Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I 75 NB to KY 18
Jurisdiction:	FHWA
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5880	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	600	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	250	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5880	600	250	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1633	167	69	v
Trucks and buses	21	15	3	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.816	0.957	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8591	817	290	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4206 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8591	9600	No
$v_{FO} = v_F - v_R$	7774	9600	No
v_R	817	2000	No
v_3 or v_{av34}	2192 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4206 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4206	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 37.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.502

Space mean speed in ramp influence area, S_R = 56.0 mph

Space mean speed in outer lanes, S_0 = 72.1 mph

Space mean speed for all vehicles, S = 63.2 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I 75 NB to KY 18
Jurisdiction:	FHWA
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7630	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	850	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	250	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7630	850	250	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2119	236	69	v
Trucks and buses	21	15	3	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.816	0.957	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11148	1157	290	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5513 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	11148	9600	Yes
$v_{FO} = v_F - v_R$	9991	9600	Yes
v_R	1157	2000	No
v_3 or v_{av34}	2817 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 5748 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	5748	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 51.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, D_S = 0.532

Space mean speed in ramp influence area, S_R = 55.1 mph

Space mean speed in outer lanes, S_0 = 70.2 mph

Space mean speed for all vehicles, S = 61.5 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I 75 NB to KY 18
Jurisdiction:	FHWA
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5930	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	550	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	180	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5930	550	180	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1647	153	50	v
Trucks and buses	21	15	3	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.816	0.957	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8664	749	209	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4200 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8664	9600	No
$v_{FO} = v_F - v_R$	7915	9600	No
v_R	749	2000	No
v_3 or v_{av34}	2232 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 4200 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4200	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 37.7 pc/mi/ln D

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.495

Space mean speed in ramp influence area, S_R = 56.1 mph

Space mean speed in outer lanes, S_0 = 72.0 mph

Space mean speed for all vehicles, S = 63.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I 75 NB to KY 18
Jurisdiction:	FHWA
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7680	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	800	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	240	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7680	800	240	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2133	222	67	v
Trucks and buses	21	15	3	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.816	0.957	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11221	1089	279	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5507 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	11221	9600	Yes
$v_{FO} = v_F - v_R$	10132	9600	Yes
v_R	1089	2000	No
v_3 or v_{av34}	2857 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 5821 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	5821	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 51.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, D_S = 0.526

Space mean speed in ramp influence area, S_R = 55.3 mph

Space mean speed in outer lanes, S_0 = 70.2 mph

Space mean speed for all vehicles, S = 61.6 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I 75 NB to KY 18
Jurisdiction:	FHWA
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5970	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	470	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	370	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5970	470	370	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1658	131	103	v
Trucks and buses	21	15	3	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.816	0.957	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8723	640	430	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4164 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8723	9600	No
$v_{FO} = v_F - v_R$	8083	9600	No
v_R	640	2000	No
v_3 or v_{av34}	2279 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4164 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4164	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 37.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.486

Space mean speed in ramp influence area, S_R = 56.4 mph

Space mean speed in outer lanes, S_0 = 71.8 mph

Space mean speed for all vehicles, S = 63.5 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I 75 NB to KY 18
Jurisdiction:	FHWA
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7830	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	700	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	510	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7830	700	510	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2175	194	142	v
Trucks and buses	21	15	3	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.816	0.957	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11441	953	592	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5526 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	11441	9600	Yes
$v_{FO} = v_F - v_R$	10488	9600	Yes
v_R	953	2000	No
v_3 or v_{av34}	2957 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 6041 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	6041	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 53.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, D_S = 0.514

Space mean speed in ramp influence area, S_R = 55.6 mph

Space mean speed in outer lanes, S_0 = 70.2 mph

Space mean speed for all vehicles, S = 61.6 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I 75 NB to KY 18
Jurisdiction:	FHWA
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5740	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	700	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	510	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5740	700	510	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1594	194	142	v
Trucks and buses	21	15	3	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.816	0.957	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8387	953	592	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4194 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8387	9600	No
$v_{FO} = v_F - v_R$	7434	9600	No
v_R	953	2000	No
v_3 or v_{av34}	2096 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 4194 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4194	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 37.6 pc/mi/ln D

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.514

Space mean speed in ramp influence area, S_R = 55.6 mph

Space mean speed in outer lanes, S_0 = 72.5 mph

Space mean speed for all vehicles, S = 62.9 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I 75 NB to KY 18
Jurisdiction:	FHWA
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7880	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	650	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	350	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7880	650	350	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2189	181	97	v
Trucks and buses	21	15	3	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.816	0.957	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11514	885	406	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5519 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	11514	9600	Yes
$v_{FO} = v_F - v_R$	10629	9600	Yes
v_R	885	2000	No
v_3 or v_{av34}	2997 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 6114 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	6114	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 54.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, D_S = 0.508

Space mean speed in ramp influence area, S_R = 55.8 mph

Space mean speed in outer lanes, S_0 = 70.2 mph

Space mean speed for all vehicles, S = 61.7 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I75 NB to US 42
Jurisdiction:	KYTC
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5130	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	450	vph
Length of first accel/decel lane	410	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	850	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	570	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5130	450	850	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1425	125	236	v
Trucks and buses	21	6	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.917	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7496	545	1058	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3576 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7496	9600	No
$v_{FO} = v_F - v_R$	6951	9600	No
v_R	545	2100	No
v_3 or v_{av34}	1960 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3576 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3576	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 31.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.347

Space mean speed in ramp influence area, S_R = 60.3 mph

Space mean speed in outer lanes, S_0 = 73.0 mph

Space mean speed for all vehicles, S = 66.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I75 NB to US 42
Jurisdiction:	KYTC
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6710	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	600	vph
Length of first accel/decel lane	410	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	900	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	570	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6710	600	900	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1864	167	250	v
Trucks and buses	21	6	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.917	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9804	727	1120	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4685 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9804	9600	Yes
$v_{FO} = v_F - v_R$	9077	9600	No
v_R	727	2100	No
v_3 or v_{av34}	2559 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4685 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4685	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D$ = 40.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, D_S = 0.363

Space mean speed in ramp influence area, S_R = 59.8 mph

Space mean speed in outer lanes, S_0 = 70.7 mph

Space mean speed for all vehicles, S = 65.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I75 NB to US 42
Jurisdiction:	KYTC
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5180	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	400	vph
Length of first accel/decel lane	410	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	550	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	570	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5180	400	550	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1439	111	153	v
Trucks and buses	21	6	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.917	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7569	484	684	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3573 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7569	9600	No
$v_{FO} = v_F - v_R$	7085	9600	No
v_R	484	2100	No
v_3 or v_{av34}	1998 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 3573 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3573	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 31.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.342

