# Microscopic Traffic Simulation Model Calibration & Validation

**June 27, 2006**

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Jongsun Won

## AGENDA

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<td>10:10 ~ 11:45</td>
<td>Calibration and Validation Method</td>
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<td>11:45 ~ 1:00</td>
<td>Lunch</td>
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<td>1:00 ~ 2:20</td>
<td>Hands-on Practice (CORSIM)</td>
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<td>2:30 ~ 3:50</td>
<td>Demo (VISSIM)</td>
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<td>4:00 ~ 4:30</td>
<td>Wrap-up / Discussion</td>
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Lesson 1

Introduction

9:30 ~ 10:00

• What is “Simulation”?
• Why “Calibration” is important?
• What to calibrate?
What is “Simulation”?

**Simulation**
The technique of “imitating the behavior of some situation or process” by means of “a suitably analogous situation or apparatus” [Oxford Dictionary]

Input → Simulation → Output

**“Computer” Simulation**

Process of …
- Designing a computerized model of a system
- Conducting experiments with this model
- Understanding behavior of system of evaluating various strategies for the operation of the system

Input → Simulation Program → Output
What is “Simulation”? 

“Traffic” Simulation

- Process of applying simulation for traffic applications
- Depending on fidelity of modeling traffic, it can be “Macro”, “Meso” or “Micro”-scopic models

What is “Simulation”? 

“Microscopic Traffic” Simulation

- Fidelity of simulation system component is modeled at an individual level
- Each vehicle is simulation system entity for conducting simulation.

<table>
<thead>
<tr>
<th>Input</th>
<th>Microscopic Traffic Simulation Model</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geometry</td>
<td>CORSIM</td>
<td>Travel Time</td>
</tr>
<tr>
<td>Volume</td>
<td>VISSIM</td>
<td>Delay</td>
</tr>
<tr>
<td>Control System</td>
<td>SimTraffic</td>
<td>Queue Length</td>
</tr>
</tbody>
</table>
What is “Simulation”?  

Simulation Models  

Examples of Microscopic traffic simulation models  

VISSIM  
CORSIM
Simulation Models - VISSIM

Background
- Developed by University of Karlsruhe in Germany (1970s)
- Distributed by PTV (1993)
- Currently being used by State DOTs, Consultants, and Research Institutes

Simulation Models - VISSIM

Overview
- Microscopic, Time-step based simulation model
- Simulate traffic operations in urban streets and freeways
- Emphasize multi-modal transportations (Bus, LRT, Heavy Rail, etc.)
Simulation Models - VISSIM

- Various measures of effectiveness (e.g., Delay, Travel Time, Queue Length, etc.)
- 2D & 3D animations
Simulation Models - CORSIM

Background

• Developed & funded by FHWA
• Widely adopted by many entities in the U.S.

TSIS
Traffic Software Integrated Systems

CORSIM

TRAFFED

TRAFFVU
Simulation Models - CORSIM

Overview

- Detailed stochastic & Microscopic simulation model
- Analysis of freeways, arterials, and basic transit operations
- NETSIM & FRESIM

Simulation Models - CORSIM

Output

- Various measures of effectiveness (e.g., Link Travel Time, Queue Length, Delay, etc)
- 2D animation (TRAFVU)
### Why calibration & validation are important?

**Calibration & Validation**

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The action or process of determining the correct position, value, capacity, etc.</td>
<td>The process of evaluating software or model at the end of the development process to ensure compliance with requirements</td>
</tr>
</tbody>
</table>

### Why calibration & validation are important?

**Traffic Simulation Model Calibration & Validation**

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process of determining appropriate parameters such that simulation model can represent field condition</td>
<td>Process of ensuring calibrated traffic simulation model can be trusted for representing untried field condition</td>
</tr>
</tbody>
</table>
### Why calibration & validation are important?

