

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 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} = 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 | = 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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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

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

$$EQ$$

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

$$FM$$

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

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, | $M_S = 0.413$ | |
| 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

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 (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_____

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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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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

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

EQ

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

FD

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

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 $v_{av34} > 2700$ 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, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= 30.0$ | pc/mi/ln |
| Level of service for ramp-freeway junction areas of influence D | | | |

Speed Estimation

| | | |
|------------------------------------------|--------------|-----|
| Intermediate speed variable, | $D = 0.545$ | |
| 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 |

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 | 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

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

$$EQ$$

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

$$FM$$

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

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

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

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 |
| $v_3 \text{ or } v_{av34}$ | 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, $v_{12A} = 6638$ | | (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, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 57.6 \text{ pc/mi/ln}$

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

$v_{12} = v_R + (v_F - v_R) P_{FD} = 3845 \text{ pc/h}$

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 $v_{av34} > 2700 \text{ pc/h?}$ | | 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, | $D = 4.252 + 0.0086 v_R - 0.009 \frac{L}{D}$ | $= 31.0 \text{ pc/mi/ln}$ |
| 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 _S = 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

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

EQ

$$P = 0.620 \quad \text{Using Equation 5}$$

FD

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

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 $v_{av34} > 2700$ 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, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= 27.4$ | pc/mi/ln |
| Level of service for ramp-freeway junction areas of influence C | | | |

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, | $S_0 = 63.3$ | 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

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

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, $D = 4.252 + 0.0086 v_R - 0.009 L_D = 41.4 \text{ pc/mi/ln}$

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

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, | $S_0 = 65.8$ | 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

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

EQ

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

FM

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

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)

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

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

Speed Estimation

| | | | |
|------------------------------------------|----------------|---------|-----|
| Intermediate speed variable, | M | = 0.395 | |
| 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

$$L = 774.38 \text{ (Equation 13-6 or 13-7)}$$

EQ

$$P = 0.572 \text{ Using Equation 2}$$

FM

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

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

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

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

EQ

$$P = 0.536 \quad \text{Using Equation 5}$$

FD

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

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 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, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 68.1 \text{ pc/mi/ln}$

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

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

EQ

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

FM

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

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, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 43.5 \text{ pc/mi/ln}$

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

Speed Estimation

| | | | |
|------------------------------------------|----------------|---------|-----|
| Intermediate speed variable, | M | = 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 | = 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 $v_{av34} > 2700$ 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

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

$$EQ$$

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

$$FM$$

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

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

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

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

EQ

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

FD

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

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 $v_{av34} > 2700$ 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, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= 27.8$ | 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-----

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

$$EQ$$

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

$$FM$$

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

-----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 | = 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 | |

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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
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 (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 _S = 0.349 | |
| 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 = (Equation 13-12 or 13-13)

EQ

P = 0.479 Using Equation 5

FD

$v_{12} = v_R + (v_F - v_R) P = 4577$ 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-----

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

$$EQ$$

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

$$FM$$

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

-----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 | = 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

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

$$EQ$$

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

$$FM$$

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

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, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= 37.3$ | pc/mi/ln |
| 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
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 | 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

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

$$EQ$$

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

$$FM$$

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

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
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 | = 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, | $D_S = 0.381$ | |
| 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 _S = 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 |

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-385 NB
Junction: Butler Rd off-ramp
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 | 3839 | 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 | 322 | 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 | 925 | vph |
| Position of adjacent ramp | Downstream | |
| Type of adjacent ramp | On | |
| Distance to adjacent ramp | 2960 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | | Ramp | | Adjacent Ramp | |
|------------------------------|---------|----|-------|----|---------------|-----|
| Volume, V (vph) | 3839 | | 322 | | 925 | vph |
| Peak-hour factor, PHF | 0.90 | | 0.90 | | 0.90 | |
| Peak 15-min volume, v15 | 1066 | | 89 | | 257 | 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 | 4649 | 390 | 1120 | pcph |

Estimation of V12 Diverge Areas

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

EQ

$$P = 0.626 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 3055 \quad \text{pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|-----------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 4649 | 6900 | No |
| $v_{FO} = v_F - v_R$ | 4259 | 6900 | No |
| v_R | 390 | 2100 | No |
| v_3 or v_{av34} | 1594 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, $v_{12A} = 3055$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 3055 | 4400 | No |

Level of Service Determination (if not F)

| | | | |
|-----------------------------------------------------------------|--------------------------------------|----------|----------|
| Density, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= 17.0$ | pc/mi/ln |
| Level of service for ramp-freeway junction areas of influence B | | | |

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.333$ | |
| Space mean speed in ramp influence area, | $S_R = 54.0$ | mph |
| Space mean speed in outer lanes, | $S_0 = 63.5$ | mph |
| Space mean speed for all vehicles, | $S = 56.9$ | 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-385 NB
Junction: Butler Rd on-ramp
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 | 3517 | 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 | 1100 | ft |
| Length of second accel/decel lane | | ft |

_____Adjacent Ramp Data (if one exists)_____

| | | |
|---------------------------|----------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent Ramp | 322 | vph |
| Position of adjacent Ramp | Upstream | |
| Type of adjacent Ramp | Off | |
| Distance to adjacent Ramp | 2960 | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 3517 | 925 | 322 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 977 | 257 | 89 | 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 | 4259 | 1120 | 390 | pcph |

Estimation of V12 Merge Areas

$$L = 1590.91 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.608 \text{ Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2591 \text{ pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|-----------|------------------------------------------|--------|
| v_{FO} | 5379 | 6900 | No |
| v_3 or v_{av34} | 1668 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, $v_{12A} = 2591$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|-----------|--------|---------------|------------|
| v_{R12} | 5379 | 4600 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 27.0 \text{ pc/mi/ln}$$

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, | $S_0 = 55.8$ | 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

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: AM
Freeway/Dir of Travel: I-385 SB
Junction: Butler Rd off-ramp
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 | 2616 | 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 | 802 | vph |
| Length of first accel/decel lane | 1000 | ft |
| Length of second accel/decel lane | | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|------------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 244 | vph |
| Position of adjacent ramp | Downstream | |
| Type of adjacent ramp | On | |
| Distance to adjacent ramp | 2570 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | | Ramp | | Adjacent Ramp | |
|------------------------------|---------|----|-------|----|---------------|-----|
| Volume, V (vph) | 2616 | | 802 | | 244 | vph |
| Peak-hour factor, PHF | 0.90 | | 0.90 | | 0.90 | |
| Peak 15-min volume, v15 | 727 | | 223 | | 68 | 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 | 3168 | 971 | 296 | pcph |

Estimation of V12 Diverge Areas

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

EQ

P = 0.636 Using Equation 5

FD

$v_{12} = v_R + (v_F - v_R) P_{FD} = 2369 \text{ pc/h}$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 3168 | 6900 | No |
| $v_{FO} = v_F - v_R$ | 2197 | 6900 | No |
| v_R | 971 | 2100 | No |
| v_3 or v_{av34} | 799 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, $v_{12A} = 2369$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 2369 | 4400 | No |

