

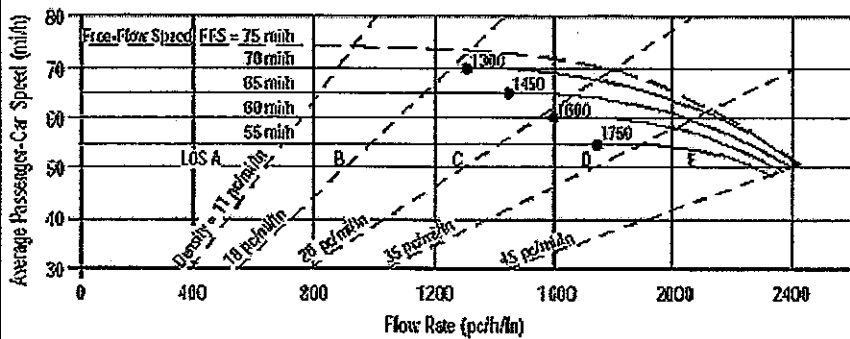
APPENDIX R

**YEAR 2030 TRAFFIC CONDITIONS FREEWAY
SEGMENT LEVEL OF SERVICE CALCULATION
WORKSHEETS – CALTRANS FACILITIES ANALYSIS
(HCM METHODOLOGY)**

APPENDIX R-1

**YEAR 2030 WITHOUT PROJECT TRAFFIC
CONDITIONS – CALTRANS FREEWAY SEGMENT
ANALYSIS (HCM METHODOLOGY)**

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: AM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 NB
 From/To: Orangewood and Katella
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 without Project

Project Description: AM Year 2030 without Project SR-57 NB Orangewood to Katella

Oper. (LOS)

Des. (N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|---------------------------|--------|
| Volume, V | 5205 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | % Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | % RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % | Length |
| Driver type adjustment | 1.00 | Up/Down % | mi |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T-1) + P_R(E_R-1)]$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | 1/mi |
| Number of Lanes, N | 5 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | | |
|----------|------|------|
| f_{LW} | | mi/h |
| f_{LC} | | mi/h |
| f_{ID} | | mi/h |
| f_N | | mi/h |
| FFS | 70.0 | mi/h |

LOS and Performance Measures

| Operational (LOS) | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1129 | pc/h/ln |
| S | 70.0 | mi/h |
| $D = v_p / S$ | 16.1 | pc/mi/ln |
| LOS | B | |

Design (N)

| Design (N) | |
|--|----------|
| Design LOS | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| S | mi/h |
| $D = v_p / S$ | pc/mi/ln |
| Required Number of Lanes, N | |

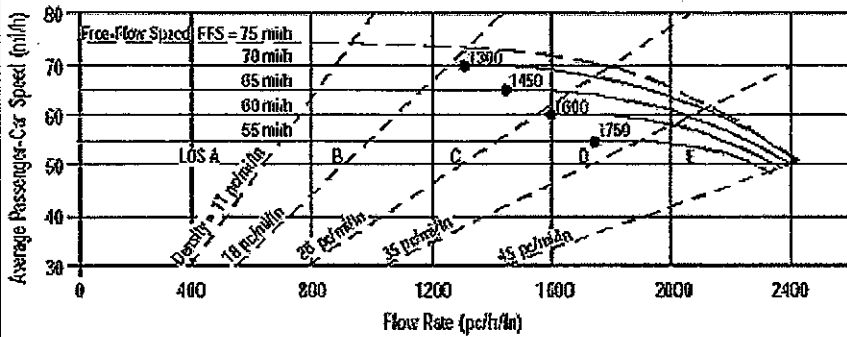
Glossary

N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume
 S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 23-8, 23-10
 E_T - Exhibits 23-8, 23-10, 23-11
 f_p - Page 23-12
 LOS, S, FFS, v_p - Exhibits 23-2, 23-3
 f_{LW} - Exhibit 23-4
 f_{LC} - Exhibit 23-5
 f_N - Exhibit 23-6
 f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: PM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 NB
 From/To: Orangewood and Katella
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 without Project

Project Description: PM Year 2030 without Project SR-57 NB Orangewood to Katella

Oper. (LOS)

Des. (N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|---------------------------|--------|
| Volume, V | 9167 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | % Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | % RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % | Length |
| Driver type adjustment | 1.00 | Up/Down % | mi |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1 / (1 + P_T(E_T - 1) + P_R(E_R - 1))$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | l/mi |
| Number of Lanes, N | 5 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | | |
|----------|------|------|
| f_{LW} | | mi/h |
| f_{LC} | | mi/h |
| f_{ID} | | mi/h |
| f_N | | mi/h |
| FFS | 70.0 | mi/h |

LOS and Performance Measures

Operational (LOS)

| | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1988 | pc/h/ln |
| S | 65.1 | mi/h |
| $D = v_p / S$ | 30.5 | pc/mi/ln |
| LOS | D | |

Design (N)

Design (N)

| | |
|--|----------|
| Design LOS | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| S | mi/h |
| $D = v_p / S$ | pc/mi/ln |
| Required Number of Lanes, N | |

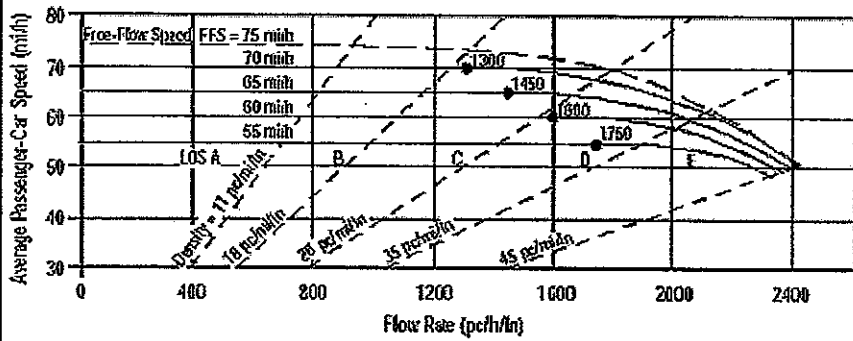
Glossary

| | |
|---------------------------------------|-----------------------------|
| N - Number of lanes | S - Speed |
| V - Hourly volume | D - Density |
| v_p - Flow rate | FFS - Free-flow speed |
| LOS - Level of service | BFFS - Base free-flow speed |
| DDHV - Directional design hour volume | |

Factor Location

| | |
|--|-------------------------|
| E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: AM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 SB
 From/To: Orangewood and Katella
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 without Project

Project Description: AM Year 2030 without Project SR-57 SB Orangewood to Katella

Oper. (LOS)