Space mean speed in ramp influence area, S_R = 60.4 mph

Space mean speed in outer lanes, S_0 = 72.9 mph

Space mean speed for all vehicles, S = 66.4 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I75 NB to US 42
Jurisdiction:	KYTC
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6760	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	550	vph
Length of first accel/decel lane	410	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	550	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	570	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6760	550	550	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1878	153	153	v
Trucks and buses	21	6	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.917	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9877	666	684	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4682 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9877	9600	Yes
$v_{FO} = v_F - v_R$	9211	9600	No
v_R	666	2100	No
v_3 or v_{av34}	2597 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4682 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4682	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 40.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, D_S = 0.358

Space mean speed in ramp influence area, S_R = 60.0 mph

Space mean speed in outer lanes, S_0 = 70.6 mph

Space mean speed for all vehicles, S = 65.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I75 NB to US 42
Jurisdiction:	KYTC
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4980	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	600	vph
Length of first accel/decel lane	410	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	780	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	570	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4980	600	780	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1383	167	217	v
Trucks and buses	21	6	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.917	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7276	727	971	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3582 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7276	9600	No
$v_{FO} = v_F - v_R$	6549	9600	No
v_R	727	2100	No
v_3 or v_{av34}	1847 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 3582 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3582	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 31.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.363

Space mean speed in ramp influence area, S_R = 59.8 mph

Space mean speed in outer lanes, S_0 = 73.5 mph

Space mean speed for all vehicles, S = 66.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I75 NB to US 42
Jurisdiction:	KYTC
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6840	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	600	vph
Length of first accel/decel lane	410	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1100	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	570	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6840	600	1100	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1900	167	306	v
Trucks and buses	21	6	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.917	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9994	727	1369	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4767 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9994	9600	Yes
$v_{FO} = v_F - v_R$	9267	9600	No
v_R	727	2100	No
v_3 or v_{av34}	2613 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4767 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4767	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 41.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, D_S = 0.363

Space mean speed in ramp influence area, S_R = 59.8 mph

Space mean speed in outer lanes, S_0 = 70.5 mph

Space mean speed for all vehicles, S = 65.0 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I75 NB to US 42
Jurisdiction:	KYTC
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5030	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	550	vph
Length of first accel/decel lane	410	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	550	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	570	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5030	550	550	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1397	153	153	v
Trucks and buses	21	6	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.917	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7349	666	684	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3580 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7349	9600	No
$v_{FO} = v_F - v_R$	6683	9600	No
v_R	666	2100	No
v_3 or v_{av34}	1884 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 3580 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3580	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 31.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	D_S = 0.358	
Space mean speed in ramp influence area,	S_R = 60.0	mph
Space mean speed in outer lanes,	S_0 = 73.3	mph
Space mean speed for all vehicles,	S = 66.2	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	I75 NB to US 42
Jurisdiction:	KYTC
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6990	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	450	vph
Length of first accel/decel lane	410	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	650	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	570	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6990	450	650	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1942	125	181	v
Trucks and buses	21	6	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.917	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	10213	545	809	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4760 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10213	9600	Yes
$v_{FO} = v_F - v_R$	9668	9600	Yes
v_R	545	2100	No
v_3 or v_{av34}	2726 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4813 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	4813	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 42.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, D_S = 0.347

Space mean speed in ramp influence area, S_R = 60.3 mph

Space mean speed in outer lanes, S_0 = 70.2 mph

Space mean speed for all vehicles, S = 65.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to Mall Rd
Jurisdiction:	FHWA
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6080	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	250	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	950	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6080	250	950	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1689	69	264	v
Trucks and buses	21	25	19	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.727	0.778	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8884	382	1356	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4089 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8884	9600	No
$v_{FO} = v_F - v_R$	8502	9600	No
v_R	382	2000	No
v_3 or v_{av34}	2397 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4089 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4089	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 37.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.462

Space mean speed in ramp influence area, S_R = 57.1 mph

Space mean speed in outer lanes, S_0 = 71.3 mph

Space mean speed for all vehicles, S = 64.0 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to Mall Rd
Jurisdiction:	FHWA
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7980	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	350	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1250	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7980	350	1250	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2217	97	347	v
Trucks and buses	21	25	19	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.727	0.778	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11660	535	1785	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5385 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	11660	9600	Yes
$v_{FO} = v_F - v_R$	11125	9600	Yes
v_R	535	2000	No
v_3 or v_{av34}	3137 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 6260 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	6260	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 55.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	D_S = 0.476	
Space mean speed in ramp influence area,	S_R = 56.7	mph
Space mean speed in outer lanes,	S_0 = 70.2	mph
Space mean speed for all vehicles,	S = 62.2	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to Mall Rd
Jurisdiction:	FHWA
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5250	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1080	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1150	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5250	1080	1150	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1458	300	319	v
Trucks and buses	21	25	19	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.727	0.778	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7671	1650	1642	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4275 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7671	9600	No
$v_{FO} = v_F - v_R$	6021	9600	No
v_R	1650	2000	No
v_3 or v_{av34}	1698 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 4275 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4275	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 38.6 pc/mi/ln D

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.576

Space mean speed in ramp influence area, S_R = 53.9 mph

Space mean speed in outer lanes, S_0 = 74.1 mph

Space mean speed for all vehicles, S = 61.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to Mall Rd
Jurisdiction:	FHWA
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6910	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1420	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1400	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6910	1420	1400	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1919	394	389	v
Trucks and buses	21	25	19	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.727	0.778	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	10096	2169	1999	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5625 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10096	9600	Yes
$v_{FO} = v_F - v_R$	7927	9600	No
v_R	2169	2000	Yes
v_3 or v_{av34}	2235 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 5625 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	5625	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 50.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, D_S = 0.623

Space mean speed in ramp influence area, S_R = 52.6 mph

Space mean speed in outer lanes, S_0 = 72.0 mph

Space mean speed for all vehicles, S = 59.7 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to Mall Rd
Jurisdiction:	FHWA
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6340	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	250	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	940	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6340	250	940	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1761	69	261	v
Trucks and buses	21	25	19	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.727	0.778	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9263	382	1342	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4254 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9263	9600	No
$v_{FO} = v_F - v_R$	8881	9600	No
v_R	382	2000	No
v_3 or v_{av34}	2504 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4254 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4254	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 38.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.462