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 \frac{L}{D} = 15.6 \text{ pc/mi/ln}$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.385$ | |
| Space mean speed in ramp influence area, | $S_R = 53.1$ | mph |
| Space mean speed in outer lanes, | $S_0 = 65.8$ | mph |
| Space mean speed for all vehicles, | $S = 55.8$ | 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-385 SB
Junction: Butler Rd on-ramp
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 | 1814 | 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 | 244 | 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 | 802 | vph |
| Position of adjacent Ramp | Upstream | |
| Type of adjacent Ramp | Off | |
| Distance to adjacent Ramp | 2570 | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 1814 | 244 | 802 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 504 | 68 | 223 | 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 | 2197 | 296 | 971 | pcph |

Estimation of V12 Merge Areas

$$L = 1150.90 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

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

$$FM$$

$$v_{12} = v_F (P_{FM}) = 1361 \text{ pc/h}$$

Capacity Checks

| | | | |
|---------------------------------------------|----------|------------------------------------------|--------|
| | Actual | Maximum | LOS F? |
| v_{FO} | 2493 | 6900 | No |
| v_3 or v_{av34} | 836 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, $v_{12A} = 1361$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | | | |
|-----------|--------|---------------|------------|
| | Actual | Max Desirable | Violation? |
| v_{R12} | 2493 | 4600 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 8.9 \text{ pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.206$ | |
| Space mean speed in ramp influence area, | $S_R = 56.3$ | mph |
| Space mean speed in outer lanes, | $S_0 = 58.8$ | mph |
| Space mean speed for all vehicles, | $S = 57.1$ | 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-385 NB
Junction: Butler Rd off-ramp
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 | 4295 | 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 | 262 | 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 | 1024 | vph |
| Position of adjacent ramp | Downstream | |
| Type of adjacent ramp | On | |
| Distance to adjacent ramp | 2960 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | | Ramp | | Adjacent Ramp | |
|------------------------------|---------|----|-------|----|---------------|-----|
| Volume, V (vph) | 4295 | | 262 | | 1024 | vph |
| Peak-hour factor, PHF | 0.90 | | 0.90 | | 0.90 | |
| Peak 15-min volume, v15 | 1193 | | 73 | | 284 | 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 | 5202 | 317 | 1240 | pcph |

Estimation of V12 Diverge Areas

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

EQ

$$P = 0.615 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 3323 \quad \text{pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|-----------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 5202 | 6900 | No |
| $v_{FO} = v_F - v_R$ | 4885 | 6900 | No |
| v_R | 317 | 2100 | No |
| v_3 or v_{av34} | 1879 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, $v_{12A} = 3323$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 3323 | 4400 | No |

Level of Service Determination (if not F)

| | | | |
|-----------------------------------------------------------------|--------------------------------------|----------|----------|
| Density, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= 19.3$ | pc/mi/ln |
| Level of service for ramp-freeway junction areas of influence B | | | |

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.327$ | |
| Space mean speed in ramp influence area, | $S_R = 54.1$ | mph |
| Space mean speed in outer lanes, | $S_0 = 62.4$ | mph |
| Space mean speed for all vehicles, | $S = 56.8$ | 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-385 NB
Junction: Butler Rd on-ramp
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 | 4033 | 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 | 1024 | vph |
| Length of first accel/decel lane | 1100 | ft |
| Length of second accel/decel lane | | ft |

_____Adjacent Ramp Data (if one exists)_____

| | | |
|---------------------------|----------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent Ramp | 262 | vph |
| Position of adjacent Ramp | Upstream | |
| Type of adjacent Ramp | Off | |
| Distance to adjacent Ramp | 2960 | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 4033 | 1024 | 262 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1120 | 284 | 73 | 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 | 4884 | 1240 | 317 | pcph |

Estimation of V12 Merge Areas

$$L = 1750.34 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.608 \text{ Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2971 \text{ pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|-----------|------------------------------------------|--------|
| v_{FO} | 6124 | 6900 | No |
| v_3 or v_{av34} | 1913 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, $v_{12A} = 2971$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|-----------|--------|---------------|------------|
| v_{R12} | 6124 | 4600 | No |

Level of Service Determination (if not F)

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

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.485$ | |
| Space mean speed in ramp influence area, | $S_R = 51.3$ | mph |
| Space mean speed in outer lanes, | $S_0 = 54.9$ | 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

Diverge Analysis

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-385 SB
Junction: Butler Rd off-ramp
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 | 5134 | 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 | 831 | vph |
| Length of first accel/decel lane | 1000 | ft |
| Length of second accel/decel lane | | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|------------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 463 | vph |
| Position of adjacent ramp | Downstream | |
| Type of adjacent ramp | On | |
| Distance to adjacent ramp | 2570 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|---------|---------------|-----|
| Volume, V (vph) | 5134 | 831 | 463 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1426 | 231 | 129 | 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 | 6218 | 1006 | 561 | pcph |

Estimation of V12 Diverge Areas

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

EQ

$$P = 0.558 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 3916 \quad \text{pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|-----------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 6218 | 6900 | No |
| $v_{FO} = v_F - v_R$ | 5212 | 6900 | No |
| v_R | 1006 | 2100 | No |
| v_3 or v_{av34} | 2302 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, $v_{12A} = 3916$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 3916 | 4400 | No |

Level of Service Determination (if not F)

| | | | |
|-----------------------------------------------------------------|--------------------------------------|----------|----------|
| Density, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= 28.9$ | pc/mi/ln |
| Level of service for ramp-freeway junction areas of influence D | | | |

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.389$ | |
| Space mean speed in ramp influence area, | $S_R = 53.0$ | mph |
| Space mean speed in outer lanes, | $S_0 = 60.7$ | 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-385 SB
Junction: Butler Rd on-ramp
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 | 4303 | 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 | 463 | 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 | 831 | vph |
| Position of adjacent Ramp | Upstream | |
| Type of adjacent Ramp | Off | |
| Distance to adjacent Ramp | 2570 | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 4303 | 463 | 831 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1195 | 129 | 231 | 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 | 5211 | 561 | 1006 | pcph |

Estimation of V12 Merge Areas

$$L = 1852.61 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

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

$$FM$$

$$v_{12} = v_F (P_{FM}) = 3228 \text{ pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|-----------|------------------------------------------|--------|
| v_{FO} | 5772 | 6900 | No |
| v_3 or v_{av34} | 1983 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, $v_{12A} = 3228$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|-----------|--------|---------------|------------|
| v_{R12} | 5772 | 4600 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 25.4 \text{ pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.358$ | |
| Space mean speed in ramp influence area, | $S_R = 53.5$ | mph |
| Space mean speed in outer lanes, | $S_0 = 54.7$ | mph |
| Space mean speed for all vehicles, | $S = 53.9$ | 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-385 NB
From/To: I-385NB - I-385NB CD Post-Div
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 1843 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 512 | 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 | 744 | 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 | 744 | 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 | 13.5 | pc/mi/ln |
| Level of service, LOS | B | |

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-385 NB
From/To: I-385NB - I-385NB CD (Pre-Div)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 4442 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 1234 | 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 | 1076 | 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 | 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 | 1076 | pc/h/ln |
| Free-flow speed, FFS | 55.0 | mi/h |
| Average passenger-car speed, S | 55.0 | mi/h |
| Number of lanes, N | 5 | |
| Density, D | 19.6 | 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-385 NB
From/To: I-385NB - I-385NB CD (Ramp)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 2599 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 722 | 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 | 1049 | 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 | 1049 | 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 | 19.1 | 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-385 NB
Junction: Woodruff - I-385 NB
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 | 55.0 | mph |
| Volume on freeway | 1843 | 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 | 983 | vph |
| Length of first accel/decel lane | 600 | ft |
| Length of second accel/decel lane | | ft |

