Solano Transportation Authority: I-80 Corridor Project Analyses 2017

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Executive Summary

Transportation infrastructure projects have economic impacts based on both construction and use once completed. Three Solano Transportation Authority (STA) projects include:

- I-80 Westbound Cordelia Truck Scales Improvements;
- I-80/I-680/SR12 Interchange Improvements; and
- I-80 Express Lanes Addition.

This study shows that over $740 million in construction spending creates over $1.003 billion in local economic impacts, including support for over 5,700 jobs and $35 million in state and local tax revenues during construction. Reducing congestion for trucking generates another $93.8 million on average for five years after project completion. Over 600 more jobs are supported due to these annual savings, and almost $5 million in state and local tax revenues. This study uses the IMPLAN® model to show the economic impacts. Academic and practitioner literature suggests there are economic, social and environmental impacts of new infrastructure. Valuing workers and trucking siting in congestion help determine how one minute saved. Two effects include: (1) saving time both getting to work and achieving tasks during the day; and (2) time savings helps local businesses to generate more revenue from more productive workers. The following is a list of basic assumptions used to determine the broader economic impacts from these improvements.

- Approximately 128,000 AADT counts in 2015 (the latest data):
  - We assume 90 percent of AADT are commuting workers facing travel times of 24.5 minutes to get to jobs in Solano County and 30.6 minutes to jobs outside;
  - These travel times are valued at $18.32 per hour at the median.
- Business generate revenue from saved time by adding 49 percent mark-up to wages;
- Truck traffic counts are approximately 7,900 daily, worth $223 million annually:
  - Trucking takes 35 minutes in 2015 (the latest data) on average; and
  - We expect trucking to rise by 1.25 percent per year based on 2010 to 2015 growth.

The following tables summarize this study's results on Solano County and the rest of California.

Summary of Estimated Construction Impacts, Life of Each Project, Solano County

Project	Direct Spending	Business Revenues	Jobs Supported	State/Local Taxes
WB Cordelia Scale	$202.3 million	$271 million	1,465 FTE jobs	$9.37 million
I-80/I-680/SR 12	$360.3 million	$484 million	2,566 FTE jobs	$16.6 million
I-80 Express Lanes	$176.9 million	$247 million	1,693 FTE jobs	$9.06 million
Total:	**$739.5 million**	**$1.002 Billion**	**5,724 FTE Jobs**	**$35.03 million**

Summary of Est. Improvements Impacts, Annual Avg, Five Years, Solano County/Rest of CA

Category of Gain	Business Revenues	Jobs Supported	State/Local Taxes
Business Value Add from Labor	$48.2/$30.7 million	275/150 FTE Jobs	$1.72/$1.4 million
Trucking	$9.4/$4.5 million	60/18 FTE jobs	$0.34/$0.21 million
Worker Time	$36.2/$31.2 million	268/141 FTE Jobs	$2.83/$1.4 million
Total:	**$9.3/$66.4 million**	**603/309 FTE Jobs**	**$4.89/3.01 million**

Introduction

This report looks at three projects being undertaken by Solano Transportation Authority (STA) to both expand and make more efficient current road infrastructure along the I-80 corridor in Solano County. These include the following projects:

- I-80 Westbound Cordelia Truck Scales Improvements;
- I-80/I-680/SR12 Interchange Project; and
- I-80 Express Lanes.

Projects such as these affect the region's economic outcomes. Like other infrastructure projects, the economic outcomes are split into two phases: construction; and an "operations" phase. The operations estimates are an average of five years from project completion, indicative of the breadth of effects after vehicles are using the new roads, lanes and scales.

Each project is different but interconnected, with economic effects dependent on the project's size, scope and timing. The economic effects or "impacts" are felt throughout Solano County, its regional economy, California, and beyond. This report provides impacts for both Solano County and California overall to show the effects beyond Solano County. These calculations describe the economic footprint of this spending, gains for hundreds of industries and tens of thousands of households and people positively affected.

The broader economic impacts depend on how jobs are affected due to reducing congestion. There are many ways in which these corridors are used, but this study focuses on three major gains from reducing congestion:

- Commuters spending less time in the car;
- Business productivity gains from more productive labor; and
- Freight carriers (trucking) being more efficient.

There is a strong connection to economic development here also. As Solano County's economy evolves, how much of that economy depends on commuting, tourism and freight movement by roadways affects the size of any forecasted economic impacts. Economic forecasts for employment, industry mix, population, and broader macroeconomic conditions all play roles in how strongly these projects may or may not affect Solano County's economy. Futurist issues such as widespread use of autonomous vehicles (including trucking) can also shift gains over time.

Congestion acts as an opportunity cost of commuting and freight travel by roadway. The IMPLAN® model applied to transportation systems, where the economic connections

among industries are connected through a "multiplier" analysis, is how the broader economic effects from these projects are measured.[1]

This study is organized as follows. Basic ideas concerning the valuation of effects are explained in Section 2. This section includes a literature overview concerning the economic impacts from transportation infrastructure projects such as these. Section 3 discusses data describing the region to be affected by these changes due to commute patterns. Data to be used inside the methodology to estimate the effects are then described in Section 4. Section 5 provides the summary impact data and a review of the calculations, and Section 6 concludes the study. The Appendix provides data in a more expansive form than the main text.

Let's start by understanding the literature and some basic ideas.

2. Basic Ideas and Literature Review

This section provides some academic logic as background on calculating the economic impacts from an expansion of roadways and other projects meant to reduce travel times, accidents, and make travel more efficient overall. The methodology addressing categories of effects, starting with the construction phase and spending, ending with the broader regional effects of savings to workers, businesses and trucking. Specific literature examples are provided in the "References" section.

