VALIDATION AND MAINTENANCE OF A 24/7 REAL TIME SIMULATION MODEL

15th TRB Applications Conference
May 18th, 2015
ICMS Innovation

Paradigm shift to more pro-active traffic management method, making use of prediction tools, on-line micro simulation and improved decision support.
Decision Support System Evolution

Response Plan Evaluation

1. Inventory + Prediction
2. Business Rules Engine
3. Event Response Suite
4. Multi Layer Analysis
5. Corridor MOE
6. Recommended Response Plan

{0.00, -13.28, 11.14, 1.19, 7.81, 2.2}

May 18th, 2015
Aimsun Online Architecture

Historical data
- Traffic patterns
- Travel demand

Live data feeds
- Sensor data
- Equipment status
- Traffic events

Aimsun Online
- Demand matching and adjustment
- Analytics and multi-level simulation
- Sensor server and status updater
- Incident detection
- Response plan generation
- Response plan evaluation

Outputs
- Network-wide traffic prediction
- Traffic management plans

Quality manager
Network Prediction System

Historical Data Sets → Speed, Flow and Occupancy Analytical Predictions (every 5 minutes)

Real Time Detector data → Quality Manager

Demand Matrix Adjustments (every 15 minutes) → Microsimulation Predictions (every 5 minutes)

Microsimulation Evaluations (on request) → DataHub
Corridor Performance Needs

- **Measures**
  - Intersection
  - Ramp Meter
  - Express Lanes
  - Sections
  - Transit
  - Routes

- **Targets (within 15%)**
  - 0-15 minutes 92%
  - 15-30 minutes 80%
  - 30-60 minutes 40%
The integrated approach

- I-15 ICM Macro model imported from SANDAG regional model
Data Inputs and Outputs

- Ramps: RMIS
- Freeway: ATMS
- Signals: RAMS
- Travel Time: ATTS
- Weather: Weather
- Events: REMS
- Events: CPS
- Tolling: RTMS
- Transit: DSS

ICMS: Data Hub
### Offline Model Validation

<table>
<thead>
<tr>
<th>MOE Criteria</th>
<th>Calibration Acceptance Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity (Model versus Observed)</strong></td>
<td></td>
</tr>
<tr>
<td>Lane Capacity (veh/hr)</td>
<td>Within 15% for &gt;85%</td>
</tr>
<tr>
<td>Visual Audit</td>
<td>Visual acceptance of bottleneck development to analyst’s satisfaction</td>
</tr>
<tr>
<td><strong>Hourly Traffic Volumes (Model versus Observed)</strong></td>
<td></td>
</tr>
<tr>
<td>&gt;2,000 veh/hr</td>
<td>Within 15% of field flow for &gt;85% of all cases</td>
</tr>
<tr>
<td>750 – 2000 veh/hr</td>
<td>Within 15% of field flow for &gt;75% of all cases</td>
</tr>
<tr>
<td>&lt;750 veh/hr</td>
<td>Within 15% or under 150 veh/hr field flow for &gt;75% of all cases</td>
</tr>
<tr>
<td>Sum of all link flows</td>
<td>Within 5% of sum of all link counts</td>
</tr>
<tr>
<td><strong>System Performance</strong></td>
<td></td>
</tr>
<tr>
<td>Journey Times, Network</td>
<td>Within 15% of observed travel times for &gt;85% of all cases</td>
</tr>
<tr>
<td>Speed Contours</td>
<td>Visually acceptable freeway based speed contour comparison to SANDAG’s satisfaction</td>
</tr>
<tr>
<td>Individual Link Speeds</td>
<td>Visually acceptable speed-flow relationship to SANDAG’s satisfaction</td>
</tr>
<tr>
<td>Bottlenecks</td>
<td>Visually acceptable queuing to SANDAG’s satisfaction</td>
</tr>
</tbody>
</table>
24/7 Model

- 11 Day Patterns
  - Weekdays
  - Holidays
  - Rainy Days
  - Special events

- 15 – Minute data sets
- Runs every 5 minutes

Aimsun Online Dashboard
Maintaining the Model

Reasons for Model Updates

• Change in travel patterns and demands;
• New Infrastructure;
• New ITS systems;
• New Public Transit;
• New Developments;
## Aimsun Online Dashboard

### Computer Info
- **Name:** ICMSAIM07
- **Address:** 10.75.1.71
- **OS:** Windows
- **Version:** 7
- **Bits:** 64
- **Cores:** 32
- **RAM:** 128GB

### Executors
- **10.75.1.59**
- **10.75.1.60**
- **10.75.1.61**
- **10.75.1.62**
- **10.75.1.70**

### Executive Summary
- **Controller**
  - **Uptime:** 42:00:05
  - **Status:** No running tasks
  - **Tasks:** No queuing tasks