_____Adjacent Ramp Data (if one exists)_____

| | | |
|---------------------------|----|-----|
| Does adjacent ramp exist? | No | |
| Volume on adjacent Ramp | | vph |
| Position of adjacent Ramp | | |
| Type of adjacent Ramp | | |
| Distance to adjacent Ramp | | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 1843 | 983 | | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | | |
| Peak 15-min volume, v15 | 512 | 273 | | v |
| Trucks and buses | 18 | 18 | | % |
| Recreational vehicles | 0 | 0 | | % |
| Terrain type: | Level | Level | | |
| Grade | % | % | % | % |
| Length | mi | mi | mi | mi |
| Trucks and buses PCE, ET | 1.5 | 1.5 | | |
| Recreational vehicle PCE, ER | 1.2 | 1.2 | | |

| | | | |
|-------------------------------|-------|-------|------|
| Heavy vehicle adjustment, fHV | 0.917 | 0.917 | |
| Driver population factor, fP | 1.00 | 1.00 | |
| Flow rate, vp | 2232 | 1191 | pcph |

Estimation of V12 Merge Areas

$L =$ (Equation 13-6 or 13-7)
 EQ
 $P = 0.594$ Using Equation 1
 FM
 $v_{12} = v_F (P_{FM}) = 1326 \text{ pc/h}$

Capacity Checks

| | Actual | Maximum | LOS F? |
|----------------------------------------------------|----------|------------------------------------------|--------|
| v_{FO} | 3423 | 6750 | No |
| $v_3 \text{ or } v_{av34}$ | 906 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, $v_{12A} = 1326$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|-----------|--------|---------------|------------|
| v_{R12} | 3423 | 4600 | No |

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 20.8 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.315$ | |
| Space mean speed in ramp influence area, | $S_R = 50.9$ | mph |
| Space mean speed in outer lanes, | $S_0 = 53.5$ | mph |
| Space mean speed for all vehicles, | $S = 51.6$ | 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-385 SB
Junction: I-385 SB to Woodruff
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 | 55.0 | mph |
| Volume on freeway | 1916 | 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 | 523 | vph |
| Length of first accel/decel lane | 0 | ft |
| Length of second accel/decel lane | | ft |

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

| | | |
|---------------------------|----------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 1612 | vph |
| Position of adjacent ramp | Upstream | |
| Type of adjacent ramp | Off | |
| Distance to adjacent ramp | 1250 | ft |

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

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|---------|---------------|-----|
| Volume, V (vph) | 1916 | 523 | 1612 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 532 | 145 | 448 | 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 | 2320 | 633 | 1952 | pcph |

Estimation of V12 Diverge Areas

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

EQ

P = 0.673 Using Equation 5

FD

$v_{12} = v_R + (v_F - v_R) P_{FD} = 1768 \text{ pc/h}$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 2320 | 6750 | No |
| $v_{FO} = v_F - v_R$ | 1687 | 6750 | No |
| v_R | 633 | 2100 | No |
| v_3 or v_{av34} | 552 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, $v_{12A} = 1768$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 1768 | 4400 | No |

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 19.5 \text{ pc/mi/ln}$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.355$ | |
| Space mean speed in ramp influence area, | $S_R = 50.4$ | mph |
| Space mean speed in outer lanes, | $S_0 = 60.3$ | mph |
| Space mean speed for all vehicles, | $S = 52.4$ | 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-385 SB
From/To: I-385SB C-D - I-385SB PostMrge
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 2616 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 727 | 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 | 634 | 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 | 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 | 634 | pc/h/ln |
| Free-flow speed, FFS | 55.0 | mi/h |
| Average passenger-car speed, S | 55.0 | mi/h |
| Number of lanes, N | 5 | |
| Density, D | 11.5 | 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
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-385 SB
From/To: I-385SB C-D - I-385SB PreMerge
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 1393 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 387 | 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 | 562 | 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 | 562 | 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 | 10.2 | pc/mi/ln |
| Level of service, LOS | A | |

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-385 SB
From/To: I-385SB C-D - I-385SB (Ramp)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 1223 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 340 | 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 | 494 | 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 | 494 | 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 | 9.0 | pc/mi/ln |
| Level of service, LOS | A | |

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-385 SB
Junction: I-385 SB C-D - I-385SB
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 | 55.0 | mph |
| Volume on freeway | 1393 | 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 | 1223 | vph |
| Length of first accel/decel lane | 1150 | ft |
| Length of second accel/decel lane | 1500 | ft |

_____Adjacent Ramp Data (if one exists)_____

| | | |
|---------------------------|----|-----|
| Does adjacent ramp exist? | No | |
| Volume on adjacent Ramp | | vph |
| Position of adjacent Ramp | | |
| Type of adjacent Ramp | | |
| Distance to adjacent Ramp | | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 1393 | 1223 | | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | | |
| Peak 15-min volume, v15 | 387 | 340 | | v |
| Trucks and buses | 18 | 18 | | % |
| Recreational vehicles | 0 | 0 | | % |
| Terrain type: | Level | Level | | |
| Grade | % | % | % | % |
| Length | mi | mi | mi | mi |
| Trucks and buses PCE, ET | 1.5 | 1.5 | | |
| Recreational vehicle PCE, ER | 1.2 | 1.2 | | |

| | | | |
|-------------------------------|-------|-------|------|
| Heavy vehicle adjustment, fHV | 0.917 | 0.917 | |
| Driver population factor, fP | 1.00 | 1.00 | |
| Flow rate, vp | 1687 | 1481 | pcph |

Estimation of V12 Merge Areas

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

$$EQ$$

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

$$FM$$

$$v_{12} = v_F (P_{FM}) = 936 \quad \text{pc/h}$$

Capacity Checks

| | | | |
|------------------------------------------------------------------|----------|------------------------------------------|--------|
| | Actual | Maximum | LOS F? |
| v _{FO} | 3168 | 6750 | No |
| v ₃ or v _{av34} | 751 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} = 964 | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | | | |
|------------------|--------|---------------|------------|
| | Actual | Max Desirable | Violation? |
| v _{12A} | 3168 | 4600 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 0.0+ \quad \text{pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|------------------------|-----|
| Intermediate speed variable, | M _S = 0.024 | |
| Space mean speed in ramp influence area, | S _R = 54.7 | mph |
| Space mean speed in outer lanes, | S ₀ = 54.2 | mph |
| Space mean speed for all vehicles, | S = 54.6 | mph |

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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-385 NB
From/To: I-385NB - I-385NB CD Post-Div
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 2452 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 681 | 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 | 990 | 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 | 990 | 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 | 18.0 | 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
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-385 NB
From/To: I-385NB - I-385NB CD (Pre-Div)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 5057 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 1405 | 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 | 1225 | 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 | 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 | 1225 | pc/h/ln |
| Free-flow speed, FFS | 55.0 | mi/h |
| Average passenger-car speed, S | 55.0 | mi/h |
| Number of lanes, N | 5 | |
| 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

Operational Analysis

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

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 2605 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 724 | 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 | 1052 | 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 | 1052 | 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 | 19.1 | 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-385 NB
Junction: Woodruff - I-385 NB
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 | 55.0 | mph |
| Volume on freeway | 2452 | 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 | 903 | vph |
| Length of first accel/decel lane | 600 | ft |
| Length of second accel/decel lane | | ft |

