Incorporation of Travel Time Reliability into the Highway Capacity Manual (L08)

SHRP 2 Tuesdays Webinar Series
November 5, 2013
Incorporation of Travel Time Reliability into the Highway Capacity Manual (PROJECT L08)

WILLIAM HYMAN
SENIOR PROGRAM OFFICER
SHRP 2 RELIABILITY FOCUS AREA
WHAT IS SHRP2?

- $232 million, federally funded research program to address critical transportation challenges
  - Making highways safer
  - Fixing deteriorating infrastructure
  - Reducing congestion
- Managed by TRB of the National Academies
- Collaborative effort of TRB, AASHTO, and FHWA
- Originally operates from 2006 to 2013 – extended to 2015
- Aims to advance innovative ways to plan, renew, operate, and improve safety on the Nation's highways
FOUR RESEARCH FOCUS AREAS

Safety: to prevent or reduce the severity of highway crashes by understanding driving behavior.

Renewal: to renew aging infrastructure through rapid design and construction methods that minimize disruption and produce long-lived facilities.

Capacity: to integrate mobility, economic, environmental, and community needs into the planning and design of new highway capacity.

Reliability .....
FOCUS AREAS

Reliability
- Reliable Travel Time
- All affect Reliability

Renewal
- Rapid Renewal and Lasting Facilities

Capacity
- Better Transport Decisions

Safety
- Safe Highways
Relation of Capacity and Reliability Research

Capacity Research
Tackles *recurring* congestion

Reliability Research
Tackles *nonrecurring* congestion
“To provide reliable travel times by preventing and reducing non-recurring congestion”

• *i.e.*, reduce the variability of travel time through reducing the underlying causes
The Reliability Focus Area research has attributed variability in travel time to seven primary causes:

1. Incidents
2. Weather
3. Work zones
4. Fluctuations in demand
5. Special events
6. Traffic control devices
7. Inadequate base capacity
Reliability, a new focus

Past focus only on Average Travel Time

Now focus is also on Variability/Reliability
RELIABILITY RESEARCH PROMOTES ADVANCES IN THESE THEME AREAS

- Organizational strategies and processes
- New data collection and analysis tools
- Understanding and influencing driver behavior
- Improving planning, programming and design
- Adopting new ideas and innovations
Incorporation of Travel Time Reliability in the Highway Capacity Manual (L08)

- Increases the realism of highway capacity analysis by accounting for uncertain and unexpected sources of congestion such as incidents, work zones and weather

- Extends FREEVAL and STREETVAL through the use of a scenario generator

- Software has been developed along with user guides

- Important for planning, facility design, and determining warrants for improvements in many agencies
PILOT TESTING 5 CORE ANALYTICAL PRODUCTS (PROJECT L38)

Data Collection
- Establishing a Travel Time Reliability Monitoring System (L02)

Analysis
- Effects of Designs (L07)
- Highway Capacity methods (L08)
- Benefit-Cost Analysis (C11)

Decision
- Reliability in Planning and Programming (L05)
SHRP2 Tuesdays

Upcoming webinars

- **November 19**: SHRP 2 Economic Impact Tools (C03 and C11)
- **December 3**: Composite Pavement Systems (R21)
- **December 17**: Integrating Freight Considerations into Collaborative Decision Making for Additions to Highway Capacity (C15)

Learn about future webinars at [www.TRB.org/SHRP2/webinars](http://www.TRB.org/SHRP2/webinars)
Incorporating Travel Time Reliability Into the Highway Capacity Manual (Project L08)

FHWA Perspective

Jim Hunt
Federal Highway Administration
Office of Operations

TRB’s SHRP 2 Tuesdays Webinar – November 5, 2013
Outline

- FHWA Operations initiatives and importance of travel time reliability
- Role of SHRP 2-L08 in advancing National priorities
- FHWA opportunities and activities to continue so support this product
Why Does FHWA Focus on Improving Operations?

- To reduce / manage impacts of congestion
- To keep people and commerce moving – a healthy economy needs a **reliable** transportation system
- To improve the safety and sustainability of the highway system
- To make more cost effective investment of limited resources
- To promote a more proactive approach
Improving Travel Time Reliability

A mix of recurring and non-recurring congestion impacts

non-recurring congestion impacts
The Role of Operations

Transportation System Management and Operations
Proactively Operating the Transportation System Requires:

- Real-time and forecasted information
- Measuring / monitoring performance
- **Good analytical foundation / tools**
- State of the art technologies and strategies
- Integration across system elements, jurisdictions, and modes
- An organization and workforce capable of managing all of the above
Operations activities...

- Influence travel demand (how much, when, where)
- Effectively manage traffic resulting from travel demand
- Anticipate and respond to planned and unplanned events (traffic incidents, work zones, bad weather, special events)
- Provide travelers with high quality traffic and weather information
The L-08 Project

• Methodologies will improve investment / project decision making process
• Leverage the respect and broad acceptance of Highway Capacity Manual
• Need to look beyond single analysis period
  – Demand variability throughout the (portion of the) day
  – Demand variability throughout the (portion of the) year
  – Capacity stealing events
The L-08 Project

• Supports FHWA Operations Efforts
  – MAP-21 Performance Measures
  – Planning for Operations
  – ATDM Program
    • ATDM Analysis Methods (draft 35, software)
    • Accelerating Ramp Metering, dynamic shoulder use, variable speed limits, dynamic pricing
  – Traffic incident management, work zone operations, freight, road weather management, managed lanes, etc
On-going Efforts To Support L-08