- **Sensor Server**
  - **Uptime:** 27:05:03
  - **Status:** Patterns: 11
  - **Real Time:** Mon Jun 02 2014 06:59:00 GMT-0700 (Pacific Daylight Time)
  - **Forecasted:** Mon Jun 02 2014 08:10:00 GMT-0700 (Pacific Daylight Time)

- **Map Server**
  - **Uptime:** 41:59:11
  - **Model:** (Model: Project)
  - **Location:** //10.75.1.58/analysis/Data/SIM/TSS_SANADAG_NETWORK_V8.ang
  - **Model DB:** QMYSQL://root@10.75.1.58:3306/sandag

- **Pattern Matcher**
  - **Uptime:** 42:00:05
  - **Current Pattern:** 1 monday

- **APM Server**
  - **Uptime:** 42:00:05
  - **Status:** Running an Analytical + Simulation process for Mon Jun 02 2014 06:55:00 GMT-0700 (Pacific Daylight Time)

- **Quality Server**
  - **Prediction vs Real:** Mon Jun 02 2014 06:50:00 GMT-0700 (Pacific Daylight Time) QM: 79.014991%
### Status/Progress Tracker

#### TSS: Transport Simulation Systems

**User Actions: License, Help, Quit**

**Computer Info:**
- **Name:** ICMA-M07
- **Address:** 10.75.1.71
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- **Versions:** > 7
- **Bits:** 64
- **Cores:** 32
- **RAM:** 128GB

**Executors:**
- 10.75.1.59
- 10.75.1.60
- 10.75.1.61
- 10.75.1.62
- 10.75.1.70

#### Task Details

<table>
<thead>
<tr>
<th>Pack</th>
<th>Name</th>
<th>Executor</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>6802</td>
<td>Response Plan 0-625918</td>
<td><a href="http://10.75.1.61.9065">http://10.75.1.61.9065</a></td>
<td>Log</td>
</tr>
<tr>
<td>6802</td>
<td>Response Plan 18791-625918</td>
<td><a href="http://10.75.1.62.9065">http://10.75.1.62.9065</a></td>
<td>Finished in 239 seconds</td>
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<tr>
<td>6802</td>
<td>Response Plan 18790-625918</td>
<td><a href="http://10.75.1.70.9065">http://10.75.1.70.9065</a></td>
<td>Finished in 265 seconds</td>
</tr>
<tr>
<td>6802</td>
<td>Response Plan 18792-625918</td>
<td><a href="http://10.75.1.59.9065">http://10.75.1.59.9065</a></td>
<td>Finished in 265 seconds</td>
</tr>
<tr>
<td>6801</td>
<td>Response Plan 0-625929</td>
<td><a href="http://10.75.1.60.9065">http://10.75.1.60.9065</a></td>
<td>Finished in 265 seconds</td>
</tr>
<tr>
<td>6801</td>
<td>Response Plan 18786-625929</td>
<td><a href="http://10.75.1.62.9065">http://10.75.1.62.9065</a></td>
<td>Finished in 261 seconds</td>
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<tr>
<td>6801</td>
<td>Response Plan 18788-625929</td>
<td><a href="http://10.75.1.81.9065">http://10.75.1.81.9065</a></td>
<td>Finished in 272 seconds</td>
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<tr>
<td>6801</td>
<td>Response Plan 18787-625929</td>
<td><a href="http://10.75.1.70.9065">http://10.75.1.70.9065</a></td>
<td>Finished in 241 seconds</td>
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<tr>
<td>6800</td>
<td>Response Plan 18783-625919</td>
<td><a href="http://10.75.1.60.9065">http://10.75.1.60.9065</a></td>
<td>Finished in 257 seconds</td>
</tr>
</tbody>
</table>
Real Time Validation Data

- Speed
- Count (with 15%; R^2; Slope)

<table>
<thead>
<tr>
<th>Simulation Time</th>
<th>Global QM</th>
<th>QM 15 minutes</th>
<th>QM 30 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-05-11T15:05:00.000Z</td>
<td>68.034359</td>
<td>66.187873</td>
<td>74.41322</td>
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<tr>
<td>2015-05-11T15:00:00.000Z</td>
<td>66.058729</td>
<td>62.885971</td>
<td>70.875246</td>
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<tr>
<td>2015-05-11T14:55:00.000Z</td>
<td>66.479892</td>
<td>61.04637</td>
<td>66.763813</td>
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<tr>
<td>2015-05-11T14:50:00.000Z</td>
<td>67.594314</td>
<td>66.812881</td>
<td>67.1158</td>
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<tr>
<td>2015-05-11T14:45:00.000Z</td>
<td>66.077082</td>
<td>67.866841</td>
<td>64.101629</td>
</tr>
</tbody>
</table>
Speed Contours

Real Data VS Predicted Data
Real Time VDS Tracking

- Sensor Server – Live Detector Quality

243906

Forecasted Data

May 18th, 2015
Questions

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