Space mean speed in ramp influence area, S_R = 57.1 mph

Space mean speed in outer lanes, S_0 = 70.9 mph

Space mean speed for all vehicles, S = 63.8 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to Mall Rd
Jurisdiction:	FHWA
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	8010	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	340	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1150	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8010	340	1150	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2225	94	319	v
Trucks and buses	21	25	19	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.727	0.778	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11704	519	1642	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5396 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	11704	9600	Yes
$v_{FO} = v_F - v_R$	11185	9600	Yes
v_R	519	2000	No
v_3 or v_{av34}	3154 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 6304 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	6304	4400	Yes

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 56.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	D_S = 0.475	
Space mean speed in ramp influence area,	S_R = 56.7	mph
Space mean speed in outer lanes,	S_0 = 70.2	mph
Space mean speed for all vehicles,	S = 62.2	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to Mall Rd
Jurisdiction:	FHWA
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6150	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	440	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1100	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6150	440	1100	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1708	122	306	v
Trucks and buses	21	25	19	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.727	0.778	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8986	672	1571	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4297 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8986	9600	No
$v_{FO} = v_F - v_R$	8314	9600	No
v_R	672	2000	No
v_3 or v_{av34}	2344 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4297 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4297	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 38.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.488

Space mean speed in ramp influence area, S_R = 56.3 mph

Space mean speed in outer lanes, S_0 = 71.5 mph

Space mean speed for all vehicles, S = 63.4 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to Mall Rd
Jurisdiction:	FHWA
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7250	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1100	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1400	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7250	1100	1400	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2014	306	389	v
Trucks and buses	21	25	19	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.727	0.778	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	10593	1681	1999	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5567 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10593	9600	Yes
$v_{FO} = v_F - v_R$	8912	9600	No
v_R	1681	2000	No
v_3 or v_{av34}	2513 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 5567 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	5567	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 49.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	D_S = 0.579	
Space mean speed in ramp influence area,	S_R = 53.8	mph
Space mean speed in outer lanes,	S_0 = 70.9	mph
Space mean speed for all vehicles,	S = 60.7	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to US 42
Jurisdiction:	FHWA
Analysis Year:	Build 2012
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4830	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	950	vph
Length of first accel/decel lane	430	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	250	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4830	950	250	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1342	264	69	v
Trucks and buses	21	19	25	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.778	0.727	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7057	1356	382	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3842 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7057	9600	No
$v_{FO} = v_F - v_R$	5701	9600	No
v_R	1356	2000	No
v_3 or v_{av34}	1607 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3842 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3842	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 33.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.550

Space mean speed in ramp influence area, S_R = 54.6 mph

Space mean speed in outer lanes, S_0 = 74.4 mph

Space mean speed for all vehicles, S = 62.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to US 42
Jurisdiction:	FHWA
Analysis Year:	Build 2040
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6360	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1250	vph
Length of first accel/decel lane	430	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	350	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6360	1250	350	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1767	347	97	v
Trucks and buses	21	19	25	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.778	0.727	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9293	1785	535	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5058 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9293	9600	No
$v_{FO} = v_F - v_R$	7508	9600	No
v_R	1785	2000	No
v_3 or v_{av34}	2117 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 5058 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	5058	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 43.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.589

Space mean speed in ramp influence area, S_R = 53.5 mph

Space mean speed in outer lanes, S_0 = 72.4 mph

Space mean speed for all vehicles, S = 60.7 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to US 42
Jurisdiction:	FHWA
Analysis Year:	Build 2012
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4630	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1150	vph
Length of first accel/decel lane	430	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1080	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4630	1150	1080	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1286	319	300	v
Trucks and buses	21	19	25	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.778	0.727	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6765	1642	1650	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3876 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6765	9600	No
$v_{FO} = v_F - v_R$	5123	9600	No
v_R	1642	2000	No
v_3 or v_{av34}	1444 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3876 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3876	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 33.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.576

Space mean speed in ramp influence area, S_R = 53.9 mph

Space mean speed in outer lanes, S_0 = 75.1 mph

Space mean speed for all vehicles, S = 61.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to US 42
Jurisdiction:	FHWA
Analysis Year:	Build 2040
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6210	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1400	vph
Length of first accel/decel lane	430	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1420	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6210	1400	1420	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1725	389	394	v
Trucks and buses	21	19	25	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.778	0.727	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9074	1999	2169	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5084 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9074	9600	No
$v_{FO} = v_F - v_R$	7075	9600	No
v_R	1999	2000	No
v_3 or v_{av34}	1995 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 5084 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	5084	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 44.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	D_S = 0.608	
Space mean speed in ramp influence area,	S_R = 53.0	mph
Space mean speed in outer lanes,	S_0 = 72.9	mph
Space mean speed for all vehicles,	S = 60.2	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to US 42
Jurisdiction:	FHWA
Analysis Year:	No Build 2012
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5170	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	940	vph
Length of first accel/decel lane	430	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	250	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5170	940	250	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1436	261	69	v
Trucks and buses	21	19	25	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.778	0.727	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7554	1342	382	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4050 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7554	9600	No
$v_{FO} = v_F - v_R$	6212	9600	No
v_R	1342	2000	No
v_3 or v_{av34}	1752 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4050 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4050	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 35.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.549

Space mean speed in ramp influence area, S_R = 54.6 mph

Space mean speed in outer lanes, S_0 = 73.9 mph

Space mean speed for all vehicles, S = 62.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to US 42
Jurisdiction:	FHWA
Analysis Year:	No Build 2040
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6560	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1150	vph
Length of first accel/decel lane	430	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	340	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6560	1150	340	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1822	319	94	v
Trucks and buses	21	19	25	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.778	0.727	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9585	1642	519	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5105 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9585	9600	No
$v_{FO} = v_F - v_R$	7943	9600	No
v_R	1642	2000	No
v_3 or v_{av34}	2240 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 5105 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	5105	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 44.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.576

Space mean speed in ramp influence area, S_R = 53.9 mph

Space mean speed in outer lanes, S_0 = 72.0 mph

Space mean speed for all vehicles, S = 61.0 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to US 42
Jurisdiction:	FHWA
Analysis Year:	No Build 2012
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5010	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1100	vph
Length of first accel/decel lane	430	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	440	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5010	1100	440	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1392	306	122	v
Trucks and buses	21	19	25	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.778	0.727	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7320	1571	672	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4078 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7320	9600	No
$v_{FO} = v_F - v_R$	5749	9600	No
v_R	1571	2000	No
v_3 or v_{av34}	1621 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 4078 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4078	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 35.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.569

