaĕon markeĕng program that encourages people to change their personal travel behaviour and increase their use of more sustainable travel modes (i.e. public transit, ridesharing, bicycling and walking) through a combinaĕon of personalized informaĕon, inceněves and rewards.

It was piloted in six neighbourhoods located in the inner, middle and outer rings of the Vancouver, Briĕsh Columbia metropolitan region, each with varying degrees of access to transit and other travel opĕons. A "before" survey was conducted to ideněfy individuals interested in parĕcipaĕng in the program and to establish baseline travel behaviour condiĕons. After the program was completed an "after" survey assessed TravelSmart-related behaviour changes. Control groups were used in both surveys to isolate the impact of any external factors.

The 13 month pilot project ended in November 2006 with more than 600 people parĕcipaĕng through all of the stages in each of the six pilot communiĕes. Program results indicate that use of more sustainable modes of transportaĕon increased substanĕally with TravelSmart parĕcipants. Walking and public transit use increased by 9% and 12%, respecĕvely, while car trips declined by 8%.

Smart Trips Welcome (www.portlandoregon.gov/transportation/43801)

With an average of 15% of the U.S. populaĕon moving each year, new residents represent a significant porĕon of urban dwellers. In response, Portland's Smart Trips program individualized markeĕng efforts designed to help new residents develop environmentally-friendly and acĕve transportaĕon habits. As a result, the city's new residents took 10% fewer drive-alone trips and the proporĕon of their trips taken by green and acĕve methods increased by 14%. This comprehensive approach includes a strong evaluaĕon design and targeted social markeĕng strategies.

Wayfinding Plan (IMAP 2007)

The Inner Melbourne Acĕon Plan includes development of a consistent wayfinding signage system to help transportaĕon system users see that the Inner Melbourne Region is accessible throughout by walking, cycling and public transport. Current wayfinding signage is fragmented and variable, and many inter-precinct walking routes are not signed for pedestrians. This project will a family of user-friendly wayfinding sings that show people the integrated "web" of sustainable transport links throughout the Region. This project:

- Ideněfies a hierarchy of signs that provide both regional and local wayfinding informaĕon in a consistent format across the Region.
- Ideněfies the regional and local pedestrian and public transport route system.
- Ideněfies regional and local signage locaĕons.
- Develops a detailed signage plan, based on the research undertaken for 1-3 above, for a "demonstraĕon project" within the Region, showing where each type of sign should be located within the demonstraĕon project area.

Marketing Public Transit Oriented Housing To Students (Taniguchi, et al. 2014)

A study tested the effects of targeted communicaĕon University of Tsukuba, Japan, students who were in the process of changing their resideněal locaĕon. These students were randomly assigned to four groups: the first group was a control group; the second group received an informaĕon brochure about apartment flats typically used by students in Tsukuba city; the third group received a brochure ideněcal to the one given to the second group, except that it also included informaĕon about the level of bus service for each flat; and

the fourth group was provided with a leaflet that provided moĕvaĕon for choosing Public Transit Oriented Residence (PTOR). After five months there was a significant difference between the groups: PTOR selecĕon was twice as high for the third and fourth groups, which were given informaĕon and encouragement to choose transit-oriented housing, as for the control group. Addiĕonally, the target groups' frequency of bus use from home or the university was significantly high compared with the control group.

Survey Indicates Declining Delight In Driving (Pew 2006)

A 2006 survey found a decline in the porĕon of motorists who like to drive or consider their vehicles special, and increased frustraĕon with traffic problems. Although 69% of American drivers say they like to drive, this is down from 79% in a 1991 Gallup survey, and just 23% say they consider their car "something special -- more than just a way to get around," barely half of the 43% who felt this way in 1991. These results suggest that many motorists would consider changing mode for a porĕon of their travel, parĕcularly if alternaĕve modes can provide convenient and comfortable service under congested condiĕons.

In Motion (www.kingcounty.gov/transportation/kcdot/MetroTransit/InMotion.aspx)

In Moĕon is a sponsored by King County (Seaĥle, Washington) Metro Transit and local communiĕes to encourage residents to use healthier travel opĕons like the bus, carpooling, bicycling and walking. It provides informaĕon and community-based resources to help residents use efficient travel opĕons, including the In Moĕon Tool Kit: Helping More People Drive Less. The program and its impact have been well documented.

Clean Air Commute, Pollution Probe (www.pollutionprobe.org).

The Clean Air Campaign is a public educaĕon and awareness component of Polluĕon Probe's comprehensive Air Programme. Each June since 1993 Polluĕon Probe has held the campaign to bring the clean air message to hundreds of workplaces across the Greater Toronto Area (GTA). The campaign is Polluĕon Probe's most visible forum to inform the public and policy-makers about the human health risks associated with smog and to promote pracĕcal air quality soluĕons. The focus of the month-long campaign is to bring individuals to acĕon against smog by promoĕng alternaĕves to driving alone. The main event of the Clean Air Campaign is the week-long Clean Air Commute.

Every year, Polluĕon Probe invites hundreds of workplaces in the Greater Toronto Area to parĕcipate in our annual Clean Air Commute. A record number of 145 workplaces and 8,000 employees helped to remove over 286 tonnes of pollutants from our atmosphere during days in June 2002. How? They simply left their cars at home for one week (unless they were carpooling) and took cleaner modes of transportaĕon to and from work. Polluĕon Probe provides a variety of materials, including brochures and posters, to support the campaign.

Clean Air Commute is a week of friendly compeĕĕon where parĕcipants learn about vehicle emissions, smog and related health issues in the spirit of a fun compeĕĕon. Personal "diary cards" are distributed to individuals to fill out during the week indicaĕng how they got to work. By filling out the distance in kilometres from their home to workplace on the diary cards, employees are able to calculate the actual weight of the major smog pollutants that they kept out of the air by not driving alone to work each day. The greenhouse gas CO2 is also figured into the calculaĕons. Following the event, these diary cards are used to calculate the workplaces percentage of parĕcipaĕon and as entry forms for prize draws to reward the parĕcipants.

Wit and Humor

Two shoe salespeople were dispatched by their company to a remote village. In a few days the head office receives telegrams from each.
One reads "Let me return home – no one here wears shoes!"
The other reads "Send more inventory – no one here owns shoes!"

References And Resources For More Information

Elizabeth Ampt (2003), Understanding Voluntary Travel Behaviour Change, presented at the 26th Australasian Transport Research Forum, TravelSmart Program (www.travelsmart.vic.gov.au); at www.transport.vic.gov.au/research/travel-behaviour-change/travelsmart/travelsmart-resources.

Ethan Arpi (2009), Transit Agencies Need to Invest in Marke ng: A Lesson from Los Angeles, The City Fix (hĥp://thecityfix.com); at hĥp://thecityfix.com/blog/transit-agencies-need-to-invest-in-markeĕng-a-lesson-from-los-angeles.

Associa on for Commuter Transporta on (www.actweb.org) is a non-profit organizaěon supporěng TDM programs.

Louise Baker (2013), A Travel Demand Management Digital Safari, IPENZ Transportaěon Group Conference, Dunedin, New Zealand; at hĥp://conf.hardingconsultants.co.nz/workspace/uploads/baker-louise-ipenztg2013-a-519196af3bf18.pdf.

Best Workplaces for Commuters (www.bwc.gov) is a program sponsored by the U.S. Environmental Protecěon Agency and the U.S. Department of Transportaěon to recognizes employers and worksites that provide outstanding commuter benefits. The website has a variety of markeěng resources, including Marke ng Commuter Benefits to Employees (www.bwc.gov/pdf/05_markeěng_5.pdf).

Werner Brög and Ian Ker (2009), "Myths, (Mis)Percepěons and Reality in Measuring Voluntary Travel Behaviour Changes," in Bonnel P, Lee-Gosselin M, Zmud J and Madre J-L (Eds), Transport Survey Methods: Keeping Up With a Changing World, Emerald Group Publishing Limited (Bingley, England), pp81-111, ISBN: 978-1-84855-844-1.

Sally Cairns, et al (2004), Smarter Choices - Changing the Way We Travel, UK Department for Transport (www.dft.gov.uk). This comprehensive study provides detailed evaluaěon of the poteněal travel impacts and costs of various mobility management strategies, including case studies of markeěng programs.

Alasdair Cain, Jennifer Flynn, and Mike McCourt (2009), Quan fying the Importance of Image and Percep on to Bus Rapid Transit, Naěonal Center for Transit Research (www.nctr.usf.edu) for the Federal Transit Administraěon: at www.nbrě.org/docs/pdf/NBRTI%20-%20BRT%20Image%20Study%20-%20March%202009_Final%20Draft_highres.pdf.

Xinyu Cao and Patricia L. Mokhtarian (2005), "How Do Individuals Adapt Their Personal Travel? Objecěve and Subjecěve Influences on the Consideraěon of Travel-related Strategies for San Francisco Bay Area Commuters," Transport Policy, Vol. 12, No. 4 (www.elsevier.com/locate/transpol), July 2005, pp. 291-302.

Center for Urban Transporta on Research (www.cutr.usf.edu) provides TDM materials and classes and publishes TMA Clearinghouse Quarterly.

Robert Cialdini (2001), "The Science of Persuasion," Scien fic American, Vol. 284, February, pp. 76-81; also see www.influenceatwork.com.

Community Based Social Marke ng Website (www.cbsm.com), provides informaěon on social markeěng techniques and resources.

Commuter Choice Program (www.epa.gov/oms/traq), provides informaěon, materials and inceněves for developing employee commute trip reducěon programs.

Jim Conley and Arlene Tigar McLaren, eds. (2009), Car Troubles: Cri cal Studies of Automobility and Auto-Mobility, Ashgate (www.ashgate.com); Introducěon at www.ashgate.com/pdf/SamplePages/Car_Troubles_Intro.pdf.

EMBARQ (2011), From Here to There: A Crea ve Guide to Making Public Transport the Way to Go, EMBARQ: The World Resources Insěture's Center for Sustainable Transport (www.wri.org/project/embarq); at www.embarq.org/sites/default/files/EMB2011_From%20Here%20to%20There_web.pdf

Peter Evere and Lucie Ozanne (1993), "Markeěng Theory and Urban Transportaěon Policy," Transporta on Research Record 1402, TRB (www.trb.org), pp. 51-56.

Carolyn Fallon, Charles Sullivan and David A. Hensher (2004), "Constraints Affecěng Mode Choices By Morning Car Commuters," Transport Policy, Vol. 11, No. 1 (www.elsevier.com/locate/tranpol), January, pp. 17-29.

Mark Fenton and Peter Jensen (2006), Influencing Home Loca on Choices for Sustainable Transport Outcomes – A Prac cal Approach, Australasian Transport Research Forum (www.patrec.org/atrf.aspx).

Fostering Sustainable Behavior (www.cbsm.com) provides informaěon on social markeěng methods, including numerous arěcles, case studies and resources.

Graham Frainea, et al. (2007), "At Home On The Road? Can Drivers' Relaěonships With Their Cars Be Associated With Territoriality?" Journal of Environmental Psychology Vol. 27, pp. 204–214.

FTA (2006), Individualized Marke ng Campaign Demonstra on, Federal Transit Administraěon (www.fta.dot.gov/iniěaěves_tech_assistance/technology/15791_ENG_HTML.htm).

Satoshi Fujii and Ayako Taniguchi (2006), "Determinants Of The Effecĕveness Of Travel Feedback Programs—A Review Of Communicaĕve Mobility Management Measures For Changing Travel Behaviour In Japan," Transport Policy (www.elsevier.com/locate/tranpol), Volume 13, Issue 5, pp. 339-348.

Birgiĥa Gaterslbgen and Katherine M. Appleton (2007), "Contemplaĕng Cycling To Work: Aħ tudes and Percepĕons in Different Stages of Change," Transporta on Research, Vol. 41, Issue 4 (www.elsevier.com/locate/tra), May, pp. 302-312.

David Gibson (2009), The Wayfinding Handbook: Informa on Design for Public Places, Princeton Architectural Press.

Richard Gilbert (2002), So Measures and Travel Behaviour, Presented at "Communicaĕng Environmentally Sustainable Transport - The Role of Soft Measures in Achieving EST" workshop, sponsored by the OECD (www.oecd.org).

Daniel Gilbert (2006), Stumbling on Happiness, Vintage Press.

Phil Goodwin (1997), "Habit and Hysteresis in Mode Choice," Urban Studies, Vo. 14, pp. 95-98.

J.W. Guiver (2007), "Modal Talk: Discourse Analysis of How People Talk About Bus and Car Travel," Transporta on Research Record A, Vol. 41, Issue 3 (www.elsevier.com/locate/tra), March 2007, pp. 233-248.

Susan Handy, Lisa Weston and Patricia L. Mokhtarian (2005), "Driving By Choice Or Necessity?" Transporta on Research, Vol. 39A, Issues 2-3 (www.elsevier.com/locate/tra), Feb/Mar., 183-203.

IMAP (2007), Inner Melbourne Wayfinding Signage, Inner Melbourne Acĕon Plan (hĥp://imap.vic.gov.au); at hĥp://imap.vic.gov.au/uploads/Strategy%20Documents/IMAP_Inner%20Melbourne%20Wayfinding%20Signage_Report_Dec%2007.pdf.

IOLT (2001), Ne ng More Passengers: The Fundamentals of Travel Informa on on the Web, Insĕtute of Logisĕcs and Transport (www.iolt.org.uk), 2001.

ITP (2007), Making Personal Travel Planning Work: Research Report, Integrated Transport Planning Ltd for the Department for Transport (www.dft.gov.uk); at www.dft.gov.uk/pgr/sustainable/travelplans/ptp/makingptpworkresearch.

Google Transit Trip Planner (www.google.com/transit) provides public transit route planning and schedule informaĕon in parĕcipaĕng ciĕes.

Green Lane Program (www.ec.gc.ca/emission/5-1e.html) by Environment Canada promotes TDM and other strategies for reducing transportaĕon environmental impacts.

Sara Hendricks and Ajay Joshi (2004), Commuter Choice Program Case Study Development and Analysis, Center for Urban Transportaĕon Research (www.nctr.usf.edu/pdf/527-06.pdf).

Stephen Hounsham (2006), Pain ng The Town Green: How To Persuade People To Be Environmentally Friendly, A Report For Everyone Involved In Promo ng Greener Lifestyles To The Public, Green-Engage Communicaĕons (www.green-engage.co.uk); at www.green-engage.co.uk/PainĕngtheTownGreen.pdf.

ILT (2001), Public Transport Informa on Websites: How to Get it Right - A Best Prac ce Guide, Insĕtute of Logisĕcs and Transport (www.trg.soton.ac.uk/bpg/index.htm). This 129-page document sets out the do's and don'ts of preseněng public transport informaĕon on the web. It is based on a review of over 50 sites in the UK and overseas.

Eric Jaffe (2014), Cu ng Car Reliance, One Trip at a Time, Atlanĕc Ciĕes (www.theatlanĕcciĕes.com); at www.theatlanĕcciĕes.com/commute/2014/04/cuħ ng-car-reliance-one-trip-ĕme-seaĥle/8822.

Jerald Jariyasunant, et al. (2013), "Quanĕfied Traveler: Travel Feedback Meets the Cloud to Change Behavior," Journal of Intelligent Transporta on Systems, Vol. 19, No. 2, pp. 109–124 (hĥp://dx.doi.org/10.1080/15472450.2013. 856714); summarized at www.accessmagazine.org/wp-content/uploads/sites/7/2015/11/access47.1sengupta.pdf.

Ian Ker (2003), Travel Demand Management: Public Transport Business Case, AARB Transport Research, RC5051, TravelSmart Program (www.travelsmart.vic.gov.au).

Johnathan Levine, Daniel Rodríguez, Jumin Song and Asha Weinstein (2006), Can Consumer Informa on Tighten The Transporta on/ Land-Use Link? A Simula on Experiment, Mineta Transportaĕon Insĕtute (www.transweb.sjsu.edu); at hĥ p://transweb.sjsu.edu/MTIportal/research/publicaĕons/documents/05-03/MTI-05-03-TranspLandUseLink.pdf.

