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NATIONAL TRANSPORTATION SECURITY CENTER OF EXCELLENCE COMMUNICATOR

NTSCOE NATIONAL TRANSPORTATION SECURITY CENTER OF EXCELLENCE

Strengthening surface transportation security today ...
FOR A BETTER TOMORROW

Welcome to the first edition of the *NTSCOE Communicator* - the quarterly newsletter of the National Transportation Security Center of Excellence. The focus of our first newsletter is on *high-speed rail security*. With the passage of the American Recovery and Reinvestment Act of 2009 which included $8 billion for high-speed rail, our country has embarked on a new era of rail transportation. Along with the technical challenges to be faced, there will be a host of new security concerns as high-speed rail grows increasingly economical and attractive to greater numbers of commuters and travelers. Collaborative research among three NTSCOE institutions – the Mineta Transportation Institute at San Jose State University; the Center for Transportation Safety, Security and Risk at Rutgers University; and the Center for Resilient Transportation Infrastructure at the University of Connecticut – is focused on collection of data and development of risk-based models to address new security concerns associated with high-speed rail operations.

NTSCOE-Strengthening High Speed Rail Security

Lessons Learned – Security and Safety Practices for High-Speed Rail

The United States is a relative novice in high-speed passenger rail operations. Research into the unique safety and security challenges faced by high-speed rail system design, construction, and operation is needed to address these issues at the appropriate time and place in the start-up and operational processes. High-speed rail systems in Europe and Asia have been operating for decades, and have learned a great deal about security and safety through research as well as the experiences of a very few but, nonetheless, tragic incidents. By reviewing empirical data on these incidents, researchers with the Mineta Transportation Institute (MTI) at San Jose State University can prioritize the vulnerabilities of high-speed rail and identify safety and security centric international benchmarks and best practices for the design, construction, and operation of new systems. MTI has also established a National High-Speed Rail Policy Center that is working on a number of other research and information technology transfer projects. Since its inception the center has completed 8 projects, with 4 in development, specifically focused on high-speed rail issues while approximately 40 additional initiatives address components of high-speed rail corridor design, development, or operations.

The relationship between high-speed rail corridors and contiguous critical infrastructure, as well as a region's response, recovery, and overall resiliency during a manmade or natural disaster, will also be explored in order to identify measures that should be integrated into the development and operation of these corridors.

In this jointly funded (DHS/DOT) project, MTI researchers are examining selected systems that represent some of the largest, oldest, newest, and most complex high-speed rail operations in the world. Their efforts will examine practices and technologies successfully implemented in European and Asian high-speed railroads to improve overall system security and safety as well as the sub-components of operations, communications and signaling, right-of-way, traction power, bridges and tunnels, stations, train sets and information technology that may be applicable to U.S.-based high-speed rail systems. MTI researchers will also compare and contrast security and safety practices of international and domestic high-speed rail systems with those of some non-high-speed regional and intercity rail operations.

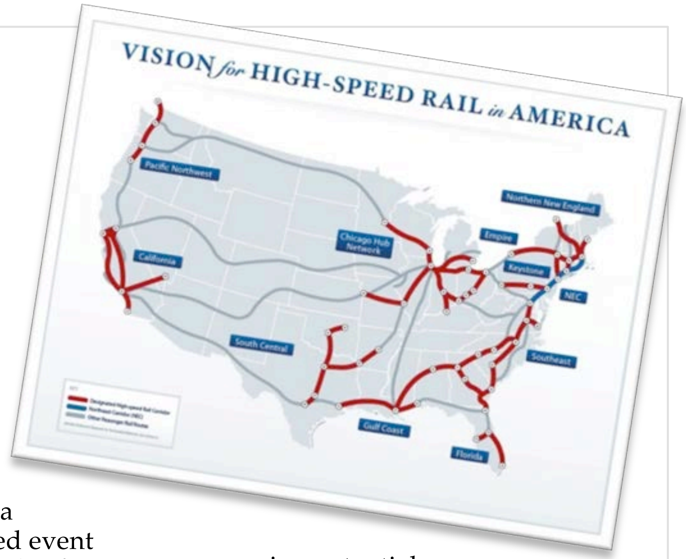
In 2009, MTI began to compile previous reports and information from all known sources on all transportation attacks, including high-speed rail, in a comprehensive database that now includes nearly 3,000 attacks and 80 searchable fields. MTI has recently completed a study, conducted jointly with a French terrorism expert, which explores the history of attacks on rail systems, including the TGV, which can be found at: http://www.transweb.sjsu.edu/MTIportal/research/publications/summary/0607-2.html. The MTI database also provides empirical data that will benefit other NTSCOE partners in their model development and validation processes.