Space mean speed in ramp influence area, S_R = 54.1 mph

Space mean speed in outer lanes, S_0 = 74.4 mph

Space mean speed for all vehicles, S = 61.5 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	I 75 SB to US 42
Jurisdiction:	FHWA
Analysis Year:	No Build 2040
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6310	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1400	vph
Length of first accel/decel lane	430	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1100	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1490	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6310	1400	1100	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1753	389	306	v
Trucks and buses	21	19	25	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.778	0.727	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9220	1999	1681	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5147 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9220	9600	No
$v_{FO} = v_F - v_R$	7221	9600	No
v_R	1999	2000	No
v_3 or v_{av34}	2036 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 5147 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	5147	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 44.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.608

Space mean speed in ramp influence area, S_R = 53.0 mph

Space mean speed in outer lanes, S_0 = 72.7 mph

Space mean speed for all vehicles, S = 60.2 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	KY 18/US 42 to I 75 SB
Jurisdiction:	FHWA
Analysis Year:	Build 2012
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4630	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	40.0	mph
Volume on ramp	860	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	950	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2230	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4630	860	950	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1286	239	264	v
Trucks and buses	0	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	1.000	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5144	956	1056	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.098 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 506 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6100	9600	No
v_3 or v_{av34}	2319 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 2057 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	6100	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 25.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.356	
Space mean speed in ramp influence area,	S_R = 60.0	mph
Space mean speed in outer lanes,	S_0 = 66.2	mph
Space mean speed for all vehicles,	S = 63.0	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	KY 18/US 42 to I 75 SB
Jurisdiction:	FHWA
Analysis Year:	Build 2040
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6080	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	40.0	mph
Volume on ramp	950	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1250	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2230	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6080	950	1250	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1689	264	347	v
Trucks and buses	0	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	1.000	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6756	1056	1389	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.086 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 580 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7812	9600	No
v_3 or v_{av34}	3088 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 2702 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	7812	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 30.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.444	
Space mean speed in ramp influence area,	S_R = 57.6	mph
Space mean speed in outer lanes,	S_0 = 64.5	mph
Space mean speed for all vehicles,	S = 61.0	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	KY 18/US 42 to I 75 SB
Jurisdiction:	FHWA
Analysis Year:	Build 2012
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4630	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	40.0	mph
Volume on ramp	1340	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1150	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2230	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4630	1340	1150	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1286	372	319	v
Trucks and buses	0	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	1.000	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5144	1489	1278	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.032 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 163 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6633	9600	No
v_3 or v_{av34}	2490 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2057 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	6633	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 29.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.412	
Space mean speed in ramp influence area,	S_R = 58.5	mph
Space mean speed in outer lanes,	S_0 = 66.2	mph
Space mean speed for all vehicles,	S = 61.8	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	KY 18/US 42 to I 75 SB
Jurisdiction:	FHWA
Analysis Year:	Build 2040
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6080	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	40.0	mph
Volume on ramp	1790	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1400	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2230	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6080	1790	1400	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1689	497	389	v
Trucks and buses	0	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	1.000	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6756	1989	1556	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = -0.031 Using Equation 4

$v_{12} = v_F (P_{FM})$ = -207 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8745	9600	No
v_3 or v_{av34}	3481 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2702 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	8745	4600	Yes

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 37.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	M_S = 0.702	
Space mean speed in ramp influence area,	S_R = 50.3	mph
Space mean speed in outer lanes,	S_0 = 64.5	mph
Space mean speed for all vehicles,	S = 56.0	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	KY 18/US 42 to I 75 SB
Jurisdiction:	FHWA
Analysis Year:	No Build 2012
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4930	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	40.0	mph
Volume on ramp	580	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	940	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2230	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4930	580	940	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1369	161	261	v
Trucks and buses	0	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	1.000	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5478	644	1044	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.137 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 752 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6122	9600	No
v_3 or v_{av34}	2363 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 2191 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	6122	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 23.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.343	
Space mean speed in ramp influence area,	S_R = 60.4	mph
Space mean speed in outer lanes,	S_0 = 65.9	mph
Space mean speed for all vehicles,	S = 63.2	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	KY 18/US 42 to I 75 SB
Jurisdiction:	FHWA
Analysis Year:	No Build 2040
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6170	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	40.0	mph
Volume on ramp	800	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1150	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2230	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6170	800	1150	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1714	222	319	v
Trucks and buses	0	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	1.000	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6856	889	1278	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.107 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 731 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7745	9600	No
v_3 or v_{av34}	3062 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2742 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	7745	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 29.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.424	
Space mean speed in ramp influence area,	S_R = 58.1	mph
Space mean speed in outer lanes,	S_0 = 64.4	mph
Space mean speed for all vehicles,	S = 61.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	KY 18/US 42 to I 75 SB
Jurisdiction:	FHWA
Analysis Year:	No Build 2012
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4930	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	40.0	mph
Volume on ramp	1400	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1100	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2230	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4930	1400	1100	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1369	389	306	v
Trucks and buses	0	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	1.000	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5478	1556	1222	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.023 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 128 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7034	9600	No
v_3 or v_{av34}	2675 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 2191 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	7034	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 30.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.442	
Space mean speed in ramp influence area,	S_R = 57.6	mph
Space mean speed in outer lanes,	S_0 = 65.9	mph
Space mean speed for all vehicles,	S = 61.2	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Southbound
Junction:	KY 18/US 42 to I 75 SB
Jurisdiction:	FHWA
Analysis Year:	No Build 2040
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6170	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	40.0	mph
Volume on ramp	1850	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1400	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2230	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6170	1850	1400	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1714	514	389	v
Trucks and buses	0	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	1.000	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6856	2056	1556	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = -0.039 Using Equation 4

$v_{12} = v_F (P_{FM})$ = -268 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8912	9600	No
v_3 or v_{av34}	3562 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 2742 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	8912	4600	Yes