Des. (N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|---------------------------|-----------|
| Volume, V | 7958 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | % Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | % RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % | Length mi |
| Driver type adjustment | 1.00 | Up/Down % | |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1 / (1 + P_T(E_T - 1) + P_R(E_R - 1))$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | 1/mi |
| Number of Lanes, N | 5 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | |
|----------|-----------|
| f_{LW} | mi/h |
| f_{LC} | mi/h |
| f_{ID} | mi/h |
| f_N | mi/h |
| FFS | 70.0 mi/h |

LOS and Performance Measures

Operational (LOS)

| | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1726 | pc/h/ln |
| S | 68.6 | mi/h |
| $D = v_p / S$ | 25.2 | pc/mi/ln |
| LOS | C | |

Design (N)

Design (N)

Design LOS

| | |
|--|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| S | mi/h |
| $D = v_p / S$ | pc/mi/ln |

Required Number of Lanes, N

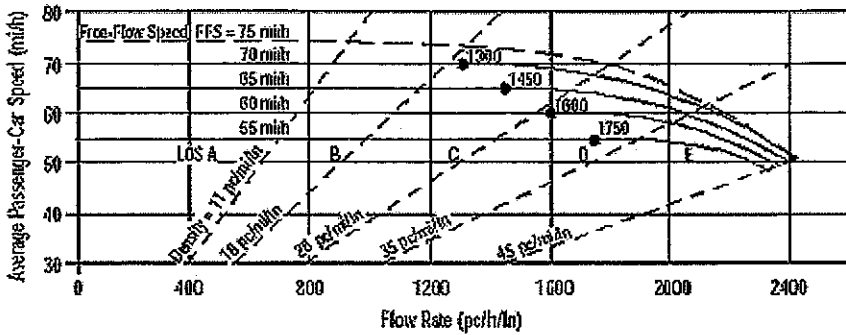
Glossary

| | |
|---------------------------------------|-----------------------------|
| N - Number of lanes | S - Speed |
| V - Hourly volume | D - Density |
| v_p - Flow rate | FFS - Free-flow speed |
| LOS - Level of service | BFFS - Base free-flow speed |
| DDHV - Directional design hour volume | |

Factor Location

| | |
|--|-------------------------|
| E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |

BASIC FREEWAY SEGMENTS WORKSHEET



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

| General Information | | Site Information | |
|---|---------------|-----------------------------|---------------------------|
| Analyst | ZS | Highway/Direction of Travel | SR-57 SB |
| Agency or Company | LLG Engineers | From/To | Orangewood and Katella |
| Date Performed | 07/14/10 | Jurisdiction | Caltrans D12 |
| Analysis Time Period | PM Peak Hour | Analysis Year | Year 2030 without Project |
| Project Description PM Year 2030 without Project SR-57 SB Orangewood to Katella | | | |

| | | |
|---|-----------------------------------|--|
| <input checked="" type="checkbox"/> Oper. (LOS) | <input type="checkbox"/> Des. (N) | <input type="checkbox"/> Planning Data |
|---|-----------------------------------|--|

| Flow Inputs | | | |
|---------------------------|------------|---------------------------|-------|
| Volume, V | 9076 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | % Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | % RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % Length | mi |
| Driver type adjustment | 1.00 | Up/Down % | |

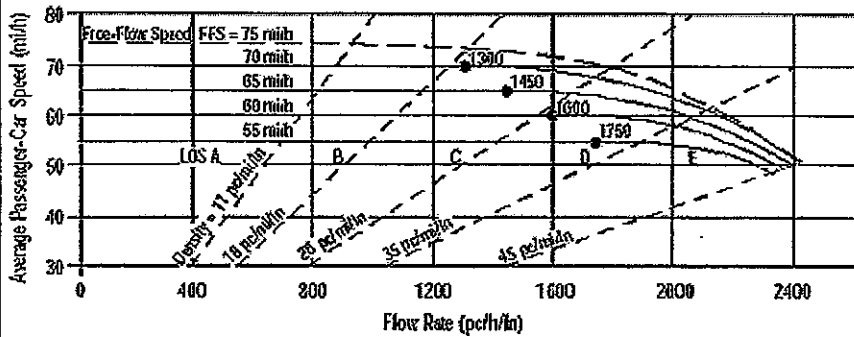
| Calculate Flow Adjustments | | | |
|----------------------------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T-1) + P_R(E_R-1)]$ | 0.971 |

| Speed Inputs | | | Calc Speed Adj and FFS | |
|----------------------------|------|------|------------------------|-----------|
| Lane Width | 12.0 | ft | f_{LW} | mi/h |
| Rt-Shoulder Lat. Clearance | 6.0 | ft | f_{LC} | mi/h |
| Interchange Density | 0.50 | 1/mi | f_{ID} | mi/h |
| Number of Lanes, N | 5 | | f_N | mi/h |
| FFS (measured) | 70.0 | mi/h | FFS | 70.0 mi/h |
| Base free-flow Speed, BFFS | | mi/h | | |

| LOS and Performance Measures | | | Design (N) | |
|--|------|----------|--|----------|
| <u>Operational (LOS)</u> | | | <u>Design (N)</u> | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1968 | pc/h/ln | Design LOS | |
| S | 65.4 | mi/h | $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| $D = v_p / S$ | 30.1 | pc/mi/ln | S | mi/h |
| LOS | D | | $D = v_p / S$ | pc/mi/ln |
| | | | Required Number of Lanes, N | |

| Glossary | | Factor Location | |
|---------------------------------------|-----------------------------|--|-------------------------|
| N - Number of lanes | S - Speed | E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| V - Hourly volume | D - Density | E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| v_p - Flow rate | FFS - Free-flow speed | f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS - Level of service | BFFS - Base free-flow speed | LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |
| DDHV - Directional design hour volume | | | |

BASIC FREEWAY SEGMENTS WORKSHEET



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

| General Information | | Site Information | |
|--|---------------|-----------------------------|---------------------------|
| Analyst | ZS | Highway/Direction of Travel | SR-57 NB |
| Agency or Company | LLG Engineers | From/To | Katella and Ball |
| Date Performed | 07/14/10 | Jurisdiction | Caltrans D12 |
| Analysis Time Period | AM Peak Hour | Analysis Year | Year 2030 without Project |
| Project Description AM Year 2030 without Project SR-57 NB Katella and Ball | | | |

| | | |
|---|-----------------------------------|--|
| <input checked="" type="checkbox"/> Oper. (LOS) | <input type="checkbox"/> Des. (N) | <input type="checkbox"/> Planning Data |
|---|-----------------------------------|--|

| Flow Inputs | | | |
|---------------------------|------------|--------------------------|-------|
| Volume, V | 5104 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | %Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | %RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % Length | mi |
| Driver type adjustment | 1.00 | Up/Down % | |

