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

FY 2020 – FY 2024

Project Number

2117-1954-00

Prepared For

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

February 2020

2020 CUTR CENTER FOR URBAN TRANSPORTATION RESEARCH CUTR.USF.EDU UNIVERSITY of SOUTH FLORIDA

This page intentionally left blank.

The Economic Impact and Benefits of the Central Florida Expressway Authority Five-Year Work Plan FY 2020 – FY 2024

Prepared for:

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

Prepared by:

Sisinnio Concas, PhD

Center for Urban Transportation Research
University of South Florida
4202 E. Fowler Ave., CUT 100, Tampa, FL 33620
Website: www.cutr.usf.edu

Final Report
February 2020

Disclaimer

This research was conducted under a grant from the Central Florida Expressway Authority. The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Central Florida Expressway Authority.

Executive Summary

To manage and operate its program of system improvements, the Central Florida Expressway Authority (CFX) 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 *2040 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

CFX commissioned this study to estimate the economic impacts and benefits of implementing the 2020-2024 *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 Work Plan economic impact is substantial in contributing to economic growth, as measured by $4.2 billion in gross business sales, $2.2 billion in gross domestic product, and a combined 5,224 jobs 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 contribution results in a total impact of $4.6 billion in gross business sales, $2.4 billion in gross domestic product, and 5,942 jobs.

Employment impacts primarily center in the professional and business services and the construction sectors but spill over to other sectors as well. 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.

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 62 travel hours annually, or $729 per year.

[1] All monetary amounts are reported in 2019 dollars unless otherwise indicated.

The expected travel time improvements would also save households save $48.4 million in out-of-pocket costs. These savings are a result of lower fuel costs 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 $33.5 million a year in indirect and induced gross domestic product, an impact that is likely to linger after the Work Plan investment schedule.

Summary of Impacts and Benefits

- *The* Work Plan investment expenditures significantly contributes to the Gross Domestic Product (GDP) and job growth.
  - ***$4.2 billion in gross business sales***
  - ***$2.4 billion in GDP***
  - ***5,942 Jobs***

- ***Implementation of the Work Plan*** strategic projects produces relevant mobility and safety improvements valued at $1.1 billion/year:
  - ✓ Reductions in travel and accident costs
  - ✓ Increased travel time savings
  - ✓ Reduction in harmful emissions

Table of Contents

List of Figures

List of Tables

Chapter 1
Introduction

1.1 Project Background

The Central Florida Expressway Authority (CFX) was established in 2014 with an expanded mandate to build and maintain a regional transportation network that connects Brevard, Lake, Orange, and Seminole counties [1]. The CFX system consists of 125 centerline miles, 841 lane miles (including ramps), 72 interchanges, 14 mainline toll plazas, and 342 bridges.

To manage and operate its program of system improvements, CFX annually updates its *Five-Year Work Plan* (Work Plan) [2]. The Work Plan strategically identifies those projects to be funded during the next five years and serves as an integral part of the *2040 Expressway Master Plan*. The Work Plan projects are intended to maintain and expand the current system and ultimately improve travel and safety conditions for users.

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

1.2 Study Objectives

The objective of this project is to estimate the economic impacts and benefits associated with the Work Plan (Fiscal Years 2020 - 2024). These estimates will help CFX:

- 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 of the Work Plan to users of CFX's 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 and the estimation results.

Chapter 2
Methodology

2.1 Introduction

The term *economic impact* is used extensively to describe and quantify the economic activities attributable to an organization and its investments. 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 affect 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.

2.2 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.

