Educating Engineers for Critical Infrastructure Protection: Addressing a Missing Variable in the Homeland Security Equation

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Design Group Director
Department of Civil and Mechanical Engineering
Your Expertise Needed...

A railroad bridge across the Mississippi in Burlington IA

Political Scientist

Structural Engineer

Hydraulic Engineer

NORTHCOM

Meteorologist

Emergency Manager

Statistician or Actuarial Mathematician

Counter Terrorism

$\$$ Economist

Systems/Network Analyst

serialyouthpastor.com/category/flood-of-2008/
<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Engineer</td>
</tr>
<tr>
<td>2.</td>
<td>Meteorologist</td>
</tr>
<tr>
<td>3.</td>
<td>Systems/Networks</td>
</tr>
<tr>
<td>4.</td>
<td>Economist</td>
</tr>
<tr>
<td>5.</td>
<td>Counter Terrorism/HS</td>
</tr>
<tr>
<td>6.</td>
<td>Statistician</td>
</tr>
<tr>
<td>7.</td>
<td>Emergency Services</td>
</tr>
<tr>
<td>8.</td>
<td>Military</td>
</tr>
<tr>
<td>9.</td>
<td>Political Scientist</td>
</tr>
</tbody>
</table>
Dom Prep 40 survey...
Are engineers well integrated into HS & EM?

- PS/PW well integrated
- Didn't know had role
- Difficult to involve
- Valuable but need NIMS
- Many Engr Involved

Percent
0 10 20 30 40 50
Are engineers well integrated into HS & EM?

1. Many engr. involved but not always & ad hoc
2. Engr valuable to process but need NIMS training
3. Difficult to involve engr
4. Did not know they had role
5. Private sector & public works engr well integrated into public safety planning
Dom Prep 40 vs USMA CE
Are engineers well integrated into HS & EM?

- PS/PW well integrated
- Didn't know had role
- Difficult to involve
- Valuable but need NIMS
- Many Engr Involved

Percent
0 20 40 60 80
<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Task Committee:</td>
<td>13 Civil Engineers</td>
</tr>
<tr>
<td>Summit Attendees:</td>
<td>85% Civil Engineers</td>
</tr>
</tbody>
</table>

Guiding Principles for the Nation’s Critical Infrastructure
TISP represents nearly two million individuals and firms involved in the planning, design, construction, and operation of infrastructure.
Resilience in your last CE degree...

- Not at all
- Conceptually or in passing
- Fully Integrated

Percent
A Survey of Critical Infrastructure Protection
Education in Homeland Security/Defense and
Engineering Programs
Typical HS/HD Courses

- Nature of National Security
- Critical Infrastructure Protection
- Emergency/Disaster Planning
- Government and Policy Making
- Civil Society and Human Rights
- Public-Private Partnerships
- Fundamentals of Terrorism/Threat
- Criminal Justice
- Risk Assessment and Analysis
Where HS/HD Programs Reside

- Public Administration
- Criminal Justice
- Emergency Management
- Law
- Public Health
- Continuing Education
- Other
University of Florida
Center for Infrastructure Protection and Physical Security

- Introduction to Protective Structures
- Advanced Protective Structures
- Retrofit Methods for Protective Structures
- Applied Protective Technology
- Impact Engineering
BACHELOR OF SCIENCE, CIVIL & INFRASTRUCTURE ENGINEERING

Fifth Semester (Fall)
- CEIE 301 Engineering and Economic Models in Civil Engineering (3)
- ENGL 302 Advanced Composition (3)
- ENGR 310 Mechanics of Materials (3)
- CEIE 340 Water Resources Engineering (3)
- PHYS 266 Introduction to Thermodynamics (1)
- CEIE 305 Soil Mechanics (3)

Sixth Semester (Spring)
- CEIE 355 Environmental Engineering and Science (3)
- CEIE 311 Structural Analysis (3)
- CEIE 360 Introduction to Transportation Engineering (3)
- BIOL 377 Applied Ecology (3)
- CEIE 370 Construction Systems (3)

Seventh Semester (Fall)
- CEIE 400 Civil Engineering Planning and Management (3)
- ENGR 401 Professional Practice and Mgmt in Engr (1)
- CEIE 4xx CEIE Technical Elective (3)
- CEIE 4xx CEIE Technical Elective (3)
- **** General Education Course (3)

Eighth Semester (Spring)
- CEIE 490 Senior Design Project (3)
- CEIE 4xx CEIE Technical Elective (3)
- CEIE 4xx CEIE Technical Elective (3)
- CEIE 4xx CEIE Technical Elective (3)
- CEIE 4xx CEIE Technical Elective (3)
BACHELOR OF SCIENCE, CIVIL & INFRASTRUCTURE ENGINEERING

1 CHEM 211 will substitute for CHEM 251

2 Each student must satisfy GE requirements in two of three areas: Arts, Global/International Issues, and Western Civilization/World History. The two GE areas to be satisfied must be approved by the CEIE advisor.