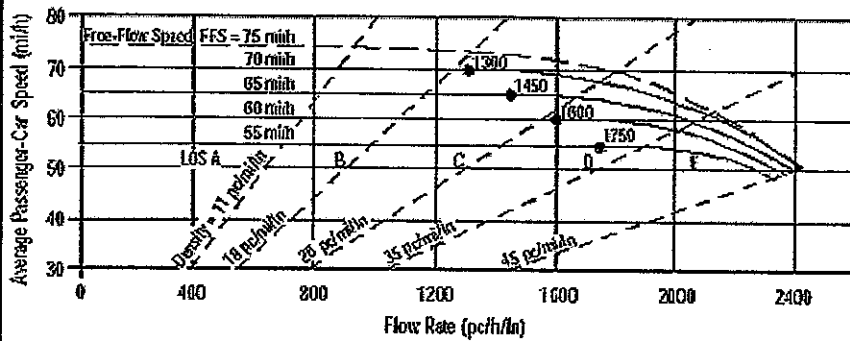
| Calculate Flow Adjustments | | | |
|----------------------------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

| Speed Inputs | | Calc Speed Adj and FFS | |
|----------------------------|-----------|------------------------|-----------|
| Lane Width | 12.0 ft | f_{LW} | mi/h |
| Rt-Shoulder Lat. Clearance | 6.0 ft | f_{LC} | mi/h |
| Interchange Density | 0.50 I/mi | f_{ID} | mi/h |
| Number of Lanes, N | 5 | f_N | mi/h |
| FFS (measured) | 70.0 mi/h | FFS | 70.0 mi/h |
| Base free-flow Speed, BFFS | mi/h | | |

| LOS and Performance Measures | | Design (N) | |
|--|---------------|--|----------|
| Operational (LOS) | | Design (N) | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1107 pc/h/ln | Design LOS | |
| S | 70.0 mi/h | $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| $D = v_p / S$ | 15.8 pc/mi/ln | S | mi/h |
| LOS | B | $D = v_p / S$ | pc/mi/ln |
| | | Required Number of Lanes, N | |

| Glossary | | Factor Location | |
|---------------------------------------|-----------------------------|--|-------------------------|
| N - Number of lanes | S - Speed | E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| V - Hourly volume | D - Density | E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| v_p - Flow rate | FFS - Free-flow speed | f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS - Level of service | BFFS - Base free-flow speed | LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |
| DDHV - Directional design hour volume | | | |

BASIC FREEWAY SEGMENTS WORKSHEET



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

| General Information | | Site Information | |
|--|---------------|-----------------------------|---------------------------|
| Analyst | ZS | Highway/Direction of Travel | SR-57 NB |
| Agency or Company | LLG Engineers | From/To | Katella and Ball |
| Date Performed | 07/14/10 | Jurisdiction | Caltrans D12 |
| Analysis Time Period | PM Peak Hour | Analysis Year | Year 2030 without Project |
| Project Description PM Year 2030 without Project SR-57 NB Katella and Ball | | | |

Oper.(LOS)
 Des.(N)
 Planning Data

| Flow Inputs | | | |
|---------------------------|------------|--------------------------|-------|
| Volume, V | 9703 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | %Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | %RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % Length | mi |
| Driver type adjustment | 1.00 | Up/Down % | |

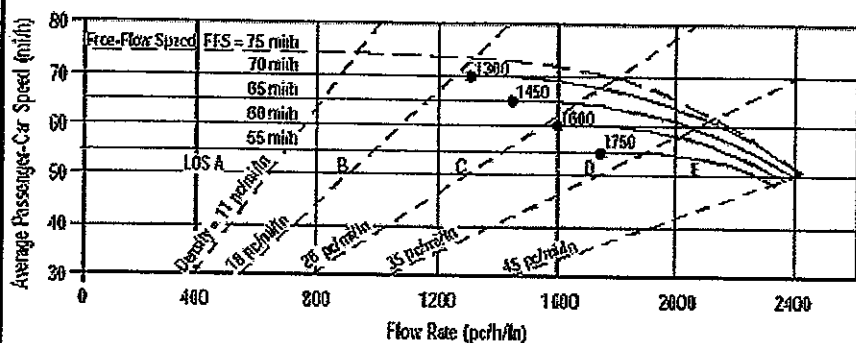
| Calculate Flow Adjustments | | | |
|----------------------------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T-1)+P_R(E_R-1)]$ | 0.971 |

| Speed Inputs | | Calc Speed Adj and FFS | |
|----------------------------|-----------|------------------------|-----------|
| Lane Width | 12.0 ft | f_{LW} | mi/h |
| Rt-Shoulder Lat. Clearance | 6.0 ft | f_{LC} | mi/h |
| Interchange Density | 0.50 l/mi | f_{ID} | mi/h |
| Number of Lanes, N | 5 | f_N | mi/h |
| FFS (measured) | 70.0 mi/h | FFS | 70.0 mi/h |
| Base free-flow Speed, BFFS | mi/h | | |

| LOS and Performance Measures | | Design (N) | |
|--|---------------|--|----------|
| Operational (LOS) | | Design (N) | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 2104 pc/h/ln | Design LOS | |
| S | 62.6 mi/h | $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| $D = v_p / S$ | 33.6 pc/mi/ln | S | mi/h |
| LOS | D | $D = v_p / S$ | pc/mi/ln |
| | | Required Number of Lanes, N | |

| Glossary | | Factor Location | |
|---------------------------------------|-----------------------------|--|-------------------------|
| N - Number of lanes | S - Speed | E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| V - Hourly volume | D - Density | E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| v_p - Flow rate | FFS - Free-flow speed | f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS - Level of service | BFFS - Base free-flow speed | LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |
| DDHV - Directional design hour volume | | | |

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: AM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 SB
 From/To: Katella and Ball
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 without Project

Project Description: AM Year 2030 without Project SR-57 SB Katella and Ball

Oper. (LOS) Des. (N) Planning Data

Flow Inputs

| | | | |
|----------------------------|------------|---------------------------|-------|
| Volume, V | 8302 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AAADT | veh/day | % Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AAADT, K | | % RVs, P_R | 0 |
| Peak-Hr Direction Prop., D | | General Terrain: | Level |
| DDHV = AAADT x K x D | veh/h | Grade % Length | mi |
| Driver type adjustment | 1.00 | Up/Down % | |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1 + P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | 1/mi |
| Number of Lanes, N | 4 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | | |
|----------|------|------|
| f_{LW} | | mi/h |
| f_{LC} | | mi/h |
| f_{ID} | | mi/h |
| f_N | | mi/h |
| FFS | 70.0 | mi/h |

