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The Economic Impact and Benefits of the Central Florida Expressway Authority Five-Year Work Plan

FINAL REPORT

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Central Florida Expressway Authority

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

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The Economic Impact and Benefits of the Central Florida Expressway Authority Five-Year Work Plan

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Disclaimer

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Executive Summary

To manage and operate its program of system improvements, the Central Florida Expressway Authority annually updates its *Five-Year Work Plan*. The Work Plan strategically identifies those projects to be funded during the next five years and serves as an integral part of the *2030 Expressway Master Plan*. The Work Plan projects are intended to maintain and enhance the current system and ultimately improve travel and safety conditions for users. In addition to travel improvement benefits to system users, the Work Plan investment can also provide a substantial contribution to the economic growth of the region and the state.

Objective

The Expressway Authority commissioned this study to estimate the economic impacts and benefits of implementing the 2016-2020 *Five-Year Work Plan* strategic investments. This study reports the estimated economic impact of project expenditures and the monetary value of travel improvement benefits associated with the construction and operation of current system improvements, system expansion, investments in intelligent transportation systems, and other improvements.

Key Findings

Results of this study include a broad range of travel improvement performance and economic impact indicators at both the regional and state levels.

Spending Impacts

The economic impact of the *Five-Year Work Plan* is substantial in contributing to economic growth, as measured by $1.9 billion in gross business sales, $934.7 million in gross domestic product, and a combined 11,390 jobs (or 2,278 jobs per year) for the four-county Orlando-Kissimmee-Sanford metropolitan statistical area.[1] In addition, the Work Plan stimulates economic activities in counties adjacent to the study area. When including the rest of the state, the Work Plan's contributions result in a total impact of $2.1 billion in gross business sales, $1.0 billion in gross domestic product, and 12,328 jobs.

Employment impacts primarily center in the professional and business services and the construction sectors, but spill over to other sectors as well. This type of investment supports employment in industries such as wholesale and retail trade; finance, insurance and real estate services; education and health services; and leisure and hospitality services.

[1] All monetary amounts are reported in 2015 dollars unless otherwise indicated.

Travel Improvement Benefits

The Work Plan could produce substantial benefits in travel time reductions, increased safety, and reduction in harmful emissions. Under the current travel forecasting scenario, improvements and expansions to the current system would save each household on average 32 travel hours annually, or $334 per year.

Households would also save $25.6 million in out-of-pocket costs. These savings are a result of lower fuel cost because of less congestion, and, avoided medical expenses due to fewer traffic accidents. Savings in fuel and medical costs represent money available for other household expenditures. These savings would generate an additional $32.0 million a year in indirect and induced impacts that are likely to linger after the initial construction impacts.

Summary of Impacts and Benefits

- ***Injection of $1.2 billion*** through fiscal 2016-2020 significantly contributes to the Gross Domestic Product (GDP) and job growth.

- ***Implementation of the Work Plan*** strategic projects produces relevant travel improvements:
  - ✓ Reduction in harmful emissions
  - ✓ Reductions in travel and accident costs
  - ✓ Travel time savings increases time for leisure

Table of Contents

List of Figures

List of Tables

List of Acronyms

CFX	Central Florida Expressway Authority
CO	Carbon Monoxide
CPI	Consumer Price Index
GDP	Gross Domestic Product
I-O	Input-Output
MSA	Metropolitan Statistical Area
NAICS	North American Industrial Classification System
NHTSA	National Highway Traffic Safety Administration
NOx	Nitrogen Oxide
NO_2	Nitrogen Dioxide
PD&E	Project Development and Environment Study
PM	Particulate Matter
QALY	Quality-Adjusted Life Year
ROW	Right-of-Way
SOx	Sulfur Oxide
VHT	Vehicle Hours of Travel
VMT	Vehicle Miles of Travel
VOC	Volatile Organic Compound

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Chapter 1
Introduction

Project Background

The Central Florida Expressway Authority (CFX) currently owns and operates 109 centerline miles of limited access roadway in Lake, Orange, Osceola, and Seminole counties totaling over 745 lane miles. The system includes 63 interchanges, 14 mainline toll plazas, 66 ramp toll plazas, and 285 bridges. In addition, CFX maintains and operates the Goldenrod Extension, a non-system two-mile tolled expressway with one mainline toll plaza.

To manage and operate its program of system improvements, the Authority annually updates its *Five-Year Work Plan*. The Work Plan strategically identifies those projects to be funded during the next five years and serves as an integral part of the *2030 Expressway Master Plan*. The Work Plan projects are intended to maintain and improve the current system and ultimately improve travel and safety conditions for users.

In addition to travel improvement benefits to system users, the Work Plan investment can also substantially contribute to the economic growth of both the region and the state.

Study Objectives

The objective of this project is to estimate the economic impacts and benefits associated with the Expressway Authority's *Five-Year Work Plan* (Fiscal Years 2016-2020). These estimates will help the Expressway Authority:

- assess the contribution of the Work Plan to the level of economic activity in the Orlando-Kissimmee-Sanford Metropolitan Statistical Area (MSA) and the rest of the state; and,
- determine the economic benefits that the Work Plan will produce for users of the Expressway Authority facilities in terms of personal travel time savings, pollution emissions, and health and safety cost changes.

The following sections of this report describe the methodology used to estimate the economic impact and benefits of the Work Plan, the inputs used in the model, and the results of its estimation.

Chapter 2
Methodology

Introduction

The term *economic impact* is used extensively to describe and quantify the economic activities attributable to an organization and its investments. To fully appreciate the term's meaning, it is important to differentiate between economic "value" and economic "impact". In simple terms, economic value is created when a product or service is consumed within a specific region's geographic boundary; however, an economic impact occurs when products or services consumed are produced by industries located within this geographic boundary.

Investment in transportation infrastructure can affect a region's economy in two ways: (1) through the spending pattern of the purchases of goods and services, and (2) through cost savings and business productivity changes that might be realized as investments improve the current transportation network. These impacts can be estimated using input-output (I-O) accounting tables. These tables produce multipliers that are used to compute the total direct, indirect, and induced effects on jobs, output, and income impacts generated per dollar spent on the Work Plan.

While economic impacts encompass a wide range of effects across many sectors of a region's economy, other factors can significantly contribute to economic growth, although they do not directly affect the flow of dollars in the economy. These benefits include travel time savings and changes in health and safety costs, such as pollution emission costs and accident costs. While some travel time savings can impact the flow of income generated depending upon the purpose of travel (business versus personal), the reduction of pollution emissions and accidents creates a value that does not directly affect the economy. This study estimates their value to users and distinguishes them from the economic impact analysis results. Typically, these benefits are directly incorporated into other assessments, such as a benefit-to-cost ratio project prioritization or evaluation.

The following sections detail the study's approach to estimate the economic impacts and benefits of the Work Plan.

Analysis Approach

Figure 2-1 summarizes the approach to evaluation adopted in this study. First, the Work Plan expenditures are evaluated and their impact estimated using an I-O model. Then, travel improvement impacts are estimated. Travel improvements produce changes to users in terms

of vehicle operating cost savings, and the study evaluates the indirect and induced impacts of those improvements. For example, fuel and vehicle operating cost savings can result in reduced household spending for vehicle fuel and maintenance. This translates into a reduction in out-of-pocket costs (i.e., savings). The resulting savings can then be allocated to the consumption of goods and services in other sectors of the local economy. In effect, this is equivalent to a reallocation of household expenditures within the impact area. The analysis in this study considers the indirect and induced effects of this reallocation.

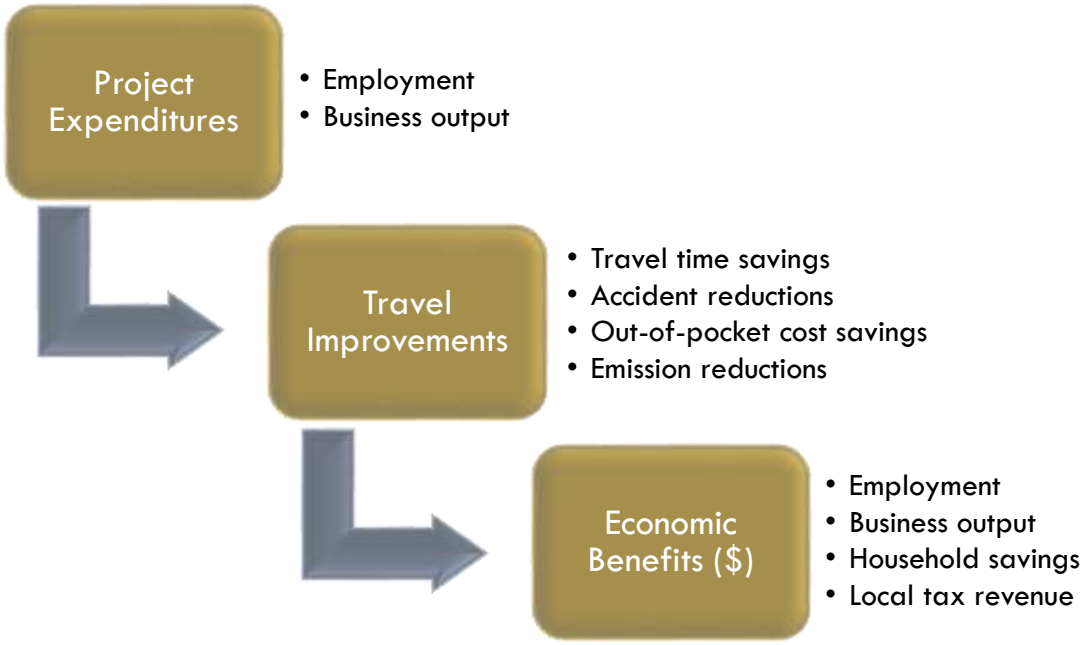


Figure 2-1: Economic Impact and Benefit Evaluation Framework

Choice of Input-Output Model

This study makes use of the IMPLAN model to generate I-O tables and multipliers. IMPLAN and the associated datasets are supported by the IMPLAN Group LLC.[2] IMPLAN is a widely used, nationally recognized input-output economic impact model. A more detailed explanation of the IMPLAN model and I-O analysis is provided in Appendix A.