The economic and social impact of infrastructure investment and expansion is widely studied in academic literature. Both local households and businesses benefit from such investments and reducing congestion. The literature generally splits the economic and social impacts into three broad categories:

- Contributions to economic growth;
- Contributions to economic development; and
- Contributions to mobility and labor market activity.

Construction impacts

An examination of any infrastructure spending starts with the projects during construction. The initial spending pays for construction materials, wages for workers helping to build the new roadways or scales, engineering and other design needs, and numerous other costs. These costs are impulses, like throwing a rock into a still pond, that then ripple out into the broader economy. Industries as diverse as dentists and local government and manufacturing jobs are all affected by this new spending.

Government spending on infrastructure is not about the initial impulse, but rather more about the broader impacts and how businesses and households gain due to the infrastructure.

[1] See www.implan.com for more on IMPLAN® as a way to make such estimates.

This study treats the economic impacts of project spending like any other major construction project. The broader gains start with how reducing congestion leads to faster commute times and more work and business productivity gains. Some recent examples of analyses include American Public Transportation Association (2014) and Connecticut Academy of Science and Engineering (2013). The White House staff also produced a study in 2014. Snieska and Simkunaite (2009) are a good literature review and way to look at the socio-economic impacts from traffic and congested roadways.

Worker Time Savings and Productivity Gains

The National Cooperative Highway Research Program (www.nchrp.org) has performed or commissioned studies as literature reviews on valuing gains from reducing congestion. The federal Department of Transportation (www.dot.gov) provides guidance on valuing travel time. CalTrans (www.caltrans.ca.gov) provides annual average daily traffic (AADT) data for both vehicle and truck traffic (see more below on trucking) as a basis for the estimates below.

We see later in the study that the large amount of vehicle miles and cars on these roads are commuters, especially during peak times of traffic. These times start as early as 5:30am and may go until 10am five days a week. On Saturdays and Sundays, different traffic patterns may emerge, but savings still comes from commuting workers who might work on those days also (tourism, retail, restaurants, etc.). Evening peak times have a similar dynamic in the opposite directions.

The worker impacts are complex and may involve hundreds of different industries that have workers on the move. As we see in the data sections below, it is wise to aggregate commuting workers using the North American Industry Classification Systems (NAICS) codes into industry-sector categories. Data is more plentiful at these aggregated levels; measuring gains to the individual employer is not possible.

As congestion falls due the three I-80 Corridor Project Improvements, gains for workers come in shorter commute times and thus savings from more time at work (higher pay), being more productive at work (higher pay), or less cost of commuting (better fuel efficiency and less personal time sitting in a car as examples). The gains are measured generally using median or average wage levels.

There are also intra-day movements of workers with similar gains as daily tasks come up. Measuring the savings during these "on-the-clock" trips is similar to valuing faster commute times, especially for those that work from home. There are also personal trips made by those that do not work, are on vacation locally, or on personal time otherwise.

The vehicle cost savings of personal trips depends on some assumptions about the amount of car trips that are not commute and how often these trips are made. Another personal use of a car and of roadways is vacation. Tourism travel happens technically when a person goes from their current place of residence to another place and spends money in that new place.

Tourism can be one city to another, one county to another, one state to another, and so on. We do not explicitly measure these personal or tourism gains, but because time savings can be seen as an income gain, businesses can experience a boost in revenue due to these additional gains as a form of economic development.

Job creation and business productivity gains are the next set of explicit benefits to be measured in this study.

Gains for Regional Businesses: More Productivity and Value-Added Gains

Adding value to raw materials is what a business generally does. Value-added activities increase in value when congestion is reduced in two ways:

- Workers are assumed to be more productive based on having more time at work and less time in the car; and
- Businesses have more labor time to add value in pricing goods and services.

The first gain is basically the same as the previous section: workers getting to work more quickly have an opportunity to work more hours. Businesses share in this part of worker productivity through wage payments.

The second layer of these gains is in how businesses add value to worker hours. For example, if a worker is able to work five extra hours per month due to reduced congestion, that worker could receive more in wages and reduced penalties for tardiness, sick leave, and other "benefits" due to commute problems. Wages rising reflect more productivity; businesses price according to their costs. If a business "marks up" labor hours inside of a product or service's price, these is more profit for the business based on this mark-up of additional hours. This is how businesses can gain from labor facing less congestion. There is also less pressure on switching away from regional labor to local labor or to capital (potentially reducing overall hiring levels) when workers are more productive. This issue of "elasticity" is discussed later.

Job creation is the key gain when analyzing business effects from new infrastructure and may also be tied to businesses that can use the new infrastructure directly as an input. With new jobs come new spending, tax revenues, and even more supported jobs through a multiplier effect. Logistics, warehousing, and transportation businesses may be able to utilize faster travel times and be more productive (generate more revenues) as a result. Looking at the mix of industries, the connection of revenues and jobs to use of these corridors, and how travel times being reduced from "origin" and "destination" areas is a large part of the positive, post-construction effects.

Growth of businesses that utilize new infrastructure and grow have a ripple effect on the local and regional economies. Another angle on the economic development gains from these projects is that the economic impacts expand beyond Solano County's borders. Adjacent

counties have economic development gains because businesses in Sacramento County or the Bay Area use these roadways and scales to move freight (for example) through and into Solano County.

Trucking, Freight Travel and Shipping

Specific industries affected by these projects include businesses that rely on trucking. While almost every business has some use of trucking or transport services, some industries may be more dependent than others. The literature suggests agriculture (moving raw materials to markets, manufacturers or other distribution points), construction (movement of people and materials from a home base to the construction site), manufacturing (trucking in raw materials to be used in the manufacturing process and also moving finished or intermediate goods to markets or logistics centers), retail (movement of goods toward the stores for sale), package delivery (companies like FEDEX, UPS, DHL, Amazon, all directly or indirectly rely on timely movements of packages for delivery) are more dependent.

