Flooded Bus Barns and Buckled Rails:
Public Transportation and Climate Change Adaptation

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Federal Transit Administration
August 3, 2011
4 Transit Impacts

↑ Intense Precipitation (very likely, >90%)
- Flooding of track, bus ways, tunnels, lots, facilities
- Landslides

↑ Very Hot Days & Heat Waves (very likely, >90%)
- Track buckling leads to slow order or derail
- Customer comfort issue
- Worker safety issue

Rising Sea Levels (virtually certain, >99%)
- Flooded track, bus ways, tunnels, lots, facilities
- Higher groundwater level floods tunnels

↑ Hurricane Intensity (likely, >66%)
- Flooding from storm surge, rain
- High winds – debris, wind damage
- Transit provision of evacuation service
Climate Impacts Already Occurring

- "When it rains, it pours"
- Note that largest impact is in Northeast, home of some of largest and oldest rail transit systems.

*defined as the heaviest 1 percent of all daily events

Source: Groisman et al as cited in USGCRP 2009.
Nashville Flood, May 2010

Photos courtesy of Nashville MTA

Cumberland River floods MTA property on Nestor Street
Sea Level Rise – San Francisco Bay Area

Blue: Areas that could be inundated by 16 inch sea level rise

Purple: Areas that could be inundated by 55 inches sea level rise

Critical infrastructure at risk
- 99 miles of major road and highway
- 81 schools
- 70 miles of railroad
- 42 healthcare facilities
- 22 wastewater treatment facilities
- 11 fire stations
- 9 police stations
- 5 major ports

Sea-level Rise + Bigger Storms = More Flooding

Boston

Dark blue hashed area = current 100-yr flood zone

Light blue = projected 100-yr flood zone

Source: UCS / NECIA
Rail Buckling
### State of the Practice: Transit & Adaptation

<table>
<thead>
<tr>
<th>Transit Agency</th>
<th>Adaptation Actions</th>
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<tbody>
<tr>
<td>Los Angeles MTA</td>
<td>Conducting climate change risk assessment of assets, to be completed July</td>
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<tr>
<td>New Jersey Transit</td>
<td>Conducting climate change risk assessment of assets, to be completed Oct. Participating in FHWA adaptation pilot</td>
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<tr>
<td>Waves Transit, AL</td>
<td>Part of multi-modal US DOT Gulf Coast Study, Phase II</td>
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<tr>
<td>TriMet</td>
<td>Participating in regional adaptation efforts</td>
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<tr>
<td>Cape Cod Transit</td>
<td>Part of interagency climate change pilot, assessment of sea level rise impacts.</td>
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<tr>
<td>Honolulu Transit</td>
<td>Participating in FHWA adaptation pilot</td>
</tr>
<tr>
<td>King County Metro</td>
<td>Stakeholder in county adaptation efforts, which are at forefront of field</td>
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<tr>
<td>Transport for London</td>
<td>Adaptation included in risk and asset management systems. Adding air conditioning, addressing flooding to existing system. Climate impacts incorporated into design of major project – “Crossrail.”</td>
</tr>
<tr>
<td>Istanbul</td>
<td>New rail link built for 3 ft sea level rise + 1 in 10,000 yr flood</td>
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<tr>
<td>Taipei</td>
<td>After typhoon dumped 50 inches of rain in two days, set new standards for entrances: 2-4’ above ground + 6” above 100 yr flood, tunnel floodgates</td>
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</table>
Kansas City Bus Rapid Transit

Flow - through rain garden in bumpout designed to collect runoff from road and sidewalk.

Trees planted back of curb at higher soil level.

Rain Gardens

Pervious Pavement
Tucson Streetcar
Double-Tiered Shade Structures
Mainstreaming Adaptation into Transit Agency Structures & Processes

- Asset management systems: offer useful framework for incorporating climate adaptation into capital plans and budgets.
- Metropolitan and Statewide Transportation Planning
- Environmental Management Systems
- Environmental Review and Project Development
- Floodplain Assessment
- Real Estate Acquisition and Relinquishment of Assets
- Design and Construction
- Retrofit
- Maintenance
- Emergency Preparedness, Response, and Recovery
- Performance Measures
- Organizational Culture and Budget Priorities
FTA Adaptation Work

- **Report** – released today
- **Pilots** of transit agency adaptation assessments – applications due August 25 (one to focus on asset management systems)
- **FTA Policy Statement** – signed May 2011; explains impact of climate change on state of good repair and safety; commits FTA to taking action

Take away point: Climate adaptation is responsible risk management.

Learn more: [www.fta.dot.gov/sustainability](http://www.fta.dot.gov/sustainability) click on “climate change”

Thank you!

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