



BUILD THE BRIDGES
COALITION

Economic Benefits Assessment of the Ohio River Bridges Project

Prepared for the:

Build the Bridges Coalition

Prepared by:

AECOM Consult, Inc.
3101 Wilson Blvd., Suite 400
Arlington, VA 22201

| **AECOM**

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EXECUTIVE SUMMARY

The Louisville and Southern Indiana metropolitan area is an economic engine, with Louisville producing more than 31 percent of the state's Gross State Product (GSP), a broad measure of economic activity. Indiana residents make up nearly 20 percent of the Louisville workforce.

A driving force in the metropolitan area's success is its significant cost advantage relative to the nation and large urban Midwestern markets; business costs are 11 percentage points below the national average. The region's location, within 500 miles of two thirds of the U.S. population, makes logistics and distribution a key industry to its past and future economic success.

A transportation investment such as the Ohio River Bridges Project will reduce congestion, improve public safety and increase access and mobility, keys for maintaining and improving the cost structure for doing business in the Louisville metropolitan area and building on one of the region's core economic strengths as a logistics center.

This Analysis examined economic benefits relating to the project during construction and after the project is completed from travel time savings, accident avoidance savings, and reduced vehicle operations costs. The long-term job growth benefits from the project that will likely occur were not part of this study's scope.

Construction Benefits

The Ohio River Bridges Project's construction is among the largest in the country and a major economic development initiative in its own right.

- The project's construction will result in:
 - Nearly 57,000 new jobs in the Louisville Metropolitan Statistical area of nine Kentucky counties and four Indiana counties, with each job lasting a year.
 - Of these jobs, about 28,000 will be directly related to project construction and about 29,000 will be in other industries and services as a result of the project's construction such as local restaurants and entertainment venues, and retail establishments.
 - Earnings from these jobs are estimated at nearly \$2 billion in 2007 dollars.
- Tax revenue: These new jobs and earnings will generate \$24 million in occupational taxes in Louisville; more than \$10 million for schools in Jefferson County and nearly \$4 million for TARC. Kentucky and Indiana will receive a total of \$50 million in income tax revenue.

User Benefits

While construction benefits last until project completion, the daily use of the new bridges and associated highway improvements present long-term and significant benefits. These include reduced congestion and the value of time saved by travelers, improved safety and the value of accidents avoided, and reduced costs of operating vehicles.

The user benefits for these savings total over \$5.5 billion dollars in 2007 dollars between 2014, the opening year of the first bridge to be completed and 2059 (35 years beyond the opening of

the project's final segment. The values are discounted to convert a stream of benefits received in the future to a present value.

On net, the benefits of the Ohio River Bridges Project far outweigh the costs. The project yields \$2.67 worth of user benefits for each construction dollar spent. That is, for every dollar of project cost, the traveling public receives a stream of benefits between 2014 (when the first bridge opens) and 2059 (35 years after the final project segment opens) that is worth \$2.67, a return of about 170 percent.

The user benefit savings are comprised of three specific types of benefits:

- Travel time savings, the value of reduced congestion, accounts for about 40 percent of the user benefits from the project, saving the traveling public about \$2.4 billion between 2014 when the first part of the project is completed, and 2059.
- Safety benefits, the value of accidents avoided, accounts for about half of the total user benefits, about \$2.9 billion between 2014 and 2059.
- Vehicle operating efficiencies, reflecting savings in fuel and other operating costs, account for the balance of the user benefits, about 10 percent of the overall total.

INTRODUCTION

Transportation connects the residents of Louisville and Southern Indiana to economic opportunity. The quality of life enjoyed by the region's residents and the economic competitiveness of its local businesses rely on the transportation network. The ability of manufacturers and agricultural producers to access markets and receive supplies depends on a reliable and efficient transportation network. The network connects residents to jobs, schools, shopping and recreation.

The region's current economic success is fostered by the cumulative benefits of past public investments to construct and maintain the transportation network. The region's ability to remain competitive with other communities depends on its ability to sustain efficient transport of people and goods.

The objective of this study is to demonstrate how the investments included in the Ohio River Bridges Project will benefit the Louisville, MSA¹. Specifically this study will:

- Estimate the construction benefits associated with building the project.
- Estimate the fiscal benefits associated with the project's construction.
- Estimate the user benefits associated with the project's use. These include the value of travel time saved due to reduced congestion, the value of accidents avoided due to improved safety, and reduced vehicle operating costs.

1. IMPORTANCE OF TRANSPORTATION TO KENTUCKY AND INDIANA

The Louisville metropolitan area is the engine of Kentucky's economy, producing over 31 percent of the state's Gross State Product (GSP) a broad measure of economic activity². Indiana residents make up nearly 20 percent of the Louisville workforce. By collecting producers, suppliers and consumers in urban centers, communication, transport, distribution and production activities are less costly. Retailers, for example benefit from a concentration of consumers in a relatively small geography. Consumers also benefit as their search costs are reduced and their choices are expanded.