_____Adjacent Ramp Data (if one exists)_____

| | | |
|---------------------------|----|-----|
| Does adjacent ramp exist? | No | |
| Volume on adjacent Ramp | | vph |
| Position of adjacent Ramp | | |
| Type of adjacent Ramp | | |
| Distance to adjacent Ramp | | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 2452 | 903 | | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | | |
| Peak 15-min volume, v15 | 681 | 251 | | v |
| Trucks and buses | 18 | 18 | | % |
| Recreational vehicles | 0 | 0 | | % |
| Terrain type: | Level | Level | | |
| Grade | % | % | % | % |
| Length | mi | mi | mi | mi |
| Trucks and buses PCE, ET | 1.5 | 1.5 | | |
| Recreational vehicle PCE, ER | 1.2 | 1.2 | | |

| | | | |
|-------------------------------|-------|-------|------|
| Heavy vehicle adjustment, fHV | 0.917 | 0.917 | |
| Driver population factor, fP | 1.00 | 1.00 | |
| Flow rate, vp | 2970 | 1094 | pcph |

Estimation of V12 Merge Areas

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

$$EQ$$

$$P = 0.594 \quad \text{Using Equation 1}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 1765 \quad \text{pc/h}$$

Capacity Checks

| | | | |
|-----------------------------------------|-----------|------------------------------------------|--------|
| | Actual | Maximum | LOS F? |
| v_{FO} | 4064 | 6750 | No |
| v_3 or v_{av34} | 1205 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, $v_{12A} = 1765$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | | | |
|-----------|--------|---------------|------------|
| | Actual | Max Desirable | Violation? |
| v_{R12} | 4064 | 4600 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 23.5 \quad \text{pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.335$ | |
| Space mean speed in ramp influence area, | $S_R = 50.6$ | mph |
| Space mean speed in outer lanes, | $S_0 = 52.5$ | mph |
| Space mean speed for all vehicles, | $S = 51.2$ | 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: PM
Freeway/Dir of Travel: I-385 SB
Junction: I-385 SB to Woodruff
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 | 55.0 | mph |
| Volume on freeway | 3976 | 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 | 866 | vph |
| Length of first accel/decel lane | 0 | ft |
| Length of second accel/decel lane | | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|----------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 2506 | vph |
| Position of adjacent ramp | Upstream | |
| Type of adjacent ramp | Off | |
| Distance to adjacent ramp | 1250 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|---------|---------------|-----|
| Volume, V (vph) | 3976 | 866 | 2506 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1104 | 241 | 696 | 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 | 4815 | 1049 | 3035 | pcph |

Estimation of V12 Diverge Areas

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

EQ

$$P = 0.591 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P = 3276 \quad \text{pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|-----------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 4815 | 6750 | No |
| $v_{FO} = v_F - v_R$ | 3766 | 6750 | No |
| v_R | 1049 | 2100 | No |
| v_3 or v_{av34} | 1539 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, $v_{12A} = 3276$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 3276 | 4400 | No |

Level of Service Determination (if not F)

| | | | |
|-----------------------------------------------------------------|--------------------------------------|----------|----------|
| Density, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= 32.4$ | pc/mi/ln |
| Level of service for ramp-freeway junction areas of influence D | | | |

Speed Estimation

| | | |
|------------------------------------------|--------------|-----|
| Intermediate speed variable, | $D = 0.392$ | |
| Space mean speed in ramp influence area, | $S_R = 49.9$ | mph |
| Space mean speed in outer lanes, | $S_0 = 58.2$ | mph |
| Space mean speed for all vehicles, | $S = 52.3$ | mph |

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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-385 SB
From/To: I-385SB C-D - I-385SB PostMrge
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 5134 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 1426 | 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 | 1244 | 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 | 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 | 1244 | pc/h/ln |
| Free-flow speed, FFS | 55.0 | mi/h |
| Average passenger-car speed, S | 55.0 | mi/h |
| Number of lanes, N | 5 | |
| Density, D | 22.6 | 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-385 SB
From/To: I-385SB C-D - I-385SB PreMerge
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 3110 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 864 | 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 | 1256 | 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 | 1256 | 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 | 22.8 | 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-385 SB
From/To: I-385SB C-D - I-385SB (Ramp)
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Flow Inputs and Adjustments

| | | |
|-------------------------------|-------|---------|
| Volume, V | 2024 | veh/h |
| Peak-hour factor, PHF | 0.90 | |
| Peak 15-min volume, v15 | 562 | 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 | 817 | 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 | 817 | 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 | 14.9 | pc/mi/ln |
| Level of service, LOS | B | |

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-385 SB
Junction: I-385 SB C-D - I-385SB
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 | 55.0 | mph |
| Volume on freeway | 3110 | 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 | 2024 | vph |
| Length of first accel/decel lane | 1150 | ft |
| Length of second accel/decel lane | 1500 | ft |

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

| | | |
|---------------------------|----|-----|
| Does adjacent ramp exist? | No | |
| Volume on adjacent Ramp | | vph |
| Position of adjacent Ramp | | |
| Type of adjacent Ramp | | |
| Distance to adjacent Ramp | | ft |

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

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 3110 | 2024 | | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | | |
| Peak 15-min volume, v15 | 864 | 562 | | v |
| Trucks and buses | 18 | 18 | | % |
| Recreational vehicles | 0 | 0 | | % |
| Terrain type: | Level | Level | | |
| Grade | % | % | % | % |
| Length | mi | mi | mi | mi |
| Trucks and buses PCE, ET | 1.5 | 1.5 | | |
| Recreational vehicle PCE, ER | 1.2 | 1.2 | | |

| | | | |
|-------------------------------|-------|-------|------|
| Heavy vehicle adjustment, fHV | 0.917 | 0.917 | |
| Driver population factor, fP | 1.00 | 1.00 | |
| Flow rate, vp | 3767 | 2451 | pcph |

Estimation of V12 Merge Areas

$L =$ (Equation 13-6 or 13-7)
 EQ
 $P = 0.555$ Using Equation 0
 FM
 $v_{12} = v_F (P_{FM}) = 2091 \text{ pc/h}$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|-----------|------------------------------------------|--------|
| v_{FO} | 6218 | 6750 | No |
| v_3 or v_{av34} | 1676 pc/h | (Equation 13-14 or 13-17) | |
| Is v_3 or $v_{av34} > 2700 \text{ pc/h?}$ | | No | |
| Is v_3 or $v_{av34} > 1.5 v_{12} / 2$ | | Yes | |
| If yes, $v_{12A} = 2152$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|-----------|--------|---------------|------------|
| v_{12A} | 6218 | 4600 | Yes |

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 16.4 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.368$ | |
| Space mean speed in ramp influence area, | $S_R = 50.2$ | mph |
| Space mean speed in outer lanes, | $S_0 = 51.0$ | mph |
| Space mean speed for all vehicles, | $S = 50.4$ | 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-385 NB
Junction: I-85SB to I-385NB
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 | 55.0 | mph |
| Volume on freeway | 2826 | vph |

_____On Ramp Data_____

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 2 | |
| Free-flow speed on ramp | 55.0 | mph |
| Volume on ramp | 1205 | vph |
| Length of first accel/decel lane | 550 | ft |
| Length of second accel/decel lane | 1500 | ft |

_____Adjacent Ramp Data (if one exists)_____

| | | |
|---------------------------|------------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent Ramp | 733 | 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) | 2826 | 1205 | 733 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 785 | 335 | 204 | 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 | 3423 | 1459 | 888 | pcph |

