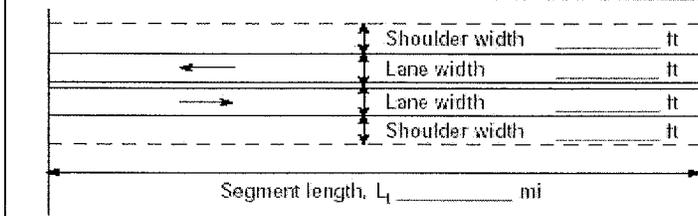


DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

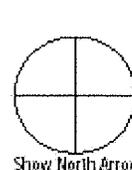
General Information		Site Information	
Analyst	MKL	Highway / Direction of Travel	Foresthill Road - Eastbound
Agency or Company	MRO Engineers, Inc.	From/To	Todd Valley W to Owl Hill Ct
Date Performed	3/5/07	Jurisdiction	Placer County
Analysis Time Period	AM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description: Foresthill Divide Community Plan

Input Data



Analysis direction vol., V_d 1095veh/h
 Opposing direction vol., V_o 1126veh/h



Class I highway Class II highway
 Terrain Level Rolling
 Grade Length 1.20 mi Up/down 3.0
 Peak-hour factor, PHF 0.59
 No-passing zone 17%
 % Trucks and Buses, P_T 2%
 % Recreational vehicles, P_R 2%
 Access points/ mi 3

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)	1958	1912
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 _i 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 _i /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 (FFS=BFFS-f _{LS} -f _A) 59.3 mi/h	
	Average travel speed, ATS=FFS-0.00776V _p -f _{np} 28.7 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)	0.93	1.00
Directional flow rate ² , v _i (pc/h)=V _i /(PHF*f _{HV} *f _G)	1987	1908
Base percent time-spent-following ⁴ , BPTSF(%)=100(1-e ^{-av_d^p})	95.4	
Adj. for no-passing zone, f _{np} (Exhibit 20-20)	3.6	
Percent time-spent-following, PTSF(%)=BPTSF+f _{np}	97.2	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	F
Volume to capacity ratio, v/c=V _p /1,700	1.15
Peak 15-min veh-miles of travel, VMT ₁₅ (veh-mi)=0.25L ₁ (V/PHF)	557
Peak-hour vehicle-miles of travel, VMT ₆₀ (veh-mi)=V*L ₁	1314
Peak 15-min total travel time, TT ₁₅ (veh-h)=VMT ₁₅ /ATS	19.4

Notes

1. If the highway is extended segment (level) or rolling terrain, f_G=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.

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	3/5/07	Jurisdiction	Placer County
Analysis Time Period	AM Peak Hour	Analysis Year	Buildout With 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)	28.7
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	97.2
Level of service ¹ , LOS_d (from Directional Two-Lane Highway Segment Worksheet)	F

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 , $ATS_{pl} = (ATS_d * L_t) / (L_u + L_d + (L_{pl}/f_{pl}) + (2L_{de}/(1+f_{pl})))$	31.6

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) $L_d = L_t - (L_u + L_{pl} + L_{de})$	-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 , $PTSF_{pl}(\%)$ $PTSF_{pl} = PTSF_d [L_u + L_d + f_{pl}L_{pl} + ((1+f_{pl})/2)L_{de}] / L_t$	63.4

Level of Service and Other Performance Measures⁴

Level of service including passing lane LOS_{pl} (Exhibit 20-3 or 20-4)	E
Peak 15-min total travel time, $TT_{15}(\text{veh-h})$ $TT_{15} = VMT_{15}/ATS_{pl}$	17.6

Notes

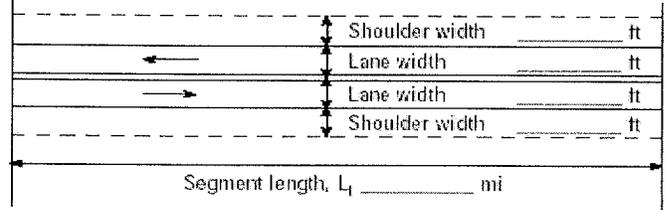
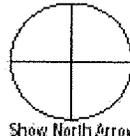
1. If $LOS_d = F$, passing lane analysis cannot be performed.
2. If $L_d < 0$, use alternative Equation 20-22.
3. If $L_d < 0$, use alternative Equation 20-20.
4. v/c, VMT_{15} and VMT_{60} are calculated on Directional Two-Lane Highway Segment Worksheet.

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	3/5/07	Jurisdiction	Placer County
Analysis Time Period	AM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description: *Foresthill Divide Community Plan*

