

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

-----Diverge Analysis-----

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: US 276 (EXIT48A)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4590	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	30.0	mph
Volume on ramp	276	vph
Length of first accel/decel lane	700	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	237	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	500	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4590		276		237	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1275		77		66	v
Trucks and buses	18		18		18	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5559	334	287	pcph

Estimation of V12 Diverge Areas

$$L = \text{(Equation 13-12 or 13-13)}$$

EQ

$$P = 0.606 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 3499 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5559	6900	No
$v_{FO} = v_F - v_R$	5225	6900	No
v_R	334	2000	No
v_3 or v_{av34}	2060 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700 \text{ pc/h?}$		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3499$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3499	4400	No

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 \frac{L}{D}$	$= 28.0 +$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence D			

Speed Estimation

Intermediate speed variable,	$D = 0.523$	
Space mean speed in ramp influence area,	$S_R = 50.6$	mph
Space mean speed in outer lanes,	$S_0 = 61.7$	mph
Space mean speed for all vehicles,	$S = 54.2$	mph

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_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4314	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	25.0	mph
Volume on ramp	237	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	627	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	420	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4314	237	627	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1198	66	174	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5225	287	759	pcph

Estimation of V12 Merge Areas

$$L = 4911.35 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 1.000 \text{ Using Equation 3}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 5225 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5512	6900	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5225$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	5512	4600	Yes

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 45.7 \text{ pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 1.266$	
Space mean speed in ramp influence area,	$S_R = 37.2$	mph
Space mean speed in outer lanes,	$S_0 = 60.0$	mph
Space mean speed for all vehicles,	$S = 37.2$	mph

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_____Merge Analysis_____

Analyst: JP
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Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4314	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	25.0	mph
Volume on ramp	237	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	276	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	500	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4314	237	276	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1198	66	77	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5225	287	334	pcph

-----Estimation of V12 Merge Areas-----

$$L = 271.05 \quad (\text{Equation 13-6 or 13-7})$$

$$EQ$$

$$P = 0.589 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F(P) = 3079 \quad \text{pc/h}$$

-----Capacity Checks-----

	Actual	Maximum	LOS F?
v _{FO}	5512	6900	No
v ₃ or v _{av34}	2146 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} = 3079		(Equation 13-15, 13-16, 13-18, or 13-19)	

-----Flow Entering Merge Influence Area-----

	Actual	Max Desirable	Violation?
v _{R12}	5512	4600	No

-----Level of Service Determination (if not F)-----

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

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

-----Speed Estimation-----

Intermediate speed variable,	M	= 0.413	
	S		
Space mean speed in ramp influence area,	S _R	= 52.6	mph
Space mean speed in outer lanes,	S ₀	= 54.1	mph
Space mean speed for all vehicles,	S	= 53.1	mph

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Diverge Analysis

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Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: US 276 (EXIT48B)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4551	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	25.0	mph
Volume on ramp	627	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	547	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4551		627		547	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1264		174		152	v
Trucks and buses	18		18		18	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5512	759	662	pcph

Estimation of V12 Diverge Areas

$$L = \text{(Equation 13-12 or 13-13)}$$

EQ

$$P = 0.587 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 3550 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5512	6900	No
$v_{FO} = v_F - v_R$	4753	6900	No
v_R	759	1900	No
v_3 or v_{av34}	1962 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, $v_{12A} = 3550$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3550	4400	No

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 31.0$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence D			

Speed Estimation

Intermediate speed variable,	$D_S = 0.626$	
Space mean speed in ramp influence area,	$S_R = 48.7$	mph
Space mean speed in outer lanes,	$S_0 = 62.1$	mph
Space mean speed for all vehicles,	$S = 52.8$	mph

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-----Diverge Analysis-----

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Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: US 276 (EXIT48B)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4551	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	25.0	mph
Volume on ramp	627	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	237	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	420	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4551		627		237	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1264		174		66	v
Trucks and buses	18		18		18	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5512	759	287	pcph

Estimation of V12 Diverge Areas

$$L = 2048.65 \text{ (Equation 13-12 or 13-13)}$$

EQ

$$P = 0.915 \text{ Using Equation 6}$$

FD

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 5107 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5512	6900	No
$v_{FO} = v_F - v_R$	4753	6900	No
v_R	759	1900	No
v_3 or v_{av34}	405 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700 \text{ pc/h?}$		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5107$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	5107	4400	Yes

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 44.4$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence E			

Speed Estimation

Intermediate speed variable,	$D_S = 0.626$	
Space mean speed in ramp influence area,	$S_R = 48.7$	mph
Space mean speed in outer lanes,	$S_0 = 65.8$	mph
Space mean speed for all vehicles,	$S = 49.7$	mph

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_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3924	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	547	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	627	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	450	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3924	547	627	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1090	152	174	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4752	662	759	pcph

Estimation of V12 Merge Areas

$$L = 569.40 \quad (\text{Equation 13-6 or 13-7})$$

EQ

$$P = 0.585 \quad \text{Using Equation 2}$$

FM

$$v_{12} = v_F (P_{FM}) = 2781 \quad \text{pc/h}$$

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	5414	6900	No
v ₃ or v _{av34}	1971 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} = 2781		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{R12}	5414	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 28.6 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M _S = 0.410	
Space mean speed in ramp influence area,	S _R = 52.6	mph
Space mean speed in outer lanes,	S ₀ = 54.7	mph
Space mean speed for all vehicles,	S = 53.4	mph

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Diverge Analysis

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Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: US 276 (EXIT48B)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4824	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	30.0	mph
Volume on ramp	478	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1135	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4824	478	1135	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1340	133	315	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5842	579	1375	pcph