Businesses also benefit from being in an urban area because they have a greater range of suppliers and access to specialized goods and services that make their own production more cost efficient. Urban areas provide access to large pools of labor, a diversity of transportation options, specialized technical and professional services and a large client base. In an increasingly global economy, Louisville is the gateway between the state and the rest of the world. These so-called agglomeration economies diminish the cost of transactions and make Louisville's firms more productive.

Balanced against the advantages of an urban location are the diseconomies of such places. These negatives include higher living and business costs such as rents and traffic congestion. As long as firms perceive that these costs are offset by the advantages of an urban location, firms will locate in metropolitan areas, incur the costs and Kentucky's metropolitan economic engine will continue to grow and thrive. When the cost savings from the agglomeration of firms and people is just offset by the increased cost of adding one more firm to the metro economy,

¹ The Louisville MSA is comprised of Clark, Floyd, Harrison, and Washington Counties in Indiana. It also includes Bullitt, Henry, Jefferson, Meade, Nelson, Oldham, Shelby, Spencer and Trimble Counties in Kentucky.

² Table 1 and Table 5. US Metro Economies: GMP – The Engine of America's Growth. The United States Conference of Mayors, June 2008.

metropolitan Louisville has reached its optimal size; that is, when the negatives of congestion, costs and other negatives such as air pollution outweigh the positives to such a degree that people and companies relocate to more competitive locations.

This leads to the question of whether the optimal size of Louisville's metropolitan economy can change over time. The answer is yes. Prime examples of factors that influence an economy's size are investments to expand capacity or improve the travel time of the transportation network. Absent the ability to move large numbers of workers in, out and within the metropolitan core, Louisville would be a smaller, less densely developed economy, and less competitive than it is today. Similarly, disinvestment in its transportation network given anticipated steady population growth would result in rising congestion and travel times, thereby canceling a portion of the advantages associated with a Louisville location and diminishing the strength of the state's economic engine.

A key driving force behind Louisville's economic success is the metro area's significant cost advantage relative to the nation and the large urban Midwestern markets. Moody's Economy.com (2007) estimates that Louisville's Cost of Doing Business³ (a weighted combination of labor, energy, tax and space costs) is 89 percent of the national average, making the metro area an attractive location for expanding and relocating business. Strengthening the attraction, however, is the metro area's cost advantage with many of the large urban Midwestern economies within a day's drive, whose business costs are estimated to be greater than the national average. A business can locate in Louisville and have good physical proximity to the urban Midwestern market, but enjoy a 10+ percent savings in business costs relative to Chicago for example. ***The success of such a strategy is supported by an efficient and reliable multimodal transportation network with which to access these higher cost economies.***

The relative cost advantage is even greater for selected metro areas. Data for Louisville, selected consumer markets and potential regional competitors is provided in Exhibit 1.

Exhibit 1: Cost of Doing Business Indices for Louisville, Selected Consumer Markets and Selected Regional Competitors, 100 = US Average Cost

CITY	OVERALL INDEX	LABOR	ENERGY	STATE & LOCAL TAXES	OFFICE RENT
Louisville	89	95	70	86	69
Chicago	107	111	90	86	121
Cleveland	104	102	114	107	84
Atlanta	98	105	90	76	99
Indianapolis	93	102	69	87	74
St. Louis	97	97	113	78	80
Cincinnati	95	107	49	76	90
Columbus	98	102	77	106	85
Memphis	95	99	85	72	77

Source: Moody's Economy.com North American Business Cost Review, updated May 2007

In combination these data show that the cost structure in Louisville, while not necessarily a "low-cost" economy, is below the national average, creating a competitive advantage relative to other locations. Analysis of employment growth and total cost trends since 1990 indicate that an area's business costs account for one-fifth of the variation in growth between states⁴.

³ North American Cost of Doing Business 2006 Edition, updated May 2007.

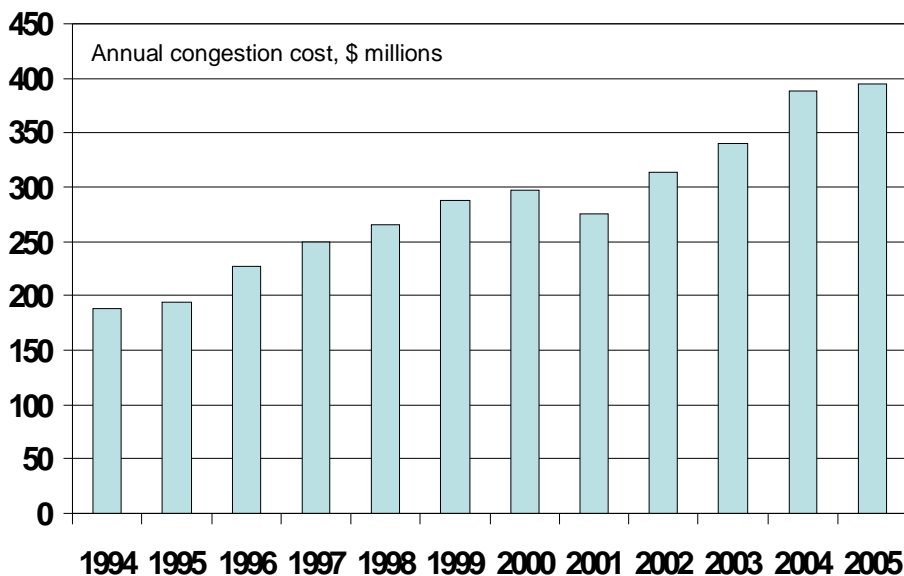
⁴ Moody's Economy.com. May 2007. "North American Business Cost Review" 2006 Edition, p. 3.