To keep from double-counting gains that are inside of other business revenues above, trucking gains come from the scales project in a focal way, and indirectly in the other projects. Trucking is a large part of what happens along the Interstate 80 corridor, easily seen any day of the week by watching traffic patterns.

Broader issues in the literature

Part of the literature looks at relieving congestion as the main goal of new transportation infrastructure. The relationships between the construction effort and subsequent use of new infrastructure are complex and difficult to measure. (Sweet, 2013) One of the major complexities is what an economist would call "endogenity" or the connection between two variables such that change in one affects another, but the effect on the other variable then changes the original variable. An example is retail sales and incomes. As incomes rise, retail sales should also rise, but rising retail sales can also increase incomes through a multiplier effect.

Germane to this study, estimating supply and demand in markets is a classic endogenity issue. Does the new infrastructure affect congestion and if different, how is it different? A reason why this concept is important is that spending on roadway infrastructure is basically increasing the capacity or "supply" of lanes available for drivers at some "user" cost. The user cost is meant to fall for drivers after infrastructure spending. We believe that there are lower costs in theory, which leads to local communities being better off by saving time moving from one place to the next. That time savings then becomes lower-cost goods and services, and generate broad economic effects. However, demand for the new roadway lanes also rises and

supply and demand feed off of each other once costs are lower to perhaps nullify any gains once congestion rises again.

Business effects are split into two types of industries: congestion-adaptive and congestion-sensitive. As congestion gets worse, there may be a natural selection of businesses that are congestion-sensitive to locate elsewhere.

A high elasticity of substitution occurs when the supplier market is homogeneous (i.e., with little difference in quality or function of product), and buyers of workers and services are very willing to make changes to save cost. In the literature, the highest elasticity of substitution among inputs was found to occur for agriculture. For commuting workers, the highest elasticity of substitution was found to occur for service occupations, private household (e.g., household workers for health care) occupations and clerical occupations. (NCHRP, 2001)

A low elasticity of substitution occurs when the supplier market is differentiated (in terms of product quality and specialized function), and buyers value access to that differentiated market. The lowest elasticity of substitution among inputs was found to occur for manufactured products, since those goods tend to be highly differentiated. For commuting workers, the lowest elasticity of substitution was found to occur for executives and managers, precision production occupations and transportation and material moving occupations.

There are further economic opportunities due to cluster or agglomeration effects throughout the region.

Agglomeration or Clustering/Regional Effects

Economic theory looks at regional economic development as achieving "agglomeration" or network effects regionally from a local impulse. Krugman (1991) is cited as a seminal study in explaining this in international settings. Local and regional economic development has used this idea also to suggest that one county's investment in infrastructure, based on how roadways and truck scales improvements affect local and regional residents and businesses have broad regional effects for all economic networks. Broader community issues from congestion include increased noise, air pollution, reduced quality of life (especially for commuters), and reduced economic opportunities.

Businesses tend to gather together in a specific area or "cluster". If there are congestion-sensitive businesses clustered together, these businesses may see larger, positive effects from congestion relief which became larger regional gains for this spending. Three key issues of agglomeration tie back to some of the challenges of measuring the effects of new roadway improvements overall:

- Traffic congestion can vary and congestion can be either regional or very specific to a location or both;

• Pattern of traffic congestion may change over time, both during the day or seasonally; and
• Traffic congestion can be random due to accident incidence patterns or events of many types or changes in the regional economy.

Another element of clustering is how local and regional economic development reacts to new infrastructure as a way to create more business diversity and growth of local industries. Businesses that are congestion-sensitive which may have not located in regional markets and clustered initially, may now be both attracted and helped to grow locally due to these improvements. Regional productivity gains may come for businesses that utilize the infrastructure for multiple locations through logistics centers, connections to ports, etc.

Summary

The literature on economic benefits from reducing congestion focus on three major categories, all of which have challenges to measure with precision. Collecting the correct data that follows the literature and logic of what is most likely to be affected by the new infrastructure is the next challenge. In short, there are four major benefits from the new infrastructure to measure:

1. Construction impacts through the purchase of labor, services and materials;
2. "Operations" impacts once the new infrastructure is operating, which include:
    a. Worker time savings, as measured by wages;
    b. Business productivity savings from labor not being on congestion, measured by the mark-up on labor used by businesses; and
    c. Reduced costs from trucking efficiency due to reduced time to deliver goods and services across Solano County.

The next section describes the projects and other data used to determine these direct impacts before the broader analysis on regional economic impacts.