Estimation of V12 Diverge Areas

L = (Equation 13-12 or 13-13)

EQ

P = 0.587 Using Equation 5

FD

$v_{12} = v_R + (v_F - v_R) P_{FD} = 3670 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5842	6900	No
$v_{FO} = v_F - v_R$	5263	6900	No
v_R	579	2000	No
v_3 or v_{av34}	2172 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700 \text{ pc/h?}$		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3670$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3670	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 30.0 \text{ pc/mi/ln}$

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

Speed Estimation

Intermediate speed variable,	$D_S = 0.545$	
Space mean speed in ramp influence area,	$S_R = 50.2$	mph
Space mean speed in outer lanes,	$S_0 = 61.2$	mph
Space mean speed for all vehicles,	$S = 53.8$	mph

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_____Merge Analysis_____

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Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4346	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	25.0	mph
Volume on ramp	1135	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	758	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	420	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4346	1135	758	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1207	315	211	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5263	1375	918	pcph

Estimation of V12 Merge Areas

$$L = 5940.21 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 1.000 \text{ Using Equation 3}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 5263 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6638	6900	No
v_3 or v_{av34}	0 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, $v_{12A} = 5263$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	6638	4600	Yes

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 54.0 \text{ pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 3.278$	
Space mean speed in ramp influence area,	$S_R = 1.0$	mph
Space mean speed in outer lanes,	$S_0 = 60.0$	mph
Space mean speed for all vehicles,	$S = 1.0$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4346	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	25.0	mph
Volume on ramp	1135	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	478	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	500	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4346	1135	478	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1207	315	133	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5263	1375	579	pcph

Estimation of V12 Merge Areas

$$L = 512.01 \quad (\text{Equation 13-6 or 13-7})$$

$$EQ$$

$$P = 0.588 \quad \text{Using Equation 2}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3097 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6638	6900	No
v_3 or v_{av34}	2166 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, $v_{12A} = 3097$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	6638	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 37.1 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.641$	
Space mean speed in ramp influence area,	$S_R = 48.5$	mph
Space mean speed in outer lanes,	$S_0 = 54.0$	mph
Space mean speed for all vehicles,	$S = 50.1$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: US 276 (EXIT 48A)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	5481	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	25.0	mph
Volume on ramp	758	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	462	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	468	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5481	758	462	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1523	211	128	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6638	918	560	pcph

Estimation of V12 Diverge Areas

$$L = \text{(Equation 13-12 or 13-13)}$$

EQ

$$P = 0.552 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 4074 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6638	6900	No
$v_{FO} = v_F - v_R$	5720	6900	No
v_R	918	1900	No
v_3 or v_{av34}	2564 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, $v_{12A} = 4074$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4074	4400	No

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 35.5$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence E			

Speed Estimation

Intermediate speed variable,	$D_S = 0.641$	
Space mean speed in ramp influence area,	$S_R = 48.5$	mph
Space mean speed in outer lanes,	$S_0 = 59.7$	mph
Space mean speed for all vehicles,	$S = 52.3$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: US 276 (EXIT 48A)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	5481	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	25.0	mph
Volume on ramp	758	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1135	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	420	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5481	758	1135	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1523	211	315	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6638	918	1375	pcph

Estimation of V12 Diverge Areas

$$L = 8934.02 \text{ (Equation 13-12 or 13-13)}$$

EQ

$$P = 1.000 \text{ Using Equation 6}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 6638 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6638	6900	No
$v_{FO} = v_F - v_R$	5720	6900	No
v_R	918	1900	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700 \text{ pc/h?}$		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 6638$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	6638	4400	Yes

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 57.6 \text{ pc/mi/ln}$
Level of service for ramp-freeway junction areas of influence E		

Speed Estimation

Intermediate speed variable,	$D_S = 0.641$	
Space mean speed in ramp influence area,	$S_R = 48.5$	mph
Space mean speed in outer lanes,	$S_0 = 65.8$	mph
Space mean speed for all vehicles,	$S = 48.5$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4723	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	25.0	mph
Volume on ramp	462	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	758	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	470	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4723	462	758	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1312	128	211	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5720	560	918	pcph

Estimation of V12 Merge Areas

$$L = 470.92 \quad (\text{Equation 13-6 or 13-7})$$

$$EQ$$

$$P = 0.591 \quad \text{Using Equation 2}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3382 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6280	6900	No
v_3 or v_{av34}	2338 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, $v_{12A} = 3382$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	6280	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 32.8 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.497$	
Space mean speed in ramp influence area,	$S_R = 51.1$	mph
Space mean speed in outer lanes,	$S_0 = 53.2$	mph
Space mean speed for all vehicles,	$S = 51.8$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: US 276 (EXIT48A)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4760	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	30.0	mph
Volume on ramp	1278	vph
Length of first accel/decel lane	700	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	449	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4760	1278	449	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1322	355	125	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5765	1548	544	pcph

Estimation of V12 Diverge Areas

L = (Equation 13-12 or 13-13)

EQ

P = 0.545 Using Equation 5

FD

$v_{12} = v_R + (v_F - v_R) P = 3845$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5765	6900	No
$v_{FO} = v_F - v_R$	4217	6900	No
v_R	1548	2000	No
v_3 or v_{av34}	1920 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, $v_{12A} = 3845$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3845	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 31.0$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	$D_S = 0.632$	
Space mean speed in ramp influence area,	$S_R = 48.6$	mph
Space mean speed in outer lanes,	$S_0 = 62.2$	mph
Space mean speed for all vehicles,	$S = 52.4$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3482	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	25.0	mph
Volume on ramp	449	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	385	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	420	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3482	449	385	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	967	125	107	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4217	544	466	pcph