The model estimates changes in the total local economic activity caused by economic changes in the area. In this analysis, the economic activities associated with the Work Plan require the purchase of goods and services from the local economy. These purchases cause changes in the overall economic activity of the region. The I-O model assesses the new level of overall economic activity. As an example, when a business purchases goods from a second business,

[2] www.implan.com

the first business is helping support the second. The model estimates all levels of activity supported by the first business.

Indirect and Induced Impacts

Direct investment in capital infrastructure results in a demand for spending in the economy, directly affecting the demand for goods and services of businesses. These businesses rely on other businesses to purchase inputs. Indirect impacts measure the economic activity of secondary businesses producing goods and services as a result of primary businesses' production of goods and services. The wages of construction and other sector workers of primary and secondary businesses generate additional retail sales for businesses, resulting in additional induced impacts. Changes in household spending spanning from improvements in the transportation network (i.e., household cost savings), also generate indirect and induced impacts.

Estimation of Expenditure Impacts

Expenditure impacts relate to changes in economic activity resulting from changes in local spending brought about by investing in the projects funded by the Work Plan. Thus, the direct impact of the Work Plan is defined as the initial change in output, or gross sales that occur in the impact area as a result of the plan's implementation. To be considered an impact, the change must occur within the boundaries of the impact area and result solely from Work Plan expenditures.

The Work Plan's injection of dollars into the local economy can directly support jobs in heavy construction, specialized services required for planning (architectural and engineering), and maintenance and landscaping services. It also stimulates the purchase of products that lead to further impacts on economic activity.

This study employs the following measures of economic impacts:

1. Employment
2. Total output
3. Value added
4. Labor income
5. Fiscal

Employment

This type of impact represents the creation (or support) of jobs in the impact area. Total employment consists of annual average full-time and part-time employees working in a given sector of the local economy.

Total Output

Total industry output measures the value of production of goods and services by businesses in the local economy. Generally, total industry output is equivalent to total business sales plus what businesses place into (or remove from) inventory. Total output measures how the region's economy would be affected by the direct impacts generated by the Work Plan.

Value Added

Total value added is equivalent to gross domestic product. It is a subset of total output that measures total output minus the cost of labor and materials. Total output is analogous to the definition of Gross Domestic Product as identified by the Bureau of Economic Analysis, and measures only the value of final goods and services [1]. In economic analysis, value added is the preferred impact measure of contribution to economic growth generated by investments.

Labor Income

Total income includes employee compensation and other income. Total employee compensation represents the total payroll costs, including wages and salaries, paid to workers by employers, as well as benefits such as health and life insurance, retirement payments, and non-cash compensation. Total other income includes income generated by self-employed individuals, corporate profits, payments for rents, royalties and dividends, as well as profit generated by corporations. Labor income represents an important share of a region's total income.

Fiscal

Fiscal estimates are strictly tied to the impact area data as provided by the IMPLAN model. These values are based on the average taxes for all the industries within the model, the average taxes associated with households, and the average taxes and transfers associated with each government institution defined by the model.

Definition of Impact Area

Economic impact study regions vary in size from single counties to multiple states, depending on the nature of the study and the industries assessed. The choice of the study area must strike a balance between covering an area large enough to capture the most important aspects of the impact, but not so large that unconnected economic activities mask the impacts.

The Expressway Authority's network is located within the Orlando-Kissimmee-Sanford MSA, as are all the projects included in its *Five-Year Work Plan*. According to the American Community Survey 2009-2013 Journey to Work, more than 91 percent of the Orlando-Kissimmee-Sanford MSA employees reside within its boundaries (Lake, Orange, Osceola, and Seminole) [2]. According to the Central Florida Expressway Customer Opinion Survey 2013, approximately 75

percent of the network's surveyed users reside in the MSA [3]. Therefore, the Orlando-Kissimmee-Sanford MSA area was selected as the core study area for the analysis.

The Work Plan also produces impacts that go beyond the core study area because the Work Plan expenditures are assumed to affect counties outside of those in the Orlando-Kissimmee-Sanford MSA. These "spillover" effects are estimated throughout the rest of the state, in addition to the impact in the core study area.

Estimation of Travel Improvement Impacts

The impact of the Work Plan spans beyond the contribution to local economic dynamics produced by the construction of proposed projects. Once built and put into operation, capacity expansion and improvement of current facilities will affect travelers, households, and businesses located in the impact area. An improved transportation network can reduce distances between origin and destination, save time during congested periods, and reduce vehicle operating expenses.

This study considers the following travel improvement benefits:

- Travel time savings
- Reductions in the cost and number of accidents
- Reductions in emission costs
- Reductions in vehicle operating costs

To quantify benefits from travel improvements, CUTR researchers relied on the Expressway Authority's traffic consultant estimates of changes in vehicle miles of travel (VMT) and vehicle hours of travel (VHT). While a consistent reduction in projected VHT is forecasted as a result of the Work Plan, there are projected increases in VMT before a decrease emerges in the 2043-year mark. This is a result of the induced demand and projected population increases in the Central Florida Expressway catchment area. Therefore, based on these estimates, economic impacts and user benefits will primarily result from the increased efficiency of the system associated with reduced VHT. Chapter 4 provides a detailed description of estimated travel improvement benefits.

Household and Business Cost Savings

Travel improvements can reduce congestion and save household out-of-pocket costs to operate and maintain vehicles. These savings are equivalent to a reduction in the cost of living (i.e., an increase in household disposable income) that can result in indirect and induced impacts on the flow of dollars within the area.

Another benefit of travel improvements is a reduction in out-of-pocket medical expenses associated with a reduced incidence of automobile accidents. As with the savings from reduced vehicle operating and maintenance costs, the private savings associated with reduced medical expenses increase disposable household income and have indirect and induced economic impacts.

This study estimates the direct and induced impacts of reduced household vehicle operating costs and out-of-pocket medical expenses, as well as business cost savings produced by reduced commute travel times for workers.

Other Benefits

Changes in business productivity costs stem from travel time improvements affecting the movement of goods and services in the impact area. In an urban area, worsening congestion can lead to substantial increases in commercial travel time. This can induce businesses to capital and labor substitution, loss of competitiveness, and in some cases relocation outside the congested area. Transportation investments directed at reducing congestion can result in increased market accessibility and can have agglomerative effects. An improved transportation network might affect business and household relocation decisions. Improved travel time and reliability of travel might incentivize new businesses to locate within the impact area and existing businesses to reap the benefits of improved market accessibility. Lower commuting travel time might influence households to relocate from other areas, thus affecting labor and real estate markets.

A theoretical and empirical framework to evaluate additional benefits from congestion reduction has been formalized by the National Cooperative Highway Research Program (NCHRP) Project 2-21 [4]. This project sought to develop a framework for estimating the cost of congestion to businesses in U.S. cities and urban areas. The framework goes beyond the usual method of accounting for user expense and travel time cost savings. The research effort produced Report 463, which provides a framework to account for the direct and indirect productivity costs associated with travel time variability, worker time availability, and all effects that congestion imposes on freight travel, just-in-time production processes, and market accessibility.

As part of the direct costs, the framework recognizes that businesses absorb some of the direct travel costs of all business-related travel, including the value of time for drivers. All other costs related to congestion that do not directly affect the cost of doing business are defined as indirect costs. For example, an indirect cost would be a reduction in business activity resulting from the effect congestion might have on the attractiveness of an area. Another indirect cost can include increased emission levels generated by increased congestion, which undermines

the livability of an area and affects labor force participation. Congestion, by negatively affecting freight travel time and travel time reliability, induces business to substitute between labor and capital inputs. Report 463 provides a framework for the empirical estimation of the relationship between business activity and congestion levels by applying the concept of elasticity of substitution with respect to travel time changes. These elasticities measure the extent to which businesses might be willing to pay a premium for specialized goods, services, and labor.

While this study estimates the impact of congestion on businesses by estimating changes in business travel times, it does not consider the long-run impacts from travel time improvements in terms of changes in labor and capital productivity, and it does not consider impacts resulting from increased market accessibility. Tailoring the approach to business productivity impact estimation detailed in Report 463 would require detailed freight traffic data at a highly disaggregated level that is beyond the scope of this study. Furthermore, although relevant, the estimation of these impacts is better suited for an evaluation of the Expressway Authority's long range plan, which will likely have substantially greater long-term impacts than the *Five-Year Work Plan*.

Chapter 3
Spending Impacts

This section describes the analytical approach to estimating the impacts associated with the Work Plan expenditures. It provides a description of the Work Plan and a detailed analysis of project expenditures that are required to analyze the plan's overall economic impact.