**Currently...**

- Uses “Default” parameters
- Modifies parameter base on “Engineer's judgment”
- Due to…
  - The *limitations* on time, cost, etc.
  - Lack of available and formal calibration procedure

**Issues**

**Solution**

---

**Why calibration & validation are important?**

**Currently...**

**Issues**

- No *single model* (i.e., a set of calibration parameters) can describe *various field conditions* perfectly
- Manual adjustment could be either *unrealistic or erroneous*
  - “*Garbage In Garbage Out*”
- Uncalibrated Simulation Model could mislead the results.

**Solution**
Why calibration & validation are important?

Currently...

Issues

Solution

- Conducting “Calibration Procedure” prior to the application of simulation model

The importance of calibration

- Example case study -
Why calibration & validation are important?

Field Travel Time

- Two video cameras were installed at each end of the segment
- Each travel time data is extracted
- Frequency of each group is plotted

Comparison of simulation model output

- Multiple run result for both “Calibrated” and “Uncalibrated”
  VISSIM network are compared with field result
**Why calibration & validation are important?**

Comparison of timing plan optimization result

Result with “Uncalibrated” model

Result with “Calibrated” model

- Effect of signal optimization can be overstated

**What to calibrate?**

**How to select calibration parameters**

- “Is the parameter difficult to collect from the field?”
  - Difficulties and limitations on field data collection

- “Is it critical to the output of the simulation model?”
  - Importance of parameter to the specific simulation model
**What to calibrate?**

**Available calibration parameters**

- Driving behavior parameters
  - Lane changing behavior
  - Desired speed
  - Car-following
- Other parameters defined by user manual
- Example parameters
  - Gap, Headway, Desired speed, Acceleration rate, etc

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**Lesson 2**

**Calibration and Validation Method**

10:10 ~ 11:45
Calibration Procedure

Calibration and Validation Concept

Calibration and Validation Overview

Validation Method

Calibration Method

Concept of calibration

**Concept**

Probability \(|\text{“Reality”} – \text{Prediction}| < \delta\) > \alpha

\(\delta\) = tolerable difference

\(\alpha\) = level of assurance


**How “Close”?**

Difference of real and predicted value < Tolerance

**How “Certain”?**

Prob. of the difference less than tolerance > Assurance level
How to calibrate?

Systematic Calibration Procedure (Simplified)

- **Usefulness of default Value**
  - Multiple runs with default parameters
  - Comparison of simulation outputs & field data

- **Parameter Range Determination**
  - Simulation runs with different parameter combinations
  - Comparison of simulation outputs & field data

- **Parameter Validation**
  - Verify calibration result with *untried data set*

- **Parameter Calibration**
  - Calibrating parameters by using “Optimization method”

How to calibrate?

Calibration Procedure Flow Chart

- **Simulation Model Setup**
  - Initial Evaluation
    - Satisfied
    - Unsatisfied
  - Experimental Design
  - Feasibility Test
  - Passed?
    - Yes
    - No
  - Adjust Key Parameter Ranges
  - Passed?
    - Yes
    - No
  - Parameter Calibration Using Genetic Algorithm
  - Evaluation of calibrated parameter set
    - Satisfied
    - Unsatisfied
  - Model Validation & Visualization
    - Satisfied
    - Unsatisfied
  - End
How to calibrate?

1. Simulation Setup

**Purpose**
Preparing simulation model

**1. Determination of Performance Measure**

Conditions for “performance measure” selection.
- Does simulation model provides corresponding output?
- Is it possible to collect from the field?
- Does the selected measure reflects traffic conditions directly?
  e.g. Travel Time, Queue Length, Delay, Speed, etc.

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How to calibrate?

1. Simulation Setup

**2. Field Data Collection**

**Fundamental Input Data**

- Required data for network coding which can be obtained from the field (e.g., Signal settings, Volume, Geometry, etc)
How to calibrate?

1. Simulation Setup

2. Field Data Collection

Performance Measure Data

- Following data are desirable to consider variability
  - Multiple days (day-to-day variability)
  - Multiple types
- Data collection location should be same as the point in simulation model to get more accurate result

How to calibrate?

1. Simulation Setup

2. Field Data Collection

Validation Data

- New performance measure data needs to be collected

New performance measure data

- Different types or surveying date
- Before/After the implementation of operation strategies
How to calibrate?