Input Data

 <p style="text-align: center;">Segment length, L_1 _____ mi</p>	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">  <p>Show North Arrow</p> </div> <div> <input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway <input type="checkbox"/> Terrain <input type="checkbox"/> Level <input type="checkbox"/> Rolling Grade Length 1.20 mi Up/down -3.0 Peak-hour factor, PHF 0.79 No-passing zone 100% % Trucks and Buses, P_T 2% % Recreational vehicles, P_R 2% Access points/ mi 4 </div> </div>
Analysis direction vol., V_d 1126veh/h	
Opposing direction vol., V_o 1095veh/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, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.998	0.948
Grade adjustment factor ¹ , f_G (Exhibit 20-7 or 20-13)	1.00	1.00
Directional flow rate ² , $v_i(\text{pc/h}) = V_i / (\text{PHF} \cdot f_{HV} \cdot f_G)$	1428	1462
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, $FFS_d = S_{FM} + 0.00776(V_f / f_{HV})$ 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) 0.8 mi/h	Free-flow speed, FFS_d ($FSS=BFFS-f_{LS}-f_A$) 59.0 mi/h	
	Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$ 35.7 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 , $v_i(\text{pc/h})=V_i/(\text{PHF} \cdot f_{HV} \cdot f_G)$	1425	1484
Base percent time-spent-following ⁴ , $\text{BPTSF}(\%)=100(1-e^{-av_d^b})$	89.9	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	16.3	
Percent time-spent-following, $\text{PTSF}(\%)=\text{BPTSF}+f_{np}$	97.9	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	E
Volume to capacity ratio, $v/c=V_p/1,700$	0.84
Peak 15-min veh-miles of travel, $\text{VMT}_{15}(\text{veh-m})=0.25L_1(V/\text{PHF})$	428
Peak-hour vehicle-miles of travel, $\text{VMT}_{60}(\text{veh-m})=V \cdot L_1$	1351
Peak 15-min total travel time, $\text{TT}_{15}(\text{veh-h})=\text{VMT}_{15}/\text{ATS}$	12.0

Notes

1. If the highway is extended segment (level) or rolling terrain, $f_G=1.0$.
2. If $v_i(v_d \text{ or } v_o) \geq 1,700$ 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.

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	3/5/07	Jurisdiction	Placer County
Analysis Time Period	AM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description: Foresthill Divide Community Plan

Input Data

Class I highway Class II highway

Show North Arrow

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)	35.7
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	97.9
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} (m) (Exhibit 20-23)	1.70
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (m) $L_d = L_t - (L_u + L_{pl} + L_{de})$	-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} (m) (Exhibit 20-23)	3.60
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (m) $L_d = L_t - (L_u + L_{pl} + L_{de})$	-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 , $PTSF_{pl}(\%)$ $PTSF_{pl} = PTSF_d [L_u + L_d + f_{pl}L_{pl} + ((1+f_{pl})/2)L_{de}] / L_t$	97.9

Level of Service and Other Performance Measures⁴

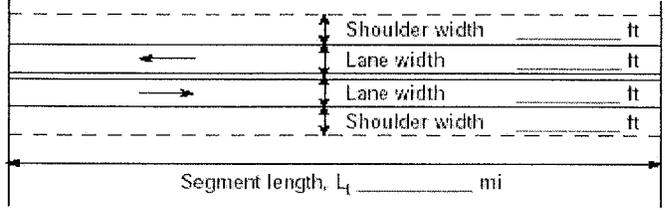
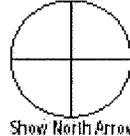
Level of service including passing lane LOS_{pl} (Exhibit 20-3 or 20-4)	
Peak 15-min total travel time, TT_{15} (veh-h) $TT_{15} = VMT_{15} / ATS_{pl}$	

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.

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	Bridge to Spring Garden Road
Date Performed	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With Forest Ranch
Project Description: Foresthill Divide Community Plan			

Input Data	
 <p style="margin-left: 20px;">Shoulder width _____ ft</p> <p style="margin-left: 20px;">Lane width _____ ft</p> <p style="margin-left: 20px;">Lane width _____ ft</p> <p style="margin-left: 20px;">Shoulder width _____ ft</p> <p style="margin-left: 20px;">Segment length, L_t _____ mi</p> <p>Analysis direction vol., V_d 1649veh/h</p> <p>Opposing direction vol., V_o 1247veh/h</p>	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">  <p>Show North Arrow</p> </div> <div> <input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway Terrain <input type="checkbox"/> Level <input type="checkbox"/> Rolling Grade Length 4.00 mi Up/down 3.0 Peak-hour factor, PHF 0.88 No-passing zone 55% % Trucks and Buses, P_T 1% % Recreational vehicles, P_R 2% Access points/ mi 2 </div> </div>

Average Travel Speed		
	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	5.7	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	1.0	1.0
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.955	0.999
Grade adjustment factor ¹ , f_G (Exhibit 20-7 or 20-13)	0.95	1.00
Directional flow rate ² , v_i (pc/h) $v_i=V_i/(PHF \cdot f_{HV} \cdot f_G)$	2065	1418
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, $FFS_d = S_{FM} + 0.00776(V_f / f_{HV})$ mi/h	Adj. for access points ³ , f_A (Exhibit 20-5) 0.5 mi/h	
Adjustment for no-passing zones, f_{np} (Exhibit 20-19) 0.7 mi/h	Free-flow speed, FFS_d ($FSS=BFFS \cdot f_{LS} \cdot f_A$) 59.5 mi/h	
	Average travel speed, $ATS=FFS \cdot 0.00776 v_p \cdot f_{np}$ 31.7 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)	0.97	1.00
Directional flow rate ² , v_i (pc/h)= $V_i/(PHF \cdot f_{HV} \cdot f_G)$	1932	1417
Base percent time-spent-following ⁴ , $BPTSF(\%)=100(1-e^{-a v_d^b})$	94.5	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	33.1	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	113.6	

Level of Service and Other Performance Measures	
Level of service, LOS (Exhibit 20-3 or 20-4)	F
Volume to capacity ratio, $v/c=V_p/1,700$	1.21
Peak 15-min veh-miles of travel, $VMT_{15}(\text{veh} \cdot \text{mi})=0.25L_t(V/PHF)$	5059
Peak-hour vehicle-miles of travel, $VMT_{60}(\text{veh} \cdot \text{mi})=V \cdot L_t$	17809
Peak 15-min total travel time, $TT_{15}(\text{veh} \cdot \text{h})=VMT_{15}/ATS$	159.4

- Notes**
1. If the highway is extended segment (level) or rolling terrain, $f_G=1.0$.
 2. If $v_i(v_d$ or $v_o) \geq 1,700$ 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.