- ATDM Capacity and Operations Analysis Guide
- Supporting Update to HCM, NCHRP 3-115
- Incorporate L-08 concepts into workshops, training
- Reviewing results of L-38 pilots
On-going Efforts To Support L-08

• SHRP 2 Implementation assistance
  – L02/07/08, C11 – Reliability Data and Analysis Tools Bundle
  – 3 Levels of assistance
  – June 2014
  – www.fhwa.dot.gov/goSHRP2

Thank you!
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SHRP 2 Project L08: Incorporation of Travel Time Reliability into the *Highway Capacity Manual*

November 5, 2013
Presentation Overview

- Project objectives and deliverables
- Reliability Concepts and Performance Measures
- Urban Streets and Freeway Facility methods
- Reliability application
- Discussion/questions
SHRP-2 L08 Project Overview

• “Incorporating Reliability Analysis in the Highway Capacity Manual”

• Scope covers Freeway Urban Street Facilities

• Research Team
  – Kittelson and Associates, Inc.
  – ITRE @ N.C. State University
  – Cambridge Systematics
  – Lily Elefteriadou (UF)

• Project concluded September 2013
The objectives of Project L08 were to:

1. Determine how non-recurrent congestion impacts can be incorporated into HCM procedures
2. Develop methodologies to predict travel time reliability on freeway and urban street facilities
3. Prepare draft material (Reliability Guide) for possible future incorporation into the HCM
SHRP2 L08 Products

- Computational procedures (and computational engines) for assessing travel time reliability
  - Freeway facilities
  - Urban streets

- Reliability Guidebook

- Draft chapters for possible inclusion in the HCM

- User guides for the computational engines
Adding the 4th Analysis Dimension

- Traditional Freeway Analysis looks at MOEs over time and space

<table>
<thead>
<tr>
<th>Analysis Segments (Space)</th>
<th>Analysis Periods (Time)</th>
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<td>50.9</td>
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Adding the 4th Analysis Dimension

- Reliability adds dimension of multiple days to capture variability in demand and capacity
Reliability terminology

- **Analysis period**
  - The time interval evaluated by a single application of the HCM

- **Study period**
  - The time interval evaluated within a day (1 or more analysis periods)

- **Reliability reporting period**
  - The time period represented by a reliability evaluation (e.g. 1 year)

- **Scenario**
  - A scenario is a unique combination of traffic demand, road geometry, capacity and traffic control conditions, as may be influenced by incident and weather events
  - It can represent one or more analysis periods provided that they all have the same conditions
Reliability Measures: Based on the Travel Time Distribution

![Travel Time Distribution Graph](image)

- **Free Flow**
- **Mean**
- **95th Percentile**
- **99th Percentile**

**Travel Time (in Minutes)**

**Number of Trips (in Thousands)**

- **Misery Time**
- **Buffer Time**
- **Planning Time**
- **Standard Deviation**
- **Failure Measure**
Core and Supplemental Measures

Core Measures
- Planning Time Index (95\textsuperscript{th} %ile TTI)
- 80\textsuperscript{th} TTI
- Semi-Standard Deviation
- Reliability Rating

Supplemental Measures
- Standard Deviation
- Misery Index (average of top 5\%; (~97-98\textsuperscript{th} TTI)
• **Reliability Rating**: Percent VMT serviced at a Travel Time Index (TTI) less than a set threshold
  - TTI = 1.33 (freeways)
  - TTI = 2.5 (urban streets)

• TTI is measured relative to Free Flow Speed (FFS)
# HCM Reliability Performance Measure in Practice

<table>
<thead>
<tr>
<th>FREEWAYS</th>
<th>Speed at TTI = 1.33 (mph)</th>
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</thead>
<tbody>
<tr>
<td><strong>Free Flow Speed (mph)</strong></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>52.6</td>
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<tr>
<td>65</td>
<td>48.9</td>
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<tr>
<td>60</td>
<td>45.1</td>
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<tr>
<td>55</td>
<td>41.4</td>
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<tr>
<td>50</td>
<td>37.5</td>
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<table>
<thead>
<tr>
<th>URBAN STREETS</th>
<th>Speed at TTI = 2.5 (mph)</th>
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</thead>
<tbody>
<tr>
<td><strong>Free Flow Speed (mph)</strong></td>
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<tr>
<td>45</td>
<td>18.0</td>
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<tr>
<td>40</td>
<td>16.0</td>
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<tr>
<td>35</td>
<td>14.0</td>
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<tr>
<td>30</td>
<td>12.0</td>
</tr>
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</table>
Urban Street Facility Method
Urban Streets Overview

• Framework for Reliability Evaluation
  – HCM urban street methodology
  – Reliability methodology

• Reliability Methodology
  – Generates scenarios
  – Uses HCM methodology to evaluate scenarios
  – Computes travel time distribution
Work Flow

- Start with the input data used to evaluate an urban street facility using the 2010 HCM methodologies
  - Enter the data in the HCM Urban Streets engine and save it to a file
  - If desired, enter and save data for each work zone or special event

Manual
Urban Streets Reliability Methodology

• Work Flow (continued)
  – Read the file and use it as basis for scenario generation
    • Work day-by-day, analysis-period-by-analysis-period in chronologic order through the year...
      – Predict weather events
      – Predict incident events
      – Adjust speed and saturation flow rate based on events
      – Adjust volumes using hourly, weekly, monthly factors
      – Save one revised file for each analysis period
  – Submit each scenario file to the HCM engine
  – Summarize results
    • Collect performance measures for each scenario
    • Compute reliability statistics for distribution
Urban Street Reliability Framework

Base Dataset
- Segment geometry
- Traffic control
- Base demands
- Demand factors
- Weather & incident history
- Reliability reporting period

Alternative Dataset
- Changes to base dataset inputs due to work zones and special events
- Schedule for work zones and special events

Scenario Generator
- Demand variation
- Weather
- Incidents

Input Dataset Adjustments
- Adjusted demand
- Adjusted capacity
- Adjusted running speed
- Adjusted saturation flow rate
- Residual queue → Initial queue

Core HCM Facility Method
- Chapter 16 (Urban Streets)

Performance Measures
- Planning Time Index
- 80th Percentile Travel Time Index
- Reliability Rating
- On-time Performance
- Semi-standard Deviation etc.

