



C

Appendix C - Alternatives Considered but Eliminated Technical Memorandum

This page intentionally left blank.

Technical Memo

Date: Monday, August 15, 2016

Project: US 21 (Sea Island Parkway) Harbor River Bridge Replacement (P026862)

Subject: **Alternatives Considered but Eliminated**

The South Carolina Department of Transportation (SCDOT) considered location and design alternatives in the process of developing the reasonable “build” alternatives. During project development, SCDOT considered several alternatives that were eliminated from further review in the environmental assessment (EA). The following technical memo provides details about the considered but eliminated alternatives, determination of whether the alternative addressed the project’s purpose and need, and reason for elimination from further analysis. **Table C-1** provides a summary of the alternatives considered but eliminated from further review.

Table C-1 Summary of alternatives considered but eliminated from further review

Considered alternative	Meets purpose and need?	Reason for elimination
Close and abandon the existing US 21 bridge	No	US 21 bridge provides only vehicle access across Harbor River to Harbor Island, Hunting Island, and Fripp Island.
Replace US 21 bridge on existing alignment	Yes	Closing and detouring traffic is not an option because the US 21 bridge provides the only vehicle access across Harbor River to Harbor Island, Hunting Island, and Fripp Island. Construction of a temporary bridge would be costly and cause project delays.
Rehabilitate the existing swing-span bridge	No	Rehabilitation would not address functional deficiencies of bridge, including travel lane widths. Rehabilitation would also likely require temporary bridge closures, which would block vehicle access on the only route to Harbor Island, Hunting Island, and Fripp Island.
Replace causeway and existing bridge between St. Helena and Harbor Island	Yes	New bridge would cost approximately \$30 million more than proposed reasonable alternatives.
New alignment to the south	Yes	Constructing a causeway and bridge in a new location would likely result in greater environmental impacts than replacing the bridge parallel to its current alignment.
Moveable-span bridge	Yes	Constructing a moveable-span bridge would result in higher construction, operations and maintenance costs, and potential constructability issues.
Tunnel	Yes	Constructing a tunnel under Harbor River would result in higher construction, operations, and maintenance costs, and may have potential constructability issues.

Close and abandon

Closing and abandoning the bridge would avoid impacts to the natural environment; however, this alternative was eliminated from further review because of impacts to the public.

Approximately 4,100 vehicles use the bridge as the only connection between Harbor Island, Hunting Island, Fripp Island and mainland Beaufort County; therefore, closing and abandoning was considered an unacceptable alternative.

Replace on existing alignment

Replacement of the existing bridge on the existing alignment was also considered. The US 21 bridge over Harbor River provides the only vehicle access between St. Helena Island and Harbor Island, Hunting Island, and Fripp Island. US 21 is also a hurricane evacuation route for surrounding communities. Therefore, the existing bridge could not be closed during construction.

A temporary bridge would have to be constructed to accommodate traffic and allow passage of boats to access St. Helena Sound. The temporary bridge would be required to meet USCG vertical and horizontal clearance requirements to accommodate existing boats on Harbor River. Construction of a temporary bridge would take at least 1 year, delaying the project schedule, and resulting in greater project costs. The temporary bridge would also result in comparable, if not greater, impacts to the surrounding environment. Therefore, this alternative, although considered feasible, is not considered prudent and has been eliminated from further consideration.

Rehabilitate existing swing-span bridge

Rehabilitating the existing swing-span bridge was also considered. Rehabilitation includes measures that address the structural condition of the bridge to maintain the carrying capacity rating. This would require extensive inspections, maintenance, and repairs to allow the bridge to be structurally sufficient without posting a vehicle weight limit. Rehabilitation would likely require temporary closures of the bridge, which is not feasible since the bridge provides the only link between mainland Beaufort County and the islands. The rehabilitation measures would also not address the substandard geometry of the bridge deck, including the width of travel lanes and shoulders. In light of the age of and structural condition of the bridge, rehabilitation was eliminated from further review.

Replace causeway and existing bridge between St. Helena Island and Harbor Island

In a letter dated July 1, 2015 (Appendix A of EA), the US Fish and Wildlife Service (USFWS) recommended eliminating the existing causeway and instead constructing a bridge over the salt marsh between St. Helena Island and Harbor Island. The new bridge would be constructed parallel to the existing causeway and bridge, allowing US 21 to remain open to traffic during construction. Once the new bridge was opened, SCDOT would remove the existing US 21 bridge and causeway, exposing approximately 11 acres of salt marsh.