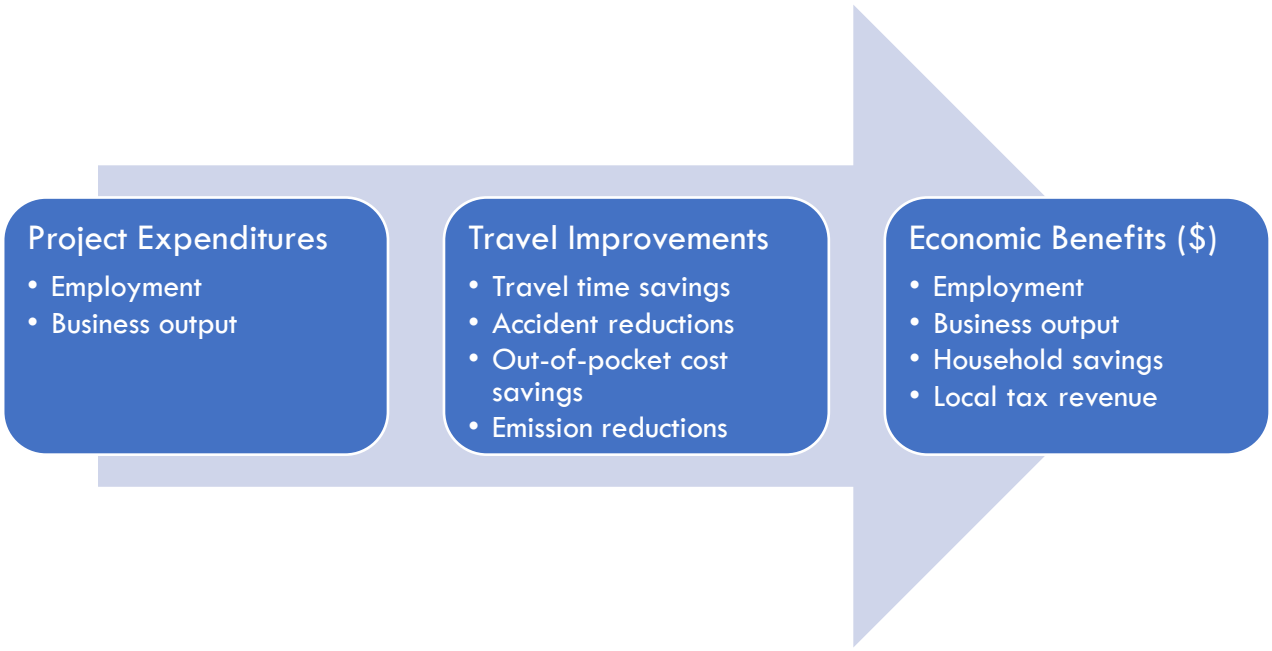


Figure 2-1 Economic Impact and Benefit Evaluation Framework

1.1.1 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. Appendix A provides a more detailed explanation of the IMPLAN model and I-O analysis.

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

1.1.2 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 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.

[2] www.implan.com

2.3 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

2.3.1 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.

1.1.1 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.

2.3.2 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 [3]. In economic analysis, value added is the preferred impact measure of contribution to economic growth generated by investments.

2.3.3 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.

2.3.4 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.

2.3.5 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.

CFX's network encompasses the Orlando-Kissimmee-Sanford MSA. According to the American Community Survey 2014-2018 5-year estimates, about 72 percent of the Orlando-Kissimmee-Sanford MSA employees reside within its boundaries (Lake, Orange, Osceola, and Seminole) [4]. According to the 2018 Central Florida Expressway Customer Opinion Survey, approximately 71 percent of the network's surveyed users reside in the MSA [5]. 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.

2.4 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 CFX'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 through 2045. 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.

2.5 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.

2.6 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 [6]. 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 CFX'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.

3.1 Overview of the Five-Year Work Plan

The FY 2020-2024 Work Plan is developed from prior Work Plans and the *2040 Expressway Master Plan*. It identifies the projects that CFX anticipates funding during the next five years. The Work Plan is key to manage CFX's program of system improvements, enhancement, and rehabilitation. During the development of the Work Plan, a Work Plan document is prepared by CFX's technical staff [7]. The report produces a list of projects grouped in the following ten categories:

1. Existing System Improvements
2. System Expansion Projects
3. Interchange Projects
4. Facilities Projects
5. Transportation Technology Projects
6. Information Technology Projects
7. Signing and Pavement Markings
8. Renewal and Replacement Projects
9. Landscape Projects
10. Non-System Projects

This study relies on project cost data from the most recent version of the Work Plan to obtain detailed information on each of the projects [7]. In the document, this information is provided under the "Section 5 Project Information." The total value of the Work Plan is $2.4 billion (2019 dollars) with yearly expenditures allocated according to Figure 3-1. Figure 3-2 shows that 46.8 percent of Work Plan expenditures will go toward existing system improvements and 32.2 percent will go to system expansion projects, with the remainder allocated to all other project categories.

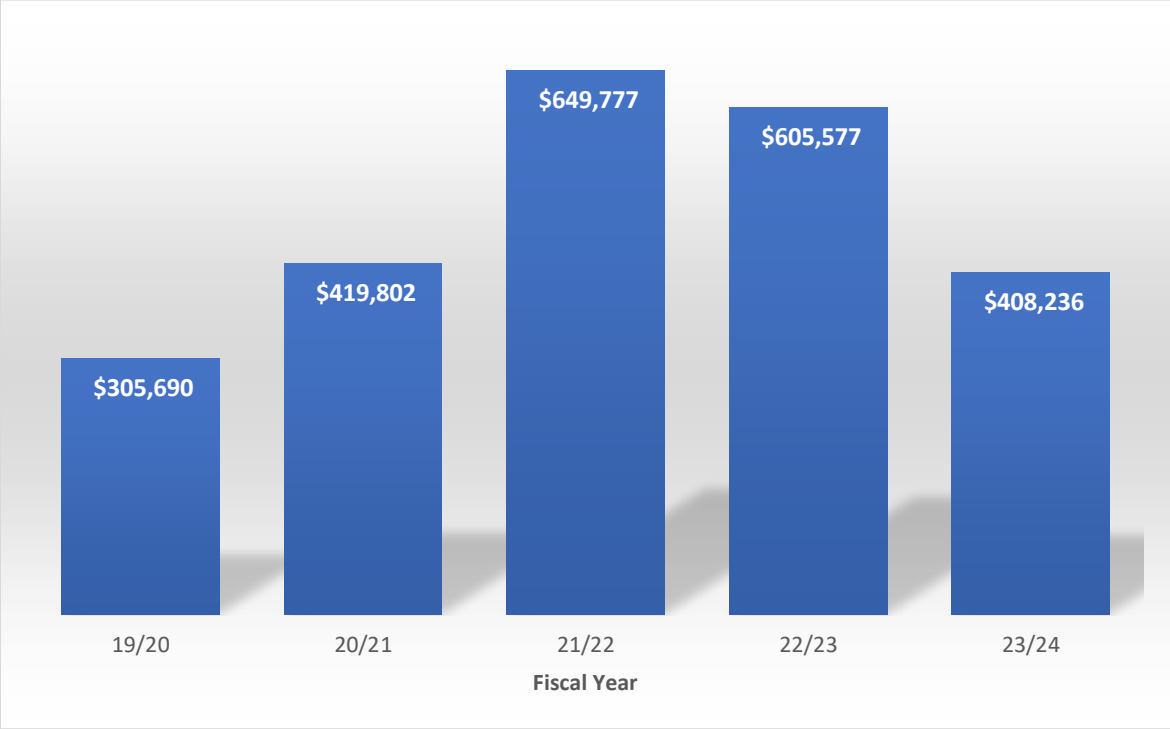


Figure 3-1: Five-Year Work Plan Expenditures (thousands of dollars)