Estimation of V12 Merge Areas

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

$$EQ$$

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

$$FM$$

$$v_{12} = v_F (P_{FM}) = 1900 \quad \text{pc/h}$$

Capacity Checks

| | | | |
|------------------------------------------------------------------|-----------|------------------------------------------|--------|
| | Actual | Maximum | LOS F? |
| v _{FO} | 4882 | 6750 | No |
| v ₃ or v _{av34} | 1523 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} = 1956 | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | | | |
|------------------|--------|---------------|------------|
| | Actual | Max Desirable | Violation? |
| v _{12A} | 4882 | 4600 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 15.1 \quad \text{pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|------------------------|-----|
| Intermediate speed variable, | M _S = 0.154 | |
| Space mean speed in ramp influence area, | S _R = 53.0 | mph |
| Space mean speed in outer lanes, | S ₀ = 51.5 | mph |
| Space mean speed for all vehicles, | S = 52.5 | 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-385 NB
Junction: I-85NB to I-385NB
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

| | | |
|----------------------------|-------|-----|
| Type of analysis | Merge | |
| Number of lanes in freeway | 4 | |
| Free-flow speed on freeway | 55.0 | mph |
| Volume on freeway | 4031 | vph |

_____On Ramp Data_____

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 1 | |
| Free-flow speed on ramp | 55.0 | mph |
| Volume on ramp | 733 | 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 | 1205 | vph |
| Position of adjacent Ramp | Upstream | |
| 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) | 4031 | 733 | 1205 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1120 | 204 | 335 | 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 | 4882 | 888 | 1459 | pcph |

Estimation of V12 Merge Areas

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

EQ

P = 0.107 Using Equation 4

FM

$v_{12} = v_F (P_{FM}) = 521$ pc/h

12 F FM

Capacity Checks

| | | | | |
|---------------------------------------|--|-----------|------------------------------------------|--------|
| | | Actual | Maximum | LOS F? |
| v_{FO} | | 5770 | 9000 | No |
| v_3 or v_{av34} | | 2180 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, $v_{12A} = 1952$ | | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | | | |
|-----------|--------|---------------|------------|
| | Actual | Max Desirable | Violation? |
| v_{12A} | 5770 | 4600 | No |

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 17.8$ pc/mi/ln

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.223$ | |
| Space mean speed in ramp influence area, | $S_R = 52.1$ | mph |
| Space mean speed in outer lanes, | $S_0 = 51.5$ | 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: AM
Freeway/Dir of Travel: I-385 SB
Junction: I-385SB to I-85
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

| | | |
|----------------------------|---------|-----|
| Type of analysis | Diverge | |
| Number of lanes in freeway | 4 | |
| Free-flow speed on freeway | 55.0 | mph |
| Volume on freeway | 3528 | vph |

Off Ramp Data

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 2 | |
| Free-Flow speed on ramp | 55.0 | mph |
| Volume on ramp | 1612 | vph |
| Length of first accel/decel lane | 1500 | ft |
| Length of second accel/decel lane | 0 | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|------------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 523 | vph |
| Position of adjacent ramp | Downstream | |
| Type of adjacent ramp | Off | |
| Distance to adjacent ramp | 1250 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|---------|---------------|-----|
| Volume, V (vph) | 3528 | 1612 | 523 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 980 | 448 | 145 | 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 | 4273 | 1952 | 633 | pcph |

Estimation of V12 Diverge Areas

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

$$EQ$$

$$P = 0.260 \quad \text{Using Equation } 0$$

$$FD$$

$$v_{12} = v_R + (v_F - v_R) P = 2555 \quad \text{pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|-----------------------------------------|----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 4273 | 9000 | No |
| $v_{FO} = v_F - v_R$ | 2321 | 9000 | No |
| v_R | 1952 | 4400 | No |
| v_3 or v_{av34} | 859 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, $v_{12A} = 2555$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 2555 | 4400 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 4.252 + 0.0086 v_R - 0.009 L_D = -0.8 \quad \text{pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.344$ | |
| Space mean speed in ramp influence area, | $S_R = 50.5$ | mph |
| Space mean speed in outer lanes, | $S_0 = 60.3$ | 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

_____Merge Analysis_____

Analyst: JP
Agency/Co.: Florence & Hutcheson
Date performed: 9/23/2011
Analysis time period: PM
Freeway/Dir of Travel: I-385 NB
Junction: I-85SB to I-385NB
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 | 55.0 | mph |
| Volume on freeway | 3355 | vph |

_____On Ramp Data_____

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 2 | |
| Free-flow speed on ramp | 55.0 | mph |
| Volume on ramp | 1471 | vph |
| Length of first accel/decel lane | 550 | ft |
| Length of second accel/decel lane | 1500 | ft |

_____Adjacent Ramp Data (if one exists)_____

| | | |
|---------------------------|------------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent Ramp | 424 | 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) | 3355 | 1471 | 424 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 932 | 409 | 118 | 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 | 4063 | 1782 | 514 | pcph |

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

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

$$EQ$$

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

$$FM$$

$$v_{12} = v_F(P) = 2255 \quad \text{pc/h}$$

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

| | | | |
|------------------------------------------------------------------|-----------|------------------------------------------|--------|
| | Actual | Maximum | LOS F? |
| v _{FO} | 5845 | 6750 | No |
| v ₃ or v _{av34} | 1808 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} = 2321 | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

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

| | | | |
|------------------|--------|---------------|------------|
| | Actual | Max Desirable | Violation? |
| v _{12A} | 5845 | 4600 | No |

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

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 20.4 \quad \text{pc/mi/ln}$$

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

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

| | | |
|------------------------------------------|------------------------|-----|
| Intermediate speed variable, | M _S = 0.271 | |
| Space mean speed in ramp influence area, | S _R = 51.5 | mph |
| Space mean speed in outer lanes, | S ₀ = 50.5 | mph |
| Space mean speed for all vehicles, | S = 51.2 | 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-385 NB
Junction: I-85NB to I-385NB
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

_____Freeway Data_____

| | | |
|----------------------------|-------|-----|
| Type of analysis | Merge | |
| Number of lanes in freeway | 4 | |
| Free-flow speed on freeway | 55.0 | mph |
| Volume on freeway | 4826 | vph |

_____On Ramp Data_____

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 1 | |
| Free-flow speed on ramp | 55.0 | mph |
| Volume on ramp | 424 | 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 | 1471 | vph |
| Position of adjacent Ramp | Upstream | |
| 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) | 4826 | 424 | 1471 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1341 | 118 | 409 | 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 | 5845 | 514 | 1782 | pcph |

Estimation of V12 Merge Areas

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

$$EQ$$

$$P = 0.154 \quad \text{Using Equation 4}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 897 \quad \text{pc/h}$$

Capacity Checks

| | | | |
|-----------------------------------------|-----------|------------------------------------------|--------|
| | Actual | Maximum | LOS F? |
| v_{FO} | 6359 | 9000 | No |
| v_3 or v_{av34} | 2474 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, $v_{12A} = 2338$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | | | |
|-----------|--------|---------------|------------|
| | Actual | Max Desirable | Violation? |
| v_{12A} | 6359 | 4600 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 18.1 \quad \text{pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.224$ | |
| Space mean speed in ramp influence area, | $S_R = 52.1$ | mph |
| Space mean speed in outer lanes, | $S_0 = 50.5$ | mph |
| Space mean speed for all vehicles, | $S = 51.2$ | 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: PM
Freeway/Dir of Travel: I-385 SB
Junction: I-385SB to I-85
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

| | | |
|----------------------------|---------|-----|
| Type of analysis | Diverge | |
| Number of lanes in freeway | 4 | |
| Free-flow speed on freeway | 55.0 | mph |
| Volume on freeway | 6482 | vph |