Transportation investments to limit congestion, promote safety and increase access and mobility are key to maintaining and improving the cost structure for doing business in Louisville and in so doing, maintaining Louisville’s solid performance in creating jobs. One of the Louisville region’s major economic development opportunities is at the 6,000-acre River Ridge Commerce Center in Jeffersonville near the planned east end bridge. Access to the property—among the largest development sites close to the amenities of a metropolitan area in the country—will improve with the new bridge and interchanges planned in the area.

2. CONGESTION

Congestion-related delays currently cost Louisville urban drivers an estimated \$395 million per year⁵. A medium-sized urban economy, congestion costs in Louisville have risen more sharply here than in the typical medium-sized economy, defined as a place with a population between 0.5 million and 1.0 million. Given the distribution industry focus of its economic base, an outlook for solid job and population growth, and its location on three major interstate corridors, traffic volumes are likely to continue rising in the coming decade. As shown in Exhibit 2, congestion costs have risen steadily and now impose a nearly \$400 million annual cost or “time tax” on the Louisville economy.

Exhibit 2: Congestion Costs Rise Steadily in Louisville and Southern Indiana



Source: Urban Mobility Report, 2007, Texas Transportation Institute

Aside from the cost of delay, congestion also reduces the reliability of the transportation network because travelers are uncertain whether a given trip will take the ‘usual’ amount of time or whether more time should be planned ‘just in case.’ The Federal Highway Administration reports that “more important than the severity, magnitude, or quantity of congestion is the reliability of

⁵ Texas Transportation Institute, Urban Mobility Report.

the highway system.” The emphasis on reliability is critical for freight shippers, where the value of time under certain just-in-time delivery circumstances may exceed \$5 per minute⁶.

In Louisville a 20-minute free-flow trip takes an average of almost 25 minutes according to data from the Urban Mobility Report. On one weekday out of 20 (essentially the worst travel day of the month) that trip will take even longer. Valued at the \$5 per minute estimate provided above, and multiplied across all shippers in Louisville on a given day, the costs rapidly become substantial. As the Urban Mobility report notes “The frustrating and economically damaging part of this penalty over and above the average peak travel time is that we cannot know which day that is and how it might affect important trips or deliveries.”⁷

The Ohio River Bridges Project will support the Louisville MSA economy through its construction and through its subsequent use once the facility is open to the public. The balance of this assessment will discuss the following classes of benefits: (1) construction benefits, (2) user benefits (time saved by autos and trucks, accidents avoided, vehicle cost savings), and the fiscal impacts associated with construction benefits.

3. CONSTRUCTION IMPACTS

Construction to build the Ohio River Bridges Project is estimated to cost roughly \$4.1 billion dollars in year of expenditure dollars that account for the impact of inflation on future building costs; this value corresponds to an equivalent \$2.9 billion in constant 2007 dollars⁸. This capital expenditure is comprised of purchases of construction labor, materials, right of way (ROW) acquisition, soft costs such as engineering and specialty professional services and contingency⁹. The economic impact of these expenditures will vary significantly by type and depends on the amount of locally produced goods and services embodied in the purchase. Construction goods and services will be purchased in the local economy. Although every building material required for the project is not produced locally, the analysis accounts for the supplier linkages for the industry, and thus adjusts for this leakage from the local economy.

The Right-of-Way expenditures are for real property only; the transaction costs associated with these expenditures are included in the Soft Cost category. As there is no labor associated with the Right-of-Way expenditures, there is no economic impact to the pure land costs. As a consequence, the construction costs are adjusted in the impact analysis to remove this component.

The Soft Costs, by contrast, are purchased in the local economy and thus do have an impact in the local economy with the same caveat for leakage noted above. In sum, there are two types of capital expenditures that are expected to impact the economy: General Construction and Soft Costs. The Exhibit 3 summarizes the construction expenditures by state, net of ROW costs.

⁶ Federal Highway Administration, Focus on Congestion Relief, accessed at http://www.fhwa.dot.gov/congestion/describing_problem.htm

⁷ Texas Transportation Institute, September 2007, Urban Mobility Report, page 13.