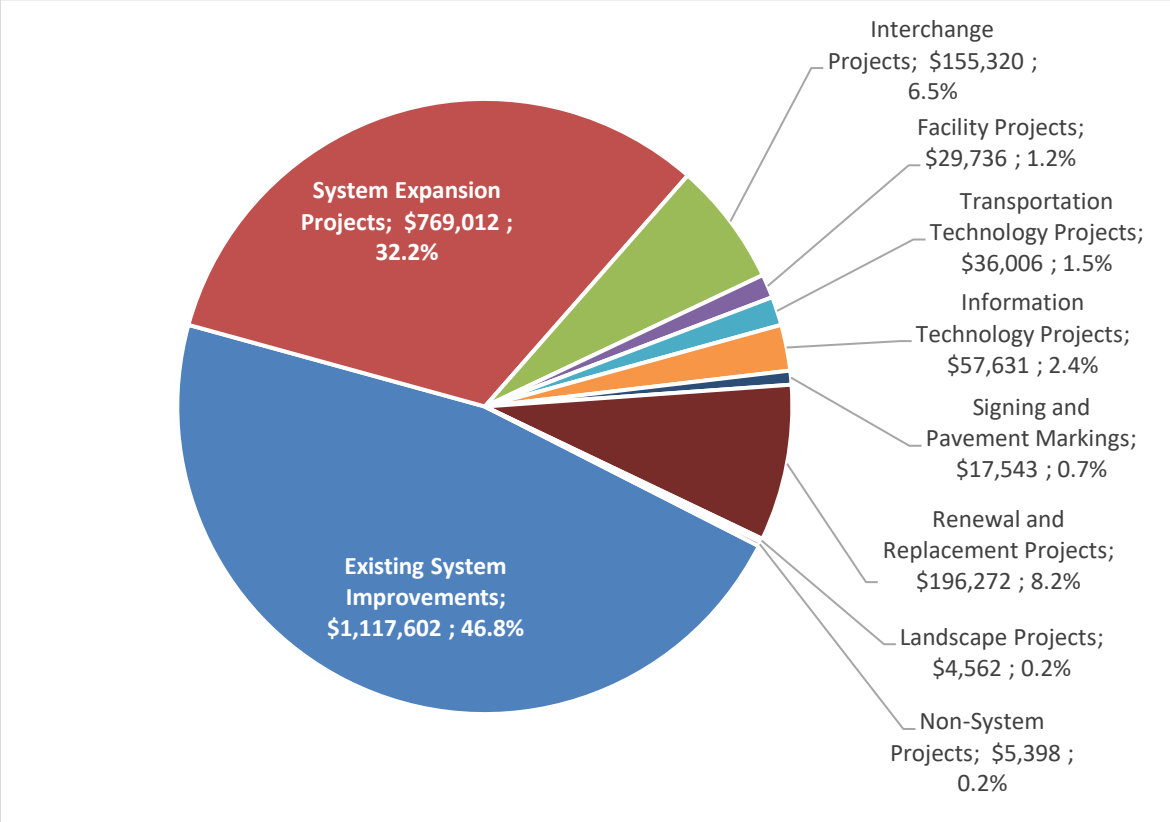


Figure 3-2: Work Plan Expenditure Allocation (thousands of dollars)

Although this information is useful to CFX 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.

3.1.1 Mix of Capital Investment Expenditures

To prepare the data for input in the estimation process, the Work Plan's $2.4 billion expenditures in project costs must be disaggregated by expenditure type. A detailed analysis of Section 5 of the Work Plan [7] 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)

Work Plan Expenditure Type	19/20	20/21	21/22	22/23	23/24
Engineering, Administration and Legal (EAL)	94,206	91,772	103,044	74,920	47,491
Construction	168,296	308,373	444,112	478,610	331,475
Landscaping Installation and Maintenance	4,340	5,207	2,489	16,790	6,827
ITS Implementation	11,971	4,290	1,950	1,280	2,330
Toll Equipment Acquisition and Replacement	26,576	10,160	5,682	3,310	4,780
Right of Way	300	0	92,500	30,667	15,333
Total	**305,690**	**419,802**	**649,777**	**605,577**	**408,236**

Source: CFX/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*
Engineering, Administration and Legal (EAL)	541300	449	411,434	18.1%
Construction	233293	56	1,730,866	76.0%
Landscaping Installation and Maintenance	561730	469	35,653	1.6%
ITS Implementation	238210	449	21,821	1.0%
Toll Equipment Acquisition and Replacement				
Toll Acquisition	334290	306	30,305	1.3%
IT/Software	541511	451	20,203	0.9%
Right of Way	541100		0	0.0%
Legal Services (10%)	531000	447	13,880	0.6%
Real Estate Services (10%)	541100	440	13,880	0.6%
Total			***2,278,042***	100.0%

Source: CFX/CUTR Aggregation

This study uses the 2017 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 $4.6 billion and represent the total production of goods and services in the impact area produced by the total expenditures anticipated in the Work Plan. 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. Of the total impact on output, approximately 91 percent, or $4.2 billion, occurs within the study area and the remaining impact occurs as spillover effects in the rest of the state.