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	Bridge to Spring Garden Road
Date Performed	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description: Foresthill Divide Community Plan

Input Data

Class I highway Class II highway

Total length of analysis segment, L_t (mi)	10.8
Length of two-lane highway upstream of the passing lane, L_u (mi)	3.0
Length of passing lane including tapers, L_{pl} (mi)	4.9
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	31.7
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	113.6
Level of service ¹ , LOS_d (from Directional Two-Lane Highway Segment Worksheet)	F

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (m) (Exhibit 20-23)	1.70
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (m) $L_d = L_t - (L_u + L_{pl} + L_{de})$	1.20
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 , $ATS_{pl} = (ATS_d * L_t) / (L_u + L_d + (L_{pl}/f_{pl}) + (2L_{de}/(1+f_{pl})))$	33.5

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (m) (Exhibit 20-23)	3.60
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (m) $L_d = L_t - (L_u + L_{pl} + L_{de})$	-0.70
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 , $PTSF_{pl}(\%)$ $PTSF_{pl} = PTSF_d [L_u + L_d + f_{pl}L_{pl} + ((1+f_{pl})/2)L_{de}] / L_t$	87.1

Level of Service and Other Performance Measures⁴

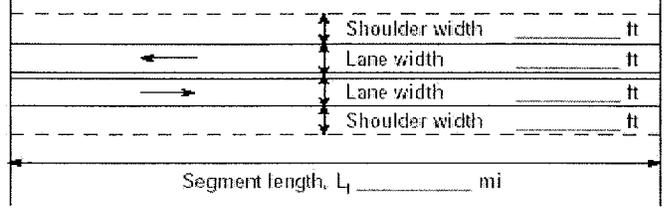
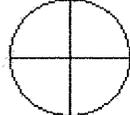
Level of service including passing lane LOS_{pl} (Exhibit 20-3 or 20-4)	E
Peak 15-min total travel time, $TT_{15}(\text{veh-h})$ $TT_{15} = VMT_{15}/ATS_{pl}$	150.9

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.

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	Bridge to Spring Garden Road
Date Performed	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With Forest Ranch
Project Description: <i>Foresthill Divide Community Plan</i>			

Input Data	
 <p style="margin-left: 20px;">Shoulder width _____ ft</p> <p style="margin-left: 20px;">Lane width _____ ft</p> <p style="margin-left: 20px;">Lane width _____ ft</p> <p style="margin-left: 20px;">Shoulder width _____ ft</p> <p style="margin-left: 20px;">Segment length, L_1 _____ mi</p>	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">  <p>Show North Arrow</p> </div> <div> <input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway Terrain <input type="checkbox"/> Level <input type="checkbox"/> Rolling Grade Length 4.00 mi Up/down -3.0 Peak-hour factor, PHF 0.76 No-passing zone 88% % Trucks and Buses, P_T 4 % % Recreational vehicles, P_R 2% Access points/ mi 2 </div> </div>
Analysis direction vol., V_d	1247veh/h
Opposing direction vol., V_o	1649veh/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	5.7
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	0.842
Grade adjustment factor f_G (Exhibit 20-7 or 20-13)		1.00	0.95
Directional flow rate ² , v_i (pc/h) $v_i=V_i/(PHF \cdot f_{HV} \cdot f_G)$		1647	2713
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) 0.5 mi/h	
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	0.7 mi/h	Free-flow speed, FFS_d ($FSS=BFFS \cdot f_{LS} \cdot f_A$) 59.5 mi/h	
		Average travel speed, $ATS=FFS-0.00776V_o \cdot f_{np}$ 25.0 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	0.97
Directional flow rate ² , v_i (pc/h)= $V_i/(PHF \cdot f_{HV} \cdot f_G)$		1641	2237
Base percent time-spent-following ⁴ , $BPTSF(\%)=100(1-e^{-av_d^b})$		92.8	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)		48.7	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$		113.4	

Level of Service and Other Performance Measures	
Level of service, LOS (Exhibit 20-3 or 20-4)	F
Volume to capacity ratio, $v/c=V_p/1,700$	0.97
Peak 15-min veh-miles of travel, $VMT_{15}(\text{veh} \cdot \text{mi})=0.25L_1(V/PHF)$	4430
Peak-hour vehicle-miles of travel, $VMT_{60}(\text{veh} \cdot \text{mi})=V \cdot L_1$	13468
Peak 15-min total travel time, $TT_{15}(\text{veh} \cdot \text{h})=VMT_{15}/ATS$	177.4

- Notes**
1. If the highway is extended segment (level) or rolling terrain, $f_G=1.0$.
 2. If $v_i(v_d \text{ or } v_o) \geq 1,700$ 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.