LOS and Performance Measures

| Operational (LOS) | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 2250 | pc/h/ln |
| S | 58.6 | mi/h |
| $D = v_p / S$ | 38.4 | pc/mi/ln |
| LOS | E | |

Design (N)

| Design (N) | |
|--|----------|
| Design LOS | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| S | mi/h |
| $D = v_p / S$ | pc/mi/ln |
| Required Number of Lanes, N | |

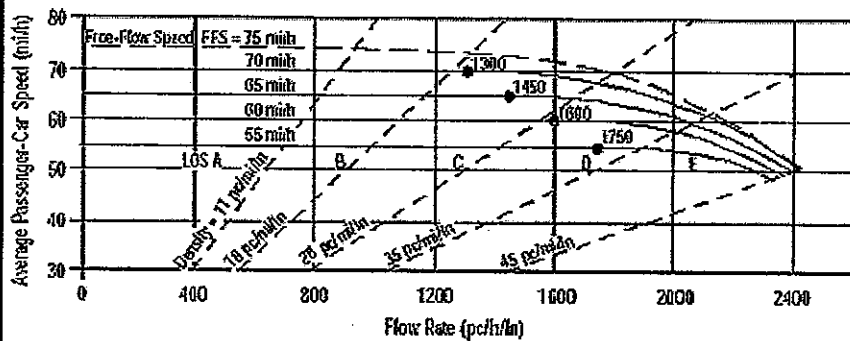
Glossary

N - Number of lanes S - Speed
 V - Hourly volume D - Density
 v_p - Flow rate FFS - Free-flow speed
 LOS - Level of service BFFS - Base free-flow speed
 DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 23-8, 23-10 f_{LW} - Exhibit 23-4
 E_T - Exhibits 23-8, 23-10, 23-11 f_{LC} - Exhibit 23-5
 f_p - Page 23-12 f_N - Exhibit 23-6
 LOS, S, FFS, v_p - Exhibits 23-2, 23-3 f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: PM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 SB
 From/To: Katella and Ball
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 without Project

Project Description: PM Year 2030 without Project SR-57 SB Katella and Ball

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|--------------------------|-------|
| Volume, V | 8339 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | %Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | %RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % Length | mi |
| Driver type adjustment | 1.00 | Up/Down % | |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | 1/mi |
| Number of Lanes, N | 4 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | | |
|----------|------|------|
| f_{LW} | | mi/h |
| f_{LC} | | mi/h |
| f_{ID} | | mi/h |
| f_N | | mi/h |
| FFS | 70.0 | mi/h |

LOS and Performance Measures

Operational (LOS)

| | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 2260 | pc/h/ln |
| S | 58.3 | mi/h |
| $D = v_p / S$ | 38.8 | pc/mi/ln |
| LOS | E | |

Design (N)

| | |
|--|----------|
| Design (N) | |
| Design LOS | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| f_p | |
| S | mi/h |
| $D = v_p / S$ | pc/mi/ln |
| Required Number of Lanes, N | |

Glossary

| | |
|---------------------------------------|-----------------------------|
| N - Number of lanes | S - Speed |
| V - Hourly volume | D - Density |
| v_p - Flow rate | FFS - Free-flow speed |
| LOS - Level of service | BFFS - Base free-flow speed |
| DDHV - Directional design hour volume | |

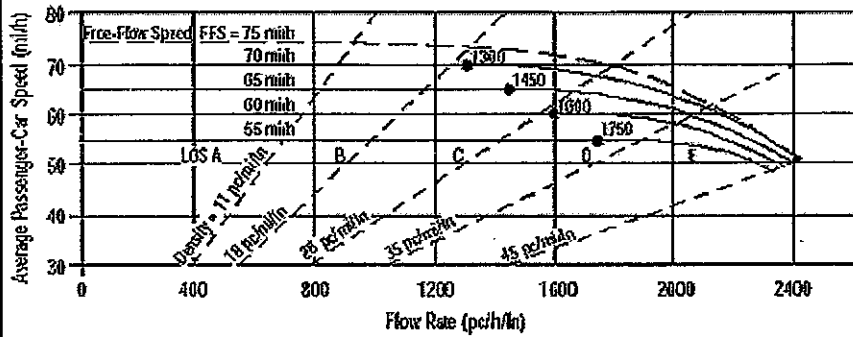
Factor Location

| | |
|--|-------------------------|
| E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |

APPENDIX R-II

**YEAR 2030 WITH PROJECT TRAFFIC CONDITIONS –
CALTRANS FREEWAY SEGMENT ANALYSIS (HCM
METHODOLOGY)**

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: AM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 NB
 From/To: Orangewood and Katella
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 With Project

Project Description: AM Year 2030 With Project SR-57 NB Orangewood to Katella

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|--------------------------|-------|
| Volume, V | 5320 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | %Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | %RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % Length | mi |
| Driver type adjustment | 1.00 | Up/Down % | |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | l/mi |
| Number of Lanes, N | 5 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | | |
|----------|------|------|
| f_{LW} | | mi/h |
| f_{LC} | | mi/h |
| f_{ID} | | mi/h |
| f_N | | mi/h |
| FFS | 70.0 | mi/h |

LOS and Performance Measures

Operational (LOS)

| | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1154 | pc/h/ln |
| S | 70.0 | mi/h |
| $D = v_p / S$ | 16.5 | pc/mi/ln |
| LOS | B | |

Design (N)

Design (N)

| | |
|--|----------|
| Design LOS | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| S | mi/h |
| $D = v_p / S$ | pc/mi/ln |
| Required Number of Lanes, N | |

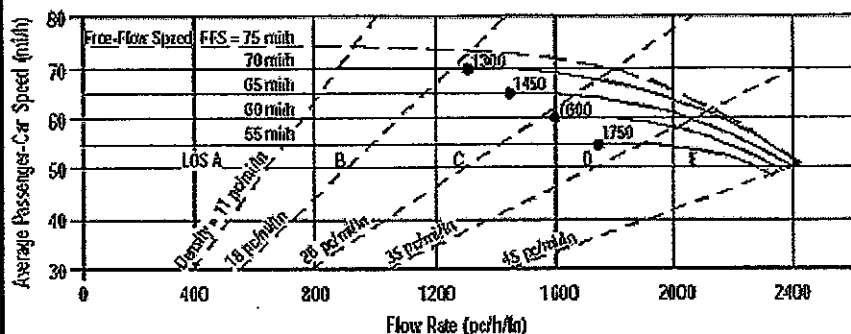
Glossary

N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume
 S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 23-8, 23-10
 E_T - Exhibits 23-8, 23-10, 23-11
 f_p - Page 23-12
 LOS, S, FFS, v_p - Exhibits 23-2, 23-3
 f_{LW} - Exhibit 23-4
 f_{LC} - Exhibit 23-5
 f_N - Exhibit 23-6
 f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: PM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 NB
 From/To: Orangewood and Katella
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 With Project

