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EFFECTS OF CATASTROPHIC EVENTS ON TRANSPORTATION SYSTEM MANAGEMENT AND OPERATIONS

Executive Summary of the August 2003 Northeast Blackout Great Lakes and New York City

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Prepared for

U.S. Department of Transportation
ITS Joint Program Office
and
Federal Highway Administration
Office of Transportation Operations

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Executive Summary

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Executive Summary:

Introduction

On Thursday, August 14, 2003, a series of seemingly small events, happening in concert, produced the largest blackout in American history. . Shortly after 2:00 p.m. on August 14, a brush fire caused a transmission line south of Columbus, Ohio, to go out of service. At 3:05 p.m. and at 3:32 p.m., two separate transmission lines in Northern Ohio failed. Over the next 30 minutes, five additional transmission lines in Ohio and Michigan failed. At 4:10 p.m., the electrical system connecting the region south of the Great Lakes, including the cities of Cleveland, Ohio, and Detroit, Mich., to New York and New Jersey experienced a profound failure due, in large part, to the sudden vulnerability of the transmission system. A cascading effect occurred, in which lines sequentially overloaded and then failed, leaving a swath of 3,700 miles – including portions of Vermont, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Ohio, Michigan, and the Maritime provinces – in the dark.

Blackout, New York City Metropolitan Area

When the blackout rolled through the New York City Metropolitan Area at approximately 4:11 p.m. on August 14, the region's rail systems ground to a halt and the roadway systems became heavily congested. All of New York City's 11,600 signalized intersections lost power. Every one of the 413 train sets operating throughout the New York City Transit (NYC Transit) subway system stopped, stranding over 400,000 passengers. The extensive commuter rail network serving New York, northern New Jersey, and southern Connecticut also ceased to function. Agency personnel were confronted with an emergency situation of unknown origin or duration. The table below provides a few of the key decisions made in the first few minutes after the onset of the event.

Key Decisions by Agency on and after August 14

Agency	Key Decisions, Coordination, and Communications
INFORM	Implemented emergency management procedures. Expanded hours of operation for highway emergency local patrols.
Joint Transportation Operation Center – NYPD, NYC DOT, NYS DOT	NYPD reassigned approximately 2,000 traffic agents to begin directing traffic.
Metropolitan Transportation Authority Bridges and Tunnels	Switched to backup generator power and continued to operate. Reversed lanes in crossings to accommodate buses returning to Manhattan. Suspended outbound tolls.
New Jersey DOT Traffic Operations Center-North	Initially lost power but within an hour was displaying highway advisories on its VMS system.
New Jersey Transit	Implemented its established non-communications plan. Established a bus "bridge" to replace the Hoboken light rail system. Started a "load and go" operation from the Port Authority Bus Terminal to the Meadowlands.

New York City Transit - Bus	Started a shuttle service from Penn Station to the Long Island Rail Road station at Jamaica. Sent buses to major subway stations. Suspended fares.
New York City Transit - Paratransit	Continued operations and prioritized patrons needing life-sustaining services.
New York City Transit - Subway	Began the process of evacuating the 400,000 passengers onboard the subway trains by 4:20 p.m.
Port Authority of New York and New Jersey	Activated the Emergency Operations Center. Closed or restricted access to facilities that had lost power, including the Port Authority Bus Terminal.
Port Authority Trans-Hudson Corporation	Identified the location of its 19 en-route trains and then shut down the system and evacuated at 4:30 p.m.
TRANSCOM	Issued facility status bulletins by fax, email, and phone.

Blackout, Great Lakes Area

The blackout hit Detroit at approximately 4:00 p.m., just at the beginning of rush hour and lasted through much of the weekend. Power in some areas was restored as early as Thursday evening and in most areas by Saturday night.

