## Beals Island Bridge - Benefit Cost Analysis

The Beals Island Bridge is a ten span steel beam bridge which spans Moosabec Reach between Jonesport on the mainland and Beals, Maine. Completed in 1958, the structure carries Bridge Street and provides a navigational channel opening of 75 feet wide and 32 feet high from mean high water. It is 1,050 feet long and 22 feet wide, with uniform span lengths of 105 feet. The bridge replacement will be an eight span prestressed concrete girder structure 1,062 feet long by 28 feet wide with a vertical navigation clearance of 33 feet from mean high water

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 Grant NOFA, February 25, 2014. 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 unquantified benefits include increased economic competitiveness, livability enhancement, and response time for emergency vehicles (ambulance and fire).

## Base Case Assumption

This benefit cost analysis focuses on replacement of 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.

## Project Benefits

## 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 $1 / 2$ mile span of the existing Beals Island Bridge.

$$
\begin{aligned}
2019 \text { VMT } & =\text { Annual Traffic } x \text { Distance } \\
& =2140 \text { vehicles per day } x 365 \text { days per year } x 1 / 2 \text { mile } \\
& =390,550 \text { VMT in } 2019
\end{aligned}
$$

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.

## 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 both motorists 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 town 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.

## 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.

## 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 $\mathrm{CO} 2,2.3$ 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 CO 2 portion of the air emissions cost increases. The net present value of air emissions costs is $\$ 22$ million at $3 \%$ discount rate.

## Project Costs

## 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.

## 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.

Beals Island Bridge Replacement
Benefit Cost Analysis (BCA) - Bridge Replacement compared to Ferry Service without Bridge Replacement

| Present Value | Benefits (Avoided Cost Associated with the Ferry Service) |  |  |  |  | Total Costs (Beals Island Bridge Replacement) | Benefit Cost Ratios |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Carbon Dioxide <br> Emissions Cost | VOC \& NOx <br> Emissions Costs | User Cost (Travel Time Savings / Avoided Delay) | Annualized Maintenance Costs | Total Costs |  |  |
| At 3 Percent | \$8,844,079 | \$12,949,249 | \$75,394,501 | \$121,753 | \$97,309,583 | \$19,264,944 | 5.1 |
| At 7 Percent | \$4,466,721 | \$6,943,672 | \$39,645,236 | \$65,305 | \$51,120,934 | \$18,257,868 | 2.8 |

## Beals Island Bridge Replacement

Benefit Cost Analysis (BCA) - Bridge Replacement compared to Ferry Service without Bridge Replacement

## Conforming to TIGER VI Requiremen

Project Description: Replacement of Beals Island Bridge over Moosabec Reach
Estimated Project Timing: 2015 - Existing Year / 2017 - Construction Start / 2019 - Construction Finished (opening year) / 2043 - 25 Year Forecast / 2068 - 50 Year Forecast.