Travel Time Distribution

Residual queue by analysis period
Urban Streets Reliability Methodology

• Input Data
  – Nearest city
  – Functional class
  – Analysis period duration (0.25 hr or 1.0 hr)
  – Study period duration (e.g., 7:00 am, extend for 3 hours)
  – Reliability reporting period (e.g., 1/1/2011, for 365 days)
  – Days of week considered (Su, M, Tu, W, Th, F, or Sa)
  – Crash frequency by...
    • Segment
    • Intersection
  – If work zone or special event present, provide...
    • Operating period (e.g., 4/1/2011, extend for 30 days)
    • Crash frequency adjustment factors
• Weather Event Procedure
  – Analyst selects “nearest city” from list of 284 cities
    • Default weather data available for 284 cities
  – Weather data used to predict condition for each day...
    • Clear, dry pavement
    • Rainfall, wet pavement (including intensity)
    • Clear, wet pavement
    • Snowfall, snow on pavement (including intensity)
    • Clear, snow on pavement
  – Monte Carlo methods used to predict hourly events
Traffic Demand Variation Procedure

- Analyst selects functional class
  - Default volume variation factors from 19 states
- Factors used to predict volume for each hour...
  - Turn movement volume for each intersection
    - Use hourly, weekly, monthly factors once to convert volume in input file to AADT
    - Use factors a second time to compute volume for specific hour based on AADT
- Monte Carlo methods used to add random volume variation to analysis periods in common hour
Urban Streets Scenario Generation

• Traffic Incident Procedure
  – Analyst inputs crash frequency for segments and intersections
    • Based on historic crash data, or HSM predictive method
    • Default incident data from existing databases
  – Data used to predict for each incident...
    • Incident type and duration
    • Incident types considered
      – Segment, intersection
      – Crash, non-crash
      – Shoulder, one-lane closed, two or more lanes closed
      – Fatal-or-injury, pdo, breakdown, other
  – Monte Carlo methods used to predict incident occurrence on hourly basis
Urban Streets Reliability Engine

• Reliability Engine
  – Software implementation of reliability methodology
  – Excel workbook

• Navigation
  – 11 worksheets
  – Key worksheets have red tabs
    • Main Menu
      – Foreword, instructions, disclaimer
    • Set Up
      – Input data, seed number, monitor scenario generation process
    • Facility Evaluation
      – Use HCM Urban Streets engine to evaluate each scenario
    • Performance Summary
      – Select performance measures and summarize
Urban Streets Reliability Engine

• **Scope**
  – Auto mode
  – Coordinated signal system
  – Sources of unreliable travel time addressed
    • Traffic incidents
    • Work zones
    • Demand fluctuations
    • Special events
    • Traffic control devices
    • Weather
    • Inadequate base capacity

• **Limitations**
  – Truck double parking, Signal malfunction,
  – Railroad crossing, Railroad preemption,
  – Signal plan transition, Fog, dust storms, or high winds
Urban Streets Reliability Engine

- **Set Up Worksheet**
  - Input data in blue cells
  - Click grey button to start scenario generation process
Urban Streets Performance Summary

• Engine Output
  – Average performance measure values for each scenario
  – Values define the distribution for reliability reporting period

• Distribution Statistics
  – Average
  – Standard deviation
  – Median
  – 5\textsuperscript{th}, 10\textsuperscript{th}, 80\textsuperscript{th}, 85\textsuperscript{th}, 95\textsuperscript{th} %
Urban Streets Performance Summary

- Performance Measures
  - By Direction
    - EB/NB
    - WB/SB
  - By System Component
    - Facility
    - Segment

- By Performance Measure
  - Travel time
  - Travel speed
  - Stop rate
  - Running time
  - Through delay
  - Total delay

Example
**Urban Streets Performance Summary**

**Summary Statistics**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
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<tbody>
<tr>
<td>Scenario evaluation interval:</td>
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<tr>
<td>Average</td>
<td>120.38</td>
</tr>
<tr>
<td>5th percentile</td>
<td>91.29</td>
</tr>
<tr>
<td>Base free-flow speed, mi/h</td>
<td>40.78</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>38.34</td>
</tr>
<tr>
<td>10th percentile</td>
<td>92.45</td>
</tr>
<tr>
<td>Base free-flow travel time, s</td>
<td>60.20</td>
</tr>
<tr>
<td>Skewness</td>
<td>7.72</td>
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<tr>
<td>80th percentile</td>
<td>139.79</td>
</tr>
<tr>
<td>Reliability rating</td>
<td>93.2</td>
</tr>
<tr>
<td>Median</td>
<td>109.73</td>
</tr>
<tr>
<td>85th percentile</td>
<td>143.76</td>
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<tr>
<td>Total vehicle-miles travel (1,000's):</td>
<td>753</td>
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<tr>
<td>Number of obs.:</td>
<td>3120</td>
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<tr>
<td>95th percentile</td>
<td>172.59</td>
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</tbody>
</table>

