2015 TIGER DISCRETIONARY GRANT APPLICATION

Jonesport-Beals, Maine

BEALS ISLAND BRIDGE

Bridge Number 5500
Federal Project STP-2262(600)
MaineDOT Work Identification Number 22626.00

PROJECT TITLE: Replacement of Beals Island Bridge
Jonesport – Beals, Maine

LEAD APPLICANT: Maine Department of Transportation
TYPE OF ELIGIBLE APPLICANT: State Government
AMOUNT OF TIGER FUNDING REQUESTED: $10.275 Million
DATE OF SUBMITTAL: May 29, 2015

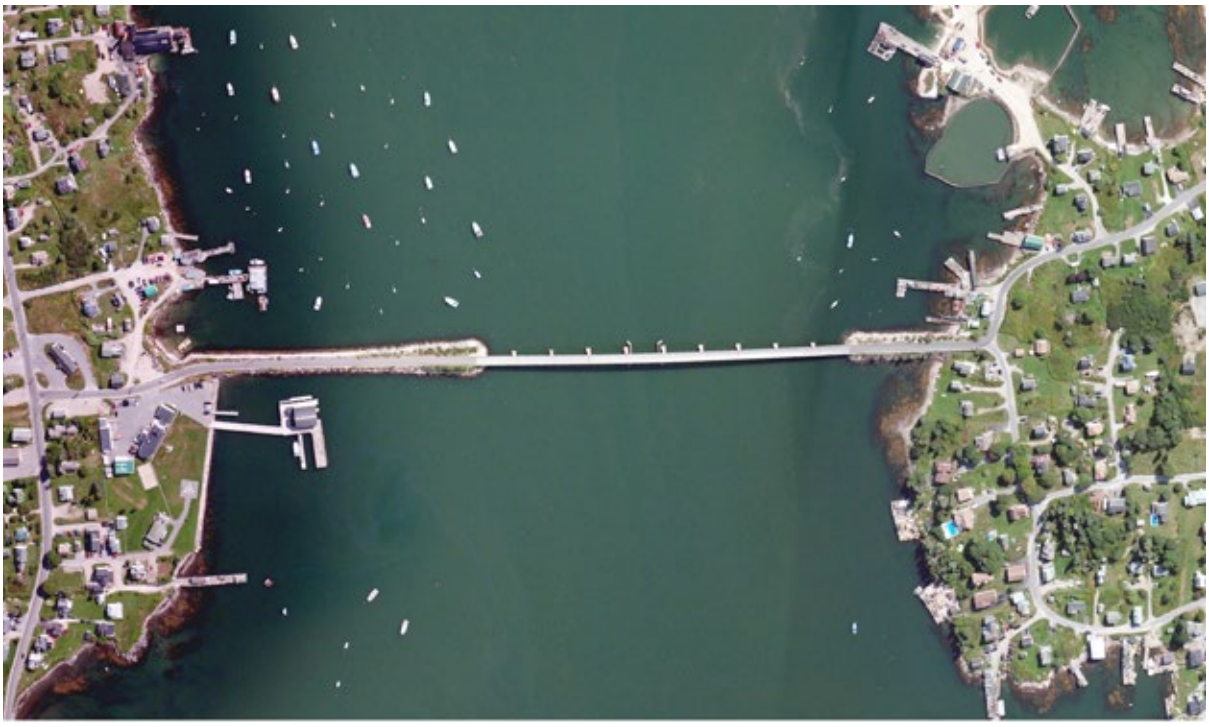
MaineDOT

PROJECT OVERVIEW

Project Name: Beals Island Bridge Replacement
Jonesport - Beals, Maine

Project Begin Location: North 44 degrees, 31 minutes, 32 seconds; West 67 degrees, 36 minutes, 54 seconds

Project End Location: North 44 degrees, 31 minutes, 22 seconds; West 67 degrees, 36 minutes, 51 seconds



Jonesport Beals Island

General Description: Constructed in 1958, Beals Island Bridge carries Bridge Street over Moosabec Reach and is the only crossing that connects the island and Town of Beals with the mainland at Jonesport. The bridge is a 10-span, 1050 foot long, steel girder bridge founded on concrete abutments and piers. The structure has a curb-to-curb bridge width of only 22 feet. The bridge is currently in disrepair with structural deficiencies and inadequate width. The structural condition driving this project involves the steel H-piles that support the piers. These H-piles are uncoated and exposed to sea water. They extend up to forty five feet in height above the ocean floor to support partially submerged concrete pier footings. One H-pile is completely severed and several others have severe section loss. Thick marine growth covering the piles and strong tidal ocean currents contribute to the difficulties of conducting underwater inspections.

MaineDOT has listed Beals Island Bridge as one of thirty-six "Forever Bridges". Construction to replace these high value bridges creates extraordinary impacts to customers and significant funding needs that can severely impact bridge resources. These bridges must last at least 100 years. MaineDOT is committed to utilizing innovative technologies and best practices as recommended by the Strategic Highway Research Program (SHRP 2) to construct and maintain our "Forever Bridges". To help meet these goals, the new structure will be founded on drilled shafts to provide superior resiliency in the aggressive salt water environment.

The proposed bridge project will replace the existing structurally deficient bridge with a 1,062 foot long precast, prestressed concrete Northeast Bulb Tee bridge. The new bridge roadway width will be increased to 28 feet curb-to-curb with 3-bar steel bridge rail. This new roadway, consisting of two 10-foot lanes and 4-foot shoulders, will not only enhance safety for trucks, emergency response vehicles, and school buses, but will create a safe crossing for bicyclists and pedestrians. It is anticipated that the new widened bridge will enhance tourism on the island.

The total cost for replacement together with approach work is estimated at $21.98 million. Less $1.18 million for preliminary engineering and $0.25 million for right-of-way costs; the remaining cost for construction and construction engineering is estimated at $20.55 million. This application request is for $10.275 million (50 percent) in TIGER Discretionary Grant funds to supplement the $10.275 million (50 percent) in existing Non-Federal funds, in order to fully fund construction and construction engineering.