⁸ Louisville-Southern Indiana Ohio River Bridges Project Initial Financial Plan, January 2008, Table 2-3

⁹ The analysis assumes that contingency will be expended and that the spending will be in a category that yields an impact.

Exhibit 3: Summary of Louisville-Southern Indiana Ohio River Bridges Project Costs (in millions, YOE \$ and 2007\$)

Project Segment	Cost in YOE Dollars	Cost in 2007 Dollars	Costs in 2007 Dollars less ROW Costs
Section 1 - Kennedy Interchange	\$ 1,749.8	\$ 1,187.4	\$ 1,145.9
Section 2 - I-65 Downtown Bridge	\$ 453.6	\$ 301.1	\$ 301.1
Section 3 - Downtown Indiana Approach	\$ 411.8	\$ 288.7	\$ 251.6
Section 4 - East End Kentucky Approach	\$ 753.3	\$ 613.8	\$ 588.1
Section 5 - East End Bridge	\$ 374.1	\$ 313.2	\$ 313.2
Section 6 - East End Indiana Approach	\$ 318.4	\$ 260.2	\$ 243.0
Other Costs	\$ 6.7	\$ 6.5	\$ 6.5
Total	\$ 4,067.7	\$ 2,970.9	\$ 2,849.4

Source: Ohio River Bridges Project Initial Financial Plan, January 2008

Note: Totals may not add due to rounding. Combines information from Tables 2-2, 2-3, and 2-4

In order to isolate the potential economic effects of the project on the Louisville MSA economy, it is necessary to distinguish in the analysis between those resources that are new to the economy and that would not be invested in the Louisville MSA but for the project, and those that would still be spent in the region with similar economic effects (for example, funds that would be allocated to other transportation construction projects in the region). Failure to make this distinction may yield results that overstate the net economic gain attributable to the project. The net gain varies by region according to the funding applied.

Based on the Project's Initial Funding Plan, all project funding is "new" to the region. Federal, Kentucky and Indiana funding sources could all be spent elsewhere in the nation or the two states but for the Ohio River Bridges Project according to the Initial Finance Plan. Kentucky's contribution outlined in the Initial Financial Plan relies on federal program funds, HPP (High Priority Project) funding and federal earmarks. The Indiana funding plan relies on Major Moves (funding from the Indiana Toll Road (ITR) lease), federal program funds, HPP funds and federal earmarks. As with Kentucky, none of these funds would be set aside to benefit Louisville if the project were not advancing. None of these funds would be committed to the Louisville economy but for the Ohio River Bridges Project.

The economic impacts associated with construction are measured using regional multipliers from the Bureau of Economic Analysis (BEA) within the U.S. Department of Commerce. Derived from the Regional Input-Output Modeling System, the so-called RIMS II multipliers measure the total change (direct + indirect effects) in output, employment, and earnings that result from an incremental change to a particular industry. The multipliers were constructed by BEA to reflect the Louisville MSA economy which contains counties in both Indiana and Kentucky. The multipliers are based on the 2006 Annual Input-Output Table for the nation and 2006 regional accounts data; they represent the most updated version available at the time this analysis was prepared.

Fiscal impacts are quantified by applying tax rate information obtained directly from the local jurisdictions and the States to the estimated changes in economic activity.

The RIMS II multipliers are applied to the capital costs (net of ROW) that will yield impacts derived in Exhibit 3. Investments to construct highways and bridge facilities will expand payrolls for the duration of the project's construction cycle. The earnings of these newly-hired construction workers and the local suppliers who support the project with goods and services will translate into a proportional increase in consumer demand as these workers purchase goods and services in the states where they live. A further increase of new employment across a variety of industrial sectors and occupational categories is expected as employers hire to meet this increase in consumer demand. This latter hiring represents the project's indirect impact.

The RIMS II Input-Output model provides information on business output and employment in accordance with the specific industry structure of the region considered (the Louisville MSA) in terms of inter-industry purchasing patterns. This is the information that comes from input-output accounting tables, which trace the extent to which each industry sector generates demand for inputs from other sectors.

For example, the construction of a bridge requires an increase in the output of the construction industry. The increase in construction requires, among other things, higher steel production, which in turn requires more chemicals, iron, ore, and limestone. Another input to construction will be paving materials and industries that produce these will in turn require inputs of their own. I-O tables trace these input chains back through the economy to arrive at the total requirements needed to support a given increase in the final demand for construction. The multiplier effects include both the direct inputs needed to build the transportation infrastructure and the indirect inputs from supply industries needed to support the direct inputs.

As an MSA or state economy does not produce the same composition of goods and services that a national economy does, it is likely that, for a given change in final demand, the local economy will have to import some of the input needed to meet the demand change. Such imports represent "leakage" from the Louisville economy since their impacts occur outside the region. The multipliers account for regional leakage as they are tailored to the region for which they are developed.

The interpretation of the multipliers shown in Exhibit 4 is as follows. The construction industry in Louisville is used as an example.