1. Simulation Setup

③ Network Coding

- All fundamental inputs need to be coded in a simulation model
  - Fundamental Inputs: Geometry, Volume,
- Data collection points and/or segments of simulation model which are corresponding to the field measured location should be installed

How to calibrate?

2. Initial Evaluation

Purpose: Check the validity of default simulation model

Performance of Default Parameter Set

- Multiple runs with default parameter set
- Extract simulation outputs (Performance measure)
- Performance measure data comparison (Field and Simulation)
- Close match found?
  - Yes: Use default parameter set for further analysis
  - No: Calibration required

Close match found?

Use default parameter set for further analysis

Calibration required
How to calibrate?

2. Initial Evaluation

What is close match?

Unacceptable Case

Close Match

Distribution of simulation output does not include field data

Distribution of simulation output does include field data

How to calibrate?

2. Initial Evaluation

Consideration of Multiple Performance Measures

Close Match

• Each dot on the X-Y plot represents each output data point that correspond to selected performance measures.
• If the combination of field collected data includes certain number of points (say 10%), it can be considered as a close match.
How to calibrate?

3. Experimental Design

Identification of Key Parameters

1) Identify all available *calibration parameters* with the selected simulation model
2) Categorize each parameter with its *characteristics*
3) Consider the *relevance* of each category for given site
4) Determine the *acceptable range* of each parameter

Why Experimental Design

- It is impossible to try out every single combinations (e.g., 10 parameters, 5 levels \(5^{10} = 9,765,625\) combinations)

Experimental Design for Calibration

- **Latin Hypercube Sampling (LHS) method**
  - Optimization-based experimental design method
  - Minimize pair-wise correlations
  - Maximally covers surface space
3. Experimental Design

Example

Random Sampling

Latin Hypercube Sampling

How to calibrate?

Example parameter set

Correlation of each parameter set

“Low Correlation” between parameters
How to calibrate?

4. Feasibility Test

Purpose
To check whether the calibration data is reasonably covered by the simulation output distribution

Feasible?

- If the field collected value falls within the 90 percent area of simulation output distribution, then it considers to be feasible.
  (e.g. ○: Feasible ×: Not Feasible)

Consideration of Multiple Performance Measures

Field collected performance measure value range

Two boxes should overlap to be recognized as a feasible range as shown in the figure on the left side.

90% Confidence interval range
Key parameter can be identified by using following two methods:

- X-Y Plot
- Analysis of Variance (ANOVA) test

Adjust key parameters:

- Understand the changing pattern of corresponding output as the parameter value alters
- Check the reality of some measures (i.e. saturation flow rate)

X-Y Plot

- Plot different parameter levels versus simulation outputs at each parameter level
- The trend of simulation outputs along different parameter levels can be observed

Example of X-Y Plot
How to calibrate?

5. Parameter Adjustment

• What is ANOVA?
  • Analysis of Variance
  • A series of statistical procedures for examining differences in means and for partitioning variance
  • Many different statistical software provides ANOVA function (i.e. SAS, SPSS, Excel, Minitab, etc.)
  • Significant source (parameter) can be determined with its “P-Value”

How to calibrate?

5. Parameter Adjustment

• ANOVA table

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F0</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable 1</td>
<td>3,276.10</td>
<td>1</td>
<td>3,276.10</td>
<td>9.82</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Variable 2</td>
<td>46,948.05</td>
<td>1</td>
<td>46,948.05</td>
<td>140.69</td>
<td>0.247</td>
</tr>
<tr>
<td>Error</td>
<td>5,339.20</td>
<td>16</td>
<td>333.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>55,563.35</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Significance value is less than 0.05.
How to calibrate?

5. Parameter Adjustment

- ANOVA test

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Significance Value (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter 1</td>
<td>0.944 X</td>
</tr>
<tr>
<td>Parameter 2</td>
<td>0.435 X</td>
</tr>
<tr>
<td>Parameter 3</td>
<td>0.037 *</td>
</tr>
<tr>
<td>Parameter 4</td>
<td>0.187 X</td>
</tr>
<tr>
<td>Parameter 5</td>
<td>0.007 *</td>
</tr>
</tbody>
</table>

*Note: Significance value is less than 0.05.