![Histogram of Planning Time](image)
Urban Streets Performance Summary

- **Facility Travel Speed**
- **Note**
  - 10 percent of analysis periods have LOS E or F

### Summary Statistics

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<td>Scenario evaluation interval:</td>
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<tr>
<td>Average:</td>
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<td>5th percentile:</td>
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<tr>
<td>Standard deviation:</td>
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<td>10th percentile:</td>
<td>16.06</td>
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<tr>
<td>Skewness:</td>
<td>-0.58</td>
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<tr>
<td>80th percentile:</td>
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<tr>
<td>Median:</td>
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<td>26.25</td>
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<tr>
<td>95th percentile:</td>
<td>26.89</td>
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</table>

Base free-flow speed, mi/h: 40.78
Base free-flow travel time, s: 60.20
Reliability rating: not app.
Total vehicle-miles travel (1,000's): not app.
Analysis Capabilities

• Alternatives Analysis
  – Work zones and special events
    • Alternative start dates and durations
    • Alternative lane closures and signal timing strategies
  – Weather
    • Examine operational effects of strategies that reduce weather-related crashes (e.g., snow removal, resurfacing)
  – Incidents
    • Examine operational effects of strategies that reduce incident frequency or duration
    • Evaluate benefit of providing shoulder for stalled vehicles
  – Design or Operation
    • Evaluate alternative signal timing plans or lane allocations to quantify benefit of available movement capacity
Freeway Facility Method
How the predictive process works....

1- Seed File Data
   Facility description
   Baseline or strategy
   Description data

2- Create FREEVAL Seed File
   Facility profiles
   --demand
   --incident
   --weather

3a- Scenario Generator Data
3b- Generate Scenarios
   Generates:
   --Probability
   --demand adjust.
   --cap. adjust.
   --FFS adjust.
   --lane adjust.

4- Execute Scenarios in FREEVAL-RL
   Expanded, enhanced version of FREEVAL2010
   Travel time index distribution,
   other statistics

5- Generate Output and Summary Report
**Demand Variability**

- Specify customized Demand Profile for Facility
  - Day of Week Variability
  - Month of Year Variability

- Combine similar demand patterns to reduce number of scenarios
  - Maximum 84 demand patterns (7x12)
  - Realistically may run 8 to 12 demand patterns

- Provide demand multipliers
  - Defaults for Urban and Rural Freeways provided
  - **Facility-specific is preferable**

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<tr>
<th>Month</th>
<th>DM</th>
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<th>Tuesday</th>
<th>Wednesday</th>
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<td>0.77</td>
<td>0.81</td>
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<td>1.01</td>
<td>1.03</td>
<td>1.08</td>
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<td>August</td>
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<td>1.06</td>
<td>1.12</td>
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<td>0.99</td>
<td>1.01</td>
<td>1.07</td>
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<td>0.98</td>
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<td>0.91</td>
<td>0.96</td>
<td>1.13</td>
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<td>December</td>
<td>0.83</td>
<td>0.79</td>
<td>0.81</td>
<td>0.86</td>
<td>1.01</td>
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Weather Impacts

• Capacity and speed reduction factors due to weather
  – Default provided from literature for 11 Weather categories (from HCM)
  – Allow custom demand adjustment factors

• Weather probability estimation
  – Historical averages provided from 10 years of data
  – Select closest city from 101 metropolitan areas

• Weather duration
  – Defaults from historical data
Incident Impacts

- Two options for specifying Incident Profile
  - Site-specific data entered if available
  - Estimation based on AADT from HERS model

- Consider capacity and speed reduction impacts from incidents
  - Default provided from literature
  - Allow user-defined demand adjustment

- Ability to add user-defined work zones and special events
  - Custom demand, capacity, and speed impacts

<table>
<thead>
<tr>
<th>Demand Pattern</th>
<th>No Incident</th>
<th>Shoulder Closure</th>
<th>One Lane Closure</th>
<th>Two Lane Closure</th>
<th>Three Lane Closure</th>
<th>Four Lane Closure</th>
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<tbody>
<tr>
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<td>91.65%</td>
<td>6.79%</td>
<td>0.88%</td>
<td>0.68%</td>
<td>0.00%</td>
<td>0.00%</td>
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<tr>
<td>2</td>
<td>91.72%</td>
<td>6.73%</td>
<td>0.87%</td>
<td>0.68%</td>
<td>0.00%</td>
<td>0.00%</td>
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<tr>
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<td>91.94%</td>
<td>6.56%</td>
<td>0.84%</td>
<td>0.66%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>4</td>
<td>92.13%</td>
<td>6.40%</td>
<td>0.82%</td>
<td>0.64%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
How the process works.. the computational engine

FREEVAL-RL

Computational Engine for Travel Time Reliability Analysis

Release December, 2012

Go to The Main Menu
Step 1: Enter Project Summary

File Header Name:
This entry will be used for all files generated in the project.

“I-40 Project_FREEVAL-RL”
“I-40 Project_Summary Output”
“I-40 Project_Comprehensive Output”
“I-40 Project_Freeway Scenario Generator”
Step 2: Seed File Management

FREEVAL-RL

Enter Project Summary

Edit The Seed File

Project Schedule

Study Period Start Time (hh:mm): 14 00
Study Period End Time (hh:mm): 18 00
Analysis Year (YYYY): 2012
RRP Start Date (MM/DD): 01 01
RRP End Date (MM/DD): 12 31
Seed Demand Day in RRP (MM/DD): 04 01

Facility Geometry

Number of HCM Segments: 4

Ramp Metering?