|  |  |  |  |  |  |  |  | Benefits (Avoided Cost Associated with the Ferry Service) |  |  |  |  |  |  |  | Costs (Beals Island Bridge Replacement) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Calendar Year | Project Year | $\begin{gathered} \text { Average } \\ \text { Annual Daily } \\ \text { Traffic AADT } \end{gathered}$ | Annual VMT ${ }^{2}$ | Annual | Net Carbon Emissions Savings (tons) ${ }^{3}$ | Carbon <br> Value (per <br> ton <br> 2007\$) | Carbon Value (per ton 2015\$) | Carbon Dioxide Costs | voc \& NOx Emissions Costs | User Cost (Travel Time Savings / Avoided Delay) ${ }^{4}$ | $\begin{aligned} & \text { Crash } \\ & \text { Costs }^{5} \end{aligned}$ | $\begin{aligned} & \text { Annualized } \\ & \text { Maintenance } \\ & \text { Costs }^{6} \end{aligned}$ | Total Annual Benefits | Discounted Benefits - Present Value @ $3 \%$ | Discounted Benefits Present Value @ 7\% | Construction Costs <br> Costs | $\begin{gathered} \text { Annual } \\ \text { Maintenance } \\ \text { Costs } \end{gathered}$ | Total Annual Costs | $\left\|\begin{array}{c} \text { Discounted } \\ \text { Costs - Present } \\ \text { Value @ 3\% } \end{array}\right\|$ | $\text { t } \left.\begin{gathered} \text { Discounted } \\ \text { Costs - Present } \\ \text { Value @ } 7 \% \end{gathered} \right\rvert\,$ |
| 2015 |  | 2060 | -375,950 | 175,443 | 6,227 | 38.0 | 44.6 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2016 |  | 2080 | -379,600 | 177,147 | 6,225 | 38.5 | 42.6 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2017 |  | 2100 | -383,250 | 178,850 | 6,223 | 39.0 | 43.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2018 |  | 2120 | -386,900 | 180,553 | 6,221 | 39.5 | 43.7 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2019 | 1 | 2140 | -390,550 | 182,256 | 6,219 | 40.0 | 44.3 | \$275,309 | \$502,560 | \$2,644,874 | \$0 | \$4,732 | \$3,427,474 | \$3,327,645 | \$3,203,247 | \$19,410,000 | \$1,500 | \$19,411,500 | \$18,846,117 | \$18,141,589 |
| 2020 | 2 | 2160 | -394,200 | 183,959 | 6,217 | 40.5 | 44.8 | \$278,660 | \$502,539 | \$2,669,592 | \$0 | \$4,732 | \$3,455,523 | \$3,257,162 | \$3,018,188 |  | \$1,500 | \$1,500 | \$1,414 | \$1,310 |
| 2021 | 3 | 2180 | -397,850 | 185,662 | 6,215 | 41.0 | 45.4 | \$282,009 | \$502,518 | \$2,694,311 | \$0 | \$4,732 | \$3,483,570 | \$3,187,960 | \$2,843,631 |  | \$1,500 | \$1,500 | \$1,373 | \$1,224 |
| 2022 | 4 | 2200 | -401,500 | 187,365 | 6,213 | 41.6 | 46.1 | \$286,457 | \$502,497 | \$2,719,029 | \$0 | \$4,732 | \$3,512,715 | \$3,121,002 | \$2,679,833 |  | \$1,500 | \$1,500 | \$1,333 | \$1,144 |
| 2023 | 5 | 2220 | -405,150 | 189,068 | 6,211 | 42.3 | 46.8 | \$290,901 | \$502,477 | \$2,743,748 | \$0 | \$4,732 | \$3,541,857 | \$3,055,237 | \$2,525,295 |  | \$1,500 | \$1,500 | \$1,294 | \$1,069 |
| 2024 | 6 | 2240 | -408,800 | 190,771 | 6,209 | 43.0 | 47.6 | \$295,343 | \$502,456 | \$2,768,466 | \$0 | \$4,732 | \$3,570,996 | \$2,990,653 | \$2,379,506 |  | \$1,500 | \$1,500 | \$1,256 | \$1,000 |
| 2025 | 7 | 2260 | -412,450 | 192,474 | 6,205 | 43.6 | 48.3 | \$299,705 | \$503,403 | \$2,793,184 | \$0 | \$4,732 | \$3,601,025 | \$2,927,962 | \$2,242,537 |  | \$1,500 | \$1,500 | \$1,220 | \$934 |
| 2026 | 8 | 2280 | -416,100 | 194,177 | 6,203 | 44.3 | 49.0 | \$304,139 | \$503,390 | \$2,817,903 | \$0 | \$4,732 | \$3,630,165 | \$2,865,685 | \$2,112,789 |  | \$1,500 | \$1,500 | \$1,184 | \$873 |
| 2027 | 9 | 2300 | -419,750 | 195,880 | 6,201 | 44.9 | 49.7 | \$308,433 | \$503,378 | \$2,842,621 | \$0 | \$4,732 | \$3,659,164 | \$2,804,445 | \$1,990,343 |  | \$1,500 | \$1,500 | \$1,150 | \$816 |
| 2028 | 10 | 2320 | -423,400 | 197,583 | 6,199 | 45.6 | 50.4 | \$312,723 | \$503,366 | \$2,867,340 | \$0 | \$4,732 | \$3,688,161 | \$2,744,338 | \$1,874,874 |  | \$1,500 | \$1,500 | \$1,116 | $\$ 763$ |
| 2029 | 11 | 2340 | -427,050 | 199,286 | 6,197 | 46.2 | 51.2 | \$317,011 | \$503,354 | \$2,892,058 | \$0 | \$4,732 | \$3,717,155 | \$2,685,352 | \$1,765,993 |  | \$1,500 | \$1,500 | \$1,084 | $\$ 713$ |
| 2030 | 12 | 2360 | -430,700 | 200,989 | 6,195 | 46.8 | 51.9 | \$321,295 | \$503,512 | \$2,916,777 | \$0 | \$4,732 | \$3,746,316 | \$2,627,591 | \$1,663,409 |  | \$1,500 | \$1,500 | \$1,052 | \$666 |
| 2031 | 13 | 2380 | -434,350 | 202,692 | 6,193 | 47.5 | 52.6 | \$325,577 | \$503,501 | \$2,941,495 | \$0 | \$4,732 | \$3,775,306 | \$2,570,799 | \$1,566,618 |  | \$1,500 | \$1,500 | \$1,021 | \$622 |
| 2032 | 14 | 2400 | -438,000 | 204,395 | 6,190 | 48.1 | 53.3 | \$329,856 | \$503,491 | \$2,966,214 | \$0 | \$4,732 | \$3,804,292 | \$2,515,085 | \$1,475,370 |  | \$1,500 | \$1,500 | \$992 | \$582 |
| 2033 | 15 | 2420 | -441,650 | 206,098 | 6,188 | 48.8 | 54.0 | \$334,132 | \$503,480 | \$2,990,932 | \$0 | \$4,732 | \$3,833,276 | \$2,460,434 | \$1,389,356 |  | \$1,500 | \$1,500 | \$963 | \$544 |
| 2034 | 16 | 2440 | -445,300 | 207,801 | 6,186 | 49.4 | 54.7 | \$338,405 | \$503,469 | \$3,015,650 | \$0 | \$4,732 | \$3,862,256 | \$2,406,831 | \$1,308,280 |  | \$1,500 | \$1,500 | $\$ 935$ | \$508 |
| 2035 | 17 | 2460 | -448,950 | 209,504 | 6,184 | 50.0 | 55.4 | \$342,675 | \$503,506 | \$3,040,369 | \$0 | \$4,732 | \$3,891,282 | \$2,354,290 | \$1,231,880 |  | \$1,500 | \$1,500 | \$908 | \$475 |
| 2036 | 18 | 2460 | -448,950 | 209,504 | 6,184 | 50.7 | 56.1 | \$347,058 | \$503,507 | \$3,040,369 | \$0 | \$4,732 | \$3,895,666 | \$2,288,293 | \$1,152,587 |  | \$1,500 | \$1,500 | \$881 | \$444 |
| 2037 | 19 | 2460 | -448,950 | 209,504 | 6,184 | 51.3 | 56.8 | \$351,441 | \$503,507 | \$3,040,369 | \$0 | \$4,732 | \$3,900,049 | \$2,224,144 | \$1,078,396 |  | \$1,500 | \$1,500 | \$855 | \$415 |
| 2038 | 20 | 2460 | -448,950 | 209,504 | 6,184 | 52.0 | 57.5 | \$355,824 | \$503,508 | \$3,040,369 | \$0 | \$4,732 | \$3,904,433 | \$2,161,790 | \$1,008,980 |  | \$1,500 | \$1,500 | \$831 | \$388 |
| 2039 | 21 | 2460 | -448,950 | 209,504 | 6,184 | 52.6 | 58.2 | \$360,207 | \$503,508 | \$3,040,369 | \$0 | \$4,732 | \$3,908,816 | \$2,101,181 | \$944,030 |  | \$1,500 | \$1,500 | \$806 | \$362 |
| 2040 | 22 | 2460 | -448,950 | 209,504 | 6,184 | 53.2 | 59.0 | \$364,590 | \$503,509 | \$3,040,369 | \$0 | \$4,732 | \$3,913,200 | \$2,042,270 | \$883,261 |  | \$1,500 | \$1,500 | \$783 | \$339 |
| 2041 | 23 | 2460 | -448,950 | 209,504 | 6,184 | 53.9 | 59.7 | \$368,974 | \$503,509 | \$3,040,369 | \$0 | \$4,732 | \$3,917,584 | \$1,985,007 | \$826,402 |  | \$1,500 | \$1,500 | \$760 | \$316 |
| 2042 | 24 | 2460 | -448,950 | 209,504 | 6,184 | 54.5 | 60.3 | \$372,946 | \$503,510 | \$3,040,369 | \$0 | \$4,732 | \$3,921,556 | \$1,929,146 | \$773,122 |  | \$1,500 | \$1,500 | \$738 | \$296 |
| 2043 | 25 | 2460 | -448,950 | 209,504 | 6,184 | 55.0 | 60.9 | \$376,918 | \$503,510 | \$3,040,369 | \$0 | \$4,732 | \$3,925,529 | \$1,874,855 | \$723,276 | \$355,000 | \$1,500 | \$356,500 | \$170,266 | \$65,685 |
| 2044 | 26 | 2460 | -448,950 | 209,504 | 6,184 | 55.6 | 61.6 | \$380,890 | \$503,511 | \$3,040,369 | \$0 | \$4,732 | \$3,929,502 | \$1,822,089 | \$676,643 |  | \$1,500 | \$1,500 | \$696 | \$258 |
| 2045 | 27 | 2460 | -448,950 | 209,504 | 6,184 | 56.2 | 62.2 | \$384,863 | \$503,511 | \$3,040,369 | \$0 | \$4,732 | \$3,933,475 | \$1,770,807 | \$633,016 |  | \$1,500 | \$1,500 | \$675 | \$241 |
| 2046 | 28 | 2460 | -448,950 | 209,504 | 6,184 | 56.8 | 62.9 | \$388,835 | \$503,512 | \$3,040,369 | \$0 | \$4,732 | \$3,937,448 | \$1,720,967 | \$592,201 |  | \$1,500 | \$1,500 | \$656 | \$226 |
| 2047 | 29 | 2460 | -448,950 | 209,504 | 6,184 | 31.8 | 35.2 | \$217,748 | \$503,512 | \$3,040,369 | \$0 | \$4,732 | \$3,766,361 | \$1,598,242 | \$529,410 |  | \$1,500 | \$1,500 | \$637 | \$211 |
| 2048 | 30 | 2460 | -448,950 | 209,504 | 6,184 | 63.6 | 70.4 | \$435,496 | \$503,513 | \$3,040,369 | \$0 | \$4,732 | \$3,984,110 | \$1,641,400 | \$523,381 |  | \$1,500 | \$1,500 | \$618 | \$197 |
| 2049 | 31 | 2460 | -448,950 | 209,504 | 6,184 | 58.5 | 64.7 | \$400,341 | \$503,513 | \$3,040,369 | \$0 | \$4,732 | \$3,948,955 | \$1,579,531 | \$484,825 |  | \$1,500 | \$1,500 | \$600 | \$184 |
| 2050 | 32 | 2460 | -448,950 | 209,504 | 6,184 | 59.0 | 65.4 | \$404,176 | \$503,514 | \$3,040,369 | \$0 | \$4,732 | \$3,952,791 | \$1,535,015 | \$453,548 |  | \$1,500 | \$1,500 | \$583 | \$172 |