Todd Litman (2009), "Mobility as a Posiĕonal Good: Implicaĕons for Transport Policy and Planning," Car Troubles: Cri cal Studies of Automobility and Auto-Mobility (Jim Conley and Arlene Tigar McLaren eds), Ashgate (www.ashgate.com/isbn/9780754677727); Introducĕon at www.ashgate.com/pdf/SamplePages/Car_Troubles_Intro.pdf; updated version at www.vtpi.org/presĕge.pdf.

Marke ng Research Associa on (www.mra-net.org) is a professional organizaĕon for the opinion and markeĕng research industry.

MC ICAM (Implementaĕon of Marginal Cost Pricing in Transport - Integrated Conceptual and Applied Model Analysis) (hĥ p://vplno1.vkw.tu-dresden.de/psycho/projekte/mcicam/e_mcicam.html), a program at the Traffic and Transportaĕon Psychology department at the Dresden University of Technology (www.verkehrspsychologie-dresden.de) explores issues related to the problems and opportuniĕes of implemeněng more efficient transportaĕon pricing.

MetroPool (www.metropool.com) delivers transportaĕon demand management employers and commuters in the Connecĕcut and New York regions.

Kate Myers (2005), Travel Behaviour Change Ini a ves: A Local Government's Innova ons, City of Darebin, Melbourne, Australia, presented at the 28th Australasian Transport Research Forum, Travel Smart Program (www.travelsmart.vic.gov.au); at hĥ p://atrf.info/papers/2005/2005_Myers.pdf.

Ali Modarres (1993), "Evaluaĕng Employer-Based Transportaĕon Demand Management Programs," Transporta on Research Record A, Vol. 27, No. 4, pp. 291-297.

John Muhlhausen (2005), Wayfinding Is Not Signage: Signage Plays An Important Part Of Wayfinding – But There's More, (www.signweb.com/ada/cont/wayfinding0800.html).

Mustel (2004), Interest in Viable Transporta on Op ons among Private Vehicle Drivers, TransLink and the Briĕsh Columbia Automobile Associaĕon, (www.translink.bc.ca); at www.translink.bc.ca/files/polls_surveys/cust_saĕsfacĕon/Report_BCAA_GVTA_Travel_Choices_Quanĕtaĕve_Nov2004.pdf.

NCTR (2004), Worksite Trip Reduc on Model and Manual, Naĕonal Center for Transit Research, Center for Urban Transportaĕon Research, University of Florida. April 2004. www.nctr.usf.edu/pdf/473-14.pdf.

NextBus (www.nextbus.com) is a private company that uses Global Posiĕoning Systems (GPS) to provide real-ĕme transit vehicle arrival informaĕon to passengers and managers in various North American ciĕes.

Raymond Novaco and Cheryl Collier (1994), Commu ng Stress, Ridesharing, and Gender: Analyses from the 1993 State of the Commute Study in Southern California, University of California Transportaĕon Center (Berkeley), Working Paper #208 (www.uctc.net).

Raymond Novaco, Wendy Kliewer and Alexander Broquet (1991), Home Environment Consequences of Commute Travel Impedance, University of California Transportaĕon Center (www.uctc.net); at www.uctc.net/papers/077.pdf.

Noxon Associates (2008), The Case For TDM In Canada: Transporta on Demand Management Ini a ves And Their Benefits – A Handbook For Prac oners, Associaĕon for Commuter Transportaĕon of Canada (www.actcanada.com); at www.actcanada.com/EN/Downloads/Case%20for%20TDM%20in%20Canada%20FINAL%20October%202008.pdf.

NRG (2007), King County Metro 2006 Rider / Non-Rider Survey Final Report. Northwest Research Group for King County Metro.

Oil-Smart Campaign (www.wsdot.wa.gov/smartmoves), sponsored by the Bullĩh Foundaĕon and the Washington State Department of Transportaĕon.

Pew (2006), Americans and Their Cars: Is the Romance on the Skids? Fewer Americans like to drive, survey shows, Pew Research Center (hĥ p://pewresearch.org/pubs/316/americans-and-their-cars-is-the-romance-on-the-skids).

Pinnacle Research (2004), Iden fying Factors to Change People's Transport Use, Land Transport New Zealand (www.pinnacleresearch.co.nz); at www.pinnacleresearch.co.nz/research/commuters/reducing_car_use.htm.

Pollu on Probe (2001), SMART Trip Reduc on Manual, Polluĕon Probe (www.polluĕonprobe.org/publicaĕons/air.htm).

PRR (2004), Travel Behavior Barriers and Benefits Research, Portland Regional Metro (www.metro-region.org).

Geoff Rose and Elizabeth Ampt (2003), "Travel Behavior Change Through Individual Engagement," Handbook of Transport and the Environment, Elsevier (www.elsevier.com), pp. 725-737.

Michael Roth (2003), Overcoming Obstacles of Car Culture: Promo ng an Alterna ve to Car Dependence Instead of Another Travel Mode, UITP Internaĕonal Markeĕng Conference (Paris), Internaĕonal Associaĕon of Public Transport (www.uitp.com); at www.vtpi.org/roth.pdf.

Jens Schade, The Acceptability of Travel Demand Management Measures, research project by Traffic and Transporta on Psychology (www.verkehrspsychologie-dresden.de) at Dresden University of Technology.

R.K. Seethaler (2005), Evalua ng Community-Based TravelSmart in Melbourne, presented at the 2005 Annual Meeĕng of the Insĕtute of Transportaĕon Engineers, Melbourne, The Urban Transport Insĕtute (www.tuĕ.com.au/Publicaĕons.html)

John Shadoff (1996), Transporta on Demand Management; A Guide for Including TDM Strategies in Major Investment Studies and in Planning for Other Transporta on Projects, Office of Urban Mobility, WSDOT (www.wsdot.wa.gov/Mobility).

Lynn Sloman, Sally Cairns, Carey Newson, Jillian Anable, Alison Pridmore and Phil Goodwin (2010), The Effects of Smarter Choice Programmes in the Sustainable Travel Towns: Summary Report, Report to the Department for Transport (www.dft.gov.uk); at www.dft.gov.uk/pgr/sustainable/smarterchoices/smarterchoiceprogrammes/pdf/summaryreport.pdf.

Marĕn Smith and Damian Price (2015), "Transport Mobility Management: Building Momentum, Achieving Success," Journeys, May, pp. 38-48; at www.lta.gov.sg/ltaacademy/LA-I13Journeys_May2015.htm.

Steven Spears, Marlon G. Boarnet and Susan Handy (2011), Dra Policy Brief on the Impacts of Voluntary Travel Behavior Change Programs Based on a Review of the Empirical Literature, for Research on Impacts of Transportaĕon and Land Use-Related Policies, California Air Resources Board (hĥp://arb.ca.gov/cc/sb375/policies/policies.htm).

Stephen G. Stradling, Jillian Anable and Michael Carreno (2007), "Performance, Importance And User Disgruntlement: A Six-Step Method For Measuring Saĕsfacĕon With Travel Modes," Transporta on Research A, Vol. 41, No. 1 (www.elsevier.com/locate/tra), Jan. 2007, pp. 98-106.

A. Taniguchi, et al. (2014), "Persuasive Communication Aimed At Public Transportation-Oriented Residential Choice And The Promotion Of Public Transport," Transportation, Vol. 41, Is. 1, pp 75-89; summary at http://link.springer.com/article/10.1007%2Fs11116-013-9472-7.

TAPESTRY (www.eu-tapestry.org) is a research project to develop beĥer communicaĕon programmes and campaigns that encourage sustainable travel behaviour.

Michael A. P. Taylor (2007), "Voluntary Travel Behavior Change Programs In Australia: The Carrot Rather Than The Sĕck In Travel Demand Management," Interna onal Journal of Sustainable Transporta on, Vol. 1, No. 3 (www.tandf.co.uk), July-Sept 2007, pp. 173-192.

Jean Taylor, Maĥ Barnard, Hayley Neil and Chris Creegan (2009), The Travel Choices and Needs of Low Income Households: the Role of the Car, The Naĕonal Centre for Social Research for the UK The Department for Transport; at www.dft.gov.uk/pgr/scienceresearch/social/theroleofthecar/roleofthecarreport.pdf.

Richard Thaler and Cass Sunstein (2008), Nudge: Improving Decisions about Health, Wealth and Happiness, Caravan Books.

-

Traffic and Transporta on Psychology (www.verkehrspsychologie-dresden.de) is a research center at Dresden University of Technology that performs research on transportaĕon aħ tudes, preferences and behavior.

-

Dr. Paul Tranter and Dr. Murray May (2005), Using the Concept of Effec ve Speed as a S mulus for Travel Behaviour Change and Policy Development, Australian Greenhouse Office (www.greenhouse.gov.au/tdm/publicaĕons/effecĕvespeed-concept.html).

-

Transporta on Control Measures Directory (hĥp://yosemite.epa.gov/aa\tcmsitei.nsf) provides a searchable database of TDM program case studies.

-

Travel Plans Website (www.local-transport.dft.gov.uk/travelplans/index.htm) provides guidance for developing employer and community transportaĕon management programs.

TravelSmart (www.travelsmart.vic.gov.au) is a community-based program that encourages people to use alternaĕves to travelling in their private car. They have an extensive collecĕon of research documents at www.travelsmart.vic.gov.au/web4/tsmart.nsf/headingpagesdisplay/Research.

TRB (2008), Understanding How to Mo vate Communi es to Support and Ride Public Transporta on, Transit Cooperaĕve Research Program (TCRP) Report 122, Transportaĕon Research Board (www.trb.org); at hĥp://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_122.pdf.

Katherine F. Turnbull (2004), "Planning The Road Ahead With Market Research: Transportaĕon Agencies Stay In Gear With Customers, Resources, and Performance Measures," TR News 230, TRB (www.trb.org), Jan.-Feb. 2004, pp. 10-16.

Katherine F. Turnbull and Richard H. Praĥ (2003), Transit Informa on and Promo on: Traveler Response to Transport System Changes, Chapter 11, Transit Cooperaĕve Research Program Report 95; TRB (www.trb.org); at hĥp://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_95c11.pdf.

TDM Resource Center (www.wsdot.wa.gov/Mobility/TDMhome.html) and Northwest Technology Transfer Center (www.wsdot.wa.gov/TA/T2) provide TDM resources.

Urban Transport Ins tute (www.tuĕ.com.au/Publicaĕons.html) is a research organizaĕon in Victoria, Australia that specializes in transport and environmental analysis and planning.

Bryon York and David Fabricatore (2003), Puget Sound Vanpool Market Ac on Plan, Draft, Office of Urban Mobility, WSDOT (www.wsdot.wa.gov); at www.vtpi.org/VanpoolMAPReport.pdf.

Joan L. Walker (2011), "Beyond Raĕonality in Travel Demand Models," Access 39, University of California Transportaĕon Center (www.uctc.net); at www.uctc.net/access/39/access39_demandmodels.shtml.

Way-to-Go Sea le! (2003), Way-To-Go Replicability Package, Way to Go, Seaĥle!, Policy, Planning and Major Projects Division, Seaĥle Department of Transportaĕon (www.seaĥle.gov/waytogo).

Edward P. Weber, David Nice, Nicholas P. Lovrich (2000), "Understanding Urban Commuters: How Are Non-SOV Commuters Different from SOV Commuters?" Transporta on Quarterly, Vol. 54, No. 2, Spring 2000, pp. 105-115.

Michael Wolf-Branigin and Karen Wolf-Branigin (2008), "The Emerging Field of Travel Training Services: A Systems Perspecĕve," Journal of Public Transporta on, Vol. 11, No. 3, pp. 109-123; at www.nctr.usf.edu/jpt/pdf/JPT11-3Wolf-Branigin.pdf.

This Encyclopedia is produced by the Victoria Transport Policy Institute to help improve understanding of Transportation Demand Management. It is an ongoing project. Please send us your comments and suggestions for improvement.

VTPI Homepage	Encyclopedia Homepage	Send Comments

Victoria Transport Policy Institute
www.vtpi.org info@vtpi.org
1250 Rudlin Street, Victoria, BC, V8V 3R7, CANADA
Phone & Fax 250-360-1560
"Efficiency - Equity - Clarity"

#23

PARKING MANAGEMENT

Description

A trip mostly begins and ends with a parked car. Whether it is the routine act of commuting from home to work or going out to eat, motorists must find a location to park their vehicle when they are not driving. In areas with dense development, finding available parking can be inefficient and frustrating.

Mother Jones Reporting

Cities see parking as a commodity and are deploying new parking technology with flexible pricing methods to better utilize the available parking inventory. Through sensors under parking spaces with online and smartphone applications, drivers can identify when and where parking is available at their destination. Real-time monitoring and active management through dynamic parking rates, cities and business districts can ensure the appropriate number of open spaces is available while reducing the traffic congestion associated with "cruising" for a parking space.

Cost:	●●○○○
Time:	**Medium**
Impact:	**Local**
Who:	**City/Private**
Hurdles:	**Coordination**

Target Market

- Urban city centers, central business districts, areas of dense development
- Locations where parking is limited and shared by multiple businesses, tenants, and visitors

How Will This Help?

- Reduce localized traffic congestion by reducing the need to "hunt" for available parking
- Reduce pollution associated with idling and circling city blocks looking for available parking
- Encourage mode shifts by making public transit more attractive is these dense areas

Success Stories

- In San Francisco, a federal grant funded the city to instrument and manage over 7,000 metered parking spaces and 15 city-owned parking garages.
- New York City has issued project requests to begin installing sensors and provide parking management services beginning in 2012. Deployment will be phased over a few years.

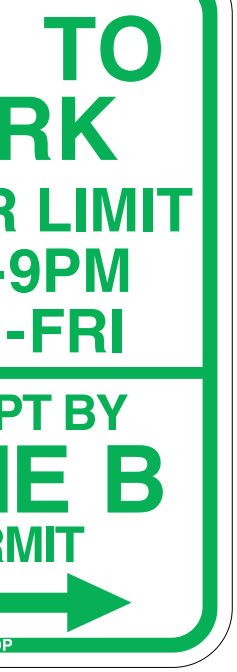
Implementation Issues

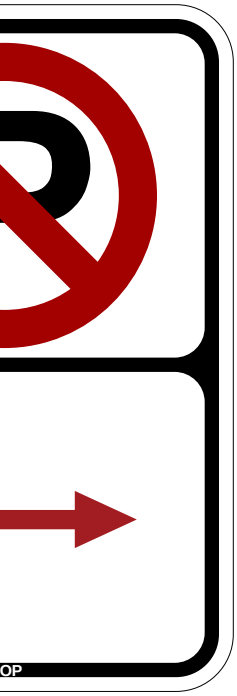
Optimizing available parking is desirable; however, where public agencies and private entities provide the limited parking inventory, fostering a spirit of cooperation is tenuous. This is exacerbated by the fact that parking generates revenues and no party wants to reduce their revenue stream. The key is to demonstrate that providing customer convenience and improving efficiency helps everyone.