Yes

No

Capacity Drop in the Queue Discharge Mode (%): 5

Terrain

Level

Rolling

Mountainous

Other / Varying

Jam Density

190 pc/mi/ln
Step 3: Scenario Generation

**SHRP2-L08**
Freeway Scenario Generator (FSG)

Build Jan 2013

Freeway Scenario Generator (FSG) generates all operational scenarios, demonstrating the different operational conditions for freeway facilities. More detail information on computations, and theoretical aspects are provided in Chapter 36, and 37 of Highway Capacity Manual 2010. The users guide provided in this package describes the steps required by user to be entered for generating the scenarios.

Scenario generation is consisted of 5 steps in FSG:

Step 1: Insert seed file’s required information into FSG
Step 2A: Configure Demand Patterns
Step 2B: Determine the daily demand multipliers
Step 3: Configure weather data
Step 4: Configure incident data
Step 5A: Generate Scenarios
Step 5B: Generate FREEVAL_Input File

**Step 1:**
Read Seed File

**Step 2A:**
Configure Demand Patterns =>
Step 3: Scenario Generation

### Step 2A: Demand Pattern Configuration for Base Run

Click "Edit Demand Pattern" to configure the demand patterns across the Reliability Reporting Period (RRP). Specific days can be excluded from RRP by pressing "Edit Excluded Days". Numbers in parentheses designate the demand pattern number.

<table>
<thead>
<tr>
<th>Week #</th>
<th>January</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>January</td>
<td>1/2/2012 (1)</td>
<td>1/3/2012 (2)</td>
<td>1/4/2012 (2)</td>
<td>1/5/2012 (2)</td>
<td>1/6/2012 (1)</td>
</tr>
<tr>
<td>Week 2</td>
<td>January</td>
<td>1/9/2012 (1)</td>
<td>1/10/2012 (2)</td>
<td>1/11/2012 (2)</td>
<td>1/12/2012 (2)</td>
<td>1/13/2012 (1)</td>
</tr>
<tr>
<td>Week 3</td>
<td>January</td>
<td>1/15/2012 (1)</td>
<td>1/17/2012 (2)</td>
<td>1/18/2012 (2)</td>
<td>1/19/2012 (2)</td>
<td>1/20/2012 (1)</td>
</tr>
<tr>
<td>Week 4</td>
<td>January</td>
<td>1/23/2012 (1)</td>
<td>1/24/2012 (2)</td>
<td>1/25/2012 (2)</td>
<td>1/26/2012 (2)</td>
<td>1/27/2012 (1)</td>
</tr>
<tr>
<td>Week 5</td>
<td>February</td>
<td>1/30/2012 (1)</td>
<td>1/31/2012 (2)</td>
<td>2/1/2012 (2)</td>
<td>2/2/2012 (2)</td>
<td>2/3/2012 (1)</td>
</tr>
<tr>
<td>Week 6</td>
<td>February</td>
<td>2/6/2012 (1)</td>
<td>2/7/2012 (2)</td>
<td>2/8/2012 (2)</td>
<td>2/9/2012 (2)</td>
<td>2/10/2012 (1)</td>
</tr>
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<td>Week 7</td>
<td>February</td>
<td>2/13/2012 (1)</td>
<td>2/14/2012 (2)</td>
<td>2/15/2012 (2)</td>
<td>2/16/2012 (2)</td>
<td>2/17/2012 (1)</td>
</tr>
<tr>
<td>Week 8</td>
<td>February</td>
<td>2/20/2012 (1)</td>
<td>2/21/2012 (2)</td>
<td>2/22/2012 (2)</td>
<td>2/23/2012 (2)</td>
<td>2/24/2012 (1)</td>
</tr>
<tr>
<td>Week 9</td>
<td>March</td>
<td>2/27/2012 (1)</td>
<td>2/28/2012 (2)</td>
<td>2/29/2012 (2)</td>
<td>3/1/2012 (4)</td>
<td>3/2/2012 (3)</td>
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<td>3/7/2012 (4)</td>
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<td>3/9/2012 (3)</td>
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<td>Week 11</td>
<td>March</td>
<td>3/12/2012 (3)</td>
<td>3/13/2012 (4)</td>
<td>3/14/2012 (4)</td>
<td>3/15/2012 (4)</td>
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<td>March</td>
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<td>3/21/2012 (4)</td>
<td>3/22/2012 (4)</td>
<td>3/23/2012 (3)</td>
</tr>
<tr>
<td>Week 13</td>
<td>April</td>
<td>3/26/2012 (3)</td>
<td>3/27/2012 (4)</td>
<td>3/28/2012 (4)</td>
<td>3/29/2012 (4)</td>
<td>3/30/2012 (3)</td>
</tr>
<tr>
<td>Week 14</td>
<td>April</td>
<td>4/2/2012 (3)</td>
<td>4/3/2012 (4)</td>
<td>4/4/2012 (4)</td>
<td>4/5/2012 (4)</td>
<td>4/6/2012 (3)</td>
</tr>
<tr>
<td>Week 15</td>
<td>April</td>
<td>4/9/2012 (3)</td>
<td>4/10/2012 (4)</td>
<td>4/11/2012 (4)</td>
<td>4/12/2012 (4)</td>
<td>4/13/2012 (3)</td>
</tr>
<tr>
<td>Week 16</td>
<td>April</td>
<td>4/16/2012 (3)</td>
<td>4/17/2012 (4)</td>
<td>4/18/2012 (4)</td>
<td>4/19/2012 (4)</td>
<td>4/20/2012 (3)</td>
</tr>
<tr>
<td>Week 17</td>
<td>April</td>
<td>4/23/2012 (3)</td>
<td>4/24/2012 (4)</td>
<td>4/25/2012 (4)</td>
<td>4/26/2012 (4)</td>
<td>4/27/2012 (3)</td>
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<tr>
<td>Week 18</td>
<td>May</td>
<td>4/30/2012 (3)</td>
<td>5/1/2012 (4)</td>
<td>5/2/2012 (4)</td>
<td>5/3/2012 (4)</td>
<td>5/4/2012 (3)</td>
</tr>
<tr>
<td>Week 19</td>
<td>May</td>
<td>5/7/2012 (3)</td>
<td>5/8/2012 (4)</td>
<td>5/9/2012 (4)</td>
<td>5/10/2012 (4)</td>
<td>5/11/2012 (3)</td>
</tr>
</tbody>
</table>
Step 3: Scenario Generation

