A Guide on Traffic Analysis Tools
1. PURPOSE

The Massachusetts Department of Transportation, Highway Division (MassDOT Highway Division) has prepared a guide on Traffic Analysis Tools to assist Transportation Engineers, Planners, and Designers in the analysis of intersection and corridor operations. This Guide serves dual purposes: first, to identify programs that are approved traffic analysis tools and second, to provide a standard for the parameters for uniform and accurate applications.

The intention of this Guide is not to address all of the features of analysis tools. Instead, this Guide focuses on some of the key input parameters used in each of the tools.

2. APPROVED LIST OF TRAFFIC ANALYSIS TOOLS

The following table summarizes the MassDOT Highway Division’s approved traffic analysis tools. Due to the nature of software development, companies may release new versions of their product that may be adopted by the MassDOT Highway Division as resources permit. Therefore, this list will be periodically updated as needed and the Designer is responsible for monitoring the MassDOT Highway Division web site to review and update accordingly. In addition to the programs listed below, The Designer may utilize other software programs as long as it supports the 95th percentile maximum back of queue (based on the Highway Capacity Manual methodologies). Use of other programs shall be pre-approved in writing by the State Traffic Engineer.

**Approved Traffic Analysis Tools**

<table>
<thead>
<tr>
<th>Program</th>
<th>Unsignalized Analysis</th>
<th>Signalized Analysis</th>
<th>Roundabout Analysis</th>
<th>Signal Optimization</th>
<th>Network Analysis</th>
<th>Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCS 2010 Ver. 6.1</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Synchro Ver. 8.0</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>SIDRA Intersection Ver. 5.1</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Transyt-7F Release 11.32</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>SimTraffic Ver. 8.0</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>TSIS-CORSIM Ver. 6.0</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>GDOT Roundabout Analysis Tool</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>VISSIM Ver. 5.40</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

For more information refer to the FHWA Traffic Analysis Toolbox
In some situations certain programs are preferred. For example, SIDRA is preferred when analyzing a single lane roundabout and VISSIM when analyzing a multilane roundabout. In addition, Synchro is preferred for signalized intersections when upstream bottlenecks exist and SimTraffic is when queuing and blocking problems exist.

3. INPUT PARAMETERS

All of the approved traffic analysis tools have input parameters consisting of type of operation, geometric conditions, traffic conditions, and field observations. The Designer shall field verify the input parameters before entering them into the software. It is crucial that this information be accurate before proceeding with the analysis.

These parameters include but are not limited to the following:

<table>
<thead>
<tr>
<th>1. Type of Operation/Module/Roadway:</th>
<th>2. Geometric Conditions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Freeway</td>
<td>i. Number and width of lanes</td>
</tr>
<tr>
<td>ii. Weaving</td>
<td>ii. Roadway Grades</td>
</tr>
<tr>
<td>iii. Ramps</td>
<td>iii. Lane Use including parking lanes</td>
</tr>
<tr>
<td>iv. Multi-lane Highway</td>
<td>iv. Node Coordinates</td>
</tr>
<tr>
<td>v. Two-lane Highway</td>
<td>v. Lane Channelization</td>
</tr>
<tr>
<td>vi. Signalized Intersections</td>
<td>vi. Link Free Flow Speed</td>
</tr>
<tr>
<td>vii. Unsignalized Intersections</td>
<td>vii. Link Length</td>
</tr>
<tr>
<td>viii. Arterials</td>
<td>viii. Length of Turn Bays</td>
</tr>
<tr>
<td>ix. Transit and Pedestrians</td>
<td>ix. Lane Drop Locations</td>
</tr>
<tr>
<td></td>
<td>x. Lane Add Locations</td>
</tr>
<tr>
<td></td>
<td>xi. Lane Connection information</td>
</tr>
</tbody>
</table>

3. Traffic Conditions:
   i. Approach Volumes
   ii. Vehicle Types
   iii. Location of Bus Stops
   iv. Pedestrian Crossing Flows
   v. Parking Movement
   vi. Origin-Destination information
   vii. Vehicle Performance

4. Field Observations/Data:
   i. Queues
   ii. Weave Zones
   iii. Lane Usage
   iv. Reaction Points
   v. Spillback
   vi. Delays

Key Input Parameters

The following parameters are required to accurately populate the model and realistically reflect network conditions. Program default values shall not be changed unless they are supported by evidence consisting of documented field observations or pertinent verified research without prior approval from the District Traffic Engineer. Approved changes shall be documented in the Operational Analysis section of the Functional Design Report.

A. SIDRA Intersection

   When using SIDRA Intersection the model shall have the correct gap acceptance, saturation flow rates, Environmental Factor, and entry and circulating flows.
B. SimTraffic

When using SimTraffic, the network is required to be seeded for a total of 15 minutes and the network shall be simulated for a one-hour duration.

It is critical that the turning lane bay length be accurate in order to properly analyze upstream blocking.

C. Synchro

The standard vehicle length referenced in the Traffic Engineering Guidelines for 25% Design Submission shall be used when developing the Synchro model. In addition, the Designer shall use the correct link speeds, turning speeds, roadway grades, and heavy vehicle percentage.

Synchro analysis does not account for “spill-back” and “lane blocking” in its analysis when analyzing networks that have queuing in the turn bays. Therefore, the Designer shall adjust the proposed design accordingly.

D. VISSIM

Driving Behavior settings shall accurately portray field conditions. This can be accomplished by calculating the existing saturation flow rates (through documented field observations) then developing a network that accurately reflects these rates. Priority rules and/or conflict areas shall be implemented accurately.

4. CALIBRATION

All of the aforementioned inputs can be gathered from field observation including capacity, route choice, and system performance. The roadway system performance can be observed in the field or be obtained through the software analysis tool when the model closely represents the system. Capacity, route choice, and system performance are the outputs of the model that can be calibrated to accurately reflect the network.

When calibrating capacity, especially in a large network with many roads and intersections, global calibration of capacity is done first. This is followed by link-specific fine-tuning. Fine tuning can be accomplished by gathering field data and comparing it to data from the model. Once this data has been collected and compared, the specific parameters can be adjusted for the model capacity to be the same as the field observed capacity.

The drivers’ route choice in the field can vary from the drivers’ route choice in the software. Route choice should also be calibrated to more accurately represent field conditions. Especially when model predicted volumes are different from actual conditions.

System performance calibration can be done by establishing measures of effectiveness
(MOE’s) for both the system and the model and match, if needed, the model’s MOE’s to the system’s MOE’s. Two roadway system parameters are; (1) Freeways: car following sensitivity factor, time to complete lane change, mean free-flow speed, and (2) Arterials: mean discharge headway and spillback probabilities. The Designer shall modify the inputs in the model to properly reflect observed operations.

When analyzing highway ramps, weaving, and merges an analysis tool which accurately reflects the field conditions must be used. If the Designer has used the correct input parameters and the analysis tool simulates an existing condition inaccurately as compared to actual measured field conditions then an alternative analysis tool should be chosen by the Designer and approved by the State Traffic Engineer.

5. FINAL REPORT

The final report shall summarize the MOE’s that were analyzed using the Analysis Tool. When reporting MOE’s for intersections it is critical to include the results for each lane group in the analysis.

Any outputs for delay shall be reported using the Highway Capacity Software (HCS) values.

Any approved changes to the default settings shall be highlighted along with supporting evidence.

6. INFORMATION/FEEDBACK

The MassDOT Highway Division welcomes constructive feedback and suggestions, especially from Designers. Specific questions, comments, or suggestions regarding this guide should be directed to:

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