Key Decisions by Agency on and after August 14: Detroit

Agency	Key Decisions, Coordination, and Communications
Ambassador Bridge	Used existing backup power to maintain Bridge operations throughout the duration of the blackout.
Detroit–Windsor Truck Ferry	Continued operations with reduced communications capabilities, processing documentation by hand rather than electronically. Suspending on-line reservation and advanced notification systems.
Detroit–Windsor Tunnel	Used pre-planned emergency protocol to close and evacuate the Tunnel within 15 minutes of the blackout.
Michigan DOT	Powered down all network operations to prevent the system from crashing. Communicated with the Governor's office by telephone.
Michigan ITS (MITS) Center	Ceased regular operations in order to reserve staff members for activities associated with the restoration of power.
Oakland County Emergency Operations Center	Opened and remained operational through the outage, supporting an area consortium of police, fire, and other responders. Distributed generators, managed water supplies, and relocated 120 critical patients to hospitals with backup power.
Road Commission for Oakland County	Prioritized intersections for use of portable generators.
Suburban Mobility Authority for Regional Transportation	Maintained operations throughout the first day of the blackout. Suspended general service during the second day due to loss of communications equipment, but continued service to priority paratransit customers. Loaned vehicles to area fire departments for use as public cooling stations.

At 4:10 p.m. on Thursday, August 14, the Beaver-Davis Besse electrical transmission line, which carries power between the Cleveland and Toledo areas, disconnected, leaving Cleveland without

power. Approximately 1 million residents in the Cleveland area immediately lost power. Cleveland then remained in the dark for over 24 hours, affecting transportation, public health, and public safety. By early evening on Saturday, August 16, full power returned to the Cleveland area.

Key Decisions by Agency on and after August 14: Cleveland

Agency	Key Decisions, Coordination, and Communications
City of Cleveland	Dispatched auxiliary police to assist with traffic management.
Cleveland Office of Emergency Preparedness	Helped to supply fuel to emergency and other types of public vehicles.
Cuyahoga County Emergency Services	Coordinated the transportation of supplies of emergency water from elsewhere in Ohio to Cuyahoga County.
Greater Cleveland Regional Transit Authority	Evacuated all light rail vehicles and transported passengers to waiting buses. Restored service in time for evening rush hour on August 15.
Ohio DOT	Provided some incident management services with the aid of backup generators.
Ohio Turnpike Commission	Maintained major operations on toll road and in service areas, including electronic fare calculation, fare collection, and fuel sales. Ceased operations of a few pre-designated functions, such as vendor kitchen areas.

Findings

Catastrophic events present transportation officials with a different set of challenges for response and recovery. This section answers questions about the ways in which transportation agencies responded to the blackout and what lessons were learned.

Guiding Priorities

During any catastrophe, there is always uncertainty over exactly what is happening, and priorities are established and modified as the incident unfolds and more knowledge is gained. The initial guiding priority in every emergency is the protection of life, but actions taken under this priority vary considerably. While police, fire, and other emergency responders have the primary task of ensuring public safety and resolving any dangerous conditions, transportation officials must also immediately coordinate with these responders to ensure that their needs are being met. The challenge that transportation officials face during an emergency is how and when to begin restoring the level of mobility that existed prior to the event.

Plan of Action

In order to properly respond to a catastrophic event, transportation agencies need to have a plan of action in place to handle both the emergency situation and the process of restoration once the immediate crisis is over. The actions needed are grouped into six topics.

- **Advanced preparation and planning**

The need for advance preparation and planning by agencies is crucial to the safe and effective management of the transportation network. Following the experiences of Y2K and September 11, 2001, many of the agencies confronting the 2003 blackout had developed emergency response plans that proved valuable during the hours of the blackout. Emergency preparation can include everything from the drafting of an emergency response plan to the stockpiling of certain emergency items to the rehearsal of particular crisis scenarios, all in the service of planning and training for an actual emergency.

Emergencies happen without warning, and it is critical to be able to rely on agency staff at all levels to make good and timely decisions, even if they lack complete knowledge of all of the mitigating circumstances. It is vital that emergency response plans make it possible for agency staff members to know their responsibilities in an emergency and to easily and quickly step into their assigned roles, with a minimum of confusion and wasted time. To maintain a state of readiness, it is important for an agency to conduct emergency response drills for its employees and to work in cooperation with other agencies.