Key Threshold Requirements:

- ✓ Eligible Project: **YES**, Bridge project eligible under Title 23, USC
- ✓ NEPA complete or under way: **YES**
- ✓ Included in relevant planning documents: **YES**
- ✓ Ready to obligate all TIGER Discretionary Grant funds by January, 2017: **YES**
- ✓ Non-Federal match provided: **50%** of the construction and construction engineering costs will be borne by the State of Maine

Additional Project Considerations:

- ✓ The project is multi-modal, providing vehicular, pedestrian, and bicycle access connecting two communities and fostering a quality community environment.

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Project Benefits:

1. Safety
   a) Provides increased shoulder width with pedestrian safe bridge rail height.
   b) Improves access to the Town of Beals for emergency services such as ambulance, police, and fire.

2. State of Good Repair
   a) Replaces a 57 year old bridge at the end of its service life.
   b) Decreases Maine's percentage of Structurally Deficient bridges to a level closer to New England's and National averages (Maine – 15.2 percent; New England – 13.3 percent, U.S. – 10.7 percent).

3. Economic Competitiveness
   a) Provides reliable access and regional mobility for highway traffic to local industries and employers.
   b) Provides a vital link from Route 187 (mainland) to Beals Island.
   c) Enhances an Economically Distressed Area likely to benefit from its short- and long-term economic activity.

4. Quality of Life
   a) Provides four foot shoulders that will provide access for bicycle and pedestrian traffic.
   b) Provides positive visitor impressions.

5. Environmental Sustainability
   a) Minimizes adverse environmental impacts.
   b) Removes the potential risks associated with a failing lead-based paint system.

6. Project Readiness
   a) Included in all applicable State planning documents and the Federal STIP.
   b) The project is currently in the design phase.
   c) The Preliminary Design Report is 100 percent complete.
   d) NEPA is underway.
   e) Ability to obligate funds no later than January, 2017.

7. Innovation
   a) MaineDOT plans to use high performance concrete and corrosion resistant reinforcing bars.
   b) MaineDOT will establish and execute an Operating Plan for this "Forever Bridge" to maximize its service life.

8. Partnership
   a) Completes an overall funding package.
   b) Has documented support from elected officials, local government and industry.

9. Benefit/Cost (3% Discount Rate)
   a) Total Benefits of $ 97.3 million
   b) Avoided Air Quality Impacts valued at $21.8 million
   c) Reduced User Costs estimated at $75.4 million
   d) Avoided Maintenance Costs of $122,000
   e) Total Costs of $19.3 million
   f) Benefit-Cost ratio of 5.1

2015 TIGER DISCRETIONARY GRANT APPLICATION

BEALS ISLAND BRIDGE, JONESPORT-BEALS, MAINE

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- U.S. Senators Collins and King
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- Town of Beals
- Town of Jonesport

Supporting Documents

- TIGER Discretionary Grant Application
- Benefit-Cost Analysis
  - Benefit-Cost Narrative and Analysis
  - Future Rehabilitation Cost Estimate
  - Ferry Worksheet
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- Detailed Cost Estimate
- Project Schedule
- Beals Island Bridge PDR
- Wage Certification
- Economically Distressed Areas Statewide

1. INTRODUCTION

The Town of Beals is predominantly an island fishing village. The island also has beaches, parks and hiking trails that attract tourism. Additionally, it is the home to Downeast Institute, a non-profit organization that creates hatcheries in an effort to rebuild shellfish stocks. Beals Island is connected by the 1,050 foot long Beals Island Bridge, which carries Bridge Street across Moosabec Reach to Jonesport on the mainland. Bridge Street is a rural major collector that joins to State Highway 187 in Jonesport, which in turn connects to U.S. Route 1.

Figure 1: Project Location Map

Beals Island Bridge, constructed in 1958, is currently in general disrepair with structural deficiencies and inadequate width. The composite 7.5 inch thick concrete deck is covered by a 2- inch concrete wearing surface. The wearing surface has moderate to extensive cracking, delaminations, patching and rutting. The bridge deck is in Fair (5) condition, with cracking and patched potholes. The superstructure is also in Fair (5) condition, and consists of four lines of painted steel rolled beam stringers with top and bottom cover plates. The steel girders have moderate pitting and small amounts of section loss. There are scattered areas of paint failure and heavy rusting at splice connections. The nine concrete bridge piers that support the superstructure consist of two-column tapered concrete bents down to partially submerged reinforced concrete footings. The concrete footings are supported by un-coated steel H-piles that are exposed to ocean currents and marine growth. These H-piles are in poor condition with one H-pile that is completely severed, and several others with severe section loss. Due to the current condition of these H-piles and their accelerated rate of deterioration, the National Bridge Inventory (NBI) condition rating for the substructure was recently lowered to Poor (4).

This project proposes constructing a new bridge slightly to the east of the existing bridge in order to: 1) avoid impacts to the United States Coast Guard Station, 2) minimize impacts to the environment and properties, and 3) allow for the maintenance of traffic on the existing bridge during construction. The bridge width will be increased from 22 to 28 feet (curb-to-curb), providing 10 foot lanes and 4 foot shoulders in each direction. The intersection at Bay View Drive in Beals will be designed for improved turning movements. These overall improvements will provide safe passage for vehicles, bicyclists and pedestrians, and will enhance opportunities for tourism.