| 2051 | 33 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,012 | \$503,514 | \$3,040,369 | \$0 | \$4,732 | \$3,956,627 | \$1,491,752 | \$424,288 |  | \$1,500 | \$1,500 | \$566 | \$161 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2052 | 34 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,012 | \$503,515 | \$3,040,369 | \$0 | \$4,732 | \$3,956,628 | \$1,448,303 | \$396,531 |  | \$1,500 | \$1,500 | \$549 | \$150 |
| 2053 | 35 | 2460 | -488,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,013 | \$503,515 | \$3,040,369 | \$0 | \$4,732 | \$3,956,629 | \$1,406,120 | \$370,589 |  | \$1,500 | \$1,500 | \$533 | \$140 |
| 2054 | 36 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,013 | \$503,516 | \$3,040,369 | \$0 | \$4,732 | \$3,956,630 | \$1,365,166 | \$346,345 |  | \$1,500 | \$1,500 | \$518 | \$131 |
| 2055 | 37 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,013 | \$503,516 | \$3,040,369 | \$0 | \$4,732 | \$3,956,631 | \$1,325,404 | \$323,687 |  | \$1,500 | \$1,500 | \$502 | \$123 |
| 2056 | 38 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,014 | \$503,517 | \$3,040,369 | \$0 | \$4,732 | \$3,956,631 | \$1,286,800 | \$302,512 |  | \$1,500 | \$1,500 | \$488 | \$115 |
| 2057 | 39 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,014 | \$503,517 | \$3,040,369 | \$0 | \$4,732 | \$3,956,632 | \$1,249,321 | \$282,721 |  | \$1,500 | \$1,500 | \$474 | \$107 |
| 2058 | 40 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,015 | \$503,518 | \$3,040,369 | \$0 | \$4,732 | \$3,956,633 | \$1,212,933 | \$264,225 |  | \$1,500 | \$1,500 | \$460 | $\$ 100$ |
| 2059 | 41 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,015 | \$503,518 | \$3,040,369 | \$0 | \$4,732 | \$3,956,634 | \$1,177,605 | \$246,940 |  | \$1,500 | \$1,500 | \$446 | \$94 |
| 2060 | 42 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,016 | \$503,519 | \$3,040,369 | \$0 | \$4,732 | \$3,956,635 | \$1,143,306 | \$230,785 |  | \$1,500 | \$1,500 | \$433 | \$87 |
| 2061 | 43 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,016 | \$503,519 | \$3,040,369 | \$0 | \$4,732 | \$3,956,636 | \$1,110,006 | \$215,687 |  | \$1,500 | \$1,500 | \$421 | \$82 |
| 2062 | 44 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,016 | \$503,520 | \$3,040,369 | \$0 | \$4,732 | \$3,956,637 | \$1,077,676 | \$201,577 |  | \$1,500 | \$1,500 | \$409 | \$76 |
| 2063 | 45 | 2460 | -448,950 | 209,504 | 6,184 | 59.6 | 66.0 | \$408,017 | \$503,520 | \$3,040,369 | \$0 | \$4,732 | \$3,956,638 | \$1,046,288 | \$188,389 |  | \$1,500 | \$1,500 | \$397 | \$71 |
| 2064 | 46 | 2460 | -448,950 | 209,504 | 6,185 | 59.6 | 66.0 | \$408,017 | \$503,521 | \$3,040,369 | \$0 | \$4,732 | \$3,956,639 | \$1,015,814 | \$176,065 |  | \$1,500 | \$1,500 | \$385 | \$67 |
| 2065 | 47 | 2460 | -448,950 | 209,504 | 6,185 | 59.6 | 66.0 | \$408,018 | \$503,521 | \$3,040,369 | \$0 | \$4,732 | \$3,956,640 | \$986,227 | \$164,547 |  | \$1,500 | \$1,500 | \$374 | \$62 |
| 2066 | 48 | 2460 | -448,950 | 209,504 | 6,185 | 59.6 | 66.0 | \$408,018 | \$503,522 | \$3,040,369 | \$0 | \$4,732 | \$3,956,641 | \$957,502 | \$153,782 |  | \$1,500 | \$1,500 | \$363 | \$58 |
| 2067 | 49 | 2460 | -448,950 | 209,504 | 6,185 | 59.6 | 66.0 | \$408,018 | \$503,522 | \$3,040,369 | \$0 | \$4,732 | \$3,956,642 | \$929,614 | \$143,721 |  | \$1,500 | \$1,500 | \$352 | \$54 |
| 2068 | 50 | 2460 | -448,950 | 209,504 | 6,185 | 59.6 | 66.0 | \$408,019 | \$503,523 | \$3,040,369 | \$0 | \$4,732 | \$3,956,643 | \$902,538 | \$134,319 | \$930,000 | \$1,500 | \$931,500 | \$212,482 | \$31,622 |