- If “p-value” is smaller than pre-determined criteria, then those parameters are considered to have significant effect to the MOE.

How to calibrate?

5. Parameter Adjustment

Parameter vs. Performance Measure

- Interval Plot
- Effect of individual parameter to the performance measure value

Interaction of Parameters

- 3D Contour Plot
- Combined effect of parameters to the performance measure value
How to calibrate?

6. Parameter Calibration

• Genetic Algorithm (GA)
  • A method of implementing the action of “Natural Selection and Evolution”
  • Widely applied in “Optimization” area
  • Why GA was chosen?
    ➔ Stochastic
    ➔ Global Search

How to calibrate?

6. Parameter Calibration

• Genetic Algorithm (GA) Process
  • Start
  • Create Initial Population of Calibration Parameters
  • Simulation Runs
  • Extracting Simulation Results
  • Stopping Criterion?
  • Generate Next Populations
  • Yes
  • Calculation of Fitness Value
  • No
  • End

Input
  • Ranges of each parameter

Output
  • Calibrated value of each parameter
How to calibrate?

6. Parameter Calibration

• Major steps in GA

Initial Population → Selection → Crossover → Mutation → New Population

Solution → Evaluation

How to calibrate?

6. Parameter Calibration

• Three main steps in GA

Selection
• Select specific settings in population for next step
• As it gives low fitness function value, it has more chances to be selected

Crossover
• Randomly select a part of the each string
• Exchange selected part of settings

Mutation
• Randomly flips some digits in the string for the settings
How to calibrate?

6. Parameter Calibration

**• Fitness Value**

- Relative error

\[ FV = \frac{|PM_{Field} - PM_{Simulation}|}{PM_{Field}} \]

Where:
- \( FV \): Fitness Value
- \( PM_{Field} \): Performance Measure collected from the field
- \( PM_{Simulation} \): Simulation Outputs

**• Stopping Criterion**

- GA stops, if one of the following conditions are satisfied
  - "Fitness Value" meets pre-defined threshold
  - Pre-defined “Max. number of generation” has reached

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How to calibrate?

6. Parameter Calibration

Applying Additional Performance Measures

- Constraints Insertion Method
- Log Transformation Method
How to calibrate?

6. Parameter Calibration

(1) Constraint Method

**Constraint Method Concept**

- **Fitness Value**
- **Acceptable Range**
- **2nd Performance Measure**

**Objective Function**

- **Primary Performance Measure**
  - Fitness Value Calculation
  
  \[
  \text{Fitness Value} = \frac{| \text{APM}_\text{field}(t) - \text{APM}_\text{true}(t) |}{\text{APM}_\text{field}(t)}
  \]

- **Subject to**
  - \( \text{PM}_{\text{min}}(t) \leq \text{APM}_\text{true}(t) \leq \text{PM}_{\text{max}}(t) \)

- **Additional Performance Measures**
  - Constraint Method

(2) Log Transformation Method

**Real vs. Log Transformed Value**

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Average Value</th>
<th>10% Alteration</th>
<th>Log Trans.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Time (sec)</td>
<td>150</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Volume (veh/hr)</td>
<td>2,000</td>
<td>200</td>
<td>2.3</td>
</tr>
</tbody>
</table>
How to calibrate?

6. Parameter Calibration

- Convergence

  - As the generation progresses, fitness value for both average value and the best value of each generation converges to “0”

7. Evaluation of calibrated parameter set

- Check the reliability of each parameter and compare the parameter setting of each cases.
  1. Make 100 runs for each “Calibrated” and “Default” models.
  2. Extract 100 outputs for each model.
  3. Draw a histogram and compare with the field result.

Why 100 runs?

- Every simulation model generates a different result to explain the variability such as “day-to-day variability.”
How to calibrate?

7. Evaluation of calibrated parameter set

- As a result, “Calibrated model” can mimic the field condition. However, default model could not.

