Gwynn’s Island Bridge – General Information

The Gwynn’s Island Bridge is a swing bridge. Swing bridges have an axis at their center and move by spinning horizontally until the bridge is perpendicular to its previous position, therefore creating two channels through which boats can run, as shown in the photograph below. Swing bridges are rarely built today. Gwynn’s Island Bridge has no detour. If the bridge were to go out of service, island residents would not have an alternate driving route off the island. Also, if the bridge malfunctions in the closed position it would impact the Coast Guard’s response to emergency calls. A schematic diagram of a center-bearing swing bridge is also provided below:

Schematic Diagram of a Typical Center-Pivot Swing Bridge

1. Swing Span (Draw)  
2. Pivot Pier  
3. Rest Pier  
4. Center Bearing  
5. Track  
6. Balance Wheel  
7. Pinion  
8. Rack  
9. Pinion  
10. End Wedges (Extended)  
11. Distribution Framing  
12. Deflected Position (Wedges Withdrawn)  
13. Live Load Wedges

*Schematic and description from FDOT “Bridge Maintenance Reference Manual”*
### Movable Bridges - Major Projects in 30-Year Plan

<table>
<thead>
<tr>
<th>Project Number</th>
<th>Project Description</th>
<th>Start Year in 30-Year Plan</th>
<th>Cost (2018 Dollars)</th>
<th>Reason for Importance/Potential Consequences of Inaction</th>
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<tbody>
<tr>
<td>1</td>
<td>Machinery and Structural Rehabilitation</td>
<td>1</td>
<td>$9M</td>
<td>• Machinery: Required to open and close bridge</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Structural Rehabilitation: Corrosion to beams has inhibited load-carrying ability</td>
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<tr>
<td>2</td>
<td>Electrical Rehabilitation</td>
<td>7</td>
<td>$5M</td>
<td>• Electrical systems are the most vulnerable bridge elements with respect to operational risk</td>
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<tr>
<td>3</td>
<td>Replacement</td>
<td>14</td>
<td>$71M</td>
<td>• Movable bridges are generally expected to last up to 70 years. At over 90 years, the structure will be overdue for replacement, as its components and technology will be completely obsolete.</td>
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</tbody>
</table>

Gwynn’s Island Bridge 30-Year Plan Total in 2018 Dollars: $85M

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**Project #1 - Machinery and Structural Rehabilitation - Start Year 1 in 30-Year Plan**

The machinery used to open and close the bridge is antiquated and in need of immediate upgrade, as is evident from the photos below.

Structural rehabilitation of steel beams and other support members are required for the safe operation and functionality of the bridge. The bridge is fracture critical, so the loss of a major structural member could lead to collapse of the movable span.

![Gwynn's Island Beam Requiring Replacement](image)

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**Project #2 – Electrical Rehabilitation - Start Year 7 in 30-Year Plan**

Electrical systems are among the most vulnerable to failure on movable bridges, and the Gwynn’s Island Bridge has an antiquated electrical supply system that is in need of upgrade. This project would also include replacement of the submarine cable that is required for power supply.

The photograph to the left shows the a diesel engine that serves as an emergency backup to the electric motor and is clearly in need of replacement.
Gwynn’s Island Bridge: Route 223 over Milford Haven (#7)

Project #3 – Replacement - Start Year 14 in 30-Year Plan

As this movable bridge approaches 95 years old in 2032, it should be replaced. While the bridge is being maintained regularly, there are certain bridge components that simply will need to be replaced or addressed in a very comprehensive manner by the time the bridge approaches age 95. Also, as previously mentioned, the bridge’s superstructure (primary support beams and trusses) is fracture-critical, meaning it provides almost no redundancy in the event of a failure of a critical member. The trusses are also connected with rivets, a 1930s-era fastening technology that provides less resistance to repetitive loading than current methods.

The estimated cost included in the 30 year plan is for replacement of the structure with a new movable bridge. However, there exists a possibility that the bridge could be replaced with a fixed span bridge (non-movable) at a much lower cost (perhaps less than one third the cost of a movable bridge). This would require accommodation with the US Coast Guard Station at Milford Haven. Coast Guard vessels are the primary cause of bridge openings, as they are the first responder for all incidents on Chesapeake Bay. If the Coast Guard facility, or its dock, could be moved to the other side of the bridge, then the need to provide high clearance at the bridge may be reduced as long as lower-clearance craft that moor at Morningstar Marinas can be accommodated. Not only would a fixed-span structure be significantly less expensive to build, it would reduce future maintenance and operations costs and risks for decades into the future. A new fixed-span structure would not be fracture-critical and the new bridge would not be among the VITAL Infrastructure.