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	Bridge to Spring Garden Road
Date Performed	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description: Foresthill Divide Community Plan

Input Data

Class I highway Class II highway

Total length of analysis segment, L_t (mi)	10.8
Length of two-lane highway upstream of the passing lane, L_u (mi)	4.8
Length of passing lane including tapers, L_{pl} (mi)	1.3
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	25.0
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	113.4
Level of service ¹ , LOS_d (from Directional Two-Lane Highway Segment Worksheet)	F

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) $L_d = L_t - (L_u + L_{pl} + L_{de})$	3.00
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 , $ATS_{pl} = (ATS_d * L_t) / (L_u + L_d + (L_{pl}/f_{pl}) + (2L_{de}/(1+f_{pl})))$	25.5

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) $L_d = L_t - (L_u + L_{pl} + L_{de})$	1.10
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 , $PTSF_{pl}(\%)$ $PTSF_{pl} = PTSF_d [L_u + L_d + f_{pl}L_{pl} + ((1+f_{pl})/2)L_{de}] / L_t$	101.0

Level of Service and Other Performance Measures⁴

Level of service including passing lane LOS_{pl} (Exhibit 20-3 or 20-4)	F
Peak 15-min total travel time, TT_{15} (veh-h) $TT_{15} = VMT_{15} / ATS_{pl}$	173.8

Notes

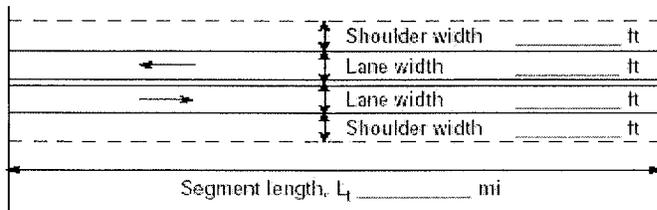
1. If $LOS_d = F$, passing lane analysis cannot be performed.
2. If $L_d < 0$, use alternative Equation 20-22.
3. If $L_d < 0$, use alternative Equation 20-20.
4. v/c, VMT_{15} and VMT_{60} are calculated on Directional Two-Lane Highway Segment Worksheet.

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	Spring Garden to Todd Valley W
Date Performed	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description: Foresthill Divide Community Plan

Input Data



<input checked="" type="checkbox"/> Class I highway	<input type="checkbox"/> Class II highway
Terrain <input type="checkbox"/> Level	<input type="checkbox"/> Rolling
Grade Length 1.70 mi	Up/down 3.4
Peak-hour factor, PHF 0.88	
No-passing zone 29%	
% Trucks and Buses, P _T 2%	
% Recreational vehicles, P _R 2%	
Access points/ mi 4	

Analysis direction vol., V_d 1203veh/h
 Opposing direction vol., V_o 1355veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E _T (Exhibit 20-9 or 20-15)	4.3	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))	0.937	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)	1458	1543
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) 0.5 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} 35.2 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)	0.94	1.00
Directional flow rate ² , v _i (pc/h)=V _i /(PHF*f _{HV} *f _G)	1448	1540
Base percent time-spent-following ⁴ , BPTSF(%)=100(1-e ^{-av_d^b})	90.4	
Adj. for no-passing zone, f _{np} (Exhibit. 20-20)	32.6	
Percent time-spent-following, PTSF(%)=BPTSF+f _{np}	106.2	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	F
Volume to capacity ratio, v/c=V _p /1,700	0.86
Peak 15-min veh-miles of travel, VMT ₁₅ (veh-mi)=0.25L ₁ (V/PHF)	581
Peak-hour vehicle-miles of travel, VMT ₆₀ (veh-mi)=V*L ₁	2045
Peak 15-min total travel time, TT ₁₅ (veh-h)=VMT ₁₅ /ATS	16.5

Notes

1. If the highway is extended segment (level) or rolling terrain, f_G=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.

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	Spring Garden to Todd Valley W
Date Performed	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With 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)	0.3
Length of passing lane including tapers, L_{pl} (mi)	1.2
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	35.2
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	106.2
Level of service ¹ , LOS_d (from Directional Two-Lane Highway Segment Worksheet)	F

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (m) (Exhibit 20-23)	1.70
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (m) $L_d = L_t - (L_u + L_{pl} + L_{de})$	-1.50
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 , $ATS_{pl} = (ATS_d * L_t) / (L_u + L_d + (L_{pl}/f_{pl}) + (2L_{de}/(1+f_{pl})))$	38.3

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (m) (Exhibit 20-23)	3.60
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (m) $L_d = L_t - (L_u + L_{pl} + L_{de})$	-3.40
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pt} (Exhibit 20-24)	0.62
Percent time-spent-following including passing lane ³ , $PTSF_{pl}(\%)$ $PTSF_{pl} = PTSF_d [L_u + L_d + f_{pt} L_{pl} + ((1+f_{pt})/2) L_{de}] / L_t$	73.1

Level of Service and Other Performance Measures⁴

Level of service including passing lane LOS_{pl} (Exhibit 20-3 or 20-4)	E
Peak 15-min total travel time, $TT_{15}(\text{veh-h})$ $TT_{15} = VMT_{15}/ATS_{pl}$	15.2