Off Ramp Data

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 2 | |
| Free-Flow speed on ramp | 55.0 | mph |
| Volume on ramp | 2506 | vph |
| Length of first accel/decel lane | 1500 | ft |
| Length of second accel/decel lane | 0 | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|------------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 866 | vph |
| Position of adjacent ramp | Downstream | |
| Type of adjacent ramp | Off | |
| Distance to adjacent ramp | 1250 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|---------|---------------|-----|
| Volume, V (vph) | 6482 | 2506 | 866 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1801 | 696 | 241 | 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 | 7850 | 3035 | 1049 | pcph |

Estimation of V12 Diverge Areas

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

EQ

P = 0.260 Using Equation 0

FD

$v_{12} = v_R + (v_F - v_R) P = 4287 \text{ pc/h}$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 7850 | 9000 | No |
| $v_{FO} = v_F - v_R$ | 4815 | 9000 | No |
| v_R | 3035 | 4400 | No |
| v_3 or v_{av34} | 1781 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, $v_{12A} = 4287$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 4287 | 4400 | No |

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 14.1 \text{ pc/mi/ln}$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.441$ | |
| Space mean speed in ramp influence area, | $S_R = 49.3$ | mph |
| Space mean speed in outer lanes, | $S_0 = 57.3$ | mph |
| Space mean speed for all vehicles, | $S = 52.6$ | 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-385 NB
Junction: Roper Mtn Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

| | | |
|----------------------------|---------|-----|
| Type of analysis | Diverge | |
| Number of lanes in freeway | 5 | |
| Free-flow speed on freeway | 55.0 | mph |
| Volume on freeway | 4764 | vph |

Off Ramp Data

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 2 | |
| Free-Flow speed on ramp | 55.0 | mph |
| Volume on ramp | 1593 | vph |
| Length of first accel/decel lane | 1500 | ft |
| Length of second accel/decel lane | 1500 | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|------------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 451 | vph |
| Position of adjacent ramp | Downstream | |
| Type of adjacent ramp | On | |
| Distance to adjacent ramp | 1900 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|---------|---------------|-----|
| Volume, V (vph) | 4764 | 1593 | 451 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1323 | 443 | 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 | 5770 | 1929 | 546 | pcph |

Estimation of V12 Diverge Areas

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

EQ

$$P = 0.260 \quad \text{Using Equation 0}$$

FD

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 2703 \quad \text{pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|-----------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 4905 | 9000 | No |
| $v_{FO} = v_F - v_R$ | 2976 | 9000 | No |
| v_R | 1929 | 4400 | No |
| v_3 or v_{av34} | 1101 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, $v_{12A} = 2703$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 2703 | 4400 | No |

Level of Service Determination (if not F)

| | | | |
|-----------------------------------------------------------------|--------------------------------------|-----------|----------|
| Density, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= -13.0$ | pc/mi/ln |
| Level of service for ramp-freeway junction areas of influence A | | | |

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.342$ | |
| Space mean speed in ramp influence area, | $S_R = 50.6$ | mph |
| Space mean speed in outer lanes, | $S_0 = 59.9$ | mph |
| Space mean speed for all vehicles, | $S = 54.4$ | 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-385 NB
Junction: Roper Mtn Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

| | | |
|----------------------------|---------|-----|
| Type of analysis | Diverge | |
| Number of lanes in freeway | 5 | |
| Free-flow speed on freeway | 55.0 | mph |
| Volume on freeway | 4764 | vph |

Off Ramp Data

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 2 | |
| Free-Flow speed on ramp | 55.0 | mph |
| Volume on ramp | 1593 | vph |
| Length of first accel/decel lane | 1500 | ft |
| Length of second accel/decel lane | 1500 | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|----------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 733 | vph |
| Position of adjacent ramp | Upstream | |
| Type of adjacent ramp | On | |
| Distance to adjacent ramp | 3100 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | | Ramp | | Adjacent Ramp | |
|------------------------------|---------|----|-------|----|---------------|-----|
| Volume, V (vph) | 4764 | | 1593 | | 733 | vph |
| Peak-hour factor, PHF | 0.90 | | 0.90 | | 0.90 | |
| Peak 15-min volume, v15 | 1323 | | 443 | | 204 | 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 | 5770 | 1929 | 888 | pcph |

Estimation of V12 Diverge Areas

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

$$EQ$$

$$P = 0.260 \quad \text{Using Equation } 0$$

$$FD$$

$$v_{12} = v_R + (v_F - v_R) P = 2703 \quad \text{pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|-----------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 4905 | 9000 | No |
| $v_{FO} = v_F - v_R$ | 2976 | 9000 | No |
| v_R | 1929 | 4400 | No |
| v_3 or v_{av34} | 1101 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, $v_{12A} = 2703$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 2703 | 4400 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 4.252 + 0.0086 v_R - 0.009 L_D = -13.0 \quad \text{pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.342$ | |
| Space mean speed in ramp influence area, | $S_R = 50.6$ | mph |
| Space mean speed in outer lanes, | $S_0 = 59.9$ | mph |
| Space mean speed for all vehicles, | $S = 54.4$ | 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-385 NB
Junction: Roper Mtn 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 | 55.0 | mph |
| Volume on freeway | 3171 | vph |

_____On Ramp Data_____

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 1 | |
| Free-flow speed on ramp | 55.0 | mph |
| Volume on ramp | 451 | 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 | 1593 | vph |
| Position of adjacent Ramp | Upstream | |
| Type of adjacent Ramp | Off | |
| Distance to adjacent Ramp | 1950 | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 3171 | 451 | 1593 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 881 | 125 | 443 | 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 | 3840 | 546 | 1929 | pcph |

Estimation of V12 Merge Areas

$$L = 2079.20 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

$$P = 0.611 \text{ Using Equation 2}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2347 \text{ pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|----------------------------------------------------|-----------|------------------------------------------|--------|
| v_{FO} | 4386 | 6750 | No |
| $v_3 \text{ or } v_{av34}$ | 1493 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, $v_{12A} = 2347$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|-----------|--------|---------------|------------|
| v_{R12} | 4386 | 4600 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 18.4 \text{ pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.226$ | |
| Space mean speed in ramp influence area, | $S_R = 52.1$ | mph |
| Space mean speed in outer lanes, | $S_0 = 51.4$ | 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: AM
Freeway/Dir of Travel: I-385
Junction: Roper Mtn Rd
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 | 55.0 | mph |
| Volume on freeway | 3496 | vph |

Off Ramp Data

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 1 | |
| Free-Flow speed on ramp | 55.0 | mph |
| Volume on ramp | 812 | vph |
| Length of first accel/decel lane | 1100 | ft |
| Length of second accel/decel lane | | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|------------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 844 | vph |
| Position of adjacent ramp | Downstream | |
| Type of adjacent ramp | On | |
| Distance to adjacent ramp | 2500 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|---------|---------------|-----|
| Volume, V (vph) | 3496 | 812 | 844 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 971 | 226 | 234 | 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 | 4234 | 983 | 1022 | pcph |