Overview of the *Five-Year Work Plan*

The Authority's system is a major transportation network consisting of 109 centerline miles of limited access expressway (745 lane miles), 63 interchanges, 14 mainline toll plazas, 66 ramp toll plazas, and 285 bridges. CFX also operates and maintains a non-system two-mile tolled expressway with one mainline toll plaza, Goldenrod Extension.

The Work Plan is developed from the Authority's *2030 Expressway Master Plan*. It identifies the projects that CFX anticipates funding during the next five years. The *Five-Year Work Plan* is key to manage the Authority's program of system improvements, enhancement, and rehabilitation. During the development of the Work Plan, a Draft Work Plan document is prepared by the Authority's technical staff [5]. The report produces a list of projects grouped in the following nine categories:

1. Existing system improvements
2. System expansion
3. Interchange
4. Toll facilities
5. Intelligent transportation systems
6. Signing and pavement markings
7. Renewal and replacement
8. Landscape
9. Non-system

The *Draft Five-Year Work Plan* provides information for each of the individual projects within the above nine categories in terms of project name, description, cost, funding source, and planning phases for the period 2016-2020.

This study relies on project cost data from the most recent version of the Draft Work Plan to obtain detailed information on each of the projects. In the document, this information is provided under the "Project Information Report" (Section 5). The total cost of the Work Plan is $1.2 billion with yearly expenditures allocated according to Figure 3-1. Figure 3-2 shows that

80.2 percent of Work Plan investment will go toward system expansion projects (34.6%), interchange projects (28.7%), and renewal and replacement projects (16.9%), with the remainder allocated to all other project categories.

Although this information is useful to the Expressway Authority for updating its financial models and assisting in the projection of fund balance, for this analysis the project costs need to be categorized by expenditure type. Project costs consist of expenditures such as preliminary engineering, project development and environment study (PD&E), design, right-of-way (ROW) acquisition, construction, maintenance, and landscaping.

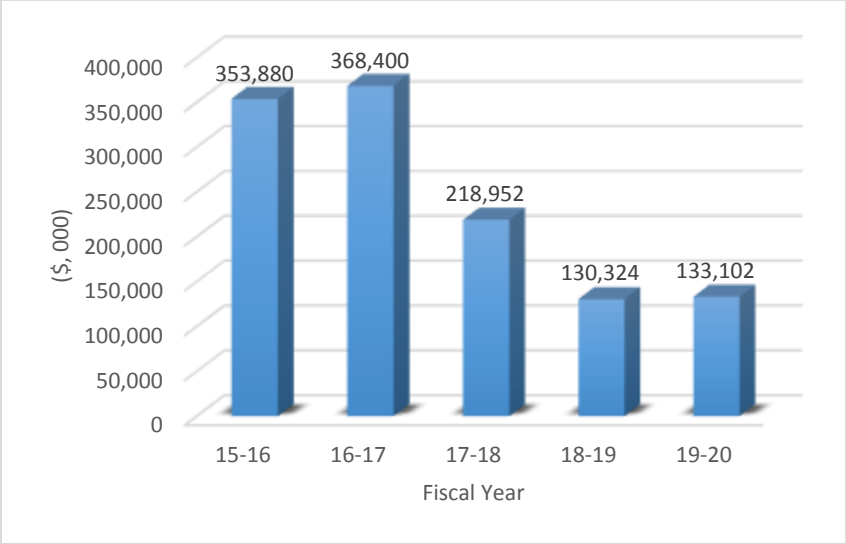


Figure 3-1: Five-Year Work Plan Expenditures (thousands of dollars)

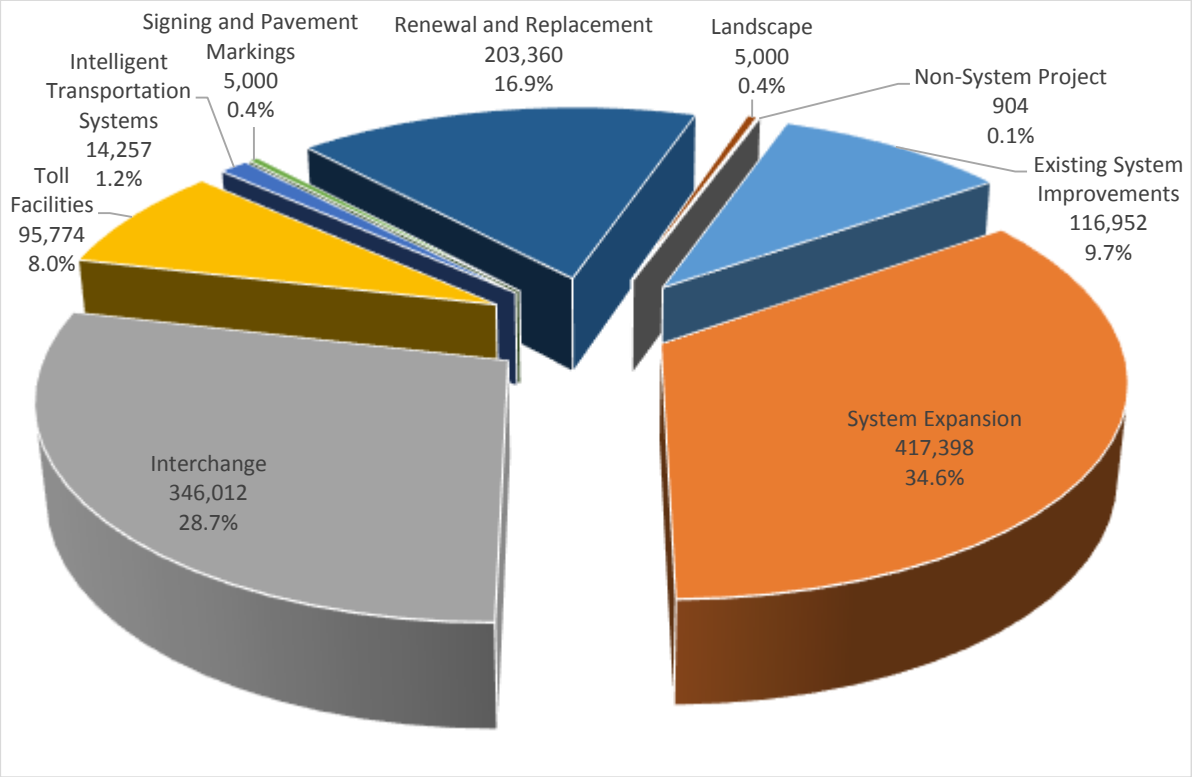


Figure 3-2: Work Plan Expenditure Allocation

Mix of Capital Investment Expenditures

To prepare the data for input in the estimation process, the Work Plan's $1.2 billion expenditures in project costs must be disaggregated by expenditure type. A detailed analysis of Section 5 of the Draft Work Plan [5] provided cost information on each project activity, which distinguishes between the following:

- Engineering, administration, and legal
- Construction
- PD&E
- ITS software implementation
- Toll equipment acquisition and replacement
- Right-of-way (ROW) acquisition
- Landscaping and maintenance

These data were compiled by fiscal year, as shown in Table 3-1.

Table 3-1: Work Plan Expenditure Breakdown (thousands of dollars)

Expenditure Type	*15-16*	*16-17*	*17-18*	*18-19*	*19-20*	*Total*
Engineering, Administration, and Legal (EAL)	52,824	41,175	22,160	8,524	5,513	130,196
Construction	218,841	277,837	158,946	105,499	125,929	887,052
Landscaping and Maintenance	4,305	1,385	575	20	20	6,305
Intelligent Transportation Systems	2,801	11,791	21,982	14,802	1,640	53,016
Toll Equipment Acquisition and Replacement	3,450	286	3,550	0	0	7,286
Right of Way	71,659	35,926	11,739	1,479	0	120,803
Total	*353,880*	*368,400*	*218,952*	*130,324*	*133,102*	*1,204,658*

Source: Central Florida Expressway Authority/CUTR Aggregation

This study treats expenditures to purchase land under ROW acquisition as a transfer of resources among parties within the impact area that does not influence business activities or create jobs. Only the ROW expenditures that pay for real estate appraisal services (10% of ROW) and legal services (10% of ROW) are considered as having an impact. Table 3-2 reports the total expenditures that are assumed to have a direct impact in the area and throughout the state. Using the 2012 North American Industrial Classification System (NAICS), researchers assigned expenditures to specific industry sectors and then matched those sectors to the corresponding IMPLAN I-O model industry sectors. Table A-1 in Appendix A describes the NAICS industry sectors with the corresponding IMPLAN industry codes.

Table 3-2: Work Plan Expenditures Considered for Impact Analysis (thousands of dollars)

	Industry Sector				
Expenditure Type	*NAICS*	*IMPLAN*	*Total*	*% of Total*	*Average*
Engineering, Administration, and Legal (EAL)	54130	449	130,196	11.8%	26,039
Construction	23	56	887,052	80.1%	177,410
Landscaping and Maintenance	5617	469	6,305	0.6%	1,261
Intelligent Transportation Systems	5415	452	53,016	4.8%	10,603
Toll Equipment Acquisition and Replacement	4884	414	7,286	0.7%	1,457
Right of Way					
Real Estate Services (10%)	531	440	12,080	1.1%	2,416
Legal Services (10%)	5411	447	12,080	1.1%	2,416
Total			*1,108,015*	*100.0%*	221,603

Source: Central Florida Expressway Authority/CUTR Aggregation

This study uses the 2013 IMPLAN accounting tables to build the I-O model to reproduce the economic activity of the Orlando-Kissimmee-Sanford MSA. The accounting tables provide the baseline model upon which to estimate changes in the demand for goods and services generated by the Work Plan expenditures.