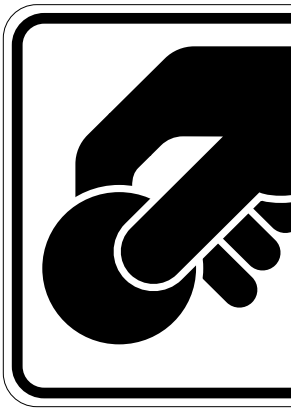
U.S. PARKING POLICIES:
An Overview of Management Strategies

Institute for Transportation and Development Policy

RACHEL WEINBERGER JOHN KAEHNY MATTHEW RUFO







ITDP
Institute for Transportation & Development Policy

U.S. Parking Policies:
An Overview of Management Strategies

Institute for Transportation &
Development Policy
127 West 26th Street, Suite 1002
New York, NY 10001
T: +1 212 629 8001
F: +1 212 629 8334
www.itdp.org

Rachel Weinberger
Department of City and Regional Planning
University of Pennsylvania
Philadelphia, PA

John Kaehny
New York, NY

Matthew Rufo
New Orleans, LA

Cover images courtesy of the City of Portland

February 2010

Table of Contents

1 Foreword

5 Executive Summary

12 Introduction

14 Part 1: Early History

24 Part 2: Current State of Parking Regulation Practice in the U.S.

34 Part 3: Rethinking the Curb and Traditional Parking Policies

50 Part 4: Case Studies

- San Francisco, California
- Portland, Oregon
- Boulder, Colorado
- Chicago, Illinois
- New York, New York
- Cambridge, Massachusetts

66 Conclusion

69 Appendix A: Commercial Off-Street Curbside Hourly Parking Rates for Select U.S. Cities

70 Appendix B: Curbside Parking Highlights in Select U.S. Cities

71 Appendix C: Works Cited

74 Appendix D: Additional Sources

77 Endnotes

Foreword: Guidance for Policy Makers

WALTER HOOK, EXECUTIVE DIRECTOR OF ITDP
MICHAEL REPLOGLE, GLOBAL POLICY DIRECTOR AND FOUNDER, ITDP

"U.S. Parking Policies: An Overview of Management Strategies" highlights best practices in parking management in the United States. In the last decade, some municipalities have reconsidered poorly conceived parking policies to address a host of negative impacts resulting from private automobile use such as traffic congestion and climate change. Unchecked, these policies have proven to be a major barrier to establishing a balanced urban transportation network.

This report identifies core sustainable parking principles and illustrates how smarter parking management can benefit consumers and businesses in time and money savings, while also leading to more livable, attractive communities.

Many aspects of current parking management in the United States do not work reliably or efficiently for anyone: Motorists find themselves circling for long periods in search of a place to park; retail employees take choice parking locations away from potential customers; developers are compelled to provide more parking than the market requires; and traffic managers encounter difficulty handling traffic generated by new parking as there is often no link between parking price, supply and the amount of available road space. Finally, the old parking paradigm doesn't work for the environment, as hidden subsidies encourage over reliance on private car use—a major, growing contributor to global warming and air pollution.

A few leading local governments around the country have started to chart a different course, earning both economic and political rewards. This report focuses primarily on these success stories and what we can learn from them.

Drawn from this important report are 10 key recommendations for government action:

1. Eliminate minimum parking requirements and encourage developers to 'unbundle' parking

In the 1970s, Boston, Portland and New York City removed parking minimum requirements and established parking caps or maximums in downtown areas. Alternatively, cities like Montgomery County, Maryland, have introduced special transit zoning districts where parking requirements are cut by 20 percent near metro stations. But most U.S. cities still have zoning rules that require new real estate developments to include a minimum level of new parking spaces

throughout the city. These minimum parking requirements pay little regard to transit availability and the urban design context in which the development is located. In some cases they led to more off-street parking than is appropriate to the local surroundings, such as in downtowns and transit-oriented residential neighborhoods. Minimums also led to sprawling cities where the costs of driving are shifted to the general public.

To pay for these spaces, developers often include ('bundle') parking into the sale of residential units or leases for office space, thereby forcing developers and their tenants to pay for parking that they do not want or need. Governments can encourage developers to stop including parking as part of a complete package in new construction projects.

The promotion of "shared parking," whereby developers coordinate access to underutilized, nearby parking facilities in other buildings, is another way to reduce minimum requirements. This strategy has been successful in Montgomery County, Maryland, Boulder, Colorado, and Cambridge, Massachusetts.

With excess parking reduced by eliminating minimums and 'unbundling' parking, spaces become priced for the users and not the general public, while also creating denser, more livable communities.

2. Coordinate on- and off-street parking management and charging

Many problems with parking management result from the lack of coordination between on- and off-street parking. While the original intention of U.S. planners was to encourage motorists to park off-street, on-street parking in cities like New York and San Francisco is much less expensive, leading to overcrowding at the curbside and underutilization of off-street parking. A coherent parking management strategy requires harmonizing these policies and pricing.

3. Charge a price for on-street parking to ensure performance standards, including occupancy rates, are met

Free or very low cost on-street parking benefits only a few commuters. Employees and shopkeepers who arrive first in the morning occupy the most convenient spaces, forcing customers arriving later to waste time and money looking for an available space farther away. Flexible parking meters, which set fees at levels that ensure an 85 percent occupancy rate throughout the day, optimize the use of scarce parking resources. San Francisco's SF*park* and New York City's ParkSmart programs are the closest to this ideal found in the U.S.

4. Create parking benefit districts where the revenue is returned to the community

One of the most important innovations in recent years for overcoming local resistance to new or increasing on- street parking charges is to create a special benefit district where the parking revenue is returned to the neighborhood in the form of enhanced public services and improved streetscapes. Of the 20–30 special parking benefit districts around the U.S., some are managed by business

improvement districts (BIDs) and others by special purpose agencies. While not all cities allow such earmarking of parking revenues, this has proven a successful win-win strategy, especially in locations where performance-based pricing is politically infeasible.

5. Use parking technologies that offer customers and policy makers the maximum flexibility

Modern parking systems allow customers to use a variety of payment options from credit cards to mobile phones. Multi-space use meters are more efficient than individualized parking meters. They can flexibly accommodate different sized vehicles, and are cheaper to install and operate. State-of-the-art systems can adjust rates based on occupancy, provide motorists with information about parking availability and accept a wide variety of payment methods. Rates can be adjusted after the first hour or two, changing those who overstay meter times from violators into higher paying customers while also maintaining incentives for the timely turnover of spaces.

6. Reclaim street space from car parking for other needed public uses such as bike sharing, cycling lanes, widened sidewalks or shared spaces

Nobody wants to lose parking, but given the choice, some communities may prefer alternative uses for the space. A growing number of cities, such as New York City, are removing on-street parking to put in exclusive bus lanes, pedestrian zones and bike lanes. Denver, San Francisco, and Los Angeles have all developed parking plans which identified a variety of options for removing parking to convert street space for alternative uses.

7. Design parking facilities that are well integrated with surrounding buildings and walking environments

Off-street parking access can disrupt the safety of a sidewalk, with cars breaching the pedestrian way to enter a garage. A typical garage is also an uninspired structure that deadens street life due to a lack of interactive ground floor space. A growing number of prime commercial locations in places such as San Francisco's Rincon Hill neighborhood and Portland, Oregon, tightly regulate the type and design of parking facilities. Some ban above-ground parking altogether. Others require multi-story facilities or valet parking. Portland and San Francisco restrict how much of a building façade can be dedicated to garage doors and regulate the design and the access to off-street parking garages.

8. Incorporate parking policies into metropolitan transportation plans

Metropolitan planning organizations (MPOs) are responsible for developing and approving short- and long-term transportation plans to meet federal funding requirements, such as compliance with the Clean Air Act. Key decision-makers in MPOs must ensure that parking strategies are included as a crucial element in transportation plans for timely attainment of national ambient air quality

standards, climate action plans, congestion management programs and livability initiatives. MPOs can consider using parking as a strategy to generate revenue to support fiscally-constrained transportation investment plans and to fund transit services that face funding cutbacks.

9. Include innovative parking management in statewide livability initiatives, congestion management, air pollution control strategies, climate action plans and innovative financing programs

The U.S. Department of Transportation (DOT) and Environmental Protection Agency (EPA) can incentivize and require parking inventories and master plans to be developed as part of State Implementation Plans (SIPs) for non-attainment areas for smog and particulate matter under the Clean Air Act. U.S. DOT can provide technical guidance to cities for the development of parking master plans, as well as significantly increase assistance on parking management strategies. Congress can strengthen incentives and requirements for parking pricing to be considered in the transportation planning process as part of alternatives analysis. Legislation can be adopted to limit greenhouse gas emissions overall and to ensure that transportation contributes in a timely and proportionate way to addressing the climate problem, including efforts to better manage existing resources like parking.

10. Promote parking and commuter programs that expand travel choices for employees and customers

Employers can become members of the *Best Workplaces for Commuters* program, which offers benefits to workers that encourage less reliance on driving, including cash in lieu of a parking. These often lead to lower costs and more attractive developments. In today's new market conditions, that is often a formula for success. Developers and real estate industry stakeholders can design new residential, retail and employment centers to include attractive walking and cycling environments with easy access to public transportation, minimizing the need to provide costly parking facilities.

Executive Summary

In the last 5 to 10 years, U.S. transportation planners have become much more aware of the impact of parking on congestion, air quality, economic development and the pedestrian environment. Historically the "parking problem" has been identified as the problem of too little supply; increasingly the problem is now seen as the poor management of existing supply and, in cases where cities have instituted parking maximums, the problem is understood to be of too much supply. There is a growing realization that the dysfunction caused by poorly conceived parking policies is a major impediment to creating an effective and balanced urban transportation system, it is also a significant cause of traffic and air pollution.

Transportation planners seeking to learn from the United States should take note of how traditional U.S. parking policies have had significant unintended consequences. By and large, these policies have produced excess parking supply. The excess has served to keep the price of parking down—99 percent of driving trips end in free parking—and consequently reduced the cost of car use. By reducing the cost of driving and by consuming large amounts of space, traditional policies have promoted automobile use and dispersed land uses thus undermining public transit, walking and bicycling.

There is a growing movement to employ parking policies that encourage balanced transportation systems and reinforce central cities. These newer approaches emphasize measures which manage parking demand through pricing, shared parking and reduced off-street requirements. These "demand management" oriented policies are most often found in dense downtown areas or central business districts served by public transit.

In the U.S., decisions about off-street parking and land use are made by planning departments within cities, towns and counties. These groups base traditional parking practices on a number of assumptions—the most fundamental of which are the notions that the automobile is always the preferred mode of travel, demand for parking is independent of price, parking should be or will be free, and there is no transit or other travel alternative. Parking policy decisions are typically made without reference to the rest of the transportation system.

This has lead to cities being designed around parking. Builders are required to provide minimum amounts of parking with most new developments—a costly requirement. These "minimum parking requirements" have contributed to a cycle of automobile dependence that is especially damaging to city centers. More parking reduces the cost of car use, which leads to more car use and more demand for parking. The walking environment is undermined and the distance between destinations increases. Ultimately, this leads to lowered densities within cities to a point where transit becomes inefficient. Street life and public spaces cease to function. This indeed is what we see in suburban office parks, big box store developments and dead downtowns. In contrast, some cities are beginning to set parking policies that promote city centers and balanced transportation systems.

Curbside parking on the other hand is frequently managed under the jurisdiction of city streets or public works departments who also have some responsibility for transportation planning. The parking and transportation dysfunction caused by the land use planners setting off-street requirements and public works departments managing curbside supply can be reduced by having clear planning objectives and one entity setting coordinated policy in both realms.

Basic principles of sustainable parking policy and planning

- Minimum parking requirements subsidize driving by shifting the costs of car use onto development and the non-driving public.
- Required parking imposes significant direct and indirect costs; parkers should bear this cost, not the general public.
- Good access is easily impeded by abundant parking. Conservative parking requirements allow better accommodation for public transit, walking and bicycling.
- Increasing supply lowers prices and stimulates increased parking demand.
- The demand for parking is influenced by price and travel alternatives.
- The supply and price of curbside and off-street parking influence each other.

While these principles are well understood they are infrequently invoked. A handful of cities in the United States are using them to develop new policies which support broader sustainability and economic development goals. The parking innovations underway in seven of those cities are profiled in this report.

Off-street parking practice and best practice in the United States

The majority of off-street parking is "accessory" to the primary land use and is regulated by land-use zoning codes written by city planning agencies and

commissions. Commercial off-street parking is provided by profit-seeking firms, primarily in dense downtowns. Municipal off-street parking is provided by the public sector, typically as a low-cost, downtown amenity. By the 1950s, most city planning commissions required a specified amount of accessory parking as part of most new residential and workplace construction. These "minimum parking requirements" were a reaction to growing automobile use that, absent any pricing mechanism, was swamping available street space. In addition, single use zoning results in segregated residential and commercial areas triggering more reliance on the automobile. As accommodation to the automobile increased, so did its use. This cycle of dependency soon prompted additional requirements for off-street accessory parking.

Minimums had a huge impact on American cities. Any visitor to the United States will be struck by the difference between cities and towns built before the adoption of minimum parking requirements and those built afterwards. The requirements led to an explosion in new parking and fueled dispersed land uses like the "office park" and "big box stores;" which consist of buildings in the midst of vast parking lots. In the 1970s, the link between the parking supply and car use was explicitly recognized when New York City, San Francisco, Portland and Boston were all forced by lawsuits brought under the federal Clean Air Act to cap parking in their central business districts (CBDs).

Minimum parking requirements is by far the most prevalent government parking policy. They profoundly influence everything from hundreds of billions of dollars in construction costs to land-use density, travel choice, environmental sustainability and the way cities look and function. Yet, the methods used to determine minimums are fundamentally flawed. Typically, requirements are based on the type of land use and its square footage with no reference to the existing transportation system or ambient development. The recommended parking requirements for a restaurant would be the same if the restaurant were in a business district—where customers could walk—or at a highway intersection with no access option other than driving. Most minimum requirements are based on a compendium of minimum requirements assembled by the Institute for Transportation Engineers. The compendium is a limited inventory without contextual analysis.

Off-street parking best practices

Planners in many cities recognize the high cost of "free" parking and offer a menu of alternative approaches to manage the parking supply more efficiently and account for mixed land uses, transit and pricing parking to manage demand. These include:

Elimination or reduction of minimum requirements: used in a number of San Francisco neighborhoods.

Shared Parking: encourages the consolidation and reduction of a neighborhood's parking facilities, allowing more productive land uses. It can also be priced in a way that accessory parking cannot. Shared parking is a key part of travel demand management in Montgomery County, Maryland Boulder, Colorado and Cambridge, Massachusetts.

In Lieu Fees: paid by developers to a city in the place of building accessory parking. The fee helps fund city-owned shared parking. This is in use in a limited number of cities.

Transit Zoning Overlays: special zones that supersede existing use, density, design and parking requirements near rail and bus lines. Typically, parking requirements are reduced.

Unbundling Parking: compels developers to sell or lease parking independently of residences or commercial leases. Thus overall parking costs are not subsidized by other uses. San Francisco is piloting unbundling but compliance by developers is proving difficult.

Cashing-out Parking: employees are given the cash equivalent of a parking perquisite (where free parking had been offered). The employee may then choose whether to "buy back" the parking space or keep the cash. Where parking cash-out is offered, single occupant vehicle use, and, thus, parking needs, have been reduced.

Parking Benefit / Travel Demand Management Districts with Curbside and Off-Street Parking Coordination: Revenues from curbside parking meters in downtown Boulder, Colorado help fund shared, public parking garages and free transit passes for downtown employees. The price of curbside and off-street parking are coordinated to shift curbside demand to off-street parking facilities. As a result, Boulder, which is surrounded by a heavily automobile dependent suburban area, has much higher transit, walk and bicycle to work shares than other small U.S. cities.

Curbside parking practice and best practice in the United States

Because off-street parking can be continuously expanded and the supply of curbside parking is essentially fixed, curbside parking policy is fundamentally about managing the demand for an unchanging supply.

Commercial streets have the greatest competition for curb space, with delivery and service vehicles competing with shoppers, store employees and local residents for parking spots. Parking policy on these streets has long and complex political histories, reflecting this conflict. However, there is a strong consensus that the most efficient use of commercial curb space is for short-term parking. Businesses largely agree and, as a result, commercial streets have a wide variety of metering, time limits and usage restrictions, intended to encourage short-term use. In contrast, residential streets are not metered, regardless of demand, and

are typically either unregulated or restricted to local residents with residential parking permits. The focus of this report is on commercial streets, where pricing policies and new technology are transforming traditional practice.

Curbside management employs four basic approaches: metering, time-limits, user restrictions and parking bans. All four approaches depend on enforcement to be effective. Unfortunately, numerous studies show that parking enforcement is rarely adequate to prevent widespread illegal parking. Where studies have been done, approximately one-fifth to one-third of vehicles are parked illegally.

However, three technologies in the early stages of adoption have the potential to revolutionize parking enforcement. The first two are license plate or vehicle recognition scanners mounted on vehicles. These can drastically reduce the personnel required to enforce time limits. The third involves the use of sensors embedded into parking spots, as seen in San Francisco's SF*park*.

Enforcement is important because of the considerable costs of illegal parking. Double parked vehicles endanger other road users, especially bicyclists; sharply reduce the capacity of roadways; delay emergency vehicles, buses and other traffic; and add to air pollution and travel costs. Vehicles which overstay time limits reduce parking availability and cause other motorists to spend more time searching or "cruising" for available spots. Studies find that cruising vehicles can represent as much as 40 percent of traffic. Removing these cruisers would free up street capacity that could be reprogrammed for pedestrians, buses or cyclists and ensure smoother flow for buses, delivery trucks and other automobiles.

Metering is demonstrably the most efficient and flexible way to manage curbside demand. However, one- or two- hour time limits represent the majority of applications. Numerous studies show that time limits are difficult to enforce and are thus often ignored. Other studies show that time limits produce longer stays, less turnover and curbs which are 100 percent occupied. Areas with time limits frequently suffer from double parking and additional cruising. During peak travel hours, many U.S. cities also use curbside parking bans to reallocate curb space from parking to buses and through traffic. This traditional measure is easy to enforce. Some cities restrict curb access to particular types of motorists, usually commercial vehicles and government and handicapped permit holders. Unfortunately, widespread abuse of government and handicap permits has been documented in several places.

Curbside / On-street parking best practices

Enforcement: Automated scanning enforcement as employed in Chicago, Illinois; parts of Virginia and Santa Barbara, California, appears transformative, though in its early stages. Other technology, especially wireless, handheld devices with cameras have made traditional enforcement more efficient; as has software which automatically issues and tracks parking summonses.

Pricing Policy: Variable or peak-hour metering in which the price is set based on a curbside occupancy target of less than 85 percent is a logical and consistent

way of managing a congested curb. San Francisco's SF*park* is the largest application of this approach, also used in Redwood City, California, and in a flexible form by New York City's ParkSmart. Another effective practice is to both restrict curb access to commercial vehicles and meter them. New York City does this in Manhattan and adds an escalating meter fee of $2, $3, and $4 per hour to encourage short stays, high turnover and faster deliveries.

Payment methods and meters: Pay-by-phone is growing rapidly in popularity. Industry experts believe that remote payment will eventually replace meters. In the meantime, the state of the art meters are solar powered, multi-space meters which are in wide use across the U.S.

Building support for metering via Parking Benefit Districts and revenue return: In 20 to 30 special parking districts, in cities as varied as Boulder, Colorado, Los Angeles and San Diego, meter revenues support streetscape improvements to attract more retail business.

Introduction

IN THE LAST FIVE TO TEN YEARS, U.S. transportation planners have become much more aware of the effect parking has on congestion, air quality, economic development and the pedestrian environment. Historically the "parking problem" has been identified as the problem of too little supply; increasingly the problem is now seen as the poor management of the existing supply and, in cases where cities have instituted parking maximums, the problem is understood to be of too much supply. There is a growing realization that the dysfunction caused by poorly conceived parking policies is a major impediment to creating an effective and balanced urban transportation system, it is also a significant cause of traffic and air pollution. This changing perspective, combined with major technological changes, and budget pressures due to the severe recession, is propelling rapid changes in curbside parking practices in the downtown areas of some of America's biggest and most influential cities. Off-street parking policy is in some ways more complex and more important, as it heavily influences urban land use, density, and the pedestrian environment. Indeed, one of the key issues to emerge from this report is the importance of merging these two domains of parking under one policy umbrella.

The relationships between parking infrastructure and transportation choices are as important as that between road infrastructure and transportation choices. Yet research on roads abounds while there is very little on parking.

This report describes how parking policies affect United States cities. Using research and case studies, it takes a historical, theoretical and an empirical approach to analyzing goals for parking management and regulatory policy designed to meet those goals. We include curbside (on-street) parking, which in most U.S. cities is managed and maintained by street and public works departments, and accessory off-street parking which is regulated by planning

OVERVIEW

Parking regulations and policies impact urban form. This influences transportation choices and numerous quality-of-life issues, including affordable housing, walkability, storm-water management, air and water quality, traffic congestion, and greenhouse gas emissions. Originally parking regulations were instituted to accomplish one of two objectives. They were intended to mitigate "spillover" effects meaning that parking demands stemming from new developments wouldn't encroach on parking in adjacent areas or parking used for pre-existing development. They were also intended to ensure that auto access to any development was a seamless experience for drivers. Imposing minimum requirements for parking provision accomplished both objectives but stimulated several unintended consequences.

Eventually it became the hope of planners in dense, but declining, urban areas that more free parking would make downtowns competitive with the evolving suburban shopping areas. Minimum parking requirements, again, were used to make the downtowns more similar to the suburbs.

In recent years the relationship between parking availability and high levels of single occupant auto driving has become more clear. Planners and residents of some American cities have come to realize that cities must reform themselves such that residents and visitors have an array of transportation modes from which to choose. These and other concerns, such as auto emissions related violations of the federally established clean air standards have led several cities, such as Los Angeles, Philadelphia, Washington, DC, and Seattle, WA to revisit their parking management strategies.

The need to redevelop parking management strategies has, in turn, led many cities to reform strict parking minimum regulations and to implement a variety of innovative parking management policies. These curbside and off-street policies include parking benefit districts, parking freezes, travel demand management (TDM) programs, pricing through metering and permitting, and parking maximum zoning regulations.

departments through zoning codes. Within curbside and off-street parking there are rules governing both commercial and residential parking. An additional category—private, for-profit parking garages typically found in dense downtowns—is treated only in the context of how parking supply affects other transportation behaviors.

Documenting examples of parking "best practices" used to manage demand and promote mobility and accessibility goals, while mitigating the negative effects of private automobile use and the over dependence on single occupant automobile trips is the focus of this report. Central cities where there is a perceived parking shortage will be at the forefront.

Part One explains historical and status quo practice in both off-street and curbside[1] parking management. Part Two highlights the "business as usual parking policy" and features some recent innovations, including reducing cruising for parking, double and other examples of illegal parking, single occupant vehicle use and reducing the air pollution, traffic congestion and danger caused by unnecessary driving. Part Three systematically describes a host of parking strategies for both off- and on-street parking. Roughly, these strategies fall into the categories of: increasing supply; decreasing demand; and managing supply and / or demand. Locations where these strategies have been implemented are noted. Part Four sets out approaches to parking policy that have been taken by cities at the forefront of innovation.

This report documents parking studies, academic research, and includes comments from many planners, parking managers, parking industry executives and other experts. Not all of the interviewees were comfortable being identified. In those cases where the comments were important enough to include, they are without attribution.

Part I: Early History

Curbside parking and the drive to off-street parking minimums

Parking supply and management has been a matter of public policy in the United States since the early 1900s. Parking bans and strict time limits were imposed on downtown streets across the country by police departments and traffic engineers. For example, Detroit imposed time limits on curbside parking in 1915; Boston did so in 1920.[2] For decades after the advent of the automobile, city engineers and planning elites strongly opposed curbside parking because it was an inefficient use of public space and impeded traffic. Parking was banned in "The Loop," Chicago's Central Business District, in 1928, and overnight parking was banned in Manhattan, New York City, until the late 1940s.[3]

However, as car ownership skyrocketed, pressure for parking grew. From 1920 to 1960, American cities responded to this demand by increasing the supply of both curbside and off-street parking. (This increase very likely induced greater demand for driving and parking.) Cities removed curbside parking bans, built huge numbers of both government and business-funded parking garages, metered curbside parking on shopping streets, and, finally, required that both new residential and commercial development include off-street parking. By 1960, almost all U.S. cities had some form of minimum parking requirement: which immediately influenced urban and suburban land use.

Woman paying for parking in downtown Oklahoma City in 1935
COURTESY OF POM INCORPORATED

Curbside parking meters were introduced in 1935, in downtown Oklahoma City, Oklahoma, at the behest of a department store owner who wanted to make parking more available for potential shoppers.[4] His own employees had been parking at the curb and making it harder for customers to access the front door. Metering, recognized as an efficient way of encouraging "turnover" on the curb, spread quickly. By 1955, all major U.S. cities had metered their central business districts (CBDs) and retail shopping streets. Ensuring curb space for short-term shoppers and deliveries remains a primary goal of curbside parking management in the United States. Though, as is discussed later in this report, the implemented policies frequently fall short in supporting that goal. These historic roots help to explain why retailers have a disproportionate voice in establishing curbside parking policy.

Although metering was introduced in the mid 1930s and became commonplace by the mid 1950s, in recent history, the political will to increase meter rates has been lacking. As a result meters became ineffective for promoting turnover.[5] Official attempts to deal with the crowded curb have taken the form of ordinances requiring that new developments include off-street parking.

In 1956, the same year the interstate highway construction was initiated, the Bureau of Public Roads (BPR) published an influential pamphlet defining the parking problem and solution.[6] The authors explicitly promoted parking solutions built around these three assumptions:

- The automobile is the best mode for every trip.
- Highways are equally desirable and appropriate for short neighborhood

and local business trips as they are for longer distance travel between cities, and between cities and suburbs, as well as for access to major shopping centers (now characterized by big box development.)

- Highways should be free flowing, and highway capacity should be increased to accommodate growing demand.[7]

Thus, by the 1950s, public policy toward parking was established to ensure a satisfactory automobile experience. It was believed that motorists should not have to pay much for parking, if anything, nor be inconvenienced with time wasting searches or walks that exceed more than a few minutes. Any competition for parking among new motoring visitors, existing residents and businesses was all but eliminated. Planners steeped in the BPR philosophy defined parking demand for facilities to be at their thirtieth busiest hour.[8] The marginal cost of land in suburban locations meant the cost of developing of parking here was also very low. In that light, the BPR philosophy assumed parking would be free, and that most, if not all, trips would be auto trips. Even momentary parking shortages were deemed unacceptable. Thus city ordinances began to require sufficient parking space to serve the highest projected parking demand, under the assumption that all visitors would arrive by private automobile and that parking would be free.

Curbside parking meters were introduced in 1935, in downtown Oklahoma City, Oklahoma, at the behest of a department store owner who wanted to make parking more available for potential shoppers.

The earliest off-street parking policy required minimum amounts of spaces for new development. To this day, parking minimums remain the most prevalent policy. The underlying idea is still adhered to that the demands of new development should not be felt by neighboring land uses. But since the Clean Air Act Lawsuits of the 1970s (see Parking Freezes box p. 43), it has occasionally been questioned (see Hudson Yards box p. 29).

Determining minimum requirements

Donald Shoup, author of *The High Cost of Free Parking*, observes a highly flawed, three-step process for determining required parking. First, planners define a land use (such as residential apartments, fast food restaurant, or professional office space), choose a starting point that is unrelated to the transportation system (usually square feet of the building), and then specify a number of spaces to require. Planners use building square footage, rather than sales, employees, or other bases for pragmatic reasons: they are easily measured and relatively stable. Parking minimums tend to ignore the transportation system and modes of travel. Because of historical bias toward the automobile and in a quest for simplicity, minimum parking requirements typically assume that all visitors arrive by automobile and have free parking. Thus, the potential behavioral effect of charging for parking, and the effect of visitors arriving by foot, transit or bicycle are minimized or ignored. The fact that catering almost exclusively to motorists fosters more automobile use has been misunderstood, understated or ignored.

Even under these assumptions it is difficult to come to grips with the question of how many spaces a city should require for every elementary school, for

every health club and every church. In many cases planners simply copy the regulations imposed by neighboring jurisdictions. In an attempt to provide standardized guidance, the Institute of Transportation Engineers (ITE) has developed a catalog of existing land uses and the associated parking that has been built alongside of them. The volume, simply called *Parking Generation*, is in its third edition. Most often, planning agencies use *Parking Generation*, which is, in essence, "copying from neighboring jurisdictions" writ large. The Parking Generation guide attempts to report parking demand for hundreds of different land uses but it does so by collecting reports on what has been done by jurisdictions across the country. In many cases the guide relies on a very small suburban sample for each of the many and diverse types of activities to which people travel: work, school, home, recreation in big cities, small towns and suburbs, in places served by transit, in places where people walk and where they drive.

The guide uses observation of *peak* demand at single use, low density, low transit, typically suburban developments to inform its parking demand requirements. The guide "predicts" parking demand based on the averages or simple regression estimates of the number of spaces provided per square foot of building. No analysis with respect to the appropriateness of the methodology or the results for any particular place is made. The assumption supporting this method is that all parking should be provided free and that land is nearly free. Finally, as noted above, observations of the parking demand for specific land uses are often very few: half of all the parking generation rates the guide predicted are based on four or fewer examples. Yet these sparse samples are presented as standard practice, rather than observations which may or may not be applicable to any given community.

Less frequently, though far superior, a particular study takes into account the specific factors of a neighborhood or development. These more realistic parking demand studies consider neighborhood density and design, demographics, transportation options, surrounding land use mix, existing off-street parking and the city's specific goals with respect to the transportation system.

Unintended consequences

Sixty years of experience with minimum parking requirements has shown several unintended consequences that have in turn become the focus of modern parking policy. Among the unintended consequences are the following:

- Parking minimums cause dispersed land use. The physical space devoted to parking is enormous. In many places this results in more space devoted to parking than to the primary land use. For instance, office space typically requires 175–250 square feet per person; parking spaces require about 200 square feet per vehicle for curbside parking, and 300–350 square feet per car in garages. A recent Manhattan development called the East River Mall couples 485,000 square feet of retail space with over 686,000 square feet of parking.[9]

- Depending on minimum parking requirements, the increasing dispersion makes other modes of travel infeasible. Walking becomes impractical because the space required for parking creates great distances between destinations; transit is adversely affected because densities are lower than reasonable transit service thresholds. Bicycling also becomes untenable because the dispersed land uses are served by collector streets that are too dangerous and uncongenial for cyclists to use.
- By degrading conditions for alternative modes, parking requirements feed a cycle of auto dependency. The parking requirement degrades other travel options and leads to increased auto use.
- Entry points to parking facilities require vehicles to cross sidewalks creating many points of pedestrian / auto conflict. This further degrades the walking environment feeding the dependence cycle.

The sum of these unintended consequences is increased automobile trips, which, in turn results in excess congestion, air pollution and greenhouse gas emissions.