2. EXISTING CONDITIONS

Project Begin Location: North 44 degrees, 31 minutes, 32 seconds; West 67 degrees, 36 minutes, 54 seconds

Project End Location: North 44 degrees, 31 minutes, 22 seconds; West 67 degrees, 36 minutes, 51 seconds

2.1 Existing Geometric Features

Horizontal Alignment

A new bridge must be constructed off-line to maintain traffic on the existing bridge during construction. An easterly alignment was selected to avoid impacts to the United States Coast Guard property immediately west of the existing bridge approach in Jonesport. About 600' of the proposed bridge follows a tangent alignment, parallel to the existing bridge. Horizontal curves are introduced at either end of the bridge to quickly tie back into the existing causeways and minimize impacts to wetlands and properties. The Jonesport approach has a long causeway, so a flattened curve (R=4100') allows for a slightly higher design speed. The Beals approach is much shorter and has a sharper curve (R=2290') with a stop condition in the southerly direction. Reverse curves are provided at both of the approaches to match into the existing roadway.

Existing roadway looking south

Vertical Alignment

The proposed profile increases the maximum grade from 5% to 5.5% with a 400' crest vertical curve. This raises the maximum height of the roadway about 6 feet to allow for a deeper superstructure with longer spans and some allowance for future sea level rise. Sag curves beyond the bridge match existing grades and minimize impacts to wetlands and properties.

Traffic on existing bridge

Four bridge rehabilitation alternatives and three bridge replacement alternatives were evaluated. These alternatives are summarized in Table 1 below. The anticipated design life for rehabilitation alternatives 1 and 2 are low, while the extensive rehabilitation alternatives 3 and 4 have similar project costs to the new bridge alternatives. The three bridge replacement alternatives include prestressed concrete girders with various span arrangements from six to ten spans. The most cost-effective and recommended solution is replacement alternative 1 consisting of a new 8- span continuous NEBT concrete girder bridge with an overall length of 1,062 feet. The structure will be supported on drilled shaft foundations, which will ensure a durable, low maintenance bridge.

Beals approach looking south

Table 1: Bridge Alternatives

	SUPERSTRUCTURE	SUBSTRUCTURE	BRIDGE WIDTH	SUPSTR/SUB DESIGN LIFE	IMPACTS BELOW HAT	PROJECT COST
REHAB - 1	WEARING SURFACE AND JOINT REHABILITATION	STRENGTHEN PILES CATHODIC PROTECT	22 FT	10 YRS 10 YRS	0 SF	$5,500,000
REHAB - 2	WEARING SURFACE AND JOINT REHABILITATION	STREGTHEN & ENCASE PILES	28 FT	10 YRS 25 YRS	330 SF	$11,900,000
REHAB - 3	REPLACE DECK REPLACE GIRDERS (PAINTED)	STREGTHEN & ENCASE PILES	28 FT	75 YRS 25 YRS	330 SF	$21,100,000
REHAB - 4	REPLACE DECK REPLACE GIRDERS (METALIZED)	SUPPLEMENTAL PILE SUPPORT	28 FT	75 YRS 45 YRS	710 SF	$22,100,000
REPLACE - 1	8 SPANS - NEBT 1800	NEW PIERS AND ABUTMENTS	28 FT	100 YRS 100 YRS	58,650 SF	$21,980,000
REPLACE - 2	10 SPANS - NEBT 1200	NEW PIERS AND ABUTMENTS	28 FT	100 YRS 100 YRS	58,650 SF	$24,100,000
REPLACE - 3	6 SPANS - NEBT 1800 (POST-TENSIONED AND PRESTRESSED)	NEW PIERS AND ABUTMENTS	28 FT	100 YRS 100 YRS	58,650 SF	$23,200,000

The complete Preliminary Design Report (PDR) is provided here:
http://www.maine.gov/mdot/tigergrants/docs/tiger2015/Beals%20Island%20Bridge%20PDR.pdf

2.2 Design Standards

Bridge Street is a Non-NHS roadway and is classified as a rural major collector. The appropriate design standards for this classification of roadway are based on a design speed of 30 mph. Table 2 shows the design elements and deficiencies due to existing conditions.

Table 2: Existing Condition vs. Design Criteria			
Design Element	Existing Condition	Design Criteria	
Design Speed	30 mph	30 mph	
Approach Lane Width	10’	10’ min.	11’ desired
Approach Shoulder Width	2’	2’ min.	6’ desired
Approach Cross Slope	2%	2% travel lane	4% shoulder
Bridge Width	22’	24’ min.	
Structural Capacity	OK for legal Loads	45 tons	
Minimum Stopping Sight Distance	245’	222’	
Max. Degree of Curve/Min. Curve Radius	73°51’/45’	21°00’/275’	

A review of the design criteria compared to the existing roadway and bridge geometry shows that there are several non-standard features associated with the existing conditions. The existing bridge width does not meet the 24 foot minimum required width and the shoulder widths on both approaches do not meet the 2 foot minimum required for this classification of roadway.

2.3 Traffic Capacity

The 2012 Annual Average Daily Traffic (AADT) for the Beals Island Bridge was 2060 vehicles per day, as is the 2015 AADT. The design hourly volume (DHV) is 12% of the AADT. Heavy trucks comprise 10% of the DHV and 12% of the AADT.

The Estimated Time of Completion (ETC) for this project is assumed to be the year 2018. The years 2038 and 2068 were subsequently assumed to be ETC+20 and ETC+50, respectively. Table 3 provides the 2015 traffic volumes as well as those calculated for ETC (2018), ETC+20 (2038), and ETC+50 (2068). Between 2015 and 2035, the traffic volumes are projected in increase in a straight-line growth pattern of 1% per year, beyond 2035, the traffic volumes are assumed to remain constant through 2068.

Table 3: Existing and Projected Traffic Volumes				
Volume	YEAR			
	2015	ETC (2018)	ETC+20 (2038)	ETC+50 (2068)
AADT (vpd)	2060	2122	2470	2470
DHV (vph)	247	255	296	296

The Beals Island Bridge provides the only highway access to the Beals Island community. While both structurally deficient and functionally obsolete, the Beals Island Bridge provides the necessary traffic capacity to sustain the life of this coastal community. Without a replacement bridge, the only option available to maintain the necessary traffic capacity would be to establish and maintain frequent ferry service.