| Present Value Benefits |  |
| :---: | :---: |
| $@ 3 \%$ | $@ 7 \%$ |
| $\$ 97,309,583$ | $\$ 51,120,934$ |


| Present Value Costs |  |
| :---: | :---: |
| $@ 3 \%$ | $@ 7 \%$ |
| $\$ 19,264,944$ | $\$ 18,257,868$ |
|  |  |
| Benefit Cost Ratios |  |
| $@ 3 \%$ | $@ 7 \%$ |
| 5.1 | 2.8 |

Discount Rates: $\quad 3 \% \quad \& \quad$ \& $\quad$ \%

1. AADT - Average Annual Daily Traffic. Source MaineDOT.
2. See spreadsheet " $J-B$ User Costs. $X \mid s$ ", tab "User cost time line
3. Air emission factors were applied to VMT and estimated speeds to derive tons of emissions. Costs per ton based on TIGER guidance and EPA Social Cost of Carbon Guidance. http://www.dot.gov/TIGER. See "Emissions Reduction - Jonesport Beals Bridge w-TOTAL. .x/s
4. VMT and VHT valued at $\$ 0.35$ per VMT and $\$ 15.51$ per VHT, based on ratio of heavy trucks to automobile traffic. See spreadsheet "J-N User Cost.sx/s", tab "User cost time line".
5. Crash costs were not calculated as there is no vehicular detour to Beals
6. Historic maintenance costs used to estimate annual average $M 80$. See spreadsheet "maintenance cost info. $|s . x| \mid x x^{\prime}$ ",
7. Minor rehabilitation (year 25) and major rehabilitation (year 50) are based upon the life-cycle cost analysis. See spreadshe et "Future Rehabilitation Cost Esimate.x|sX"