The **Final Demand Earnings Multiplier** represents the total dollar change in earnings of Louisville households employed by all industries for each additional dollar of output delivered to final demand by the construction industry.

The **Final Demand Employment Multiplier** represents the total change in number of jobs in Louisville that occurs in all industries for each \$1 million of output delivered to final demand by the construction industry.

The **Final Demand Output Multiplier** represents the total dollar change in output that occurs in all industries for each additional dollar of output delivered to final demand by the construction industry.

Exhibit 4: Net Effects of Construction Activity on the Louisville MSA

Geographic Region	Net Capital Expenditure (mil 2007\$)	Output Multiplier	Earnings Multiplier	Employment Multiplier	Net Output Impact (mil 2007\$)	Net Earnings Impact (mil 2007\$)	Net Jobs Impact (worker years)	Jobs of Five Years' Duration
Louisville MSA -- Initial Finance Plan	\$ 2,849.4	2.1601	0.6913	20.9322	\$ 6,155	\$ 1,970	56,862	11,372

Source: BEA RIMS II Multipliers and AECOM Calculations; Note: Because the multipliers are based on 2006 data, the employment impacts calculation adjusts output to 2006 values using RS Means factors.

Applying the Final Demand Multipliers for construction to the amount of funding that will be used for project implementation provides estimates of the net output, earnings and employment impacts generated statewide by the Ohio River Bridges Project. Note that these are one-time impacts that last for the duration of the project's construction (column labeled Net Jobs Impact). One job is defined as a job for one person of one year's duration. As an example, a job for one person that had duration of three years would be defined as three person-year jobs. In order to translate this into a metric that is more familiar to people, a final column was added to show the number of jobs in terms of continuous five-year employment span. The interpretation of this last column of the table is that construction in the Louisville MSA will create over 11,000 new jobs five-year period if the funding plan in the Initial Finance Plan is followed. Of these, roughly 5,400 would be directly associated with the construction activity; the balance would be dispersed across a range of industries. Earnings for Louisville residents and workers would total \$1.97 billion. The net change in output attributable to the project, the value of goods and services produced in the economy, totals over \$6 billion across both states. These are jobs, earnings and output that would not occur in Louisville, but for the Ohio River Bridges Project.

4. FISCAL IMPACT

The expansion of payrolls identified above increases the tax base of Louisville. Personal income and local occupational taxes will increase as a consequence. These revenues stay in the communities and help local government provide services such as schools, parks and other public services. Exhibit 5 provides estimates of the tax yield from the Louisville, Kentucky and Indiana perspective.

The estimate of the Kentucky and Louisville personal income taxes relies on an estimate of the effective tax rate. The nominal tax rate on personal income in Indiana is 3.4 percent. In Kentucky, personal income is taxed on a sliding scale that ranges between 2 percent and 6 percent, rising with aggregate income. In both cases, the nominal rate is tempered by numerous exemptions and adjustments. In order to make an estimate, the tax revenue yield for personal income (collected from the departments of revenue) was compared to the personal income in the two states (collected from the Bureau of Economic Analysis) to calculate an effective tax rate—essentially an average yield across all filings. The calculated rate for Indiana was 2.18 percent. The rate for Kentucky was estimated at 2.67 percent. These effective rates are applied in Exhibit 5 to estimate the tax yield.

Estimates of the three components of the Occupational tax are also provided.

Exhibit 5: Fiscal Impact Associated with Construction Impacts (mil 2007\$)

Geographic Region	Net Earnings From Construction	Indiana Income Tax (a)	Kentucky Income Tax (b)	Louisville Metro Occupational Tax (0.0125)	School Board Tax (.0075)(c)	TARC (0.0020)
Louisville MSA -- Initial Finance Plan	\$ 1,969.8	\$ 12.1	\$ 37.7	\$ 24.6	\$ 10.6	\$ 3.9

Source: Occupational License Fee/Tax Imposed in Louisville Metro, Kentucky; Indiana Department of Revenue 2008 Annual Report, 2007-2008 Kentucky Department of Revenue Annual Report, BEA, and AECOM Calculations

(a) Effective tax rate accounts for exemptions and numerous adjustments. (b) See (a). (c) School tax does not apply to non residents of Jefferson County.

The Exhibit calculates the tax yield across each of the geographic areas considered in the analysis. Overall, Louisville gains \$24 million in the license tax; the school districts receive just over \$10 million, and transit receives just under \$4 million over the construction cycle of the project. Personal income tax revenues in Indiana will yield just over \$12 million. Similarly, personal income tax revenues in Kentucky are nearly \$38 million.

