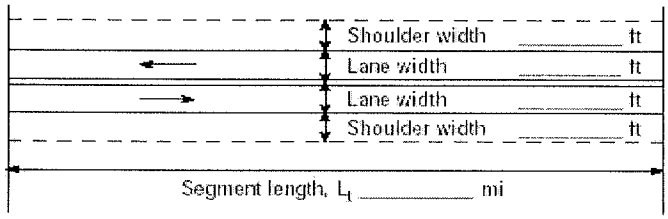
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*MKL*	Highway / Direction of Travel	*Foresthill Road - Westbound*
Agency or Company	*MRO Engineers, Inc.*	From/To	*Spring Garden to Todd Valley W*
Date Performed	*2/27/07*	Jurisdiction	*Placer County*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Buildout Without Forest Ranch*

Project Description: *Foresthill Divide Community Plan*

Input Data



☑ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.70* mi Up/down *-3.4*

Peak-hour factor, PHF *0.88*

No-passing zone *100%*

% Trucks and Buses , P_T *3 %*

% Recreational vehicles, P_R *2%*

Access points/ *mi* *5*

Analysis direction vol., V_d *1305*veh/h

Opposing direction vol., V_o *1117*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.1*	*4.3*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*	*0.909*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*1487*	*1397*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*0.0 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*1.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*0.9 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*58.8 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*35.5 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*0.94*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*1483*	*1345*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*90.0*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*16.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*98.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*E*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.87*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*630*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*2219*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*17.8*

Notes

1. If the highway is extended segment (level) or rolling terrain, fG=1.0 .
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Copyright © 2005 University of Florida, All Rights Reserved

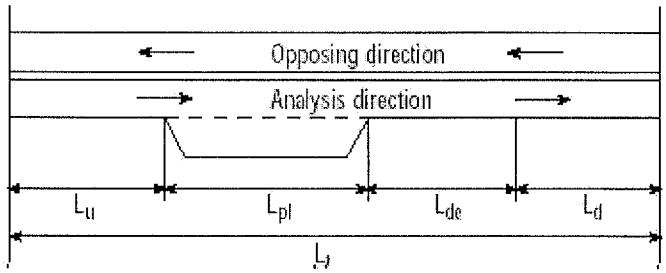
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

General Information		Site Information	
Analyst	*MKL*	Highway of Travel	*Foresthill Road - Westbound*
Agency or Company	*MRO Engineers, Inc.*	From/To	*Spring Garden to Todd Valley W*
Date Performed	*2/27/07*	Jurisdiction	*Placer County*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Buildout Without Forest Ranch*

Project Description: *Foresthill Divide Community Plan*

Input Data

☑ Class I highway ☐ Class II highway



Total length of analysis segment, L_t (*mi*)	*1.7*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*1.7*
Length of passing lane including tapers , L_{pl} (*mi*)	*0.0*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*35.5*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*98.8*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*E*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.70*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.11*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+(2L_{de}/(1+f_{pl}))$)	
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*3.60*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)$=L_t-(L_u+L_{pl}+L_{de})$	*-3.60*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl} (Exhibit 20-24)	*0.62*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$	*98.8*
Level of Service and Other Performance Measures[4]	
Level of service including passing lane LOS_{pl} (Exhibit 20-3 or 20-4)	
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}= VMT_{15}/ATS_{pl}$	

Notes

1. If LOS_d=F, passing lane analysis cannot be performed.
2. If L_d <0, use alternative Equation 20-22.
3. If L_d<0, use alternative Equation 20-20.
4. v/c, VMT_{15} and VMT_{60} are calculated on Directional Two-Lane Highway Segment Worksheet.

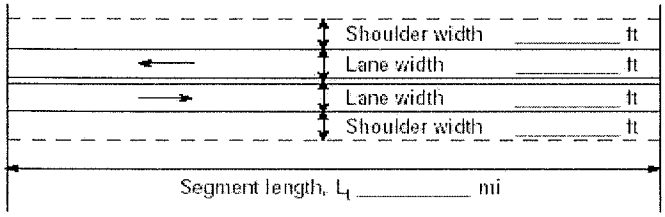
Copyright © 2005 University of Florida, All Rights Reserved

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*MKL*	Highway / Direction of Travel	*Foresthill Road - Eastbound*
Agency or Company	*MRO Engineers, Inc.*	From/To	*Todd Valley W to Owl Hill Ct.*
Date Performed	*2/27/07*	Jurisdiction	*Placer County*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Buildout Without Forest Ranch*

Project Description: *Foresthill Divide Community Plan*

Input Data



☑ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.20* mi Up/down *3.0*

Peak-hour factor, PHF *0.85*

No-passing zone *17%*

% Trucks and Buses , P_T *2 %*

% Recreational vehicles, P_R *2%*

Access points/ *mi* *3*

Analysis direction vol., V_d *956*veh/h

Opposing direction vol., V_o *1119*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*3.7*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.948*	*0.998*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*1186*	*1319*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*0.0 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.8 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*0.5 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*59.3 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*39.3 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*0.93*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*1204*	*1316*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*85.5*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*8.2*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*89.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*E*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.70*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*337*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*1147*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*8.6*

Notes

1. If the highway is extended segment (level) or rolling terrain, fG=1.0 .
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Copyright © 2005 University of Florida, All Rights Reserved

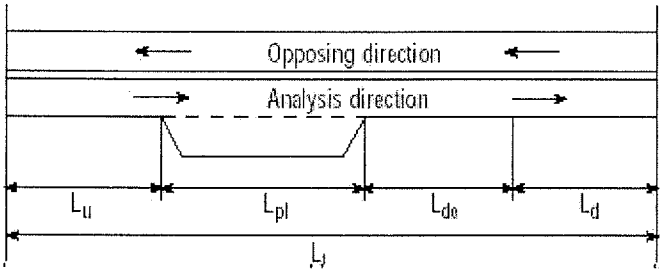
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

General Information		Site Information	
Analyst	*MKL*	Highway of Travel	*Foresthill Road - Eastbound*
Agency or Company	*MRO Engineers, Inc.*	From/To	*Todd Valley W to Owl Hill Ct.*
Date Performed	*2/27/07*	Jurisdiction	*Placer County*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Buildout Without Forest Ranch*

