Disaster Resilience & Transit Asset Management

July 13, 2016

U.S. Department of Transportation
Federal Transit Administration

Agenda

❑ Hurricane Sandy & Disaster Resilience

❑ Incorporating Risk & Hazard Vulnerability in TAM

❑ Hazard Mitigation Benefit Cost Analysis

❑ Discussion Questions

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Hurricane Sandy

Hurricane Sandy

Hurricane Sandy

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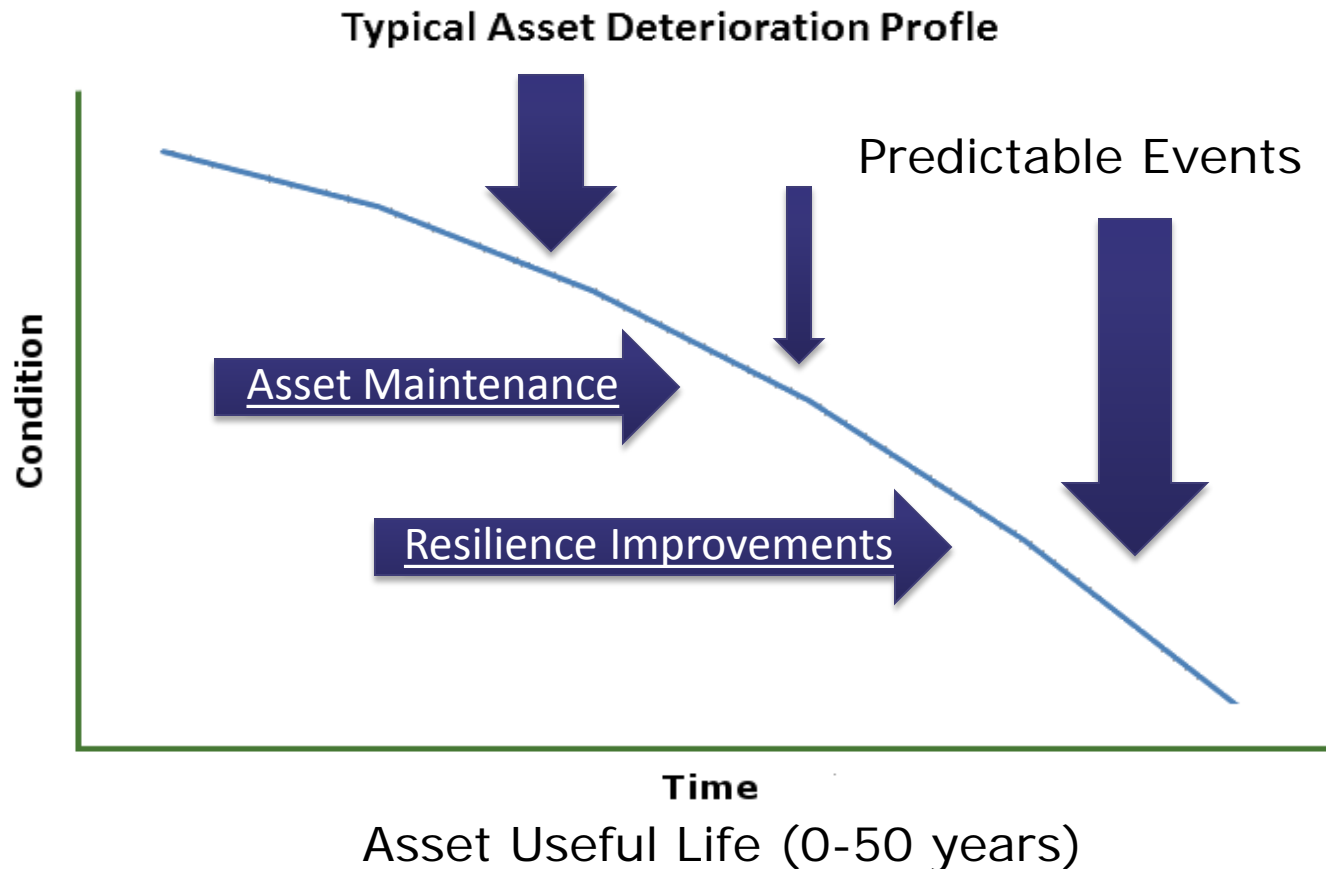
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Risk & Transit Asset Mgmt

- "Risk is the positive or negative effects of uncertainty or variability upon agency objectives"
- Asset Management is fundamentally an exercise in Risk Management
  - Age and Condition affect risk of breakdown, service impacts
  - External factors affect risk related to asset design/location/etc.
- Hazard Risk = Vulnerability x Criticality…
- Given the absence of information, is it worth the effort to plan for unlikely events?