2.4 Structural Conditions

The condition summary in the table below depicts the sharp decline of the major bridge elements

over time. It is clear that the existing 57 year old structure was not equipped to deal with its harsh marine environment.

Table 4: Bridge Condition Summary			
Year	**Deck**	**Superstructure**	**Substructure**
2001	Good (7)	Good (7)	Good (7)
2009	Satisfactory (6)	Satisfactory (6)	Fair (5)
2012	Fair (5)	Fair (5)	Fair (5)
2015	Fair (5)	Fair (5)	Poor (4)

The wearing surface and bridge deck exhibit moderate cracking with numerous patched potholes, delaminations and surface rutting. The concrete deck was last rehabilitated in 1986. The steel girders have areas with moderate section loss, as well as pack rust at several splice plates. A few concrete pier caps have vertical cracks directly below the bridge bearings. The timber fender system was last replaced in 2001 and requires frequent maintenance.

Typical superstructure underside view

The primary structural deficiency driving this project involves the steel H-piles that support the concrete pier footings. These H-piles are uncoated and subjected to sea water. The exposed pile height ranges from ten feet up to forty five feet from mudline to the bottom of the submerged concrete pier footings. One of these H-piles is completely severed and several others have severe section loss. Marine growth covering the piles and strong tidal ocean currents contribute to the difficulties in conducting underwater inspections. Recent underwater inspections have found that the rate of deterioration has increased sharply, and several areas now show complete loss of the steel flanges.

Concrete wearing surface deterioration

Transverse deck cracking with efflorescence

Missing guard stones on Jonesport approach. United States Coast Guard Station in background (looking northerly from bridge).

Corrosion and pitting at splice connection

Cracking at end of pier cap

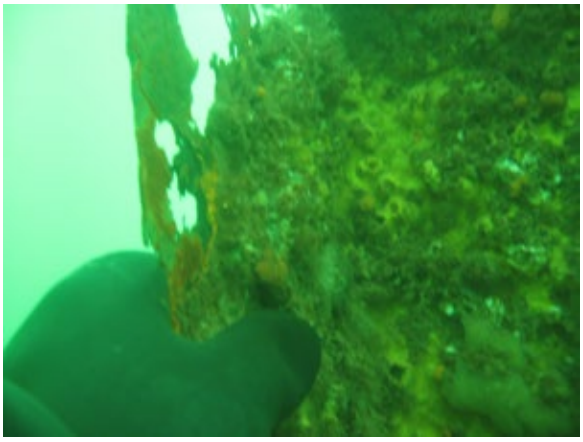
Concrete deterioration and rebar corrosion at base of #9 pier column

Figure 2: General Condition Photos

The underwater inspectors have observed accelerated section loss at areas previously cleaned for visual inspection.

Typical H-Pile section loss at flange

Severed H-Pile pier #6 corner Pile #7



Pier #4, Pile #1 thinning flange

Pier #6, Pile #1, 1 foot above ocean floor

Figure 3: Underwater Pile Photos

3. PROJECT DETAILS

The proposed bridge project will replace the existing bridge with a 1,062 foot long precast, prestressed concrete NEBT bridge. Five different span arrangements were evaluated with five different superstructure types including: prestressed box beams, prestressed NEBT, post-tensioned NEBT, metalized steel plate girders, and post-tensioned segmental concrete. A feasibility study for the segmental alternatives compared to a four–girder NEBT configuration favored the four-girder NEBT superstructure based on cost, risk, maintenance and long term durability. The NEBT 1800 beams will support a composite 8 inch concrete deck and 3 inch asphalt wearing surface on ¼ inch high-performance membrane waterproofing. The new bridge roadway width will be increased to 28 feet curb-to-curb with 3-bar steel bridge rail. The bridge and approaches will have 10 foot lanes and 4 foot shoulders.

The bridge will have two end spans at 126 feet and six remaining interior spans at 135 feet, for a total length of 1062 feet. The concrete stub abutments will have "u-back" wingwalls supported on spread footings bearing on rock fill. The seven piers will each consist of two column bents on "floating" footing caps that are supported on drilled shaft foundations to bedrock.

Retaining walls on the Beals approach will be provided to avoid and minimize coastal wetland and property impacts. The existing bridge will be used to maintain traffic during construction. Following the construction of the new crossing, the existing piers, superstructure, and fender system will be completely removed. The abutments will be removed to one foot below finished grade. A fender system at the navigational channel was found not to be necessary as most vessels are relatively light fishing boats.