-----Estimation of V12 Merge Areas-----

$$L = 3015.40 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.840 \text{ Using Equation 3}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3543 \text{ pc/h}$$

-----Capacity Checks-----

		Actual	Maximum	LOS F?
v _{FO}		4761	6900	No
v ₃ or v _{av34}		674 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} = 3543			(Equation 13-15, 13-16, 13-18, or 13-19)	

-----Flow Entering Merge Influence Area-----

	Actual	Max Desirable	Violation?
v _{R12}	4761	4600	No

-----Level of Service Determination (if not F)-----

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 34.5 \text{ pc/mi/ln}$$

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

-----Speed Estimation-----

Intermediate speed variable,	M	= 0.532	
Space mean speed in ramp influence area,	S _R	= 50.4	mph
Space mean speed in outer lanes,	S ₀	= 59.4	mph
Space mean speed for all vehicles,	S	= 51.5	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3482	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	25.0	mph
Volume on ramp	449	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1278	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	500	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3482	449	1278	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	967	125	355	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4217	544	1548	pcph

Estimation of V12 Merge Areas

$$L = 110.33 \quad (\text{Equation 13-6 or 13-7})$$

$$EQ$$

$$P = 0.589 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2485 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4761	6900	No
v_3 or v_{av34}	1732 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, $v_{12A} = 2485$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	4761	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 26.2 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.381$	
Space mean speed in ramp influence area,	$S_R = 53.1$	mph
Space mean speed in outer lanes,	$S_0 = 55.6$	mph
Space mean speed for all vehicles,	$S = 54.0$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: US 276 (EXIT48B)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3931	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	25.0	mph
Volume on ramp	385	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	642	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3931		385		642	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1092		107		178	v
Trucks and buses	18		18		18	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4761	466	778	pcph

Estimation of V12 Diverge Areas

L = (Equation 13-12 or 13-13)

EQ

P = 0.620 Using Equation 5

FD

$v_{12} = v_R + (v_F - v_R) P_{FD} = 3127 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4761	6900	No
$v_{FO} = v_F - v_R$	4295	6900	No
v_R	466	1900	No
v_3 or v_{av34}	1634 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700 \text{ pc/h?}$		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3127$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3127	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D = 27.4 \text{ pc/mi/ln}$

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

Speed Estimation

Intermediate speed variable,	$D_S = 0.600$	
Space mean speed in ramp influence area,	$S_R = 49.2$	mph
Space mean speed in outer lanes,	$S_0 = 63.3$	mph
Space mean speed for all vehicles,	$S = 53.3$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

-----Diverge Analysis-----

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: US 276 (EXIT48B)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3931	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	25.0	mph
Volume on ramp	385	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	449	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	420	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3931		385		449	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1092		107		125	v
Trucks and buses	18		18		18	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4761	466	544	pcph

Estimation of V12 Diverge Areas

$$L = 3749.47 \text{ (Equation 13-12 or 13-13)}$$

EQ

$$P = 1.000 \text{ Using Equation 6}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 4761 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4761	6900	No
$v_{FO} = v_F - v_R$	4295	6900	No
v_R	466	1900	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4761$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4761	4400	Yes

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 41.4$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence E			

Speed Estimation

Intermediate speed variable,	$D = 0.600$	
Space mean speed in ramp influence area,	$S_R = 49.2$	mph
Space mean speed in outer lanes,	$S_0 = 65.8$	mph
Space mean speed for all vehicles,	$S = 49.2$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3546	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	642	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	385	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	450	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3546	642	385	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	985	178	107	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4295	778	466	pcph

Estimation of V12 Merge Areas

$$L = 496.42 \quad (\text{Equation 13-6 or 13-7})$$

EQ

$$P = 0.590 \quad \text{Using Equation 2}$$

FM

$$v_{12} = v_F (P_{FM}) = 2534 \quad \text{pc/h}$$

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	5073	6900	No
v ₃ or v _{av34}	1761 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} = 2534		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{R12}	5073	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 27.5 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M	= 0.395	
	S		
Space mean speed in ramp influence area,	S _R	= 52.9	mph
Space mean speed in outer lanes,	S ₀	= 55.5	mph
Space mean speed for all vehicles,	S	= 53.8	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

-----Diverge Analysis-----

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: US 276 (EXIT48B)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	6247	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	30.0	mph
Volume on ramp	431	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	677	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	500	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6247	431	677	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1735	120	188	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7566	522	820	pcph

Estimation of V12 Diverge Areas

$$L = \text{(Equation 13-12 or 13-13)}$$

EQ

$$P = 0.547 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 4374 \quad \text{pc/h}$$

Capacity Checks

		Actual	Maximum	LOS F?
$v_{Fi} = v_F$		7566	6900	Yes
$v_{FO} = v_F - v_R$		7044	6900	Yes
v_R		522	2000	No
v_3 or v_{av34}		3192 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, $v_{12A} = 4866$			(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	4866	4400	No

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 40.2$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence F			

Speed Estimation

Intermediate speed variable,	$D = 0.540$	
Space mean speed in ramp influence area,	$S_R = 50.3$	mph
Space mean speed in outer lanes,	$S_0 = 59.2$	mph
Space mean speed for all vehicles,	$S = 53.1$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	5816	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	25.0	mph
Volume on ramp	677	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	493	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	420	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5816	677	493	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1616	188	137	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7044	820	597	pcph

Estimation of V12 Merge Areas

$$L = 3863.08 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.922 \text{ Using Equation 3}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 6496 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7864	6900	Yes
$v_3 \text{ or } v_{av34}$	548 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 6496$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	7864	4600	Yes