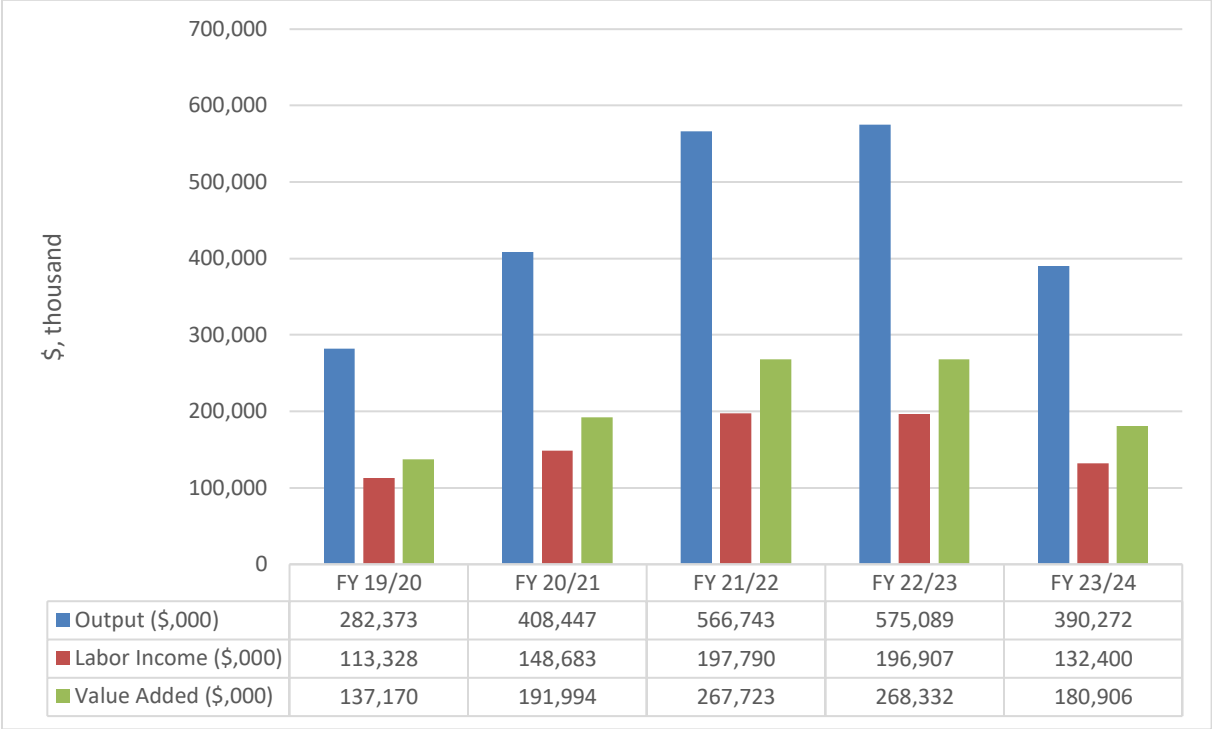
Table 3-3: Total Impacts by Type

Impact Type	*Output ($,000)*	*Labor Income ($,000)*	*Value Added ($,000)*	*Employment*[†]
Direct	2,222,925	789,108	1,046,125	2,570
Indirect	1,187,314	389,495	641,111	1,542
Induced	1,191,641	376,002	697,789	1,830
Total	***4,601,879***	***1,554,605***	***2,385,025***	***5,942***

[†]*Estimated using 5-year average expenditures*

The total impact on value added (or GDP) is $2.4 billion with about $2.2 billion occurring within the study area and about $199.6 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 $1.4 billion within the study area and $106.6 million in the rest of the state for a total impact of $1.6 billion. Figure 3-3 shows the impact by fiscal year, following the investment schedule of the Work Plan.



	FY 19/20	FY 20/21	FY 21/22	FY 22/23	FY 23/24
Output ($,000)	282,373	408,447	566,743	575,089	390,272
Labor Income ($,000)	113,328	148,683	197,790	196,907	132,400
Value Added ($,000)	137,170	191,994	267,723	268,332	180,906

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

3.1.2 Employment Impact by Industry and Occupation

The Work Plan will support approximately 5,942 jobs, 87.9 percent (5,224) of which are within the study area and the remaining 12.1 percent (719) throughout the rest of the state.

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. The employment impact is heavily weighted in construction (32.4%) and professional and business services (15.0%), with indirect and induced effects on several relevant industry sectors, such as management of companies (7.8%), real estate and insurance (6.4%), and leisure and hospitality (6.3%).