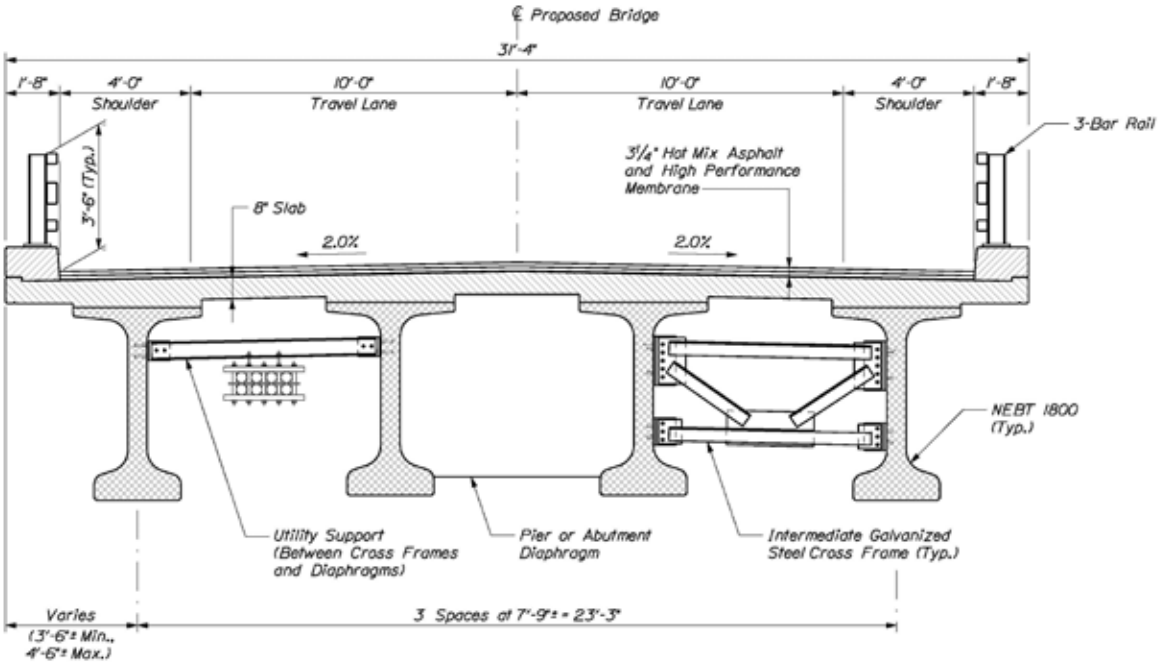


Figure 4: Proposed Superstructure Section

4. PROJECT PARTIES

MaineDOT will continue to consult with stakeholders during the development of this project. Documentation of stakeholder support to date is included as web links under the applicable Selection Criteria subsections.

Federal Highway Administration – Maine Division (MEFHWA)
Maine Department of Environmental Protection (DEP)
Maine Department of Inland Fisheries & Wildlife (IF&W)
Maine Historic Preservation Office (MHPC)
National Oceanic and Atmospheric Administration (NOAA)
Town of Beals
Town of Jonesport
U.S. Army Corps of Engineers (ACOE)
U.S. Coast Guard (USCG)
U.S. Environmental Protection Agency (EPA)
U.S. Fish & Wildlife Service (USFWS)

United States Coast Guard Station in background - looking north along west bridge fascia

5. GRANT FUNDS AND SOURCES/USES OF PROJECT FUNDS

Preliminary Engineering and Right-of-Way acquisition are underway and are not included in derivation of the construction portion of the project, but Construction Engineering is included. The overall amount for TIGER Discretionary Grant funding purposes is therefore $20.55 million. This breakdown assumes that 50 percent ($10.275 million) in a TIGER Discretionary Grant will be awarded to complete the required funding for this project, as follows:

Table 5: Proposed Funding ($ in millions)

	Federal	Non-Federal	TIGER	Total
Preliminary Engineering	$0.94	$0.24	$0	$1.43
Right-of-Way	$0.20	$0.05		
Construction (C)	$0	$9.685	$10.275	$20.55
Construction Engineering (CE)		$0.59		
TOTAL	$1.14	$10.565	$10.275	$21.98
Percentage of C / CE	0%	50%	50%	100%

The details of the cost estimate are provided at the following link:
http://www.maine.gov/mdot/tigergrants/tiger2015/

6. SELECTION CRITERIA

6.1 Long Term Outcomes

6.1.1 Safety

The loss of this bridge would have significant impacts to safety for the Town of Beals in particular and its residents. It would result in the elimination of any surface transportation access by emergency services such as ambulance, police, and firefighting. The island community is reliant on mainland emergency services based in Jonesport and other Washington County locations. Even with a full ferry service to replace the bridge, response times to an emergency scene on the Island would take an additional 10 to 15 minutes. A trip to the scene and then to a nearby hospital would take an additional 20 to 30 minutes. The added travel time for emergency responders would leave people there at a major safety and health risk. Finally, the bridge is also the only surface transportation emergency evacuation route for the Town of Beals.

6.1.2 State of Good Repair

According to data from the National Bridge Inspection database, 15.2 percent of Maine's Federally eligible bridges are Structurally Deficient (SD). Advancing this project will remove a major bridge

from the SD list and free-up scarce financial resources for other statewide bridge needs, which total approximately $140 million per year.

In 2014, MaineDOT's *Keeping Our Bridges Safe* report listed Beals Island Bridge as one of thirty-six "Forever Bridges". Construction to replace these high value bridges creates extraordinary impacts to customers and create significant funding needs that can severely impact bridge resources. These bridges must last at least 100 years. As one of Maine's "Forever Bridges", an Operating Plan specific to Beals Island Bridge will be established to sufficiently plan and execute timely preservation work to maximize the service life for this new bridge.

6.1.3 Economic Competitiveness

Route 187 provides the only access into and out of Jonesport. Bridge Street and the Beals Island Bridge provide the only crossing to the island communities of Beals and Great Wass. It provides access to tourists, residents, businesses and commuters to and from the island for commerce. The community of Beals is completely dependent on the Bridge for economic competitiveness, including exporting lobster and other ocean products, as well as access to critical daily services such as health care providers, emergency services, grocery stores, schools, and access to off-island employment. The Average Annual Daily Traffic (AADT) over the Beals Island Bridge is 2,060 vehicles, of which approximately 12% are trucks – many serving the Fishing Industry. Both Jonesport and Beals are dependent upon the bridge for maintaining social and familial connections between the two communities.