Project Description: PM Year 2030 With Project SR-57 NB Orangewood to Katella

Oper. (LOS)

Des. (N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|--------------------------|-----------|
| Volume, V | 9180 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | %Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | %RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % | Length mi |
| Driver type adjustment | 1.00 | Up/Down % | |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | 1/mi |
| Number of Lanes, N | 5 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | | |
|----------|------|------|
| f_{LW} | | mi/h |
| f_{LC} | | mi/h |
| f_{ID} | | mi/h |
| f_N | | mi/h |
| FFS | 70.0 | mi/h |

LOS and Performance Measures

Operational (LOS)

| | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1991 | pc/h/ln |
| S | 65.0 | mi/h |
| $D = v_p / S$ | 30.6 | pc/mi/ln |
| LOS | D | |

Design (N)

Design (N)

Design LOS

| | | |
|--|--|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | | pc/h |
| S | | mi/h |
| $D = v_p / S$ | | pc/mi/ln |
| Required Number of Lanes, N | | |

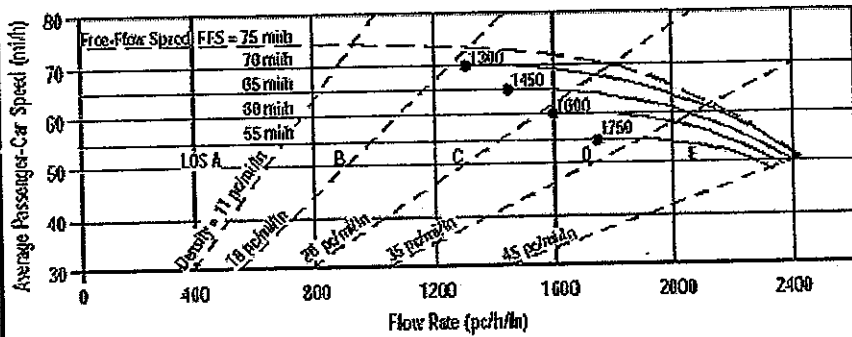
Glossary

| | |
|---------------------------------------|-----------------------------|
| N - Number of lanes | S - Speed |
| V - Hourly volume | D - Density |
| v_p - Flow rate | FFS - Free-flow speed |
| LOS - Level of service | BFFS - Base free-flow speed |
| DDHV - Directional design hour volume | |

Factor Location

| | |
|--|-------------------------|
| E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: AM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 SB
 From/To: Orangewood and Katella
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 With Project

Project Description: AM Year 2030 With Project SR-57 SB Orangewood to Katella

Oper. (LOS)

Des. (N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|---------------------------|--------|
| Volume, V | 7980 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AA DT | veh/day | % Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | % RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % | Length |
| Driver type adjustment | 1.00 | Up/Down % | |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1 / [1 + P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | 1/mi |
| Number of Lanes, N | 5 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | | |
|----------|------|------|
| f_{LW} | | mi/h |
| f_{LC} | | mi/h |
| f_{ID} | | mi/h |
| f_N | | mi/h |
| FFS | 70.0 | mi/h |

LOS and Performance Measures

Operational (LOS)

| | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1730 | pc/h/ln |
| S | 68.6 | mi/h |
| $D = v_p / S$ | 25.2 | pc/mi/ln |
| LOS | C | |

Design (N)

Design (N)

Design LOS

| | | |
|--|--|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | | pc/h |
| S | | mi/h |
| $D = v_p / S$ | | pc/mi/ln |

Required Number of Lanes, N

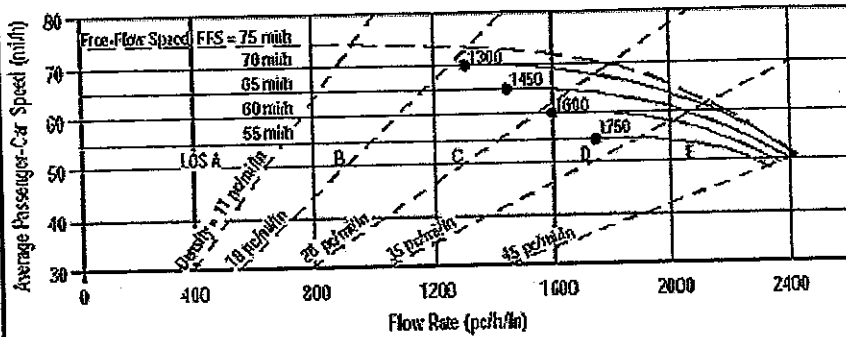
Glossary

| | |
|---------------------------------------|-----------------------------|
| N - Number of lanes | S - Speed |
| V - Hourly volume | D - Density |
| v_p - Flow rate | FFS - Free-flow speed |
| LOS - Level of service | BFFS - Base free-flow speed |
| DDHV - Directional design hour volume | |

Factor Location

| | |
|--|-------------------------|
| E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |

BASIC FREEWAY SEGMENTS WORKSHEET



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

| General Information | | Site Information | |
|--|---------------|-----------------------------|------------------------|
| Analyst | ZS | Highway/Direction of Travel | SR-57 SB |
| Agency or Company | LLG Engineers | From/To | Orangewood and Katella |
| Date Performed | 07/14/10 | Jurisdiction | Caltrans D12 |
| Analysis Time Period | PM Peak Hour | Analysis Year | Year 2030 With Project |
| Project Description PM Year 2030 With Project SR-57 SB Orangewood to Katella | | | |

| | | |
|---|-----------------------------------|--|
| <input checked="" type="checkbox"/> Oper. (LOS) | <input type="checkbox"/> Des. (N) | <input type="checkbox"/> Planning Data |
|---|-----------------------------------|--|

| Flow Inputs | | | |
|---------------------------|------------|---------------------------|-------|
| Volume, V | 9160 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | % Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | % RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % Length | mi |
| Driver type adjustment | 1.00 | Up/Down % | |