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 59.5 \text{ pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 6.166$	
Space mean speed in ramp influence area,	$S_R = -51.0$	mph
Space mean speed in outer lanes,	$S_0 = 59.8$	mph
Space mean speed for all vehicles,	$S =$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	5816	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	25.0	mph
Volume on ramp	677	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	431	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	500	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5816	677	431	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1616	188	120	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7044	820	522	pcph

Estimation of V12 Merge Areas

L = 774.38 (Equation 13-6 or 13-7)

EQ

P = 0.572 Using Equation 2

FM

$v_{12} = v_F (P_{FM}) = 4028$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7864	6900	Yes
v_3 or v_{av34}	3016 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, $v_{12A} = 4344$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	7864	4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 42.7$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	M	= 0.982	
Space mean speed in ramp influence area,	S_R	= 42.3	mph
Space mean speed in outer lanes,	S_0	= 51.1	mph
Space mean speed for all vehicles,	S	= 45.0	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: US 276 (EXIT 48A)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	6493	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	25.0	mph
Volume on ramp	493	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	624	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	468	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	6493		493		624	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1804		137		173	v
Trucks and buses	18		18		18	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7864	597	756	pcph

Estimation of V12 Diverge Areas

L = (Equation 13-12 or 13-13)

EQ

P = 0.536 Using Equation 5

FD

$v_{12} = v_R + (v_F - v_R) P = 4492$ pc/h

Capacity Checks

		Actual	Maximum	LOS F?
$v_F = v_{Fi}$		7864	6900	Yes
$v_F = v_F - v_R$		7267	6900	Yes
v_R		597	1900	No
v_3 or v_{av34}		3372 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, $v_{12A} = 5164$			(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	5164	4400	Yes

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$		44.9	pc/mi/ln
Level of service for ramp-freeway junction areas of influence F				

Speed Estimation

Intermediate speed variable,	$D = 0.612$		
Space mean speed in ramp influence area,	$S_R = 49.0$	mph	
Space mean speed in outer lanes,	$S_0 = 59.2$	mph	
Space mean speed for all vehicles,	$S = 52.1$	mph	

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: US 276 (EXIT 48A)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	6493	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	25.0	mph
Volume on ramp	493	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	677	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	420	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6493	493	677	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1804	137	188	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7864	597	820	pcph

Estimation of V12 Diverge Areas

$$L = 3970.94 \text{ (Equation 13-12 or 13-13)}$$

EQ

$$P = 1.000 \text{ Using Equation 6}$$

FD

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 7864 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7864	6900	Yes
$v_{FO} = v_F - v_R$	7267	6900	Yes
v_R	597	1900	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7864$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	7864	4400	Yes

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 68.1$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence F			

Speed Estimation

Intermediate speed variable,	$D_S = 0.612$	
Space mean speed in ramp influence area,	$S_R = 49.0$	mph
Space mean speed in outer lanes,	$S_0 = 65.8$	mph
Space mean speed for all vehicles,	$S = 49.0$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: US 276
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	6000	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	25.0	mph
Volume on ramp	624	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	493	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	470	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6000	624	493	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1667	173	137	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7267	756	597	pcph

Estimation of V12 Merge Areas

$$L = 843.92 \quad (\text{Equation 13-6 or 13-7})$$

EQ

$$P = 0.568 \quad \text{Using Equation 2}$$

FM

$$v_{12} = v_F (P_{FM}) = 4126 \quad \text{pc/h}$$

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	8023	6900	Yes
v ₃ or v _{av34}	3141 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} = 4567		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{12A}	8023	4600	Yes

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v _R + 0.0078 v ₁₂ - 0.00627 L _A	=	43.5	pc/mi/ln
Level of service for ramp-freeway junction areas of influence	F		

Speed Estimation

Intermediate speed variable,	M _S = 1.095	
Space mean speed in ramp influence area,	S _R = 40.3	mph
Space mean speed in outer lanes,	S ₀ = 51.1	mph
Space mean speed for all vehicles,	S = 43.4	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: Woodruff Rd.
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4278	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	546	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1506	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	2250	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4278	546	1506	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1188	152	418	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5181	661	1824	pcph

-----Estimation of V12 Merge Areas-----

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.619 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3210 \quad \text{pc/h}$$

-----Capacity Checks-----

	Actual	Maximum	LOS F?
v _{FO}	5842	6900	No
v ₃ or v _{av34}	1971 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} = 3210		(Equation 13-15, 13-16, 13-18, or 13-19)	

-----Flow Entering Merge Influence Area-----

	Actual	Max Desirable	Violation?
v _{R12}	5842	4600	No

-----Level of Service Determination (if not F)-----

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 26.0 \quad \text{pc/mi/ln}$$

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

-----Speed Estimation-----

Intermediate speed variable,	M _S = 0.373	
Space mean speed in ramp influence area,	S _R = 53.3	mph
Space mean speed in outer lanes,	S ₀ = 54.7	mph
Space mean speed for all vehicles,	S = 53.8	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: Woodruff Rd.
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	5322	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	925	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1490	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	2250	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5322	925	1490	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1478	257	414	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6446	1120	1805	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.619 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3993 \quad \text{pc/h}$$

Capacity Checks

		Actual	Maximum	LOS F?
v _{FO}		7566	6900	Yes
v ₃ or v _{av34}		2453 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} = 3993			(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{R12}	7566	4600	Yes

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 35.4 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M _S = 0.834	
Space mean speed in ramp influence area,	S _R = 45.0	mph
Space mean speed in outer lanes,	S ₀ = 52.6	mph
Space mean speed for all vehicles,	S = 47.2	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: C-D ROAD
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4471	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	1806	vph
Length of first accel/decel lane	350	ft
Length of second accel/decel lane	0	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	389	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	7300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4471		1806		389	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1242		502		108	v
Trucks and buses	18		15		15	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	