3 A total of six CEIE Technical Elective courses must be selected. The first four must be selected to satisfy a requirement of at least one additional course in four of these five technical areas: **structural engineering** (CEIE 412 or 413), **water resources engineering** (CEIE 440 or 442), **environmental engineering** (CEIE 450, 452, 456), **construction engineering** (CEIE 471, 472) and **transportation engineering** (CEIE 461 or 462). The fifth CEIE Technical Elective course may be selected from any CEIE 4xx course. The sixth CEIE technical Elective course may be selected from any CEIE 4xx course or related advanced science or engineering course approved by the student’s advisor.

The Center for Infrastructure Protection seeks to fully integrate the disciplines of law, policy, and technology for enhancing the security of cyber-networks, physical systems, and economic processes supporting the nation's critical infrastructure.
A Conceptual Framework for Teaching Infrastructure Resiliency
Fundamental Concepts


2. Identify critical components of a complex infrastructure.

3. Define the threats and hazards facing those critical components.

4. Select the level of protection for those components.

5. Design protective systems to achieve the level of protection.
<table>
<thead>
<tr>
<th>Department</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineers</td>
<td>22</td>
</tr>
<tr>
<td>Environ Engineers</td>
<td>2</td>
</tr>
<tr>
<td>Languages</td>
<td>4</td>
</tr>
<tr>
<td>Military History</td>
<td>1</td>
</tr>
<tr>
<td>Math</td>
<td>1</td>
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<tr>
<td>Social Sciences</td>
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</tr>
<tr>
<td>GIS</td>
<td>1</td>
</tr>
<tr>
<td>Arts, Phil, &amp; Lit</td>
<td>1</td>
</tr>
</tbody>
</table>
Concept 2

Modules

History

Concepts 3 & 4
A Conceptual Framework for Teaching Resiliency

- Business Continuity
- Risk Management
- Engineering
- Homeland Defense
- Public Admin
- Homeland Security
- Undergraduate Degree
  - Engineering
  - Social Science
  - Economics
  - Mathematics
  - Sciences
  - History

In one course
A Conceptual Framework for Teaching Resiliency

<table>
<thead>
<tr>
<th></th>
<th><strong>MS in Resilient Engineering</strong></th>
<th><strong>MPA in Resiliency Policy</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1-Strategy</strong></td>
<td>• HS Policy</td>
<td>• Principles of P.A.</td>
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<tr>
<td></td>
<td>• Counter-Terrorism</td>
<td>• HS Policy</td>
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<tr>
<td></td>
<td></td>
<td>• Counter-Terrorism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Emergency Mgmt</td>
</tr>
<tr>
<td><strong>2-Critical Nodes</strong></td>
<td>• Network Analysis</td>
<td>• Network Analysis</td>
</tr>
<tr>
<td><strong>3&amp;4-Threat, Hazards, Protection</strong></td>
<td>• Risk Management</td>
<td>• Risk Management</td>
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<td></td>
<td>• Security Engineering</td>
<td>• Security Engineering</td>
</tr>
<tr>
<td></td>
<td>• Earthquake Engr.</td>
<td>• Continuity of Ops</td>
</tr>
<tr>
<td></td>
<td>• Flood Plain Mgmt</td>
<td>• Disaster Recovery</td>
</tr>
<tr>
<td></td>
<td>• Disaster Recovery</td>
<td></td>
</tr>
<tr>
<td><strong>5-Protective Design</strong></td>
<td>• Protective Design</td>
<td>• Protective concepts and security operations</td>
</tr>
<tr>
<td></td>
<td>• Retrofit Strategies</td>
<td></td>
</tr>
</tbody>
</table>

In two related Master Degrees
Educating Engineers for Critical Infrastructure Resiliency: Addressing a Missing Variable in the Homeland Security Equation

Discussion