Economic Impact of Spending

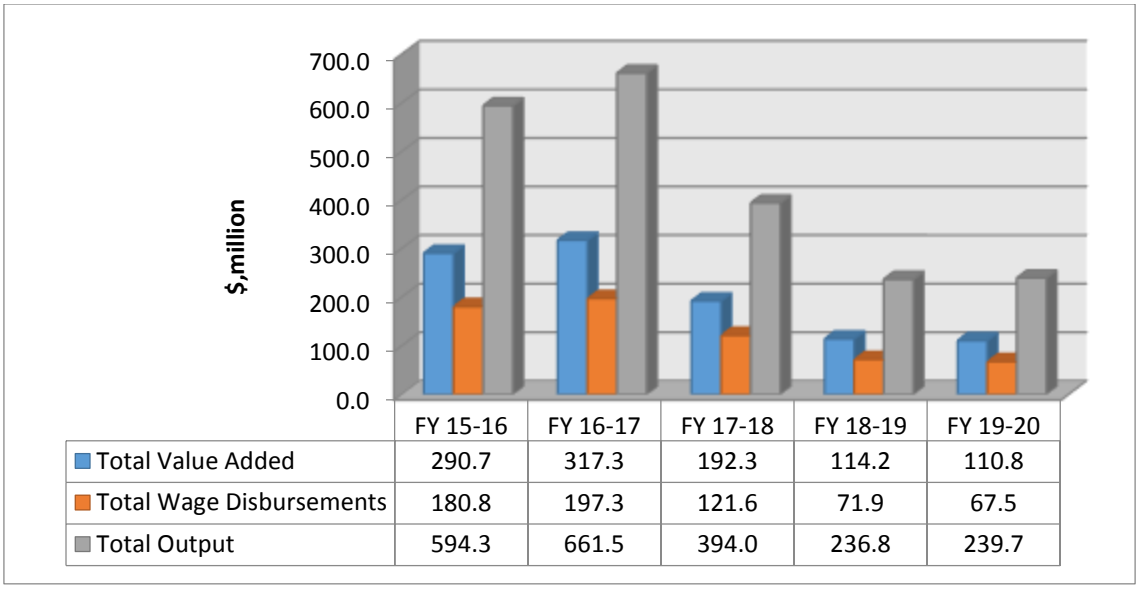
Table 3-3 summarizes direct, indirect, induced, and total impacts in terms of output, income, and employment. Total impacts on output are about $2.1 billion and represent the total

production of goods and services in the impact area produced by the total expenditures anticipated in the Work Plan. Of the total impact on output, approximately 90 percent, or $1.9 billion, occurs within the study area and the remaining impact occurs as spillover effects in the rest of the state. Total industry output measures the value of the production of goods and services by businesses in the local economy. Generally, total industry output is equivalent to total business sales plus what businesses place into (or remove from) inventory.

Table 3-3: Total Impacts by Type

Impact Type	*Output ($,000)*	*Labor Income ($,000)*	*Value Added ($,000)*	*Employment*
Direct	1,049,205	342,540	435,985	4,980
Indirect	585,923	188,029	302,849	3,561
Induced	490,992	164,325	286,536	3,788
Total	*2,126,120*	*694,894*	*1,025,370*	*12,328*

The total impact on value added (or GDP) is $1.0 billion with approximately $934.7 million occurring within the study area and the remaining impact of about $90.7 million occurring as spillover effects in the rest of the state. Value added measures the value of gross profits and is a measure of wealth created by the Work Plan. The Work Plan expenditure will also generate wages and other income of approximately $642.9 million within the study area and $52.0 million in the rest of the state for a total impact of $694.9 million. In addition, it will create approximately 12,328 jobs, 92.4 percent (11,390) of which are within the study area and the remaining 7.6 percent (938) throughout the rest of the state. Taking a multiyear approach to job impact estimation, this is equivalent to 2,466 person-year jobs statewide. Figure 3-3 shows the impact by fiscal year, following the investment schedule of the Draft Work Plan.



	FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20
Total Value Added	290.7	317.3	192.3	114.2	110.8
Total Wage Disbursements	180.8	197.3	121.6	71.9	67.5
Total Output	594.3	661.5	394.0	236.8	239.7

Figure 3-3: Work Plan Impact by Fiscal Year (millions of dollars)

Employment Impact by Industry and Occupation

Figure 3-4 shows a breakdown of job impacts by major industry group. The impact on jobs depends on the mix of project investment included in the Work Plan. With 34.6 percent of Work Plan expenditures spent on system expansion, 28.7 percent allocated to interchange projects, 16.9 percent designated for renewal and replacement projects, and 9.7 percent spent on existing system improvements, the impact is heavily weighted in construction (29.8%) and professional and business services (31.9%).

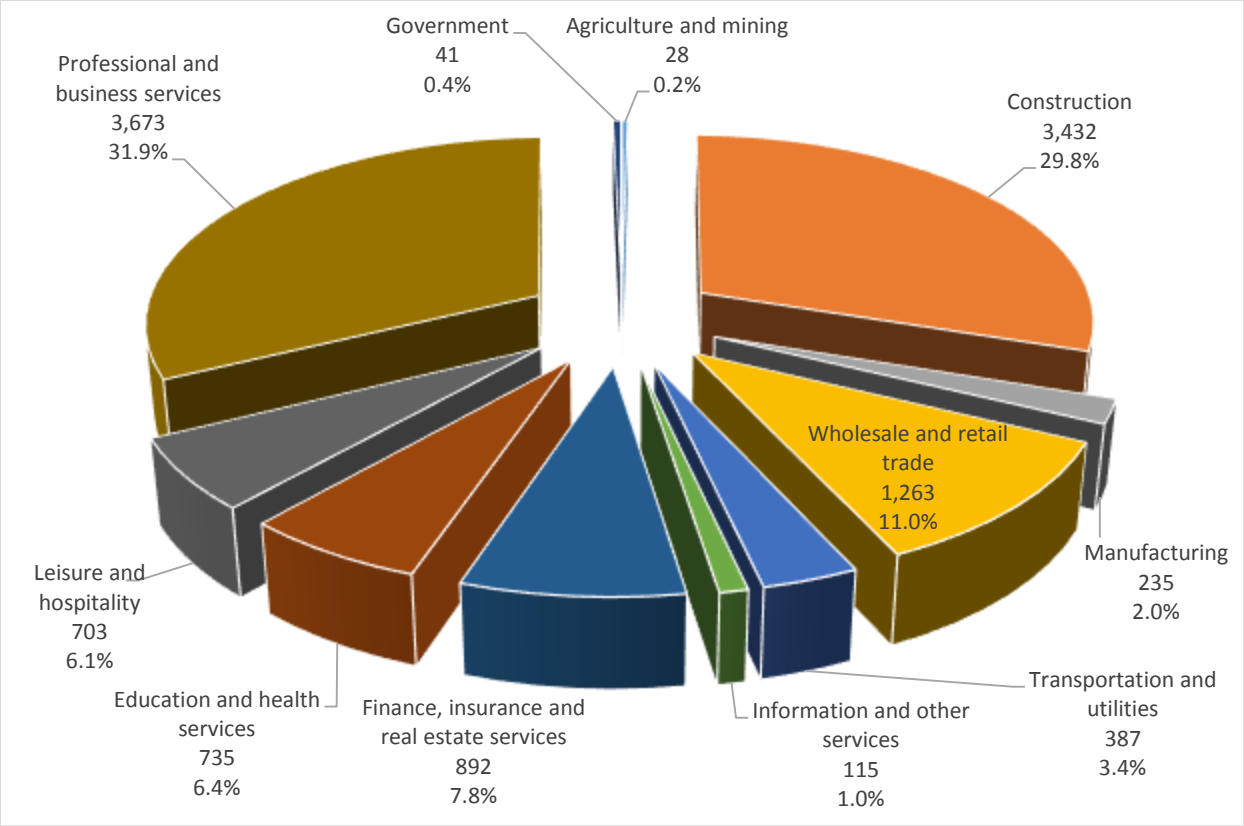


Figure 3-4: Work Plan Employment Impact by Industry

Work Plan Contribution to Local Economic Growth

The Greater Orlando area is diversifying its economy with a stronger emphasis on biotechnology and life sciences, research, and high-tech industries, in addition to a strong tourism industry. In 2014, employment in Orlando-Kissimmee-Sanford MSA increased by 3.6 percent overall, with significant growth concentrated in Life, Physical, and Social Science Occupations (17.6%), Computer and Mathematical Occupations (12.8%), and Management (6.2%). Research conducted by Moretti (2010) suggests that highly skilled jobs help generate and support a large number of unskilled jobs [6].

Figure 3-4 shows that the Work Plan investment impacts highly specialized jobs within the professional and business services sector, providing additional momentum to the economic recovery of the area. By providing safe and efficient connection throughout the region, the Work Plan strategic transportation infrastructure investments can support quickly growing industry sectors attracting high-wage, highly skilled workers and residents.