Project Description: *Foresthill Divide Community Plan*

Input Data

☑ Class I highway ☐ Class II highway



Total length of analysis segment, L_t (*mi*)	*1.2*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*0.1*
Length of passing lane including tapers , L_{pl} (*mi*)	*1.0*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*39.3*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*89.3*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*E*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.60*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.11*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+(2L_{de}/(1+f_{pl}))$)	*43.2*
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*3.60*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)$=L_t-(L_u+L_{pl}+L_{de})$	*-3.50*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl} (Exhibit 20-24)	*0.62*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$	*58.3*
Level of Service and Other Performance Measures[4]	
Level of service including passing lane LOS_{pl} (Exhibit 20-3 or 20-4)	*D*
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}= VMT_{15}/ATS_{pl}$	*7.8*

Notes

1. If LOS_d=F, passing lane analysis cannot be performed.
2. If L_d <0, use alternative Equation 20-22.
3. If L_d<0, use alternative Equation 20-20.
4. v/c, VMT_{15} and VMT_{60} are calculated on Directional Two-Lane Highway Segment Worksheet.

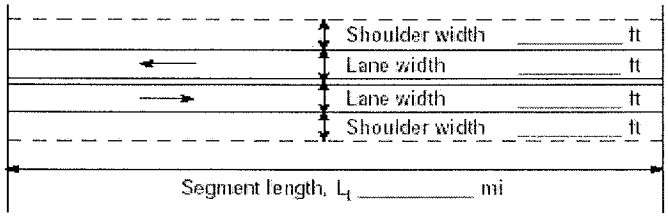
Copyright © 2005 University of Florida, All Rights Reserved *HCS+™* Version 5.21 Generated: 4/3/2007 4:14 PM

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*MKL*	Highway / Direction of Travel	*Foresthill Road - Westbound*
Agency or Company	*MRO Engineers, Inc.*	From/To	*Todd Valley W to Owl Hill Ct.*
Date Performed	*2/27/07*	Jurisdiction	*Placer County*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Buildout Without Forest Ranch*

Project Description: *Foresthill Divide Community Plan*

Input Data



☑ Class I highway ☐ Class II highway

Terrain ☐ Level ☑ Rolling

Grade Length *1.20* mi Up/down *-3.0*

Peak-hour factor, PHF *0.88*

No-passing zone *100%*

% Trucks and Buses , P_T *4 %*

% Recreational vehicles, P_R *2%*

Access points/ *mi* *4*

Analysis direction vol., V_d *1119*veh/h

Opposing direction vol., V_o *956*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.1*	*3.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.996*	*0.901*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*1277*	*1205*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*0.0 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*1.0 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.1 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*59.0 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*38.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*0.93*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*1272*	*1163*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*85.7*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*12.5*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*92.2*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*E*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.75*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*381*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*1343*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*9.9*

Notes

1. If the highway is extended segment (level) or rolling terrain, fG=1.0 .
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Copyright © 2005 University of Florida, All Rights Reserved

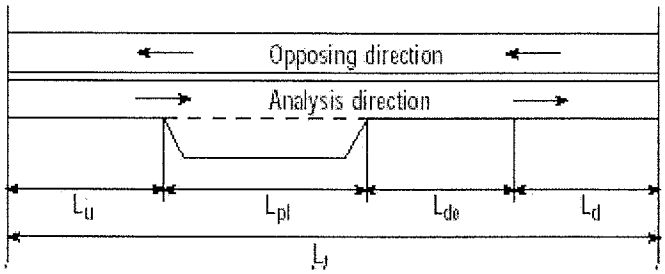
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

General Information		Site Information	
Analyst	*MKL*	Highway of Travel	*Foresthill Road - Westbound*
Agency or Company	*MRO Engineers, Inc.*	From/To	*Todd Valley W to Owl Hill Ct.*
Date Performed	*2/27/07*	Jurisdiction	*Placer County*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Buildout Without Forest Ranch*

Project Description: *Foresthill Divide Community Plan*

Input Data

☑ Class I highway ☐ Class II highway



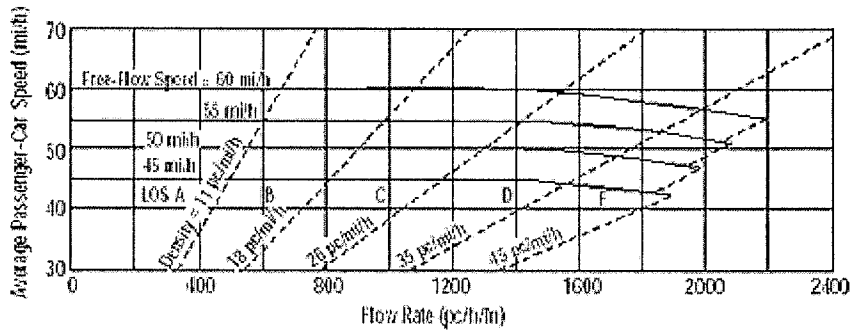
Total length of analysis segment, L_t (*mi*)	*1.2*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*1.2*
Length of passing lane including tapers , L_{pl} (*mi*)	*0.0*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*38.7*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*92.2*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*E*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.70*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.11*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+(2L_{de}/(1+f_{pl}))$)	
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*3.60*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)$=L_t-(L_u+L_{pl}+L_{de})$	*-3.60*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl} (Exhibit 20-24)	*0.62*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$	*92.2*
Level of Service and Other Performance Measures[4]	
Level of service including passing lane LOS_{pl} (Exhibit 20-3 or 20-4)	
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}= VMT_{15}/ATS_{pl}$	

Notes

1. If LOS_d=F, passing lane analysis cannot be performed.
2. If L_d <0, use alternative Equation 20-22.
3. If L_d<0, use alternative Equation 20-20.
4. v/c, VMT_{15} and VMT_{60} are calculated on Directional Two-Lane Highway Segment Worksheet.