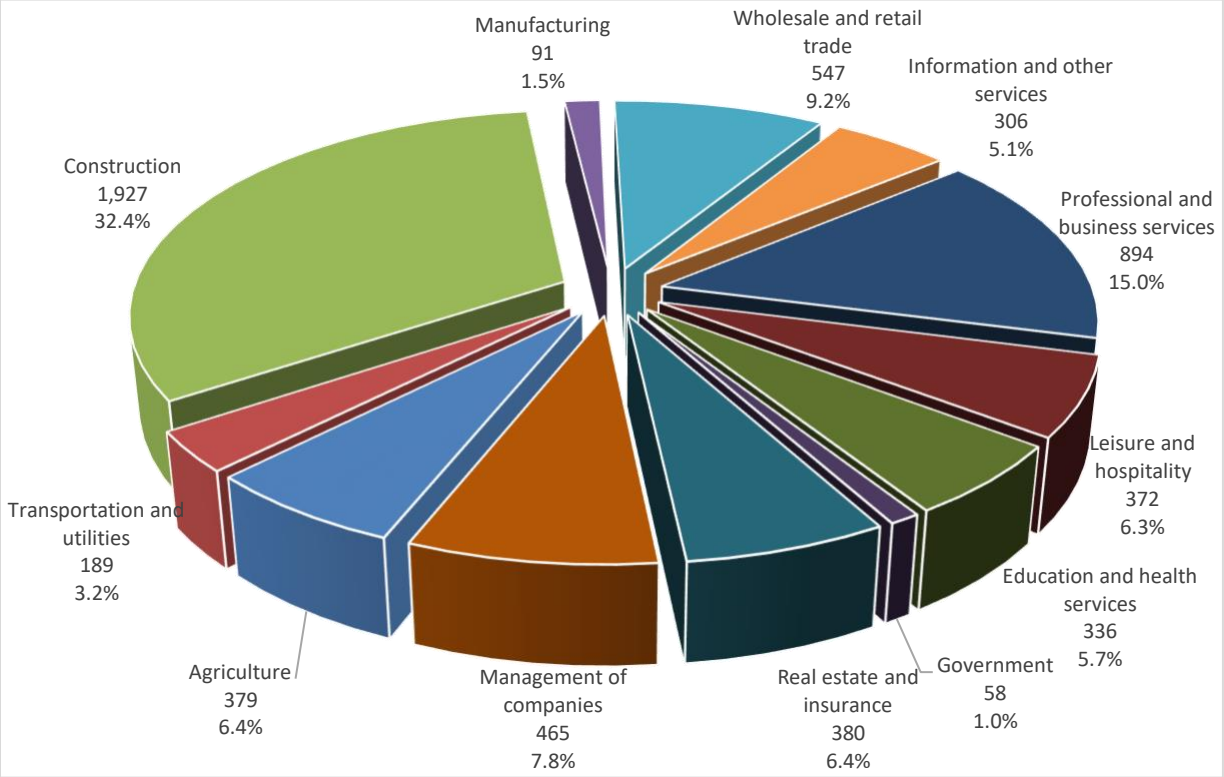


Figure 3-4: Work Plan Employment Impact by Industry

3.1.3 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. Between 2018 and 2019, employment in Orlando-Kissimmee-Sanford MSA increased by 3.8 percent overall compared to 2.7 percent statewide, with significant growth concentrated in Professional, Scientific and Technical Services (8.1%), and Business Support Services (8.1%), and Management of Companies and Enterprises (3.8%). Research conducted on the relationship between jobs and economic growth suggests that highly skilled jobs help generate and support a large number of unskilled jobs [8].

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. Figure 3-4 shows that the Work Plan investment impacts highly specialized jobs within the professional and business services sector (15.0%) and management of companies (7.8%), providing additional momentum to the economic growth of the area.

3.1.4 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 $67.6 million comes from sales tax revenues collected in the impact area. The collection of $35.8 million in property taxes constitutes about 27 percent of the total government revenue impacts. Corporate taxes contribute approximately $5.2 million to revenues.

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

Revenue Source	*Total Impact*
Sales Tax	67,594
Property Tax	35,827
Motor Vehicle Tax	750
Corporation Taxes	5,242
Other Taxes*	23,545
Total	***132,958***

** Fines and fees (non-tax)*

Chapter 4
Travel Improvement Impacts

According to the U.S. Census, the Orlando-Kissimmee Metropolitan Statistical area (Lake, Orange, Osceola and Seminole counties), is home to 2.4 million residents or about 12 percent of the State's population [4]. During 2015-2018, population in these four counties grew by approximately 19.4 percent, compared to 4.8 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 *2019 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 57 hours in traffic and 22 gallons of fuel due to congestion delays, costing the average commuter about $1,100 dollar per year [9]. The 2018 CFX Customer Survey revealed that 93 percent of the CFX users prefer to use the expressways to save time [5]. The Work Plan investments directed at improving the existing system or adding new capacity could produce substantial benefits to the region and its travelers.

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 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 system. To estimate changes in travel conditions, CFX's 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 2025-2045 forecast period. The Work Plan is expected to reduce travel times occurring during congestion periods, reduce emissions, and improve safety.

Table 4-1: Forecasted Travel Improvement Changes 2025 - 2045

Model Performance Measures	*Without Work Plan*	*With Work Plan*	*Change*	*Change (%)*
Vehicle Miles of Travel (million)	29,498	29,591	93	0.3
Vehicle Hours of Travel (million)	1,049	1,021	-28	-2.7
Total Crashes	94,803	93,138	-1,665	-1.8
Total Injuries	48,921	48,069	-852	-1.7
Total Fatalities	309	305	-4	-1.3
Total Fuel Consumption (gallons, million)	406	395	-11	-2.7

Source: CUTR calculations based on CFX's traffic engineers' forecasts

All figures represent annual averages for 2025-2045

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 for 364 days. Appendix C describes in more detail the formula used to estimate user benefits and the original data sources.

4.1.1 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 CFX 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 [10]. The prevailing average wage rate for the impact area is provided by the current Bureau of Labor Statistics and is equal to $22.0 per hour (in 2019 dollars) [11]. This study uses the 2017 National Household Travel Survey to estimate the percent of travel for work and personal purposes [12]. 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.

4.1.2 Health and Safety

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.

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 2019, 62,000 motor vehicle crashes were recorded in the Orlando MSA. This amounts to approximately 10.9 percent of the total crashes in the state. Of these accidents, about 39.0 percent reported injury, which produced 24,193 injuries (14.5% of the state's 166,378 total injuries). Crashes with fatalities represent about one-half percent of the total accidents in the MSA or 327 fatalities, accounting for 11.3 percent of the fatalities in the state.

