

# Evaluation of Expected Project Costs and Benefits

## ***Methodology and Assumptions***

In order to weigh the expected project benefits versus the costs, a rigorous technical evaluation of the stream of monetized potential user benefits was compared against initial construction cost estimates and long-term operation and maintenance cost estimates. The benefit and cost comparison was produced for construction of the entire 200-mile statewide corridor across Missouri because the I-70 Truck-Only Lanes Project seeking TIGER Grant funding represents an initial section of an overall corridor wide implementation of truck-only lanes. It is recognized that the full benefits of a truck-only lanes facility would be realized by ultimate completion of the statewide corridor.

## **Project Costs**

MoDOT has estimated the total project cost for construction of the entire 200-mile statewide corridor at \$3.5 billion in 2009 dollars. The estimated cost, based upon the information from the I-70 SEIS, is broken down into 28 percent right-of way (\$980 million), 57 percent roadway construction costs (\$2 billion) and 15 percent bridge construction costs (\$525 million). The benefit-cost analysis performed for this project assumed that purchased right-of-way would maintain 100 percent of its value over the life of the project, bridges would maintain 75 percent of their value, and the roadway would not have any remaining value at the end of the life-cycle in 2050. These assumptions resulted in a residual value calculation of the I-70 truck-only lanes investment of \$1.4 billion in 2050 (in 2009 dollars). Additionally, MoDOT has estimated that ongoing maintenance and operations cost for the statewide project would be approximately \$13 million per year.

## **Project Benefits**

Data used in the calculation of estimated project benefits over the life cycle of the 30-year project were entirely derived from previous or updated traffic analysis, travel demand modeling and MoDOT crash record databases used in the I-70 Second Tier and SEIS environmental NEPA studies. All forecasted average daily traffic (ADT) and vehicle-miles traveled (VMT) data were derived from the updated I-70 Statewide Travel Demand Model utilized in the I-70 Second Tier Environmental Studies. Vehicle-hours traveled (VHT) were derived from the elimination of delay in the urban areas of Kansas City, Columbia and St. Louis. "Existing" traffic and crash data used in calculations were updated with the most recent ADT and crash data available from MoDOT databases. All calculations of the 30-year streams of benefits were discounted at the federally accepted discount rate of seven percent.

- ***Travel Time Savings*** - Travel time savings over the improved I-70 Corridor were estimated by eliminating forecasted delays in urban areas associated with congestion, which resulted in a conservative value of an average 20-minute reduction for each vehicle (both truck and passenger vehicles) traveling the full length of the corridor. Although each vehicle likely does not traverse the full 200-miles of the I-70 Corridor, the assumption was made that on average, each vehicle traveling a significant distance would receive approximately 20-minutes in travel time savings due to the elimination of delays. Utilizing USDOT guidance on the *Valuation of Travel Time in Economic Analysis*, values of travel time were inflated to 2009 dollars and were estimated to be

\$20.17 an hour for each “all-purpose” automobile (a weighted average of business automobile and passenger automobile travelers). For commercial trucks traveling the I-70 Corridor, the value of travel time was estimated to be \$23.40 an hour. Discounted (Net Present Value) travel time savings for an improved I-70 Corridor with truck-only lanes between 2020 and 2050 were estimated to be \$3.1 billion.

