

# SOFTWARE OVERVIEW

The SimCap User Group intends to address modeling questions related to various levels of capacity analysis software – including deterministic (equation-based) models such as HCS2000 or aaSIDRA, microsimulation models such as VISSIM or CORSIM, and hybrid models such as Synchro/SimTraffic. All models have in common that they are trying to predict the operational performance of a transportation system and are used for Levels-of-Service analyses and planning problems.

## What is Microsimulation?

- Microsimulation is the modeling of individual vehicle movements on a second or subsecond basis for the purpose of assessing the traffic performance of highway and street systems.
- Microsimulation models are stochastic models that simulate traffic behavior based on random distributions of driver behavioral attributes (gap acceptance, vehicle arrivals, car-following, lane changing ...). In this sense they account for the variability of traffic parameters and require multiple simulation runs to arrive at an average estimate of expected operations.

## What are Deterministic Capacity Models?

- Deterministic Capacity Models are macroscopic models that predict aggregate traffic behavior from a set of fixed equations. These models are typically intended for the analysis of individual intersections or freeway segments, but can in some cases also be applied for simple network analysis.
- Deterministic Capacity Models are based on equations that were originally derived from traffic flow theory concepts and/or field observations. The estimates from these models are fixed, so that the same inputs always result in the same outputs.
- These models are typically much easier to use than microsimulation, deliver quicker results and are more easily standardized in their application. However, these models are typically limited to basic or standardized analyses and oftentimes cannot be used to evaluate unconventional geometries.

## Why use models?

- Improve the decision making process: Which projects will be built? What will be their impact?
- Evaluate and prioritize planning/operational alternatives
- Improve design and evaluation time and costs: Less costly than full implementation and/or field experiments
- Reduce disruptions to traffic: Estimates effects prior to project deployment, causing virtually no disruption to existing traffic flow
- Present/market strategies to the public/stakeholders: Animations and graphical displays
- Operate and manage existing roadway capacity: Optimize systems to maximize performance

## What are the limitations of deterministic capacity models?

- Most deterministic methods do not consider effects of adjacent roadways/intersections
- Interactions between travel modes using same facility (e.g. pedestrians at roundabout with Streetcar/Light Rail using roundabout) cannot be evaluated
- Reports density in equivalent passenger cars (heavy vehicles counted more than once in density computation)
- Reports vehicle flows in passenger-car equivalents
- Aggregates queue and delay reporting
- Infamous # / \*

## Some benefits of simulation

- Reports density for actual vehicles
- Reports flows in actual number of vehicles
- Isolates delay reports to street segments
- Reports queues on street segments where vehicles are actually queued
- Can simulate various modes using single facility
- Can model complex and unconventional geometries
- Can model unique driver characteristics

# TYPES OF MODELS

**Sketch-planning tools:** Evaluates projects or alternatives without in-depth traffic engineering analysis. Gives order-of-magnitude estimates of travel demand and traffic operations

**Travel demand models:** O/D, mode choice, route choice, etc for transportation networks.

**Analytical/deterministic tools (HCM-based):** Quickly predicts capacity, density, speed, delay, and queuing on a variety of transportation facilities through time-tested, validated methodologies.

**Traffic signal optimization tools:** Develops optimal signal-phasing and timing plans for isolated signal intersections, arterial streets, or signal networks.

**Macroscopic simulation models:** Based on the deterministic relationships of the flow, speed, and density of the traffic stream. Uses a section-by-section approach rather than tracking individual vehicles.

**Mesoscopic simulation models:** Combines the properties of microscopic and macroscopic models. Measures traffic flow using individual vehicles, but vehicle movements are measured macroscopically (example - average speed on a travel link). Aggregates performance measures.

**Microscopic simulation models:** Simulates movements of individual vehicles based on carfollowing and lane-changing theories. Arrivals are varied using statistical distributions and vehicles are tracked over small time intervals. Vehicles have individual types, driver types, and origin/destinations.

<b>Sketch Planning</b>	<b>Travel Demand</b>	<b>Analytical/Deterministic</b>
IMPACTS SMITE SPASM TEAPAC QuickZone	CUBE/MINUTP EMME/2 QRS II TransCAD TRANSIMS	aaSIDRA HCS TRAFFIX ICU TS/PP
<b>Traffic Optimization</b>	<b>Macroscopic</b>	<b>Mesoscopic</b>
PASSER Synchro TRANSYT-7F SOAP-84 PROGO	BTS TRAF-CORFLO VISTA KRONOS FREQ12	CONTRAM DYNAMIT-P DYNASMART-P MesoTS
<b>Microscopic</b>		
CORSIM/TSIS Paramics SimTraffic VISSIM WATSim		

# MODEL APPLICATIONS

Variables affecting model choice:

- Geographic Scope/Study Area
- Facility Type
- Travel Modes
- Traffic Control/Management Strategies
- Driver Response & Behavior
- Produce Performance Measures (MOEs)
- Cost Effectiveness

	Microscopic	Sketch Planning	Travel Demand	Analytical / Deterministic	Traffic Optimization	Macroscopic	Mesoscopic
PLANNING	NO	YES	YES	POSSIBLE	NO	POSSIBLE	POSSIBLE
DESIGN	YES	NO	POSSIBLE	YES	YES	YES	YES
OPERATIONS / CONSTRUCTION	YES	POSSIBLE	NO	YES	YES	YES	YES

# LINKS AND RESOURCES

## GENERAL RESOURCES

North Carolina Section of ITE, NCSITE

- <http://www.ncsite.org>

FHWA Traffic Analysis Toolbox, Volumes 1-3

- <http://ops.fhwa.dot.gov/trafficanalysistools/toolbox.htm>

Traffic Appraisal in Urban Areas: Highways Agency, Manual for Roads and Bridges, Volume 12, Department for Transport, London, England, United Kingdom

- <http://www.standardsforhighways.co.uk/dmrb/index.htm>

HCM Applications Guide

- <http://hcmguide.com/>

FHWA Roundabout Informational Guide

- <http://www.tfrc.gov/safety/00068.htm>

TRB Highway Capacity & Quality of Service Committee

- [http://trb.org/directory/comm\\_detail.asp?id=1526](http://trb.org/directory/comm_detail.asp?id=1526)

## SOFTWARE PROGRAMS AND DEVELOPERS - SIMULATION

VISSIM - <http://www.ptvamerica.com/vissim.html>

CORSIM - <http://mctrans.ce.ufl.edu/featured/TSIS/Version5/corsim.htm>

AIMSUN - <http://www.aimsun.com/site/>

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## SOFTWARE PROGRAMS AND DEVELOPERS – CAPACITY MODELS

HCS2000/HCS+ - <http://mctrans.ce.ufl.edu/hcs/hcs2000/>

SIDRA - <http://www.sidrasolutions.com/sidra/index.htm>

Synchro - <http://www.trafficware.com/>

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