XX - Inout value from supporting spreadsheet.


| Highway User Costs of Jonesport-Beals Bridge Closure (assuming a ferry service substitute) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | base |  |  | Opening Year |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
| AADT | 2060 | 2080 | 2100 | 2120 | 2140 | 2160 | 2180 | 2200 | 2220 | 2240 | 2260 | 2280 | 2300 | 2320 | 2340 | 2360 | 2380 |
| Highway Vehicle Use of Ferry Service |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Added VMT (million) | -375950 | -379600 | -383250 | -386900 | -390550 | -394200 | -397850 | -401500 | -405150 | -408800 | -412450 | -416100 | -419750 | -423400 | -427050 | -430700 | -434350 |
| Added VHT | 175443 | 177147 | 178850 | 180553 | 182256 | 183959 | 185662 | 187365 | 189068 | 190771 | 192474 | 194177 | 195880 | 197583 | 199286 | 200989 | 202692 |
| Idling Vehicle Time (for air quality purposes) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Subset of Added VHT | 25063 | 25084 | 25105 | 25126 | 25147 | 25168 | 25189 | 25210 | 25231 | 25252 | 25273 | 25294 | 25315 | 25336 | 25357 | 25378 | 25399 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Combined User Cost (\$Million) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Added VMT | \$ (0.128) | \$ (0.129) | \$ (0.130) | \$ (0.132) | \$ (0.133) | \$ (0.134) | \$ (0.135) | \$ (0.137) | \$ (0.138) | \$ (0.139) | \$ (0.140) | \$ (0.142) | \$ (0.143) | \$ (0.144) | \$ (0.145) | \$ (0.147) | \$ (0.148) |
| Added VHT | \$ 2.674 | \$ 2.700 | \$ 2.726 | \$ 2.752 | \$ 2.778 | \$ 2.804 | \$ 2.830 | \$ 2.856 | \$ 2.882 | \$ 2.908 | \$ 2.934 | \$ 2.960 | \$ 2.986 | \$ 3.011 | \$ 3.037 | \$ 3.063 | \$ 3.089 |
| Combined | \$ 2.546 | \$ 2.571 | \$ 2.595 | \$ 2.620 | \$ 2.645 | \$ 2.670 | \$ 2.694 | \$ 2.719 | \$ 2.744 | \$ 2.768 | \$ 2.793 | \$ 2.818 | \$ 2.843 | \$ 2.867 | \$ 2.892 | \$ 2.917 | \$ 2.941 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Added VMT | -375950 | -379600 | -383250 | -386900 | -390550 | -394200 | -397850 | -401500 | -405150 | -408800 | -412450 | -416100 | -419750 | -423400 | -427050 | -430700 | -434350 |
| Added VHT | 175443 | 177147 | 178850 | 180553 | 182256 | 183959 | 185662 | 187365 | 189068 | 190771 | 192474 | 194177 | 195880 | 197583 | 199286 | 200989 | 202692 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Combined (\$) | \$ 2,546,000 | \$ 2,570,718 | \$ 2,595,437 | \$ 2,620,155 | \$ 2,644,874 | \$ 2,669,592 | \$ 2,694,311 | \$ 2,719,029 | \$ 2,743,748 | \$ 2,768,466 | \$ 2,793,184 | \$ 2,817,903 | \$ 2,842,621 | \$ 2,867,340 | \$ 2,892,058 | \$ 2,916,777 | \$ 2,941,495 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| User Time Costs | Pass. Car | \$ 12 | /veh-hour |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Heavy Veh | \$ 39 | /veh-hour | Pct. of vol. | 13.0\% |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Avg. Veh. | \$ 15.51 | /veh-hour |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| User Mileage Costs | Pass. Car | \$0.25 | /veh-mile |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (excluding | Heavy Veh | \$1.00 | /veh-mile |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| crash costs) | Avg. Veh. | \$ 0.35 | /veh-mile |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| User Crash Costs | Avg. Veh. | \$0.07 | /veh-mile |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Avg. Cost per Crash | Avg. Veh. | \$36,000 | /crash |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| VMT speed |  | mph |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

User cost time line

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
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|  |  |  |  |  |  |  |  |  |  |  | 25-Year |  |  |  |  |  |  |  |
| 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 |
| 2400 | 2420 | 2440 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| -438000 | -441650 | -445300 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 |
| 204395 | 206098 | 207801 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25420 | 25441 | 25462 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| \$ (0.149) | \$ (0.150) | \$ (0.152) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) |
| \$ 3.115 | \$ 3.141 | \$ 3.167 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 |
| \$ 2.966 | \$ 2.991 | \$ 3.016 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| -438000 | -441650 | -445300 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 |
| 204395 | 206098 | 207801 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| \$ 2,966,214 | \$ 2,990,932 | \$ 3,015,650 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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User cost time line

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
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|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 50-Year |
| 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 |
| 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 | 2460 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 |
| 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 |
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|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 | 25483 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) | \$ (0.153) |
| \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 | \$ 3.193 |
| \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 | \$ 3.040 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 | -448950 |
| 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 | 209504 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 | \$ 3,040,369 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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## Air Quality Analysis: Jonesport Beals Proposed Ferry Crossing

Ferry Fuel Usage

| Annual Diesel Fuel ${ }^{1}$ | $\mathrm{kWh}^{2}$ | Emission Factors (g/kWh) ${ }^{3}$ |  |  | Emissions Increase (Metric Tons / Year) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | VOC | NOx | CO2 | VOC | NOx | CO2 |
| 228,800 | 9,312,160 | 0.270 | 6.800 | 690.00 | 3 | 63 | 6425 |