5. TRAVEL TIME SAVINGS

Absent capacity expansion such as that outlined in the Ohio River Bridges Project, conditions on Louisville's highways will worsen sharply. The FEIS for the project reports that the Preferred Alternative will reduce Louisville vehicle hours traveled (VHT) between 51,000 and 52,000 per workday in the project area in 2025¹⁰. Assuming 260 work days per year, this translates into an annual time savings of between 13.2 and 13.5 million hours per year in 2025. The balance of this analysis will apply the midpoint of this range; 13.35 million vehicle hours. These savings are shared by commuters, leisure auto travelers, and commercial truck travelers. Trucks' share of traffic varies by route, time of day, and direction; on average the truck share appears to hover around 11 percent¹¹. For the purposes of this analysis, an average share of 11 percent is applied. The remaining 89 percent of traffic is assumed to be in an auto with an average occupancy rate of 1.65 people per trip¹². The share of truck traffic is important, because the value of time differs depending on whether the trip is made by a commercial truck, an auto trip for business purposes or an auto trip for leisure. Exhibit 6 derives the average value of time. Applying this average hourly value to the number of hours saved yields a savings of over \$335 million annually, valued in 2007 dollars as reported in Exhibit 7.

¹⁰ Ohio River Bridges Project, FEIS, Summary Chapter, page S-19. This is the most up to date information available at the time of this analysis.

¹¹ Ohio River Bridges FEIS, Chapter 2, page 2-23 and 2-24.

¹² KIPDA Household Travel Survey, 2001.

Exhibit 6: Value of Travel Time

	Person-hours in Traffic (%)	Hourly Earnings	Share Applied	Total
Auto Business	31%	\$ 17.99	100%	\$ 17.99
Auto Leisure	58%	\$ 17.99	70%	\$ 12.59
Truck Travel	11%	\$ 21.48	100%	\$ 21.48
Total weighted average time value (\$ per person-hour)				\$ 15.24

Note: Personal hours in traffic derived from truck share data provided in FEIS and share of non-work auto trips from KIPDA Travel Survey. Hourly earnings for trucks is from BLS, Occupational Outlook Handbook, 2008-09 Edition --wage for Tractor Trucks escalated to 2007 with the PPI for General Freight Trucking. Average wage for non-truck travel is the mean hourly wage obtained from BLS, Occupational Employment Statistics for Louisville MSA. Leisure time valued at 70% of full wage following USDOT Guidance on Value of Time estimation.

Exhibit 7: Value of Time Saved by Ohio River Bridges Project (2007\$)

Number of Vehicle Hours Saved in 2025	Occupancy Rate	Total Person Hours	2025 Value of Time Saved @ \$15.24, in 2007\$	Discounted Total over 2014 to 2059 Period, in 2007\$
13,350,000	1.65	22,027,500	\$ 335,785,481	\$ 2,449,390,782

Exhibit 7 calculates the value of time saved in 2007 dollars. The analysis assumes that the project opening dates remain those in the Initial Finance Plan. Construction on the East End Bridge is completed in 2013; the first full year of operation begins January 1, 2014. The Finance Plan schedule assumes that the construction on the Downtown Bridge is completed in 2019; the first full year of operation begins January 1, 2020. Finally, the Kennedy Interchange construction wraps up in 2024 under the Finance Plan schedule. The first full year of its operation is 2025. The analysis distributes the time savings gradually over the forecast horizon beginning with 2014, the year the first phase of construction is completed and ending in 2059 (35 years after the final section—the Kennedy Interchange—is completed). The gains increase over time as more road is completed and available for use. As a final step, the stream of benefits is discounted by seven percent to reflect that they will be received in the future.

The benefit estimates associated with the Ohio River Bridges Project were discounted because they occur in the future, over a period extending from 2014 to 2059. A dollar today is worth more than a dollar in the future, even if inflation is excluded, because today's dollar can be used productively in the ensuing years, yielding a value greater than the initial dollar. Future benefits are discounted to reflect this fact. The purpose of discounting is to put all present and future benefits in a common metric, their present value. The seven percent discount rate is recommended by the Office of Management and Budget for impact studies.

6. SAFETY

Investments to improve the safety of Louisville's network is anticipated to result in fewer accidents, fatalities and injuries. This would in turn help mitigate economic losses associated with crashes such as medical care, insurance, lost time in the workplace and property damage. Even projects that do not have safety as their main objective may yield improved safety as older roads are rebuilt to newer design standards.

The Ohio River Bridges FEIS reports that the Preferred Alternative will yield a safer road system. The redesigned interchange in particular will reduce the number of conflict points and is projected to reduce the crash rate by 33 percent to 50 percent¹³. A conservative estimate of the number of crashes avoided is then one third of the current 261 crashes per 100 million VMT or 86 fewer crashes for every 100 million vehicle miles traveled.