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 38.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	M_S = 0.750	
Space mean speed in ramp influence area,	S_R = 49.0	mph
Space mean speed in outer lanes,	S_0 = 64.4	mph
Space mean speed for all vehicles,	S = 55.1	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	Mall Rd to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5970	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	45.0	mph
Volume on ramp	250	vph
Length of first accel/decel lane	830	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	600	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5970	250	600	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1658	69	167	v
Trucks and buses	21	3	15	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.957	0.816	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8723	290	817	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.182 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1584 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9013	9600	No
v_3 or v_{av34}	3569 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 3489 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	9013	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 29.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.417	
Space mean speed in ramp influence area,	S_R = 58.3	mph
Space mean speed in outer lanes,	S_0 = 61.6	mph
Space mean speed for all vehicles,	S = 60.2	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	Mall Rd to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7590	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	45.0	mph
Volume on ramp	250	vph
Length of first accel/decel lane	830	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	850	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7590	250	850	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2108	69	236	v
Trucks and buses	21	3	15	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.957	0.816	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11090	290	1157	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.182 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 2013 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	11380	9600	Yes
v_3 or v_{av34}	4538 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 4436 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	11380	4600	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 37.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	M_S = 0.686	
Space mean speed in ramp influence area,	S_R = 50.8	mph
Space mean speed in outer lanes,	S_0 = 57.3	mph
Space mean speed for all vehicles,	S = 54.4	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	Mall Rd to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5970	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	45.0	mph
Volume on ramp	180	vph
Length of first accel/decel lane	830	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	550	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5970	180	550	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1658	50	153	v
Trucks and buses	21	3	15	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.957	0.816	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8723	209	749	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.192 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1672 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8932	9600	No
v_3 or v_{av34}	3525 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 3489 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	8932	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 29.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.404	
Space mean speed in ramp influence area,	S_R = 58.7	mph
Space mean speed in outer lanes,	S_0 = 61.6	mph
Space mean speed for all vehicles,	S = 60.3	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	Mall Rd to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7590	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	45.0	mph
Volume on ramp	240	vph
Length of first accel/decel lane	830	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	800	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7590	240	800	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2108	67	222	v
Trucks and buses	21	3	15	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.957	0.816	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11090	279	1089	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.183 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 2029 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	11369	9600	Yes

v_3 or v_{av34} 4530 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 4436 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	11369	4600	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 36.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	M_S = 0.682	
Space mean speed in ramp influence area,	S_R = 50.9	mph
Space mean speed in outer lanes,	S_0 = 57.3	mph
Space mean speed for all vehicles,	S = 54.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	Mall Rd to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6240	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	45.0	mph
Volume on ramp	370	vph
Length of first accel/decel lane	830	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	470	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6240	370	470	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1733	103	131	v
Trucks and buses	21	3	15	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.957	0.816	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9117	430	640	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.164 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1496 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9547	9600	No
v_3 or v_{av34}	3810 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 3646 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	9547	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 31.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.476	
Space mean speed in ramp influence area,	S_R = 56.7	mph
Space mean speed in outer lanes,	S_0 = 60.9	mph
Space mean speed for all vehicles,	S = 59.0	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	Mall Rd to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7620	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	45.0	mph
Volume on ramp	510	vph
Length of first accel/decel lane	830	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	700	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7620	510	700	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2117	142	194	v
Trucks and buses	21	3	15	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.957	0.816	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11134	592	953	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.144 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1601 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	11726	9600	Yes
v_3 or v_{av34}	4766 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 4453 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	11726	4600	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 39.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	M_S = 0.852	
Space mean speed in ramp influence area,	S_R = 46.2	mph
Space mean speed in outer lanes,	S_0 = 57.2	mph
Space mean speed for all vehicles,	S = 51.9	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	Mall Rd to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6240	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	45.0	mph
Volume on ramp	510	vph
Length of first accel/decel lane	830	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	700	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6240	510	700	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1733	142	194	v
Trucks and buses	21	3	15	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.957	0.816	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9117	592	953	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.144 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1311 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9709	9600	Yes
v_3 or v_{av34}	3903 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 3646 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	9709	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 33.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	M_S = 0.516	
Space mean speed in ramp influence area,	S_R = 55.5	mph
Space mean speed in outer lanes,	S_0 = 60.9	mph
Space mean speed for all vehicles,	S = 58.4	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	Mall Rd to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7620	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	45.0	mph
Volume on ramp	350	vph
Length of first accel/decel lane	830	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	650	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1730	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7620	350	650	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2117	97	181	v
Trucks and buses	21	3	15	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.957	0.816	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11134	406	885	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.167 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1860 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	11540	9600	Yes
v_3 or v_{av34}	4637 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 4453 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	11540	4600	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 38.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	M_S = 0.749	
Space mean speed in ramp influence area,	S_R = 49.0	mph
Space mean speed in outer lanes,	S_0 = 57.2	mph
Space mean speed for all vehicles,	S = 53.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 EB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5080	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30.0	mph
Volume on ramp	850	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	400	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5080	850	400	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1411	236	111	v
Trucks and buses	21	8	12	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.893	0.847	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7422	1058	524	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.086 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 635 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8480	9600	No
v_3 or v_{av34}	3393 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 2968 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	8480	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 29.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.477	
Space mean speed in ramp influence area,	S_R = 56.7	mph
Space mean speed in outer lanes,	S_0 = 63.8	mph
Space mean speed for all vehicles,	S = 60.2	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 EB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6620	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30.0	mph
Volume on ramp	900	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	500	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6620	900	500	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1839	250	139	v
Trucks and buses	21	8	12	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5*	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.893	0.847	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9673	1120	656	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.078 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 753 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	10793	9600	Yes
v_3 or v_{av34}	4460 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 3869 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	10793	4600	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 37.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, M_S = 0.830

Space mean speed in ramp influence area, S_R = 46.7 mph

Space mean speed in outer lanes, S_0 = 59.9 mph

Space mean speed for all vehicles, S = 53.0 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 EB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5080	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30.0	mph
Volume on ramp	550	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	760	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5080	550	760	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1411	153	211	v
Trucks and buses	21	8	12	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.893	0.847	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7422	684	996	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.132 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 982 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8106	9600	No
v_3 or v_{av34}	3220 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 2968 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	8106	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 27.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.408	
Space mean speed in ramp influence area,	S_R = 58.6	mph
Space mean speed in outer lanes,	S_0 = 63.8	mph
Space mean speed for all vehicles,	S = 61.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 EB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6620	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30.0	mph
Volume on ramp	550	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	950	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6620	550	950	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1839	153	264	v
Trucks and buses	21	8	12	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.893	0.847	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9673	684	1246	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.132 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1280 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	10357	9600	Yes
v_3 or v_{av34}	4196 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 3869 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	10357	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 34.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	M_S = 0.628	
Space mean speed in ramp influence area,	S_R = 52.4	mph
Space mean speed in outer lanes,	S_0 = 59.9	mph
Space mean speed for all vehicles,	S = 56.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 EB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5090	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30.0	mph
Volume on ramp	780	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	370	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5090	780	370	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1414	217	103	v
Trucks and buses	21	8	12	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.893	0.847	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7437	971	485	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.096 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 717 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8408	9600	No

v_3 or v_{av34} 3360 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2974 (Equation 13-15, 13-16, 18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	8408	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 29.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.460	
Space mean speed in ramp influence area,	S_R = 57.1	mph
Space mean speed in outer lanes,	S_0 = 63.8	mph
Space mean speed for all vehicles,	S = 60.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 EB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6740	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30.0	mph
Volume on ramp	1100	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	500	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6740	1100	500	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1872	306	139	v
Trucks and buses	21	8	12	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.893	0.847	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9848	1369	656	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.047 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 460 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	11217	9600	Yes
v_3 or v_{av34}	4694 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 3939 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	11217	4600	Yes