8. Model Validation and Visualization

- Purpose
  - Verifying calibrated simulation model with untried data

- Model Validation
  - Conduct another multiple runs
  - Compare “Untried data” with the distribution of simulation outputs
  - Untried data can be either same or different type of data that has been collected on different day
How to calibrate?

8. Model Validation and Visualization

- **Visualization Check**
  - Conduct additional simulation runs and watch animation
  - Check whether unacceptable animation occurs or not.
  - If *unrealistic animations* were observed, go back to GA optimization step and conduct new calibration procedure

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**Example of Unrealistic Animation in VISSIM**

- Some vehicles on right-hand side lane are trying to make left turn

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**Example of validated data**

- Calibrated with Travel Time data
- Validation data was selected as a “Max. queue length”
- Validation was satisfied in this case
Questions?

Lesson 3

Exercise

1:00 ~ 3:50
Exercise

Goal

Working on the proposed calibration and validation procedure by using automated calibration computer program

Selected Site

Isolated Actuated Signalized Intersection (Zion Crossroads, VA)

Exercise

1. Site Description – Site 15
2. Preparation to Calibration
3. Exercise – CORSIM / Site 15
4. Demo Presentation – VISSIM / Site 15
Exercise

1. Site Description – Site 15

2. Preparation to Calibration

3. Exercise – CORSIM / Site 15

4. Demo Presentation – VISSIM / Site 15

---

Exercise - 1. Site Description

Where is it?

- Located between Charlottesville and Richmond
- Junction of Rt. 15 and Rt. 250
- Closely located to Interstate 64 Exit # 136

We are here!

Site 15

Rt. 250

Rt. 15

Google Maps

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Exercise - 1. Site Description

Site 15 Overview

- Fully actuated signal system
- 4-leg intersection with 2 lanes (1 shared lane + exclusive Right-turn lane on each approach)

Exercise

1. Site Description – Site 15

2. Preparation for the Calibration

3. Exercise – CORSIM / Site 15

4. Demo Presentation – VISSIM / Site 15
Exercise - 2. Prepare for the Calibration

**Required Types of Data**

- **Geometry**
  - Lane Alignment
  - Lane Utilization
- **Traffic Data**
  - Traffic Volume
  - Heavy Vehicle %
  - Turning %
- **Signal Setting**
  - Actual Signal Data
  - Controller Setup
- **Performance Measure Data**
  - Calibration Data
  - Validation Data

**Data Collection**

**Preliminary Data Collection**
- Prior to the field data collection
- Geometry Information
- Signal Setting

**Field Data Collection**
- Apr 15, 22, May 13 (Tue) and Jun 5 (Thu) in 2003 (p.m. peak 5:00~ 6:00 p.m.)
- Signal Setting
- Performance Measure Data
- Traffic Data
- Other Complimenting Data
Exercise - 2. Prepare for the Calibration

Preliminary Data Collection

Geometry Information

- Aerial photo was used as a background image
- Geometry information was confirmed by preliminary site visit

Signal Setting

- Traffic Signal Timing Data obtained from VDOT personnel.
- The Traffic Signal Timing Data Manipulated to be suitable for the simulation model

Field Data Collection

- Apr. 15, 22, May 13 (Tue) and June 5 (Thu) in 2003 (PM peak 5:00~ 6:00 p.m.)
- To account for day-to-day variability

Traffic Data

- Traffic Volume
- Heavy Vehicle %
- Turning %
- Recorded by Video Camera mounted on the STV
- Extracted by watching recorded video
Exercise - 2. Prepare for the Calibration

Field Data Collection

Signal Setting Data
- To obtain actual signal timing data (e.g., average green time)
  - Recorded by Video Camera
  - Extracted by watching recorded video

Performance Measure Data
- Travel Time on South Bound Approach
  - Heavy traffic during PM peak period
    - Camera 1: Recorded the License Plate Number from Entry
    - Camera 2: Recorded the License Plate Number from Exit
Field Data Collection