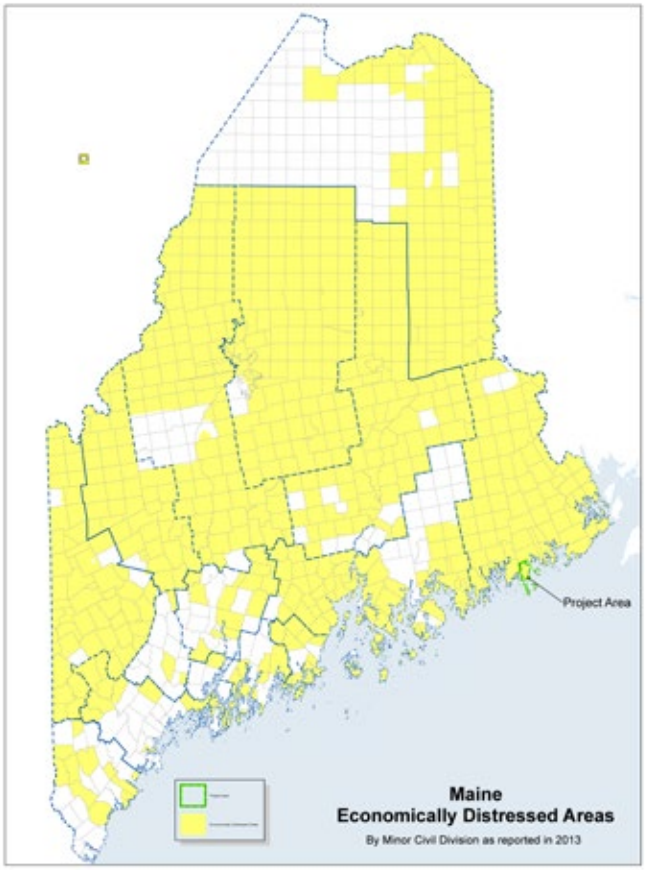


Figure 5: Maine Economically Distressed Areas

The vast majority of Washington County, in which the bridge is located, is an economically distressed area, including Jonesport and Beals Island. The latest data (2013) from the U.S. Bureau of Economic Analysis indicates that the per capita income for the United States was $44,765, and for Maine it was $40,924. In Washington County, per capita income for that same period was $35,887. http://www.bea.gov/regional/bearfacts/pdf.cfm?fips=23029&areatype=23000&geotype=4. It is also instructive that very recent data from the U.S. Bureau of Labor Statistics Local Area Unemployment Statistics Program indicates that for March, 2015 the unemployment rate for the United States was 5.5%, and for Maine 4.8%. The unemployment rate for Washington County for that same period was 9.5%. http://www.maine.gov/labor/cwri/laus.html.

6.1.4 Quality of Life

Currently, the Beals Island Bridge provides only 1 foot shoulders, creating risk for pedestrians and bicyclists crossing the bridge. The limited shoulders do not offer the features that a crossing in the heart of these connected towns require for fostering a quality community environment. The bridge is within a short walking distance of village areas and an established sidewalk system. The new bridge connection with its planned 4 foot shoulders will provide safer accommodation for bicycles and pedestrians and will encourage more visitors to experience the pleasure and convenience of car-free tourism between Jonesport and Beals Island. Once on Beals Island, visitors can then access the 1,576 acre Great Wass Island Preserve, owned by The Nature Conservancy. Great Wass offers a beautiful five mile hiking loop that has been characterized as "one of the very best hikes on the entire coast of Maine" by the author of this Portland Press herald article: http://www.pressherald.com/2014/05/04/carey_kish__downeast_hiking_at_its_best_/.

Scenic byways continue to grow in popularity among vehicular travelers and touring bicyclists. The new Bold Coast Scenic Byway, "Where the Journey IS the Destination!" highlights cultural, historical, scenic, and recreational opportunities throughout the Washington County portion of the corridor. In Columbia Falls, the byway loops along State Route 187 through Jonesport to rejoin US-1 in Jonesboro. The intersection of Bridge Street and Route 187 is an important part of the experience of this segment of the Bold Coast Scenic Byway as it is the western "gateway" to the towns of Jonesport and Beals. Positive visitor impressions create positive recommendations and generate return visits, thereby stimulating the economy and quality of life related to this. In a recent development, the Washington County Council of Governments was awarded Plan of the Year for the Bold Coast Scenic Byway initiative by the Maine Association of Planners on May 21, 2015.

6.1.5 Environmental Sustainability

MaineDOT recognizes that assuring sustainability of habitats, ecosystems and transportation infrastructure can occur in concert rather than in conflict. Toward that end, MaineDOT endeavors to exercise reasonable stewardship over both natural resources and transportation infrastructure through its commitment to addressing aquatic organisms, wildlife habitat and fish passage in cooperation with natural resource agencies, while weighing all aspects of a proposed project.

6.2 Innovations

MaineDOT has listed Beals Island Bridge as one of thirty-six "Forever Bridges". Construction to replace these high value bridges creates extraordinary impacts to customers and significant funding needs that can severely impact bridge resources. These bridges must last at least 100 years. MaineDOT is committed to utilizing innovative technologies and best practices as recommended by the Strategic Highway Research Program (SHRP 2) to construct and maintain its bridges. Corrosion of reinforcing steel is the main reason that concrete structures fail. To maximize the service life of the bridge, MaineDOT plans to use High Performance Concrete and corrosion resistant reinforcing bars. As one of Maine's "Forever Bridges", an Operating Plan specific to Beals Island Bridge will be established to sufficiently plan and execute timely preservation work to maximize the service life for this bridge.

6.3 Partnership

The project website contains numerous letters confirming stakeholder collaboration and project support. http://www.maine.gov/mdot/tigergrants/tiger2015/

7. RESULTS OF BENEFIT COST ANALYSIS

A Benefit Cost Analysis was conducted on replacing the Beals Island Bridge. The analysis looks at the project from the standpoint of society as a whole, and accounts for the net benefits and net costs based on the criteria described in the TIGER Discretionary Grant NOFA, March 30, 2015. The analysis presented here addresses benefits from travel time savings, user costs, and emissions reduction. Several benefits of the Beals Island Bridge replacement are difficult to quantify. These un-quantified benefits include increased economic competitiveness, livability enhancement, and response time for emergency vehicles (ambulance and fire).

7.1 Base Case Assumption

This Benefit Cost Analysis focuses on replacement of the Beals Island Bridge, and compares the replacement to the "No Build' scenario, which is the base case assumption. This assumes that the existing bridge would be closed to traffic. The spreadsheets and files pertinent to this BCA are referenced in the BCA spreadsheet and are included in the Appendices to this application. The "No Build" scenario assumed in this BCA is that the Beals Island Bridge would be closed. Existing and future traffic crossing the bridge would be replaced with ferry service that carries motor vehicles.