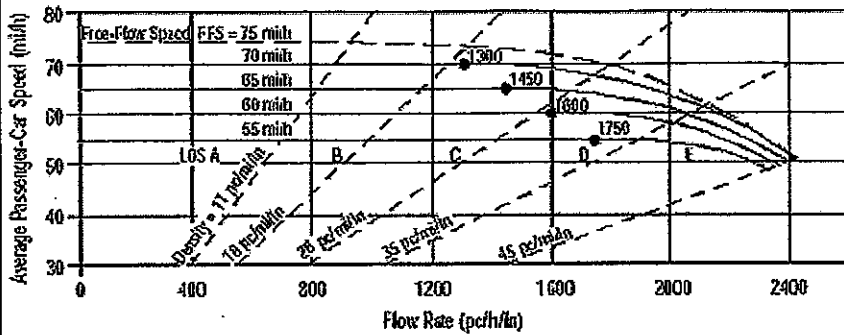
| Calculate Flow Adjustments | | | |
|----------------------------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T-1)+P_R(E_R-1)]$ | 0.971 |

| Speed Inputs | | Calc Speed Adj and FFS | |
|----------------------------|-----------|------------------------|-----------|
| Lane Width | 12.0 ft | f_{LW} | mi/h |
| Rt-Shoulder Lat. Clearance | 6.0 ft | f_{LC} | mi/h |
| Interchange Density | 0.50 1/mi | f_{ID} | mi/h |
| Number of Lanes, N | 5 | f_N | mi/h |
| FFS (measured) | 70.0 mi/h | FFS | 70.0 mi/h |
| Base free-flow Speed, BFFS | mi/h | | |

| LOS and Performance Measures | | Design (N) | |
|--|---------------|--|----------|
| Operational (LOS) | | Design (N) | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1986 pc/h/ln | Design LOS | |
| S | 65.1 mi/h | $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| $D = v_p / S$ | 30.5 pc/mi/ln | S | mi/h |
| LOS | D | $D = v_p / S$ | pc/mi/ln |
| | | Required Number of Lanes, N | |

| Glossary | | Factor Location | |
|---------------------------------------|-----------------------------|--|-------------------------|
| N - Number of lanes | S - Speed | E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| V - Hourly volume | D - Density | E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| v_p - Flow rate | FFS - Free-flow speed | f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS - Level of service | BFFS - Base free-flow speed | LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |
| DDHV - Directional design hour volume | | | |

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: AM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 NB
 From/To: Katella and Ball
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 With Project

Project Description: AM Year 2030 With Project SR-57 NB Katella and Ball

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|--------------------------|-----------|
| Volume, V | 5140 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | %Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | %RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % | Length |
| Driver type adjustment | 1.00 | | Up/Down % |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

Speed Inputs

| | | | | |
|----------------------------|------|------|----------|------|
| Lane Width | 12.0 | ft | f_{LW} | mi/h |
| Rt-Shoulder Lat. Clearance | 6.0 | ft | f_{LC} | mi/h |
| Interchange Density | 0.50 | 1/mi | f_{ID} | mi/h |
| Number of Lanes, N | 5 | | f_N | mi/h |
| FFS (measured) | 70.0 | mi/h | FFS | 70.0 |
| Base free-flow Speed, BFFS | | mi/h | | |

Calc Speed Adj and FFS

LOS and Performance Measures

| | | | |
|--|------|-------------------|--|
| Operational (LOS) | | Design (N) | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1115 | pc/h/ln | Design LOS |
| S | 70.0 | mi/h | $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ |
| $D = v_p / S$ | 15.9 | pc/mi/ln | S |
| LOS | B | | $D = v_p / S$ |
| | | | Required Number of Lanes, N |

Glossary

N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume

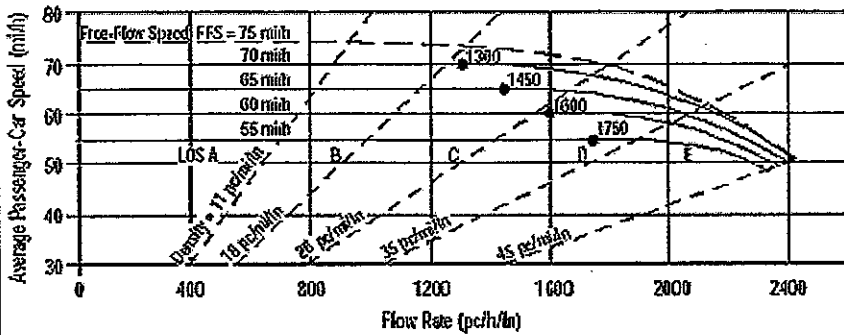
S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 23-8, 23-10
 E_T - Exhibits 23-8, 23-10, 23-11
 f_p - Page 23-12
 LOS, S, FFS, v_p - Exhibits 23-2, 23-3

f_{LW} - Exhibit 23-4
 f_{LC} - Exhibit 23-5
 f_N - Exhibit 23-6
 f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: PM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 NB
 From/To: Katella and Ball
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 With Project

Project Description: PM Year 2030 With Project SR-57 NB Katella and Ball

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|--------------------------|--------|
| Volume, V | 9840 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | %Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | %RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % | Length |
| Driver type adjustment | 1.00 | Up/Down % | mi |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | l/mi |
| Number of Lanes, N | 5 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | | |
|----------|------|------|
| f_{LW} | | mi/h |
| f_{LC} | | mi/h |
| f_{ID} | | mi/h |
| f_N | | mi/h |
| FFS | 70.0 | mi/h |

LOS and Performance Measures

Operational (LOS)

| | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 2134 | pc/h/ln |
| S | 61.9 | mi/h |
| $D = v_p / S$ | 34.5 | pc/mi/ln |
| LOS | D | |

Design (N)

| | |
|--|----------|
| Design (N) | |
| Design LOS | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| f_p | |
| S | mi/h |
| $D = v_p / S$ | pc/mi/ln |
| Required Number of Lanes, N | |

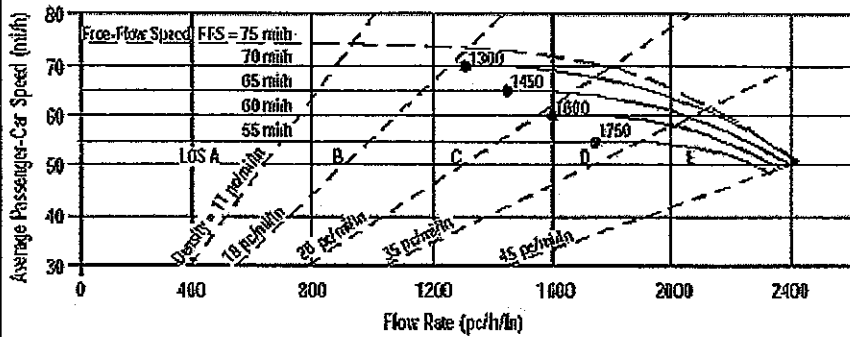
Glossary

| | |
|---------------------------------------|-----------------------------|
| N - Number of lanes | S - Speed |
| V - Hourly volume | D - Density |
| v_p - Flow rate | FFS - Free-flow speed |
| LOS - Level of service | BFFS - Base free-flow speed |
| DDHV - Directional design hour volume | |

