The Importance of Transportation

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The Importance of Transportation and Other Infrastructure Density around Vulnerable Sites

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rae.zimmerman@nyu.edu

Other Collaborators:
Henry Willis, RAND

1. Executive Summary ................................................................. Error! Bookmark not defined.
2. Research Accomplishments ...................................................... Error! Bookmark not defined.
2.1. The Importance of Transportation and Other Infrastructure Density Around Vulnerable Sites........ Error!

1.1. Social and economic consequences of a terrorist attack on a vulnerable site can magnify impacts by indirectly damaging nearby critical infrastructure systems. This work extended research conducted in Years 4 and 5 on the implications of proximity and concentration of infrastructure facilities for nearby vulnerable sites. Metrics and models are necessary to approach this problem. This work is applicable to both resource allocation and emergency response, and provides a method of portraying the risks involved in infrastructure interdependencies.

The methodology develops and applies smoothing-based nonparametric probability density estimators to the effect of infrastructure systems on vulnerable sites. An anonymous set of vulnerable sites located in California was drawn from the DHS Buffer Zone Protection Program (BZPP) program was used to illustrate how the methodology developed as part of this research can be applied to resource allocation and emergency response. Other data sets used as part of the research include the location of high hazard dams and Bay Area Rapid Transit (BART) tracks.

The methodology to estimate infrastructure density used in this work can also be applied to the distribution of resources for mutual-aid agreements among counties or other neighboring geographical areas. A high density of infrastructure facilities suggests a greater potential for an
event requiring emergency response to occur and the area of operations for response organizations often extends beyond county and other geographical borders.

Other related research areas focusing on consequences of disabling infrastructure that were published during Year 6 included an analysis of the recovery of transit infrastructure following the September 11, 2001 attacks in New York City and the cost consequences of disabling natural gas transmission and distribution systems, which was a companion piece to costs and consequences of disabling hazardous liquid pipelines completed in Year 4.

2. Research Accomplishments

2.1 The Importance of Transportation and Other Infrastructure Density around Vulnerable Sites

This work extended research conducted in Years 4 and 5 on the implications of proximity and concentration of infrastructure facilities for nearby vulnerable sites. Metrics and models are necessary to approach this problem. This work is applicable to both resource allocation and emergency response, and provides a method of portraying the risks involved in infrastructure interdependencies.

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2.2 Other Critical Infrastructure-Related Research Synergistic with CREATE Research

Other related research areas focusing on consequences of disabling infrastructure that were published during Year 6 included an analysis of the recovery of transit infrastructure following the September 11, 2001 attacks in New York City and the cost consequences of disabling natural gas transmission and distribution systems, which was a companion piece to costs and consequences of disabling hazardous liquid pipelines completed in Year 4.

3. Applied Relevance

3.1 Resource Allocation Based on Proximity of Infrastructure to Vulnerable Targets
The Proximity project (Simonoff, Restrepo, Zimmerman, Naphtali, and Willis (forthcoming in the *Journal of Risk Research*, 2011) enables decision makers to:

- Visualize infrastructure proximity to vulnerable sites
- Rank vulnerable sites according to their proximity to critical infrastructure systems
- Rank counties or other geographical areas with respect to the risk of collateral damage and associated economic and social consequences to high hazard dams (with the methodology transferable to other infrastructure) as a result of an attack on a randomly chosen vulnerable site
- Form meaningful groupings of counties or other geographical areas, which can guide resource allocation and emergency response decisions by highlighting similarities and differences across areas

For example, one can take into account two kinds of variations in considering the relative eligibility of counties for funding: two counties might have an equal amount of nearby infrastructure but one has a larger number of vulnerable sites making that county a stronger candidate for more funding to prevent collateral damage to high hazard dams due to an attack on the vulnerable sites; alternatively, two counties might have an equal number of vulnerable sites, but one county may have more nearby infrastructure than another thus making it a stronger candidate for funding.

4. Collaborative Projects

Various projects – grants obtained - with Polytechnic Institute of New York University (NYUPoly) – synergistic with CREATE mission, but not funded by CREATE:

NYU’s research has also been conducted in collaboration with NYU’s the Center for Catastrophe Preparedness and Response project, “Public Infrastructure Support for Protective Emergency Services,” supported by U.S. DHS but not through CREATE. A major collaborative effort is underway between NYU and the Polytechnic Institute of New York University which merged with NYU in July 2008. The NYU-Wagner members of CREATE received a NYUPoly seed grant which established a cyber security center, Center for Interdisciplinary Studies in Security and Privacy (CRISSP). The Center has already obtained an NSF grant for security education, ASPIRE (A Scholarship for Service (SFS) Program (or Partnership) for Interdisciplinary Research and Education) with NYU/Poly – Computer Science and Electrical Engineering:

R. Zimmerman, Co-Principal Investigator, Integrative Graduate Education and Research Training Program (IGERT) – INSPIRE: Information Security and Privacy: An Interdisciplinary, Research and Education Program, NYU-Poly funded by the National Science Foundation (NSF). Members of the NYU CREATE team are participating: J.S. Simonoff is a senior faculty investigator and C. E. Restrepo as a member of the team.

R. Zimmerman, Co-Principal Investigator, ASPIRE: A Scholars for Service (SFS) Program for Interdisciplinary Research and Education, NYU-Poly, funded by NSF.

CRISSP also conducted a cyber security workshop held in Abu Dhabi: Workshop on Interdisciplinary Studies in Information Security and Privacy (WISSP10), NYUAD, Abu Dhabi, UAE (http://crissp.poly.edu/wissp10/) including a Panel on Digital Security of Critical
Infrastructure. R. Zimmerman of the NYU-CREATE team participated as a panel organizer, moderator, and co-presenter.

### COLLABORATIVE PROJECTS

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<tr>
<th>Project Title</th>
<th>Institution</th>
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<th>CREATE Lead</th>
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<td>Nasir Memon</td>
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<td>ASPIRE: A Scholars for Service (SFS) Program for Interdisciplinary Research and Education</td>
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<td>Zimmerman</td>
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5. **Research Products**

#### Research Products (Please detail below)

| 5a | # of peer-reviewed journal reports published | 2 |
| 5a | # of peer-reviewed journal reports accepted for publication | 1 |
| 5a | # of non-peer reviewed publications and reports | 3 |
| 5a | # of scholarly journal citations of published reports | ~1700 |
| 5b | # of scholarly presentations (conferences, workshops, seminars) | 11 |
| 5b | # of outreach presentations (non-technical groups, general public) | 5 |
| 5c | # of products delivered to DHS, other Federal agencies, or State/Local | 2 |
| 5c | # of patents filed | N/A |
| 5c | # of patents issued | N/A |
| 5c | # of products in commercialization pipeline (products not yet to market) | N/A |
| 5c | # of products introduced to market | N/A |

5.1 Publications and Reports

### CREATE PUBLICATIONS

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5.2 Conference Presentations


6. Education and Outreach Products

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<td># of students graduated</td>
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<td># of contacts with DHS, other Federal agencies, or State/Local (committees)</td>
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<td># of DHS committees served or Congressional testimony provided</td>
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<td># of existing courses modified with new material</td>
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CREATE STUDENTS

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<th>Department</th>
<th>Degree</th>
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</table>

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6.1 New Course Developed:

New graduate level course at the NYU Wagner School, P11.2645 “Planning for Emergencies and Disasters.” Course development funded by a Curricular Development Challenge Fund grant from New York University

6.2 Education/Outreach Presentations:


