URBAN PUBLIC SERVICE RESPONSE AND RECOVERY POST-SEPTEMBER 11TH: PRELIMINARY RESEARCH FINDINGS AND SUMMARY OF A RESEARCH WORKSHOP[1]

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1.0 Introduction

Public services are fundamental to our way of life and our ability to recover in a time of crisis. As a consequence of September 11th, the disabling and in some cases massive destruction of services were felt throughout the immediate vicinity of the World Trade Center, the City, the Region, the Nation and the world. In and around the New York area, the connectivity that these services provide and that are often taken for granted was disrupted. This was captured by McGrath (2001), for example, in the case of transportation who observed that the shutdown of the bridges and tunnels disrupted a pattern of commutation that left people with a sense that they we were "living in someplace new. Its exact boundaries were still unclear, but wherever it was, it had no suburbs."

Public expectations of and protocols for the services that support communication, transportation, and environmental services change over the course of a catastrophe from response through recovery and restoration. These changes are in part reflected in measures of performance or criteria used gage service conditions, levels of service, and changes. This research examines the nature of the public service delivery system before, during and after September 11th in New York City that enabled the system to rebound so effectively in the short-term and will contribute to how it will recover in the long-term. The research hypothesis is that "initial and future resiliency of infrastructure systems depends not only upon their historical design and operation but also the choice of how service performance is measured along a continuum to reflect changing values and differences."[2] The work is largely based on the analysis of secondary data provided by infrastructure management organizations.

2.0 Preliminary Findings

The initial response of much of the infrastructure on the one hand fell victim to the very complex interconnectedness of many of the public services, but on the other hand was able to respond relatively rapidly given the redundancy and flexibility built into the design and operations of the infrastructure.

For example, as reported by Zimmerman (2001) based on observations by Guernsey (2001) among others, interconnectedness of the water system with electrical and telecommunications created the following scenario:

"Water originated from broken distribution lines and from fire fighting and was a major contributor to the destruction of the transportation system (i.e., the flooding of train lines) and the electric power systems, which in turn disrupted telecommunications by incapacitating Verizon's backup generators, AT&T's telephone switching equipment, and the high speed Internet transmissions provided by nearby "telecom hotels"."[3]

Yet, redundancy and flexibility expanded the capacity of public services by taking advantage of bypasses, alternative routes, and temporary portable facilities.[4]

Throughout the few weeks following September 11th, service performance was largely measured in terms of service area delineations - for outages, service restoration, and the like. In addition, measures that used prior conditions as a basis for comparing existing conditions were also used. They reflected very fundamental service expectations rather than sophisticated user preferences. Some examples follow.

2.1 Transportation

It is well known that modes of travel shifted dramatically after September 11th and still have not fully recovered. Shifts occurred locally from automobile and transit to ferries and from air travel to commuter rail.

Moreover, dramatic changes in the flow of traffic along major arteries and crossings were reported by the transportation agencies. Transportation agencies reported dramatic declines in some corridors and dramatic increases in other corridors before and after September 11th. These conditions do not always reflect physical damage to the facilities, but reflect administrative decisions and priority setting.

2.2 Water

Water system disruptions were localized largely to the vicinity of the World Trade Center where about a half dozen water mains broke. The initial objective of the response was to restore pressure in the system to aid firefighting. This was followed by restoration of water to residents and businesses to allow them to return to the area. Finally, water quality became a concern, and water quality testing became a key part of the response effort.

2.3 Electrical and Communications Utilities

As in the case of other services, the extent of outages (e.g., 300,000 customers without phone lines), miles of line destroyed or restored (e.g., Con Edison reported restoring 33 miles of cable), and the area

affected were key measures of performance in the weeks following the attack. These measures will move to critical capacity factors in the months and years it will take to move toward full recovery.

2.4 Debris Removal

The performance of debris removal in the weeks following September 11th were characterized in terms of the loads and tonnage of debris removed for steel and other debris. The rate was dramatic, with well over half of the debris removed within a couple of months, even with an elevating estimate of the total (that total estimated at 1.4 million tons by the end of the year). An analysis conducted in this research of the weekly figures for debris removal through the end of 2001 indicated a steady rate of removal in spite of the many uncertainties the operation faced.

3.0 Some Observations

3.1. The nature of how we deploy our services and the performance of such deployment reflects how we live and our values. For a lot of our infrastructure we have a combination of very long networks for distribution and very centralized production centers. These not only increase vulnerability by increasing the number of points of intervention, but also increase the difficulty of protection.

3.2.The ability to move large numbers of people in a short amount of time underscores the need for sensible mass transit both in times of crisis and times of normalcy. Not only is there a need to rebuild the structures, but also to rebuild confidence in our services.

3.3.As we move forward we must be aware of changes in public expectations as a crises moves from initial response to restoration affect how we view things. And these changing expectations alter the way we look at our services – their performance and the performance of the institutions that manage them.

3.4 Infrastructure risk assessment that quantifies the probability and magnitude of occurrence and the probability and magnitude of consequences that are connected to those occurrences that combines social and economic effects with technological ones is needed to enrich performance measurement approaches in extreme events.

APPENDIX: Report of "Learning from Urban Disasters: National Science Foundation Response and Opportunities for Future Research Workshop," an NSF-funded workshop, December 12-13, 2001. (http://www.nyu.edu/icis/Recovery)

1.0 Introduction

To address the many issues raised by the World Trade Center disaster, including urban infrastructure as well as other topics, NSF awarded Small Grants for Exploratory Research and through the Natural Hazards Center in Boulder, CO, Quick Response grants to obtain information early on that could

disappear later. It was important to bring these entities together to share their experiences and knowledge with one another and with first-line responders in order to move research forward and increase its relevancy to catastrophic events of all kinds. The connectivity of the research community to emergency managers is critical.

Participants came from many disciplines and perspectives. They included engineers, urban planners, geographers, sociologists, political scientists, and academicians from other disciplines. They were located at close to two dozen (21) universities in over a dozen states in all of the regions of the country (Washington, Oregon, California, Arizona, Texas, Ohio, Kentucky, Florida, Georgia, South Carolina, Delaware, Maryland, DC, and New York State).

The workshop agenda was structured around initial summary presentations by the researchers followed by insights from over a dozen government officials and other front-line responders.

Following the Workshop, a group of participants scoped out some preliminary research needs to direct future research. The research topics outlined below reflect the views of workshop participants in a collective setting and are drawn from http://www.nyu.edu/icis/Recovery.

2.0 Preliminary Research Topics Identified

2.1 Social and Human Behavioral Dimensions

2.1.1.Resiliency, Vulnerability and Criticality of Human Systems

- Methods, Models for Assessment
- Direct, Indirect and Ripple Effects
- Risk Factors Affecting Impacts and Outcomes

2.1.2. Relationships and Connections Between Human and Physical (engineered) Systems

- Methods, Models, Data to Characterize Interfaces
- Risk Communication, Pre-Event Planning, Post-Event Response

2.1.3. Institutional Arrangements

- Capability and Adaptability of Institutions to Deal With Vulnerability
- Multi-Agency Dynamics
- Communications and Information Sharing
- Influences on Institutional Behavior

2.1.4. Decision-making and Risk

- Approaches to Characterize Tradeoffs and Decision Processes

- Decision Processes that Provide Linkages Across the Management Cycle

2.2 Structures and Physical Systems

2.2.1.Analytical Models and Simulations

- Performance
- Building Systems
- Emergency Management and Human Response
- Information Flows and Information Sharing
- Overarching need for WTC Data to Validate Models and Simulations

2.2.2. Debris Field and Collateral Damage

2.2.3. Structure of Collapsed Buildings

2.2.4. Environmental Consequences

2.2.5. Distributed Networks - Effect of Network Configuration on Reactions and Responses

2.2.6.Tools for Risk-Informed Decisions

2.2.7.Fragility Curves for Organizational Collapse

2.2.8.Interdependencies Between and Among Infrastructure Systems

2.2.9.Cost/Consequence Models

2.2.10.Damage/Update/Reanalyze for Real Performance Deterioration

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[2] Research statement drawn from R. Zimmerman, "Urban Infrastructure Services in a Time of Crisis: Lessons from September 11th".

[3] R. Zimmerman (2001) "Social Implications of Infrastructure Network Interactions," Journal of Urban Technology, Vol. 8, No. 3, p. 100.

[4] R. Zimmerman (2001) "Social Implications of Infrastructure Network Interactions," Journal of Urban Technology, Vol. 8, No. 3, p. 105.