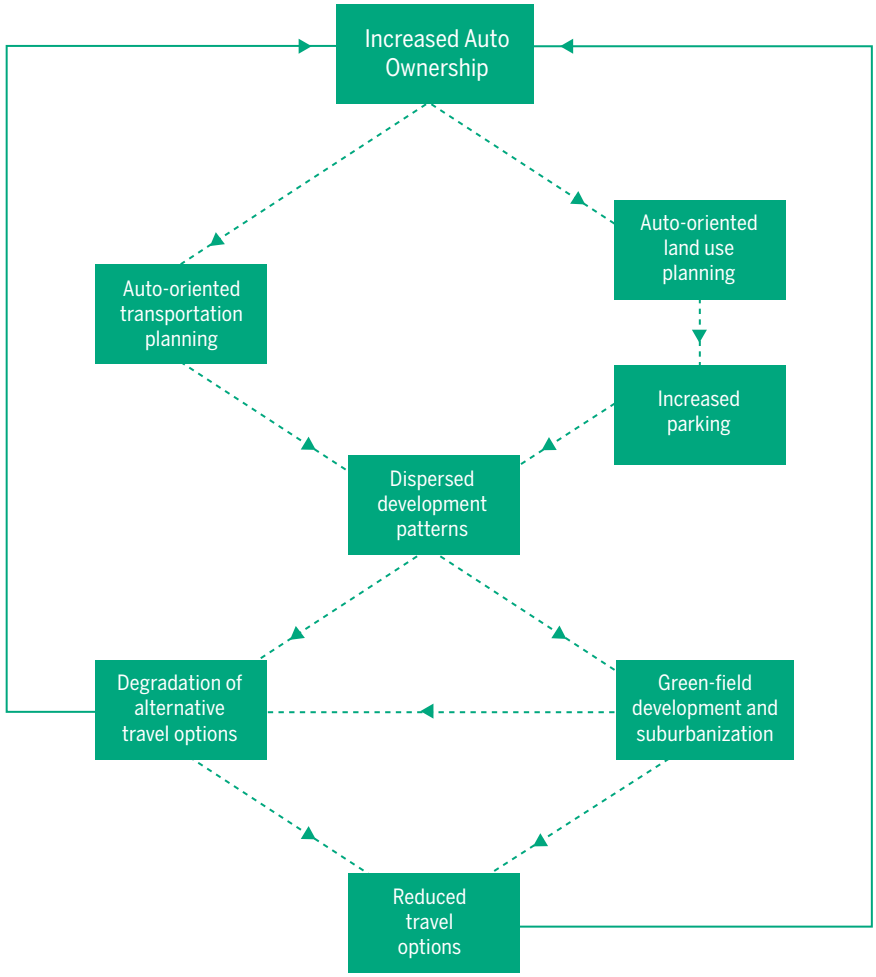
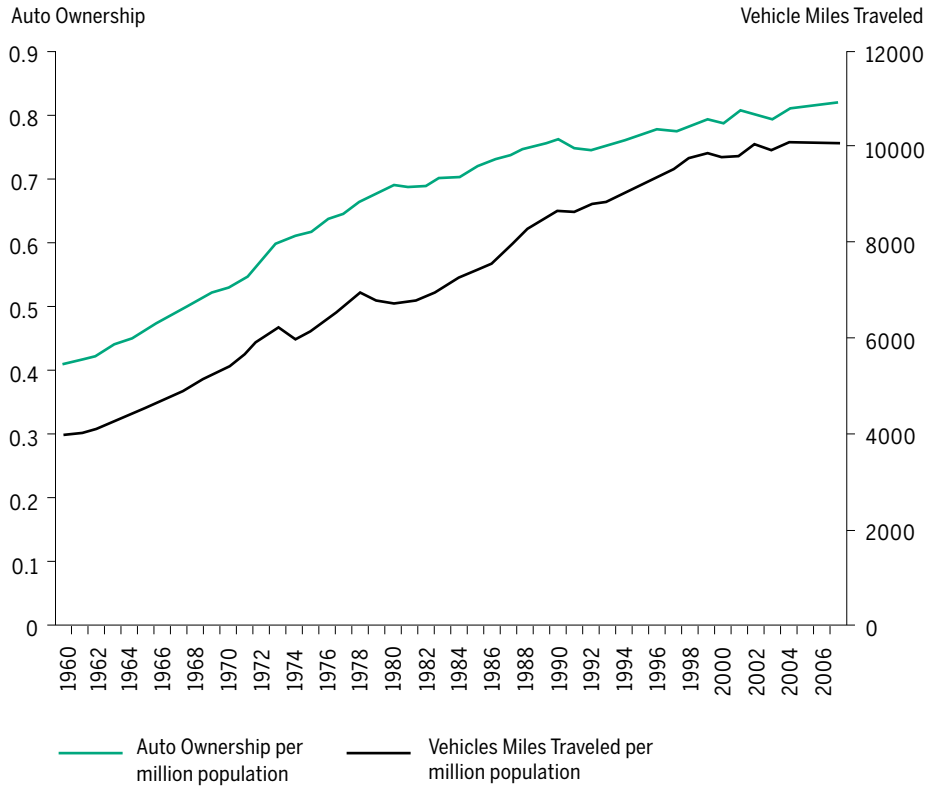


Figure 1: The Cycle of Automobile Dependency

Car ownership, car use and parking

Fueled by massive road building and ample amounts of new, typically free parking, private automobile transportation became the dominant from of personal travel in the United States. Increases in auto dependence in the United States both drive and have been driven by parking policy. Auto ownership per 1,000 people doubled in the United States from 441 in 1960 to 820 in 2007. Autos are now used for 86 percent of trips.[10] Ninety-nine percent of those trips begin and end in a free parking spot. And experts in the United States and the United Kingdom estimate that automobiles are parked approximately 95 percent of the time. In many places in the U.S., for every automobile there are at least three parking spots: one at home, one at work and one at "play" i.e. any non-work destination. The three-spots-per-car estimate was corroborated most recently by researchers in Indiana. Counting only off-street surface parking spaces, and not including residential land where garages and driveways are common, the research team determined that there were approximately 2.2 spaces per registered vehicle in the county they studied.[11] Where parking is not provided for free or where the cash equivalent of free parking is offered, people respond by carpooling and using public transportation (see Parking Cash Out box p. 19). Several studies show a relationship between high priced and / or restricted parking supply in downtowns and higher rates of public transit use.[12] Two recent studies of New York City show that relatively scarce off-street parking contributes to lower greenhouse gas emissions and keeps vehicle miles traveled (VMT) per capita lower than the national average as well.[13]

Figure 2: Per capita car ownership has doubled in the past 45 years



Parking and transportation choices

Off-street parking basics

From a theoretical perspective, it would be easy to predict that minimum parking requirements would lead to auto dependence and the degradation of walkable cities. The automobile transportation system has three components: streets, vehicles and parking. Together streets and parking spaces create the system supply or capacity, vehicles and the amount of vehicle use comprise demand. Regulations that require parking as part of new development facilitate automobile use. They make car use cheaper by eliminating the time-cost associated with searching for a spot, and retrieving a vehicle when it is not parked adjacent to the traveler's origin or destination. Likewise, at least initially, increases in roadway capacity and the road network, reduce a motorist's travel time. As a result of these time savings, car use is made cheaper and, in turn, more common by increasing the parking or roadway supply.

When the price drops on a commodity, more users are drawn into the market and demand increases. The concept that demand for parking is influenced by the free supply of parking has only recently begun to receive widespread recognition in the policy arena. Another important point to consider is that expansion of urban street capacity requires knocking down buildings. Thus, an important side effect of increasing the parking supply is that it creates increased demand for road space, which usually leads to increased traffic congestion until roads can be widened. The converse is also true. When roads are widened, the demand for parking increases.

PARKING CASH-OUT

Several studies have shown that when individuals are required to pay for their own parking they will drive less. Other studies show that when employees are offered the cash equivalent of their "free parking benefit" many will take the cash and leave the car at home.

Percent of employees who drive alone to work when their employers pay the parking fee versus when they pay the parking fee:

	Study Date	Employer pays	Employee pays	Greater probability of driving alone
Washington, D.C.	1991	72%	50%	44%
Los Angeles	1991	69%	48%	44%
Los Angeles	1980–1989	75%	43%	74%
Portland*	2001	62%	46%	35%

*model estimate
Compiled from Willson (1991); Miller (1991); Shoup (1995) and Hess (2001)

Percent of employees who drive alone to work before and after cash-out:

	Study Date	Drive alone before	Drive alone after	Reduction
Southern California	1997	76%	63%	20%
Minneapolis, MN**	1999	87%	67%	30%
Eden Prairie, MN	1999	93%	87%	7%
Bellevue, WA	N / A	89%	54%	65%

*Average of eight case studies
**Suburban location
Compiled from Shoup (1995); USEPA (2001)

Marina City in Chicago consists of two condominium buildings with 19 of the first 60 floors dedicated to car parking
MATTHEW RUFO

When it is understood that the parking supply helps induce more driving and demand for parking, it is easy to see that adding capacity increases congestion. A preponderance of research shows that adding capacity increases congestion. In his books, *Stuck in Traffic* and *Still Stuck in Traffic* Anthony Downs shows how the building of more motor vehicle infrastructure results in greater congestion.[14] Likewise Martin Mogridge,[15] in *The Self Defeating Nature of Urban Road Capacity Policy*, describes the history of road capacity policy, how it has not achieved the ends expected and, worse, how it has brought about results opposite of those intended. This has been documented in numerous studies including quite conclusively by the British Government in the 1995 report Trunk Roads and the Generation of Traffic by the Standing Advisory Committee for Trunk Road Assessment.[16]

There are four conditions under which the parking supply meets demand.

- When there is no scarcity of cheap land (for example at the urban fringe);
- When roads are so congested that they (rather than the parking supply) represent a bottleneck on the system;[17]
- When government regulations require so much parking that there is a surplus of parking far exceeding even peak demand; and
- When parking is priced at a level that tempers demand to meet the available supply.

Increasingly planners and transportation system managers are coming to appreciate that requiring a sufficient supply of parking to meet unconstrained demand may not be an efficient or desirable objective and it will likely lead to higher levels of roadway congestion. Instead, strategies to better manage supply and demand or, in some cases, to reduce demand, are being tested. Parking policy is increasingly used to generate revenue (see Chicago case study p. 60), decrease double parking and other illegal parking (see New York City case study p. 62), decrease the "cruising" for spaces that contributes to unwanted congestion and unnecessary emissions (see San Francisco and New York case studies p. 50 and p. 62), mitigate disruptions to the urban fabric and recalibrate the allocation of land, both rights-of-way and parking lots among users of all modes (see Portland case study p. 54).

Curbside parking basics

The basics of curbside parking are simple. The supply of curbside parking is essentially fixed. It can be affected by the number of curb cuts, restrictions, and the use of angled parking, but by and large, regardless of demand from motorists and regardless of the level of development, the supply is inelastic. If there are fewer curbside parking spots than motorists seeking to park, motorists must circle or search for parking until a spot opens up, double park, seek parking elsewhere or park in an illegal space (e.g. bus stop, loading zone or blocking a fire hydrant). The problem is exacerbated if there are no alternatives to the car for access—such as transit, walking or cycling. While it is often asserted that parking is a "public good" and therefore should be free, a true public good is one whose use by one party does not impinge on its use by another (like a lighthouse or a TV broadcast). Although curbside parking uses public streets, it is clearly not a public good; each motorist who parks takes a potential space away from another motorist, likewise curb cuts for driveways take part of the public right of way and assign it for the exclusive use of the driveway owner. In most dense urban areas, there is excessive demand for curbside parking. In areas where parking is free or underpriced, this means that the curb is almost always full.

Transportation policy and parking policy: two separate realms

While curbside and off-street parking clearly constitute a city's parking supply, it is rare that consistent policy is set or managed in a way that recognizes their influence on each other. The lack of coordination between transportation agencies that manage the street systems and planning departments that set parking requirements underscores a larger disconnect between transportation and land use planning. Though criticized for its ineffectiveness, the federal government has attempted to address this through successive federal transportation bills. However, the fact remains that transportation policy is most frequently set at a regional, state or national scale and land use policy is set and implemented locally, by sometimes very small towns and lightly populated counties. For example in the nine-county region around Philadelphia there are over 350 local cities and townships which set land use policy without regard for neighboring jurisdictions or larger state or regional goals. While both curbside and off-street parking policies are set locally, the broader transportation context is set regionally and at the state level. This issue is squarely at the crossroads of transportation and land use planning, off-street parking is part of the transportation system but completely regulated by land use plans.

Parking policy, as well, is split into two separate realms with street departments responsible for curbside management and planning departments responsible for off-street supply. Off-street is further divided into public access and accessory parking. Commercial parking is frequently owned and operated by private corporations with prices set at profit earning levels, sometimes it is municipally owned and either municipally or privately operated. In the latter two cases, prices are seldom set to maximize profit but at a politically expedient level or in some cases—e.g. when managed by parking benefit districts[18]—to promote economic development or other transportation goals. Both of these are public access arrangements as these lots are open to all motorists. Accessory parking is parking that is used almost exclusively by patrons of a particular building, and it is usually provided without charge. The cost of such parking is absorbed into other revenue generating centers of the building.

It is unfortunate that on-street and off-street parking have been treated primarily in separate domains with coordination of these two arenas occurring in rare instances, and sometimes only at the behest of small business improvement areas (see Boulder case study p. 56).

Early mitigations

As early as 1973, three major U.S. cities instituted caps on downtown off-street parking to settle litigation forcing them to comply with the Clean Air Act. These parking restrictions, which explicitly recognize that parking supply contributes to congestion and air pollution, were codified in legal agreements between the cities and the federal government (see Parking Freezes box p. 43).

With the exception of Boulder, Colorado and Portland, Oregon (see case studies p. 56 and p. 54, respectively), there was very little innovation in parking policy for the next 20 years. More recently, a small but increasing number of initiatives have been undertaken in U.S. cities to correct the unintended consequences of past parking policy. They also seek to use parking policy to restore urban centers, mitigating some of the congestion, air pollution, and infrastructure and public health costs associated with over-reliance on automobiles.

Part 2: Current State of Parking Practice in the U.S.

Curbside

Managing "commercial" curb parking

American transportation planners and traffic engineers divide city streets into two basic types: commercial and residential. Commercial streets have retail store fronts or are in central business districts (CBDs). In this section we are most interested in examining commercial on-street parking because this is where the competition for parking is greatest, and the proper functioning of the curb is most important to the transportation system and the overall public benefit. There is a universal consensus among U.S. transportation planners that curbside parking on commercial streets is best used by short-time parkers, including: delivery and service vehicles and short term visitors, often shoppers. Parking shortages are frequently perceived when the curb is full yet nearby off-street commercial lots may be well below capacity.

There are five direct ways to address demand for urban curbside parking, described here from least to most effective.

Increasing supply

As previously noted, the most popular American strategy for managing the demand for curbside parking has been to increase the supply of off-street parking. As U.S. cities experienced curbside parking shortages, they mandated off-street parking and / or encouraged private garages. There are multiple problems with this approach. Increasing the off-street parking supply encourages more driving. Since the supply of urban street space is fixed, additional driving contributes to traffic congestion, air pollution and other social costs. It also consumes valuable land in the urban core and degrades the pedestrian environment. And, if the cost of curbside parking is lower than off-street parking, additional garages do not reduce curb congestion.

If the cost of curbside parking is significantly below that of off-street, the addition of garages is ineffective in addressing congested curbside parking. In New York City, for example, the Department of Transportation is piloting a "ParkSmart" program which increased meter rates in Park Slope, Brooklyn, from $0.75 to $1.50 per hour during the parking peak. In Greenwich Village, rates have been increased from $1 to $3 per hour as a result of the program. Yet off-street parking rates range between $13 and $25 per hour[19] with the typical rate being $15 or $16. The rate differential results in a $12 to $13 savings per every hour parked at the curb, which is essentially equivalent to paying oneself $12 per hour if it takes a full hour to find a curbside spot. Spending 15 minutes to save $12 is the equivalent hourly rate of someone earning $100,000 annual salary. Indeed, as one recent Philadelphia news reporter[20] said in response to that city's parking meter increase, "Circling the block to find a parking meter is a daunting task, but it's worth it to save a couple of a [*sic*] bucks." Assuming a curbside spot could be found at any moment within an hour the strategy of searching is cost effective for someone who values his or her time up to $56 an hour. If it takes at least 10

ParkSmart meters lining the street in Park Slope, Brooklyn
NYC DEPARTMENT OF TRANSPORTATION

minutes but not more than one hour to find a spot, the expected pay back to the searcher is at a rate of $26 an hour. Many people will not want to bother searching or keeping the meter paid and will immediately enter a lot, but others will continue to exploit the advantage to be gained by cruising for parking.