Notes

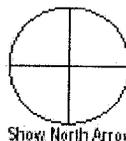
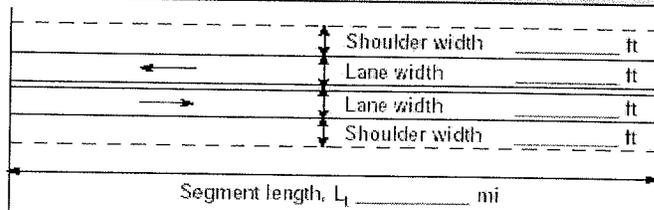
1. If $LOS_d = F$, passing lane analysis cannot be performed.
2. If $L_d < 0$, use alternative Equation 20-22.
3. If $L_d < 0$, use alternative Equation 20-20.
4. v/c, VMT_{15} and VMT_{60} are calculated on Directional Two-Lane Highway Segment Worksheet.

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	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description: *Foresthill Divide Community Plan*

Input Data



<input checked="" type="checkbox"/> Class I highway	<input type="checkbox"/> Class II highway
Terrain <input type="checkbox"/> Level <input type="checkbox"/> 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 1355veh/h
 Opposing direction vol., V_o 1203veh/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) $v_i=V_i/(PHF \cdot f_{HV} \cdot f_G)$	1544	1504
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) 0.8 mi/h	Free-flow speed, FFS_d ($FSS=BFFS \cdot f_{LS} \cdot f_A$) 58.8 mi/h	
	Average travel speed, $ATS=FFS-0.00776v_p \cdot f_{np}$ 34.3 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)	1.00	0.94
Directional flow rate ² , v_i (pc/h) $=V_i/(PHF \cdot f_{HV} \cdot f_G)$	1540	1448
Base percent time-spent-following ⁴ , $BPTSF(\%)=100(1-e^{-a v_d^b})$	97.1	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	11.7	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	97.2	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	E
Volume to capacity ratio, $v/c=V_p/1,700$	0.91
Peak 15-min veh-miles of travel, $VMT_{15}(\text{veh} \cdot \text{mi})=0.25L_p(V/PHF)$	654
Peak-hour vehicle-miles of travel, $VMT_{60}(\text{veh} \cdot \text{mi})=V \cdot L_t$	2304
Peak 15-min total travel time, $TT_{15}(\text{veh} \cdot \text{h})=VMT_{15}/ATS$	19.1

Notes

1. If the highway is extended segment (level) or rolling terrain, $f_G=1.0$.
2. If v_d or $v_o \geq 1,700$ 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.

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	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With 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)	34.3
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	97.2
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) $L_d = L_t - (L_u + L_{pl} + L_{de})$	-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 , $PTSF_{pl}(\%)$ $PTSF_{pl} = PTSF_d [L_u + L_d + f_{pl}L_{pl} + ((1+f_{pl})/2)L_{de}] / L_t$	97.2

Level of Service and Other Performance Measures⁴

Level of service including passing lane LOS_{pl} (Exhibit 20-3 or 20-4)	
Peak 15-min total travel time, TT_{15} (veh-h) $TT_{15} = VMT_{15} / ATS_{pl}$	

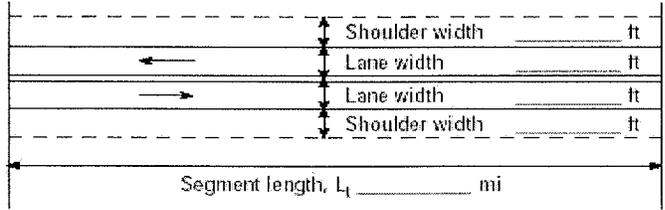
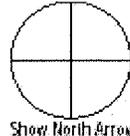
Notes

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.

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	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description: *Foresthill Divide Community Plan*

Input Data	
 <p>Shoulder width _____ ft</p> <p>Lane width _____ ft</p> <p>Lane width _____ ft</p> <p>Shoulder width _____ ft</p> <p>Segment length, L_1 _____ mi</p> <p>Analysis direction vol., V_d 1072veh/h</p> <p>Opposing direction vol., V_o 1211veh/h</p>	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">  <p>Show North Arrow</p> </div> <div> <input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway Terrain <input type="checkbox"/> Level <input type="checkbox"/> 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 </div> </div>

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) $v_i=V_i/(PHF \cdot f_{HV} \cdot f_G)$	1330	1428
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 ($FFS=BFFS-f_{LS}-f_A$) 59.3 mi/h	
	Average travel speed, $ATS=FFS-0.00776V_o \cdot f_{np}$ 37.3 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)= $V_i/(PHF \cdot f_{HV} \cdot f_G)$	1350	1425
Base percent time-spent-following ⁴ , $BPTSF(\%)=100(1-e^{-av_d^b})$	88.5	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	25.4	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	100.9	

Level of Service and Other Performance Measures	
Level of service, LOS (Exhibit 20-3 or 20-4)	F
Volume to capacity ratio, $v/c=V_p/1,700$	0.78
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi)= $0.25L_1(V/PHF)$	378
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi)= $V \cdot L_1$	1286
Peak 15-min total travel time, TT_{15} (veh-h)= VMT_{15}/ATS	10.1

- Notes**
1. If the highway is extended segment (level) or rolling terrain, $f_G=1.0$.
 2. If v_i (v_d or v_o) $\geq 1,700$ 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.