Increase in delay VHT through idling at Jonesport and Beals Terminals

| Annual VHT | Emission Factors (g/hour) |  | Emissions Increase (Tons / Year) |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | VOC | NOx | CO2 | VOC | NOx | CO2 |
| 25,063 | 9.996 | 2.867 | 1402.75 | 0 | 0 | 35 |

Emission Analysis

| Annual Emissions | Total Emission Increase (Metric Tons / Year) |  |  | Value of Emissions (\$ / Metric Ton) ${ }^{5}$ |  |  | Value of Emissions (\$ / Year) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | VOC | NOx | CO 2 | VOC | NOx | CO2 | VOC | NOx | CO2 |
|  | 3 | 63 | 6461 | \$1,999 | \$7,877 | \$43 | \$5,527 | \$499,359 | \$277,804 |

## NOTES

"Based on annual fuel usage of the Margaret Chase Smith Ferry. It is assumed that the Jonesport-Beals crossing would require two vessels comparable to the Smith. ${ }^{2} 40.7 \mathrm{kWh}$ in 1 gallon [U.S.] of diesel oil
${ }^{3}$ Emission factors for Category 1, Teir 2 Marine Engies from U.S. EPA, Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories: Final Report, April 2009

Idling

| Year | Increase in delay VHT through idling at Jonesport and Beals Terminals |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Annual VHT | Emission Factors (g/hour) ${ }^{4}$ |  |  | Emissions Increase (Tons / Year) |  |  |
|  |  | VOC | NOx | CO2 | VOC | NOx | CO2 |
| 2015 | 25063 | 9.996 | 2.867 | 1402.75 | 0.251 | 0.072 | 35 |
| 2016 | 25084 | 9.996 | 2.867 | 1402.75 | 0.251 | 0.072 | 35 |
| 2017 | 25105 | 9.996 | 2.867 | 1402.75 | 0.251 | 0.072 | 35 |
| 2018 | 25126 | 9.996 | 2.867 | 1402.75 | 0.251 | 0.072 | 35 |
| 2019 | 25147 | 9.996 | 2.867 | 1402.75 | 0.251 | 0.072 | 35 |
| 2020 | 25168 | 9.996 | 2.867 | 1402.75 | 0.252 | 0.072 | 35 |
| 2021 | 25189 | 9.996 | 2.867 | 1402.75 | 0.252 | 0.072 | 35 |
| 2022 | 25210 | 9.996 | 2.867 | 1402.75 | 0.252 | 0.072 | 35 |
| 2023 | 25231 | 9.996 | 2.867 | 1402.75 | 0.252 | 0.072 | 35 |
| 2024 | 25252 | 9.996 | 2.867 | 1402.75 | 0.252 | 0.072 | 35 |
| 2025 | 25273 | 9.996 | 2.867 | 1402.75 | 0.253 | 0.072 | 35 |
| 2026 | 25294 | 9.996 | 2.867 | 1402.75 | 0.253 | 0.073 | 35 |
| 2027 | 25315 | 9.996 | 2.867 | 1402.75 | 0.253 | 0.073 | 36 |
| 2028 | 25336 | 9.996 | 2.867 | 1402.75 | 0.253 | 0.073 | 36 |
| 2029 | 25357 | 9.996 | 2.867 | 1402.75 | 0.253 | 0.073 | 36 |
| 2030 | 25378 | 9.996 | 2.867 | 1402.75 | 0.254 | 0.073 | 36 |
| 2031 | 25399 | 9.996 | 2.867 | 1402.75 | 0.254 | 0.073 | 36 |
| 2032 | 25420 | 9.996 | 2.867 | 1402.75 | 0.254 | 0.073 | 36 |
| 2033 | 25441 | 9.996 | 2.867 | 1402.75 | 0.254 | 0.073 | 36 |
| 2034 | 25462 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2035 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2036 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2037 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2038 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2039 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2040 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2041 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2042 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2043 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2044 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2045 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2046 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2047 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2048 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2049 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2050 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2051 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2052 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2053 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2054 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2055 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2056 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2057 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2058 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2059 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2060 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2061 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2062 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2063 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2064 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2065 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2066 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2067 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |
| 2068 | 25483 | 9.996 | 2.867 | 1402.75 | 0.255 | 0.073 | 36 |