- **Vehicle Operating Cost Savings** - Vehicle operating cost savings for automobiles were estimated at \$0.17 per mile (2009 dollars) utilizing Triple A (AAA) guidance, *Estimated Costs to Operate Passenger Vehicles*, which excluded insurance and registration costs and included fuel costs. Minnesota DOT research, *Per-Mile Costs of Operating Trucks and Automobiles*, was utilized to develop the \$0.60 cost per mile (2009 dollars, inflated) to operate commercial trucks. These per-mile operating costs were applied to the I-70 VMT model output to obtain vehicle-operating costs savings. Several adjustments were made to estimated VMT, including a conservative assumption that 30 percent of all VMT in the I-70 Corridor is from commercial trucks. It was also assumed that 35 percent of trucks would be effectively removed from the roadway due to the future anticipated use of longer-combination vehicles on I-70 through Missouri that will allow the hauling of greater loads (multiple combinations) with one tractor trailer. As a result of these adjustments, discounted vehicle operating cost savings between 2020 and 2050 were estimated to be -\$740 million, meaning that no savings are expected to be realized. Rather, an overall net cost to users is expected due to an expected increase in VMT over the I-70 Corridor which results from more vehicles being attracted to the roadway due to excess capacity and otherwise generally safe travel conditions in the corridor.
- **Crash Savings** - Crash savings were estimated by utilizing research and analyses completed for the I-70 Second Tier Environmental Studies that determined that safety enhancements and design upgrades would result in an overall crash rate reduction of approximately 20 percent. The most recent available MoDOT crash database data was also analyzed to determine if past crash incidence and severity trends were still valid. FHWA guidance on the Value of Statistical Lives updated in 2009 was consulted to determine the appropriate values to apply to each analyzed category of crash severity. Those crash severity categories and values included Property-Damage Only (\$4,100), Minor Injury (\$93,000), Major Injury (\$345,000), and Fatal (\$6 million) crashes. The result of the analysis was that between 2020 and 2050, improving the I-70 Corridor with truck-only lanes would result in a discounted net present value crash savings of \$1.6 billion. This estimate is considered conservative due to the exclusion of potential crash reduction benefits resulting from the physical separation of large trucks and passenger vehicles and the addition of a concrete median barrier for opposing truck traffic. The impact these design features may have on crash reduction could not be quantified due to the lack of comparable existing roadway facilities and empirical evidence. However, it is a reasonable assumption that the separation of passenger cars and large trucks would have a significant positive impact on the reduction in the number and severity of crashes.

## I-70 TRUCK-ONLY LANES USER BENEFITS SUMMARY

|                                     |                        |
|-------------------------------------|------------------------|
| Total Construction Cost (All Years) | <b>\$3,500,000,000</b> |
| Annual Maintenance Costs            | <b>\$13,007,299</b>    |

### RESIDUAL CALCULATIONS

|              | Cost Breakdown         | Residual % | Residual Amount        |
|--------------|------------------------|------------|------------------------|
| Right-of-Way | <b>\$982,000,000</b>   | 100%       | \$982,000,000          |
| Bridge       | <b>\$525,000,000</b>   | 75%        | \$393,750,000          |
| Roadway      | <b>\$1,993,000,000</b> | 0%         | \$0                    |
| Total        | <b>\$3,500,000,000</b> |            | <b>\$1,375,750,000</b> |

### TRAVEL TIME SAVINGS CALCULATIONS

|                                | VHT Savings (Hours per Day) | VHT Savings (Hours per Year)   | Auto-All Purpose \$ Savings (Year) | Auto-Business \$ Savings (Year) | Truck \$ Savings (Year) | Total \$ Savings (Year) |
|--------------------------------|-----------------------------|--|------------------------------------|---------------------------------|-------------------------|-------------------------|
| Travel Time Savings (2020)     | <b>23,472</b>               | 8,567,212  | \$120,960,460                      | \$0                             | \$60,141,825            | <b>\$181,102,286</b>    |
| Travel Time Savings (2050)     | <b>45,115</b>               | 16,466,794   | \$232,494,660                      | \$0                             | \$115,596,892           | <b>\$348,091,551</b>    |
| Auto - All Purpose Trips %     | <b>70%</b>                  | Source: I-70 2nd Tier Studies Traffic Analysis   |                                    |                                 |                         |                         |
| Commercial Truck Trip %        | <b>30%</b>                  | Source: I-70 2nd Tier Studies Traffic Analysis   |                                    |                                 |                         |                         |
| All Purpose Auto Value of Time | <b>\$20.17</b>              | Source: USDOT guidance on Valuation of Travel Time in Economic Analysis, updated from 2000\$ to 2008\$ |                                    |                                 |                         |                         |
| Commercial Truck Value of Time | <b>\$23.40</b>              | Source: USDOT guidance on Valuation of Travel Time in Economic Analysis, updated from 2000\$ to 2008\$ |                                    |                                 |                         |                         |