Heavy vehicle adjustment, fHV	0.917	0.930	0.930	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5415	2157	465	pcph

Estimation of V12 Diverge Areas

$$L = \text{(Equation 13-12 or 13-13)}$$

EQ

$$P = 0.450 \quad \text{Using Equation 0}$$

FD

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 3623 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5415	6900	No
$v_{FO} = v_F - v_R$	3258	6900	No
v_R	2157	4200	No
v_3 or v_{av34}	1792 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700 \text{ pc/h?}$		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3623$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3623	4400	No

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 29.1$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence D			

Speed Estimation

Intermediate speed variable,	$D_S = 0.492$	
Space mean speed in ramp influence area,	$S_R = 51.1$	mph
Space mean speed in outer lanes,	$S_0 = 62.7$	mph
Space mean speed for all vehicles,	$S = 54.5$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 1/24/2012
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: C-D ROAD
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2665	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	389	vph
Length of first accel/decel lane	1450	ft
Length of second accel/decel lane	285	ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	2155	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	5000	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2665	389	2155	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	740	108	599	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3228	471	2610	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.555 \quad \text{Using Equation 0}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 1792 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	3699	6900	No
v ₃ or v _{av34}	1436 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} = 1844		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{12A}	3699	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 3.3 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M _S = 0.074	
Space mean speed in ramp influence area,	S _R = 58.7	mph
Space mean speed in outer lanes,	S ₀ = 56.8	mph
Space mean speed for all vehicles,	S = 58.0	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 1/24/2012
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: C-D ROAD
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2665	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	389	vph
Length of first accel/decel lane	1450	ft
Length of second accel/decel lane	285	ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1806	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	5600	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2665	389	1806	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	740	108	502	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3228	471	2187	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.555 \quad \text{Using Equation 0}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 1792 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	3699	6900	No
v ₃ or v _{av34}	1436 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} = 1844		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{12A}	3699	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 3.3 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M _S = 0.074	
Space mean speed in ramp influence area,	S _R = 58.7	mph
Space mean speed in outer lanes,	S ₀ = 56.8	mph
Space mean speed for all vehicles,	S = 58.0	mph

HCS 2010: Basic Freeway Segments Release 6.1

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

 Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: PM
Freeway/Direction: I-85 SB
From/To: I-85SB - I-85SB CD PostDiverge
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

 Flow Inputs and Adjustments

Volume, V	3832	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1064	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1547	pc/h/ln

 Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

 LOS and Performance Measures

Flow rate, vp	1547	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	25.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.1

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: AM
Freeway/Direction: I-85 SB
From/To: I-85SB - I-85SB CD Pre-Diverge
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

Volume, V	5805	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1613	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1406	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1406	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	5	
Density, D	23.4	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800

Fax: (803)929-0334

E-mail:

Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: AM
Freeway/Direction: I-85 SB
From/To: I-85SB - I-85SB CD (RAMP)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

Volume, V	3033	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	843	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1224	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

LOS and Performance Measures

Flow rate, vp	1224	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	22.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: I-385 Ramps
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2772	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1506	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane	1500	ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	546	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	4300	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2772	1506	546	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	770	418	152	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3357	1824	661	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.555 \quad \text{Using Equation 0}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 1863 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5181	6900	No
v_3 or v_{av34}	1494 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, $v_{12A} = 1918$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	5181	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 15.0 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.216$	
Space mean speed in ramp influence area,	$S_R = 56.1$	mph
Space mean speed in outer lanes,	$S_0 = 56.6$	mph
Space mean speed for all vehicles,	$S = 56.3$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: I-385 Ramps
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2772	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1506	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane	1500	ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	3033	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	7500	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2772	1506	3033	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	770	418	843	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3357	1824	3673	pcph

Estimation of V12 Merge Areas

L = (Equation 13-6 or 13-7)

EQ

P = 0.555 Using Equation 0

FM

$v_{12} = v_F (P_{FM}) = 1863$ pc/h

12 F FM

Capacity Checks

		Actual	Maximum	LOS F?
v		5181	6900	No
FO				
v or v		1494 pc/h	(Equation 13-14 or 13-17)	
3	av34			
Is v or v	> 2700 pc/h?	No		
3	av34			
Is v or v	> 1.5 v /2	Yes		
3	av34 12			
If yes, v	= 1918	(Equation 13-15, 13-16, 13-18, or 13-19)		
12A				

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	5181	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 15.0$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	M	= 0.216	
	S		
Space mean speed in ramp influence area,	S	= 56.1	mph
	R		
Space mean speed in outer lanes,	S	= 56.6	mph
	0		
Space mean speed for all vehicles,	S	= 56.3	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: C-D ROAD
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4188	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	1813	vph
Length of first accel/decel lane	350	ft
Length of second accel/decel lane	0	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1331	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	7300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4188	1813	1331	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1163	504	370	v
Trucks and buses	18	15	15	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.930	0.930	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5072	2166	1590	pcph

Estimation of V12 Diverge Areas

L = (Equation 13-12 or 13-13)

EQ

P = 0.450 Using Equation 0

FD

$v_{12} = v_R + (v_F - v_R) P_{FD} = 3474 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5072	6900	No
$v_{FO} = v_F - v_R$	2906	6900	No
v_R	2166	4200	No
v_3 or v_{av34}	1598 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700 \text{ pc/h?}$		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3474$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3474	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D = 27.8 \text{ pc/mi/ln}$