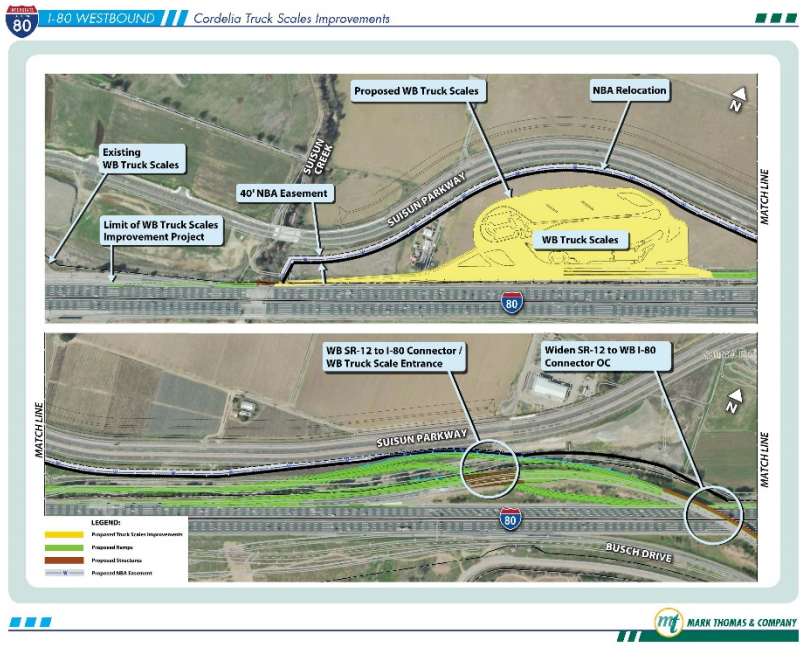
3. Data description

One of this project's largest challenges is data on operations after construction is completed. This analysis is no exception; data challenges are a constant in the literature as a major impediment to precise estimates. The construction phases are like any other project: a budget provides the initial spending inputs that become new infrastructure and also gains from that spending in the form of economic impacts. The bulk of this section look at those challenges after introducing each of the projects and related construction data.

These projects happen over time. The construction phase can provide construction jobs for years. Long-term construction projects can provide stability to families, local areas from which the workers are drawn. Let's look now at each project.[2]

I-80 Westbound Cordelia Truck Scales Improvements

This project's goal is to increase processing capacity from 500 to 700 trucks per day to 1,000 per hour given truck traffic estimates over a five-year timeline. Benefits include reductions in congestion and vehicle accidents. The proposed project replaces the existing Cordelia truck scales along Westbound I-80 in Solano County. The existing truck scales consists of two dynamic and one static scale, four inspection bays, and limited parking. Existing access from l-80 consists of short on- and off-ramps, resulting in truck traffic backing up onto I-80 and increasing the potential for rear-end accidents.[3] During peak traffic periods experienced several times per week, the facility is closed to incoming trucks to prevent this queuing.



[2] Solano Transportation Authority (STA) provided this information to the author.

[3] The latest data on collisions in Solano County comes from CalTrans and is from 2014 as of March 2017. For the 81.5 miles of freeway there are an estimated 2,865 million vehicle miles (MVM) driven with a total of 1,615 accidents. Of these accidents, 19 included a fatality (the largest cost to congestion when an accident happens) with 21 deaths. The number of accidents is generally insignificant in terms of vehicle miles estimated.

The new truck scales facility will be relocated 0.7 miles east of its current location and provide a new off-ramp connection and new entrance ramp connection with Westbound I-80. The new facility will have the capacity to inspect all westbound I-80 trucks passing the facility 24 hours per day, seven days a week.

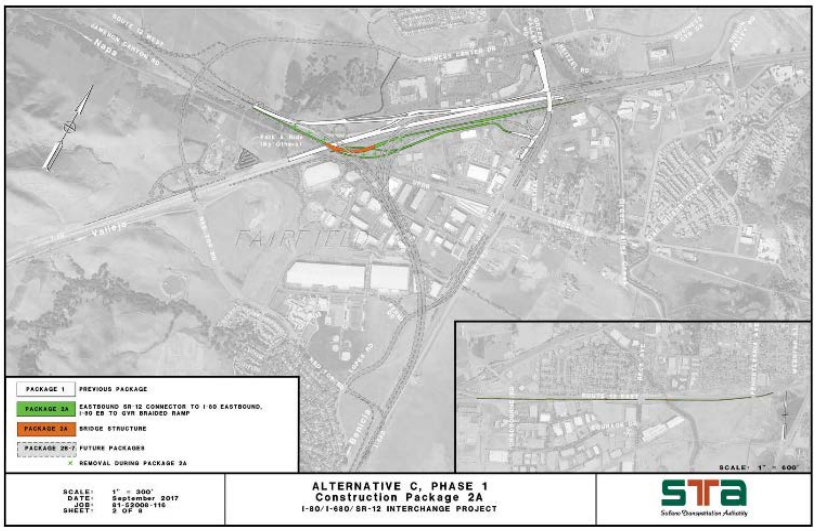
Figure 1 describes the current project for the I-80 westbound improvements at the Cordelia truck scales with electrical in 2018 to the end of 2019, and the right-of-way work on the scale improvements in 2020 to 2021.

Figure 1: Estimated Costs of I-80 Westbound Cordelia Truck Scales Improvements, Millions of Dollars, 2018-2021

Category of Cost	Year 1	Year 2	Year 3	Totals
Plan Specification and Engineering (PS&E)	$17.0	$-	$-	$17.0
Right of Way (R/W) work	$18.8	$18.8	$-	$37.5
Construction Management (CM)	$-	$10.0	$7.0	$17.0
STA Administration and Design Services During Construction (DSDC)	$1.0	$1.0	$1.0	$3.0
Construction	$-	$50.0	$50.0	$100.0
5% annual escalation	$5.9	$12.7	$9.3	$27.9
Totals	**$42.6**	**$92.5**	**$67.3**	**$202.4**

Source: Solano Transportation Authority (STA)

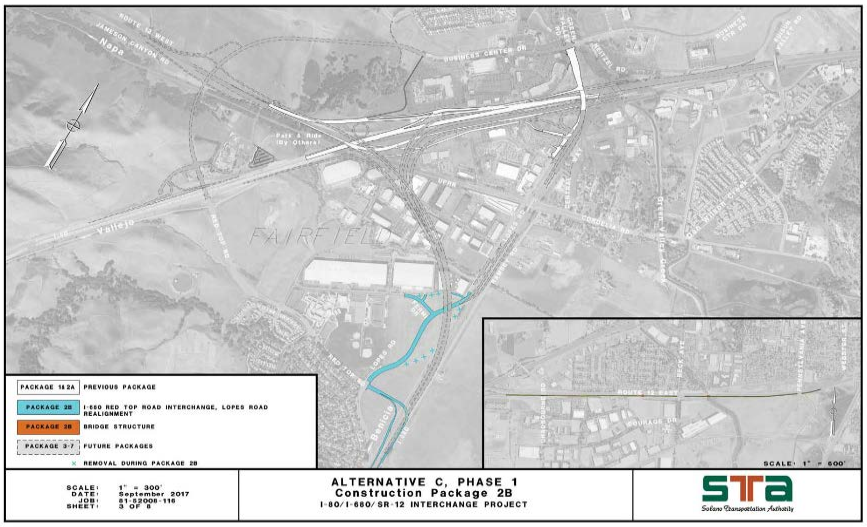
I-80/I-680/SR12 Interchange Project[4]



