A Framework for Developing and Integrating Effective Routing Strategies Within the Emergency Management Decision Support System for Transit Centers

Anurag Pande, Ph.D., Frances Edwards Ph.D., and Joseph Yu, M.S.

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To most effectively evacuate an urban man-made disaster area, reducing the number of vehicles through transit based evacuation would be ideal.

The terrorist attacks on September 11th, as well as other coordinated attacks on transit centers in Madrid and London, have underscored the importance of evacuation planning to transportation professionals. With computer technology advancement, urban transportation networks can now be simulated with great detail and accuracy. This research aimed to aid in effective evacuation planning for downtown San Jose through a simulation model. Specifically, the objectives of this study were the following:

1. Develop a microscopic simulation model to evaluate the pre- and post-disaster performance of a downtown street network.
2. Find traffic bottlenecks that would impede evacuating private vehicle traffic and emergency vehicle entry.
3. Develop a simulation-based framework for evaluating routing strategies for dispatching emergency-response vehicles into the disaster area and evacuating the general public given existing transportation network conditions.
4. Demonstrate rerouting strategies for vehicles in the event of network link closures.

Study Methods

This report describes the modeling, calibration, and validation of the VISSIM traffic simulation model coded for downtown San Jose (VISSIM is an acronym for the German words "Verkehr in Städten –Simulation" which means traffic in cities simulation model). The network was then used to test various evacuation scenarios to determine evacuation strategies that would be effective in the case of a disaster. The modeled network required a large amount of data on network geometry, signal timings, signal coordination schemes, and turning-movement volumes. Turning-movement counts at intersections were used to assess the differences between observed and simulated counts. For freeways, the simulation model was validated using actual travel time information. Once the base network was validated, various scenarios were tested to estimate vehicle-based evacuation time and travel time of emergency-response vehicles.

Findings

It was found that in the event of coordinated terrorist attacks occurring at four locations in the downtown San Jose area (specified in the disaster scenario): HP Pavilion, IRS Building, State of California Building and Convention Center; Santa Clara Street and Montgomery Street would face severe bottlenecks due to evacuee traffic. Contraflow lanes helped the evacuee traffic (Scenario 2) but traffic incidents potentially resulting from all the chaos could complicate evacuations. If 30% of the evacuee traffic uses transit available at Diridon station (Scenario 3) it would lead to the least travel time for evacuees as well as emergency responders. Nonetheless, the other scenarios were also critical to this study since they provided a response strategy in case the transit station is also affected by the attacks.

MINETA TRANSPORTATION INSTITUTE
MTI

SJSU Research Center
210 N. Fourth St., 4th Fl.
San José, CA 95112

Tel // 408.924.7560
Fax // 408.924.7565

transweb.sjsu.edu

Origin	Base Case[a]	Scenario 1[a,b]	Scenario 2[a,c]	Scenario 3[a,d]
HP Pavilion	11.5	15.6	5.9	8.5
San Jose Convention Center	5.6	5.0	6.0	4.1
IRS building	9.9	9.8	9.7	8.4
State of California Building	7.1	7.1	5.6	6.3

Note:

a Travel times are in minutes

b This scenario involved a traffic incident on Bird Ave. before the I-280 NB onramp

c This was the contraflow lane scenario

d 30% of evacuees in this scenario used transit at Diridon station for evacuation

Policy Recommendations

The investigators recommend that reducing the number of vehicles on the road through public transit ridership would be the optimal approach while leaving area roads uncongested for the emergency response personnel. It underscores the role transit can play in a dense urban setting not only for the commuter traffic but also during an emergency. To alleviate congestion during the attacks, contraflow lanes should be used on Montgomery Street which becomes Bird Ave to help reduce the anticipated traffic.

If public transit at Diridon Station is affected by attacks, contraflow lanes on Montgomery Street could aid in evacuating downtown San Jose.

About the Authors

Anurag Pande is an Assistant Professor of Civil Engineering at Cal Poly State University, San Luis Obispo. In addition, he is the coordinator for the dual degree program in Civil Engineering and City and Regional Planning and an MTI Research Associate.

Frances Edwards, MUP, PhD, CEM, is the director of the Master of Public Administration program and professor of political science at San José State University. She is also deputy director of the National Transportation Security Center at Mineta Transportation Institute, where she teaches emergency management in the Master of Science in Transportation Management program.

Joseph Yu obtained his Bachelor of Science degree in civil engineering from California Polytechnic State University, San Luis Obispo. The focus of his Masters degree research was transportation, specifically, traffic operations and microscopic simulation study. He has completed his advanced degree.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/project/2901.html

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