Risk & Transit Asset Mgmt

Typical Asset Deterioration Profle

Predictable Events

Asset Maintenance

Resilience Improvements

Condition

Time

Asset Useful Life (0-50 years)

Natural Hazard Resilience

- Hurricane Sandy: $7.4 Billion in Damage to Transit Systems

- Between 2004-2014, 86 weather-related disasters with over $1 billion in damage
    - Hurricanes, Tropical Storms, Extreme Heat, Winter Storms, Flooding, Landslides, Wildfires, etc.

- Total damages in this period: $557 billion

- Transit systems have suffered from each type of hazard

- <u>Protecting assets from reasonably projected hazards is an asset management requirement</u>

Protective Measures*

* A.k.a., Asset Management Strategies

Protective Measures

Protective Measures

Protective Measures

Resilience in TAM

How can transit agencies incorporate resilience in TAM?

- <u>Inventory of Capital Assets</u>: Include location / elevation / criticality to operations

- <u>Condition Assessment</u>: Overlay floodplain, assess hazard vulnerability based on design/condition

- <u>Decision Support Tools</u>: Apply BCA analysis to ascertain risk-weighted benefits of resilience investments

- <u>Investment Prioritization</u>: Prioritize resilience improvements as part of maintenance/replacement. Add weight for most critical/vulnerable assets and safety.

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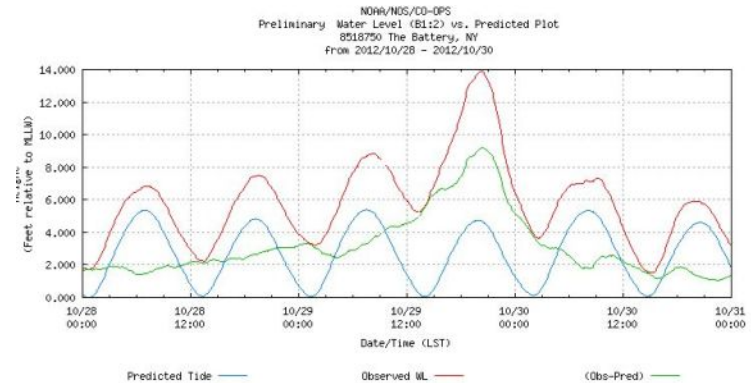
Resilience Benefit Cost Analysis

Hazard Mitigation Cost Effectiveness

❑ Probability-weighted cost-effectiveness analysis for potential resilience projects.

❑ Statistical modeling addresses the uncertainty of disaster recurrence within the infrastructure asset's service lifetime.

❑ Allows for multiple possible disaster magnitudes and damage scenarios.

❑ Purpose is to accurately estimate the value today of protecting an existing or proposed transportation asset.

❑ Analysis is based in part on FEMA's Damage Frequency Assessment Methodology

Resilience Benefit Cost Analysis

Factors for Analysis

- ❑ Asset useful lifetime
- ❑ Cost to replace
- ❑ Vulnerability to Damage
- ❑ Value of Time
- ❑ Disaster Recurrence Interval
- ❑ Multiple Severity Scenarios
- ❑ Sea Level Rise / Increased Frequency
- ❑ Engineering Estimates of Project Effectiveness

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Resilience Benefit Cost Analysis

Costs and Benefits

Costs include:

- ❑ Design & Construction
- ❑ Ongoing Maintenance
- ❑ Operational Expenses
- ❑ Project construction impacts

Benefits include:

- ❑ Reduced cost of repairs
- ❑ Reduced service disruption
- ❑ Temporary service expenses
- ❑ Incremental difference from baseline disaster scenarios

Resilience Benefit Cost Analysis

Available in *BETA* for testing

Flexible Web-Based Tool

- ❑ Any Transportation Asset
- ❑ Any Disaster Scenario
- ❑ Any Resilience Project
- ❑ User-Defined Application

Discussion Questions

- Does your agency track natural-hazard related damages? (including minor events)

- Do you have a policy or process for assessing asset vulnerability / criticality to operations?

- How would your TAM plan treat an asset (linear or fixed) in acceptable condition, but with a known vulnerability to flood damage?

- What other information would a TAM plan require to adequately reflect risk of loss/damage from a natural hazard?

Questions?

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