7.2 Project Benefits

7.2.1 Travel Costs

The Beals Island Bridge is the only crossing between the Town of Beals, which is comprised of Beals Island and Great Wass Island, and the mainland (specifically Jonesport). If the Bridge were closed and taken out of service, with no other alternative crossings available to motorists, a ferry service carrying vehicles would need to be provided.

Under this condition, the total change in vehicle-miles-traveled (VMT) was estimated at a reduction of 390,550 miles in 2019. This reduction in VMT is the result of vehicles no longer traveling along the ½ mile span of the existing Beals Island Bridge.

2019 VMT = *Annual Traffic x Distance*
= *2140 vehicles per day x 365 days per year x ½ mile*
= *390,550 VMT in 2019*

Under this same condition, the total change in vehicle-hours-traveled (VHT) was estimated at an increase of 182,256 hours in 2019. This increase in VHT is the difference between VHT on the ferry and VHT on the bridge.

The net changes in VMT and VHT were then multiplied by the weighted average user costs ($0.34 and $15.24 respectively) to get the user cost savings. The total annual user costs are estimated at $2,644,874 in 2019, and increasing thereafter based on traffic growth. These operating costs are avoided by bridge replacement.

7.2.2 Safety

In comparison to the existing bridge, the Beals Island Bridge replacement will improve safety for all users. Specifically, the existing 22 foot roadway width will be widened to 28 feet (providing 10 foot lanes and 4 foot shoulders), thereby improving safety for motorists, bicyclists and pedestrians.

As described above, it is critical to point out that the existing bridge is the only vehicular connection between Beals and the mainland. The Town of Jonesport provides emergency service aid to the Town of Beals as there are no hospitals, medical treatment facilities, fire stations, pumpers, or other emergency response equipment located on the island. Under the "No Build" scenario with the existing bridge closed, emergency vehicles would be required to service the entire Village of Beals via the ferry, increasing the emergency response time by 10 to 15 minutes in each direction. Although, this impact cannot be quantified in the BCA, the increased emergency response time could have serious effects on medical health and/or loss of property where response time is paramount.

7.2.3 State of Good Repair

Estimated annualized maintenance costs for the existing bridge are $4,732. This number was derived from actual costs incurred from 1996 to 2014. If the bridge were closed these costs are avoided. In this BCA the annualized costs are added to user benefits since they are avoided costs to society if a new bridge is constructed.

7.2.4 Sustainability

The avoided air emissions are based on the ferry emissions, the idling vehicles using the ferry, and the reduced VMT from the closure of the bridge. The net emission savings have been calculated for nitrogen oxides, volatile organics, and carbon dioxide. The calculations are based on factors that were applied to the avoided ferry service resulting from closure of the bridge. Data is not available for sulfur dioxide or particulate emissions.

Based on the annual VMT and VHT approximately 6,219 metric tons of CO2, 2.3 metric tons of VOCs, and 63.2 metric tons of NOX, are avoided in the year 2019. These emissions amount to a total of approximately $775,000 in the year 2019 and $910,000 in the year 2068. The cost of carbon in CO2 emissions has been calculated in the BCA spreadsheet using the social cost of carbon (SCC) assumptions found in "Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866". The reason being that the SCC increases over time because future emissions are expected to produce larger incremental damages as physical and economic systems become more stressed in response to greater climatic change. In conformity with this viewpoint, this analysis escalates the CO2 portion of the air emissions cost

increases. The net present value of air emissions costs is $22 million at 3% discount rate.

7.3 Project Costs

7.3.1 Total Construction Costs

The benefit cost analysis uses the replacement construction cost of $19.4 million. Construction costs also include a minor rehabilitation ($355,000) after 25 years and full major rehabilitation ($930,000) after 50 years. Maintenance and operations costs for the replacement structure are considered negligible (estimated at approximately $1,500 annually), but have been included in the BCA for completeness.

7.4 Conclusion

The annual benefits and costs values were discounted at 3% and 7% over a 50 year time horizon. Three percent is the most appropriate rate for the analysis because the bridge has a very long life, and in addition, the alternate use of funds would be a public expenditure as opposed to a private investment. The full analysis can be found in the spreadsheet attachment to this application. A summary of the results of this analysis are as follows:

- Total Benefits of $ 97.3 million
- Avoided Air Quality Impacts valued at $21.8 million
- Reduced User Costs estimated at $75.4 million
- Avoided Maintenance Costs of $122,000
- Total Costs of $19.3 million
- Benefit-Cost ratio of 5.1

When discounted at 7%, the benefits and costs are lower. A larger discount rate implies that time preference for future amounts are preferentially discounted more severely. The amounts are shown below.

- Total Benefits of $ 51.1 million
- Avoided Air Quality Impacts valued at $11.4 million
- Reduced User Costs estimated at $ 39.6 million
- Avoided Maintenance Costs of $65,000
- Total Costs of $ 18.3 million
- Benefit-Cost ratio of 2.8

The user costs followed by the air quality impacts represent the largest portion of the total annual benefits. These user cost savings are the key drivers of the benefit-cost ratio; the other cost savings, such as maintenance, have a very small influence on the results.

8. PROJECT READINESS

8.1 Technical Feasibility

MaineDOT has replaced several large bridges recently; among them, the award winning Penobscot Narrows Bridge and the Norridgewock Covered Bridge. These two projects alone totaled over $100 million and demonstrate the capability of the Department required in complex project management and delivery. It is also noteworthy that Maine was the first state in the Nation to fully obligate all American Recovery and Reinvestment Act of 2009 (ARRA) funding.