### Step 2B: Daily Demand Multipliers for Base Run

The Analyst can either accept the default demand multipliers (DM) for each combination of weekdays and months of the year, or insert facility-specific factors if available. (Reference is to facility AADT)

<table>
<thead>
<tr>
<th>DM</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Month</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>0.996623</td>
<td>1.027775</td>
<td>1.040394</td>
<td>1.052601</td>
<td>1.081612</td>
</tr>
<tr>
<td>February</td>
<td>0.939253</td>
<td>1.010728</td>
<td>1.039214</td>
<td>1.092029</td>
<td>1.140072</td>
</tr>
<tr>
<td>March</td>
<td>1.043305</td>
<td>1.069335</td>
<td>1.063524</td>
<td>1.110921</td>
<td>1.171121</td>
</tr>
<tr>
<td>April</td>
<td>1.073578</td>
<td>1.087455</td>
<td>1.098238</td>
<td>1.161974</td>
<td>1.215002</td>
</tr>
<tr>
<td>May</td>
<td>1.076331</td>
<td>1.106182</td>
<td>1.113955</td>
<td>1.157717</td>
<td>1.210434</td>
</tr>
<tr>
<td>June</td>
<td>1.078043</td>
<td>1.085853</td>
<td>1.067470</td>
<td>1.138720</td>
<td>1.180327</td>
</tr>
<tr>
<td>July</td>
<td>1.082580</td>
<td>1.070993</td>
<td>1.102512</td>
<td>1.147279</td>
<td>1.184981</td>
</tr>
<tr>
<td>August</td>
<td>1.046045</td>
<td>1.052146</td>
<td>1.060371</td>
<td>1.093243</td>
<td>1.164901</td>
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<tr>
<td>September</td>
<td>1.016023</td>
<td>1.024051</td>
<td>1.023625</td>
<td>1.074782</td>
<td>1.152946</td>
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<tr>
<td>October</td>
<td>1.048981</td>
<td>1.045723</td>
<td>1.066986</td>
<td>1.107044</td>
<td>1.160954</td>
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<tr>
<td>November</td>
<td>0.974044</td>
<td>0.999947</td>
<td>1.041211</td>
<td>1.081541</td>
<td>1.070354</td>
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<tr>
<td>December</td>
<td>0.974785</td>
<td>0.956475</td>
<td>0.987019</td>
<td>0.916107</td>
<td>1.007695</td>
</tr>
</tbody>
</table>
Step 3: Scenario Generation

Step 3: Weather Data for Base Run

The analyst can either use weather defaults based on 10 year average by pressing "Extract Longterm Regional Weather Data for Specified Location", or directly put the probabilities for different weather categories. If the user wants to use 10 year average, then he needs to select the nearest metropolitan area to the facility.

| Select Nearest Metro Politan area to the Facility | Raleigh, NC | Extract Longterm Regional Weather Data for Specified Location |

Weather Categories (based on HCM 2010 Chapter 10: Freeway Facilities)

<table>
<thead>
<tr>
<th>Month</th>
<th>Med Rain</th>
<th>Heavy Rain</th>
<th>Light Snow</th>
<th>LM Snow</th>
<th>MH Snow</th>
<th>Heavy Snow</th>
<th>Severe Cold</th>
<th>Low Vis</th>
<th>Very Low Vis</th>
<th>Min Vis</th>
<th>Normal Weather</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>0.738%</td>
<td>0.502%</td>
<td>1.477%</td>
<td>0.213%</td>
<td>0.038%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.784%</td>
<td>0.000%</td>
<td>0.525%</td>
<td>95.7223%</td>
</tr>
<tr>
<td>February</td>
<td>1.040%</td>
<td>0.144%</td>
<td>0.544%</td>
<td>0.386%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.727%</td>
<td>0.000%</td>
<td>0.319%</td>
<td>96.9392%</td>
</tr>
<tr>
<td>March</td>
<td>1.364%</td>
<td>0.670%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.242%</td>
<td>0.000%</td>
<td>0.308%</td>
<td>97.4149%</td>
</tr>
<tr>
<td>April</td>
<td>0.335%</td>
<td>0.669%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>98.9951%</td>
</tr>
<tr>
<td>May</td>
<td>1.295%</td>
<td>1.086%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.108%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>97.5118%</td>
</tr>
<tr>
<td>June</td>
<td>0.936%</td>
<td>1.338%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>97.7254%</td>
</tr>
<tr>
<td>July</td>
<td>0.805%</td>
<td>1.523%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>97.5253%</td>
</tr>
<tr>
<td>August</td>
<td>0.369%</td>
<td>1.141%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.369%</td>
<td>0.000%</td>
<td>98.1211%</td>
</tr>
<tr>
<td>September</td>
<td>1.075%</td>
<td>1.056%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>97.8538%</td>
</tr>
<tr>
<td>October</td>
<td>0.486%</td>
<td>0.325%</td>
<td>0.000%</td>
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<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>98.4081%</td>
</tr>
<tr>
<td>November</td>
<td>1.059%</td>
<td>0.709%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.294%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>97.9369%</td>
</tr>
<tr>
<td>December</td>
<td>0.614%</td>
<td>0.778%</td>
<td>0.695%</td>
<td>0.262%</td>
<td>0.069%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>1.404%</td>
<td>0.000%</td>
<td>0.463%</td>
<td>95.7145%</td>
</tr>
</tbody>
</table>