Even longer term rates (i.e. all day parking) in garages are typically higher than curbside rates. Using New York City again to illustrate, CBD meter rates (outside the ParkSmart pilot areas) are $2 per hour. It would cost $8 to park there for a half day, paying the hourly meter rate, but exceeding the time limit, a common practice. Garage parking in the CBD ranges from $14 to $60 for four hours (it would be the same for eight hours), with a typical rate of $15 or $20[21] for a curbside savings of $7 to $12. All day parking at the curb would finally be equivalent to the low end of the price range for garage parking.

Typical downtown curbside meter and commercial garage rates are shown in Appendix A.

Where these rate differentials exist, drivers have a huge incentive to search for curbside metered parking and, when and if they do find a spot, to occupy it beyond the legal limit.

Where accessory parking is abundant, as in many U.S. cities, the cost to park is usually free. Where it is not, "parking validation" is a common practice where the parking charges are paid by the merchant and not the customer. A merchant will stamp, or validate a customer's parking ticket so that the charges are waived for the customer, but accrue to the merchant. Both accessory parking and validation are a form of "bundling" the cost of parking with the development or activity. In the case of bundling, the cost is passed along to all residents, employees and shoppers using the building, whether they are drivers or not. It amounts to a subsidy for driving. See additional details under "The costs of parking," page 31.

Managing demand

The remaining four curb management approaches attempt to "ration" the use of the fixed curb parking supply through pricing, time limits, and restrictions on user groups. In practice many cities use a mixture of approaches.

Restrictions on user groups

Restrictions on user groups can work well if the privileged group, usually commercial vehicles, is also subject to metering and expected to park for short time periods. The most common form of curbside restriction on commercial streets is to ban private cars and allow only vehicles with commercial license plates or permits. These "commercial vehicle only" rules are typically combined with time limits and / or commercial vehicle meters. New York City both meters commercial vehicles and bans private cars from parking on most arterial streets in its central business districts, as does Houston in its metered CBD "Red Zones." These restricted meter zones work well.

Restrictions that allow privileged user groups to park for long periods at the curb without metering contribute to parking shortages and traffic dysfunction. Examples are parking permits for the private cars of government employees and handicap parking permits. Both kinds are widely abused in the cities where they are used. For example, in New York City and San Francisco permit holders consume a hugely disproportionate amount of the curbside spaces. However, in the past two years, NYC has eliminated more than half of the parking permits held by public employees, a reduction of more than 75,000.

Time limits

Time limits are among the earliest and most common ways to ration space. They have repeatedly been shown to be ineffective and are difficult to enforce. Comprehensive surveys compiled by the *Handbook of Transportation Engineering*, 2004, of unmetered locations in times and places as far apart as Rochester, New York, in 1937, Germany in 1991, Seattle in 2000 found that 40 percent to 60 percent of vehicles overstay free time limits. In Seattle, the average time in one-hour spaces was 2.1 hours. Time limits tend to result in a "shuffle" in which commuters and other long-term parkers periodically move their cars to avoid being ticketed. Not only are time limits difficult to enforce, they are also inherently inefficient compared to metering. Motorists parked at a meter have an incentive, however small, to limit their stay to less than the maximum allowed time. Motorists with free, time limited parking, have no incentive to reduce their parking stays and therefore have been found to park longer than metered parkers.

Curbside parking bans

As far back as the 1920s, American cities banned curbside parking on commercial streets, and many still do. Cities use the curbside space for buses, through traffic or turning lanes. Also, common are peak-hour parking bans and off-peak delivery hours. Curbside parking bans are generally easy to enforce and are

frequently, though not always, complied with. They allow optimal use of the curb during periods of highest demand, for example, for peak hour bus service. However, where road capacity is adequate and off-street parking scarce, curbside parking bans may not be practical or desirable. As interest in Bus Rapid Transit grows, there has been more demand for dedicated bus-way space and growing interest in curbside parking bans.

Metering the curb

Transportation experts quickly recognized the connection between meter prices, curb occupancy and cruising. By 1937, there were detailed studies showing that underpriced curbs led to high occupancy which, in turn, resulted in cruising for a bargain. In 1954, Nobel Prize winning economist William Vickrey explained why higher peak hour metering, and metering generally, was superior to time limits. New technologies, especially meters which take credit cards, have made varying meter prices much easier. As cities begin to experiment with peak-hour meter pricing a number of important conceptual issues have come to the fore. The most important question is how much to charge at the meter. The 1956 BPR report suggests an occupancy rate greater than 90 percent indicated a problem. Donald Shoup has advocated and popularized an 85 percent curbside occupancy target, which has been widely adopted and many experts now advocate setting meter rates at a price that results in an 85 percent occupancy, or one open spot per block. This might be thought of as a market clearing price. Metering is a response to the irrationality of the claim that "paying with your time" is as reasonable a rationing algorithm as paying with money. But this discounts two important facts. First, the motorists cruising for parking pays with his or her time, *and* the time of everyone stuck in traffic behind him. Second, neighborhood residents suffer from the additional air pollution, noise, danger and degraded quality of life caused by cruising and the additional traffic congestion it engenders.

In 1954, Nobel Prize winning economist William Vickrey explained why higher peak hour metering, and metering generally, was superior to time limits. New technologies, especially meters which take credit cards, have made varying meter prices much easier.

Off-street

Regulating parking through zoning

With the exception of Houston, all large cities in the United States enforce parking regulations through zoning, the primary tool for land use regulation.[22] Zoning is done at the municipal level, though it requires state level enabling legislation. Municipalities have practiced zoning since 1916 when New York City introduced the country's first zoning ordinance. The United States Department of Commerce created the Standard State Zoning Enabling Act of 1921; which has served as a model for zoning enabling legislation across the nation. In a 1926 court challenge to the legality of zoning as land use regulation, the U.S. Supreme Court ruled zoning legal and constitutional. By 1930 more half the states had adopted zoning laws. Today, all states allow zoning regulations.

The three main types of zoning regulate land by:

- Use (Euclidean Zoning)
- Design (form-based zoning)
- Incentives.

Though Euclidean zoning[23] is by far the most common, together these three methods govern a given parcel's permitted use—whether industrial, residential, commercial, entertainment, or a mixture—and the building characteristics, such as height, lot coverage, setbacks and proportions, and of course, parking requirements. Many municipal planning agencies create zoning codes in compliance with a comprehensive plan that sets the framework for the plan and related zoning code. Most municipalities also employ appeals systems comprised of elected or appointed officials who grant use or form variances to landowners who demonstrate hardships imposed by the existing zoning. In some cases appeals can be used to alter the amount of parking required and / or permitted.

The proliferation of single-use Euclidean zoning throughout the U.S. resulted in the separation of land uses. Homes are separated from manufacturing and office land uses which, in turn, are separated from shopping and entertainment places.

The proliferation of single-use Euclidean zoning throughout the U.S. resulted in the separation of land uses. Homes are separated from manufacturing and office land uses which, in turn, are separated from shopping and entertainment places. This segregation has resulted in the need to overcome greater distances between home and the activities of life. Great reliance on private automobiles became the solution to bridge these growing geographic divides. The spatial requirements needed to accommodate automobiles, such as parking and rights-of-way, forced even more space between uses, reinforcing the cycle of auto dependence. Highway funding and development comes from the top of the U.S. government structure and transportation planning is typically done at the regional level. To receive federal transportation funds large regions are required to have a legitimate regional transportation plan—the solution to the growing problem of just where to *put* Americans' parked cars emerged within the planning agencies of municipalities throughout the country.

Minimum parking requirements

Since the 1930s, planners have imposed minimum off-street parking requirements to accommodate peak parking demand for an ever-increasing number of defined land uses.[24]

The rationale for creating parking minimums stems from the concern that new developments will fail to provide adequate parking. The assumption is that this lack of parking will create traffic congestion, causing parking to spill over into surrounding neighborhoods where it will compete with current land uses. The resulting scarcity of spaces will lead to cruising, thereby increasing traffic congestion and illegal parking. In addition, planners were concerned that a building's future use may have a higher parking demand than its current use and jurisdictions would have no future recourse to hold tenants accountable for parking shortages due to future changes in land use.[25] Today, municipalities

specify minimum off-street parking requirements for hundreds of different land uses. The underlying idea, that parking demands of new development should not be borne by adjacent areas, is still adhered to but, given the unintended consequences described in Section One, the approach is coming under increasing challenge (see Hudson Yards, NYC box p. 29).

Minimum parking regulations impose major societal costs and undermine efforts to create balanced, sustainable transportation systems. . As discussed earlier in this text and also in *The High Cost of Free Parking*, minimum parking regulations create a cycle that encourages transportation by private automobile, and, in turn, influences public authorities to require more parking. This analysis is strengthened by a New York study which found that accessory parking at home is more likely to generate auto commutes than other factors including household income, auto ownership or a host of other things usually associated with the decision to drive [26]. Minimum parking regulations reduce density, and increase distances between destinations. This reduces land values and increases traffic congestion, storm-water runoff pollution, air pollution, and construction costs, as well as discouraging walking, bicycling and public transit.

Minimum parking requirements are especially damaging to central business districts (CBDs). The inherent advantage of CBDs is density and diversity of land uses. Parking consumes scarce land, reduces density and disrupts and degrades the pedestrian environment. Downtown parking, which is expensive to build, makes mixed residential / office land uses extraordinarily expensive, sometimes inhibiting development. As a result, many American cities experience "dead downtowns" which empty out after work.

Alternatively, large surface parking lots scattered throughout downtowns usurp real estate making development less feasible and creating unpleasant districts that repel shoppers and workers alike.

HUDSON YARDS, NEW YORK CITY

In 2004 the New York City Department of City Planning created a redevelopment plan for the Hudson Yards on the west side of Manhattan. The plan required approximately 17,000 new parking spaces. To determine the level of parking planners relied on the principle that parking demand generated by the new development should be met by the new development and not rely on existing parking facilities. The plan did not recognize that both parking demand and driving demand are driven by parking supply. The level of parking called for would inadvertently make driving to the site the preferred mode.

A local civic group understood that parking reduction strategies would complement plans for more efficient access including more public transit, cycling and walking without compromising the development. They knew that the plan would encourage more driving thus undermining the City's efforts to reduce harmful greenhouse gas emissions and to comply with federal clean air standards. The group successfully sued the City claiming that the parking plan violated agreements to meet the federal clean air standards. The new development plan limits parking to about one third of the spaces originally proposed.

Surface parking in downtown Minneapolis, MN between Hennepin Avenue and 8th / 9th Streets
ZACHARY KORB

Implicit in minimum parking requirements are several assumptions and principles that are often unstated in zoning codes. These include:

- Local governments have the responsibility to ensure that each building's users are able to access the building by private automobile.
- Each of these users should be able to park at the building without wait at peak hours.
- The cost of these spaces is irrelevant; additional development costs associated with required parking is simply a cost of doing business, no different from meeting standards of structural integrity.

As shown in the section "Determining minimum requirements," whether or not off-street parking provides a necessary service and prevents parking spillover into adjacent neighborhoods, the methods used to determine the required number of spaces per land use is typically arbitrary and ad hoc.

Developer response

Studies suggest that the majority of developments build just the amount of parking required by a city's zoning code. One study[27] found that 70 percent of suburban office developments in southern California built exactly the minimum required amount of parking. Similarly, a Chicago Regional Transportation Authority study of office developments in 10 Chicago suburbs found that developers did not supply more parking than the minimum required.[28]

Many cities use ITE's *Parking Generation* manual, with its small samples of peak parking demand in suburban locales, as the basis of their *minimum* requirements. The result is that many of the constructed parking spaces are empty most of the time. Since there is no demand for many of these spots much of the year, the market price of these always empty parking spaces is close to zero, which

helps explains why 99 percent of all auto trips end in a free parking space. The surplus spaces keep parking costs very low and encourage single occupant vehicle use and its attendant societal costs. The excess spaces also prevent property owners from properly pricing parking and compel them to spread the high costs of building and maintaining these spaces—both occupied and empty—throughout the driving and non-driving populace. Recent research has illuminated precisely what these costs are.

The costs of parking

According to one source, 10 percent of development costs are typically dedicated to parking.[29] Parking costs depend on a number of factors that vary by region, including local land values, the costs of construction, and other aspects such as facility type and size. Regardless of the construction costs, a common thread throughout U.S. municipalities is the small proportion of the total cost actually paid by users. A typical user pays just 5 percent of non-residential parking costs.[30] Two funding sources—public subsidies and developer capital—finance the remaining cost. Thus, the cost of providing parking is passed on to all taxpayers and users of the development for which parking is required regardless of their transportation choices.

Direct costs

The physical costs of constructing, operating, and maintaining parking spaces are easiest to measure, and are, therefore, the best documented. They include the cost of land, construction, and operations, as well as the opportunity costs.

Off-street parking spaces tend to occupy an average 300–350 square feet / space, including access lanes and landscaping. This translates to 100–150 spaces / acre for a surface lot. Urban land tends to be more expensive than suburban and rural land, and structured parking tends to be cost-effective only when land prices are greater than $1M per acre.[31]

Construction costs vary according to the type of facility. Parking structures are more expensive than surface lots, and underground garages, which require excavation, waterproofing, shoring, ventilation and round-the-clock lighting, rendering them the most expensive.[32]

According to the building construction cost clearinghouse RS Means, the 2009 median price of above-ground parking structures was $18,300 / space.[33] Each space in a parking structure roughly amounts to between $105 and $180 / month. Larger structures may enjoy greater economies of scale since smaller structures must distribute the fixed costs of elevators, ramps, and stairwells among fewer spaces.

Cleaning, lighting, maintenance, repairs, security, landscaping, snow removal, access control (e.g., entrance gates), fee collection (for priced parking), enforcement, insurance, labor and administration all make up parking facility operating costs. A 2005 survey shows that operating costs at commercial facilities range from $450–$850 per space per year.[34]

And as with all developments, opportunity costs factor into the total cost of providing parking. Land devoted to parking could also be used for buildings to lease or sell. The higher a parcel's value, the greater the opportunity costs. These costs are therefore particularly high in central urban areas.

Table 1: Typical Parking Facility Costs
SOURCE: VICTORIA TRANSPORT POLICY INSTITUTE, 2009. ASSUMES 7% ANNUAL INTEREST RATE, AMORTIZED OVER 20 YEARS (2005 DOLLARS)

Type of Facility	Land Costs Per Acre (000s)	Land Costs Per Space	Construction Costs Per Space	O & M Costs Annual, Per Space	Annual Cost Annual, Per Space	Monthly Cost Monthly, Per Space
Suburban, On-Street	$50	$200	$2,000	$200	$408	$34
Suburban, Surface, Free Land	$0	$0	$2,000	$200	$389	$32
Suburban, Surface	$50	$455	$2,000	$200	$432	$36
Suburban, 2-Level Structure	$50	$227	$10,000	$300	$1,265	$105
Urban, On-Street	$250	$1,000	$3,000	$200	$578	$48
Urban, Surface	$250	$2,083	$3,000	$300	$780	$65
Urban, 3-Level Structure	$250	$694	$12,000	$400	$1,598	$133
Urban, Underground	$250	$0	$20,000	$400	$2,288	$191
CBD, Surface	$2,000	$15,385	$3,000	$300	$2,035	$170
CBD, 4-Level Structure	$2,000	$3,846	$15,000	$400	$2,179	$182
CBD, Underground	$2,000	$0	$25,000	$500	$2,645	$220

External costs

A recent study of off-street parking in New York City notes that expanding parking infrastructure serves latent demand by adding capacity and induces additional demand by reducing costs.[35] Thus, parking spaces not only incur construction costs, but induce travel by private automobile. That additional auto use in turn creates additional, indirect costs in the form of traffic congestion, vehicle emissions, costly crashes and injuries to pedestrians, cyclists and other motorists. It also imposes environmental externalities, such as storm-water runoff, flooding and the urban heat island effect.