Table 4-2: Accidents by Severity Type in the Orlando MSA, 2019

Category	*Orlando MSA*	*State*	*Percent of State (%)*
Fatality	327	2,902	11.3
Injury*	24,193	166,378	14.5
Total Crashes	62,000	569,968	10.9

Source: Florida Department of Highway Safety and Motor Vehicles

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

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. CFX traffic engineers travel forecasts show that the Work Plan system improvements and expansion will result in an increased use of CFX facilities away from arterials and other less safe roads, reducing exposure to crashes. Historically, CFX facilities are characterized by lower crash rates compared to other facilities, such arterials or unrestricted roads. This study estimates the total change in accident cost as the product of three values:

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

The National Highway Traffic Safety Administration (NHTSA) report on the economic and societal impact of motor vehicle crashes provides accident cost estimates [13]. The 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 (Table A-2, p. 242). These costs are updated in 2019 constant dollars.

Crash rates are positively related to traffic density, vehicle speeds, and roadway characteristics. For example, Kockelman [14] reports a nonlinear positive relationship between crash rates and vehicle speeds. Wang and Kockelman [15] 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 [16, 17] 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, measured in crashes per million VMT, from historical traffic accident data presented by Florida Department of Highway Safety and Motor Vehicles[3]. Table C-2 in Appendix C reports the results of this estimation.

4.1.3 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 [17, 18]. This study considers carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) as major sources of motor vehicle pollutants having major repercussions on the health and livability of residents. The cost of pollution to the study area residents is the product of the following values:

- Excess fuel consumption under congested travel
- Emission estimates, measured in kilograms/gallon
- 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 emission cost estimates by the U.S. Environmental Protection Agency [19]. This approach to emission cost estimation is also consistent with the methodology of the U.S. Department of Transportation Highway Economic Requirement System [20]. Table C-4 in Appendix C reports the results of this estimation.

4.1.4 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) [21].

4.1.5 Direct User Benefits Estimates

[3] https://www.flhsmv.gov/traffic-crash-reports/crash-dashboard/

Table 4-3 reports the results of estimated direct user benefits. The results indicate that most of the benefits accrue due to travel time ($624 million/year) and accident cost savings ($308 million/year). These savings are likely to increase when approaching the 2045 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	623.5
To Businesses	101.8
Accident Costs	308.0
Fuel Costs	
To Households	25.7
To Businesses	11.0
Emission Costs	20.8
Total	***1,090.8***

Businesses will also benefit from the network improvements, with travel time savings of about $102 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 affect 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 [13]. 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 $57.4 million in annual total output and $33.6 million in additional GDP with the support of 381 jobs per year. 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	*Output ($,000)*	*Labor Income ($,000)*	*Value Added ($,000)*	*Employment*
Induced Effect	57,414	17,777	33,576	381

Under the current travel forecasting scenario, improvements of the current system would save each household $30 per year in fuel and vehicle operating costs. Savings on fuel and out-of-pocket medical expenses ($57 per household) represent money saved to use on other household expenditures. According to the U.S. Census Bureau, there are about 59,000 families (10.7% of total families) in Lake, Orange, Osceola, and Seminole counties living below the poverty line. 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 $4.6 billion in total output (gross business sales), $2.4 billion in local gross domestic product, and a combined 5,942 jobs.

Table 5-1: Local and Statewide Impacts

Economic Impact	*Lake, Orange, Osceola, Seminole*	*Statewide*
Jobs (Employment)	5,224	5,942
Output (Gross Business Sales, $ billions)	4.2	4.6
GDP (Value Added, $ billions)	2.2	2.4
Labor Income ($, billions)	1.4	1.6

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 62 hours in travel annually, or $730 per year. Each households would also save $57 in 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, which in turn help sustain and stimulate economic growth.

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 estimate the impact of business productivity improvements 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 2040 Master Plan.

References

1. *About CFX*. 2020; Available from: https://www.cfxway.com/agency-information/agency-overview/about-cfx/.
2. *Five-Year Work Plan FY 2020 - 2024*. 2019, Central Florida Expressway Authority.
3. *Relation of GDP by state to U.S. Gross Domestic Product*. Regional Economic Accounts 2010.
4. *American Community Survey (ACS)* 2018, U.S. Census Bureau.
5. *2018 Customer Opinion Survey*. 2019, Central Florida Expressway.
6. Weisbrod, G.E., et al., *Economic implications of congestion*, in *National Cooperative Highway Research Program*. 2001, National Academy Press: Washington, D.C.
7. Authority, C.F.E. and *Five-Year Work Plan FY 2016-2020*. 2015. p. 4-5.
8. Moretti, E., *Local Multipliers.* American Economic Review, 2010. **100**(2): p. 373-77.
9. Schrank, D., B. Eisele, and T. Lomax, *2019 Urban Mobility Scorecard*. 2019, Texas A&M Transportation Institute: College Station, Texas.
10. *The Value of Saving Time: Departmental Guidance for Conducting Economic Valuation*. 1997, U.S. Department of Transportation: Washington, D.C.
11. *May 2018 Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates, Orlando-Kissimmee*. 2019, Bureau of Labor Statistics.
12. *2017 National Household Travel Survey* 2017, U.S. Federal Higway Administration.
13. Blincoe, L., et al., *The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised)*. 2015, National Highway Traffic Safety Administration: Washington, DC.
14. Kockelman, K., *Safety Impacts and Other Implications of Raised Speed Limits on High-Speed Roads*. 2006, National Cooperative Highway Research Program, Transportation Research Board of the National Academies: Washington, DC.
15. 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, Journal of the Transportation Research Board, 2005. **1908**(1): p. 195-204.
16. Litman, T., *Energy Conservation and Emission Reduction Strategies*, in *TDM Encyclopedia*, V.T.P. Institute, Editor. 2008, Victoria Transport Policy Institute: Victoria.
17. 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.
18. 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.
19. *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866*. 2016, Interagency Working Group on Social Cost of Greenhouse Gases, United States Government Washington, DC.
20. *HERS-ST Technical Report*, in *HERS -ST Highway Economic Requirements System-State Version*. 2005, Federal Highway Administration: Washington, D.C.
21. *Gasoline and Diesel Fuel Update*. 2019, Energy Information Administration: Washington, DC.
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*. 2019 November 2019]; Available from: www.implan.com.

