Appendix A

Technical Memorandum: Benefit/ Cost Analysis, 10 August 2014

Technical Memorandum: Summary of the Benefit Cost Analysis for the Heartland Expressway Corridor in Nebraska, 24 August 2012

TECHNICAL MEMORANDUM

Date:	August 19, 2014
To:	Jim Wilkinson, PE Nebraska Department of Roads
From:	Olsson Associates
RE:	Junction of L62A/US 385 to Alliance NDOR Project No. NH-385-3(118) Control No. 51432 Benefit/Cost Analysis
Project #:	NH-385-3(118) – CN 51432
cc:	File

INTRODUCTION

Benefit/Cost (B/C) analysis is the systematic process of calculating and comparing benefits and costs of a project to determine if the investment is justified. B/C analysis assesses the relative value of a project in monetary estimates by dividing the incremental monetized benefits related to a project by the incremental costs of that project. The resulting benefit/cost ratio is the primary output of this analysis. A B/C greater than one are said to be investments that provide benefits that are greater than the project cost. A second common output measure from B/C analysis is a project Net Benefit. This is a calculation where the net benefits are summed, and then the costs of the project are subtracted.

Benefits calculated in traditional B/C analysis and the analysis completed for this project included:

- Travel time
- Crashes
- Fuel use
- Vehicle operating costs
- Emissions/air quality

Each of these items can have either a positive or negative monetary value.

B/C analysis is typically forward looking. In this case, a five year project development and construction period was assumed. The time horizon in which both benefits and costs were considered was 20 years following construction. The B/C analysis discounts the stream of benefits and costs in future years to represent the time value of money to obtain a present value for comparison purposes.

ANALYSIS TOOL

A number of tools and software are available to complete B/C analysis. Some of the wider used software products are described in a report entitled *Operations Benefit/Cost Analysis Desk Reference*, FHWA, 2012. The list of software identified was reviewed and following review the software CAL-BC was used for this project. CAL-BC is an excel spreadsheet tool developed by Caltrans. The version used conducts benefit/cost analysis for traditional highway improvements.

ASSUMPTIONS

Time frame – a five year period for project engineering, purchase of right-of-way and construction was assumed. A 20-year project horizon was used to capture project costs and benefits.

Discount rate – The discount rate is the rate at which future predicted costs and benefits are reduced to reflect the time cost of money. This converts the future value to present value. The discount rate for this project was 7 percent. This is the rate suggested by the Office of Management and Budget (OMB) for projects anticipated to provide benefits to the general public. In some cases a discount rate of 3% is used, which is the rate used for evaluating public agency projects and also is a rate that is closer to the current interest rates. There is not a clear consensus on what discount rate should be used with the typical range being between 3 and 7 percent. The results for both 3% and 7% are presented below.

Capital costs – the capital costs were obtained from the Nebraska Department of Roads. Costs included engineering, right-of-way, utilities and construction.

Operating and maintenance costs – the costs to maintain the roadway over the 20-year project life were estimated to be 5 percent of the construction costs for every 10 year period.

Traffic volumes and forecasts – traffic volumes and traffic forecasts are based upon review of the traffic data and documentation provided for this project. Based upon this review, it was determined that the analysis would include the following. The forecast daily traffic volume for US-385 from its junction with L-62A (mile marker 84+70) to Alliance (mile marker 109+25) for the year 2019 when the project would be completed is 3,920, with the 20-year year 2039 design year projection of 5,135. The heavy truck percentage is currently 19%; heavy trucks could potentially grow at a rate greater than that of overall traffic. For this analysis the future truck percentage of 20 percent was used.

Crash data – crash data were obtained from the Safety Analysis Report for the US 385 Study dated November 14, 2011. The potential crash benefits of the project were estimated based upon research reported in the Highway Safety Information Systems (HSIS) report *Safety Effects of the Conversion of Rural Two-lane Roadways to Four-Lane Roadways*.

Travel time savings – the base travel speed for the two-lane highway segment was taken from the Statewide Travel Model which was 62 m.p.h. A travel speed of 65 m.p.h. was assumed to be achieved by the project to address the vertical profile of the existing roadway and the elimination of passing zones with the additional lanes.

RESULTS

Discount Rate of 7%

The B/C ratio for the project is 1.2. The Net Present Value is $9.8 million. The benefits of the project over the 20 year period are as follows:

Travel time savings: $7.9 million
Vehicle operating costs savings: $3.6 million
Crash cost savings: $45.6 million
Emission cost savings: -$0.1 million

Total Benefits: $57.0 million
Life-cycle Costs: $47.2 million

Discount Rate of 3%

The B/C ratio for the project is 1.7. The Net Present Value is $36.1 million. The benefits of the project over the 20 year period are as follows:

Travel time savings: $13.3 million
Vehicle operating costs savings: $0.0 million
Crash cost savings: $75.4 million
Emission cost savings: -$0.5 million

Total Benefits: $88.3 million
Life-cycle Costs: $52.2 million

The full version to this Technical Memorandum is available upon request.