The value of avoiding a crash depends on the severity of the incident avoided. Crashes are typically divided into three types: fatal, injury, and property-damage only (PDO). Exhibit 8 provides values of each type of accident, adjusted to 2007 dollars. The economic value of the accidents avoided is determined using research from the National Safety Council¹⁴. The Council publishes two sets of estimates. One set is for measuring the economic loss to a community resulting from past motor vehicle crashes. These losses are wage and productivity losses, medical expenses, administrative expenses, motor vehicle damage, and employers' uninsured costs. The Council cautions users, however, that these estimates of past losses are not appropriate for use in benefit cost analyses as they omit the value of what people are willing to pay for improved safety in order to live longer and to protect the quality of life. To capture this impact, the Council developed a second set of motor vehicle cost estimates known as the "comprehensive cost" estimates for use in cost benefit applications. These comprehensive costs of motor vehicle costs include the economic cost components noted above (wage and productivity losses, medical expenses, administrative expenses, motor vehicle damage, and employers' uninsured costs) as well as a measure of the value of lost quality of life. The value of lost quality of life was developed by the Council through empirical studies of what people actually pay to reduce their safety and health risks. The Council's last published estimates are for 2006. These were adjusted to 2007 dollars for consistent comparison with other figures reported.

Exhibit 8: Average Comprehensive Cost by Type of Injury

Type	2006 Cost	2007 Cost
Death	\$4,000,000	\$4,135,501
Incapacitating	\$201,100	\$207,912
Nonincapacitating evident injury	\$50,400	\$52,107
Possible injury	\$24,400	\$25,227
No injury	\$2,200	\$2,275

Source: National Safety Council

The FEIS does not provide information on the breakout of the types of crashes avoided, thus shares derived from statistics for Kentucky are applied¹⁵. The shares are for incidents on interstate highways. This is an imperfect proxy, but the closest available. Exhibit 9 breaks out the 86 accidents avoided by accident type and adjusts for the occupancy rate as more than one person is likely to be involved in a vehicle crash.

¹³ Ohio River Bridges FEIS, Summary Chapter, page S-30.

¹⁴ National Safety Council "Estimating the Costs of Unintentional Injuries, 2006" Available on the web at <http://www.nsc.org/resources/issues/estcost.aspx>

¹⁵ Green, Eric, Kenneth Agent and Jerry Pigman. 2008. Analysis of Traffic Crash Data in Kentucky (2003-2007).

Exhibit 9: Annual Accidents Avoided

	Total Reduction	Est. PDO	Est. Injury	Est. Fatal
Accidents, per \$100 MVM	86.0	64.8	19.8	1.3
People, per \$100 MVM	141.9	107.0	32.7	2.2
Value (2007\$), per MVM	\$12,384,996	\$243,308	\$3,113,572	\$9,028,117
2025 No Build VMT	31.7	31.7	31.7	31.7
Annual Savings, 2007\$	\$392,604,386	\$7,712,856	\$98,700,226	\$286,191,304

Note: The number of people who avoid accidents is likely underestimated. While the number of incidents is adjusted for the average occupancy rate of 1.65, there is no adjustment for the number of vehicles involved in the incident as the data do not provide enough detail.

As with travel time savings, these are annual savings that recur each year over the planning horizon. Distributing the \$392.6 million annual savings in Exhibit 9 by over the planning horizon, accruing benefits as sections of the project open and begin serving the public as with the travel time savings, and discounting, yields a total estimated safety benefit of \$15.8 billion in 2007\$ and a discounted benefit of just under \$3.0 billion.

7. OPERATING COST SAVINGS

The operating cost estimation entails the application of a per mile operation cost to the VMT savings estimated for the Build the Bridges project. The per mile costs for autos and trucks are presented in the sections below, followed by the derivation of the operating cost savings.

Auto Operating Costs. The cost of operating a passenger vehicle was obtained from the American Automobile Association (AAA). The association provides an estimate of the cost per mile to operate a personal passenger vehicle that is updated annually. The 2007 value is 52.2 cents per mile, inclusive of depreciation, insurance, fuel and maintenance costs. This is an average across all sizes of autos, assuming an average of 15,000 miles driven annually.

Truck Operating Costs. The cost of operating a truck was obtained from the American Trucking Association, Inc.'s 2008-2009 American Trucking Trends. The data describe the per mile cost for a range of industry inputs, ranging from equipment rentals, to fuel, to taxes, to driver wages. A summary of these costs is provided in Exhibit 10. The trucking association data are in 2006 dollars. The Producer Price Index (PPI) is used to escalate costs from 2006 dollars to 2007 dollars. The PPI is a barometer of cost increases on the producers' side of the market, similar to the more familiar Consumer Price Index (CPI), which measures cost inflation from the consumer's perspective.

Exhibit 10: Truck Costs per Mile (cents per mile)

Expense Item	Cost	
	(2006\$)	(2007\$)
Equipment Rents and Purchased Transportation	\$0.47	\$0.47
Other Wages and Benefits	\$1.32	\$1.35
Driver Wages	\$0.75	\$0.77
Miscellaneous	\$0.38	\$0.39
Fuel and Fuel Taxes	\$0.48	\$0.49
Depreciation	\$0.13	\$0.13
Insurance	\$0.09	\$0.09
Outside Maintenance	\$0.05	\$0.06
Taxes and License	\$0.05	\$0.05
Tires	\$0.03	\$0.03
Total	\$3.75	\$3.82

Source: American Trucking Trends, 2008-2009 published by the American Trucking Association, Inc.
 Notes: Escalated by change in U.S. Producer Price Index (PPI) for Truck Transportation. Columns may not sum to totals due to rounding.