Copyright © 2005 University of Florida, All Rights Reserved *HCS+™* Version 5.21 Generated: 4/3/2007 4:15 PM

MULTILANE HIGHWAYS WORKSHEET(Direct 1)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Bridge to Spring Garden Rd
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1040	Peak-Hour Factor, PHF	0.88
AADT(veh/h)		%Trucks and Buses, P_T	6
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	4.00
Driver Type Adjustment	1.00	Up/Down %	3.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	3.0
E_T	2.5	f_{HV}	0.885

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	2
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.5
f_M (mi/h)	1.6
FFS (mi/h)	57.9

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	667
Speed, S (mi/h)	57.9
D (pc/mi/ln)	11.5
LOS	B

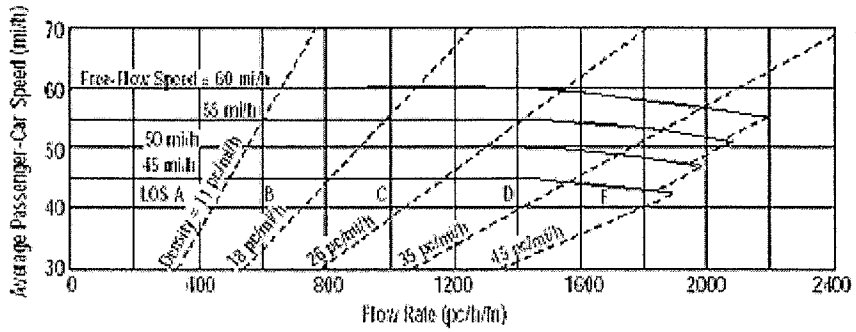
Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direct 2)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Bridge to Spring Garden Rd
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1768	Peak-Hour Factor, PHF	0.88
AADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	4.00
Driver Type Adjustment	1.00	Up/Down %	-3.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.986

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	2
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.5
f_M (mi/h)	1.6
FFS (mi/h)	57.9

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	1018
Speed, S (mi/h)	57.9
D (pc/mi/ln)	17.6
LOS	B

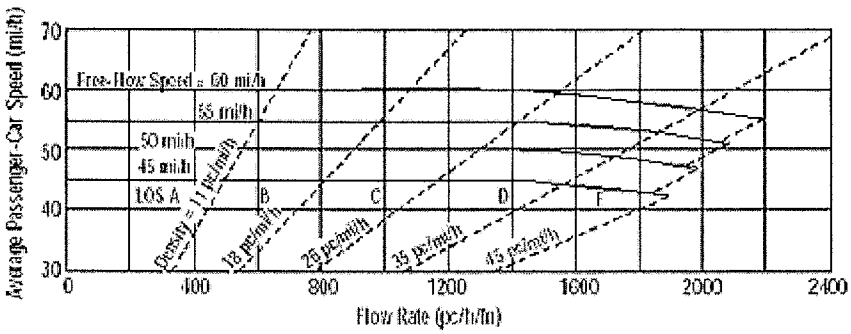
Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Spring Garden to Todd Valley W
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1160	Peak-Hour Factor, PHF	0.75
AADT(veh/h)		%Trucks and Buses, P_T	3
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	1.70
Driver Type Adjustment	1.00	Up/Down %	3.40
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	3.0
E_T	3.8	f_{HV}	0.891

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	4
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	1.0
f_M (mi/h)	1.6
FFS (mi/h)	57.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	868
Speed, S (mi/h)	57.4
D (pc/mi/ln)	15.1
LOS	B

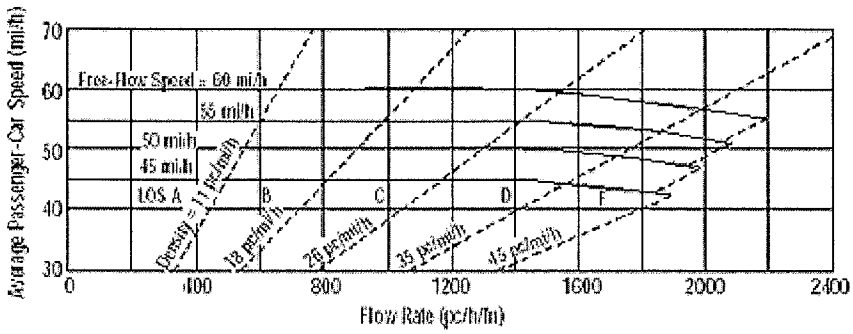
Design

Design (N)

Required Number of Lanes, N
Flow Rate, v_p (pc/h)
Max Service Flow Rate (pc/h/ln)
Design LOS

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direct 2)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Spring Garden to Todd Valley W
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1215	Peak-Hour Factor, PHF	0.88
AADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	1.70
Driver Type Adjustment	1.00	Up/Down %	-3.40
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.986

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	5
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	1.3
f_M (mi/h)	1.6
FFS (mi/h)	57.2

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	700
Speed, S (mi/h)	57.2
D (pc/mi/ln)	12.2
LOS	B

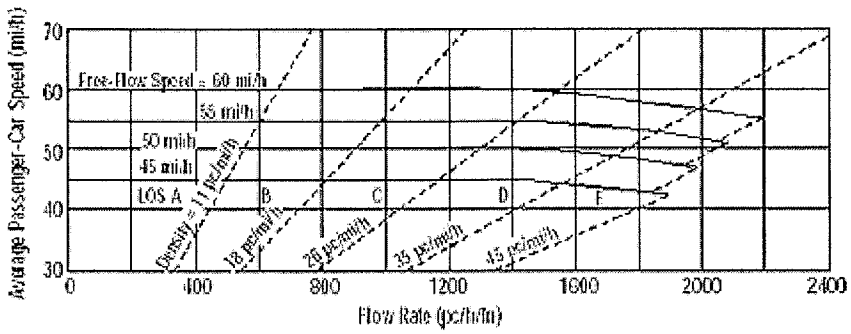
Design

Design (N)

Required Number of Lanes, N
Flow Rate, v_p (pc/h)
Max Service Flow Rate (pc/h/ln)
Design LOS

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Todd Valley W to Owl Hill Ct
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1049	Peak-Hour Factor, PHF	0.59
AADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	1.20
Driver Type Adjustment	1.00	Up/Down %	3.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	3.0
E_T	2.5	f_{HV}	0.935