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	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With 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)	37.3
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	100.9
Level of service ¹ , LOS_d (from Directional Two-Lane Highway Segment Worksheet)	F

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 , $ATS_{pl} = (ATS_d * L_t) / (L_u + L_d + (L_{pl}/f_{pl}) + (2L_{de}/(1+f_{pl})))$	41.1

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) $L_d = L_t - (L_u + L_{pl} + L_{de})$	-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 , $PTSF_{pl}$ (%) $PTSF_{pl} = PTSF_d [L_u + L_d + f_{pl}L_{pl} + ((1+f_{pl})/2)L_{de}] / L_t$	65.8

Level of Service and Other Performance Measures⁴

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) $TT_{15} = VMT_{15}/ATS_{pl}$	9.2

Notes

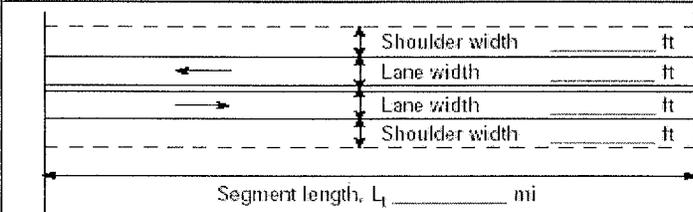
1. If $LOS_d = F$, passing lane analysis cannot be performed.
2. If $L_d < 0$, use alternative Equation 20-22.
3. If $L_d < 0$, use alternative Equation 20-20.
4. v/c, VMT_{15} and VMT_{60} are calculated on Directional Two-Lane Highway Segment Worksheet.

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	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description: Foresthill Divide Community Plan

Input Data



 Show North Arrow	<input checked="" type="checkbox"/> Class I highway <input type="checkbox"/> Class II highway
	Terrain <input type="checkbox"/> Level <input type="checkbox"/> 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 1211veh/h
 Opposing direction vol., V_o 1072veh/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)	1382	1352
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) 0.9 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} 36.8 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)	1376	1304
Base percent time-spent-following ⁴ , BPTSF(%)=100(1-e ^{-av_d^b})	88.3	
Adj. for no-passing zone, f _{np} (Exhibit. 20-20)	13.7	
Percent time-spent-following, PTSF(%)=BPTSF+f _{np}	95.3	

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	0.81
Peak 15-min veh-miles of travel, VMT ₁₅ (veh- mi)=0.25L _t (V/PHF)	413
Peak-hour vehicle-miles of travel, VMT ₆₀ (veh- mi)=V*L _t	1453
Peak 15-min total travel time, TT ₁₅ (veh-h)=VMT ₁₅ /ATS	11.2

Notes

1. If the highway is extended segment (level) or rolling terrain, f_G=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.

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	3/5/07	Jurisdiction	Placer County
Analysis Time Period	PM Peak Hour	Analysis Year	Buildout With 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)	36.8
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	95.3
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) $L_d = L_t - (L_u + L_{pl} + L_{de})$	-1.70
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) $L_d = L_t - (L_u + L_{pl} + L_{de})$	-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 , $PTSF_{pl}(\%)$ $PTSF_{pl} = PTSF_d [L_u + L_d + f_{pl} L_{pl} + ((1+f_{pl})/2) L_{de}] / L_t$	95.3

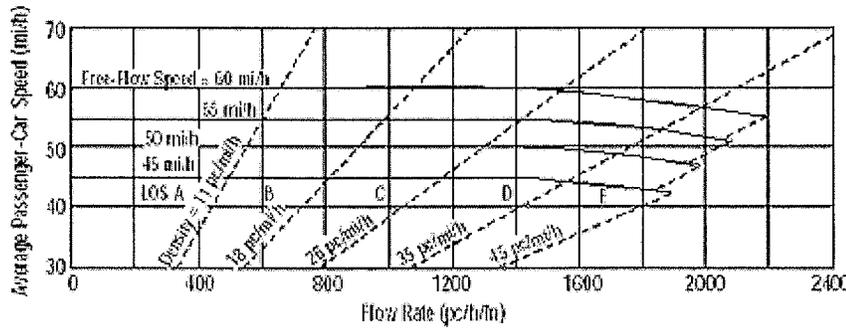
Level of Service and Other Performance Measures⁴

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.

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	Site Information
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Analyst MRO Engineers, Inc.	Highway/Direction to Travel Foresthill Road - Mitigated
Agency or Company MRO Engineers, Inc.	From/To Bridge to Spring Garden Rd
Date Performed 4/3/2007	Jurisdiction Placer County
Analysis Time Period AM Peak Hour	Analysis Year Buildout With Forest Ranch

Project Description Foresthill Divide Community Plan

Oper.(LOS) Des. (N) Plan. (v_p)