Impacts on State and Local Taxes

Table 3-4 summarizes the impact of the Work Plan on tax revenues in the Greater Orlando area. The largest impact of $26.4 million comes from sales tax revenues collected in the impact area. The collection of $19.1 million in property taxes constitutes about 34 percent of the total government revenue impacts. Corporate taxes contribute approximately $6.9 million to revenues. An additional $3.0 million in taxes are collected from licenses for motor vehicles, fishing and hunting, and various fines and fees.

Table 3-4: Local and State Fiscal Impact (thousands of dollars)

Revenue Source	*Total Impact*
Sales Tax	26,378,118
Property Tax	19,116,850
Motor Vehicle Tax	1,142,954
Corporation Taxes	6,942,460
Other Taxes*	2,974,603
Total	*56,554,985*

** Fines and fees (non-tax)*

Chapter 4
Travel Improvement Impacts

The Orlando-Kissimmee-Sanford MSA is experiencing significant population growth. During 2010-2014, population in Lake, Orange, Osceola, and Seminole counties grew by approximately 6.2 percent, compared to 3.8 percent for the state of Florida. Increased economic and population growth results in additional traffic growth and pressure on the region's transportation network. According to the Texas Transportation Institute *2015 Urban Mobility Scorecard*, the Orlando urban area ranks among the most congested areas in the U.S., with each peak period traveler annually wasting about 46 hours in traffic and 21 gallons of fuel due to congestion delays [7]. The Work Plan investments directed at improving the existing Expressway Authority system or adding new capacity could produce substantial benefits to the region.

This section of the report describes the approach to estimate benefits to highway users as Work Plan projects are built and put into operation. These benefits phase in based on the project construction schedule reported in the Draft Work Plan. Travel improvements that directly affect user travel times, safety, and reductions in emissions are considered benefits that do not produce a flow of money into the economy. Other improvements that produce out-of-pocket cost savings to individuals and businesses are assumed to produce indirect and induced impacts on the local area. These are discussed at the end of this section.

Direct User Benefits

The total value of travel benefits depends on the changes in travel conditions brought about by the Work Plan and by the mix of users of the Expressway Authority system. To estimate changes in travel conditions, the Expressway Authority traffic engineers run a travel demand model for a build versus no-build alternative. Table 4-1 summarizes these results and reports estimates in travel conditions based on annual average figures for the 2023-2043 forecast period. The Work Plan is expected to reduce travel times occurring during congestion periods, as well as reduce emissions and improve safety.

Table 4-1: Forecasted Travel Improvement Changes

Model Performance Measures	*Without Work Plan*	*With Work Plan*	*Change*	*Change (%)*
Vehicle Miles of Travel (million)	35,150	35,147	-3.1	0.0
Vehicle Hours of Travel (million)	1,216	1,199	-16.3	-1.3
Total Crashes	62,406	61,871	-535.0	-0.9
Total Injuries	46,821	46,426	-395.0	-0.8
Total Fatalities	408	405	-3.0	-0.7
Total Fuel Consumption (gallons, million)	526	519	-7.1	-1.3

Source: CUTR calculations based on Authority traffic engineers forecasts

All figures represent annual averages for 2023-2043

Next, these changes in travel conditions are translated into quantifiable user benefits. The benefits are assumed to occur yearly after the construction phase, under the assumption that travel occurs during 364 days. Appendix C describes in more detail the formula used to estimate user benefits and the original data sources.

Travel Time Savings

The value of travel time savings is equal to the opportunity cost of time spent in a motor vehicle for work or non-work related purposes; time that could be spent on other activities, such as leisure, family time, or more work. In this context, the Work Plan would benefit the Expressway Authority users by reducing average travel time per trip. This study considers the cost associated with travel time spent for commuting and for other purposes, or non-work travel. It also estimates travel time savings associated with commercial travel. The value of travel time savings is the product of four values:

- Change in VHT
- Vehicle occupancy rate
- Value of time, measured in dollars per hour
- Percent of travel by trip purpose

Travel time savings for non-work purposes are valued at 50 percent of the prevailing average wage rate. Travel time savings for commuting purposes are valued at 100 percent of the prevailing average wage rate. This evaluation is consistent with recommendations by the U.S. Department of Transportation [8]. The prevailing average wage rate for the impact area is provided by the current Bureau of Labor Statistics and is equal to $19.28 per hour (in 2015 dollars) [9]. This study uses the 2009 National Household Travel Survey to estimate the percent of travel for work and personal purposes [10]. These percentages are used to weight the total value of travel time savings. Table C-1 in Appendix C reports the results of this estimation.

Health and Safety

A considerable amount of the state's motor vehicle accidents occur in the Orlando MSA, accounting for a significant amount of injuries and fatalities. In 2014, a total of 40,613 motor vehicle crashes occurred in the Orlando MSA. This amounts to approximately 11.8 percent of the total crashes in the state. Of these accidents, nearly half reported injury, which produced a total of 28,801 injuries (12.8% of the state's 225,616 total injuries). Crashes with fatalities represent about one-half percent of the total accidents in the MSA and result in 264 fatalities, or 10.6 percent of the fatalities in the state.

Table 4-2: Accidents by Severity Type in the Orlando MSA, 2014

Category	*Orlando MSA*	*State*	*Percent of State (%)*
Total Crashes	40,613	345,470	11.8
Total Injuries*	28,801	225,616	12.8
Traffic Fatalities	264	2,496	10.6

Source: Florida's Integrated Report Exchange System (FIRES)

**Includes total possible, incapacitating, non-incapacitating injuries*

Changes in health and safety costs associated with crashes represent another relevant component of the benefits associated with travel improvements. These include monetary costs, such as property and personal injury damages caused by collisions and cost avoidance activities, as well as nonmonetary costs, such as pain and loss of productivity. This study estimates the change in comprehensive health and safety costs associated with changes in the number of vehicle crashes resulting from the Work Plan.

Comprehensive health and safety costs associated with vehicle crashes are estimated as the total cost per accident by severity type multiplied by the change in the number of crashes in each severity class; the product is summed over all severity classes. The total change in accident cost is the product of three values:

- Change in VMT
- Accident rates (in million per VMT) by road functional classification and severity type
- Cost of accident by severity type

Accident cost estimates are derived from the National Highway Traffic Safety Administration (NHTSA) report on the economic and societal impact of motor vehicle crashes [11]. This report provides estimates of average economic and comprehensive costs by the KABCO injury scale. KABCO denotes injury categories as fatal (K), incapacitating (A), non-incapacitating (B), possible injury (C), and none (O).

Economic costs include loss of human capital, market productivity, household productivity, medical care, property damage, legal costs, and travel delay. NHTSA does not recommend using economic costs for cost-benefit ratios, since economic costs do not include the "willingness to pay" or intangible costs to avoid these events. The willingness to pay is included in the comprehensive cost estimates using a quality-adjusted life year (QALY) factor loss. The comprehensive cost estimates are presented in Appendix A of the above referenced report (Blincoe et al., 2015, Table A-2, p. 242). These costs are updated in 2015 constant dollars.

Crash rates are positively related to traffic density, vehicle speeds, and roadway characteristics. For example, Kockelman [12] reports a nonlinear positive relationship between crash rates and vehicle speeds. Wang and Kockelman [13] find that crash rates vary according to vehicle type with light-duty vehicles (minivans, pickups, and sport utility vehicles) being associated with higher crash rates. Litman [14, 15] provides empirical evidence that crashes increase with annual vehicle mileage and that mileage reduction reduces crashes and crash costs.

This study uses estimates in accident rates from historical traffic accident data presented by Florida's Integrated Report Exchange System[3]. Table C-2 in Appendix C reports the results of this estimation.

Pollution Emission Costs

Air pollution costs are costs associated with emissions produced by motor vehicle use. Motor vehicles produce various harmful emissions that have a negative effect at local and global levels. Exhaust air emissions cause damage to human health, visibility, materials, agriculture, and forests [15, 16]. The major sources of motor vehicle pollutants include carbon monoxide (CO), volatile organic compounds (VOCs), nitrogen oxide (NOx), sulphur oxide (SOx), and particulate matter (PM).

Pollution costs are the product of three values:

- Changes in VMT
- Emission estimates, measured in grams/mile
- Emission costs, measured in $/Kg

The estimation of pollution emissions relies on emission pollution factors. Pollution emission costs are measured in damages related to health and visibility impacts, and physical impacts on the environment. This study adopts the cost estimates of Delucchi [16], who estimated costs for several impact categories for urban areas of the U.S. in 1991. Delucchi recently updated the original values to account for changes in information about pollution and its effects [17]. Delucchi customizes these estimates by using regional exposure scalars to adjust the average

[3] https://www.firesportal.com/Pages/Public/Home.aspx?ReturnUrl=%2f

exposure basis in U.S. urban areas to the average exposure in each of the metropolitan statistical areas. According to Delucchi, population density is the best simple measure of exposure to air pollution. This exposure scalar is the ratio of population density in each individual area to the average urban-area population density in the original analysis of 1991 (2,150 persons per square mile). The original 1991 $/Kg are scaled to 2009 dollar values using the consumer price index (CPI). To account for cost of living geographical differences, these estimates are scaled to each individual region using the ratio of an area's median household income to the U.S. median household income. This approach to emission cost estimation is also consistent with the methodology of the U.S. Department of Transportation Highway Economic Requirement System [18]. Table C-4 in Appendix C reports the results of this estimation.