Exercise - 2. Prepare for the Calibration

Performance Measure Data

Travel Time Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 15, 2003 Tue.</td>
<td>5:00 ~ 6:00</td>
</tr>
<tr>
<td>April 22, 2003 Tue.</td>
<td>5:00 ~ 6:00</td>
</tr>
<tr>
<td>May 13, 2003 Tue.</td>
<td>5:00 ~ 6:00</td>
</tr>
<tr>
<td>June 5, 2003 Thu.</td>
<td>5:00 ~ 6:00</td>
</tr>
</tbody>
</table>

- Calibration Data
- Validation Data

Exercise - 2. Prepare for the Calibration

Field Data Collection

Smart Travel Van (STV)
- A: Vehicle movement
- B: Turning Movement and Vehicle Classifications

Video Camera
- License Plate (Travel Time)
- P2, P3, P4: Queue Length
- P5: Displayed green times
Exercise - 2. Prepare for the Calibration

Field Data Collection

Travel Time Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Travel Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 15, 2003</td>
<td>Tues. p.m.</td>
<td></td>
</tr>
<tr>
<td>April 22, 2003</td>
<td>Tues. p.m.</td>
<td></td>
</tr>
<tr>
<td>May 13, 2003</td>
<td>Tues. p.m.</td>
<td></td>
</tr>
<tr>
<td>June 5, 2003</td>
<td>Thur. p.m.</td>
<td></td>
</tr>
</tbody>
</table>

Calibration Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Travel Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/22/2003</td>
<td></td>
<td>70.4 sec</td>
</tr>
<tr>
<td>5/13/2003</td>
<td></td>
<td>53.3 sec</td>
</tr>
<tr>
<td>5/20/2003</td>
<td></td>
<td>46.5 sec</td>
</tr>
<tr>
<td>6/5/2003</td>
<td></td>
<td>51.5 sec</td>
</tr>
</tbody>
</table>

Validation Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Travel Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>56.8 sec</td>
</tr>
</tbody>
</table>
Exercise - 2. Prepare for the Calibration

Network Coding

- Network was drawn based on the aerial photo
- Field collected data was reduced and applied to the model
- Calibration and Validation Data Collection points were installed on the exactly same locations
- Multiple test runs were made to check the validity of the simulation network
- Network was built with CORSIM and VISSIM
- Site 15 CORSIM network file

Subject Section:
Rt. 15 SB approach

Travel Time measurement section
- 960 ft distance
- From node # : 6
- To node # : 2
- Link : (6, 2)
Exercise

1. Site Description – Site 15
2. Preparation for the Calibration
3. Exercise – CORSIM / Site 15
4. Demo Presentation – VISSIM / Site 15

Exercise - 3. CORSIM / Site 15

Calibration Program Set Up

Enabling MS Excel Macro Function

1. Load MS-Excel Program
2. Tools ➔ Macro ➔ Security
Starting Up

Enables to conduct
Evaluation of “Default” Model

Run Default

Enables to conduct
Calibration Procedure

Run Calibration

Simulation Model Selection
Click on CORSIM

Exercise - 3. CORSIM / SITE 15

What Simulation Model Do You Calibrate?
Click on the program that you want to use.

CORSIM
VISSIM

Exercise - 3. CORSIM / SITE 15

Starting Up

Run Default
Run Calibration
EXIT
Exercise - 3. CORSIM / SITE 15

Default Model Testing

1. Number of Multiple runs you want to make with default model
2. Defining the location of simulation input file (e.g., CORSIM: *.trf, VISSIM: *.inp)
3. Defining the location of executable simulation program

Exercise - 3. CORSIM / SITE 15

Default Model Testing

1. Pull down to select your link of interest 5. (6, 2)
2. Click on “View Histogram” Button to display the travel time output distribution
3. Check out the travel time output value of each runs
4. After looking at the histogram, click on “Start Calibration” to Calibrate the model
Exercise - 3. CORSIM / SITE 15

Default Model Testing

Click "Exit" or "Back" button to go back

Histogram of 100 Travel Time outputs

Check on "yes" and type the field measured travel time value. Then click the button on the right side

Exercise - 3. CORSIM / SITE 15

Calibration Parameter Selection

Let's try to select the CORSIM calibration parameters with "Your own" judgment !!!