Congestion creates additional time and fuel consumption costs, which may be measured by fuel costs per mile traveled. The cost of vehicle emissions may be calculated by determining the cost of reducing the average amount of pollutants generated per vehicle mile traveled. Specific costs differ across cities according to their existing congestion and air quality, and fluctuate according to the price of fuel. For instance, the average combined congestion and emissions costs for Los Angeles has been estimated at about 16 cents per vehicle mile traveled, whereas in New Jersey it is between 8 and 13 cents per vehicle mile traveled.[36] The additional travel induced by increased parking supply contributes to these additional external costs.

Impact of parking on costs of other resources

Required parking spaces add costs to developments that are often passed through to the tenants and users. For instance, a study found that each parking space provided for urban affordable housing, adds 12.5 percent to the total

development costs.[37] Nonprofit affordable housing developers in San Francisco report that the city's requirements added 20 percent to the cost of each unit and decreased the number of buildable units on site by 20 percent.[38] Using a hedonic price model for homes in six San Francisco neighborhoods, a 1999 study determined that the price of single family homes and condos that included off-street parking was over 10 percent higher than those that did not include parking.[39] Though the result is due to two unrelated studies and may not be directly comparable, if the additional development cost to provide parking is 12.5 percent of a unit cost and only yields an additional 10 percent on the sale price then inclusion of off-street parking is valued in the market below its cost to provide. The parking is subsidized by the unit.

When public parking is privately owned and operated (off-street)

The majority of commercial off-street parking available to the public in the U.S. is owned by private companies. Additionally, private companies operate government owned garages in many central business districts. There are significant policy implications to the public and private ownership of off-street parking.

The goal of private garage owners is to maximize profit. Because demand for short-term parking is less elastic than everyday commuter parking, private garages make much of their profit by charging very high rates for the first hour. It is also likely that their labor costs are reduced by accommodating long-term parkers rather than high turnover which requires more intervention. The net effect is a price structure that charges high rates for short-term parking. Unless curbside meters are comparably priced which occurs more frequently when the curbside and off-street is managed jointly, as in Boulder and Ann Arbor, these high first hour prices increase demand for curb parking, and add to cruising and double parking. This phenomenon is observed in Manhattan, downtown San Francisco, and within the Chicago Loop.

Part 3: Rethinking the Curb and Traditional Parking Policies

Curbside parking

There are two basic problems associated with on-street parking: too much demand (high occupancy) and insufficient enforcement of existing regulations. This section highlights some of the innovative policies and technologies used to address these problems. Since parking policy is so highly political, new parking innovations are often as much a response to political constraints as they are to practical issues.

Curb Occupancy

Measuring turnover versus measuring occupancy

Historically, parking meter rates have been determined, somewhat arbitrarily, by politics and "turnover" with the goal of maintaining 100 percent occupancy, though early guidance indicates that occupancy below 90 percent is desired.[40] Turnover measures how many vehicles occupy a parking spot in a given time period. A fundamental conceit of current parking practice is that 100 percent curb occupancy is attainable if the right turnover is established. While in theory full occupancy has some appeal, in practice it is impossible to achieve. One hundred percent occupancy would require a perfect choreography between the arrival and departure of motorists or a queue of waiting vehicles standing ready to occupy each newly vacated space. To complicate the issue, there is no standard definition of turnover, there is no optimal turnover rate and there is no standard way of measuring it. As a result, even traffic professionals are not really sure what turnover calculations done by other cities or agencies really mean. In fact, it is impossible to have an optimal turnover rate, since the optimal turnover would naturally vary depending on specific land-use, and land uses are endlessly varied. In the real world, 100 percent occupancy, typically even 90 percent, results in cruising, double parking and other illegal parking. Turnover is difficult to measure, so when turnover is the basic measure of success, it is difficult to know whether or not policy objectives are being met and equally difficult to make policy corrections when they are not met.

In contrast, curbside occupancy targets are easy to measure. Keeping one open spot per block ensures motorists do not need to circle or park illegally. It is also relatively easy to gradually increase or decrease meter rates until this rate is achieved. Different prices can also be set to address the different levels of demand experienced at different times of day. New York City, San Francisco and a number of smaller cities are experimenting with variable meter rates, in which higher meter prices are charged during periods of highest demand.

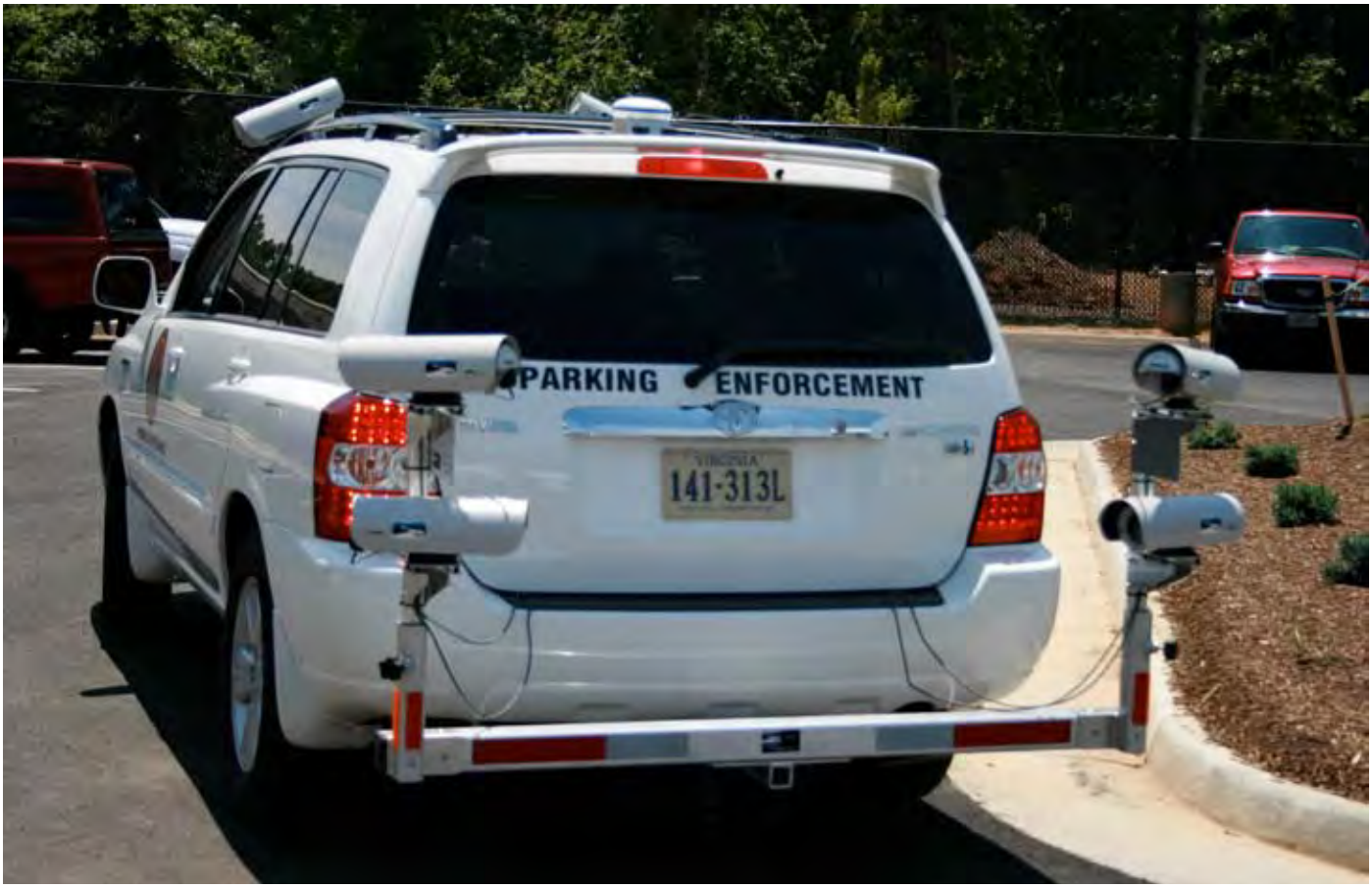
In U.S. cities, illegal curbside parking is a big portion of all parking

In American cities with high curb demand, poor enforcement and underpriced curb space combine to produce large scale illegal parking. There is strong evidence to suggest that a large share of all curb parkers overstay their time or fail to put money in the meters. A 2004 University of California study in the City of

Berkeley found 32 percent of motorists in one-hour metered parking overstayed. Though curbs were 90 percent occupied, parking turnover for eight hours was only 4.2 vehicles, instead of the roughly 7 to 8 expected if all parkers heeded the one hour time limit. Furthermore, surveys suggest that 30 percent of driving commuters in the area parked illegally every day. A 2007 study by the San Francisco comptroller found that in and near downtown, more than a third of parkers overstayed time limits or did not pay at metered parking.[41] San Francisco also found that disabled permit holders, who comprise 10 percent of all vehicles, occupied 20 percent of all available metered time. In 1998 Arlington County, Virginia, where vehicles displaying handicap license plates or placards had been allowed to park for free, revoked that privilege because of well documented placard abuse. In New York City placard abuse by government employees has also been well documented.[42]

Other studies such as one conducted in 2008 in New York City found 20 percent of all vehicles parked in one Brooklyn neighborhood were illegally parked. A similar study in Manhattan found the average stay in one hour metered parking was 93 minutes. Audits by a scanner equipped vehicle in Fredericksburg, Virginia, found that 25 percent of all curbside parkers overstayed time limits. In that case rigorous enforcement, using the same scanner vehicle, created 20 percent more parking availability. In Seattle, Washington, 2,000 spaces in 35 neighborhoods were surveyed. Analysts found that the average parking duration in one hour parking zones was 2.1 hours.

Enforcement vehicle with mounted cameras used to scan parked cars in Fredericksburg, VA
FREDERICKSBURG POLICE DEPARTMENT



A 2007 study in Park Slope, Brooklyn, found that illegal parking increases exponentially as curb occupancy exceeds 85 percent.[43] This means that one form of illegal parking, overstaying time limits, triggers other types of illegal parking. The most common infractions are parking in no standing or no parking zones followed closely by double parking, other violations include parking at bus stops, blocking fire hydrants and overstaying time limits.[44] Vehicles are also observed parking in driveways and sometimes on sidewalks.

The scale of illegal parking in the U.S. has major implications for street management. Double parked vehicles significantly degrade available street capacity, delay buses and endanger cyclists and pedestrians. Vehicles parked in bus stops force buses to stop in traffic lanes also degrading street capacity. Vehicles parked in loading zones prevent trucks from accessing the curbs, and vehicles in fire hydrants cause unnecessary risk where cities have attempted to maintain safety standards.

The airport model

Sometimes high occupancy results from the poor distribution of the demand. This can take place when there is a poor match between supply and demand when the excess supply may be relatively near-by. A nearly universal airport model of parking management parcels parking into short-, mid-, and long- term parking. The supply is managed by pricing the lots to distribute parkers among them. There is a huge amount of variation in the actual rates but the general principal is that the daily maximum cost of short-term parking is typically three or four times the daily maximum for long-term parking. The pricing mechanism

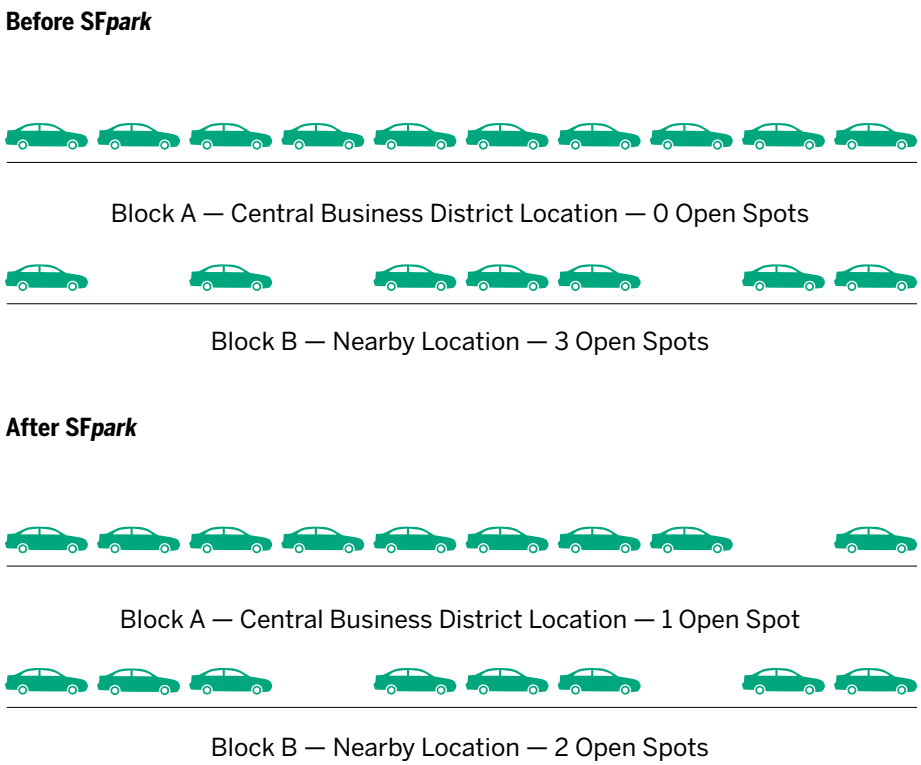


Figure 3: S*Fpark*, San Francisco's curbside parking reform plan, illustrates the logic of the airport model

rations the parking in such a way that travelers wanting to leave their vehicles for several days are encouraged to park remotely and use a shuttle to arrive at the terminal, while people who are simply dropping off or picking up passengers and only need a half hour or an hour of time will be able to easily access the terminal.

The urban analog is commuters and other all-day parkers versus parkers who are making deliveries, shopping, picking up an item or attending a meeting. From a space rationing perspective it makes more sense to have employees of an establishment—who will be there for several hours a day—park somewhat more remotely[45] and walk a block or two to their destination rather than have someone else walk a block or two to perform a short task. The scheme is very well accepted in the case of airports but has gained little traction in cities where meter rates tend to be more uniform. Some cities operate shuttle services from remote parking fields to downtowns, but these add to travel time and have not been popular.

Increasing metering opportunities

There is usually local political opposition to metering more parking. Even in areas with high spillover and very high curbside parking demand, the political cost of metering more parking is perceived to outweigh the public benefit. Metering is, therefore, typically constrained to spots directly in front of retail store fronts and on arterial streets. As a result there is often a high level of curb dysfunction in dense neighborhoods with mixed land-uses, because only a small share of total curbside parking is metered. This encourages cruising for free parking on non-metered side streets. The only cities we have identified as adding new metered spots are Houston and Chicago. As part of the creation of 20 miles of new light rail, Houston is more than doubling the number of parking spots it meters. By 2016, Houston plans to add 7,500 new metered spots to the 6,300 spots it already meters. Many of the new metered spots will be near light rail stations and areas expected to have land use changes because of the new transit. In Chicago the city has entered a long term lease turning over future meter revenue on 34,500 meters but it will establish 4,400 new metered spots for which the city will retain control.

In Chicago the city has entered a long term lease turning over future meter revenue on 34,500 meters but it will establish 4,400 new metered spots for which the city will retain control.

Parking enforcement: technological transformations

Urban parking managers agree that consistent, frequent parking enforcement is essential if curbside rules and meters are to be effective. However, they also agree that illegal parking is rampant, and enforcement, especially in big cities, is grossly inadequate, sporadic, and not well distributed. In some parts of San Francisco, fewer than 20 percent of vehicles are legally parked. This level of illegal parking may seem surprising since parking fines can be expensive. However, parking managers in several cites told us that their city councils approve inadequate numbers of parking agents because parking enforcement is unpopular.

Along with being understaffed, parking enforcers face a myriad of obstacles, ranging from difficulty enforcing time limits to being bullied and assaulted by motorists. However, parking enforcement appears to be on the cusp of major technological advances that will result in stricter and more consistent enforcement. In turn, reliable enforcement has been shown to significantly increase available parking and turnover. Parking enforcement can be divided into four tasks—detection, ticketing, collection and adjudication—all of which are being transformed by technology.