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

Speed Estimation

Intermediate speed variable,	$D_S = 0.493$	
Space mean speed in ramp influence area,	$S_R = 51.1$	mph
Space mean speed in outer lanes,	$S_0 = 63.5$	mph
Space mean speed for all vehicles,	$S = 54.5$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: C-D ROAD
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2375	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1331	vph
Length of first accel/decel lane	1450	ft
Length of second accel/decel lane	285	ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	2997	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	5000	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2375	1331	2997	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	660	370	833	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2876	1612	3630	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.555 \quad \text{Using Equation 0}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 1596 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	4488	6900	No
v ₃ or v _{av34}	1280 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} = 1643		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{12A}	4488	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 10.2 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M _S = 0.135	
Space mean speed in ramp influence area,	S _R = 57.6	mph
Space mean speed in outer lanes,	S ₀ = 57.4	mph
Space mean speed for all vehicles,	S = 57.5	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: C-D ROAD
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2375	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1331	vph
Length of first accel/decel lane	1450	ft
Length of second accel/decel lane	285	ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1813	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	5600	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2375	1331	1813	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	660	370	504	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2876	1612	2196	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.555 \quad \text{Using Equation 0}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 1596 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	4488	6900	No
v ₃ or v _{av34}	1280 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} = 1643		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{12A}	4488	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 10.2 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M _S = 0.135	
Space mean speed in ramp influence area,	S _R = 57.6	mph
Space mean speed in outer lanes,	S ₀ = 57.4	mph
Space mean speed for all vehicles,	S = 57.5	mph

HCS 2010: Basic Freeway Segments Release 6.1

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: PM
Freeway/Direction: I-85 SB
From/To: I-85SB - I-85SB CD PostDiverge
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

Volume, V	3832	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1064	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1547	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1547	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	25.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.1

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: PM
Freeway/Direction: I-85 SB
From/To: I-85SB - I-85SB CD Pre-Diverge
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

Volume, V	6307	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1752	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1528	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1528	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	5	
Density, D	25.5	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800

Fax: (803)929-0334

E-mail:

Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: PM
Freeway/Direction: I-85 SB
From/To: I-85SB - I-85SB CD (RAMP)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

Volume, V	2475	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	688	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	999	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

LOS and Performance Measures

Flow rate, vp	999	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	18.2	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

-----Merge Analysis-----

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: I-385 Ramps
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

-----Freeway Data-----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3832	vph

-----On Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1490	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane	1500	ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	925	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	4300	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3832	1490	925	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1064	414	257	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4641	1805	1120	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.555 \quad \text{Using Equation 0}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2576 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	6446	6900	No
v ₃ or v _{av34}	2065 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} = 2652		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{12A}	6446	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 20.6 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M _S = 0.387	
Space mean speed in ramp influence area,	S _R = 53.0	mph
Space mean speed in outer lanes,	S ₀ = 54.6	mph
Space mean speed for all vehicles,	S = 53.5	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: I-385 Ramps
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3832	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45.0	mph
Volume on ramp	1490	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane	1500	ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	2475	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	7500	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3832	1490	2475	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1064	414	688	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4641	1805	2998	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.555 \quad \text{Using Equation 0}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2576 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6446	6900	No
v_3 or v_{av34}	2065 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, $v_{12A} = 2652$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	6446	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 20.6 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.387$	
Space mean speed in ramp influence area,	$S_R = 53.0$	mph
Space mean speed in outer lanes,	$S_0 = 54.6$	mph
Space mean speed for all vehicles,	$S = 53.5$	mph

HCS 2010: Basic Freeway Segments Release 6.1

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800

Fax: (803)929-0334

E-mail:

 Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: AM
Freeway/Direction: I-85 NB
From/To: I-85 to I-85NB (Post-Merge)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

 Flow Inputs and Adjustments

Volume, V	5209	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1447	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1262	pc/h/ln

 Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

 LOS and Performance Measures

Flow rate, vp	1262	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	5	
Density, D	21.0	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: AM
Freeway/Direction: I-85 NB
From/To: I-85 to I-85NB (Pre-Merge)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

Volume, V	3054	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	848	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1233	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1233	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	20.5	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: AM
Freeway/Direction: I-85 NB
From/To: I-85 to I-85NB (RAMP)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

Volume, V	2155	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	599	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	870	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

LOS and Performance Measures

Flow rate, vp	870	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	15.8	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

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Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800

Fax: (803)929-0334

E-mail:

 Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: PM
Freeway/Direction: I-85 NB
From/To: I-85 to I-85NB (Post-Merge)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

 Flow Inputs and Adjustments

Volume, V	6703	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1862	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1624	pc/h/ln

 Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

 LOS and Performance Measures

Flow rate, vp	1624	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	5	
Density, D	27.1	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: PM
Freeway/Direction: I-85 NB
From/To: I-85 to I-85NB (Pre-Merge)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

Volume, V	3706	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1029	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1496	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1496	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	24.9	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Operational Analysis

Analyst: JP
Agency or Company: Florence & Hutcheson
Date Performed: 9/23/2011
Analysis Time Period: PM
Freeway/Direction: I-85 NB
From/To: I-85 to I-85NB (RAMP)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

Volume, V	2997	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	833	v
Trucks and buses	18	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1210	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

LOS and Performance Measures

Flow rate, vp	1210	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	22.0	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: Pelham Road
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	5209	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	1858	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	751	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1325	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5209	1858	751	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1447	516	209	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6309	2250	910	pcph

Estimation of V12 Diverge Areas

$$L = \text{(Equation 13-12 or 13-13)}$$

EQ

$$P = 0.499 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 4275 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6309	6900	No
$v_{FO} = v_F - v_R$	4059	6900	No
v_R	2250	2000	Yes
v_3 or v_{av34}	2034 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,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 27.5$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence F			