Factor Location

| | |
|--|-------------------------|
| E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |

BASIC FREEWAY SEGMENTS WORKSHEET



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

| General Information | | Site Information | |
|----------------------|---------------|-----------------------------|------------------------|
| Analyst | ZS | Highway/Direction of Travel | SR-57 SB |
| Agency or Company | LLG Engineers | From/To | Katella and Ball |
| Date Performed | 07/14/10 | Jurisdiction | Caltrans D12 |
| Analysis Time Period | AM Peak Hour | Analysis Year | Year 2030 With Project |

Project Description AM Year 2030 With Project SR-57 SB Katella and Ball

Oper.(LOS)
 Des.(N)
 Planning Data

| Flow Inputs | | | |
|---------------------------|------------|--------------------------|-----------|
| Volume, V | 8490 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | %Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | %RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % | Length mi |
| Driver type adjustment | 1.00 | Up/Down % | |

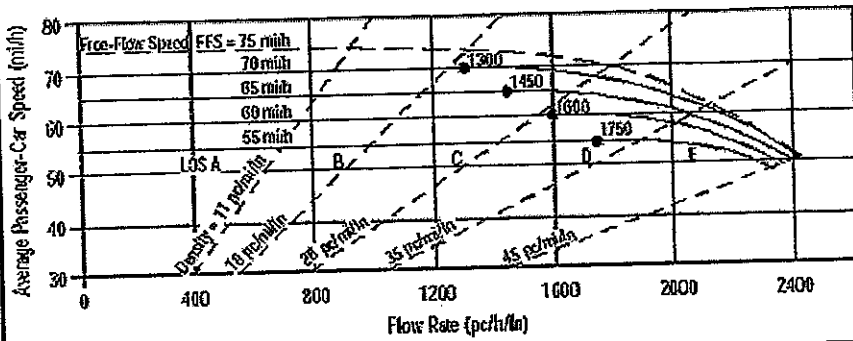
| Calculate Flow Adjustments | | | |
|----------------------------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

| Speed Inputs | | Calc Speed Adj and FFS | |
|----------------------------|-----------|------------------------|-----------|
| Lane Width | 12.0 ft | f_{LW} | mi/h |
| Rt-Shoulder Lat. Clearance | 6.0 ft | f_{LC} | mi/h |
| Interchange Density | 0.50 I/mi | f_{ID} | mi/h |
| Number of Lanes, N | 4 | f_N | mi/h |
| FFS (measured) | 70.0 mi/h | FFS | 70.0 mi/h |
| Base free-flow Speed, BFFS | mi/h | | |

| LOS and Performance Measures | | Design (N) | |
|--|---------------|--|----------|
| <u>Operational (LOS)</u> | | <u>Design (N)</u> | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 2301 pc/h/ln | Design LOS | |
| S | 57.0 mi/h | $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| $D = v_p / S$ | 40.4 pc/mi/ln | S | mi/h |
| LOS | E | $D = v_p / S$ | pc/mi/ln |
| | | Required Number of Lanes, N | |

| Glossary | | Factor Location | |
|---------------------------------------|-----------------------------|--|-------------------------|
| N - Number of lanes | S - Speed | E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| V - Hourly volume | D - Density | E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| v_p - Flow rate | FFS - Free-flow speed | f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS - Level of service | BFFS - Base free-flow speed | LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |
| DDHV - Directional design hour volume | | | |

BASIC FREEWAY SEGMENTS WORKSHEET



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

| General Information | | Site Information | |
|----------------------|---------------|-----------------------------|------------------------|
| Analyst | ZS | Highway/Direction of Travel | SR-57 SB |
| Agency or Company | LLG Engineers | From/To | Katella and Ball |
| Date Performed | 07/14/10 | Jurisdiction | Caltrans D12 |
| Analysis Time Period | PM Peak Hour | Analysis Year | Year 2030 With Project |

Project Description **PM Year 2030 With Project SR-57 SB Katella and Ball**

Oper.(LOS) Des.(N) Planning Data

| Flow Inputs | | | |
|---------------------------|------------|--------------------------|-------|
| Volume, V | 8360 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | %Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | %RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % Length | mi |
| Driver type adjustment | 1.00 | Up/Down % | |

| Calculate Flow Adjustments | | | |
|----------------------------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

| Speed Inputs | | Calc Speed Adj and FFS | |
|----------------------------|-----------|------------------------|-----------|
| Lane Width | 12.0 ft | f_{LW} | mi/h |
| Rt-Shoulder Lat. Clearance | 6.0 ft | f_{LC} | mi/h |
| Interchange Density | 0.50 I/mi | f_{ID} | mi/h |
| Number of Lanes, N | 4 | f_N | mi/h |
| FFS (measured) | 70.0 mi/h | FFS | 70.0 mi/h |
| Base free-flow Speed, BFFS | mi/h | | |

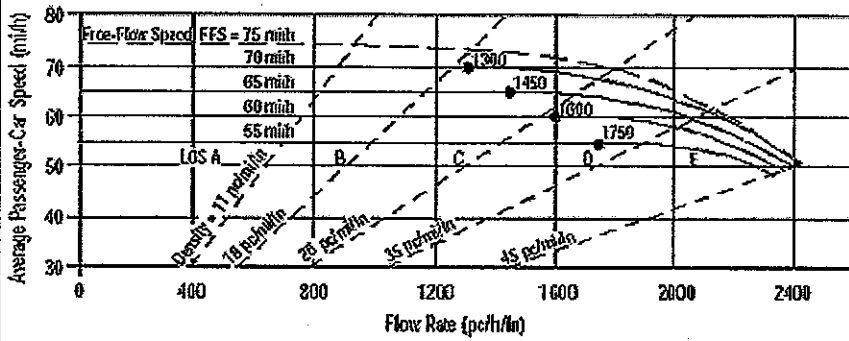
| LOS and Performance Measures | | Design (N) | |
|--|---------------|--|----------|
| Operational (LOS) | | Design (N) | |
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 2266 pc/h/ln | Design LOS | |
| S | 58.1 mi/h | $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | pc/h |
| $D = v_p / S$ | 39.0 pc/mi/ln | S | mi/h |
| LOS | E | $D = v_p / S$ | pc/mi/ln |
| | | Required Number of Lanes, N | |

| Glossary | | Factor Location | |
|---------------------------------------|-----------------------------|--|-------------------------|
| N - Number of lanes | S - Speed | E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| V - Hourly volume | D - Density | E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| v_p - Flow rate | FFS - Free-flow speed | f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS - Level of service | BFFS - Base free-flow speed | LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |
| DDHV - Directional design hour volume | | | |

