Comparative Analysis Reports on Tunnel Security

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9/11 Act Recommendations

- The *Implementing Recommendations of the 9/11 Commission Act of 2007*:
  - Risk Assessments on critical infrastructure and key resources of the United States must be conducted.
  - In addition, a report shall also be prepared on the comprehensive assessments evaluating threat, vulnerability, and consequence.
“Significant” Infrastructures

More than 590,000 Bridges with a 20 Meter Span or More

52 Bridges Originally Identified by TSA

350 Tunnels with greater than 100 Meter Length

20 Tunnels Originally Identified by TSA
Protective Design Center

- What is the Protective Design Center (PDC)?
  - Army's center of expertise for engineering services related to force protection and protective design
  - Located in Omaha Nebraska, Omaha District, Northwestern Division
- Services: wartime threats, secure storage, accidental explosions, classified programs
- Security engineering and protective design
- Perform vulnerability analyses and risk assessments to determine recommended protection, and design of protective structures/systems,
- Write criteria for DoD

Web Page: https://pdc.usace.army.mil
Project Delivery Team

- Department of Homeland Security (DHS) Transportation Security Administration (TSA) Highway and Motor Carrier Branch (HMC)
- USACE Omaha District Protective Design Center
- Black & Veatch Federal Services Division
Bridge and Tunnel Assessment Program for TSA

- **Inter Agency Agreement Signed 24 Jan 2010**
  - 1\textsuperscript{st} Bridge Site Visit conducted: 8 Feb 2010
    - 34 Assessment Reports Completed
    - 5 Assessment Reports in Process
  - 1\textsuperscript{st} Tunnel Site Visit conducted: 15 Nov 2011
    - 9 Assessment Reports Completed
    - 5 Assessment Reports in Process
Bridge and Tunnel Assessment Program for TSA

- **Focus on Antiterrorism**
  - Vulnerability Assessment
  - Risk Analysis
  - Feasible Mitigation Measures (with cost)

- TSA provides interface with bridge owner, schedule, and coordination

- Three steps in process:
  - 1 - Site survey
  - 2 – Risk Assessment
  - 3 – Report to TSA
Step One: Site Survey Assessment

- **Data Collection**
  - Review of available drawings and information
  - Completion of questionnaires
  - Conduct information gathering discussions
  - On-site survey
Step Two: Risk Assessment

- Vulnerability Analysis
  - Identify Threats
  - Identify Vulnerable Components
  - Prioritize using Component Risk Analysis
  - Develop Threat Scenarios

- Risk Reduction
  - Develop Protective Measures
  - Develop Mitigation Measures
  - Mitigated Component Risk Analysis
  - Mitigation Measures Cost Estimates
Risk Analysis Method

\[ R_{ij} = O_{ij} \times V_{ij} \times I_j \]

- \( R \) = Risk for component \( j \) subject to threat \( i \)
- \( O_j \) = (Occurrence) Measure of the relative likelihood of threat \( i \) occurring against component \( j \)
- \( V_{ij} \) = Measure of the relative vulnerability of component \( j \) to threat \( i \)
- \( I_j \) = Importance of an individual component \( j \)

Tunnel Assessment

• Leveraged Best Practices and recommendations from past work. Key studies include:
  • Risk-Based Prioritization of Terrorist Threat Mitigation Measures on Bridges, ASCE
  • TRANSPORTATION SECURITY, Volume 12: Making Transportation Tunnels Safe and Secure, National Cooperative Highway Research Program (NCHRP) REPORT 525, 2006.
  • The “Tunnel vulnerability Assessment Best Practices Guide” by TSWG
  • AASHTO Bridge and Tunnel Blue Ribbon Panel Report
• Developed risk assessment method similar to bridge risk process (look and feel like)
Bridge versus Tunnel Risk Assessment

- **Bridge**: One Risk Assessment
  - **Structure Risk Analysis** Evaluate individual bridge components since loss of life is prevented by protecting the structure (stability)
    - Threats are VBIED, HEIED, NECD, VI, Fire