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 39.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, M_S = 1.046

Space mean speed in ramp influence area, S_R = 40.7 mph

Space mean speed in outer lanes, S_0 = 59.5 mph

Space mean speed for all vehicles, S = 48.9 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 EB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5090	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30.0	mph
Volume on ramp	550	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	750	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5090	550	750	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1414	153	208	v
Trucks and buses	21	8	12	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.893	0.847	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7437	684	983	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.132 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 984 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8121	9600	No
v_3 or v_{av34}	3226 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 2974 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	8121	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 27.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.409	
Space mean speed in ramp influence area,	S_R = 58.5	mph
Space mean speed in outer lanes,	S_0 = 63.8	mph
Space mean speed for all vehicles,	S = 61.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 EB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	6740	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30.0	mph
Volume on ramp	650	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	500	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6740	650	500	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1872	181	139	v
Trucks and buses	21	8	12	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.893	0.847	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9848	809	656	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.117 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1149 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	10657	9600	Yes
v_3 or v_{av34}	4349 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 3939 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	10657	4600	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 35.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	M_S = 0.708	
Space mean speed in ramp influence area,	S_R = 50.2	mph
Space mean speed in outer lanes,	S_0 = 59.5	mph
Space mean speed for all vehicles,	S = 55.0	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 WB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5880	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	400	vph
Length of first accel/decel lane	900	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	850	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	270	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5880	400	850	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1633	111	236	v
Trucks and buses	21	12	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.847	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8591	524	1058	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.152 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1308 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9115	9600	No
v_3 or v_{av34}	3641 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 3436 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	9115	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 30.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.463	
Space mean speed in ramp influence area,	S_R = 57.0	mph
Space mean speed in outer lanes,	S_0 = 61.8	mph
Space mean speed for all vehicles,	S = 59.6	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 WB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7680	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	500	vph
Length of first accel/decel lane	900	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	900	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	270	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7680	500	900	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2133	139	250	v
Trucks and buses	21	12	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.847	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11221	656	1120	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.136 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1524 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	11877	9600	Yes

v_3 or v_{av34} 4848 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 4488 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	11877	4600	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 39.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, M_S = 0.926

Space mean speed in ramp influence area, S_R = 44.1 mph

Space mean speed in outer lanes, S_0 = 57.1 mph

Space mean speed for all vehicles, S = 50.6 mph

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Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 WB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5880	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	760	vph
Length of first accel/decel lane	900	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	550	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	270	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5880	760	550	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1633	211	153	v
Trucks and buses	21	12	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.847	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8591	996	684	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.093 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 802 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9587	9600	No
v_3 or v_{av34}	3894 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		Yes	
Is v_3 or v_{av34} > 1.5 v_{12} /2		Yes	

If yes, v_{12A} = 3436 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	9587	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 33.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.586	
Space mean speed in ramp influence area,	S_R = 53.6	mph
Space mean speed in outer lanes,	S_0 = 61.8	mph
Space mean speed for all vehicles,	S = 57.7	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 WB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7680	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	950	vph
Length of first accel/decel lane	900	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	550	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	270	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7680	950	550	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2133	264	153	v
Trucks and buses	21	12	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.847	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11221	1246	684	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.062 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 696 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	12467	9600	Yes
v_3 or v_{av34}	5262 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 4488 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	12467	4600	Yes

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 44.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	M_S = 1.464	
Space mean speed in ramp influence area,	S_R = 29.0	mph
Space mean speed in outer lanes,	S_0 = 57.1	mph
Space mean speed for all vehicles,	S = 39.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 WB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5830	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	370	vph
Length of first accel/decel lane	900	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	780	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	270	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5830	370	780	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1619	103	217	v
Trucks and buses	21	12	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.847	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8518	485	971	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.157 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1339 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9003	9600	No
v_3 or v_{av34}	3589 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 3407 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	9003	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 30.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.449	
Space mean speed in ramp influence area,	S_R = 57.4	mph
Space mean speed in outer lanes,	S_0 = 61.9	mph
Space mean speed for all vehicles,	S = 59.9	mph

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Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	AM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 WB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7730	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	500	vph
Length of first accel/decel lane	900	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1100	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	270	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7730	500	1100	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2147	139	306	v
Trucks and buses	21	12	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.847	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11294	656	1369	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.136 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1534 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	11950	9600	Yes

v_3 or v_{av34} 4880 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 4517 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	11950	4600	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 39.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, M_S = 0.946

Space mean speed in ramp influence area, S_R = 43.5 mph

Space mean speed in outer lanes, S_0 = 56.9 mph

Space mean speed for all vehicles, S = 50.2 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 WB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2012 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	5830	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	750	vph
Length of first accel/decel lane	900	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	550	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	270	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5830	750	550	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1619	208	153	v
Trucks and buses	21	12	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.847	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8518	983	684	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.095 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 809 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9501	9600	No
v_3 or v_{av34}	3854 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	Yes	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	Yes	

If yes, v_{12A} = 3407 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	9501	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 33.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.572	
Space mean speed in ramp influence area,	S_R = 54.0	mph
Space mean speed in outer lanes,	S_0 = 61.9	mph
Space mean speed for all vehicles,	S = 58.0	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JJL
Agency/Co.:	Qk4
Date performed:	12/28/2012
Analysis time period:	PM Design Hour
Freeway/Dir of Travel:	Interstate 75 Northbound
Junction:	US 42 WB to I 75 NB
Jurisdiction:	FHWA
Analysis Year:	2040 No Build
Description:	Mall Road Interchange

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	70.0	mph
Volume on freeway	7730	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	500	vph
Length of first accel/decel lane	900	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	650	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	270	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7730	500	650	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2147	139	181	v
Trucks and buses	21	12	8	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Rolling	Rolling	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	

Heavy vehicle adjustment, fHV	0.760	0.847	0.893	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11294	656	809	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.136 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1534 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	11950	9600	Yes

v_3 or v_{av34} 4880 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 4517 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	11950	4600	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 39.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	M_S = 0.946	
Space mean speed in ramp influence area,	S_R = 43.5	mph
Space mean speed in outer lanes,	S_0 = 56.9	mph
Space mean speed for all vehicles,	S = 50.2	mph

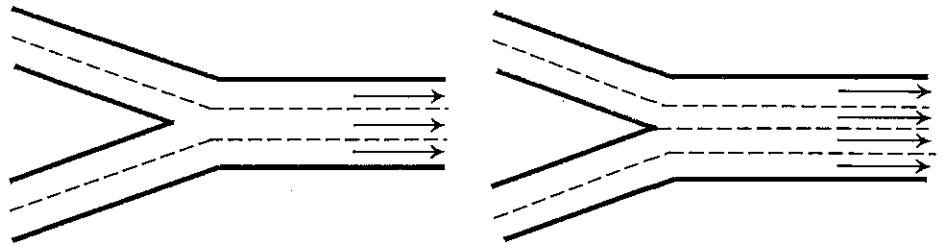
There is no calibrated procedure for adapting the methodology of this chapter to freeways with more than five lanes in one direction. The approach of Equation 13-25 is, however, conceptually adaptable to such situations. A local calibration of the amount of traffic using Lanes 5+ would be needed. The remaining flow could then be modeled as if it were taking place on a four-lane (one direction) segment.

