DHS Science and Technology Directorate

Protective Mats

Tunnels are vulnerable targets for explosives

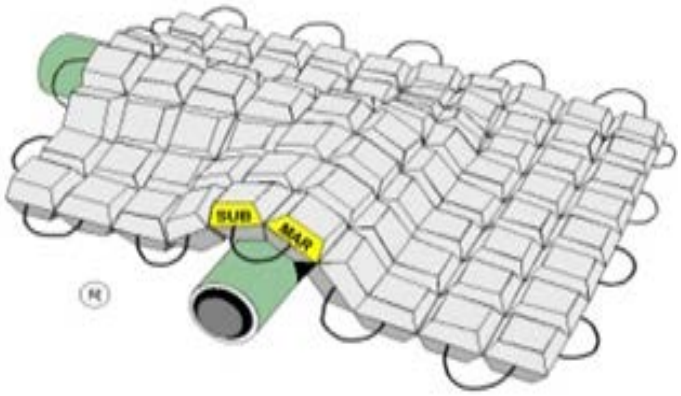
Tunnels are integral to our nation's transportation infrastructure. They provide main routes in and out of a region and can be an attractive target for any attack. Most domestic tunnels were not designed with explosives attacks in mind; however, a well-placed explosive device could have catastrophic results, with flooding as a major concern for underwater tunnels. The Department of Homeland Security (DHS) Science and Technology Directorate (S&T) conducted research to identify ways to reinforce our tunnels and shield them from potential threats. S&T's Protective Measures and Design Tool project developed and tested flexible concrete mats that can be used to protect underwater tunnels.

Protective mats being installed in 2010.

New uses for old ideas

S&T has established a longstanding partnership with a major mass transit agency to protect underwater tunnels in their system. In 2006, S&T initiated an effort at the request of the transit agency to investigate flexible concrete mats, typically used for erosion protection in marine environments, for tunnel protection.

S&T designed and tested the flexible concrete mats to protect transportation tunnels if an underwater, near-surface tunnel is breached. This project was completed in 2009, and the resulting tunnel mat design was transitioned into operational use. This highly innovative and cost-effective solution to tunnel protection adds significantly to existing knowledge of articulated concrete mat design and construction.



.

Depiction showing how the system would cover underwater tunnels.

The mats are designed to be pre-deployed on the river bottom above the tunnels and dropped into place following a tunnel breach to block the inflow of water. The S&T-led project featured: 1) multiple series of scaled experimental tests in a geotechnical centrifuge performed by Rensselaer Polytechnic Institute; and 2) high fidelity computational modeling by Lawrence Livermore National Laboratory.

Successful transition

The project, which represented an S&T investment of approximately $1.5 million over three years, resulted in the transit agency's decision to move forward with construction and deployment of mats for tunnel protection. The transit agency approved a $49 million acquisition program to construct and deploy the mats, and subsequently received $24 million in Transit Security Grant Program funding from the Transportation Security Administration (TSA) and Federal Emergency Management Agency (FEMA) for the project. Deployment of the mats began in November 2010 and was completed in April 2011.

Performers and partners

S&T's project team included the Lawrence Livermore National Laboratory and Rensselaer Polytechnic Institute. Key stakeholders include TSA, FEMA, DHS Office of Infrastructure Protection, and transportation agencies nationwide.

Homeland Security
Science and Technology

To learn more about the Protective Mats project, contact sandt.rsd@hq.dhs.gov.

2014-08-10