8.2 Financial Feasibility

MaineDOT has non-Federal funding to provide 50 percent ($10.275 million) of the remaining project cost of $20.55 million for construction and construction engineering to partner with the Federal government on this project. MaineDOT has successfully administered prior TIGER grants and has adequate resources to expend TIGER funds effectively and expeditiously in accordance with all grant requirements.

8.3 Project Schedule

The proposed project milestones are as follows:

Table 6: Project Milestones	
PDR/Preliminary Plan Complete	April 2015
Formal Public Contact	May 2015
NEPA Complete	April 2016
Environmental Approvals	September 2016
R/W Certified	July 2016
PS&E Complete	November 2016
Obligation of Funds	January 2017
Project Advertising	February 2017
Construction Begin	April 2017
Construction Complete	May 2019

Upon receipt of TIGER Discretionary Grant notification, MaineDOT will proceed quickly to secure all necessary permits, ensuring that any unexpected delays will not put TIGER Discretionary Grant funds at risk of expiring before they are obligated.

A complete Project Schedule is provided here:
http://www.maine.gov/mdot/tigergrants/docs/tiger2015/TIGERGrantDetailedSchedule.pdf

8.4 Assessment of Risks and Mitigation Strategies

The preliminary design study considers key issues and constraints unique to the bridge site. A broad range of bridge improvement criteria has been evaluated, including rehabilitation and replacement, location and alignment, span and clearance requirements, hydraulics and bridge scour, constructability, environmental, right-of–way and utility impacts, future maintenance requirements, initial construction cost, life-cycle costs and aesthetics. Other site-specific considerations include socio-economic impacts, geologic site conditions, horizontal and vertical roadway alignment, approach section, approach guardrail transitions, bridge rail requirements, and wearing surface requirements.

The impact of the pier footprint has been minimized by designing long spans. Additionally, steep riprapped slopes are used at abutments and approaches to further minimize environmental impact.

8.5 Environmental Approvals

Communication with environmental agencies and interested parties are underway. Following is the status of the environmental approvals and permits required for the project:

Table 7: Environmental Approvals and Permits

Task	Proposed Submittal	Anticipated Approval
Section 106 effects determination	6/1/15	7/15/15
Section 106 MOA	7/15/15	8/19/15
Section 4(f)	9/1/15	12/1/15
Section 7	10/1/15	12/15/15
Essential Fisheries Habitat	10/1/15	12/15/15
NEPA (ME FHWA)	4/1/16	4/15/16
U.S. ACOE and State Permits	3/1/16	9/20/16
U.S. Coast Guard Permit	8/3/16	11/8/16

8.5.1 National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) process, including historic and archeological reviews, has been incorporated by FHWA into the Preliminary Design Report process. The project has been classified as a Categorical Exclusion in accordance with 23 CFR 771.117(c)(28). The FHWA Maine Division is the lead on NEPA. NEPA is already underway and no major issues have arisen or are expected to arise. The NEPA process is expected be completed by April 15, 2016. Should any issues arise, there will be ample time for them to be addressed prior to the required TIGER Discretionary Grant obligation date.

8.5.2 U.S. Coast Guard Permit

A U.S. Coast Guard permit will be required to remove existing structures and also to install new structures within the navigable waterway. A U.S. Coast Guard permit is anticipated by November 8, 2016.

8.5.3 Other Federal and State Environmental Permits

A U.S. Army Corps of Engineers permit will be required for work being conducted within waters of the United States. A Maine Department of Environmental Protection permit will also be required. All permit approvals are expected to be received by September 20, 2016.

8.5.4 Historic and Archeological

Section 106 consultation is currently being conducted. National Register eligibility within the Area of Potential Effect (APE) has concurrence by the Maine State Historic Preservation Officer (SHPO). The Bridge is eligible for the National Register of Historic Places along with another property. Native American tribes have been consulted and they have expressed no concerns. Section 106 concurrence and a signed Memorandum of Agreement (MOA) are anticipated from the SHPO by August 19, 2015. Any adverse impacts to affected resources will be addressed in coordination with the applicable review agencies.

8.5.5 Section 4(f) of the Department of Transportation Act

Section 4(f) documentation and approval will be required for the Bridge. Documentation will be provided to the FHWA Maine Division for approval. Approval is anticipated by December 1, 2015.

8.5.6 Endangered Species and Essential Fisheries Habitat

Consultation under Section 7 of the Endangered Species Act is in process with NOAA for the listed Atlantic Sturgeon, Short-Nose Sturgeon and Atlantic Salmon. The project area is also mapped as Essential Fish Habitat under Magnusson-Stevens Sustainable Fisheries Act for numerous species. Section 7 and the Essential Fish Habitat process is expected to be complete by December 15, 2015.

The project has been presented to federal and state resource and regulatory agencies at the MaineDOT Interagency Meeting on May 12, 2015 for permit and approval levels. Maine State permits and an U.S. Army Corps of Engineers permit will be obtained by September 2016. No local permits are required.

Table 8: Planning Approvals	
NEPA	April 2016
Design Complete	November 2016
Right-of-Way	July 2016
Obligate Funding	January 2017
Construction Complete	May 2019

8.6 Legislative Approvals

The project is partially funded for Preliminary Engineering and Right- of-Way in the *MaineDOT Work Plan Calendar Years 2014-2015-2016* which was presented to the Maine Legislature.

8.7 State and Local planning Approvals

The proposed project is contained in MaineDOT's Work Plan and the Statewide Transportation Improvement Plan (STIP).

9. FEDERAL WAGE RATE CERTIFICATION

As with all Federal projects, MaineDOT complies with all required Federal provisions, including the Davis-Bacon Act. http://www.maine.gov/mdot/tigergrants/tiger2015/

10. ENVIRONMENTAL, FEDERAL, STATE AND LOCAL ACTIONS

The project has been presented to federal and state resource and regulatory agencies at the MaineDOT Interagency Meeting on May 12, 2015 for permit and approval levels. Maine State permits and an U.S. Army Corps of Engineers permit will be obtained by September 2016. No local permits are required.

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