Major Merge Areas

A major merge area is one in which two primary roadways, each having multiple lanes, merge to form a single freeway segment. Such junctions occur when two freeways join to form a single freeway or when a major multilane high-speed ramp joins with a freeway. Major merges are different from one- and two-lane on-ramps in that each of the merging roadways is generally at or near freeway design standards and no clear ramp or acceleration lane is involved in the merge.

Such merge areas come in a variety of geometries, all of which fall into one of two categories. In one geometry, the number of lanes leaving the merge area is one less than the total number of lanes entering it. In the other, the number of lanes leaving the merge area is the same as that entering it. These geometries are illustrated in Exhibit 13-18.

Exhibit 13-18
Major Merge Areas Illustrated



(a) Major Merge with One Lane Dropped (b) Major Merge with No Lane Dropped

There are no effective models of performance for a major merge area. Therefore, analysis is limited to checking capacities on the approaching legs and the downstream freeway segment. A merge failure would be indicated by a *v/c* ratio in excess of 1.00. LOS cannot be determined for major merge areas. Problems in major merge areas usually result from insufficient capacity of the downstream freeway segment.

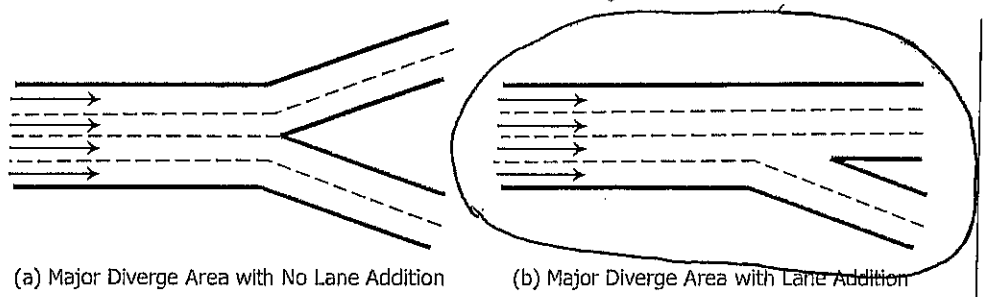
LOS cannot be determined for major merge areas.

Major Diverge Areas

The two common geometries for major diverge areas are illustrated in Exhibit 13-19. In the first case, the number of lanes leaving the diverge area is the same as the number entering it. In the second, the number of lanes leaving the diverge area is one more than the number entering it.

The principal analysis of a major diverge area involves checking the capacity of entering and departing roadways, all of which are generally built to mainline standards. A failure results when any of the demand flow rates exceeds the capacity of the segment.

I 75 SB to KY 18



(a) Major Diverge Area with No Lane Addition (b) Major Diverge Area with Lane Addition

Exhibit 13-19
Major Diverge Areas Illustrated

For major diverge areas, a model exists for computing the average density across all approaching freeway lanes within 1,500 ft of the diverge, as given in Equation 13-26:

$$D_{MD} = 0.0175\left(\frac{v_F}{N}\right)$$

Equation 13-26

where

D_{MD} = density in the major diverge influence area (which includes all approaching freeway lanes) (pc/mi/ln),

v_F = demand flow rate immediately upstream of the major diverge influence area (pc/h), and

N = number of lanes approaching the major diverge.

The result can be compared with the criteria of Exhibit 13-2 to determine a LOS for the major diverge influence area. Note that the density and LOS estimates are only valid for stable cases (i.e., not in cases in which LOS F exists because of a capacity deficiency on the approaching or departing legs of the diverge).

Effect of Ramp Control at On-Ramps

For the purposes of this methodology, procedures are not modified in any way to account for the local effect of ramp control—except for the limitation that the ramp meter may have on the ramp demand flow rate. Research (5) has found that the breakdown of a merge area may be a probabilistic event based on the platoon characteristics of the arriving ramp vehicles. Ramp meters facilitate uniform gaps between entering ramp vehicles and may reduce the probability of a breakdown on the associated freeway mainline.

OVERLAPPING RAMP INFLUENCE AREAS

Whenever a series of ramps on a freeway is analyzed, the 1,500-ft ramp influence areas could overlap. In such cases, the operation in the overlapping region is determined by the ramp influence area having the highest density.

- No heavy vehicles,
- 12-ft lanes,
- Adequate lateral clearances (≥6 ft), and
- Road users familiar with the facility (i.e., $f_p = 1.00$).

LOS CRITERIA FOR MERGE AND DIVERGE SEGMENTS

LOS A–E is defined in terms of density; LOS F exists when demand exceeds capacity.

Merge/diverge segment LOS is defined in terms of density for all cases of stable operation (LOS A–E). LOS F exists when the freeway demand exceeds the capacity of the upstream (diverges) or downstream (merges) freeway segment, or where the off-ramp demand exceeds the off-ramp capacity.

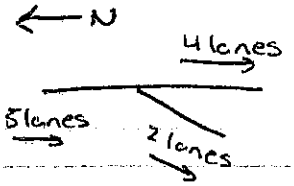
At LOS A, unrestricted operations exist, and the density is low enough to permit smooth merging or diverging with very little turbulence in the traffic stream. At LOS B, merging and diverging maneuvers become noticeable to through drivers, and minimal turbulence occurs. At LOS C, speed within the ramp influence area begins to decline as turbulence levels become much more noticeable. Both ramp and freeway vehicles begin to adjust their speeds to accomplish smooth transitions. At LOS D, turbulence levels in the influence area become intrusive, and virtually all vehicles slow to accommodate merging or diverging maneuvers. Some ramp queues may form at heavily used on-ramps, but freeway operation remains stable. LOS E represents operating conditions approaching or at capacity. Small changes in demand or disruptions within the traffic stream can cause both ramp and freeway queues to form.