25. *Crash and Citation Reports and Statistics*. 2020, Florida Deparment of Highway Safety and Motor Vehicles.
26. 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. .

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, LLC[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 2017 IMPLAN County Data files that report economic data for 540 industry sectors. After the impact analysis is conducted at this level, the results are aggregated at major industry sectors. Table A-1 describes the North American Industrial Classification System (NAICS) two-digit level classification.

Table A-1 NAICS Industry Classification used for IMPLAN Model Aggregation

NAICS Industry	*Description*
11	Ag, Forestry, Fishing, Hunting
21	Mining
22	Utilities
23	Construction
31-33	Manufacturing
42	Wholesale Trade
44-45	Retail Trade
48-49	Transportation & Warehousing
51	Information
52	Finance and Insurance
53	Real Estate and Rental
54	Professional, Scientific and Technical Services
56	Management of Companies
56	Administrative and Support Services
61	Education
62	Health & Social Services
71	Arts, Entertainment & Recreation
72	Accommodations & Food Services
81	Other Services
92	Government &non-NAICS

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 2 of this 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

NAICS Industry	*Description*	*Direct Effects*	*Indirect Effects*	*Induced Effects*	*Total Effects*
11	Ag, Forestry, Fishing, Hunting	1.0	0.2	0.5	1.6
21	Mining	1.0	0.3	0.3	1.6
22	Utilities	1.0	0.3	0.2	1.5
23	Construction	1.0	0.3	0.4	1.8
31-33	Manufacturing	1.0	0.3	0.3	1.6
42	Wholesale Trade	1.0	0.4	0.5	1.9
44-45	Retail Trade	1.0	0.5	0.5	2.0
48-49	Transportation & Warehousing	1.0	0.5	0.5	2.0
51	Information	1.0	0.6	0.4	2.0
52	Finance and Insurance	1.0	0.7	0.5	2.2
53	Real Estate and Rental	1.0	0.4	0.2	1.6
54	Professional, Scientific and Technical Services	1.0	0.5	0.7	2.1
56	Management of Companies	1.0	0.5	0.7	2.2
56	Administrative and Support Services	1.0	0.4	0.6	2.1
61	Education	1.0	0.3	0.8	2.1
62	Health & Social Services	1.0	0.4	0.7	2.1
71	Arts, Entertainment & Recreation	1.0	0.4	0.5	1.9
72	Accommodations & Food Services	1.0	0.3	0.5	1.8
81	Other Services	1.0	0.3	0.6	1.9
92	Government &non-NAICS	1.0	0.1	0.8	1.9

Table B-2 Total Value Added Multipliers

NAICS Industry	*Description*	*Direct Effects*	*Indirect Effects*	*Induced Effects*	*Total Effects*
11	Ag, Forestry, Fishing, Hunting	0.6	0.1	0.3	1.0
21	Mining	0.4	0.2	0.2	0.8
22	Utilities	0.5	0.2	0.1	0.8
23	Construction	0.5	0.2	0.3	1.0
31-33	Manufacturing	0.3	0.2	0.2	0.7
42	Wholesale Trade	0.7	0.2	0.3	1.2
44-45	Retail Trade	0.6	0.3	0.3	1.2
48-49	Transportation & Warehousing	0.5	0.3	0.3	1.1
51	Information	0.4	0.3	0.2	1.0
52	Finance and Insurance	0.4	0.4	0.3	1.1
53	Real Estate and Rental	0.7	0.2	0.1	1.0
54	Professional, Scientific and Technical Services	0.6	0.3	0.4	1.3
56	Management of Companies	0.6	0.2	0.4	1.2
56	Administrative and Support Services	0.6	0.3	0.4	1.3
61	Education	0.7	0.2	0.5	1.3
62	Health & Social Services	0.6	0.2	0.4	1.3
71	Arts, Entertainment & Recreation	0.7	0.2	0.3	1.2
72	Accommodations & Food Services	0.6	0.2	0.3	1.1
81	Other Services	0.7	0.2	0.4	1.2
92	Government &non-NAICS	0.9	0.1	0.5	1.5