- **Tunnel**: Two Risk Assessments
  - **Operation Risk Analysis (Closure)** Evaluate tunnel components and systems for “catastrophic damage” (Shut-Down of Operations)
    - Threats are VBIED, HEIED, NECD, VI, Fire
  - **Casualty Risk Analysis (Injury)** Evaluate magnitude of casualties caused by attack (Policy Decision to Shut-Down of Operations)
    - Threats are VBIED, Fire, Chemical
Identify Vulnerable Components

- As recognized during the data collection process

<table>
<thead>
<tr>
<th>Tunnel Structure</th>
<th>Tunnel Utilities</th>
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<tbody>
<tr>
<td>Portal</td>
<td><strong>Ventilation Systems</strong></td>
</tr>
<tr>
<td>Tunnel Shell</td>
<td>Ventilation Building</td>
</tr>
<tr>
<td>Liner</td>
<td>Ventilation Structure</td>
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<tr>
<td>Immersed Tube</td>
<td>Ventilation Shaft or plenums</td>
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<tr>
<td>Cut-and-Cover</td>
<td>Life Safety</td>
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<tr>
<td>Bored or Mined</td>
<td>Drainage</td>
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<tr>
<td>Column or Wall</td>
<td>Fire Protection</td>
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<tr>
<td>Roof Slab</td>
<td><strong>Electrical Systems</strong></td>
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<tr>
<td></td>
<td>Stand-Alone Substation</td>
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<tr>
<td></td>
<td>Exposed Duct bank</td>
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<td></td>
<td>Utility Building</td>
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<tr>
<td>Tunnel Communications, Command and Control Systems</td>
<td></td>
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<tr>
<td>C&amp;C Center Above Tunnel</td>
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<tr>
<td>Stand-Alone C&amp;C Center</td>
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<tr>
<td>Components: CCTV, SCADA, phones, signals, system control, traffic control</td>
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</tbody>
</table>

- Consider key components listed in various industry reports.
  - The “Tunnel vulnerability Assessment Best Practices Guide” by TSWG
  - AASHTO Bridge and Tunnel Blue Rib Panel Rpt
  - Making Transportation Tunnels Safe and Secure, NCHRP REPORT 525, 2006
Step Three: Report to TSA - Highway Motor Carrier Branch

- Individual Site Report
  - Phase Ia: Risk Assessment Tables
  - Phase Ib: Draft Report, USACE Internal Review
  - Phase II: Draft Final Report, TSA / FHWA / Stakeholder Review
  - Final Report shared with Cleared Owner Personnel

- Aggregate Vulnerability Report
  - Two Separate Reports:
    - Bridge
    - Tunnel
  - Trend and Summary Information
  - Developed at completion of individual site reports
  - Classification TBD
Individual Structure Report

- Report Classification is “Secret”
- Executive Summary is “Sensitive Security Information”
- Report Chapters
  - Introduction
  - Methodology & Observations
  - Conclusions & Recommendations
  - Summary
- Appendices
Individual Structure Report (continue)

- Appendices Include:
  - Assessment Information
  - TSA Checklist
  - Risk Analysis and Calculation Details
  - Scenarios / Mitigation Strategies
  - Cost Estimates
  - Report Quality Control Measures
  - Risk Assessment Methodology
Comparative Analysis Report for Tunnels

• Following individual tunnel reports:
  • Identify Highest Risk Components/Threat Combinations
  • Look at:
    • Vulnerabilities by type of structure
    • Existing Security Measures
    • Operational Procedures
    • Mitigation strategies by structure type
    • Effectiveness of proposed mitigation
    • Compare cost of mitigation
Recommendations for Research - Tunnels

• **Vulnerability:**
  - Tunnel structure breech / liner vulnerability
  - Blast damage to ventilation systems
  - Blast propagation

• **Mitigation Materials:**
  - Tunnel hardening – VBIED/HEIED
  - Rapid recovery and repair
  - Flexible ventilation control with damage?
  - Ventilation system design
  - Traffic control and risk management procedures
TSA Program Status

- 9 Reports Complete
- 5 Reports in Process
- 5 States
- Rock, Soft Earth, Cut & Cover, Immersed Tube, Shield Driven, Air Rights Structure
- Length from 825’ to more than 2 miles
- 2 lanes to 9 lances (total in all bores)
- All site visits complete
- All Individual Reports and Comparative Report Complete by early 2016
TSA and USACE Evaluate Attack Scenarios for Highway Tunnels and Bridges

Questions??

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