### VEHICLE OPERATING COST SAVINGS CALCULATIONS

|                                       | VMT Savings (Miles per Day) | VMT Savings (Miles per Year)  | Auto \$ Savings (Year) | Truck \$ Savings (Year) | Total \$ Savings (Year) |
|---------------------------------------|-----------------------------|---|------------------------|-------------------------|-------------------------|
| Vehicle Operating Cost Savings (2020) | <b>-118,988</b>             | -152,930,620  | -\$18,042,449          | -\$17,982,347           | <b>-\$36,024,796</b>    |
| Vehicle Operating Cost Savings (2050) | <b>-1,305,224</b>           | -476,406,740  | -\$56,205,514          | -\$56,018,287           | <b>-\$112,223,801</b>   |
| Truck Percentage                      | <b>30%</b>                  |   |                        |                         |                         |
| Auto Percentage                       | <b>70%</b>                  |   |                        |                         |                         |
| LCV Adjustment                        | <b>65%</b>                  | Assumes negative 35% adjustment in number of trucks traveling due to use of LCVs  |                        |                         |                         |
| VOC-Autos                             | <b>\$0.17</b>               | Source: AAA 2009\$ Estimated costs to operate passenger vehicles, excludes insurance, registration costs, assumes fuel costs included |                        |                         |                         |
| VOC-Trucks                            | <b>\$0.60</b>               | Source: AAA 2009\$ Per-Mile Costs of Operating Trucks and Automobiles, MNDOT  |                        |                         |                         |

### CRASH COST SAVINGS CALCULATIONS

|                              | PDO Crashes Saved (Year) | Minor Injury Accidents Saved (Year)   | Major Injury Crashes Saved (Year) | Fatal Accidents Saved (Year) | Total Accidents Saved (Year) | Total PDO \$ Savings (Year) | Total Minor Injury \$ Savings (Year) | Total Major Injury \$ Savings (Year) | Total Fatal \$ Savings (Year) | Total \$ Savings (Year) |  |
|------------------------------|--------------------------|---|-----------------------------------|------------------------------|------------------------------|-----------------------------|--------------------------------------|--------------------------------------|-------------------------------|-------------------------|--|
| Accident Cost Savings (2020) | <b>484</b>               | <b>123</b>  | <b>28</b>                         | <b>13</b>                    | <b>647</b>                   | \$1,982,873                 | \$11,431,449                         | \$9,584,782.17                       | \$77,699,656                  | <b>\$100,698,760</b>    |  |
| Accident Cost Savings (2050) | <b>683</b>               | <b>177</b>  | <b>40</b>                         | <b>20</b>                    | <b>920</b>                   | \$2,798,952                 | \$16,502,740                         | \$13,836,843.70                      | \$120,530,038                 | <b>\$153,668,574</b>    |  |
| PDO Crash Value              | <b>\$4,100</b>           | MoDOT Guidance, updated to 2009\$   |                                   |                              |                              |                             |                                      |                                      |                               |                         |  |
| Minor Injury Crash Value     | <b>\$93,000</b>          | FHWA Guidance on Value of Statistical Life, Moderate Severity of Injury Crash |                                   |                              |                              |                             |                                      |                                      |                               |                         |  |
| Major Injury Crash Value     | <b>\$345,000</b>         | FHWA Guidance on Value of Statistical Life, Severe Severity of Injury Crash   |                                   |                              |                              |                             |                                      |                                      |                               |                         |  |
| Fatal Accident Value         | <b>\$6,000,000</b>       | FHWA Guidance on Value of Statistical Life, Fatal Severity of Crash           |                                   |                              |                              |                             |                                      |                                      |                               |                         |  |