| Year | Ferry |  |  | Idling |  |  | Reductions from VMT |  |  | Total Emissions |  |  | Emissions Costs |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Emissions Increase (Metric Tons / Year) |  |  | Emissions Increase (Tons / Year) |  |  | Tons / Year |  |  | Tons / Year |  |  |  |  |  |
|  | voc | NOx | CO2 | voc | NOx | CO2 | voc | NOx | CO2 | voc | NOx | CO2 | voc | NOx | Total |
| 2015 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.197 | -0.228 | -211.397 | 2.32 | 63.2 | 6227 | \$4,642 | \$498,000 | \$502,643 |
| 2016 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.199 | -0.230 | -213.449 | 2.32 | 63.2 | 6225 | \$4,639 | \$497,983 | \$502,622 |
| 2017 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.201 | -0.233 | -215.501 | 2.32 | 63.2 | 6223 | \$4,635 | \$497,966 | \$502,601 |
| 2018 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.203 | -0.235 | -217.554 | 2.32 | 63.2 | 6221 | \$4,631 | \$497,949 | \$502,580 |
| 2019 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.205 | -0.237 | -219.606 | 2.31 | 63.2 | 6219 | \$4,627 | \$497,933 | \$502,560 |
| 2020 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.207 | -0.239 | -221.659 | 2.31 | 63.2 | 6217 | \$4,623 | \$497,916 | \$502,539 |
| 2021 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.208 | -0.241 | -223.711 | 2.31 | 63.2 | 6215 | \$4,619 | \$497,899 | \$502,518 |
| 2022 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.210 | -0.244 | -225.763 | 2.31 | 63.2 | 6213 | \$4,616 | \$497,882 | \$502,497 |
| 2023 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.212 | -0.246 | -227.816 | 2.31 | 63.2 | 6211 | \$4,612 | \$497,865 | \$502,477 |
| 2024 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.214 | -0.248 | -229.868 | 2.31 | 63.2 | 6209 | \$4,608 | \$497,848 | \$502,456 |
| 2025 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.153 | -0.144 | -233.488 | 2.37 | 63.3 | 6205 | \$4,730 | \$498,672 | \$503,403 |
| 2026 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.154 | -0.145 | -235.554 | 2.37 | 63.3 | 6203 | \$4,728 | \$498,663 | \$503,390 |
| 2027 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.156 | -0.146 | -237.620 | 2.36 | 63.3 | 6201 | \$4,725 | \$498,653 | \$503,378 |
| 2028 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.157 | -0.147 | -239.687 | 2.36 | 63.3 | 6199 | \$4,722 | \$498,644 | \$503,366 |
| 2029 | 3 | 63 | 6425 | 0.005 | 0.128 | 13 | -0.158 | -0.149 | -241.753 | 2.36 | 63.3 | 6197 | \$4,720 | \$498,634 | \$503,354 |
| 2030 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.154 | -0.130 | -243.819 | 2.37 | 63.3 | 6195 | \$4,728 | \$498,784 | \$503,512 |
| 2031 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.155 | -0.131 | -245.886 | 2.36 | 63.3 | 6193 | \$4,725 | \$498,776 | \$503,501 |
| 2032 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.157 | -0.132 | -247.952 | 2.36 | 63.3 | 6190 | \$4,723 | \$498,768 | \$503,491 |
| 2033 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.158 | -0.133 | -250.018 | 2.36 | 63.3 | 6188 | \$4,720 | \$498,760 | \$503,480 |
| 2034 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.159 | -0.134 | -252.084 | 2.36 | 63.3 | 6186 | \$4,718 | \$498,752 | \$503,469 |
| 2035 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,789 | \$503,506 |
| 2036 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,790 | \$503,507 |
| 2037 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,790 | \$503,507 |
| 2038 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,791 | \$503,508 |
| 2039 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,791 | \$503,508 |
| 2040 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,792 | \$503,509 |
| 2041 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,792 | \$503,509 |
| 2042 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,793 | \$503,510 |
| 2043 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,793 | \$503,510 |
| 2044 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,794 | \$503,511 |
| 2045 | 3 | 63 | 6425 | 0.005 | 0.129 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,794 | \$503,511 |
| 2046 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,795 | \$503,512 |
| 2047 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,795 | \$503,512 |
| 2048 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,796 | \$503,513 |
| 2049 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,796 | \$503,513 |
| 2050 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,797 | \$503,514 |
| 2051 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,797 | \$503,514 |
| 2052 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,798 | \$503,515 |
| 2053 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,798 | \$503,515 |
| 2054 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,799 | \$503,516 |
| 2055 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,799 | \$503,516 |
| 2056 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,800 | \$503,517 |
| 2057 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,800 | \$503,517 |
| 2058 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,801 | \$503,518 |
| 2059 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,801 | \$503,518 |
| 2060 | 3 | 63 | 6425 | 0.005 | 0.130 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,802 | \$503,519 |
| 2061 | 3 | 63 | 6425 | 0.005 | 0.131 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,802 | \$503,519 |
| 2062 | 3 | 63 | 6425 | 0.005 | 0.131 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,803 | \$503,520 |
| 2063 | 3 | 63 | 6425 | 0.005 | 0.131 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6184 | \$4,717 | \$498,803 | \$503,520 |
| 2064 | 3 | 63 | 6425 | 0.005 | 0.131 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6185 | \$4,717 | \$498,804 | \$503,521 |
| 2065 | 3 | 63 | 6425 | 0.005 | 0.131 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6185 | \$4,717 | \$498,804 | \$503,521 |
| 2066 | 3 | 63 | 6425 | 0.005 | 0.131 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6185 | \$4,717 | \$498,805 | \$503,522 |
| 2067 | 3 | 63 | 6425 | 0.005 | 0.131 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6185 | \$4,717 | \$498,805 | \$503,522 |
| 2068 | 3 | 63 | 6425 | 0.005 | 0.131 | 13 | -0.160 | -0.129 | -254.151 | 2.36 | 63.3 | 6185 | \$4,717 | \$498,806 | \$503,523 |


| CPI (Annual) |  |  |
| :--- | ---: | ---: | \% Change

Value of Carbon taken from:
Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 Interagency, May 2013

Revised Social Cost of $\mathrm{CO}_{2}, 2010-2050$ (in 2007 dollars per metric ton of $\mathrm{CO}_{2}$ )

| Discount Rate | $5.0 \%$ | $3.0 \%$ | $2.5 \%$ | $3.0 \%$ |
| :---: | :---: | :---: | :---: | :---: |
| Year | Avg | Avg | Avg | 95 th |
| 2010 | 11 | 33 | 52 | 90 |
| 2015 | 12 | 38 | 58 | 109 |
| 2020 | 12 | 43 | 65 | 129 |
| 2025 | 14 | 48 | 70 | 144 |
| 2030 | 16 | 52 | 76 | 159 |
| 2035 | 19 | 57 | 81 | 176 |
| 2040 | 21 | 62 | 87 | 192 |
| 2045 | 24 | 66 | 92 | 206 |
| 2050 | 27 | 71 | 98 | 221 |