- **Institutional coordination (both internal and external)**

The response to catastrophic events usually requires participation by federal, state, regional, and local jurisdictions and agencies, and representatives of these entities must coordinate their actions in order to respond effectively. Internally, transportation agencies need pre-established plans but externally, transportation agency personnel must know the functions and capabilities of other transportation and non-transportation agencies and understand the delineation of authority among the agencies. Pre-established relationships developed during day-to-day coordination are key for allowing agency staff to identify the correct person to contact and interact with during an emergency. Coordination among agencies should be an ongoing activity and continually reassessed, particularly after a serious incident. Furthermore, agency personnel must know how to provide the media and the public with accurate and timely information.

- **Operating decisions**

Agency managers may have to make a number of difficult operating decisions during a catastrophic event, such as how to fill staffing needs, how to best serve customers under the circumstances, and whether to continue operations at all. Since emergencies come in many different forms and are often difficult to predict, agencies should be prepared to make spontaneous decisions as necessary in case of a crisis. As with prior catastrophic events, the 2003 blackout showed that in some cases, agency managers have determined in advance the degree to which they will continue operations under extreme circumstances.

Training and incident command systems can help prepare and empower day-of-event decision makers. It should be clear who is authorized to make what kinds of decisions under different circumstances, and how decisions should be communicated.

- **Role of advanced technology**

Once a catastrophic event has occurred, advanced technologies and ITS can provide information and assist decision makers in several ways:

- Provide information on decisions regarding when and how to open or restrict facilities

- Provide a mechanism by which information can be transferred to other public and private agencies involved in the response
- Provide a way to inform the public about the status of the transportation system.

Over the last decade, the installed base of ITS technology has grown, and it now plays a larger role in helping managers to operate their systems during both normal times and emergencies. As many agencies discovered during the 2003 blackout, however, advanced technology is vulnerable to the loss of power at any point along the information chain, from equipment in the field to the control centers. As agencies incorporate ITS equipment into their daily operations activities, it is important to identify those parts of the ITS network that should be capable of operating during a blackout or other emergency situation, and allocate capital and operating funds to maintain backup power in those parts of the system.

- **Communications**

The demand for accurate and timely information increases dramatically after an emergency. Often, this increased demand comes at a time when the technology required to provide the needed information is most compromised. The blackout resulted in different failures of communications technology. The plain old telephone system proved to be the most reliable form of communications technology, as cellular phones, cell telephone towers, radio repeaters, and Internet connections failed due to a loss of electrical power.

- **System redundancy and resiliency**

Redundancy, the ability to activate backup systems for critical parts of the system that fail, is extremely important to consider in the development of an emergency response and recovery plan. The backup systems needed in any one emergency are determined by the nature and scope of the particular emergency.

The blackout experience has served to expand the definition of what is meant by redundancy. It highlighted the fact that it may be necessary to have backup centers located physically or virtually outside of the affected region. At a minimum, emergency response planners should consider designing redundancy into emergency response and recovery plans in several areas:

- The regional transportation network
- Agency personnel
- Communications
- Utilities
- Control centers
- Equipment and supplies.

Building redundancy into the system can be expensive and seen as “wasteful spending” in ordinary times. It is always cheaper to have only one of a particular type of infrastructure or system, but the failure of that system can significantly hamper response and recovery efforts. But as seen from examples in both studies, the existence of parallel systems or the rapid implementation of additional service was extremely helpful in restoring the capacity to move people and goods.

Conclusion

Widespread emergencies test the people, procedures, and equipment involved in managing the incidents. While emergencies share certain similar characteristics, each is unique, and from each, new insight can be gained into how to prepare, plan, prioritize, and respond. The past 10 years have seen several large emergency preparation and response efforts - for the Northridge earthquake, the transition to Y2K, the Baltimore rail tunnel fire, September 11, 2001, and the 2003 blackout - and the experience of each is adding to a growing base of knowledge on emergency response and planning.