#### PLEASE NOTE:

- 1) Yellow cells denote input cells
- 2) Cells with red fonts denote fixed values and should not be modified or altered
- 3) Cells with black bold fonts are values that are transferred to the Benefit-Cost Spreadsheet

**TRAVEL EFFICIENCY FEASIBILITY  
I-70 Truck-Only Lanes - 200 Mile Section**

|                                | <u>Capital</u>         | <u>Maintenance</u>   | <u>Total Costs</u>     | <u>Time Savings</u>    | <u>VOC Savings</u>       | <u>Crash Savings</u>   | <u>Total Benefits</u>  | <u>Net Benefits</u>    |
|--------------------------------|------------------------|----------------------|------------------------|------------------------|--------------------------|------------------------|------------------------|------------------------|
| 2020                           | \$3,500,000,000        |                      | \$3,500,000,000        | \$181,102,286          | (\$36,024,796)           | \$100,698,760          | \$245,776,250          | (\$3,254,223,750)      |
| 2021                           |                        | \$13,007,299         | \$13,007,299           | \$185,089,983          | (\$37,415,450)           | \$102,127,528          | \$249,802,062          | \$236,794,762          |
| 2022                           |                        | \$13,007,299         | \$13,007,299           | \$189,165,486          | (\$38,859,788)           | \$103,576,569          | \$253,882,267          | \$240,874,968          |
| 2023                           |                        | \$13,007,299         | \$13,007,299           | \$193,330,728          | (\$40,359,880)           | \$105,046,169          | \$258,017,016          | \$245,009,717          |
| 2024                           |                        | \$13,007,299         | \$13,007,299           | \$197,587,684          | (\$41,917,881)           | \$106,536,620          | \$262,206,424          | \$249,199,124          |
| 2025                           |                        | \$13,007,299         | \$13,007,299           | \$201,938,375          | (\$43,536,024)           | \$108,048,219          | \$266,450,569          | \$253,443,270          |
| 2026                           |                        | \$13,007,299         | \$13,007,299           | \$206,384,863          | (\$45,216,633)           | \$109,581,265          | \$270,749,496          | \$257,742,197          |
| 2027                           |                        | \$13,007,299         | \$13,007,299           | \$210,929,259          | (\$46,962,117)           | \$111,136,063          | \$275,103,205          | \$262,095,906          |
| 2028                           |                        | \$13,007,299         | \$13,007,299           | \$215,573,718          | (\$48,774,981)           | \$112,712,921          | \$279,511,658          | \$266,504,359          |
| 2029                           |                        | \$13,007,299         | \$13,007,299           | \$220,320,443          | (\$50,657,827)           | \$114,312,153          | \$283,974,769          | \$270,967,470          |
| 2030                           |                        | \$13,007,299         | \$13,007,299           | \$225,171,687          | (\$52,613,356)           | \$115,934,075          | \$288,492,406          | \$275,485,107          |
| 2031                           |                        | \$13,007,299         | \$13,007,299           | \$230,129,751          | (\$54,644,374)           | \$117,579,010          | \$293,064,387          | \$280,057,087          |
| 2032                           |                        | \$13,007,299         | \$13,007,299           | \$235,196,986          | (\$56,753,795)           | \$119,247,285          | \$297,690,476          | \$284,683,176          |
| 2033                           |                        | \$13,007,299         | \$13,007,299           | \$240,375,797          | (\$58,944,645)           | \$120,939,229          | \$302,370,381          | \$289,363,082          |
| 2034                           |                        | \$13,007,299         | \$13,007,299           | \$245,668,640          | (\$61,220,067)           | \$122,655,180          | \$307,103,753          | \$294,096,454          |
| 2035                           |                        | \$13,007,299         | \$13,007,299           | \$251,078,027          | (\$63,583,327)           | \$124,395,478          | \$311,890,177          | \$298,882,878          |
| 2036                           |                        | \$13,007,299         | \$13,007,299           | \$256,606,523          | (\$66,037,815)           | \$126,160,468          | \$316,729,175          | \$303,721,876          |