Table B-3 Total Employment Multipliers

NAICS Industry	*Description*	*Direct Effects*	*Indirect Effects*	*Induced Effects*	*Total Effects*
11	Ag, Forestry, Fishing, Hunting	12.0	1.0	3.4	16.4
21	Mining	6.3	1.8	2.1	10.2
22	Utilities	0.9	1.7	1.5	4.2
23	Construction	5.9	2.2	3.1	11.3
31-33	Manufacturing	2.8	1.8	2.2	6.8
42	Wholesale Trade	4.1	2.3	3.5	9.9
44-45	Retail Trade	11.3	2.6	3.7	17.7
48-49	Transportation & Warehousing	6.4	3.1	3.5	12.9
51	Information	2.3	3.6	2.9	8.8
52	Finance and Insurance	4.5	3.8	3.7	12.1
53	Real Estate and Rental	2.9	2.4	1.4	6.7
54	Professional, Scientific and Technical Services	6.9	3.1	4.9	14.9
56	Management of Companies	12.6	3.0	4.7	20.3
56	Administrative and Support Services	4.2	3.0	4.9	12.0
61	Education	16.6	1.6	5.6	23.8
62	Health & Social Services	9.1	2.6	4.9	16.6
71	Arts, Entertainment & Recreation	11.3	2.7	3.6	17.6
72	Accommodations & Food Services	12.5	1.9	3.3	17.7
81	Other Services	16.1	1.7	4.7	22.5
92	Government &non-NAICS	12.4	0.6	6.1	19.2

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 11 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 ($, 2019)*		
Category	*Daily*	*Annual*		*Daily*	*Annual*	*Value of Time †††($/hour)*	*Daily*	*Annual*
Private								
Personal†	63,512	23,118,478	2.1	133,376	48,548,803	11.0	1,466,560	533,827,754
Commuting†	9,490	3,454,485	1.2	11,199	4,076,292	22.0	246,273	89,643,325
Total Private‡ (A)	73,003	26,572,963		144,574	52,625,095		1,712,833	623,471,080
Commercial‡ (B)	5,144	1,872,297	1.0	5,144	1,872,297	54.4	279,720	101,818,047
Total (A+B)	78,146	28,445,260		149,718	54,497,393		1,992,553	725,289,127

† Split based on 2017 National Household Travel Survey using distribution of travel on various modes by purpose (87.0% personal; 13.0% commuting)

‡Split based on 2018 Florida Traffic Information database using annual VMT for Orlando-Kissimmee by vehicle type (93.4% private motorvehicle;6.6% commercial)

†††Value of time based on travel purpose (50% of prevailing wage rate for personal; 100% of prevailing wage for commuting).

Value of commercial travel time is from TTI Urban Mobility Scorecard.

Wage rates for Orlando-Kissimmee were obtained from the Bureau of Labor Statistics (https://www.bls.gov/oes/current/oessrcma.htm)

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 2017 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 https://nhts.ornl.gov/

The private versus commercial travel split data are from the 2018 Florida Traffic Information Database, available from the Florida Department of Transportation at https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/statistics/docs/fti-2018.zip?sfvrsn=68610df5_4

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

Accident Cost Savings

Accident costs savings are estimated as the net 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 by computing the difference in number of crashes with the Work Plan and the number of crashes without the Work Plan. The estimates rely on crash exposure rates by facility type (measured in crashes per million VMT) derived from historical crash data from the Florida Department of Highway Safety and Motor Vehicles [25].

Table C-2 Accident Cost Savings (2019 dollars)

Category	*Accidents† Without Work Plan*	*Accidents† With Work Plan*	*Difference*	*Cost per accident‡ ($)*	*Cost Savings ($)*	*Share of Total*	*Medical Costs††† *
Traffic Fatalities	309	305	-4	4,631,056	18,524,224	6.0%	
Injury Crashes	48,921	48,069	-852	266,722	227,247,036	73.8%	
Total Crashes	94,803	93,138	-1,665	37,353	62,192,215	20.2%	
Total			***-2,521***	***4,935,131***	***307,963,475***		**22,724,704**

†CUTR calculations

‡CUTR calculations based on estimates from Blincoe et al. (2015)

††† Assumes 10% of total cost of injury crashes

Crash Costs

Crash cost estimates come from the National Highway Traffic Safety Administration (NHTSA) report on the economic impact of motor vehicle crashes [26]. 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 2019 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: [26] .[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:

$$PC_{ik} = \sum \left(\frac{KG_{ik}}{gallon}\right)(Gallons\ of\ Fuel_i)\left(\frac{\$}{KG_k}\right)$$

Table C-4 Changes in Pollution Emission Costs

	Reduction in Emissions†		*Reduction in Costs‡*	
Category	*(kg/day)*	*(metric ton/year)*	*($/metric ton)*	*($/year)*
Atmospheric Carbon Dioxide (CO2)	302	109,819	51.8	5,687,178
Methane (CH4)	0	2	1,479.6	2,769
Nitrous Oxide (N2O)	2	815	18,495.3	15,079,776
Total	**304**	**110,636**		**20,769,724**

†CUTR calculations based on EPA MOVES emission rates and CUTR estimates of reduced fuel consumption

‡CUTR calculations based on unit cost estimates from EPA (2017)

[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. This study adopts the societal cost estimates produced by the U.S. Environmental Agency (EPA) [19]. EPA cost estimates consider the damage costs because of climate change, changes in net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning. EPA and other federal agencies use these estimates to assess climate impacts of rulemakings. The cost estimates are available here:

https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html

Fuel Cost Savings

This study estimates changes in fuel costs associated with private travel. The change in fuel consumption is measured in total gallons saved because of Work Plan travel improvements. CFX's traffic 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)*
Fuel Cost Savings			
Private Vehicles	10,283,737	2.5	25,709,341
Commercial Vehicles	3,658,469	3.0	10,975,406
Operating Cost Savings			
Total	**13,942,205**		**36,684,748**

†CUTR calculations based on CFX's traffic engineers' forecasts

††Energy Information Administration

The annual average cost per gallon of fuel net of taxes is available from the Energy Information Administration: https://www.eia.gov/petroleum/gasdiesel/