The new bridge would be approximately 13,300 feet long; approximately 130,000 cubic yards of the material from the existing causeway would be removed, transported, and disposed in an offsite location. Construction of this alternative would cost approximately \$30 million more than the preferred build alternative. Greater than 1 acre of salt marsh would likely be filled to construct the new bridge approaches. The new bridge would shade approximately 6 acres of salt marsh. SCDOT considered this alternative, but it was eliminated because of higher design and construction costs.

New alignment to the south

SCDOT considered relocating US 21 to cross the Harbor River south of Ward Creek. This alternative would involve construction of a new 4 to 6 mile long causeway and bridge connecting St. Helena Island to either Hunting Island or Fripp Island. The existing causeway and bridge would be removed. Constructing a causeway and bridge in a new location would likely result in greater environmental impacts than replacing the bridge parallel to its current alignment (approximately 1.4 miles long). Adverse effects would occur to wetlands and navigable waterways.

Moveable-span bridge

SCDOT also considered replacing the existing swing-span bridge with a similar bridge including a moveable main-span. Constructing a moveable-span bridge was eliminated from further review because of the higher construction, operations and maintenance (O&M) costs, and potential constructability issues.

SCDOT evaluated three moveable-span bridge options: a swing-span, a single-leaf bascule, and a double-leaf bascule. Single-leaf bascule bridges are moveable bridges with a single counterweight that balances the leaf during operation. Double-leaf bascule bridges have two smaller leafs compared to a single-leaf bridge, which typically allows for a quicker opening operation to river traffic. However, this requires separate counterweights and operating mechanisms on either side of the bridge, increasing building cost and anticipated maintenance.

Moveable-span bridges are more expensive to construct, operate, and maintain compared to a fixed-span bridge. **Table C-2** provides a comparison of estimated costs to construct, operate, and maintain a fixed-span or moveable bridge on US 21 across the Harbor River. Because of the regular boat traffic on the Harbor River, the moveable-span bridge would require an operator on site 24 hours per day. Moveable-span alternatives also include a substantial repair or maintenance on the span every 20 years. O&M costs for a fixed-span were estimated annually and escalated at 2.5 percent over a 75-year bridge life span. Cost estimates for moveable-span bridge alternatives vary between \$149 million and \$175 million, which are higher than cost estimates for fixed-span alternatives.

Replacing the existing swing-span with a moveable-span parallel to the existing bridge also poses potential challenges because the existing bridge must remain operational during construction. Constructing a new bridge close to the existing bridge would create conflicts when both moveable-spans needed to open simultaneously during construction. A new moveable-span bridge would need to be located far enough from the existing bridge so the two moveable

spans do not conflict. Based on potential constructability concerns and greater costs, constructing a new moveable bridge is not considered prudent and has been eliminated from further consideration.

Table C-2 Comparison of cost estimates for reasonable build alternatives and moveable-span bridge alternatives (\$ millions)

	Fixed-span (Reasonable build alternatives)	Swing-span	Single-leaf bascule	Double-leaf bascule
Construction	55.2 – 59.8	69.8–71.1	55.5–60.6	57.7–62.8
O&M [†]	10.7	104.1	93.5	108.1
Total	65.9 – 70.5	173.9–175.2	149.0–154.1	165.8–170.9

[†] O&M cost estimate assumes 2.5 percent escalation of O&M costs over a 75-year bridge life span.

Tunnel

SCDOT considered replacing the existing bridge with a tunnel under Harbor River to provide for navigation and reduce visual impacts on the surrounding communities. The tunnel would be constructed beneath the Harbor River, with the tunnel openings designed above the anticipated 10-year storm surge. Geotechnical data has not been collected in the potential tunnel area; therefore, it is unknown whether the tunnel would be constructible or structurally feasible. Based on conceptual cost estimates, a 6,250-foot long tunnel would be approximately \$225 to \$310 million to construct. Based on potential constructability concerns and greater construction costs, constructing a tunnel is not considered prudent and has been eliminated from further consideration.