LOS F defines operating conditions within queues that form on both the ramp and the freeway mainline when capacity is exceeded by demand. For on-ramps, LOS F exists when the total demand flow rate from the upstream freeway segment and the on-ramp exceeds the capacity of the downstream freeway segment. For off-ramps, LOS F exists when the total demand flow rate on the approaching upstream freeway segment exceeds the capacity of the upstream freeway segment. LOS F also occurs when the off-ramp demand exceeds the capacity of the off-ramp.

Exhibit 13-2 summarizes the LOS criteria for freeway merge and diverge segments. These criteria apply to all ramp–freeway junctions and may also be applied to major merges and diverges; high-speed, uncontrolled merge or diverge ramps on multilane highway sections; and merges and diverges on freeway C-D roadways. LOS is not defined for ramp roadways, while the LOS of a ramp–street junction is defined in Chapter 22, Interchange Ramp Terminals.

Exhibit 13-2
LOS Criteria for Freeway Merge and Diverge Segments

LOS	Density (pc/mi/ln)	Comments
A	≤10	Unrestricted operations
B	>10–20	Merging and diverging maneuvers noticeable to drivers
C	>20–28	Influence area speeds begin to decline
D	>28–35	Influence area turbulence becomes intrusive
E	>35	Turbulence felt by virtually all drivers
F	Demand exceeds capacity	Ramp and freeway queues form

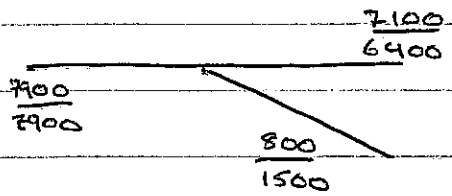


21% Trucks on Mainline

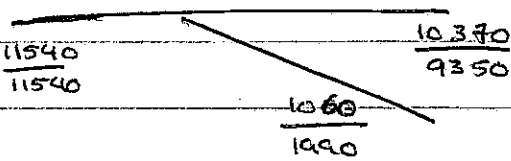
13% Trucks on Ramp

NB 2012

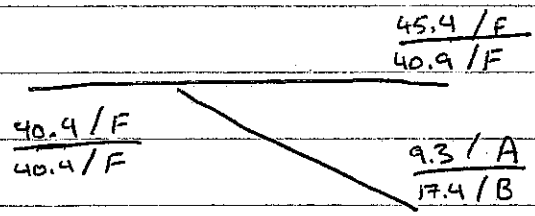
Base Volumes



Passenger Cars Per Hour

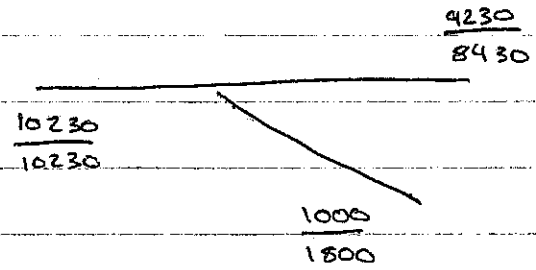


Density / LOS

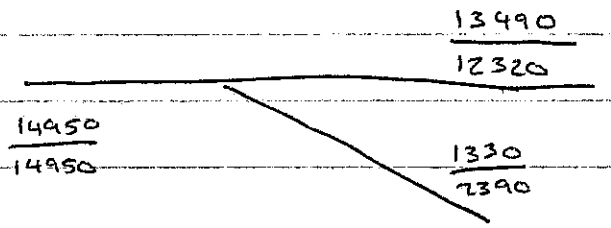


NB 2040

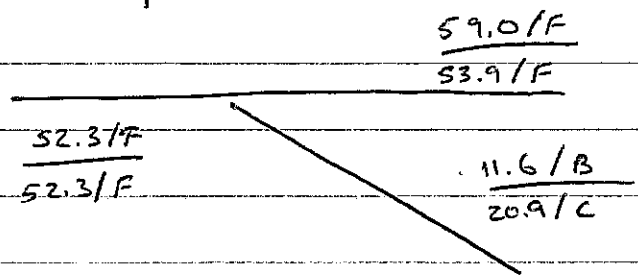
Base Volumes



Passenger Loss Per Hour

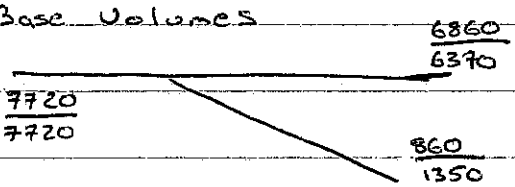


Density / LOS

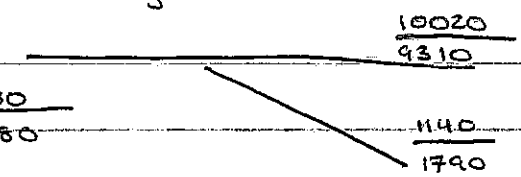


Build 2012

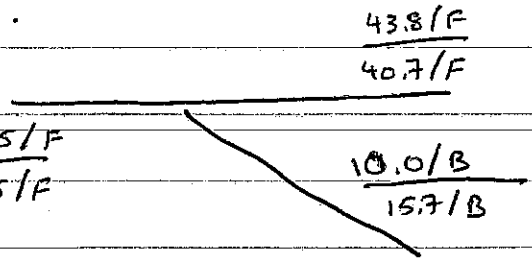
Base Volumes



Passenger Loss Per Hour

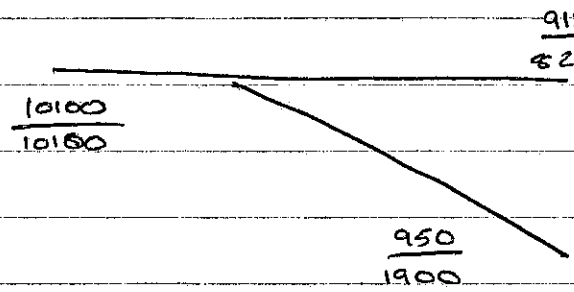


Density / LOS

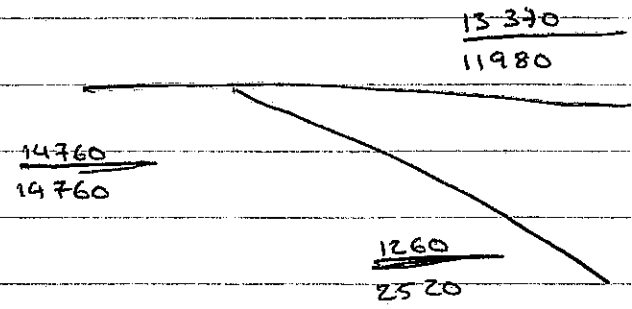


Build 2040

Base Volumes



Passenger Cars Per Hour



Density / LOS