Flow Inputs

Volume, V (veh/h)	1126	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

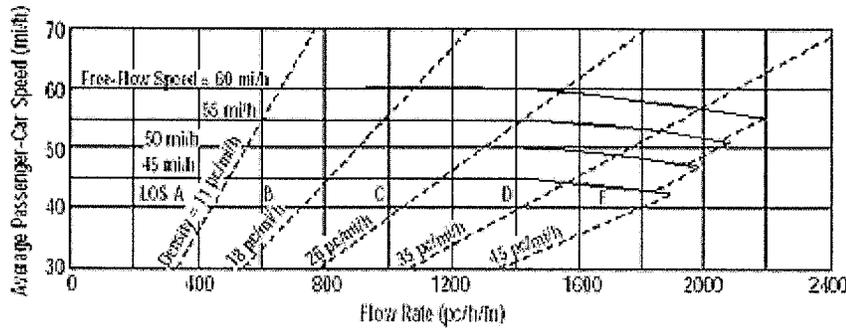
Speed Inputs	Calc Speed Adj and FFS
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Lane Width, LW (ft)	12.0	f_{LW} (mi/h)	0.0
Total Lateral Clearance, LC (ft)	12.0	f_{LC} (mi/h)	0.0
Access Points, A (A/mi)	2	f_A (mi/h)	0.5
Median Type, M	Undivided	f_M (mi/h)	1.6
FFS (measured)		FFS (mi/h)	57.9
Base Free-Flow Speed, BFFS	60.0		

Operations	Design
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Operational (LOS)	Design (N)
Flow Rate, v_p (pc/h/ln)	Required Number of Lanes, N
Speed, S (mi/h)	Flow Rate, v_p (pc/h)
D (pc/mi/ln)	Max Service Flow Rate (pc/h/ln)
LOS	Design LOS

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		Site Information	
Analyst	MKL	Highway/Direction to Travel	Foresthill Road - Mitigated
Agency or Company	MRO Engineers, Inc.	From/To	Bridge to Spring Garden Rd
Date Performed	4/3/2007	Jurisdiction	Placer County
Analysis Time Period	AM Peak Hour	Analysis Year	Buildout With Forest Ranch
Project Description Foresthill Divide Community Plan			

Oper.(LOS)
 Des. (N)
 Plan. (vp)

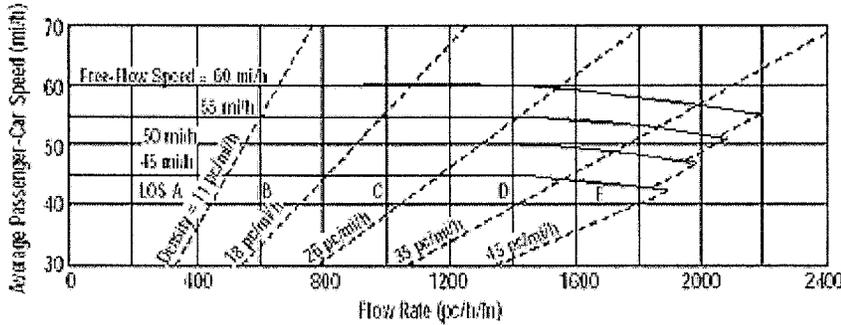
Flow Inputs			
Volume, V (veh/h)	1853	Peak-Hour Factor, PHF	0.88
AADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	4.00
Driver Type Adjustment	1.00	Up/Down %	-3.00
		Number of Lanes	2

Calculate Flow Adjustments			
f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.986

Speed Inputs		Calc Speed Adj and FFS	
Lane Width, LW (ft)	12.0	f_{LW} (mi/h)	0.0
Total Lateral Clearance, LC (ft)	12.0	f_{LC} (mi/h)	0.0
Access Points, A (A/mi)	2	f_A (mi/h)	0.5
Median Type, M	Undivided	f_M (mi/h)	1.6
FFS (measured)		FFS (mi/h)	57.9
Base Free-Flow Speed, BFFS	60.0		

Operations		Design	
Operational (LOS)		Design (N)	
Flow Rate, v_p (pc/h/ln)	1067	Required Number of Lanes, N	
Speed, S (mi/h)	57.9	Flow Rate, v_p (pc/h)	
D (pc/mi/ln)	18.4	Max Service Flow Rate (pc/h/ln)	
LOS	C	Design LOS	

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, LOS, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information		Site Information	
Analyst	MKL	Highway/Direction to Travel	Foresthill Road - Mitigated
Agency or Company	MRO Engineers, Inc.	From/To	Spring Garden to Todd Valley W
Date Performed	4/3/2007	Jurisdiction	Placer County
Analysis Time Period	AM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description Foresthill Divide Community Plan

Oper.(LOS)
 Des. (N)
 Plan. (vp)

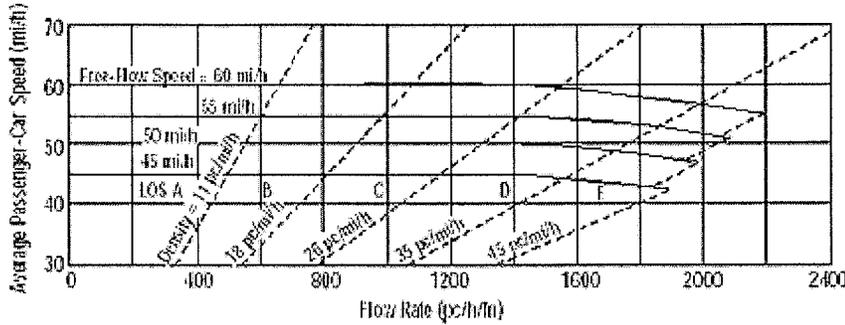
Flow Inputs			
Volume, V (veh/h)	1286	Peak-Hour Factor, PHF	0.88
AADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	1.70
Driver Type Adjustment	1.00	Up/Down %	-3.40
		Number of Lanes	2

