Homeland Security
Science and Technology

TechNote

U.S. Department of Homeland Security
SAVER
System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions.

Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

For more information on this and other technologies, contact the SAVER Program Support Office.

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Escape Route Modeling Tools

Escape route modeling tools that help identify potential vehicular bottlenecks and determine the most efficient evacuation routes from a city or other highly populated area can be important resources for emergency managers. These computer-based models can quickly provide simple point-to-point routes to use during a hurricane, flood, fire, terrorist act, or other emergency. They can also simulate extensive and complex evacuation networks in a large region to support the development of effective evacuation plans (Figure 1).

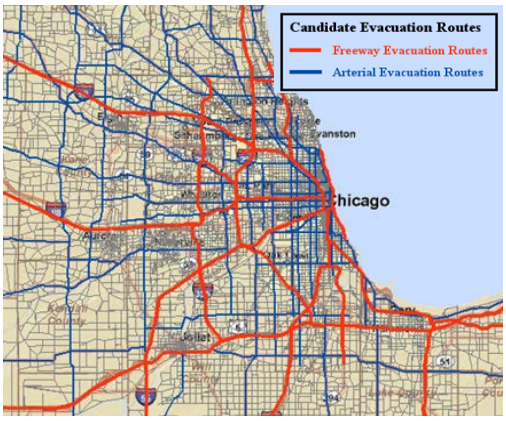

Figure 1. Simulation of extensive and complex evacuation networks in Chicago *(Graphic courtesy of Michael Hope, Argonne National Laboratory)*

Modeling Approaches

In order to develop optimal escape routes with efficient movement of traffic and minimal congestion, escape route modeling software analyzes information about traffic volume and composition, roadway topology, traffic control devices, vehicle performance characteristics, human behavior in emergency situations, and many other factors. There are three basic modeling approaches—macro, meso, and micro— that are distinguished primarily by the size or scale of the geographic area they can model, and by the precision, or level of detail, of the analysis (Figure 2). For any given application, selecting the best modeling approach is a tradeoff between scale and level of detail.

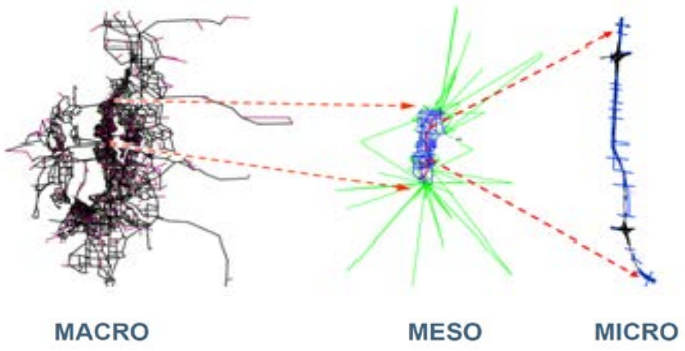

Figure 2. Escape route modeling approaches
(Graphic courtesy U.S. Department of Transportation)

Macro models are appropriate for major incidents such as hurricanes, floods, or nuclear power plant accidents that threaten large geographic areas. These models include the road network in an entire metropolitan area and are capable of estimating traffic congestion on a large scale (e.g., cross-state traffic flows).

Micro models are applied to a segment of road, such as a specific corridor or interchange, and can provide highly detailed information (e.g., estimated number of vehicles in an interchange). Micro models can also accurately describe features including reversible lanes on roadways and street intersections (Figure 3).

Figure 3. SIM TRAFFIC model showing reversible lanes on street intersections
(Graphic courtesy of Trafficware, LLC)

Meso models are intermediate between macro and micro. They can more accurately represent congestion conditions than macro models and yet still cover a larger geographic region than micro models. Meso models can model cross-state traffic flows and emergency traffic patterns.

Applications and Tools

Escape route modeling tools are usually integrated with another type of computer-based software tool, geographic information systems (GIS), which can facilitate the mapping and analysis of information within a geographical area. By employing GIS, the road network, evacuation routes, their feeder routes, and the affected population can be better visualized by emergency planners and managers.

Table 1 shows a few popular modeling tools for simulating vehicle escape routes, which are available through the listed websites. For example, ETIS was used in the Texas and Louisiana Gulf Coast region to assist with the evacuation of almost 400,000 people as Hurricane Lili approached in October 2002. Modeling tools were also used to evaluate a plan for optimal use of contraflow lanes as evacuation routes during Hurricane Katrina in August 2005. To apply the models, users follow instructions to specify the input data, such as road maps, population density, vehicle types and total number, maximum vehicle speed, numbers of lanes on urban streets or freeways, two- or one-way traffic flows, percentage of vehicles turning at each intersection, etc. Model outputs can include a map of vehicle escape routes with traffic flows, and estimates of potential bottlenecks and congestion. Emergency response professionals can learn to use simple escape route tools with minimal training. However, the more sophisticated and complex models require thorough training and practice. Support can usually be obtained from the government agency, academic institution, or commercial vendor supplying the modeling tool.

Approach	Tool Name	Website
MACRO	ETIS	www.fhwaetis.com
	OREMS	www.cta.ornal.gov
	PCDYNEV	www.kldassociates.com
MESO	CUBE AVENUE	www.citilabs.com
	DYNASMART	www.dynasmart.umd.edu
	TRANSIMS	www.transims-opensource.net
MICRO	SIM TRAFFIC	www.trafficware.com
	VISSIM	www.ptvamerica.com
	PARAMICS	www.paramics-online.com

Table 1. Escape Route Modeling Tools

Conclusions

Modeling tools are available to assist in the planning and execution of evacuation operations by establishing a network of vehicle escape routes that optimize evacuation efficiency. In order to select an appropriate model, one needs to consider the tradeoffs between more capability and increased complexity. Complex models require detailed input information, which may not always be available. Model results can vary considerably depending on the quality and quantity of input information.

References

Evacuation Management Operations (EMO) Modeling Assessment: Transportation Modeling Inventory, Oct. 2007, U.S. Department of Transportation, http://www.its.dot.gov/its_publicsafety/emo/

Escape Route Modeling Software Tools Market Survey Report, November 2005, SAVER Report_4190_v5, AEL: 04AP-06-TRAF.