APPENDIX R-III

**YEAR 2030 WITH PROJECT WITH MITIGATION
TRAFFIC CONDITIONS – CALTRANS FREEWAY
SEGMENT ANALYSIS (HCM METHODOLOGY)**

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: AM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 SB
 From/To: Katella and Ball
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 With Project With Mi

Project Description: AM Year 2030 With Project SR-57 SB Katella and Ball

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|--------------------------|-----------|
| Volume, V | 8490 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AAADT | veh/day | %Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AAADT, K | | %RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AAADT x K x D | veh/h | Grade % | Length mi |
| Driver type adjustment | 1.00 | Up/Down % | |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1/[1+P_T(E_T-1) + P_R(E_R-1)]$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | l/mi |
| Number of Lanes, N | 5 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | | |
|----------|------|------|
| f_{LW} | | mi/h |
| f_{LC} | | mi/h |
| f_{ID} | | mi/h |
| f_N | | mi/h |
| FFS | 70.0 | mi/h |

LOS and Performance Measures

Operational (LOS)

| | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1841 | pc/h/ln |
| S | 67.4 | mi/h |
| $D = v_p / S$ | 27.3 | pc/mi/ln |
| LOS | D | |

Design (N)

Design (N)

Design LOS

| | | |
|--|--|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | | pc/h |
| S | | mi/h |
| $D = v_p / S$ | | pc/mi/ln |
| Required Number of Lanes, N | | |

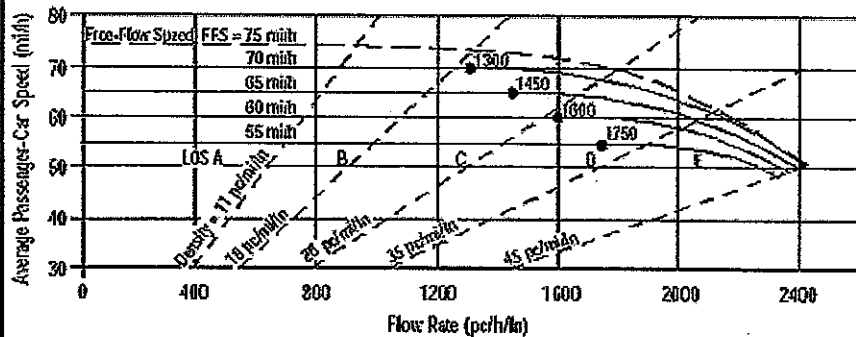
Glossary

| | |
|---------------------------------------|-----------------------------|
| N - Number of lanes | S - Speed |
| V - Hourly volume | D - Density |
| v_p - Flow rate | FFS - Free-flow speed |
| LOS - Level of service | BFFS - Base free-flow speed |
| DDHV - Directional design hour volume | |

Factor Location

| | |
|--|-------------------------|
| E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |

BASIC FREEWAY SEGMENTS WORKSHEET



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

General Information

Analyst: ZS
 Agency or Company: LLG Engineers
 Date Performed: 07/14/10
 Analysis Time Period: PM Peak Hour

Site Information

Highway/Direction of Travel: SR-57 SB
 From/To: Katella and Ball
 Jurisdiction: Caltrans D12
 Analysis Year: Year 2030 With Project With Mi

Project Description: PM Year 2030 With Project SR-57 SB Katella and Ball

Oper. (LOS)

Des. (N)

Planning Data

Flow Inputs

| | | | |
|---------------------------|------------|---------------------------|-------|
| Volume, V | 8360 veh/h | Peak-Hour Factor, PHF | 0.95 |
| AADT | veh/day | % Trucks and Buses, P_T | 6 |
| Peak-Hr Prop. of AADT, K | | % RVs, P_R | 0 |
| Peak-Hr Direction Prop, D | | General Terrain: | Level |
| DDHV = AADT x K x D | veh/h | Grade % Length | mi |
| Driver type adjustment | 1.00 | Up/Down % | |

Calculate Flow Adjustments

| | | | |
|-------|------|--|-------|
| f_p | 1.00 | E_R | 1.2 |
| E_T | 1.5 | $f_{HV} = 1 / [1 + P_T(E_T - 1) + P_R(E_R - 1)]$ | 0.971 |

Speed Inputs

| | | |
|----------------------------|------|------|
| Lane Width | 12.0 | ft |
| Rt-Shoulder Lat. Clearance | 6.0 | ft |
| Interchange Density | 0.50 | 1/mi |
| Number of Lanes, N | 5 | |
| FFS (measured) | 70.0 | mi/h |
| Base free-flow Speed, BFFS | | mi/h |

Calc Speed Adj and FFS

| | | |
|----------|------|------|
| f_{LW} | | mi/h |
| f_{LC} | | mi/h |
| f_{ID} | | mi/h |
| f_N | | mi/h |
| FFS | 70.0 | mi/h |

LOS and Performance Measures

Operational (LOS)

| | | |
|--|------|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | 1813 | pc/h/ln |
| S | 67.7 | mi/h |
| $D = v_p / S$ | 26.8 | pc/mi/ln |
| LOS | D | |

Design (N)

Design (N)

Design LOS

| | | |
|--|--|----------|
| $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ | | pc/h |
| S | | mi/h |
| $D = v_p / S$ | | pc/mi/ln |

Required Number of Lanes, N

Glossary

| | |
|---------------------------------------|-----------------------------|
| N - Number of lanes | S - Speed |
| V - Hourly volume | D - Density |
| v_p - Flow rate | FFS - Free-flow speed |
| LOS - Level of service | BFFS - Base free-flow speed |
| DDHV - Directional design hour volume | |

Factor Location

| | |
|--|-------------------------|
| E_R - Exhibits 23-8, 23-10 | f_{LW} - Exhibit 23-4 |
| E_T - Exhibits 23-8, 23-10, 23-11 | f_{LC} - Exhibit 23-5 |
| f_p - Page 23-12 | f_N - Exhibit 23-6 |
| LOS, S, FFS, v_p - Exhibits 23-2, 23-3 | f_{ID} - Exhibit 23-7 |