Calculate Flow Adjustments			
f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.986

Speed Inputs		Calc Speed Adj and FFS	
Lane Width, LW (ft)	12.0	f_{LW} (mi/h)	0.0
Total Lateral Clearance, LC (ft)	12.0	f_{LC} (mi/h)	0.0
Access Points, A (A/mi)	5	f_A (mi/h)	1.3
Median Type, M	Undivided	f_M (mi/h)	1.6
FFS (measured)		FFS (mi/h)	57.2
Base Free-Flow Speed, BFFS	60.0		

Operations		Design	
Operational (LOS)		Design (N)	
Flow Rate, v_p (pc/h/ln)	740	Required Number of Lanes, N	
Speed, S (mi/h)	57.2	Flow Rate, v_p (pc/h)	
D (pc/mi/ln)	12.9	Max Service Flow Rate (pc/h/ln)	
LOS	B	Design LOS	

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		Site Information	
Analyst	MKL	Highway/Direction to Travel	Foresthill Road - Mitigated
Agency or Company	MRO Engineers, Inc.	From/To	Todd Valley W to Owl Hill Ct
Date Performed	4/3/2007	Jurisdiction	Placer County
Analysis Time Period	AM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description Foresthill Divide Community Plan

Oper.(LOS)
 Des. (N)
 Plan. (v_p)

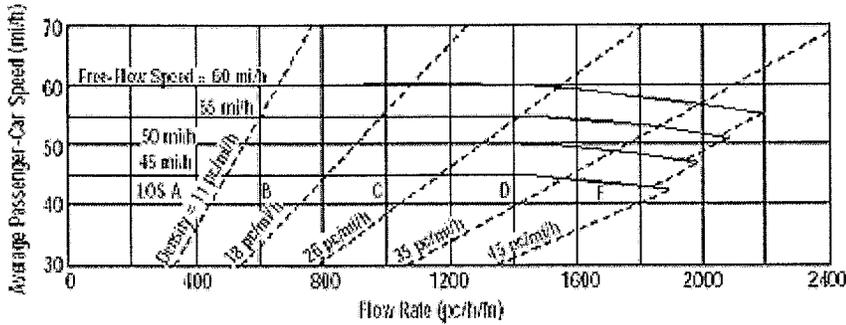
Flow Inputs			
Volume, V (veh/h)	1095	Peak-Hour Factor, PHF	0.59
AAADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AAADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Grade
DDHV (veh/h)		Grade Length (mi)	1.20
Driver Type Adjustment	1.00	Up/Down %	3.00
		Number of Lanes	2

Calculate Flow Adjustments			
f_p	1.00	E_R	3.0
E_T	2.5	f_{HV}	0.935

Speed Inputs		Calc Speed Adj and FFS	
Lane Width, LW (ft)	12.0	f_{LW} (mi/h)	0.0
Total Lateral Clearance, LC (ft)	12.0	f_{LC} (mi/h)	0.0
Access Points, A (A/mi)	3	f_A (mi/h)	0.8
Median Type, M	Undivided	f_M (mi/h)	1.6
FFS (measured)		FFS (mi/h)	57.7
Base Free-Flow Speed, BFFS	60.0		

Operations		Design	
Operational (LOS)		Design (N)	
Flow Rate, v_p (pc/h/ln)	992	Required Number of Lanes, N	
Speed, S (mi/h)	57.7	Flow Rate, v_p (pc/h)	
D (pc/mi/ln)	17.2	Max Service Flow Rate (pc/h/ln)	
LOS	B	Design LOS	

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		Site Information	
Analyst	MKL	Highway/Direction to Travel	Foresthill Road - Mitigated
Agency or Company	MRO Engineers, Inc.	From/To	Todd Valley W to Owl Hill Ct
Date Performed	4/3/2007	Jurisdiction	Placer County
Analysis Time Period	AM Peak Hour	Analysis Year	Buildout With Forest Ranch

Project Description Foresthill Divide Community Plan

Oper.(LOS) Des. (N) Plan. (v_p)

Flow Inputs			
Volume, V (veh/h)	1126	Peak-Hour Factor, PHF	0.79
AAADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AAADT (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		Calc Speed Adj and FFS	
Lane Width, LW (ft)	12.0	f_{LW} (mi/h)	0.0
Total Lateral Clearance, LC (ft)	12.0	f_{LC} (mi/h)	0.0
Access Points, A (A/mi)	4	f_A (mi/h)	1.0
Median Type, M	Undivided	f_M (mi/h)	1.6
FFS (measured)		FFS (mi/h)	57.4
Base Free-Flow Speed, BFFS	60.0		

Operations		Design	
Operational (LOS)		Design (N)	
Flow Rate, v_p (pc/h/ln)	722	Required Number of Lanes, N	
Speed, S (mi/h)	57.4	Flow Rate, v_p (pc/h)	
D (pc/mi/ln)	12.6	Max Service Flow Rate (pc/h/ln)	
LOS	B	Design LOS	