Tools / Resources for Considering Climate Change Impacts on the Built Environment

Local Solutions: Northeast Climate Change Preparedness Conference

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Tools/Resources

- **Challenge**: Our systems are designed for a static environment – yet moving forward, stationarity will not hold true

- Processes to identify important pathways of climate impacts on the built environment

- Resources for understanding infrastructure sensitivities to climate-related hazards
General Framework for Climate Assessments

- Criticality
  - Exposure
  - Sensitivity
  - Impact
    - Adaptive Capacity
    - Vulnerability
Impacts on the Built Environment

- Identify *which elements* in the built environment may be susceptible to *what hazards* potentially affected by climate change
- Match time horizons
- Consider non-climate drivers
Conceptualize the System

**Climate Drivers**

- Sea level rise
- Changes in Storm Events
- Changes in Precipitation
- Increased Temperatures

**Hazards**

- Higher High Tides
- Storm Surge
- Increased Runoff / Heavy Precip.
- Drought
- Changes in cloud cover / Increase in solar radiation
- Warmer Temps / Heat Events

**Impacts**

- Flooding of exchanges, manholes, and underground pits
- Damage to infrastructure (transmission lines / towers)
- Power outages
- Potential loss of services
- Lightening disruption
- Soil moisture decrease the stability in structures / foundations
- Large fluctuations in wet/dry spells may cause cracks in foundation
- Degrade cable coverings and lead to outages and service interruptions.
- Power outages (if duration is longer than backup generators capable of supporting)
- Switch failures

**Networks**

- Mobile line network
- Fixed line network
Understanding Today’s Impacts

Identify hazards of concern

- Local National Weather Service office – records of past events
- Newspaper clippings
- Discussions with engineers, operators, etc.

“Quantify” the identified hazards

- Design standards
- Damage functions
- Early warning systems
- Impacts observed during/after past events
- Expert anecdotal evidence/understanding within the system
- Drawing from analysis conducted at similar municipalities
- Urban planning tools (zoning)
- Hazard susceptibility maps
- Old maps
Examples to Identify Thresholds/Relationships

Pavement (design)

<table>
<thead>
<tr>
<th>PERFORMANCE GRADE</th>
<th>PG 46</th>
<th>PG 52</th>
<th>PG 58</th>
<th>PG 64</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34</td>
<td>28</td>
<td>34</td>
<td>16</td>
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<td>40</td>
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<td>46</td>
<td>18</td>
<td>46</td>
<td>16</td>
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<tr>
<td>Average 7-day Maximum Pavement Design Temperature, °C*</td>
<td>&lt;46</td>
<td>&lt;52</td>
<td>&lt;58</td>
<td>&lt;64</td>
</tr>
<tr>
<td>Minimum Pavement Design Temperature, °C*</td>
<td>&gt;-34</td>
<td>&gt;-28</td>
<td>&gt;-34</td>
<td>&gt;-10</td>
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</tbody>
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Flooding of a 1-story house w/out basement (Damage Function)
Considering Future Impacts

Using the key thresholds/relationships, consider how the exposure to these thresholds/relationships may change in the future.

*Where can I easily access future climate information?*
Impacts in the United States

http://nca2014.globalchange.gov/
<table>
<thead>
<tr>
<th>Region</th>
<th>Impact Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast</td>
<td>Communities are affected by heat waves, more extreme precipitation events, and coastal flooding due to sea level rise and storm surge.</td>
</tr>
<tr>
<td>Southeast and Caribbean</td>
<td>Decreased water availability, exacerbated by population growth and land-use change, causes increased competition for water. There are increased risks associated with extreme events such as hurricanes.</td>
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<tr>
<td>Midwest</td>
<td>Longer growing seasons and rising carbon dioxide levels increase yields of some crops, although these benefits have already been offset in some instances by occurrence of extreme events such as heat waves, droughts, and floods.</td>
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<tr>
<td>Great Plains</td>
<td>Rising temperatures lead to increased demand for water and energy and impacts on agricultural practices.</td>
</tr>
<tr>
<td>Southwest</td>
<td>Drought and increased warming foster wildfires and increased competition for scarce water resources for people and ecosystems.</td>
</tr>
</tbody>
</table>

*Melillo et al., 2014*
User-friendly Climate Data Portals

http://www.climatewizard.org/

http://sdwebx.worldbank.org/climateportal
Sea Level Rise and Coastal Flooding Impacts
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

http://www.csc.noaa.gov/slr/viewer/#
Example:

DOT’s Gulf Coast Project, Phase 2
In Sum, Considering Future Impacts

- Use the projections to consider how to the identified hazards/indicators may change in the future
- Also consider are the non-climate stressors that dampen or increase the vulnerability to the hazard
- Consider the planning horizon / infrastructure lifetime
- Actionable in light of uncertainty