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	3
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.8
f_M (mi/h)	1.6
FFS (mi/h)	57.7

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	951
Speed, S (mi/h)	57.7
D (pc/mi/ln)	16.5
LOS	B

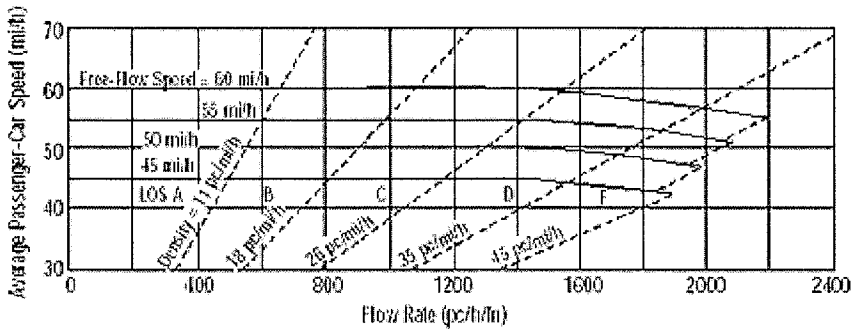
Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direct 2)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Todd Valley W to Owl Hill Ct
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1060	Peak-Hour Factor, PHF	0.79
AADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	1.20
Driver Type Adjustment	1.00	Up/Down %	-3.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.986

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	4
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	1.0
f_M (mi/h)	1.6
FFS (mi/h)	57.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	680
Speed, S (mi/h)	57.4
D (pc/mi/ln)	11.8
LOS	B

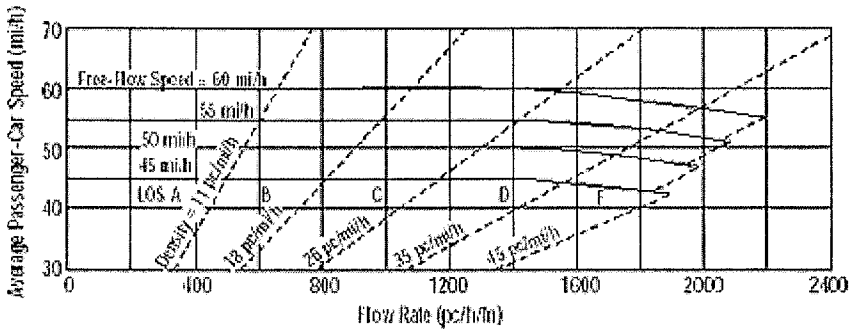
Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Bridge to Spring Garden Rd
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1574	Peak-Hour Factor, PHF	0.88
AADT(veh/h)		%Trucks and Buses, P_T	1
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	4.00
Driver Type Adjustment	1.00	Up/Down %	3.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	3.0
E_T	3.0	f_{HV}	0.943

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	2
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.5
f_M (mi/h)	1.6
FFS (mi/h)	57.9

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	947
Speed, S (mi/h)	57.9
D (pc/mi/ln)	16.4
LOS	B

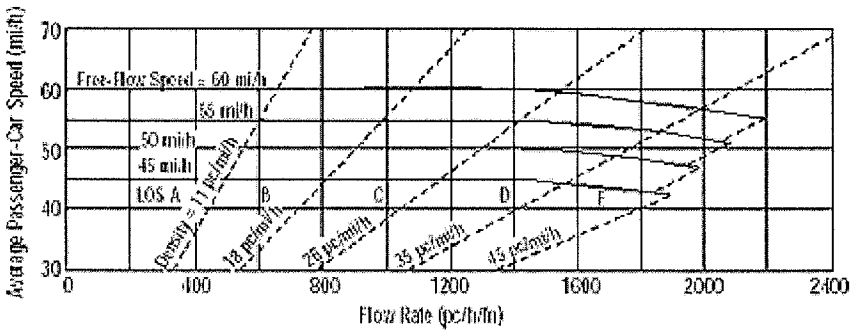
Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Bridge to Spring Garden Rd
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1210	Peak-Hour Factor, PHF	0.76
AADT(veh/h)		%Trucks and Buses, P_T	4
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	4.00
Driver Type Adjustment	1.00	Up/Down %	-3.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.977

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	2
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.5
f_M (mi/h)	1.6
FFS (mi/h)	57.9

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	815
Speed, S (mi/h)	57.9
D (pc/mi/ln)	14.1
LOS	B

Design

Design (N)

Required Number of Lanes, N

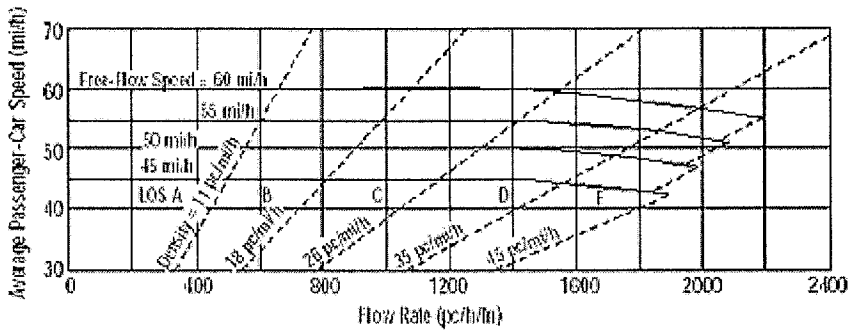
Flow Rate, v_p (pc/h)

Max Service Flow Rate (pc/h/ln)

Design LOS

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Spring Garden to Todd Valley W
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1117	Peak-Hour Factor, PHF	0.88
AADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	1.70
Driver Type Adjustment	1.00	Up/Down %	3.40
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	3.0
E_T	4.0	f_{HV}	0.909

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	4
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	1.0
f_M (mi/h)	1.6
FFS (mi/h)	57.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	698
Speed, S (mi/h)	57.4
D (pc/mi/ln)	12.2
LOS	B

