

Section 9

Lifelines—Field Investigation

Types of Data to Be Collected and Recorded

Attempt to identify primary and secondary impacts of lifeline disruption, e.g., impact on emergency response, effects on other lifelines or on community, etc.

CHECKLIST

Lifelines

In General

If lifeline disruption affected emergency response, refer to Section 12, Emergency Management and Response—Field Investigation, for applicable checklists.

1. What was the impact of dysfunction on lifeline system? On other lifelines?
2. What was impact of dysfunction of the lifeline on the community?
3. Evaluate impact on emergency response—communications, power, and water systems, in particular.
4. Document secondary impacts of a specific lifeline malfunction on other lifelines.

Communications Systems

In General

1. Evaluate transmission and reception performance with emphasis on facilities, transmission lines, towers, etc.
2. Was communication system disrupted? If so, describe extent.

Telephone and Telegraph

1. Evaluate performance of 911 systems.
2. Evaluate radio communications with emphasis on emergency response and critical facilities.
3. Evaluate overloading of network control on system reliability.
4. Evaluate seismic performance of digital switches, with particular emphasis on loss of function due to circuit packs vibrating out of their racks.
5. Evaluate equipment anchorage and bracing systems used to support communications equipment.
6. Evaluate elevated floors in communications facilities and other computer centers.
7. Evaluate performance of optical fiber transmission lines.
8. Evaluate performance of private branch exchanges with emphasis on critical facilities.
9. Evaluate underground services with emphasis on those systems specifically designed to allow for differential earth movements.
10. Document performance of microwave towers and disks.
11. Determine effectiveness of emergency power supplies.
12. Document any pole or line breakage.

Radio and Television

1. Assess anchorages and bracing with emphasis on ability to remain operational. Did building damage affect operability?
2. Evaluate antenna towers. Note heights, foundations, type (guyed or freestanding), and materials.
3. Were emergency power supplies available? What type? Were they used?

Newspapers and Magazines

1. Did printing equipment remain aligned and operable?
2. Describe any damage to stock of printing materials.
3. Was service interrupted or delayed by damage to the building?
4. Note damage to equipment or storage racks.

Electric Power Delivery Systems

Refer to Section 8, Industrial Facilities—Field Investigation, for checklists on fossil fuel and hydroelectric generating plants and on geothermal, gas turbine, and nuclear power plants.

Overhead and Buried Transmission Lines

1. Buried lines:
 - a. Collect damage statistics on a unit length basis that deaggregate data by pipe material, diameter, age, and details of the failure.
 - b. Collect detailed information on soil properties at locations where soil failure has caused pipe damage.
2. Overhead lines:
 - a. Determine whether or not surface faulting or landslides affected towers, poles, or caused sag in conductors.
 - b. Were towers or poles damaged? If so, what is condition of tower members and base connections? How far were poles embedded? In what type of soil?
 - c. Was there any short-circuiting of conductors or damage to insulators?

Substations and Switchyards

1. Check for damaged equipment.
2. Refer to Section 8, Industrial Facilities—Field Investigations; Checklists: In General and Fossil Fuel and Hydroelectric Generating Plants.
3. Control buildings:
 - a. Check electrical equipment, including panelboards.
 - b. Did failure of auxiliary support equipment (such as lighting, heating, or ventilation) cause station to be inoperative?
4. Yard equipment:
 - a. Was there movement of equipment on rails and base pads? What is condition of anchorages?
 - b. Check condition of electrical equipment.

- c. Check condition of ceramic materials. What is impact of flexible and rigid bus on ceramic performance? Evaluate methods to improve earthquake performance of high-voltage ceramic members.
5. Yard structure:
 - a. Were there broken connections or distortion in structure? Cracked footings?
 - b. Was there any soil movement or cracking between footings?

Water Delivery and Treatment/Wastewater Conveyance and Treatment

1. Document water and sewer line breaks, including details of location.
2. Check mechanical and electrical equipment. Note anchorage and bracing, if any.
3. Describe the facility's ability to continue functioning.
4. Inspect piping and containers that store dangerous liquids or chemicals.
5. Document and assess performance of water treatment facilities with emphasis on tanks, control systems, storage of hazardous materials.
6. Document the design and seismic performance of all facilities that contain hazardous materials.
7. If possible, determine construction practices that affect the performance of large, below-grade, liquid holding tanks.
8. Was there any soil liquefaction at site?

Gas and Liquid Fuels

1. Document types of materials and types of joints in pipelines and conduits that crossed fault displacements, or experienced ground shaking, settlement, landslides, or liquefaction.
2. Check for cracked cradles, footings, or distortion in supply structures.

Damage from Fire

1. What was initial cause of fire and its place of origin?
2. Was the water supply system operational for firefighting? Was there an emergency water supply system? Was it used? Was it adequate?
3. Were there combustible materials in building that fed fire and allowed it to spread? Note conditions of wood paneling, plastic accessories, fabric, furniture, and equipment. Note toxic combustion gases, if existent.
4. Note streets adjacent to the building: Did debris or surface ruptures affect accessibility for fire and rescue team operations?
5. Were elevators, stairways, and corridors operable?
6. Note any weather conditions that intensified or mitigated effects of fire, such as dry or rainy season, high winds, and humid or dry conditions.
7. Determine the extent to which firespread affected other floors and areas.
8. What was the availability of firefighting supplies and equipment in the building?

Fire-Resisting Elements

1. Did firewalls and separations between floors maintain their integrity, or did they shatter and permit firespread?

2. Did fire doors work correctly?
3. Was any structural fireproofing present? If so, describe.

Internal Utilities

1. Were emergency electrical power systems or emergency generators available and functional? Were they used? Did they function properly?
2. Was the natural gas supply system equipped with automatic shutoff valve? Did it operate?
3. Describe the effect of utility damage on telephone and communication systems.

Damage from External Water

1. Describe source and cause.
2. What was direction and magnitude of water force?
3. Where appropriate, describe natural environmental conditions and topography in areas adjacent to building.
4. Determine whether water caused damage to foundations, building substructure, or superstructure.
5. Was there any damage from mud and silt?
6. Was there any damage to the building contents, ceilings, carpets, and finishes?

Field Investigation Form—Lifelines

Name of Investigator: _____ Date: _____

Facility Data

Name of facility:

Location:

Lifeline function:

Owner: Contact:

Are drawings available? Yes _____ No _____ Where?

Date constructed:

Strong motion recording instruments present? Yes _____ No _____

Is lifeline contained in a building? Yes _____ No _____

(If yes, Refer to Section 7, Engineered Buildings—Field Investigation, and complete Field Investigation form in addition to this form.)

Lifeline description (capacity and features):

Foundation material:

Site: Slope _____% Level _____

Earthquake Damage

Is lifeline functional? Yes _____ No _____ If no, why not? _____

Estimated time to repair: 1 day _____ 1 week _____ 1 month _____

Complete reconstruction required

Describe damage to:

Lifeline:

Building:

Foundation:

Principal cause of damage (shaking, differential ground surface movement):

Impact of equipment/earthquake damage on facility and system operation:

What was the extent of disruption at this location?

What was the time to restore service?_____ Complete repairs?

Total estimated loss:

Less than 10% 10–50% over 50%

Performance of anchorages:

Does lifeline warrant further investigation? Yes_____ No_____

If yes, why?

Miscellaneous Data

Photos: Yes No Roll #: Frame(s) #:

Cross-reference to Engineered Buildings form (if applicable):

Name of facility: Date:

Use back of this sheet for sketches and additional notes.

Recommendations for Further Research on Lifelines