This multi-year, multi-phase project is located in two places in Solano County. The southwest project limits are near Fairfield's Green Valley and Cordelia neighborhoods; the northeast project limits are near Suisun City.

[4] Ibid.

Once completed, the project improves safety and travel times for motorists on I-80, I-680, Highway 12, and also adjacent city streets. Features include a realignment of I-680, an improved direct connector route between I-80 and Highway 12, construction of new interchange overcrossings, new entrance/exit ramps, bike and pedestrian safety improvements, and the extension of some local streets leading to I-80 and Highway 12:



- Increase from 145,000 vehicles to 270,000 per day by 2035;
- Reduce delay hours by 11,200 per day.

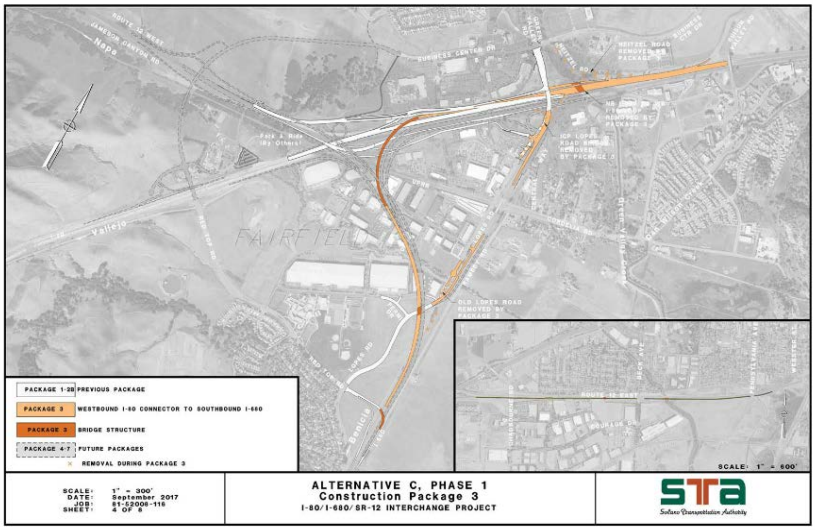


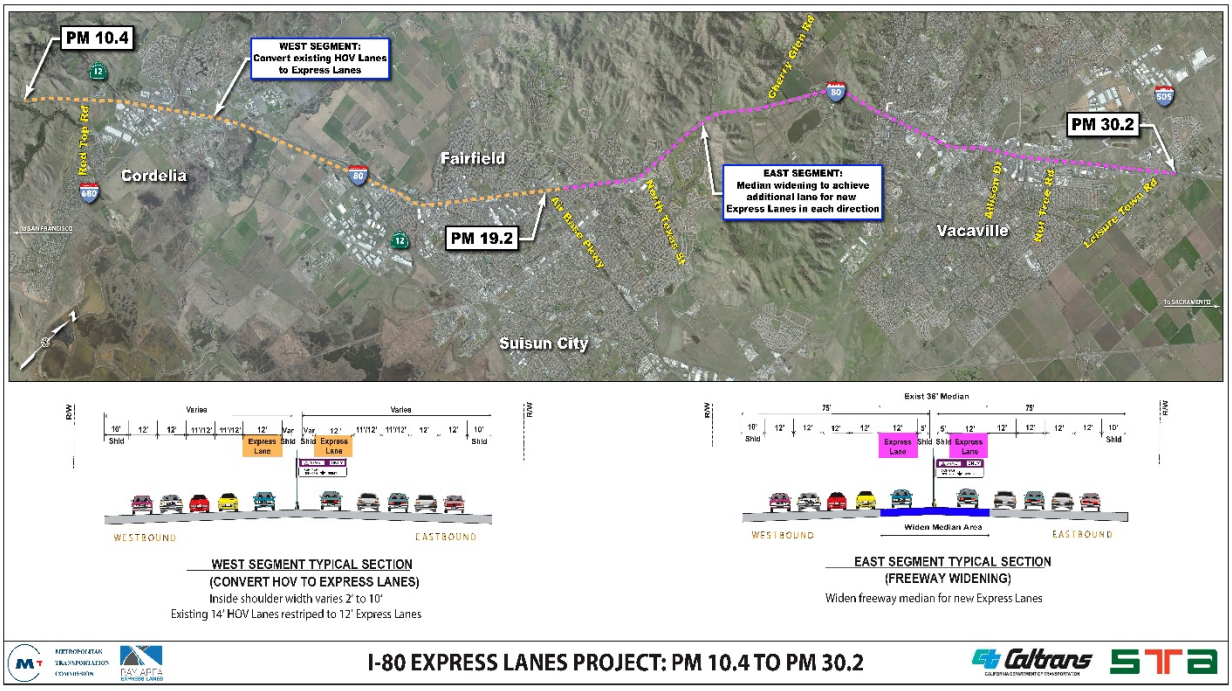
Figure 2 shows these over the construction period. The projected increase capacity is an important feature, as it is an enlarged "supply" of roadway. This project has the following costs, where part 1 is now completed and is the brand new interchange that links Highway 12 to I-680 and I-80 at Suisun City going west. There is also an estimate of 4,407 jobs (full-time equivalents) during each "package".