Speed Estimation

Intermediate speed variable,	$D_S = 0.631$	
Space mean speed in ramp influence area,	$S_R = 48.7$	mph
Space mean speed in outer lanes,	$S_0 = 61.8$	mph
Space mean speed for all vehicles,	$S = 52.2$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3351	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	751	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	539	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	2900	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3351	751	539	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	931	209	150	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4058	910	653	pcph

-----Estimation of V12 Merge Areas-----

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.596 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2417 \quad \text{pc/h}$$

-----Capacity Checks-----

	Actual	Maximum	LOS F?
v _{FO}	4968	6900	No
v ₃ or v _{av34}	1641 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} = 2417		(Equation 13-15, 13-16, 13-18, or 13-19)	

-----Flow Entering Merge Influence Area-----

	Actual	Max Desirable	Violation?
v _{R12}	4968	4600	No

-----Level of Service Determination (if not F)-----

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 26.9 \quad \text{pc/mi/ln}$$

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

-----Speed Estimation-----

Intermediate speed variable,	M _S = 0.391	
Space mean speed in ramp influence area,	S _R = 53.0	mph
Space mean speed in outer lanes,	S ₀ = 55.9	mph
Space mean speed for all vehicles,	S = 53.9	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3351	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	751	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1858	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1300	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3351	751	1858	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	931	209	516	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4058	910	2250	pcph

Estimation of V12 Merge Areas

$$L = 518.35 \quad (\text{Equation 13-6 or 13-7})$$

$$EQ$$

$$P = 0.596 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2417 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4968	6900	No
v_3 or v_{av34}	1641 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, $v_{12A} = 2417$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	4968	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 26.9 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.391$	
Space mean speed in ramp influence area,	$S_R = 53.0$	mph
Space mean speed in outer lanes,	$S_0 = 55.9$	mph
Space mean speed for all vehicles,	$S = 53.9$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

-----Merge Analysis-----

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 NB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

-----Freeway Data-----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4102	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	539	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	751	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	2800	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4102	539	751	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1139	150	209	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4968	653	910	pcph

-----Estimation of V12 Merge Areas-----

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.619 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3078 \quad \text{pc/h}$$

-----Capacity Checks-----

		Actual	Maximum	LOS F?
v _{FO}		5621	6900	No
v ₃ or v _{av34}		1890 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}	= 3078		(Equation 13-15, 13-16, 13-18, or 13-19)	

-----Flow Entering Merge Influence Area-----

	Actual	Max Desirable	Violation?
v _{R12}	5621	4600	No

-----Level of Service Determination (if not F)-----

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 24.9 \quad \text{pc/mi/ln}$$

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

-----Speed Estimation-----

Intermediate speed variable,	M	= 0.349	
	S		
Space mean speed in ramp influence area,	S _R	= 53.7	mph
Space mean speed in outer lanes,	S ₀	= 55.0	mph
Space mean speed for all vehicles,	S	= 54.1	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: Pelham Road
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	5871	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	1858	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	335	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5871	1858	335	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1631	516	93	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7110	2250	406	pcph

Estimation of V12 Diverge Areas

$$L = \text{(Equation 13-12 or 13-13)}$$

EQ

$$P = 0.479 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 4577 \quad \text{pc/h}$$

Capacity Checks

		Actual	Maximum	LOS F?
$v_{Fi} = v_F$		7110	6900	Yes
$v_{FO} = v_F - v_R$		4860	6900	No
v_R		2250	2100	Yes
v_3 or v_{av34}		2533 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, $v_{12A} = 4577$			(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4577	4400	Yes

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 31.0$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence F			

Speed Estimation

Intermediate speed variable,	$D = 0.501$	
Space mean speed in ramp influence area,	$S_R = 51.0$	mph
Space mean speed in outer lanes,	$S_0 = 59.8$	mph
Space mean speed for all vehicles,	$S = 53.8$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4013	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	335	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	1457	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	2760	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4013	335	1457	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1115	93	405	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4860	406	1765	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.593 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2881 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5266	6900	No
v_3 or v_{av34}	1979 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, $v_{12A} = 2881$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	5266	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 27.5 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.392$	
Space mean speed in ramp influence area,	$S_R = 52.9$	mph
Space mean speed in outer lanes,	$S_0 = 54.7$	mph
Space mean speed for all vehicles,	$S = 53.6$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4013	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	335	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	1858	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2800	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4013	335	1858	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1115	93	516	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4860	406	2250	pcph

Estimation of V12 Merge Areas

$$L = 537.72 \quad (\text{Equation 13-6 or 13-7})$$

$$EQ$$

$$P = 0.593 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2881 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5266	6900	No
v_3 or v_{av34}	1979 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, $v_{12A} = 2881$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	5266	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 27.5 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.392$	
Space mean speed in ramp influence area,	$S_R = 52.9$	mph
Space mean speed in outer lanes,	$S_0 = 54.7$	mph
Space mean speed for all vehicles,	$S = 53.6$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-85 SB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4348	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	1457	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	335	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	2800	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4348	1457	335	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1208	405	93	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5266	1765	406	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.619 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3262 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7031	6900	Yes
v_3 or v_{av34}	2004 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, $v_{12A} = 3262$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	7031	4600	Yes

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 34.5 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.781$	
Space mean speed in ramp influence area,	$S_R = 45.9$	mph
Space mean speed in outer lanes,	$S_0 = 54.6$	mph
Space mean speed for all vehicles,	$S = 48.1$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: Pelham Road
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	6703	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	2061	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	979	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1325	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6703	2061	979	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1862	573	272	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8118	2496	1186	pcph

Estimation of V12 Diverge Areas

$$L = \text{(Equation 13-12 or 13-13)}$$

EQ

$$P = 0.442 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 4982 \quad \text{pc/h}$$