Average Duration for Weather Type(min):

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>33.7</th>
<th>33.4</th>
<th>21.7</th>
<th>7.3</th>
<th>0</th>
<th>76.2</th>
<th>0</th>
<th>144.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Capacity Adjustment Factor:</td>
<td>92.76%</td>
<td>85.87%</td>
<td>95.71%</td>
<td>91.34%</td>
<td>88.96%</td>
<td>77.57%</td>
<td>91.55%</td>
<td>90.33%</td>
<td>88.53%</td>
</tr>
<tr>
<td>Default FFS Adjustment Factor:</td>
<td>95.00%</td>
<td>93.00%</td>
<td>92.00%</td>
<td>90.00%</td>
<td>88.00%</td>
<td>88.00%</td>
<td>95.00%</td>
<td>95.00%</td>
<td>94.00%</td>
</tr>
<tr>
<td>Demand Adjustment Factor</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>
Step 3: Scenario Generation

---

Step 4: Incident Data for Base Run

The analyst can either use option A for generating incident data, or he can directly put probability of incidents in Option B section.

**Option A: for Data Poor Facilities:**
Step 1: Enter incident or crash rate (Per 100 million vehicle mile):

- Entry data are: ○ Incident Rate ○ Crash Rate ○ HERS Model
- If monthly crash rates will be entered then enter site specific crash to incident rate ratio
- National Default Ratio is 4.9

Step 2: Enter expected duration and standard deviation of the incident type, and their distribution. Incidents will only be modeled when at least one lane is open, otherwise they will be ignored.

**Option B (for Data Rich Facilities): Enter Probabilities Directly in the Table from Incident Logs**

By pressing button below, the table clears and analyst can enter facility specific incident probabilities. The incidents will only be modeled where there is at least one lane open, otherwise the scenarios will be ignored.

**Probability of Different Incident Types**

<table>
<thead>
<tr>
<th>Demand Pattern</th>
<th>No Incident</th>
<th>Shoulder Closure</th>
<th>One Lane Closure</th>
<th>Two Lane Closure</th>
<th>Three Lane Closure</th>
<th>Four Lane Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>86.82%</td>
<td>9.71%</td>
<td>2.85%</td>
<td>1.12%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>2</td>
<td>86.39%</td>
<td>9.66%</td>
<td>2.84%</td>
<td>1.12%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>3</td>
<td>84.90%</td>
<td>10.70%</td>
<td>3.16%</td>
<td>1.24%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>4</td>
<td>85.18%</td>
<td>10.51%</td>
<td>3.10%</td>
<td>1.22%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>5</td>
<td>84.57%</td>
<td>10.65%</td>
<td>3.14%</td>
<td>1.24%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>6</td>
<td>85.43%</td>
<td>10.33%</td>
<td>3.04%</td>
<td>1.20%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>7</td>
<td>85.68%</td>
<td>10.15%</td>
<td>2.99%</td>
<td>1.18%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>8</td>
<td>85.50%</td>
<td>10.00%</td>
<td>2.94%</td>
<td>1.16%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
Step 3: Scenario Generation

**Step 5: List of Detailed Scenarios for Base Run**

<table>
<thead>
<tr>
<th>Summary of Detailed Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scenario Type</strong></td>
</tr>
<tr>
<td>Demand Scenarios</td>
</tr>
<tr>
<td>Demand &amp; Incident Scenarios</td>
</tr>
<tr>
<td>Demand &amp; Weather Scenarios</td>
</tr>
<tr>
<td>Demand, Incident, &amp; Weather Scenarios</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
</tr>
</tbody>
</table>

**Percent Distribution Covered**: 99.76%

<table>
<thead>
<tr>
<th>Detailed Scenario #</th>
<th>Demand Pattern #</th>
<th>Parent Scenario #</th>
<th>Weather Label</th>
<th>Incident Label</th>
<th>Probability of Detailed Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>1</td>
<td>Normal Weather</td>
<td>No Incident</td>
<td>1.128078%</td>
</tr>
<tr>
<td>2</td>
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<td>Normal Weather</td>
<td>No Incident</td>
<td>1.854095%</td>
</tr>
<tr>
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<td>No Incident</td>
<td>1.077928%</td>
</tr>
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<td>No Incident</td>
<td>1.901457%</td>
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<tr>
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<td>Normal Weather</td>
<td>No Incident</td>
<td>0.502566%</td>
</tr>
<tr>
<td>6</td>
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<td>6</td>
<td>Normal Weather</td>
<td>No Incident</td>
<td>1.170292%</td>
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<td>Normal Weather</td>
<td>No Incident</td>
<td>1.297885%</td>
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<td>9</td>
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<td>1</td>
<td>Normal Weather</td>
<td>Shoulder Closure</td>
<td>0.526991%</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>1</td>
<td>Normal Weather</td>
<td>Shoulder Closure</td>
<td>0.526991%</td>
</tr>
<tr>
<td>11</td>
<td>4</td>
<td>1</td>
<td>Normal Weather</td>
<td>Shoulder Closure</td>
<td>0.526991%</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>1</td>
<td>Normal Weather</td>
<td>Shoulder Closure</td>
<td>0.526991%</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>1</td>
<td>Normal Weather</td>
<td>Shoulder Closure</td>
<td>0.526991%</td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td>1</td>
<td>Normal Weather</td>
<td>Shoulder Closure</td>
<td>0.526991%</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
<td>1</td>
<td>Normal Weather</td>
<td>Shoulder Closure</td>
<td>0.526991%</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>1</td>
<td>Normal Weather</td>
<td>Shoulder Closure</td>
<td>0.526991%</td>
</tr>
</tbody>
</table>
Step 4: Run Scenarios

