Resiliency of Movable Bridges

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H&H

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Agenda

- Introduction
- A Focus on Massachusetts
- Industry Innovations
- Conclusion
Movable Bridge Components
Resiliency

- Extreme Heat
- Sea Rise
- Weather Patterns
- Extreme Storms
- Blast/Collision
- Earthquakes
### Sea Rise-Adjusted Design Flood Elevation (DFE)

<table>
<thead>
<tr>
<th>End of Useful Life</th>
<th>Freeboard Added</th>
<th>Sea Level Rise Adjustment</th>
<th>Total DFE Adjustment</th>
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</thead>
<tbody>
<tr>
<td><strong>Critical Facilities</strong></td>
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<td>2020s (through 2039)</td>
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Source: Climate Ready Boston Report
Movable Bridge Resiliency

- Redundancy
- Protection
- Maintenance
Basic Movable Bridge Types

- BASCULE
- SWING
- VERTICAL LIFT

Photo Credit: MassDOT
Bascule Bridge Resiliency

Redundancy
- Operating Machinery
- Span Locks

Protection
- Counterweight Pits
- Operating Machinery
- Span Locks
- Electrical Equipment

Maintenance
- Climate Control
- Access
  - Trunnions/Pins
  - Span Locks
  - Live Load Bearings
Swing Bridge Resiliency

Redundancy
- Operating Machinery
- End Lifts/Wedges
- Center Wedges

Protection
- Pivot Machinery
  - Rack/Track
  - Pivot Bearing
  - Balance Wheels
  - Rim Bearing Wheels
- End Wedges/Lifts
- Electrical Equipment

Maintenance
- Operating Machinery
- End/Center Wedges
- Pivot Bearing
Vertical-Lift Bridge Resiliency

Redundancy
- Operating Machinery
- Operating Ropes
- Counterweight Ropes

Protection
- Pier Protection
- Span Locks
- Electrical Equipment

Maintenance
- Drive System
- Tower Drive
- Span Drive
- Access
Mother Nature

Photo Credit: John E. Robison, Amherst, Massachusetts

Here we go! #morrisseyblvd #dorchester
Fore River Bridge
QUINCY, MA
MBTA Gloucester
GLOUCESTER, MA
Belden Bly (Fox Hill) Bridge
LYNN, MA
Belden Bly (Fox Hill) Bridge
LYNN, MA

TRUNNION ASSEMBLY RAISED ABOVE WATERWAY
Belden Bly (Fox Hill) Bridge
LYNN, MA

MACHINERY ALSO RAISED ABOVE WATERWAY
Blynman Bridge
GLOUCESTER, MA

- Innovative Configuration Concepts
Blynman Bridge
GLOUCESTER, MA

- Innovative Configuration Concepts
Boca Grande Swing Bridge
GASPARILLA ISLAND, FL
Raritan River Bridge
PERTH AMBOY, NJ
Spuyten Duyvil Bridge
BRONX, NY
Composite Bearings

- Lifetime Self Lubricated
- Eliminates Corrosion Concerns
- Pressures up to 6.5 ksi
Bearing Systems

- STANDARD SPHERICAL BEARING
- SPHERICAL ROLLER THRUST BEARING
Deck-Mounted Span Locks

- Raise Above Flood Levels
- Eases Inspection and Maintenance
Remote Monitoring Systems

- Real-time Data
- Alerts
Conclusion

- Redundancy
- Protection
- Maintenance

Service Life