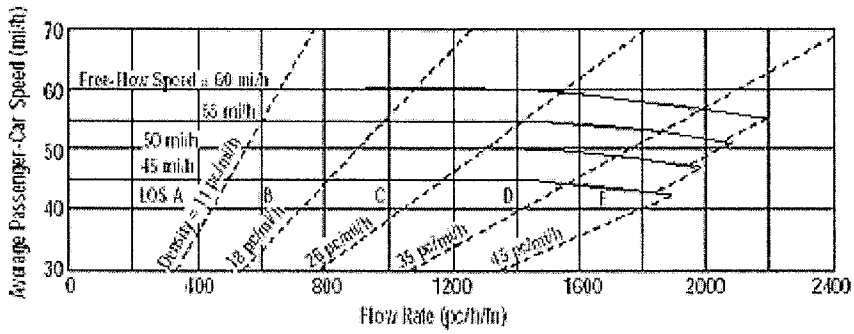
Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Spring Garden to Todd Valley W
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1305	Peak-Hour Factor, PHF	0.88
AADT(veh/h)		%Trucks and Buses, P_T	3
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	1.70
Driver Type Adjustment	1.00	Up/Down %	-3.40
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.981

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	5
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	1.3
f_M (mi/h)	1.6
FFS (mi/h)	57.2

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	755
Speed, S (mi/h)	57.2
D (pc/mi/ln)	13.2
LOS	B

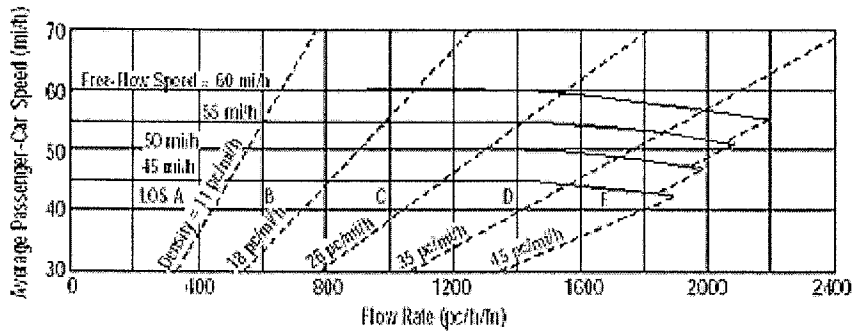
Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Todd Valley W to Owl Hill Ct
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	956	Peak-Hour Factor, PHF	0.85
AADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	1.20
Driver Type Adjustment	1.00	Up/Down %	3.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	3.0
E_T	2.5	f_{HV}	0.935

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	3
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.8
f_M (mi/h)	1.6
FFS (mi/h)	57.7

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	601
Speed, S (mi/h)	57.7
D (pc/mi/ln)	10.4
LOS	A

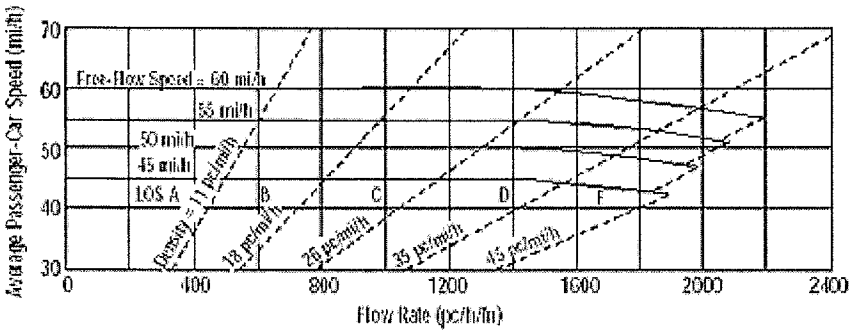
Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

Copyright © 2005 University of Florida, All Rights Reserved

MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	MKL
Agency or Company	MRO Engineers, Inc.
Date Performed	4/3/2007
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Foresthill Road - Mitigated
From/To	Todd Valley W to Owl Hill Ct
Jurisdiction	Placer County
Analysis Year	Buildout Without Forest Ranch

Project Description Foresthill Divide Community Plan

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1119	Peak-Hour Factor, PHF	0.88
AADT(veh/h)		%Trucks and Buses, P_T	4
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	1.20
Driver Type Adjustment	1.00	Up/Down %	-3.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.977

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	4
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	1.0
f_M (mi/h)	1.6
FFS (mi/h)	57.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	651
Speed, S (mi/h)	57.4
D (pc/mi/ln)	11.3
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

Copyright © 2005 University of Florida, All Rights Reserved

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95					1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	0.98					1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.93					1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1525	1770	3227					1770	1863	1548
Flt Permitted	0.95	1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1525	1770	3227					1770	1863	1548
Volume (vph)	90	295	175	388	631	579	0	0	0	259	195	55
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	321	190	422	686	629	0	0	0	282	212	60
RTOR Reduction (vph)	0	0	125	0	120	0	0	0	0	0	0	49
Lane Group Flow (vph)	98	321	65	422	1195	0	0	0	0	282	212	11
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Prot		Perm	Prot						Split		Perm
Protected Phases	7	4		3	8					6	6	
Permitted Phases			4									6
Actuated Green, G (s)	9.4	38.4	38.4	40.6	69.6					22.0	22.0	22.0
Effective Green, g (s)	8.4	37.4	37.4	39.6	68.6					21.0	21.0	21.0
Actuated g/C Ratio	0.08	0.34	0.34	0.36	0.62					0.19	0.19	0.19
Clearance Time (s)	3.0	3.0	3.0	3.0	3.0					3.0	3.0	3.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)	135	633	519	637	2012					338	356	296
v/s Ratio Prot	c0.06	0.17		0.24	c0.41					c0.16	0.11	
v/s Ratio Perm			0.12									0.04
v/c Ratio	0.73	0.51	0.12	0.66	0.59					0.83	0.60	0.04
Uniform Delay, d1	49.7	28.9	25.0	29.6	12.4					42.8	40.6	36.3
Progression Factor	1.00	1.00	1.00	1.34	1.79					1.00	1.00	1.00
Incremental Delay, d2	17.6	2.9	0.5	2.4	1.2					16.1	2.7	0.1
Delay (s)	67.2	31.8	25.5	41.9	23.3					58.9	43.3	36.3
Level of Service	E	C	C	D	C					E	D	D
Approach Delay (s)		35.6			27.9			0.0			50.5	
Approach LOS		D			C			A			D	