Capacity Checks

		Actual	Maximum	LOS F?
$v_{Fi} = v_F$		8118	6900	Yes
$v_{FO} = v_F - v_R$		5622	6900	No
v_R		2496	2000	Yes
v_3 or v_{av34}		3136 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, $v_{12A} = 5418$			(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	5418	4400	Yes

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$			
Level of service for ramp-freeway junction areas of influence F				

Speed Estimation

Intermediate speed variable,	$D = 0.653$		
Space mean speed in ramp influence area,	$S_R = 48.3$	mph	
Space mean speed in outer lanes,	$S_0 = 59.2$	mph	
Space mean speed for all vehicles,	$S = 51.4$	mph	

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4642	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	979	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	786	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	2900	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4642	979	786	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1289	272	218	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5622	1186	952	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.596 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3349 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	6808	6900	No
v ₃ or v _{av34}	2273 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} = 3349		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{R12}	6808	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 36.2 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M _S = 0.646	
Space mean speed in ramp influence area,	S _R = 48.4	mph
Space mean speed in outer lanes,	S ₀ = 53.6	mph
Space mean speed for all vehicles,	S = 50.0	mph

Florence & Hutcheson
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_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4642	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	979	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	2061	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1300	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4642	979	2061	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1289	272	573	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5622	1186	2496	pcph

Estimation of V12 Merge Areas

$$L = 912.11 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.596 \text{ Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3349 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6808	6900	No
$v_3 \text{ or } v_{av34}$	2273 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3349$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	6808	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 36.2 \text{ pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.646$	
Space mean speed in ramp influence area,	$S_R = 48.4$	mph
Space mean speed in outer lanes,	$S_0 = 53.6$	mph
Space mean speed for all vehicles,	$S = 50.0$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 NB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	5621	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	786	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	979	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	2800	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5621	786	979	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1561	218	272	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6808	952	1186	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.619 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 4218 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7760	6900	Yes
v_3 or v_{av34}	2590 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, $v_{12A} = 4218$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	7760	4600	Yes

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 36.0 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.872$	
Space mean speed in ramp influence area,	$S_R = 44.3$	mph
Space mean speed in outer lanes,	$S_0 = 51.7$	mph
Space mean speed for all vehicles,	$S = 46.5$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: Pelham Road
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	5315	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	757	vph
Length of first accel/decel lane	1400	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	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5315	757	600	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1476	210	167	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6437	917	727	pcph

Estimation of V12 Diverge Areas

$$L = \text{(Equation 13-12 or 13-13)}$$

EQ

$$P = 0.557 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 3991 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6437	6900	No
$v_{FO} = v_F - v_R$	5520	6900	No
v_R	917	2100	No
$v_3 \text{ or } v_{av34}$	2446 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3991$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3991	4400	No

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_R - 0.009 L_D$	$= 26.0$	pc/mi/ln
Level of service for ramp-freeway junction areas of influence C			

Speed Estimation

Intermediate speed variable,	$D = 0.381$	
Space mean speed in ramp influence area,	$S_R = 53.2$	mph
Space mean speed in outer lanes,	$S_0 = 60.2$	mph
Space mean speed for all vehicles,	$S = 55.6$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

-----Merge Analysis-----

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

-----Freeway Data-----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4558	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	600	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	1149	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	2760	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4558	600	1149	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1266	167	319	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5520	727	1392	pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.593 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3273 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6247	6900	No
v_3 or v_{av34}	2247 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, $v_{12A} = 3273$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	6247	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 32.9 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.501$	
Space mean speed in ramp influence area,	$S_R = 51.0$	mph
Space mean speed in outer lanes,	$S_0 = 53.7$	mph
Space mean speed for all vehicles,	$S = 51.9$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4558	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	600	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	757	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2800	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4558	600	757	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1266	167	210	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5520	727	917	pcph

Estimation of V12 Merge Areas

$$L = 747.66 \quad (\text{Equation 13-6 or 13-7})$$

$$EQ$$

$$P = 0.593 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3273 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6247	6900	No
v_3 or v_{av34}	2247 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, $v_{12A} = 3273$		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	6247	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 32.9 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$M_S = 0.501$	
Space mean speed in ramp influence area,	$S_R = 51.0$	mph
Space mean speed in outer lanes,	$S_0 = 53.7$	mph
Space mean speed for all vehicles,	$S = 51.9$	mph

Florence & Hutcheson
501 Huger Street
Columbia, SC 29201

Phone: (803)254-5800
E-mail:

Fax: (803)929-0334

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-85 SB
Junction: Pelham Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	5158	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	1149	vph
Length of first accel/decel lane	1500	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	On	
Distance to adjacent Ramp	2800	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5158	1149	600	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1433	319	167	v
Trucks and buses	18	18	18	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.917	0.917	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6247	1392	727	pcph

-----Estimation of V12 Merge Areas-----

$$L = \text{(Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.619 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3870 \quad \text{pc/h}$$

-----Capacity Checks-----

		Actual	Maximum	LOS F?
v _{FO}		7639	6900	Yes
v ₃ or v _{av34}		2377 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} = 3870			(Equation 13-15, 13-16, 13-18, or 13-19)	

-----Flow Entering Merge Influence Area-----

	Actual	Max Desirable	Violation?
v _{R12}	7639	4600	Yes

-----Level of Service Determination (if not F)-----

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 36.5 \quad \text{pc/mi/ln}$$

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

-----Speed Estimation-----

Intermediate speed variable,	M	= 0.938	
Space mean speed in ramp influence area,	S _R	= 43.1	mph
Space mean speed in outer lanes,	S ₀	= 53.0	mph
Space mean speed for all vehicles,	S	= 45.8	mph