Excess Fuel Consumption

The total cost of excess fuel consumption is equal to total annual gallons of excess fuel consumed multiplied by the cost of fuel. Changes in fuel consumption account for vehicle fuel efficiency under congested conditions. This study uses the average gasoline (for all formulations) pre-tax price for sale to end users produced by the U.S. Energy Information Administration (EIA) [19].

Vehicle Operating Costs

Changes in non-fuel operating costs are captured as changes in the cost of operating and maintaining a vehicle. Vehicle operating costs are the product of two values:

- Changes in VMT
- Non-fuel operating cost ($/mile)

This study uses the 2015 non-fuel vehicle operating cost estimates of the American Automobile Association's *Your Driving Cost* report [20]. The average operating cost across all vehicle classifications is $0.06 per mile. Table C-5 in Appendix C reports the results of the estimation of fuel and vehicle operating cost savings.

Direct User Benefits Estimates

Table 4-3 reports the results of estimated direct user benefits. The results indicate that most of the benefits accrue due to travel time and accident cost savings.

These savings are likely to increase when approaching the 2025 forecast design year. Travel time savings measure the value of time that is lost due to congestion and that the Work Plan travel improvements help recoup; time that households can dedicate to other uses, such as leisure or personal time.

Table 4-3: Direct User Benefits

Cost Savings Category	*($,Million/Year)*
Travel Time	
To Households	257.7
To Businesses	22.3
Accident Costs	143.9
Emission Costs	0.5
Fuel Costs	16.2
Total	*440.6*

Businesses will also benefit from the network improvements, with travel time savings of about $22.3 million annually. Businesses might be able to convert these savings into additional sales, resulting in increased productivity. This study does not capture these benefits for the reasons explained in the last section of Chapter 2 in this report.

It is relevant to differentiate between the monetary impacts of Chapter 3, which are defined as economic impacts, versus the monetary values estimated in this section. Benefits associated with reductions in accidents, decreased pollutant emissions, and time spent in travel (which could be dedicated to other activities) do not directly impact the flow of money into the local economy. That is, they do not directly increase business sales. These benefits are relevant for project evaluation purposes, when comparing the cost of investment versus potential benefits produced.

On the other hand, savings in out-of-pocket costs, such as fuel and out-of-pocket medical expenses, have impacts that spill over to the rest of the local economy.

Household Cost Savings

Gasoline and out-of-pocket medical expense savings due to reduced travel times and improved travel conditions and accident reductions are equivalent to change in personal disposable income toward other goods and services. The reallocation of this consumer spending across all sectors within the impact area is proportionate to the baseline consumer spending on these categories of goods and services. This approach recognizes that baseline consumer spending depends on household income levels. It assumes that household out-of-pocket medical costs amount to 10 percent of accident costs [21]. This impact is net of the reduction in gasoline sales resulting from the gallons saved due to congestion improvements discussed in this section.

Table 4-4 reports an estimated additional $32.0 million in annual total output and $18.9 million in additional GDP with the support of 250 jobs per year by 2025. These estimates represent the additional indirect and induced effect generated by increased household disposable income.

Table 4-4: Household Cost Savings Indirect and Induced Impacts

Impact Type	*Employment*	*Labor Income ($,000)*	*Value Added ($,000)*	*Output ($,000)*
Induced Effect	250	10,744	18,899	31,996

Under the current travel forecasting scenario, improvements of the current system would save each household $35 per year in fuel and vehicle operating costs. Savings on fuel and out-of-pocket medical expenses represent money saved to use on other household expenditures. According to the U.S. Census Bureau, there are about 97,000 households in the Orlando-Kissimmee-Sanford MSA earning $15,000 or less per year. These savings, combined with the annual travel time benefits, could provide these households with some gains in purchasing power.

Chapter 5
Conclusions

The economic impact of the *Five-Year Work Plan* is substantial in its contribution to economic growth in the four-country Orlando-Kissimmee-Sanford metropolitan statistical area and spillover effects occurring throughout the state of Florida. The total economic impact measured $2.1 billion in total output (gross business sales), $1.0 billion in local gross domestic product, and a combined 12,328 jobs.

Table 5-1: Local and Statewide Impacts

Economic Impact	*Orlando-Kissimmee-Sanford MSA*	*Statewide*
Jobs (Employment)	11,390	*12,328*
Output (Gross Business Sales, $ billions)	1.9	*2.1*
GDP (Value Added, $ billions)	0.9	*1.0*
Labor Income ($ millions)	642.9	*694.9*

In addition to the impact generated by infrastructure investment spending, the construction and implementation of the strategic projects identified by the Work Plan can produce substantial benefits in terms of travel time reductions, increased safety, and a reduction in harmful emissions. Under the current travel forecasting scenario, improvements and expansions to the current system would save each household on average 32 hours in travel annually, or $334 per year. Households would also save out-of-pocket costs due to reduced medical expenses because of fewer accidents. Savings on fuel and vehicle medical costs represent money saved to use on other household expenditures. These savings provide an income benefit to those households at the lowest ranges of incomes, representing a consistent gain in purchasing power.

Businesses would also benefit from improved travel conditions. The conservative estimates presented in Chapter 4 only considered the travel time savings related to freight movement across the region. This study did not consider the incremental operating cost savings that can also be produced by network improvements, the long-term economic implications of increased accessibility to other markets, or potential increases in business productivity from improved travel times. Tailoring the approach to business productivity impact estimation would require detailed freight traffic data at a highly disaggregated level. This more comprehensive effort would be beneficial to assess the contribution of a long-term plan, such as the 2030 Master Plan.

References

1. *Relation of Gdp by State to U.S. Gross Domestic Product*. Regional Economic Accounts 2010.
2. *American Community Survey*, 2008, U.S. Census Bureau.
3. Expressway, C.F., *Customer Opinion Survey*, 2013.
4. Weisbrod, G.E., et al., *Economic Implications of Congestion*, in *NCHRP report,*2001, National Academy Press: Washington, D.C. pp. 1 v. (various pagings).
5. Authority, C.F.E. and *Five-Year Work Plan Fy 2016-2020*, 2015. pp. 4-5.
6. Moretti, E., Local Multipliers. *American Economic Review*. Vol. 100, 2, 2010, pp. 373-77.
7. Lomax, T., D. Schrank, and B. Eisele, *2015 Urban Mobility Scorecard*, in *Urban Mobility Report*2015, Texas A&M Transportation Institute: College Station, Texas.
8. *The Value of Saving Time: Departmental Guidance for Conducting Economic Valuation*, 1997, U.S. Department of Transportation: Washington, D.C.
9. *May 2008 Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates, Orlando-Kissimmee*, 2009, Bureau of Labor Statistics.
10. *Person Trips by Travel Day*, 2009, National Household Travel Survey.
11. Blincoe, L.J., et al., *The Economic Impact of Motor Vehicle Crashes 2000*, N.H.T.S. Administration, Editor 2002, U.S. Department of Transportation: Washington, D.C. .
12. Kockelman, K., *Safety Impacts and Other Implications of Raised Speed Limits on High-Speed Roads*, N.C.H.R. Program, Editor 2006, Transportation Research Board of the National Academies.
13. Wang, X. and K. Kockelman, Use of Heteroscedastic Ordered Logit Model to Study Severity of Occupant Injury: Distinguishing Effects of Vehicle Weight and Type. *Transportation Research Record*. Vol. 1908, 1908, 2005, pp. 195-204.
14. Litman, T., *Energy Conservation and Emission Reduction Strategies*, in *TDM Encyclopedia*, V.T.P. Institute, Editor 2008, Victoria Transport Policy Institute: Victoria.
15. Litman, T., *Air Pollution Costs*, in *Transportation Cost and Benefit Analysis - Techniques, Estimates and Implications*, V.T.P. Institute, Editor 2009, Victoria Transport Policy Institute: Victoria.
16. Delucchi, M., *Summary of the Nonmonetary Externalities of Motor-Vehicle Use*, in *The annualized social cost of motor-vehicle use in the United States, based on 1990-1991 Data*1998, Institute of Transportation Studies.
17. Delucchi, M., *The Social-Cost Calculator (Scc): Documentation of Methods and Data, and Case Study of Sacramento*, 2005, Institute of Transportation Studies.
18. *Hers-St Technical Report*, in *HERS -ST Highway Economic Requirements System-State Version*2005, Federal Highway Administration: Washington, D.C.

19. *Gasoline Prices by Formulation, Grade, Sales Type*, 2009, Energy Information Administration.
20. *Your Driving Costs*, 2009, American Automobile Association.
21. Blincoe, L., et al., *The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised)*, 2015: Washington, DC: National Highway Traffic Safety Administration.
22. Barreto, H. and F.M. Howland, *Introductory Econometrics: Using Monte Carlo Simulation with Microsfot Excel,* 2006, New York: Cambridge University Press.
23. *Regional Input-Output Modeling System (Rims Ii)* 2010; Available from: http://www.bea.gov/regional/rims/.
24. *Implan.Com*. 2010; Available from: www.implan.com.

Appendix A
Choice of Input-Output Model

Input-output (I-O) modeling, originally introduced by Leontief [22], describes commodity flows from producers to intermediate and final consumers. It depicts an economic system as a set of tables where the total industry purchases of commodities, services, employment compensation, value added, and imports is equal to the value of the commodities produced. Purchases for final use (final demand) drive the model. Industries producing goods and services for final demand purchase goods and services from other producers. These other producers, in turn, purchase goods and services. This buying of goods and services (indirect purchases) continues until leakages from the region (imports and value added) stop the cycle. These indirect and induced effects (the effects of household spending) can be mathematically derived. The derivation is called the Leontief inverse. The resulting sets of multipliers describe the change of output for each regional industry caused by a one-dollar change in final demand for any given industry.