Intersection Summary			
HCM Average Control Delay	33.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑↑↑		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		1.00	0.91		1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		1863	5085		1770	1548
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		1863	5085		1770	1548
Volume (vph)	0	569	1418	0	291	195
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	618	1541	0	316	212
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	618	1541	0	316	212
Confl. Peds. (#/hr)	5			5	5	5
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		79.4	79.4		23.6	23.6
Effective Green, g (s)		78.4	78.4		23.6	23.6
Actuated g/C Ratio		0.71	0.71		0.21	0.21
Clearance Time (s)		3.0	3.0		4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		1328	3624		380	332
v/s Ratio Prot		c0.33	0.30		c0.18	
v/s Ratio Perm						0.14
v/c Ratio		0.47	0.43		0.83	0.64
Uniform Delay, d1		6.8	6.5		41.3	39.3
Progression Factor		0.10	0.43		1.00	1.00
Incremental Delay, d2		1.0	0.1		14.3	4.0
Delay (s)		1.7	2.9		55.6	43.3
Level of Service		A	A		E	D
Approach Delay (s)		1.7	2.9		50.7	
Approach LOS		A	A		D	

Intersection Summary			
HCM Average Control Delay	12.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	119.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0	4.0			
Lane Util. Factor	1.00	1.00			0.95			1.00	1.00			
Frpb, ped/bikes	1.00	1.00			0.99			1.00	0.96			
Flpb, ped/bikes	1.00	1.00			1.00			0.99	1.00			
Frt	1.00	1.00			0.96			1.00	0.85			
Flt Protected	0.95	1.00			1.00			0.95	1.00			
Satd. Flow (prot)	1770	1863			3363			1758	1525			
Flt Permitted	0.95	1.00			1.00			0.95	1.00			
Satd. Flow (perm)	1770	1863			3363			1758	1525			
Volume (vph)	140	680	0	0	1213	444	190	5	451	0	0	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	739	0	0	1318	483	207	5	490	0	0	0
RTOR Reduction (vph)	0	0	0	0	34	0	0	0	0	0	0	0
Lane Group Flow (vph)	152	739	0	0	1767	0	0	212	490	0	0	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Prot						Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases							2		2			
Actuated Green, G (s)	10.0	70.0			57.0			34.0	34.0			
Effective Green, g (s)	9.0	69.0			56.0			33.0	33.0			
Actuated g/C Ratio	0.08	0.63			0.51			0.30	0.30			
Clearance Time (s)	3.0	3.0			3.0			3.0	3.0			
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0			
Lane Grp Cap (vph)	145	1169			1712			527	458			
v/s Ratio Prot	c0.09	0.40			c0.54							
v/s Ratio Perm								0.12	0.32			
v/c Ratio	1.05	0.63			1.03			0.40	1.07			
Uniform Delay, d1	50.5	12.7			27.0			30.6	38.5			
Progression Factor	0.81	0.50			0.44			1.00	1.00			
Incremental Delay, d2	84.3	2.3			17.1			0.5	62.0			
Delay (s)	125.3	8.6			29.0			31.2	100.5			
Level of Service	F	A			C			C	F			
Approach Delay (s)		28.5			29.0			79.5			0.0	
Approach LOS		C			C			E			A	

Intersection Summary			
HCM Average Control Delay	39.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	119.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	0.99		1.00	0.98		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.96		1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1863	1548	1770	3379		1770	3139		1770	3539	1548
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1863	1548	1770	3379		1770	3139		1770	3539	1548
Volume (vph)	160	666	240	286	1152	413	415	175	281	167	85	125
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	724	261	311	1252	449	451	190	305	182	92	136
RTOR Reduction (vph)	0	0	71	0	33	0	0	263	0	0	0	0
Lane Group Flow (vph)	174	724	190	311	1668	0	451	232	0	182	92	136
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)	31.0	31.0	31.0	37.0	37.0		21.0	16.0		13.0	8.0	8.0
Effective Green, g (s)	31.0	31.0	31.0	36.0	36.0		20.0	15.0		12.0	7.0	7.0
Actuated g/C Ratio	0.28	0.28	0.28	0.33	0.33		0.18	0.14		0.11	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	967	525	436	579	1106		322	428		193	225	99
v/s Ratio Prot	0.05	c0.39		0.18	c0.50		c0.25	c0.16		0.10	0.03	
v/s Ratio Perm			0.17									0.09
v/c Ratio	0.18	1.38	0.44	0.54	1.51		1.40	0.54		0.94	0.41	1.37
Uniform Delay, d1	29.9	39.5	32.3	30.2	37.0		45.0	44.3		48.7	49.5	51.5
Progression Factor	1.02	0.98	1.03	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	177.3	1.8	1.0	233.4		198.1	1.4		48.3	1.2	219.4
Delay (s)	30.8	215.9	35.1	31.2	270.4		243.1	45.7		97.0	50.7	270.9
Level of Service	C	F	D	C	F		F	D		F	D	F
Approach Delay (s)		147.4			233.4			139.8			144.3	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	183.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.40		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95					1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	0.98					1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.92					1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1530	1770	3217					1770	1863	1551
Flt Permitted	0.95	1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1530	1770	3217					1770	1863	1551
Volume (vph)	125	533	240	316	652	659	0	0	0	348	155	65
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	136	579	261	343	709	716	0	0	0	378	168	71
RTOR Reduction (vph)	0	0	154	0	192	0	0	0	0	0	0	54
Lane Group Flow (vph)	136	579	107	343	1233	0	0	0	0	378	168	17
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Prot		Perm	Prot						Split		Perm
Protected Phases	7	4		3	8					6	6	
Permitted Phases			4									6
Actuated Green, G (s)	10.3	37.9	37.9	20.9	48.5					22.2	22.2	22.2
Effective Green, g (s)	9.3	36.9	36.9	19.9	47.5					21.2	21.2	21.2
Actuated g/C Ratio	0.10	0.41	0.41	0.22	0.53					0.24	0.24	0.24
Clearance Time (s)	3.0	3.0	3.0	3.0	3.0					3.0	3.0	3.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)	183	764	627	391	1698					417	439	365
v/s Ratio Prot	0.08	0.31		c0.19	c0.44					c0.21	0.09	
v/s Ratio Perm			0.17									0.05
v/c Ratio	0.74	0.76	0.17	0.88	0.73					0.91	0.38	0.05
Uniform Delay, d1	39.2	22.7	16.8	33.9	16.3					33.4	28.9	26.6
Progression Factor	1.00	1.00	1.00	1.08	1.02					1.00	1.00	1.00
Incremental Delay, d2	15.0	6.9	0.6	17.7	2.5					22.8	0.6	0.1
Delay (s)	54.2	29.7	17.4	54.4	19.0					56.2	29.5	26.6
Level of Service	D	C	B	D	B					E	C	C
Approach Delay (s)		29.8			25.9			0.0			45.5	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM Average Control Delay	30.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑↑↑		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		1.00	0.91		1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		1863	5085		1770	1551
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		1863	5085		1770	1551
Volume (vph)	0	876	1427	0	373	200
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	952	1551	0	405	217
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	952	1551	0	405	217
Confl. Peds. (#/hr)	5			5	5	5
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		59.0	59.0		24.0	24.0
Effective Green, g (s)		58.0	58.0		24.0	24.0
Actuated g/C Ratio		0.64	0.64		0.27	0.27
Clearance Time (s)		3.0	3.0		4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		1201	3277		472	414
v/s Ratio Prot		c0.51	0.30		c0.23	
v/s Ratio Perm						0.14
v/c Ratio		0.79	0.47		0.86	0.52
Uniform Delay, d1		11.6	8.2		31.4	28.1
Progression Factor		0.24	0.34		1.00	1.00
Incremental Delay, d2		3.3	0.0		14.3	1.2
Delay (s)		6.1	2.8		45.7	29.3
Level of Service		A	A		D	C
Approach Delay (s)		6.1	2.8		40.0	
Approach LOS		A	A		D	