Estimation of V12 Diverge Areas

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

EQ

P = 0.609 Using Equation 5

FD

$v_{12} = v_R + (v_F - v_R) P_{FD} = 2963 \text{ pc/h}$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 4234 | 6750 | No |
| $v_{FO} = v_F - v_R$ | 3251 | 6750 | No |
| v_R | 983 | 2200 | No |
| v_3 or v_{av34} | 1271 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, $v_{12A} = 2963$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 2963 | 4400 | No |

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D = 19.8 \text{ pc/mi/ln}$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.256$ | |
| Space mean speed in ramp influence area, | $S_R = 51.7$ | mph |
| Space mean speed in outer lanes, | $S_0 = 59.3$ | mph |
| Space mean speed for all vehicles, | $S = 53.7$ | 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-385 SB
Junction: Roper Mtn 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 | 55.0 | mph |
| Volume on freeway | 2684 | vph |

_____On Ramp Data_____

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 1 | |
| Free-flow speed on ramp | 55.0 | mph |
| Volume on ramp | 844 | 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 | 1612 | vph |
| Position of adjacent Ramp | Downstream | |
| Type of adjacent Ramp | Off | |
| Distance to adjacent Ramp | 1780 | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 2684 | 844 | 1612 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 746 | 234 | 448 | 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 | 3251 | 1022 | 1952 | pcph |

Estimation of V12 Merge Areas

$$L = 7226.95 \text{ (Equation 13-6 or 13-7)}$$

EQ

$$P = 0.837 \text{ Using Equation 3}$$

FM

$$v_{12} = v_F (P_{FM}) = 2721 \text{ pc/h}$$

12 F FM

Capacity Checks

| | Actual | Maximum | LOS F? |
|-----------------------------------------|----------|------------------------------------------|--------|
| v_{FO} | 4273 | 6750 | No |
| v_3 or v_{av34} | 530 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, $v_{12A} = 2721$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|-----------|--------|---------------|------------|
| v_{R12} | 4273 | 4600 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 24.8 \text{ pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.321$ | |
| Space mean speed in ramp influence area, | $S_R = 50.8$ | mph |
| Space mean speed in outer lanes, | $S_0 = 54.9$ | mph |
| Space mean speed for all vehicles, | $S = 51.3$ | 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-385 SB
Junction: Roper Mtn 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 | 55.0 | mph |
| Volume on freeway | 2684 | vph |

_____On Ramp Data_____

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 1 | |
| Free-flow speed on ramp | 55.0 | mph |
| Volume on ramp | 844 | 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 | 812 | vph |
| Position of adjacent Ramp | Upstream | |
| Type of adjacent Ramp | Off | |
| Distance to adjacent Ramp | 2220 | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 2684 | 844 | 812 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 746 | 234 | 226 | 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 | 3251 | 1022 | 983 | pcph |

Estimation of V12 Merge Areas

$$L = 2055.02 \text{ (Equation 13-6 or 13-7)}$$

$$EQ$$

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

$$FM$$

$$v_{12} = v_F (P_{FM}) = 2014 \text{ pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|-----------|------------------------------------------|--------|
| v_{FO} | 4273 | 6750 | No |
| v_3 or v_{av34} | 1237 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, $v_{12A} = 2014$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|-----------|--------|---------------|------------|
| v_{R12} | 4273 | 4600 | No |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 19.3 \text{ pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 0.237$ | |
| Space mean speed in ramp influence area, | $S_R = 51.9$ | mph |
| Space mean speed in outer lanes, | $S_0 = 52.3$ | mph |
| Space mean speed for all vehicles, | $S = 52.0$ | 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-385 NB
Junction: Roper Mtn Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

| | | |
|----------------------------|---------|-----|
| Type of analysis | Diverge | |
| Number of lanes in freeway | 5 | |
| Free-flow speed on freeway | 55.0 | mph |
| Volume on freeway | 5250 | vph |

Off Ramp Data

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 2 | |
| Free-Flow speed on ramp | 55.0 | mph |
| Volume on ramp | 896 | vph |
| Length of first accel/decel lane | 1500 | ft |
| Length of second accel/decel lane | 1500 | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|------------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 825 | vph |
| Position of adjacent ramp | Downstream | |
| Type of adjacent ramp | On | |
| Distance to adjacent ramp | 1900 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|---------|---------------|-----|
| Volume, V (vph) | 5250 | 896 | 825 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1458 | 249 | 229 | 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 | 6358 | 1085 | 999 | pcph |

Estimation of V12 Diverge Areas

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

EQ

$$P = 0.260 \quad \text{Using Equation } 0$$

FD

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 2208 \quad \text{pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 5405 | 9000 | No |
| $v_{FO} = v_F - v_R$ | 4320 | 9000 | No |
| v_R | 1085 | 4400 | 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, $v_{12A} = 2208$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 2208 | 4400 | No |

Level of Service Determination (if not F)

| | | | |
|-----------------------------------------------------------------|--------------------------------------|-----------|----------|
| Density, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= -17.3$ | pc/mi/ln |
| Level of service for ramp-freeway junction areas of influence A | | | |

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.266$ | |
| Space mean speed in ramp influence area, | $S_R = 51.5$ | mph |
| Space mean speed in outer lanes, | $S_0 = 58.0$ | mph |
| Space mean speed for all vehicles, | $S = 55.2$ | 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: PM
Freeway/Dir of Travel: I-385 NB
Junction: Roper Mtn Rd
Jurisdiction: Greenville, SC
Analysis Year: 2015
Description: I-85/I-385 Alternate 4A

Freeway Data

| | | |
|----------------------------|---------|-----|
| Type of analysis | Diverge | |
| Number of lanes in freeway | 5 | |
| Free-flow speed on freeway | 55.0 | mph |
| Volume on freeway | 5250 | vph |

Off Ramp Data

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 2 | |
| Free-Flow speed on ramp | 55.0 | mph |
| Volume on ramp | 896 | vph |
| Length of first accel/decel lane | 1500 | ft |
| Length of second accel/decel lane | 1500 | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|----------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 424 | vph |
| Position of adjacent ramp | Upstream | |
| Type of adjacent ramp | On | |
| Distance to adjacent ramp | 3100 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|---------|---------------|-----|
| Volume, V (vph) | 5250 | 896 | 424 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1458 | 249 | 118 | 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 | 6358 | 1085 | 514 | pcph |

Estimation of V12 Diverge Areas

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

EQ

$$P = 0.260 \quad \text{Using Equation } 0$$

FD

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 2208 \quad \text{pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|---------------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 5405 | 9000 | No |
| $v_{FO} = v_F - v_R$ | 4320 | 9000 | No |
| v_R | 1085 | 4400 | 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, $v_{12A} = 2208$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 2208 | 4400 | No |

Level of Service Determination (if not F)

| | | | |
|-----------------------------------------------------------------|--------------------------------------|-----------|----------|
| Density, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= -17.3$ | pc/mi/ln |
| Level of service for ramp-freeway junction areas of influence A | | | |

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.266$ | |
| Space mean speed in ramp influence area, | $S_R = 51.5$ | mph |
| Space mean speed in outer lanes, | $S_0 = 58.0$ | mph |
| Space mean speed for all vehicles, | $S = 55.2$ | 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-385 NB
Junction: Roper Mtn 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 | 55.0 | mph |
| Volume on freeway | 4354 | vph |