To conduct economic impact analysis, I-O tables can be acquired by the Bureau of Economic Analysis [23] or by the IMPLAN Group, Inc. (MIG) [24]. IMPLAN is a web-based software that allows the user to develop local level input-output models to assess the economic impact of new firms moving into an area, construction expenditure impacts, firm relocation, and many more activities. The IMPLAN model accounts closely follow the accounting conventions used in the "Input-Output Study of the U.S. Economy" by the Bureau of Economic Analysis and the rectangular format recommended by the United Nations.

The Work Plan economic impact analysis of this report makes use of the IMPLAN model. The reason is that IMPLAN presents a high degree of flexibility in both geographic coverage and model formulation. IMPLAN databases combined with the IMPLAN professional software system allow the user to develop local level input-output models that can estimate the economic impact of new firms moving into an area, professional sports teams, recreation and tourism, and many other activities. The data and software also generates a complete set of social accounting matrices for advanced computable general equilibrium model and tax analysis.

IMPLAN databases are available at the county level and cover several industry sectors. This study uses the 2013 IMPLAN county data files that report economic data for 536 industry sectors. After the impact analysis is conducted at this level, the results are aggregated at major

industry sectors. Table A-1 describes the IMPLAN industry sectors, which parallel the North American Industrial Classification System (NAICS) two-digit level classification.

Table A-1: NAICS Industry Classification and IMPLAN

Industry	*Industry Code*	
	NAICS	*IMPLAN*
Agriculture	11	1
Mining	21	20
Utilities	22	31
Construction	23	34
Manufacturing	31-33	84
Wholesale Trade	42	319
Retail Trade	44-45	320
Transport and Warehousing	48-49	332
Information	51	341
Finance and Insurance	52	354
Real Estate and Leasing	53	360
Professional and Technical Services	54	367
Management of Companies	55	381
Administrative and Support Services	56	382
Educational Services	61	391
Health Care Services	62	394
Arts and Recreation Services	71	402
Accomodation and Food Services	72	412
Other Services	81	416
Government	92	427

IMPLAN provides a means to assess economic impacts caused by changes made to the accounting expenditure matrix for the region analyzed. By entering a change, say, in expenditure in one industry sector, the analyst can see how this affects the overall economic structure of the region. The effects are measured by the same metric used to express the elements composing the original database matrix.

The changes are measured in terms of the following:

- Industry Output
- Employment
- Value Added
- Final Demands

Industry output is a single number in dollars, or millions of dollars, for each industry present in the region. The dollars represent the value of an industry's production. Employment is listed as

a single number of jobs for each industry. Data is usually derived from the ES202 employment security data and supplemented by county business patterns and REIS data. It includes both temporary and permanent jobs.

Value added is a subset of total output and is equal to total output minus the cost of material and labor. It represents a measure of the contribution of production factors and is often used as a measure of economic activity (also defined as GDP). There are four sub-components of value added:

1. Employee Compensation
2. Proprietary Income
3. Other Property Type Income
4. Indirect Business Taxes

Employee compensation describes the total payroll costs (including benefits) of each industry in the region. It includes the wages and salaries of workers paid by employers, as well as benefits such as health insurance and life insurance. Proprietary income consists of payments received by self-employed individuals as income. Other types of income include payments for rents, royalties, and dividends. Indirect business taxes consist of excise taxes, property taxes, fees, licenses, and taxes paid by businesses.

Appendix B
Tables of Direct, Indirect, and Induced Multipliers

Chapter 3 of the report describes how the Work Plan project expenditures are processed and inputted in IMPLAN. Analysts categorize expenditures and then assign them to specific industry sectors. Running the model then produces a set of multipliers to estimate direct, indirect, and induced impacts. The three tables below report output, value added, and employment multipliers, respectively. Multipliers are aggregated at the North American Industry Classification System (NAICS) two-digit level with the corresponding IMPLAN industry sector.

Table B-1: Total Output Multipliers

Industry Code			*Multiplier*			
NAICS	*IMPLAN*	*Industry*	*Direct Effects*	*Indirect Effects*	*Induced Effects*	*Total*
11	1	Agriculture	1.0	0.2	0.4	1.6
21	20	Mining	1.0	0.4	0.3	1.6
22	33	Utilities	1.0	0.1	0.1	1.3
23	34	Construction	1.0	0.3	0.2	1.5
31-33	41	Manufacturing	1.0	0.4	0.3	1.8
42	319	Wholesale Trade	1.0	0.5	0.4	1.9
44-45	320	Retail Trade	1.0	0.5	0.4	1.9
48-49	332	Transport and Warehousing	1.0	0.5	0.4	1.8
51	341	Information	1.0	0.4	0.3	1.6
52	354	Finance and Insurance	1.0	0.4	0.3	1.7
53	360	Real Estate and Leasing	1.0	0.4	0.4	1.8
54	367	Professional and Technical Services	1.0	0.5	0.4	1.9
55	381	Management of companies and enterprises	1.0	0.5	0.4	1.9
56	382	Administrative and Support Services	1.0	0.5	0.5	2.0
61	391	Educational Services	1.0	0.6	0.4	2.0
62	394	Health Care Services	1.0	0.4	0.5	1.9
71	402	Arts and Recreation Services	1.0	0.5	0.4	1.9
72	411	Accommodation and Food Services	1.0	0.6	0.5	2.1
81	414	Other Services	1.0	0.6	0.5	2.1
92	427	Government	1.0	0.5	0.3	1.8

Table B-2: Total Value Added Multipliers

Industry Code			Multiplier			
NAICS	IMPLAN	Industry	Direct Effects	Indirect Effects	Induced Effects	Total
11	1	Agriculture	0.7	0.1	0.2	1.0
21	20	Mining	0.0	0.2	0.2	0.4
22	33	Utilities	0.8	0.1	0.1	1.0
23	34	Construction	0.6	0.1	0.1	0.9
31-33	41	Manufacturing	0.4	0.2	0.2	0.8
42	319	Wholesale Trade	0.2	0.3	0.2	0.8
44-45	320	Retail Trade	0.3	0.3	0.2	0.8
48-49	332	Transport and Warehousing	0.3	0.2	0.2	0.8
51	341	Information	0.3	0.2	0.2	0.6
52	354	Finance and Insurance	0.3	0.2	0.2	0.7
53	360	Real Estate and Leasing	0.4	0.2	0.2	0.9
54	367	Professional and Technical Services	0.3	0.3	0.2	0.8
55	381	Management of companies and enterprises	0.4	0.3	0.3	0.9
56	382	Administrative and Support Services	0.4	0.3	0.3	0.9
61	391	Educational Services	0.3	0.3	0.2	0.8
62	394	Health Care Services	0.7	0.2	0.3	1.2
71	402	Arts and Recreation Services	0.6	0.3	0.3	1.1
72	411	Accommodation and Food Services	0.4	0.3	0.3	1.0
81	414	Other Services	0.5	0.3	0.3	1.1
92	427	Government	0.6	0.3	0.2	1.0

Table B-3: Total Employment Multipliers

Industry Code			Multiplier			
NAICS	IMPLAN	Industry	Direct Effects	Indirect Effects	Induced Effects	Total
11	1	Agriculture	11.7	1.3	3.2	16.1
21	20	Mining	7.7	2.2	2.0	11.9
22	33	Utilities	2.0	0.9	1.2	4.0
23	34	Construction	5.0	1.8	1.9	8.7
31-33	41	Manufacturing	3.8	2.8	2.6	9.2
42	319	Wholesale Trade	2.8	3.5	3.0	9.3
44-45	320	Retail Trade	3.5	3.1	2.8	9.4
48-49	332	Transport and Warehousing	2.7	2.7	2.9	8.4
51	341	Information	3.1	2.1	2.3	7.4
52	354	Finance and Insurance	1.9	2.2	2.3	6.5
53	360	Real Estate and Leasing	2.8	2.4	3.3	8.5
54	367	Professional and Technical Services	4.2	3.3	2.9	10.4
55	381	Management of companies and enterprises	3.5	3.2	3.4	10.1
56	382	Administrative and Support Services	7.0	3.2	3.7	13.8
61	391	Educational Services	6.3	4.2	3.2	13.7
62	394	Health Care Services	7.0	2.9	3.8	13.7
71	402	Arts and Recreation Services	10.4	3.1	3.4	16.8
72	411	Accommodation and Food Services	8.7	4.1	4.0	16.8
81	414	Other Services	6.7	4.6	4.0	15.3
92	427	Government	5.0	3.5	2.4	10.9

The employment multipliers presented in Table B-3 above are based on the IMPLAN I-O model estimates. They estimate the required number of jobs in each industry for every $1 million of expenditures. For example, each $1 million spent in the construction sector leads to a demand for 8.7 workers, including direct and indirect industry demand.

Appendix C
Travel Improvement Impacts, Assumptions, and Data Sources

Travel Time Savings

The value of time measures the opportunity cost of time spent on a motor vehicle for work or non-work related purposes; time that could be spent on other activities, such as leisure or other more work. Table C-1 details the calculations applied to estimate travel time savings.