Detection

There are two major, and very new, technological advances in detecting and responding to illegal parking. These include networked curbside sensors, like those to be used in San Francisco's SF*park* and vehicle mounted scanners using vehicle and / or license plate recognition. Curbside sensors can determine how long vehicles are parked and they can direct enforcement agents to vehicles which have not paid or are over time limits. Vehicle mounted scanners, like AutoChalk and AutoVue, have been used in Fredericksburg, Virginia, and Santa Barbara, California, to keep track of how long vehicles remain parked and issue automatic citations when appropriate. License Plate Recognition (LPR) reads plates and determines if a vehicle is over the time limit, registered in a residential permit parking zone or even stolen. LPR for parking enforcement is in use in smaller cities including Ft. Collins, Colorado, to enforce time limits. LPR is also in use on 100 street-cleaning vehicles in Chicago.

AutoChalk is a vehicle mounted scanner used for parking enforcement in Santa Barbara, CA
SANTA BARBARA POLICE DEPARTMENT

Ticketing / Citations

Most large cities and towns employ parking agents, equipped with handheld computers or PDAs. The handhelds scan vehicle windshield registration stickers, print tickets and transmit citation information to a central computer. The next generation of enforcement technology is vehicle mounted detection systems like Autochalk and Autovue which can automatically issue tickets. These systems are currently uncommon because they are new to the market and can be expensive and in many places their adoption is constrained by political opposition and by laws forbidding photo enforcement.

Collection and adjudication

Modern ticketing software significantly reduces errors. This translates into much higher payment of fines and fewer voided tickets. Additionally, many jurisdictions use PDAs which photograph illegally parked vehicles.

Curb pricing technology

The technological revolution spawned by the advent of the microchip and wireless networking is changing how Americans pay for curbside parking. This is important to policy makers because new, credit card and cash capable, meters and pay-by-phone systems make variable meter pricing and higher meter rates much easier to implement than coin only meters. Experts suggest that much of the real technological advance has been in software system integration which allows for secure credit card payment and extremely accurate auditing of cash payments and automated receipts.

Many parking meter experts believe that within 20 to 30 years, parking meters will be completely replaced by pay-by-phone, pay by web, SMS text messaging or other digital systems. However, the tech transformation is still in its early days. Parking industry experts estimate that fewer than 10 percent of the country's approximately two million metered curbside spots are metered by modern multi-space meters which can take credit cards or cash. Less than 2 percent of metered spots can be paid by phone. Furthermore, roughly 85 percent of meters still take only coins.

Multi-space meters

The state of the art curbside meters are solar powered, wireless, multi-space, pay and display meters. Each meter controls eight to ten parking spots and is networked with a central computer which can process credit and pre-paid parking cards. Multi-space meters have several advantages which accrue to both the user and the city. Their ease of payment, capable of handling credit cards, prepaid cards, cash and taking payment by cell phone, have increased the convenience and popularity with the public. Because each meter handles eight to ten cars, the actual parking spot designation is less rigid. Depending on the vehicle size, this sometimes results in up to 15 percent more parking spaces than would be available using conventional meters and conventional spacing.

Drivers pay 25 cents for 5 minutes of curbside parking in Chicago, IL
COURTESY OF ITSBETTERONAMAC/FLICKR

Multi-space parking meter in Chicago
COURTESY OF WIKIMEDIA COMMONS

From a city's perspective multi-space meters are more reliable than coin machines which are often out of service due to vandalism or sabotage. They have a higher revenue return—typically 20 percent to 30 percent more—due to increased ease of payment. The computerized audit trail reduces theft and employee pilferage, improves revenue tracking and provides good data for policy analysis. The meters also allow flexible pricing which is extremely important for cities that wish to vary their meter rates to manage demand throughout the day.

Pay-by-Phone parking is available in Miami, FL
ZEB DROPKIN

Pay by phone

Miami, Florida has the largest pay-by-phone curbside operation in the U.S. with 5,500 spots and plans to expand to 8,000 within the next few years. Motorists there are very enthusiastic about the service, which includes texted reminders that parking time is expiring and the option to pay to extend time. Numerous other U.S. cities are using pay-by-phone on a smaller scale, and use is spreading rapidly. Even meter manufacturers say that pay-by-cell or Smart Phone will eventually become the primary form of payment. However, pay-by-phone is still new in the U.S., and older motorists and those without credit cards have not embraced it. Adoption has also been slowed by high cell phone charges. Miami motorists using pay-by-phone pay $1.25 / hour for parking and a $0.35 charge to their cell phone.

Sensors and data integration

New meters can be networked with software which allows parking managers to easily assess revenue and parking activity at a glance. The technology is so new that meter vendors say few cities have taken full advantage of it. Two that have are San Francisco and Los Angeles where experimentation with parking sensors is ongoing. (see San Francisco case study, p. 50).

Information on space availability

Seattle is attempting to reduce pressure on curbside parking by directing more parkers to off-street parking garages via the large scale introduction of a real-time Electronic Guidance System which tells motorists via variable message signs and the web what parking is available in nearby garages. The system is based on those installed in major German as well as other European cities. It will be operational in 2012. A drawback of electronic guidance systems is that they are generally unattractive adding to the visual noise of a district. Urban design considerations may restrict their use.

A rendering of the electronic parking guidance system planned for Seattle, Washington
SEATTLE DEPARTMENT OF TRANSPORTATION

In-Vehicle meters

As of this writing, in-vehicle meters are used in few places and are thought by both industry vendors and city parking managers to have been leapfrogged by pay-by-phone / PDA technology and to have no future.

Private versus public parking: Curbside

It is very common in the U.S. for private businesses to have a role in curbside operations. In all cases, the municipal governments set policy to determine how curbside space is used and, if it is used for parking, how that parking is regulated. City governments determine whether a curbside parking spot has a time limit, is metered, what the meter rate is, or whether parking is restricted to certain user groups. City governments also set the fines for parking violations and receive all revenue—even if a private vendor is paid to collect fines.

Outside of determining curb uses and regulations, city governments employ many different combinations of public and private sector workforces to operate their parking systems. In other words, governments set the rules, but how those rules are enforced, parking fines collected, meters maintained, and meter revenue collected, varies a great deal. Most common is for city governments to enforce parking regulations and collect fines, but hire private sector vendors to supply and maintain parking meters, process credit card transactions, and run the computer systems which issue parking and track parking summonses. In some cities, including Charlotte, North Carolina, a private vendor completely manages everything from issuing parking tickets, to adjudicating those tickets. They collect fine revenue, install meters and collect revenue from those meters. Other cities, including New York City, purchase meters from private companies, but conduct all other parking operations using city workers. There is no authoritative analysis of the advantages or disadvantages of various forms of operating curbside parking systems, though one is needed. There appear to be regional patterns, with Southern cities using the most private vendors.

In Chicago, Illinois, meter rates are set based on a contract between the government and a private vendor. (see Chicago case study p. 60) In return for a $1.15 billion upfront payment, Chicago agreed to give 75 years of future meter revenue to a private consortium. However, even in Chicago, the government may raise, lower or eliminate meter prices, or eliminate parking, as long as the vendor is provided the same level of revenue as it would from the contractually agreed upon meter rates. This means that a new metered spot in one area could be substituted for another in a similar location. However, in practical terms, this limits Chicago's ability to convert metered parking to bus or bicycle lanes or other uses. Additionally, Chicago continues to keep all parking fine revenue and enforces and adjudicates parking fines.

Institutional arrangements (hybrid curbside and off-street management)

Parking benefit districts and "revenue return" to neighborhoods

Parking meters were invented to open up curb space for short shopping visits to downtown retail areas. But as time passed, and suburbs rapidly expanded, the same downtown merchants who initially supported metering became afraid that metering would steer customers to free parking at suburban malls. As a

result, meter prices in many American cities remained unchanged for decades. Ironically, these artificially low curbside prices contributed to the exact parking shortages and inconvenience for shoppers so feared by downtown merchants. These fears of the draw of free suburban parking are still a major influence on urban parking policy.

In 1970, Boulder, Colorado, suspected that properly priced curbside parking meters might revitalize its struggling downtown commercial district. Boulder's conceptual breakthrough was to create a Parking Benefit District (PBD), where meter rates would make curb parking more available, pay for parking structures, and pay for streetscape improvements to make the downtown more attractive. Merchants were persuaded that customers would pay more for parking, if they got more in return. A fundamental tenet is to create a "park once" area, where motorists could leave their cars and walk. Thus, PBD's would help restore walkable neighborhoods in city and town centers.

Today, there are approximately 20–30 Parking Benefit Districts in the U.S. Most were established in the 1990s and modeled on the Boulder concept. They are most frequently found on the West Coast but their success has prompted spreading across the country.

The most common Parking Benefit Districts are run by existing Business Improvement Districts in walkable, historic downtown districts where retail businesses have deteriorated because of competition from suburban big box malls. Augmented by funding from a special real estate tax, some or all revenue from curb meters goes to pay for new parking structures and often public space improvements. One of the best known parking benefit districts is Old Pasadena, Los Angeles, which was established in 1995.

The most extensive, and oldest, PBDs are in Boulder, Colorado and Ann Arbor, Michigan. Those PBD's are actively engaged in Travel Demand Management and subsidizing and promoting public transit (see Boulder case study p. 56). Additional, but small-scale, parking meter revenue-return experiments, in which meter revenue pays for streetscape and other improvements in the neighborhood where they are collected, are underway in Washington, D.C., and Austin, Texas. In those cities, a portion of meter revenue is dedicated to cycling, walking and transit improvements in residential neighborhoods. The revenue-return model is predicated on the idea that community acceptance will be heightened if the community sees direct benefits. The Washington, D.C. and Austin programs are too new, and small, to evaluate.

Off-Street

Set Maximum requirements

When cities set minimum standards, they are *requiring* that parking be provided. Maximum standards *allow* parking to be supplied up to a certain level. A few cities imposed parking caps in the 1970s to resolve litigation forcing them to comply with federal air quality standards (see Parking Freezes box p. 39). The connection

between parking supply and auto mode choice was, by then, already established and the parking caps were intended to reduce or arrest auto use. This was one of several strategies to reduce harmful auto emissions.

Recently, additional cities, such as San Francisco, California, Redmond, Washington, and Cambridge, Massachusetts,, have begun to impose *maximum* off-street parking regulations. Their objectives include promotion of higher density development, walkable downtown areas, promotion of transit and other transportation modes (to increase choice and reduce congestion), as well as the original intent of reducing auto use and harmful emissions. Maximums are often coupled with minimums, thus creating a range from which a developer may choose. Similar to minimums, maximum amounts are typically expressed according to square feet of built space in a city's zoning code. In more rare cases, maximums are calibrated to transit capacity (see Portland case study p. 54), but even then the number of spaces is tied to building characteristics.

Parking maximums can be stipulated in many different ways. In some San Francisco areas, for example, the rule is that parking cannot be more than 7 percent of the gross floor area of a building. In Downtown Portland, Oregon, where there is a high level of transit service and where maximums are calibrated to the level of transit service, one parking space is allowed for every 400 square feet of office area which equates roughly to one space per two employees. Smaller cities experimenting with maximums sometimes set them too high to have any effect.[46] Redmond, Washington, for example has set its maximums at 3.5 spaces per 1,000 square feet. Since a typical office layout allows about 250 square feet per worker, the Redmond maximum is about 3.5 spaces per four workers or 1 space per 1.14 people—allowing enough parking so that 87.5 percent of employees can drive alone to work. With parking set so high, the city is unlikely to see non-auto mode shares exceeding 13 percent of commute trips.

PARKING FREEZES

U.S. cities such as Boston, Portland, OR, and New York City have implemented parking freezes to contain the negative impact of excessive off-street parking supplies on congestion, urban form and air quality, under the notion that excess parking enables additional vehicle miles traveled. The 1972 Clean Air Act, which created federal air quality standards for cities, spurred these two northeastern metropolises to forge agreements with the EPA to limit off-street downtown parking growth through parking freezes.[1]

Planning agencies uses freezes to cap the number of public and / or private off-street spaces in specified districts. These policies typically are viable in central cities served by reliable transit options, and encourage development by increasing project profitability, for fewer required spaces allows developers to devote more project square footage to leasable or sellable space [2].

Clean Air Districts: New York & Boston

At the time of the Clean Air Act's passage, New York City's zoning code accommodated substantial off-street parking provisions: it required off-street parking for at least 40% of units in residential developments, allowed up to 225 off-street spaces as-of-right for commercial and civic developments, and allowed public parking lots up to 150 spaces in size as-of-right.[3]

In response, in 1973 the New York State and City of New York adopted the Transportation Control Plan, which aimed to lower the CBDs' off-street parking by 40%. New York City implemented an amendment to its zoning code that froze off-street parking construction in specific districts in the area of Manhattan below East 96th Street and West 110th Street, which includes the city's densest residential areas and the Midtown and Downtown office districts. (continued)

Appropriate limits to the number of off-street parking spaces landowners may develop can meet both city and developer interests. The cities gain environmental benefits from preserved open space, limited impervious surfaces, and more attractive and pedestrian-friendly urban design. In addition, the disincentive to single occupant auto use created by limiting parking availability encourages use of alternatives such as public transit, bicycling, walking and carpooling. Consequent reduction in private automobile use may improve mobility by reducing congestion, and improve air quality. When developers and their competitors each face parking restrictions, they gain from minimizing construction, maintenance and operation costs of typically low-revenue generating land use, and increased FAR and leasable space.

The most rational approach to setting maximums is to pre-determine the desired levels of access by different modes and ensure adequate facilities for each. If high auto access is desired, large amounts of parking should be in place. If high transit access is preferred, more transit capacity and less parking should be made available, likewise for bicycle and pedestrian access. Parking provided in excess of the desired levels of auto access will likely impede the mode split goals.

Eliminate or reduce minimum requirements

The most straightforward parking policy reform that planners may pursue would be to eliminate minimum off-street parking regulations allowing developers and building owners to decide how many spaces to voluntarily provide. Proponents of deregulation argue that these parties are best qualified to make the case-by-case decision of how many parking spaces to provide, for it is in their best financial interest to provide enough parking to satisfy tenants and customers while avoiding a wasteful oversupply.[47]

PARKING FREEZES (CONTINUED)

The 1982 legislation prohibited public parking lots in the Midtown, Downtown and convention center districts. It also replaced the residential minimum requirement with a maximum limit of parking spaces for 20% or 35% of new units, depending on neighborhood; and, reduced the number of allowable parking spaces for hospitals to 100, for 15% of units for hotels (up to 225), and all other commercial and civic spaces to one space per 4000 square feet of floor area (up to 200 total).[4]

The City of Boston implemented a similar parking freeze plan following the passing of the Clean Air Act. Similar to New York, the city's plan is included in a statewide transportation plan, the Massachusetts State Implementation Plan, which created the city's Air Pollution Control Commission. In addition to reducing VMT, the plan aimed to limit CBD public commercial parking ratios to a 1 per 2.500 square feet of commercial floor area.[5] The freeze prohibits parking spaces from increasing beyond 10% of the 1973 levels in downtown Boston.

The city has applied the parking freeze to separate uses in three different neighborhoods over the last few decades: commercial public spaces in the CBD, Back Bay and South End (1973); non-residential, commercial off-street parking in South Boston (1993); and rental and park-and-fly spaces in the airport district of East Boston (1993) .

Data from a 1998 inventory conducted by the city suggests that the parking freeze has successfully limited parking space growth and encouraged use of public transportation for commuting. From 1977–1997 the total number of spaces in these areas grew just 9% from 51,000 to 59,100 spaces, whereas the number of exempt spaces grew by 26%—which the city attributes to employee space growth.[6] And according to a 1992 survey, 43.4% of CBD commuters use transit, compared to 37.1% single occupancy vehicle. The rest carpooled, walked or biked.[7] Increased parking prices have made Boston's blic off-street parking market the second-most expensive in the U.S. (after Manhattan), but the city, however, is one of the largest in compliance with the EPA's standards.[8]