Not all costs vary with the amount of truck travel. Put another way, trucking industry costs can be divided between fixed costs—those that producers must pay no matter how much they drive in a year—and variable costs, those that do depend on the amount of miles traveled. An example of a fixed cost is insurance—the firm pays an annual premium that does not change if the vehicle travels 500 miles more or less in a given year. An example of a variable cost is fuel—the amount the firm pays for fuel is directly correlated with the amount of mileage driven.

Of the costs included in the above, four are variable costs: fuel and fuel taxes, tires, depreciation, and outside maintenance. Together, these per mile costs sum to \$0.71 (2007). Driver wages are excluded here as they are embodied in the truck travel times savings estimation developed above.

The value of reduced vehicle operation is a straightforward calculation that applies the per mile costs for trucks and autos to the estimated daily VMT savings provided in the Ohio River Bridges FEIS. The calculation is presented in Exhibit 11. The estimate uses 260 days as the annualization factor as the VMT per day is VMT per weekday. The estimates represent the value of benefits in stated in 2007 dollars and discounted to reflect the major project opening dates as described above.

Exhibit 11: Value of Vehicle Operating Efficiencies, in 2007 Dollars

Total VMT Savings (autos and trucks) in 2025	Auto/Truck	Share of VMT	Share of VMT Savings	Operating Cost Per Mile (cent/mile) 2007	Annual Operating Cost Savings in 2025, in 2007\$	Annual Total Operating Cost Savings (autos and trucks) in 2025, in 2007\$	Operating Cost Savings (autos and trucks) over 2014 to 2059 Period, in 2007\$	Discounted Operating Cost Savings (autos and trucks) over 2014 to 2059 Period, in 2007\$
48,230,000	Auto	0.89	42,924,700	0.522	22,406,693	\$ 26,173,456	\$ 1,055,662,741	\$ 194,213,872
	Truck	0.11	5,305,300	0.71	3,766,763			

Sources: Ohio River Bridges FEIS, American Auto Association, and American Trucking Association

In order to calculate the value of the travel cost savings associated with the VMT saved in the region, the VMT savings are distributed over the 2014 to 2059 period, according to the anticipated opening year of major project sections indicated in the Finance Plan construction schedule and is the same as the one assumed for the travel time savings. The interpolation method distributes the savings gradually over the forecast horizon beginning with 2014, the year the first phase of construction is completed, and ending in 2059 (35 years after the final section is completed in 2024). The gains increase over time as more road is completed and available for use and as the hindrance caused by construction crews becomes increasingly scarce.

8. SUMMARY OF PROJECT BENEFITS

As the analysis demonstrates, the Ohio River Bridges Project yields multiple kinds of benefits. No single benefit justifies the project cost, but in combination they yield a significant benefit to the Louisville economy that yields a positive return on investment. The benefits considered in this analysis include the near-term construction job and earnings and associated fiscal benefits; these last for the duration of the project's construction cycle. As the project section is completed, the project begins to generate recurring benefits to users, measured in terms of travel time savings, improved safety, and vehicle operating cost savings. As many of these benefits will be received in the future, they are expressed in two ways: constant 2007 dollars and discounted dollars.

Exhibit 12: Summary of Recurring User Benefits (in millions)

Type of User Benefit	Total over 2014 to 2059 Period, 2007 Dollars	Total over 2014 to 2059 Period, Discounted Dollars 2007 \$	Discounted Project Cost 2007 \$	Benefit / Cost Ratio
Travel Time Savings	\$ 13,543	\$ 2,449		
Safety	\$ 15,835	\$ 2,913		
Vehicle Operating Efficiencies	\$ 1,056	\$ 194		
Total	\$ 30,434	\$ 5,557	\$ 2,083	2.67

As reported in Exhibit 3 in the beginning of the analysis, the project cost is \$2.97 in billions of constant 2007 dollars. Distributing the constant 2007 project costs for each project segment over the construction period and discounting back as with the benefits, yields a discounted project cost of \$2.08 billion. Comparing the \$5.56 billion in Exhibit 12 to the discounted project cost yields an estimated benefit cost ratio of 2.67, a strong return on the public investment. This assessment is conservative for several reasons. First, it only considers the recurring user benefits generated by the project. Short-term construction earnings and potential economic development opportunities opened up by the project are not added into this ratio. Second, the assessment assumes that traffic is flat in the planning horizon beyond 2025, the planning year used in the Project's Final Environmental Impact Statement (FEIS). In reality, the number of travelers is likely to grow in the period beyond 2025 until the system again reaches its new capacity. And finally, the safety benefits assessment is not able to fully adjust for the number of people likely involved in an accident as it is based on a "per incident" estimate of savings and there is insufficient information to adjust for the number of vehicles involved in an incident on average.