Blended Risk-Based Decision Support Tools

Destructive cascading effects occur when an event at one node or link in a transportation system produces disruptions that ripple across the entire system. In the case of a passenger rail corridor, the impact of a serious terrorist-initiated event could be felt for hundreds of miles along the corridor, spreading out like a wave from the rail line to connected light rail, bus, and highway networks. The issue has grown more urgent as the federal government has advanced plans to build up to 10 high-speed rail corridors in the United States.

Researchers at the Center for Transportation Safety, Security and Risk (CTSSR) are building three distinct hybrid mathematical-simulation models, linking them using a risk analysis framework, and applying them to the passenger rail corridor system in New Jersey. The models will present immediately useful information to managers and serve as a prototype for other passenger rail corridor systems that seek to engage in preemptive planning and investing.

The first is an industrial systems model that simulates the normal operation of a passenger rail corridor at a critical station and then perturbs it with events ranging from normal slowdowns to serious terrorist-initiated events. In the case of terrorist-initiated events, it is prudent to assume the events could occur and then determine how they can be prevented or mitigated. Therefore, the second model builds upon the center's expertise in air plume modeling and posits a hypothetical scenario in which two or three extremely serious events occur at multiple locations in New Jersey. The model will allow CTSSR personnel to



examine potential health impacts on passengers and workers at rail stations, as well as people in the surrounding environment and the transit systems connected to the rail.

By combining models 1 and 2, the researchers can predict the impact of the events in terms of fatalities, injuries, physical damage to assets, environmental effects, and economic impacts. To capture the economic impacts, they are building a computable general equilibrium (CGE) model to simulate the impact of events on the New Jersey economy and then to test plausible scenarios that could prevent the event or reduce the number and/or severity of its impacts.

The Rutgers team faces four major challenges. The first involves problems with data collection, which are complicated by the extreme sensitivity of certain of the data. Second, the models themselves would be invaluable to attackers as well as defenders, so extraordinary security will be critical. Third, in constructing the models, the researchers must balance their desire to ensure the very best theory and data are used, with the need to construct practical models that defenders may use for pre-emptive security and transportation planning. Finally, the three models will not present a complete portrait of the impacts but can be used as a template for others.

Network Vulnerability, Game Theory and High-Speed Rail

Researchers at the Center for Resilient Transportation Infrastructure (CRTI) at the University of Connecticut (UConn) are developing complementary transportation network models – based on game theory – to assess network vulnerability in conjunction with high-speed rail corridors. The vulnerability of a transportation network is strongly correlated with the ability of the network to withstand shocks and disruptions. A robust network with strategic redundancy allows the redistribution or reassignment of traffic without unduly compromising system performance. The introduction of high-speed rail to the network may have profound effects on the transportation network at a local, corridor, and regional scale.

UConn's work seeks to establish a computationally efficient methodology for evaluating the impacts of the addition of high-speed rail to network vulnerability and for the protection of high-speed rail elements once built. Their model will incorporate realistic human factors in traffic decisions through equilibrium assignment methods, create a product that can be deployed in a response as well as planning context, and identify elements of the infrastructure for hardening and/or technology deployment to reduce the risk of disruption and speed the response and recovery time – thereby improving the resilience of the system.

The UConn team has recently made significant progress in introducing congestion into the model specification, in several different forms. They have begun the computational and algorithmic implementations to make this efficient and are working to scale the model and solution methodologies to successfully apply it at a regional scale across multiple modes of transportation (rail and highway). They will continue to improve model structure and algorithmic efficiency, and to further incorporate technology deployment optimization routines to facilitate improved resilience at the design and planning stages of high-speed rail.

From a practical standpoint, the UConn researchers have used their game theory model to identify vulnerable links and to provide graphic outputs to a state Department of Transportation or a transportation engineer or planner. This provides valuable insight into the most critical points in the network that warrant monitoring or strengthening. The intent of their research is to ensure transportation professionals have the information needed to make better decisions in deploying security technology, whether it is sensors or improving the infrastructure by making it stronger.

The NTSCOE – Bringing Multi-layered Security to High-Speed Rail

The collaborative research on high-speed rail at MTI, Rutgers and UConn provides transportation engineers and planners with network level analysis tools to address security concerns at the local, corridor, and regional scales. Additional efforts within the seven NTSCOE partnering institutions are addressing other aspects of security thereby providing our nation with a multi-layered platform for high-speed rail security. These efforts include training of transportation security professionals and first responders; public awareness campaigns; and development of advanced materials and monitoring systems for rail infrastructure.

For more information about the NTSCOE activities, please contact the NTSCOE Program Manager at ntscoe@dhs.gov or visit our website at www.ntscoe.uconn.edu

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