_____On Ramp Data_____

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 1 | |
| Free-flow speed on ramp | 55.0 | mph |
| Volume on ramp | 825 | 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 | 896 | vph |
| Position of adjacent Ramp | Upstream | |
| Type of adjacent Ramp | Off | |
| Distance to adjacent Ramp | 1950 | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 4354 | 825 | 896 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1209 | 229 | 249 | 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 | 5273 | 999 | 1085 | pcph |

Estimation of V12 Merge Areas

$$L = 2482.81 \text{ (Equation 13-6 or 13-7)}$$

EQ

$$P = 0.586 \text{ Using Equation 2}$$

FM

$$v_{12} = v_F (P_{FM}) = 3089 \text{ pc/h}$$

12 F FM

Capacity Checks

| | Actual | Maximum | LOS F? |
|------------------------------------------------------------------|-----------|------------------------------------------|--------|
| v _{FO} | 6272 | 6750 | No |
| v ₃ or v _{av34} | 2184 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} = 3089 | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|------------------|--------|---------------|------------|
| v _{R12} | 6272 | 4600 | No |

Level of Service Determination (if not F)

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

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

Speed Estimation

| | | | |
|------------------------------------------|----------------|---------|-----|
| Intermediate speed variable, | M | = 0.389 | |
| | S | | |
| Space mean speed in ramp influence area, | S _R | = 49.9 | mph |
| Space mean speed in outer lanes, | S ₀ | = 48.9 | mph |
| Space mean speed for all vehicles, | S | = 49.6 | 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-385
Junction: Roper Mtn Rd
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 | 55.0 | mph |
| Volume on freeway | 5569 | vph |

Off Ramp Data

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 1 | |
| Free-Flow speed on ramp | 55.0 | mph |
| Volume on ramp | 883 | vph |
| Length of first accel/decel lane | 1100 | ft |
| Length of second accel/decel lane | | ft |

Adjacent Ramp Data (if one exists)

| | | |
|---------------------------|------------|-----|
| Does adjacent ramp exist? | Yes | |
| Volume on adjacent ramp | 1796 | vph |
| Position of adjacent ramp | Downstream | |
| Type of adjacent ramp | On | |
| Distance to adjacent ramp | 2500 | ft |

Conversion to pc/h Under Base Conditions

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|---------|---------------|-----|
| Volume, V (vph) | 5569 | 883 | 1796 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1547 | 245 | 499 | 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 | 6745 | 1069 | 2175 | pcph |

Estimation of V12 Diverge Areas

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

EQ

$$P = 0.542 \quad \text{Using Equation 5}$$

FD

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 4147 \quad \text{pc/h}$$

Capacity Checks

| | Actual | Maximum | LOS F? |
|-----------------------------------------|-----------|------------------------------------------|--------|
| $v_{Fi} = v_F$ | 6745 | 6750 | No |
| $v_{FO} = v_F - v_R$ | 5676 | 6750 | No |
| v_R | 1069 | 2200 | No |
| v_3 or v_{av34} | 2598 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, $v_{12A} = 4147$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Diverge Influence Area

| | Actual | Max Desirable | Violation? |
|----------|--------|---------------|------------|
| v_{12} | 4147 | 4400 | No |

Level of Service Determination (if not F)

| | | | |
|-----------------------------------------------------------------|--------------------------------------|----------|----------|
| Density, | $D = 4.252 + 0.0086 v_R - 0.009 L_D$ | $= 30.0$ | pc/mi/ln |
| Level of service for ramp-freeway junction areas of influence D | | | |

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $D_S = 0.264$ | |
| Space mean speed in ramp influence area, | $S_R = 51.6$ | mph |
| Space mean speed in outer lanes, | $S_0 = 54.1$ | mph |
| Space mean speed for all vehicles, | $S = 52.5$ | 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-385 SB
Junction: Roper Mtn 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 | 55.0 | mph |
| Volume on freeway | 4686 | vph |

_____On Ramp Data_____

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 1 | |
| Free-flow speed on ramp | 55.0 | mph |
| Volume on ramp | 1796 | 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 | 2506 | vph |
| Position of adjacent Ramp | Downstream | |
| Type of adjacent Ramp | Off | |
| Distance to adjacent Ramp | 1780 | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 4686 | 1796 | 2506 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1302 | 499 | 696 | 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 | 5675 | 2175 | 3035 | pcph |

Estimation of V12 Merge Areas

$L = 11236.58$ Equation 13-6 or 13-7)
 EQ
 $P = 0.997$ Using Equation 3
 FM
 $v_{12} = v_F (P_{FM}) = 5657$ pc/h

Capacity Checks

| | | | |
|-----------------------------------------|---------|------------------------------------------|--------|
| | Actual | Maximum | LOS F? |
| v_{FO} | 7850 | 6750 | Yes |
| v_3 or v_{av34} | 18 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, $v_{12A} = 5657$ | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | | | |
|-----------|--------|---------------|------------|
| | Actual | Max Desirable | Violation? |
| v_{R12} | 7850 | 4600 | Yes |

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 56.2$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence F

Speed Estimation

| | | |
|------------------------------------------|---------------|-----|
| Intermediate speed variable, | $M_S = 9.984$ | |
| Space mean speed in ramp influence area, | $S_R = -74.8$ | mph |
| Space mean speed in outer lanes, | $S_0 = 55.0$ | 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-385 SB
Junction: Roper Mtn 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 | 4686 | vph |

_____On Ramp Data_____

| | | |
|-----------------------------------|-------|-----|
| Side of freeway | Right | |
| Number of lanes in ramp | 1 | |
| Free-flow speed on ramp | 55.0 | mph |
| Volume on ramp | 1796 | 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 | 883 | vph |
| Position of adjacent Ramp | Upstream | |
| Type of adjacent Ramp | Off | |
| Distance to adjacent Ramp | 2220 | ft |

_____Conversion to pc/h Under Base Conditions_____

| Junction Components | Freeway | Ramp | Adjacent Ramp | |
|------------------------------|---------|-------|---------------|-----|
| Volume, V (vph) | 4686 | 1796 | 883 | vph |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | |
| Peak 15-min volume, v15 | 1302 | 499 | 245 | 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 | 5675 | 2175 | 1069 | pcph |

Estimation of V12 Merge Areas

$$L = 2820.50 \text{ (Equation 13-6 or 13-7)}$$

EQ

$$P = 0.582 \text{ Using Equation 2}$$

FM

$$v_{12} = v_F (P_{FM}) = 3300 \text{ pc/h}$$

12 F FM

Capacity Checks

| | Actual | Maximum | LOS F? |
|------------------------------------------------------------------|-----------|------------------------------------------|--------|
| v _{FO} | 7850 | 6900 | Yes |
| v ₃ or v _{av34} | 2375 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} = 3300 | | (Equation 13-15, 13-16, 13-18, or 13-19) | |

Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|------------------|--------|---------------|------------|
| v _{R12} | 7850 | 4600 | Yes |

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 37.8 \text{ pc/mi/ln}$$

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

Speed Estimation

| | | |
|------------------------------------------|------------------------|-----|
| Intermediate speed variable, | M _S = 1.087 | |
| Space mean speed in ramp influence area, | S _R = 40.4 | mph |
| Space mean speed in outer lanes, | S ₀ = 53.0 | mph |
| Space mean speed for all vehicles, | S = 43.6 | mph |