Figure 2: Estimated Costs of I-80/I-680/SR-12 Interchange Project Improvements
Millions of Dollars, 2018-2020

Category of Costs	Year 1	Year 2	Year 3	Totals
Construction Package 2a	$76.0			$76.0
Construction Package 2	$-	$67.3		$67.3
Construction Package 3	$-		$217.0	$217.0
Totals	**$76.0**	**$67.3**	**$217.0**	**$360.3**

Source: Solano Transportation Authority

I-80 Express Lanes[5]



Proposed improvements include a High Occupancy Vehicle (HOV) Express Lanes in each direction on I-80 from west of Red Top Road to east of I-505. The project includes the conversion of an existing HOV Lane to an Express Lane (Western Segment - Red Top Road to Air Base Parkway) and new construction of an Express Lane (Eastern Segment - Air Base Pkwy to I-505). The project constructs approximately 18 miles of express lanes in the I-80 corridor through conversion and highway widening. The Express Lanes would be free for carpools, vanpools and buses and be available to single-occupant vehicles for a fee when there is enough capacity. Tolls for single-occupant vehicles will increase as lanes reach capacity to encourage high-occupancy and transit users. A revenue forecast report (from March 2013) for this 18-mile corridor shows that an estimate of revenues after operations of $3.7 million vs. $1.6 million for the conversion segment only.

[5] Ibid.

Figure 3: Estimated Costs for 1-80 Express Lanes, Millions of Dollars

Category of Cost	Year 1	Year 2	Year 3	Totals
Project Approval & Environmental Document (PA/ED)	$10.8	$-	$-	$10.8
Plan Specification and Engineering (PS&E)	$3.2	$10.0	$3.1	$16.3
Right of Way (R/W) work	$1.2	$2.9	$-	$4.1
Construction Management (CM)	$2.7	$5.2	$5.2	$13.1
STA Administration and Design Services During Construction (DSDC)	$1.4	$1.9	$1.9	$5.2
Construction	$33.8	$47.4	$47.4	$128.5
Totals	**$53.1**	**$67.4**	**$57.6**	**$178.0**

Source: Solano Transportation Authority

Summary: These data are the basis for the construction impacts in a later section. Figures 1 through 3 show the direct economic impacts. It is important to recognize the amount of spending these projects represent. Like any other commercial or heavy construction project, once these projects are completed there are additional economic effects. In this case, the effects are from congestion reduction. The next section provides data that help understand both the number of potential workers and business affected by reducing congestion.

Valuing Vehicle Trips, Truck Travel and Travel Time

The first category of data is what we know about the demand for the roadways affected by these projects once completed. CalTrans (California Department of Transportation) provides Annual Average Daily Trips (AADT) data for major roadways in Solano County. The Census Bureau, through its American Community Survey data (factfinder.census.gov), provides travel time to work for both those that work in Solano County (employees) and those that live in Solano County (residents). For some workers, they both live and work in Solano County.

Truck trip data are also available from CalTrans. Like vehicle trips, truck trips are provided for the major roadways in Solano County. These three data sets begin our ability to measure the flow of commerce in and through Solano County to provide a valuation for new roadways and truck scales and subsequent economic impacts. Figure 4 shows the growth in vehicle trips and specific to more trucks on the road since the economic recovery began in 2010. The latest data is from 2015. The "Post Mile" data defines the location measured along the described state route, where letter "A" signifies northbound or eastbound movements and "B" signifies southbound or westbound movements.

Figure 4: Annual Average Daily Trips (AADT) data for Solano County Corridors 2010 to 2015, Growth of AADT (from 2010 baseline), Vehicle Trips

Description of Route	Direction	Post Mile	2010-2015 Vehicles	2010-2015 Trucks
JCT. RTE. 80	East	R2.794B	3,000	1,521
JCT. RTE. 80	East	L1.801A	1,000	52
VALLEJO, JCT. RTE. 37 WEST	West	5.634B	10,000	518
VALLEJO, JCT. RTE. 37 WEST	West	5.634A	14,000	710
JCT. RTE. 12 WEST	West	R11.976B	14,000	784
JCT. RTE. 12 WEST	West	R11.976A	19,000	988
JCT. RTE. 680 SOUTH	South	12.839B	19,000	1,246
JCT. RTE. 680 SOUTH	South	12.839A	28,000	1,608
FAIRFIELD, EAST JCT. RTE. 12	East	15.815A	18,000	1,044
FAIRFIELD, EAST JCT. RTE. 12	East	15.815B	28,000	1,292
FAIRFIELD, NORTH TEXAS STREET	West	20.925B	18,000	661
FAIRFIELD, NORTH TEXAS STREET	West	20.925A	19,000	997
JCT. RTE. 505 NORTH	North	R28.36B	29,000	2,954
JCT. RTE. 505 NORTH	North	R28.36A	7,000	430
JCT. RTE. 113 SOUTH	South	38.21B	2,000	134
JCT. RTE. 113 NORTH	North	42.67B	7,000	469

Source: http://traffic-counts.dot.ca.gov/; Mapping is available at http://arcg.is/2pg3jcb.

Figure 4 implies that as Solano County's economy has grown since the recent recession, so has the number of vehicles using roadways including trucking also using scales. The junction of SR-12 and Interstate 80, the Interstate 680 junction with Interstate 80, and the Interstate 505 junction with Interstate 80 have the most growth in vehicle use, where trucks are

part of that growth. Interstate 505 is an area where trucking growth has taken place, moving north to south and then east and west in Solano County. We now digress to look at commuting.