## FERRY SERVICE ANALYSIS FROM JONESPORT TO BEALS

BCA

## PROJECT DATA

| Distance: | 1/2 mile | Trips per day | 69 average |
| :---: | :---: | :---: | :---: |
| AADT(2012): | 2060 | Trips per year | 25,063 |
| Peak Traffic Count: | 228 | Vehicles per year | 751,900 |
| Peak Traffic Time: | 2:00pm-3:00pm |  |  |
| Peak Traffic Minutes: | 60 minutes |  |  |
| Estimated Actual Travel Time (10 kt: 3 minutes |  |  |  |
| Estimated Trip Time: | 10 minutes (including loading and unloading, may be 15 minutes) |  |  |
| Water Depth: | ???? looks like 8'-20' |  |  |
| Estimated Operating Trip Cost | \$325 |  |  |

## MAINE'S LARGEST VESSEL DATA

## Margaret Chase Smith

Port to Port: Lincolnville to Islesboro
Maximum Vehicles: 30
Passengers: 221
Max Deck Wt (tonnage): 161
Operating Speed (kts): 14
Maximum Vertical Clearance: 15'
Clearance: 10'
Length: 166.5'

Yearly Fuel Consumption (2014) 108,806
Estimate Life 40 years

## LOGISTICS

Estimated Possible Trips per hour (2 Vessels in opposing directions)

Estimated Possible Trips per hour at 228 vehicles
(September 2012 weekday traffic count)

## ESTIMATED CAPITAL COSTS

| 1 Vessel: | \$15 million | 2 Vessels: | $\$ 30,000,000$ |
| :--- | :--- | :--- | ---: |
| 2 Transfer Bridges: | $\$ 10-15$ million | 2 Transfer Bridges: | $\$ 12,500,000$ |
| Facility | $\$ 1$ million | Facility | $\$ 1,000,000$ |
| ROW: | $?$ |  |  |
| Parking: | $?$ |  | $\$ 43,500,000$ |

## ESTIMATED OPERATING COSTS

Cost per trip:
\$325
Yearly Trips Cost
\$8,145,583.33

Questions: Will we need to dredge?
How many vessels? Do we need a backup vessel?
Restrictions with Vessel traffic: eg. Propane
Other Factors: Emergency traffic/
Closest Shipyard Maintenance?
Do we need to look at bigger vessels? Depth? Cost?

Beals-Jones Port---Routine Maintenance
Existing Bridge

| Year | Annual Totals |  |
| :--- | :--- | ---: |
| 1996 | $\$$ | 1,852 |
| 1997 | $\$$ | 3,373 |
| 1998 | $\$$ | 1,726 |
| 1999 | $\$$ | 20,764 |
| 2000 | $\$$ | 489 |
| 2001 | $\$$ | 474 |
| 2002 | $\$$ | 1,183 |
| 2003 | $\$$ | 1,591 |
| 2004 | $\$$ | 3,277 |
| 2005 | $\$$ | 1,236 |
| 2006 | $\$$ | 11,052 |
| 2007 | $\$$ | 895 |
| 2008 | $\$$ | 1,659 |
| 2009 | $\$$ | 5,221 |
| 2010 | $\$$ | 6,069 |
| 2011 | $\$$ | 4,157 |
| 2012 | $\$$ | 8,656 |
| 2013 | $\$$ | 12,203 |
| 2014 | $\$$ | 4,028 |

AVG $=\$ \quad$ 4,732 PER YEAR (not including wearing surface replacements)


## Revision 5-15-15

(1) Includes stone fill for causeway widening
(2) TCP and MOT Cost
(3) Includes $\$ 472,000$ for mitigation, $\$ 36,000$ in special waste disposal, and $\$ 200,000$ for retaining walls.
(4) Estimated values
(5) Assumed value of $\$ 250,000$

| BEALS-JONESPORT Beals Island Bridge |  |  |
| :---: | :---: | :---: |
| Future Rehabilitation Work Estimates |  | Cost |
| Year 25 |  |  |
| Replace wearing surface and waterproofing membrane | \$ | 150,000 |
| Replace expansion joint troughs at each abutment | \$ | 20,000 |
| Mill \& Overlay approach pavement (1000 feet) | \$ | 50,000 |
| Traffic Control | \$ | 25,000 |
| Miscellaneous Items and Minor Repairs | \$ | 35,000 |
| Preliminary Engineering and Construction Engineering | \$ | 75,000 |
| Year 25 TOTAL = | \$ | 355,000 |
| Year 50 |  |  |
| Replace wearing surface and waterproofing membrane | \$ | 150,000 |
| Replace expansion joint troughs at each abutment | \$ | 20,000 |
| Mill \& Overlay approach pavement (1000 feet) | \$ | 50,000 |
| Replace expansion joints and concrete headers at deck ends | \$ | 100,000 |
| Abutment Concrete Rehabilitation | \$ | 40,000 |
| Deck and Curb Rehabilitation | \$ | 200,000 |
| Pier Rehabilitation | \$ | 100,000 |
| Traffic Control | \$ | 50,000 |
| Miscellaneous Items and Minor Repairs | \$ | 70,000 |
| Preliminary Engineering and Construction Engineering | \$ | 150,000 |
| Year 50 TOTAL = | \$ | 930,000 |