Refer to the "worksheet" and "copy of CORSIM manual" ➔ 5~10 minutes
Exercise - 3. CORSIM / SITE 15

Calibration Parameter Selection

Select all the parameters that need to be calibrated by clicking on the checkbox of each parameter.

Click on "OK" button to go to next step.

Parameter Range Determination

Activated text box indicates selected parameter.

Let’s try to determine the range of selected calibration parameters with "Your own" judgment !!!
Refer to the "worksheet" and "copy of CORSIM manual"

5~10 minutes
**Exercise - 3. CORSIM / SITE 15**

**Parameter Range Determination**

1. Type in determined minimum and maximum value for each selected parameter. (For record type 145 and 149, unless you select any specific type, it uses the same value for two parameters)

2. For the parameters that take a distribution format, just use the value for driver type 1.

3. Determine the number of samples that you want to test.

**Experimental Design**

1. Number of multiple runs you want to make with default model.

2. Defining the location of simulation input file (e.g., CORSIM: *.trf, VISSIM: *.inp).

3. Defining the location of executable simulation program.

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Exercise - 3. CORSIM / SITE 15

Feasibility Test

Pull down to select your link of interest 5. (6, 2)

Click on "View Histogram" Button to check out the travel time output distribution

Exercise - 3. CORSIM / SITE 15

Feasibility Test

Click "Exit" or "Back" button to go back

Histogram of 200 Average Travel Time outputs

Check on "yes" and type in the field measured travel time value. Then click the button on the right side
Exercise - 3. CORSIM / SITE 15

Parameter Range Determination

Is the set of ranges acceptable?

No

Yes

Adjust Ranges

Start Calibration

Parameter Range Adjustment

Copy the location information

Click on “Statistical Analysis” button to start parameter range adjustment
Exercise - 3. CORSIM / SITE 15

Parameter Range Adjustment

Click on “Start Button”

!! If you cannot load the Excel program, please check your security level again
Remember! It has to be “LOW”.

Exercise - 3. CORSIM / SITE 15

Parameter Range Adjustment

Select the simulation model name that you are using (e.g., CORSIM)

Paste the location information that you copied from last window

If you are all set, click “Run”
Exercise - 3. CORSIM / SITE 15

Parameter Range Adjustment

Select the calibration parameters that you want to generate X-Y plot (e.g., X (Travel time), Y (Parameter Value))

Click on “Run” button to generate X-Y plots
In order to start calibration procedure, you need to specify:
1. Number of Generations
2. Field Travel Time
3. Link identification number
4. Number of Populations

Type in all those information whenever asked on the black window

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Look at two files in "bin" folder

**result.dat**

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</table>

**Save_parameters.dat**
Exercise - 3. CORSIM / SITE 15

Parameter Calibration

Calibrated Parameter Values
(e.g., “0” means that parameter was not selected to be calibrated

Click on “Test Parameters” to evaluate the calibrated model

Exercise - 3. CORSIM / SITE 15

Evaluation

Pull down to select your link of interest 5. (6, 2)

Travel Time Outputs from multiple runs with calibrated model

Check on the level of Travel Time to conduct visualization

Then, click on “Run percentile” button
Next Steps…

- Watch animation with the calibrated parameters set to make sure it is acceptable. If not, go back to one of previous steps…
- Conduct validation of calibrated parameters set using untried dataset.

4. Demo Presentation – VISSIM / Site 15
Exercise - 4. VISSIM / SITE 15 Demo Presentation

VIDEO

Exercise

QUESTIONS or COMMENTS?
Lesson 4

Discussion

4:00 ~ 4:30

Summary

• Emphasized the importance of microscopic simulation model calibration and validation
• Reviewed two commonly used microscopic simulation models, VISSIM and CORSIM
• Provided microscopic calibration and validation Procedure
• Demonstrated calibration and validation can be achieved using a case study of an actuated signalized intersection
Recommendations

• Microscopic traffic simulation models under default parameters shall be used with caution
• Microscopic traffic simulation models should be calibrated and validated before being used for evaluating alternatives
• Microscopic traffic simulation models should be calibrated and validated on the basis of the proposed procedure

Thank you!

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