Commuting Workers

Because there are thousands of car trips daily along these corridors, a challenge is to estimate the volume of commuting workers as a percentage of non-truck vehicle trips. These include trips during the day or "on-the-clock" trips as discussed in the literature. A recent study by a partnership of CalTrans and the California Economy Forecast in 2016 forecasting 2017 to 2050 for all counties in California's economy shows Solano County's labor market expanding jobs and industry breadth.[6]

There are two phases to increased labor market activity boosts that come from these investments. The first is the employment created by the projects and their economic impacts. The second consists of new jobs supported and additional incomes from expanded economic activity as more commerce and workers move along these roadways. Much of this is not the direct activity that is moving on the freeway but the supply-chain activity that moves across these roadways and helps other businesses become more efficient in moving goods from one place to another.

There are also additional benefits from the tolls that are charged on the stability of governmental employment, but this is likely a small feature. The augmented economic activity can help drive more tax revenue and ultimately provide more stability. Because of the length of time in which these projects are in place, there can be a large number of jobs in the trades supported over time in the local economy also. One of the large selling points of infrastructure investment is the "middle-class" jobs supported.

For our purposes, we assume that Solano County's residents and employees grow at one percent per year on average once construction ends and congestion alleviation begins.

However, there are caveats. Autonomous vehicles, which may include trucking, can help reduce the number of additional jobs that would be directly associated with congestion reduction.

The number of daily trips tell part of the story. The next part is the travel time. According to the American Community Survey (factfinder.census.gov), the average time to work for Solano County workers to get to work (including those that work and live in Solano County) was 23.5 minutes in 2010 and was 24.6 minutes by 2016. Solano County residents took 23.5 minutes in 2010 to get to work and by 2016, county residents took 30.8 minutes, and increase of over seven minutes per day. This change shows that congestion has increased.

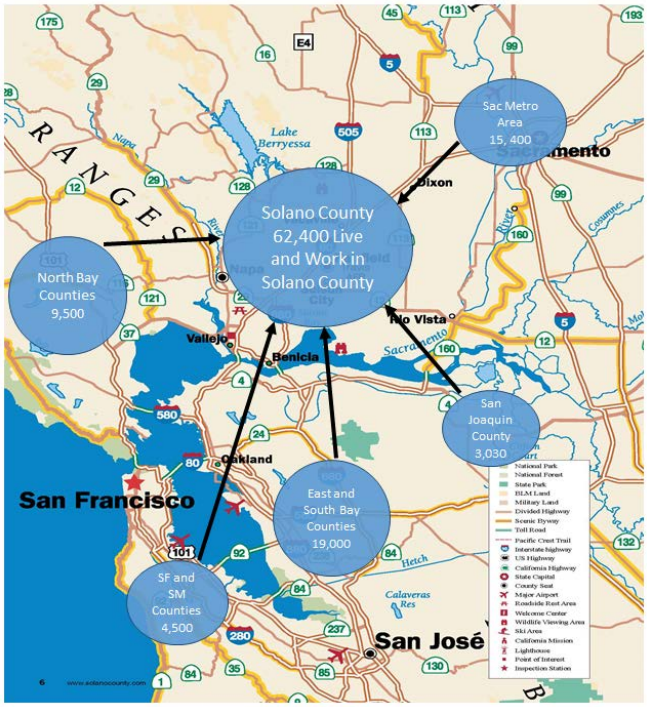
[6] http://www.dot.ca.gov/hq/tpp/offices/eab/socio_economic_files/2017/FullReport2017.pdf

The Longitudinal Employment and Household Dynamics (LEHD) database (see http://onthemap.ces.census.gov). These data show where Solano County's workers and residents come from and go to for work. These data are linked to the data on travel time to work, as the places where workers originate dictates how much time it takes to go to work and how much congestion can affect worker productivity and where the businesses are that are affected by these delays. The same is true for truck travel; where trucks start and where they finish suggests, just like workers, that some truckers use Solano County as an origin, a destination, or as a pass-through in all directions.

The commute data from LEHD also help define a "laborshed" or where people work and live. These commute data stretch from 2002 to 2015 (the latest data as of September 2017) and tell a story about where people live versus where they work, the types of industries that employ people that live locally versus those that work locally, and other data.

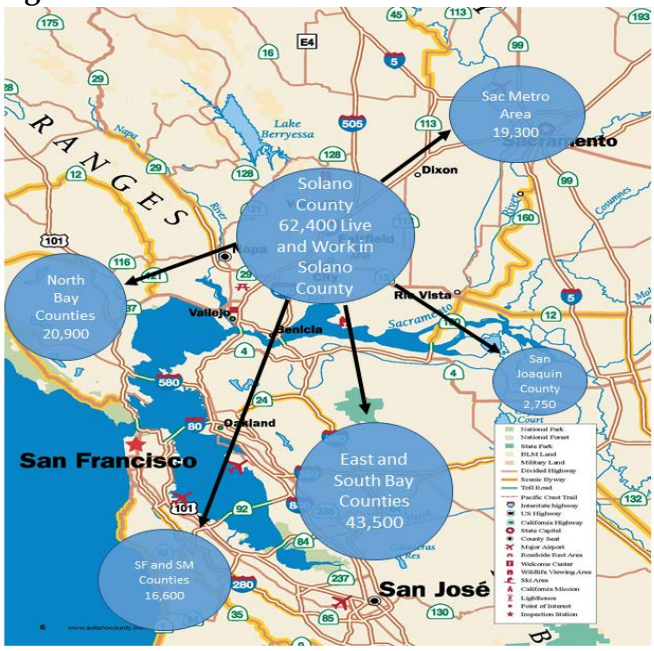
Figures 5 and 6 show a mapping of the number of employees coming from different parts of Solano County's laborshed from 2014. The Appendix has further data on commute patterns that show the entire time series. However, by using 90 percent of the AADT for Solano County in 2015 (the latest data), the base number of commuters could be as high as 119,000 car trips; we assume 90 percent of this value to remain conservative and also recognize that there are non-commuters on the roads during even the most peak traffic times. Data in Figures 5 and 6 come from a recent project called Moving Solano Forward, Phase II (http://www.movingsolanoforwardii.com).