Table C-1: Estimation of Travel Time Savings

	Travel Time Savings (Vehicle Hours Traveled)		*Vehicle Occupancy*	*Travel Time Savings (Person Hours Traveled)*		*Travel Time Savings ($, 2015)*		
Category	*Daily*	*Annual*		*Daily*	*Annual*	*Value of Time* [†††] *($/hour)*	*Daily*	*Annual*
Private								
Personal[†]	35,632	13,005,621	1.7	60,218	21,979,499	9.6	580,360	211,831,538
Commuting[†]	5,768	2,105,380	1.1	6,518	2,379,080	19.3	125,637	45,857,657
Total Private[‡] (A)	41,400	15,111,001		66,736	24,358,579		705,998	257,689,195
Commercial[‡] (B)	3,288	1,200,006	1.0	3,288	1,200,006	18.6	61,142	22,316,868
Total (A+B)	**44,688**	**16,311,007**		**70,024**	**25,558,585**		**767,140**	**280,006,062**

[†] *Split based on 2009 National Household Travel Survey using distribution of travel on various modes by purpose (86.1% personal; 13.9% commuting).*

[‡] *Split based on 2013 Florida Traffic Information database using annual VMT for Orlando-Kissimmee by vehicle type (92.6% private motorvehicle; 7.4% commercial).*

[†††] *Value of time based on travel purpose (50% of prevailing wage rate for personal; 100% of prevailing wage for commuting and commercial). Wage rates for Orlando-Kissimmee were obtained from the Bureau of Labor Statistics http://www.bls.gov/oes/2014/may/oes_36740.htm#b00-0000.*

Change in delay is measured as the change in vehicle of hours of travel under congestion and is obtained from the Expressway Authority traffic engineers.

Average vehicle occupancy is taken from the 2009 National Household Travel Survey person trip file, which reports the number of travel day person trips by trip purpose. These data are available online using the Table Designer feature at http://nhts.ornl.gov/tables09/ae/TableDesigner.aspx.

The private versus commercial travel split data are from the 2014 Florida Traffic Information DVD, available from the Florida Department of Transportation at http://www.dot.state.fl.us/planning/statistics/trafficdata/fti.shtm.

The average prevailing wage rate for the Orlando-Kissimmee-Sanford MSA is obtained from the Bureau of Labor Statistics at http://www.bls.gov/oes/current/oes_36740.htm.

Accident Cost Savings

Accident costs savings are estimated as the change in health and safety costs associated with vehicle crashes. To estimate these changes, the total social cost per accident by severity type is multiplied by the change number of crashes in each severity class; its product summed over all severity classes

$$Total\ Health\ and\ Safety\ Costs = \sum Total\ Crash\ Cost_i\ x\ Change\ in\ Number\ of\ Crashes_i$$

Table C-2 displays the calculations applied to estimate changes in accident cost savings. Changes in the accident rates were estimated using historical traffic accident data from Florida's Integrated Report Exchange System.

Table C-2: Accident Cost Savings (2014 dollars)

Category	*Accidents*[†]			*Cost per accident*[‡] *($)*	*Cost Savings ($)*	*Share of Total*	*Medical Costs*
	Without Work Plan	*With Work Plan*	*Difference*				
Vehicle Crashes	62,406	61,871	-535	45,791	24,497,998	17.0%	1,489,097
Total Injuries	46,821	46,426	-395	269,691	106,527,921	74.1%	2,601,454
Traffic Fatalities	408	405	-3	4,276,196	12,828,589	8.9%	36,755
Total	*109,635*	*108,702*	*-933*	*4,591,678*	*143,854,507*		*4,127,307*

[†] *CUTR calculations based on historical crash data from the Florida Integrated Report Exchange System (FIRES)*

[‡] *CUTR calculations based on estimates from Blincoe et al. (2015), Table D-1, pp. 251*

Crash Costs

Crash cost estimates come from the National Highway Traffic Safety Administration (NHTSA) report on the economic impact of motor vehicle crashes [11]. The report provides estimates of average economic and comprehensive costs by crash-assigned injury scale (KABCO). Economic costs consist of loss of human capital, market productivity, household productivity, medical care, property damage, legal costs, and travel delay and include the "willingness to pay" or intangible costs to avoid these events. The willingness to pay is included in the comprehensive cost estimates using a quality-adjusted life year (QALY) factor loss. The comprehensive cost estimates are presented in Appendix D of the same report (Table D-1, p. 251), and are reported below in Table C-3. These costs are updated from 2010 to 2015 dollars using the Consumer Price Index series for all urban consumers, South Region.

Table C-3: Monetary and Nonmonetary Crash Costs ($/crash, 2010 dollars)

Type	*No Injury (O)*	*Possible Injury (C)*	*Non-incapacitating Injury (B)*	*Incapacitating Injury (A)*
Medical Care	2,571	4,393	4,981	21,189
EMS	20	45	56	122
Market Productivity	2,184	5,096	6,465	24,403
Household Productivity	710	1,562	1,966	7,182
Insurance Administration	2,240	3,648	3,670	11,751
Workplace	7	208	1,459	3,941
Legal	56	1,125	1,684	8,557
Subtotal Injury	***7,788***	***16,077***	***20,281***	***77,145***
Congestion	1,026	1,009	995	1,385
Property Damage	1,624	2,407	2,465	3,518
QALYs	31,859	108,274	252,268	919,158
Subtotal Non-injury	***34,509***	***111,690***	***255,728***	***924,061***
Total	***42,297***	***127,767***	***276,009***	***1,001,206***

Source: [11] .[4]

The full report with the comprehensive cost of accidents is available from the National Highway Traffic Safety Administration at http://www-nrd.nhtsa.dot.gov/pubs/812013.pdf.

Changes in Pollution Emission Costs

Table C-4 details the calculations of savings in pollution emissions. For each mode *i* and each pollutant *k*, the total pollution cost *PC* is equal to:

$$PC_{ik} = \sum \left(\frac{gram_{ik}}{mile}\right)(VMT_i)\left(\frac{\$}{gram_k}\right)$$

Table C-4: Changes in Pollution Emission Costs

Category	*Reduction in Emissions†*		*Reduction in Costs‡*	
	(kg/day)	*(kg/year)*	*($/kg)*	*($/year)*
Global Warming (CO_2 Equivalent)	18904.79	6,900,249	0.07	472,973.6
Carbon Monoxide (CO)	118.13	43,118	0.14	5,911.0
Nitrogen Oxides (NOx)	0.94	343	4.97	1,704.5
Nitrogen Dioxide (NO_2)	1.30	476	4.97	2,363.2
Particulate Matter (PM2.5)	0.02	6	6.61	41.1
Particulate Matter (PM10)	0.46	167	6.61	1,106.1
Sulphur Oxides (SOx)	0.05	18	11.52	205.4
Volatile Organic Compounds (VOC)	0.31	112	3.77	423.1
Total	*19,026*	*6,944,489*		*484,728*

†CUTR calculations based on EPA MOVES emission rates and CFX traffic engineers traffic estimates

‡CUTR calculations based on unit cost estimates from Delucchi (2002)

[4] KABCO scale classifies crash victims as K–killed, A–incapacitating injury, B–non-incapacitating injury, C–possible injury, or O–no apparent injury.

Emission Costs

Emission costs are measured in $/Kg damages related to health and visibility impacts and physical impacts on the environment. For purposes of this report, cost estimates by Delucchi were adopted [17]. Delucchi's calculations account for exposure damage, which are scaled according to population density levels. This exposure scalar is equal to the ratio of population density in each individual area to the average urban-area population density in the original analysis of 1991 (2,150 persons per square mile). The original 1991 cost estimates were updated to 2015 dollar values using the consumer price index (CPI).

The source of emission costs can also be found at UCDavis Institute of Transportation Studies website: http://www.its.ucdavis.edu/publications/2004/UCD-ITS-RR-96-03(01)_rev1.pdf.

Fuel and Vehicle Operating Costs

This study estimates changes in fuel and vehicle operating costs associated with private travel. The change in fuel consumption is measured in total gallons saved as a result of Work Plan travel improvements. Expressway Authority engineers provided the estimates of annual gallons saved. These estimates account for changes in fuel efficiency due to traveling in congested periods. Changes in vehicle operating costs are based on changes in overall travel, measured by VMT. Table C-5 details these calculations.

Table C-5: Changes in Fuel and Vehicle Operating Costs

Category	*Gallons Saved*[†] *(gallons/year)*	*Fuel Cost*[†] *($/gallon)*	*Fuel Cost Savings ($/year)*	*Operating Cost*[†††] *($/mile)*	*Reduced Travel*[†] *(VMT/year)*	*Operating Cost Savings ($/year)*
Fuel Cost Savings (VHT)	7,057,286	2.26	15,914,180	0.06	-3,076,220	187,342
Fuel Cost Savings (VMT)	133,170	2.26	300,298			
Operating Cost Savings						
Total			*16,214,478*			

[†]*CUTR calculations (Appendix A)*

[††]*Energy Information Administration*

[†††]*AAA, your driving costs, 2009 edition*

The annual average cost per gallon of fuel net of taxes is available from the Energy Information Administration: http://tonto.eia.doe.gov/dnav/pet/pet_pri_refoth_dcu_nus_a.htm.

Per-mile vehicle operating costs (net of fuel costs) are provided by the American Automobile Association (AAA): http://exchange.aaa.com/wp-content/uploads/2015/04/Your-Driving-Costs-2015.pdf.