Mexico-Peru Bridge Benefit Cost Analysis

The Mexico-Peru Bridge is a three span steel through-truss bridge which spans the Androscoggin River from Mexico to Peru, Maine. Completed in 1930, the bridge carries North Maine Street over the Androscoggin River. It is 576 feet long and 23 feet wide, with a maximum single span of 186 feet. The bridge replacement will be a five span welded steel girder structure 840 feet long by 40.25 feet wide.

A benefit cost analysis was conducted on replacing the Mexico-Peru 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, safety, and emissions reduction. Several benefits of M-P replacement are difficult to quantify. These un-quantified benefits include increased economic competitiveness, and livability enhancement.

Base Case Assumption

This benefit cost analysis focuses on replacement of Mexico-Peru Bridge (M-P), 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 M-P Bridge would be closed. Existing and future traffic would be diverted to alternate routes, and to other bridges, thereby increasing travel time, mileage, air emissions and increased accidents.

Project Benefits

Travel Costs

The Mexico-Peru Bridge is an important crossing on the Androscoggin River. The nearest alternative crossings are at the U.S. Route 2 crossing at Rumford-Mexico, about 4.7 miles away, and the State Route 140 crossing in Canton, which is about 20 miles away. If the Bridge were closed and taken out of service, travelers would be forced to use these alternate crossings and encounter significant detour routes. The total increase in vehicle-miles-traveled was estimated at 12,385,823 miles for 2015. This number was developed using MaineDOT's Statewide Travel Demand Model, a transportation analysis tool, based on the TRIPS modeling software that can be used to evaluate the impact of major changes in the highway network. The Model relies on population demographics, employment, and economic activity in order to forecast VMT. The Model can be used to evaluate the travel time and distance benefits of a major new bridge or highway facility and can also be used to evaluate the travel costs (disbenefits) of closing a major facility.

For this analysis the Model was run twice, once with the bridge in place and operating and once with the bridge lost or removed from service. The Model run with the bridge in place represents existing conditions. The modeling run with the bridge removed represents conditions in which the loss of the bridge forces bridge users to alternate river-crossing routes that are longer in distance and time between the start and end points of their trips. Subtracting the existing

conditions Model results from the closed conditions provides an estimate of the increases in user costs from closure of the bridge. The increases in travel distances and travel times that are avoided by replacing the bridge, rather than allowing the crossing to be lost, represent the user benefits of a replacement bridge. The table below summarizes the assumptions for the calculations. Due the large volume of truck traffic the average vehicle-mile costs and average vehicle-hour costs are increased based on proportionate share. The total annual user costs are estimated at $4,939,559 in the first year of closure, and increasing thereafter based on traffic growth. These operating costs are avoided by bridge replacement.

Safety

In comparison to the existing bridge, the Mexico-Peru Bridge replacement will improve safety for all users. The current 22 road width will be widened, thereby improving safety for motorists and pedestrians.

If the loss of this river crossing is prevented by the replacement of the existing bridge, an increase of 12,385,823 vehicle-miles traveled (VMT) annually will be avoided. The added VMT from the loss of a bridge at this location would increase the number of crashes, and increase crash costs by almost $1.3 million annually, based on overall Maine crash statistics. This estimate is based on a statewide average estimate of $0.10 in crash costs per VMT, a value that has been observed in recent Maine crash history.

State of Good Repair

Estimated annualized maintenance costs for the existing bridge are $13,830. This number was derived from actual costs incurred from 2004 to 2013. 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 avoided VMT from closure of the bridge and the loss of this crossing location. The 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 VMT resulting from closure of the bridge. Data is not available for sulfur dioxide or particulate emissions. Based on the annual VMT and VHT approximately 7,019 metric tons of CO2, 6 metric tons of VOCs, and 8 metric tons of NOX, are avoided. These emissions amount to a total of over $300,000 annually. 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 estimated on Table 5: “Changes in the Average Annual Growth Rates of SCC Estimates between 2010 and 2050” in the report. The net present value of air emissions costs is $11 million at 3% discount rate.

Project Costs

Total Construction Costs

The benefit cost analysis uses the replacement construction cost of $12.7 million. Construction costs also include a minor rehabilitation after 25 years and full major rehabilitation after 50 years. Maintenance and operations costs for the replacement structure are considered negligible.

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 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 $ 272.2 million
- Avoided Air Quality Impacts valued at $11.0 million
- Reduced User Costs estimated at $232.1 million
- Avoided Crash Costs of $ 37.0 million
- Avoided Maintenance Costs of $35,600 million
- Total Costs of $ 14.1 million
- Benefit-Cost ratio of 19.3

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 show below.

- Total Benefits of $ 137.6 million
- Avoided Air Quality Impacts valued at $5.5 million
- Reduced User Costs estimated at $ 122.1 million
- Avoided Crash Costs of $ 19.5 million
- Avoided Maintenance Costs of $19,000
- Total Costs of $ 12.4 million
- Benefit-Cost ratio of 11.0
-

User costs represent nearly a large portion of the total annual benefits. These user cost savings are the key driver of the benefit-cost ratio; the other cost savings individually have a small influence on these results.