Intersection Summary			
HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	162.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0	4.0			
Lane Util. Factor	1.00	1.00			0.95			1.00	1.00			
Frpb, ped/bikes	1.00	1.00			0.99			1.00	0.97			
Flpb, ped/bikes	1.00	1.00			1.00			0.99	1.00			
Frt	1.00	1.00			0.95			1.00	0.85			
Flt Protected	0.95	1.00			1.00			0.95	1.00			
Satd. Flow (prot)	1770	1863			3328			1762	1530			
Flt Permitted	0.95	1.00			1.00			0.95	1.00			
Satd. Flow (perm)	1770	1863			3328			1762	1530			
Volume (vph)	250	954	0	0	1067	521	360	10	844	0	0	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	1037	0	0	1160	566	391	11	917	0	0	0
RTOR Reduction (vph)	0	0	0	0	67	0	0	0	55	0	0	0
Lane Group Flow (vph)	272	1037	0	0	1660	0	0	402	862	0	0	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Prot						Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases							2		2			
Actuated Green, G (s)	11.0	48.0			34.0			36.0	36.0			
Effective Green, g (s)	10.0	47.0			33.0			35.0	35.0			
Actuated g/C Ratio	0.11	0.52			0.37			0.39	0.39			
Clearance Time (s)	3.0	3.0			3.0			3.0	3.0			
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0			
Lane Grp Cap (vph)	197	973			1220			685	595			
v/s Ratio Prot	c0.15	0.56			c0.52							
v/s Ratio Perm								0.23	0.60			
v/c Ratio	1.38	1.07			1.36			0.59	1.45			
Uniform Delay, d1	40.0	21.5			28.5			21.8	27.5			
Progression Factor	0.96	0.93			1.15			1.00	1.00			
Incremental Delay, d2	189.2	42.1			162.6			1.3	211.3			
Delay (s)	227.6	62.2			195.4			23.1	238.8			
Level of Service	F	E			F			C	F			
Approach Delay (s)		96.6			195.4			173.0			0.0	
Approach LOS		F			F			F			A	

Intersection Summary			
HCM Average Control Delay	158.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.47		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	162.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	0.99		1.00	0.98		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.96		1.00	0.92		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1863	1551	1770	3365		1770	3186		1770	3539	1551
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1863	1551	1770	3365		1770	3186		1770	3539	1551
Volume (vph)	420	1048	310	203	843	345	490	345	424	282	195	255
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	457	1139	337	221	916	375	533	375	461	307	212	277
RTOR Reduction (vph)	0	0	71	0	50	0	0	246	0	0	0	0
Lane Group Flow (vph)	457	1139	266	221	1241	0	533	590	0	307	212	277
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)	31.0	31.0	31.0	19.0	19.0		16.0	16.0		11.0	11.0	11.0
Effective Green, g (s)	31.0	31.0	31.0	18.0	18.0		15.0	15.0		10.0	10.0	10.0
Actuated g/C Ratio	0.34	0.34	0.34	0.20	0.20		0.17	0.17		0.11	0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	1182	642	534	354	673		295	531		197	393	172
v/s Ratio Prot	0.13	c0.61		0.12	c0.38		c0.30	c0.26		0.17	0.06	
v/s Ratio Perm			0.22									0.18
v/c Ratio	0.39	1.77	0.50	0.62	1.84		1.81	1.11		1.56	0.54	1.61
Uniform Delay, d1	22.3	29.5	23.3	32.9	36.0		37.5	37.5		40.0	37.8	40.0
Progression Factor	1.01	0.99	1.01	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.1	348.9	0.3	3.4	385.8		376.2	73.3		274.6	1.4	300.0
Delay (s)	22.6	378.2	24.0	36.3	421.8		413.7	110.8		314.6	39.3	340.0
Level of Service	C	F	C	D	F		F	F		F	D	F
Approach Delay (s)		232.4			365.5			228.7			250.1	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	269.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	118.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95					1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	0.98					1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.93					1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1525	1770	3227					1770	1863	1548
Flt Permitted	0.95	1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1525	1770	3227					1770	1863	1548
Volume (vph)	90	295	175	388	631	579	0	0	0	259	195	55
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	321	190	422	686	629	0	0	0	282	212	60
RTOR Reduction (vph)	0	0	125	0	120	0	0	0	0	0	0	49
Lane Group Flow (vph)	98	321	65	422	1195	0	0	0	0	282	212	11
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Prot		Perm	Prot						Split		Perm
Protected Phases	7	4		3	8					6	6	
Permitted Phases			4									6
Actuated Green, G (s)	9.4	38.4	38.4	40.6	69.6					22.0	22.0	22.0
Effective Green, g (s)	8.4	37.4	37.4	39.6	68.6					21.0	21.0	21.0
Actuated g/C Ratio	0.08	0.34	0.34	0.36	0.62					0.19	0.19	0.19
Clearance Time (s)	3.0	3.0	3.0	3.0	3.0					3.0	3.0	3.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)	135	633	519	637	2012					338	356	296
v/s Ratio Prot	c0.06	0.17		0.24	c0.41					c0.16	0.11	
v/s Ratio Perm			0.12									0.04
v/c Ratio	0.73	0.51	0.12	0.66	0.59					0.83	0.60	0.04
Uniform Delay, d1	49.7	28.9	25.0	29.6	12.4					42.8	40.6	36.3
Progression Factor	1.00	1.00	1.00	1.38	1.92					1.00	1.00	1.00
Incremental Delay, d2	17.6	2.9	0.5	2.4	1.2					16.1	2.7	0.1
Delay (s)	67.2	31.8	25.5	43.2	24.9					58.9	43.3	36.3
Level of Service	E	C	C	D	C					E	D	D
Approach Delay (s)		35.6			29.4			0.0			50.5	
Approach LOS		D			C			A			D	