| 2037                           |                        | \$13,007,299         | \$13,007,299           | \$262,256,751          | (\$68,587,054)           | \$127,950,500          | \$321,620,198          | \$308,612,899          |
| 2038                           |                        | \$13,007,299         | \$13,007,299           | \$268,031,392          | (\$71,234,699)           | \$129,765,931          | \$326,562,624          | \$313,555,324          |
| 2039                           |                        | \$13,007,299         | \$13,007,299           | \$273,933,185          | (\$73,984,551)           | \$131,607,119          | \$331,555,753          | \$318,548,454          |
| 2040                           |                        | \$13,007,299         | \$13,007,299           | \$279,964,930          | (\$76,840,555)           | \$133,474,432          | \$336,598,807          | \$323,591,508          |
| 2041                           |                        | \$13,007,299         | \$13,007,299           | \$286,129,488          | (\$79,806,808)           | \$135,368,239          | \$341,690,919          | \$328,683,620          |
| 2042                           |                        | \$13,007,299         | \$13,007,299           | \$292,429,783          | (\$82,887,566)           | \$137,288,916          | \$346,831,133          | \$333,823,834          |
| 2043                           |                        | \$13,007,299         | \$13,007,299           | \$298,868,805          | (\$86,087,250)           | \$139,236,845          | \$352,018,400          | \$339,011,101          |
| 2044                           |                        | \$13,007,299         | \$13,007,299           | \$305,449,608          | (\$89,410,451)           | \$141,212,413          | \$357,251,570          | \$344,244,271          |
| 2045                           |                        | \$13,007,299         | \$13,007,299           | \$312,175,314          | (\$92,861,936)           | \$143,216,010          | \$362,529,389          | \$349,522,089          |
| 2046                           |                        | \$13,007,299         | \$13,007,299           | \$319,049,114          | (\$96,446,657)           | \$145,248,036          | \$367,850,492          | \$354,843,193          |
| 2047                           |                        | \$13,007,299         | \$13,007,299           | \$326,074,268          | (\$100,169,759)          | \$147,308,893          | \$373,213,402          | \$360,206,103          |
| 2048                           |                        | \$13,007,299         | \$13,007,299           | \$333,254,109          | (\$104,036,582)          | \$149,398,991          | \$378,616,517          | \$365,609,218          |
| 2049                           |                        | \$13,007,299         | \$13,007,299           | \$340,592,043          | (\$108,052,676)          | \$151,518,744          | \$384,058,112          | \$371,050,812          |
| 2050                           | (\$1,375,750,000)      | \$13,007,299         | (\$1,362,742,701)      | \$348,091,551          | (\$112,223,801)          | \$153,668,574          | \$389,536,324          | \$1,752,279,025        |
| <b>Total</b>                   | <b>\$2,124,250,000</b> | <b>\$390,218,978</b> | <b>\$2,514,468,978</b> | <b>\$7,931,950,576</b> | <b>(\$2,086,153,101)</b> | <b>\$3,886,950,637</b> | <b>\$9,732,748,112</b> | <b>\$7,218,279,134</b> |
| Discounted Total               | \$2,214,252,336        | \$161,408,112        | \$3,480,679,801        | \$3,064,648,318        | (\$740,029,075)          | \$1,563,733,477        | \$3,888,352,719        | \$407,672,919          |
| <b>Discount Rate</b>           |                        |                      | <b>7.00%</b>           |                        |                          |                        |                        |                        |
| <b>Net Present Value</b>       |                        |                      | <b>\$407,672,919</b>   |                        |                          |                        |                        |                        |
| <b>Internal Rate of Return</b> |                        |                      | <b>8.03%</b>           |                        |                          |                        |                        |                        |
| <b>Benefit/Cost Ratio</b>      |                        |                      | <b>1.12</b>            |                        |                          |                        |                        |                        |