Run Scenarios:

When all scenarios have been generated using the FSG tool, The user runs them in FREEVAL-RL

When all scenarios are processed, FREEVAL-RL file is automatically saved as “Comprehensive Output”

Also, a summary output file and summary report are saved as “Summary Output” file.
Step 5: View Results

View Summary Output:
This button takes the user to summary output worksheet which covers all the scenarios information and their respective run results in a tabular format.
Summary Report – Part I

- Summary report with key indicators (4-7 pm, weekdays)
- At zero inclusion threshold, # of scenario runs → 1,928
- At recommended threshold of 0.01% → 602 (about 45 min)
### Percent Contribution to Total Vehicular Hours of Delay (VHD)

<table>
<thead>
<tr>
<th>VHD Under Condition (Veh. Hrs)</th>
<th>Total During RRP</th>
<th>Average in 15 min</th>
<th>%Time in Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurring</td>
<td>29,227</td>
<td>9.33</td>
<td>83.7%</td>
</tr>
<tr>
<td>Non-Recurring</td>
<td>39,328</td>
<td>12.56</td>
<td>16.3%</td>
</tr>
<tr>
<td>Total</td>
<td>68,555</td>
<td>21.89</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

### Analysis Details for Reliability Reporting Period by Congestion Status

#### Scenarios with Recurring Congestion

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Segment D/C Ratio</td>
<td>1.1</td>
</tr>
<tr>
<td>Maximum Facility TTI</td>
<td>1.6</td>
</tr>
<tr>
<td>% Time with Queues on the Facility</td>
<td>23.40%</td>
</tr>
<tr>
<td>% Time without Queues on the Facility</td>
<td>76.60%</td>
</tr>
</tbody>
</table>

#### All Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Segment D/C Ratio</td>
<td>4.99</td>
</tr>
<tr>
<td>Maximum Facility TTI</td>
<td>37.1</td>
</tr>
<tr>
<td>% Time with Queues on the Facility</td>
<td>31.32%</td>
</tr>
<tr>
<td>% Time without Queues on the Facility</td>
<td>68.68%</td>
</tr>
<tr>
<td>% VMT Served in the Study Period</td>
<td>100.00%</td>
</tr>
<tr>
<td>% VMT Unserved in the Study Period</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
• An 11 HCM segment, 6mi. facility that is barely undersaturated

• Segment 8 downstream of ONR-3 is potential bottleneck
  – demand-to-capacity ratio, \( d/c=0.99 \)

• Standard analysis says facility is “fine”
### Single-Run Results (1.25 hours)

#### Density Based Level of Service

<table>
<thead>
<tr>
<th>Time</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C</td>
<td>C</td>
<td>D</td>
<td>C</td>
<td>D</td>
<td>C</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>C</td>
</tr>
<tr>
<td>2</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>3</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
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<td>E</td>
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<tr>
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<td>D</td>
<td>D</td>
<td>C</td>
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<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>B</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>

#### Density Contours (veh/mi/ln)

- 40.00-45.00
- 35.00-40.00
- 30.00-35.00
- 25.00-30.00
- 20.00-25.00
- 15.00-20.00
- 10.00-15.00
- 5.00-10.00
- 0.00-5.00

#### Space Mean Speed Contours (mi/hr)

- 50.00-60.00
- 40.00-50.00
- 30.00-40.00
- 20.00-30.00
- 10.00-20.00
- 0.00-10.00
Testing Reliability Treatments

1. Baseline

2. Geometric treatment
   – bottleneck mitigation Segments 7-11

3. Incident Management
   – improve incident response time

4. Safety Treatment
   – reduce crash rate on facility

5. Demand Management
   – promote peak spreading
### Reliability Performance Measure

<table>
<thead>
<tr>
<th>Objective: Comparing Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean TTI across all scenarios</strong></td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>Mean TTI across all scenarios</td>
</tr>
<tr>
<td>Facility Mean Speed (mph)</td>
</tr>
<tr>
<td>PTI (95% percentile TTI)</td>
</tr>
<tr>
<td>Misery Index (mean of worse 5%TTI)</td>
</tr>
<tr>
<td>Mean VHD in a 3hr study period</td>
</tr>
<tr>
<td>% VHD Due to Non-Recurring Effects</td>
</tr>
<tr>
<td>Reliability Rating</td>
</tr>
<tr>
<td>Percent VMT Served @ TTI &lt;1.33</td>
</tr>
</tbody>
</table>
Status and Next Steps

• Draft HCM2010 Chapters have been made available to AHB40 Committee

• Computational Engines are being tested by committee members and friends now
  – Always looking for more volunteers!!!

• Real-world and independent agency testing through SHRP2 L38 is underway

• NCHRP 3-115 is updating the HCM 2010 and will include the L08 work.
  – Target completion is December 2015
For more information

L08 Final Report, Draft Chapters and Computational Engines available through TRB

http://www.trb.org/Main/Blurbs/169595.aspx

Or simply Google “SHRP2 L08”
Questions/Discussion

Thank you!