Intersection Summary			
HCM Average Control Delay	34.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑↑↑		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		1.00	0.91		1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		1863	5085		1770	1548
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		1863	5085		1770	1548
Volume (vph)	0	569	1418	0	291	195
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	618	1541	0	316	212
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	618	1541	0	316	212
Confl. Peds. (#/hr)	5			5	5	5
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		79.4	79.4		23.6	23.6
Effective Green, g (s)		78.4	78.4		23.6	23.6
Actuated g/C Ratio		0.71	0.71		0.21	0.21
Clearance Time (s)		3.0	3.0		4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		1328	3624		380	332
v/s Ratio Prot		c0.33	0.30		c0.18	
v/s Ratio Perm						0.14
v/c Ratio		0.47	0.43		0.83	0.64
Uniform Delay, d1		6.8	6.5		41.3	39.3
Progression Factor		0.10	0.59		1.00	1.00
Incremental Delay, d2		1.0	0.3		14.3	4.0
Delay (s)		1.7	4.1		55.6	43.3
Level of Service		A	A		E	D
Approach Delay (s)		1.7	4.1		50.7	
Approach LOS		A	A		D	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	92.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0		4.0	4.0			
Lane Util. Factor	1.00	1.00			0.95	1.00		1.00	0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.96		1.00	0.96			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		0.99	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1770	1863			3539	1525		1758	2684			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1770	1863			3539	1525		1758	2684			
Volume (vph)	140	680	0	0	1213	444	190	5	451	0	0	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	739	0	0	1318	483	207	5	490	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	77	0	0	0	0	0	0
Lane Group Flow (vph)	152	739	0	0	1318	406	0	212	490	0	0	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Prot					Perm	Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases						8	2		2			
Actuated Green, G (s)	10.0	78.5			65.5	65.5		25.5	25.5			
Effective Green, g (s)	9.0	77.5			64.5	64.5		24.5	24.5			
Actuated g/C Ratio	0.08	0.70			0.59	0.59		0.22	0.22			
Clearance Time (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	145	1313			2075	894		392	598			
v/s Ratio Prot	c0.09	0.40			c0.37							
v/s Ratio Perm						0.32		0.12	0.18			
v/c Ratio	1.05	0.56			0.64	0.45		0.54	0.82			
Uniform Delay, d1	50.5	8.0			15.0	12.8		37.8	40.6			
Progression Factor	0.81	0.46			0.28	0.12		1.00	1.00			
Incremental Delay, d2	84.3	1.6			0.4	0.4		1.5	8.6			
Delay (s)	125.3	5.3			4.6	1.9		39.3	49.2			
Level of Service	F	A			A	A		D	D			
Approach Delay (s)		25.7			3.9			46.2			0.0	
Approach LOS		C			A			D			A	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.98		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1863	1548	1770	3539	1548	3433	3139		1770	3539	1548
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1863	1548	1770	3539	1548	3433	3139		1770	3539	1548
Volume (vph)	160	666	240	286	1152	413	415	175	281	167	85	125
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	724	261	311	1252	449	451	190	305	182	92	136
RTOR Reduction (vph)	0	0	71	0	0	156	0	263	0	0	0	0
Lane Group Flow (vph)	174	724	190	311	1252	293	451	232	0	182	92	136
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	31.0	31.0	31.0	37.0	37.0	37.0	18.6	16.0		13.0	10.4	10.4
Effective Green, g (s)	31.0	31.0	31.0	36.0	36.0	36.0	17.6	15.0		12.0	9.4	9.4
Actuated g/C Ratio	0.28	0.28	0.28	0.33	0.33	0.33	0.16	0.14		0.11	0.09	0.09
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	967	525	436	579	1158	507	549	428		193	302	132
v/s Ratio Prot	0.05	c0.39		0.18	c0.35		0.13	c0.16		c0.10	0.03	
v/s Ratio Perm			0.17			0.29						0.09
v/c Ratio	0.18	1.38	0.44	0.54	1.08	0.58	0.82	0.54		0.94	0.30	1.03
Uniform Delay, d1	29.9	39.5	32.3	30.2	37.0	30.7	44.7	44.3		48.7	47.2	50.3
Progression Factor	0.83	0.82	0.75	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	180.2	2.6	1.0	51.3	1.6	9.6	1.4		48.3	0.6	86.6
Delay (s)	25.1	212.5	26.9	31.2	88.3	32.3	54.3	45.7		97.0	47.8	136.9
Level of Service	C	F	C	C	F	C	D	D		F	D	F
Approach Delay (s)		142.6			67.0			49.8			99.2	
Approach LOS		F			E			D			F	

Intersection Summary			
HCM Average Control Delay	85.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group