Figure 5: Inbound workers to Solano County (Employees), 2014



Source: Moving Solano Forward, Phase II

Figure 6: Outbound Residents from Solano County, 2014 to Where They Work



Source: Moving Solano Forward, Phase II

Truck Traffic

Figure 7 shows the change in AADT for truck traffic since 2010 as of 2015. What the truck traffic data provide is a way to see the flow of commerce from one end of Solano County to the other. Measuring what is in the trucks is virtually impossible without a complete inspection or invoice for everything in the truck. Even the weight of each truck may not be indicative of the load's value. There is wide agreement that the time savings for business travel should equal the gross hourly cost of employment, including payroll taxes and fringe benefits.

A reduction in the time from origin to destination then has positive economic benefits for deliveries, regardless of their value or use. The truck counts give a volume of "transactions"; the challenge is to provide a value to each of those transactions to act as a baseline. From there, we need to make assumptions about the types of industries that use trucking **regionally** and how those regional flows.

Figure 7 shows the types of trucks that make up the 2015 truck counts. Notice that most are either two axles (simple trucks, including flatbed and box trailer trucks) and five or more axles (tractor and trailer or 14 to 18 wheels). Few trucks are in-between. That suggests that truck traffic is mixed between local movements (smaller trucks) and long-haul trucking (5 or more axles).

Figure 7: Truck Counts, 2015, by Post Mile in Solano County

Description	Post Mile	2 Axles	3 Axles	4 Axles	5+ Axles	Total
JCT. RTE. 80	R2.794B	1,848	158	70	1,785	3,861
JCT. RTE. 80	L1.801A	428	140	34	1,079	1,681
VALLEJO, JCT. RTE. 37 WEST	5.634B	1,853	500	304	4,375	7,032
VALLEJO, JCT. RTE. 37 WEST	5.634A	1,970	386	223	3,657	6,236
JCT. RTE. 12 WEST	R11.976B	2,273	565	227	3,823	6,888
JCT. RTE. 12 WEST	R11.976A	2,404	641	258	5,017	8,320
JCT. RTE. 680 SOUTH	12.839B	2,642	695	808	6,351	10,496
JCT. RTE. 680 SOUTH	12.839A	3,148	758	1,166	7,098	12,170
FAIRFIELD, EAST JCT. RTE. 12	15.815A	3,328	738	364	6,590	11,020
FAIRFIELD, EAST JCT. RTE. 12	15.815B	3,083	672	497	6,168	10,420
FAIRFIELD, NORTH TEXAS STREET	20.925B	1,868	409	236	3,910	6,423
FAIRFIELD, NORTH TEXAS STREET	20.925A	2,769	737	340	5,604	9,450
JCT. RTE. 505 NORTH	R28.36B	5,400	759	384	5,371	11,914
JCT. RTE. 505 NORTH	R28.36A	2,469	620	206	4,577	7,872
JCT. RTE. 113 SOUTH	38.21A	2,561	870	293	4,407	8,131
JCT. RTE. 113 SOUTH	38.21B	2,326	554	578	4,538	7,996
JCT. RTE. 113 NORTH	42.67B	2,487	832	352	4,905	8,576

Source: http://traffic-counts.dot.ca.gov/

Given the traffic's geography, we use the following logic to determine the number of trucks on a daily (seven days a week) basis:

- Not all trucks are going all the way through Solano County;
    - For the ones that stop in Solano County, it is unknown where they go, how many go to the same place (thus affecting a narrow breadth of industries), and many go through to other destinations; and
    - Assess the benefit of reducing trucking times by one minute through or stopping in Solano County.

In summary, the number of trucks we use below as the baseline traffic count is 7,937, the average AADT truck count in 2015.

Other Benefits from Congestion Reduction

There are four other benefits from the literature that may be available to Solano County and its regional economy:

- Personal time saved based on less congestion (better quality of life), including reduced vehicle costs;
- Better air quality and noise environments;
- Better flow of tourism from one point to another; and
- Wage savings for logistics and trucking based on faster times between origin and destination points.

For each of these cases, we do not provide an explicit estimate; we assume that our conclusions and final estimates either have these benefits embedded or are relatively small or immeasurable to the point that any potential estimation would more speculative than precise. However, we assume these benefits are greater than zero if congestion times were reduced by new infrastructure.

The personal time savings can come from less time spent to run a household (due to not sitting in as much traffic to pick up children at school, go to medical appointments, or an array of other tasks) that convert to savings and potentially more spending and business revenues. A better flow of tourism can allow more tourism-facing businesses and attractions to develop in the local and regional economies, as they are easier to access given new infrastructure. For example, new express lanes may provide incentives to place hotels and conference spaces at the beginning and end of new express lanes under the assumption of more car trips and their customers (like more foot traffic in a shopping mall) due to less congestion.

Wages for trucking and logistics may have less reason to rise as less worker time idle spent in traffic. For example, reducing wait times by 5 minutes means 5 minutes more work (productivity) from employees and reduces the amount of time truck drivers are waiting in traffic between origin and destination points. This also reduces "buffer" time, or time used to leave earlier than normal to avoid traffic, further enhancing worker productivity and time spent with family at home. However, there are also costs from congestion reduction.

Other Costs from Congestion Reduction

These costs, like the other benefits above, are not going to be measured explicitly for this exercise. We can (for the sake of being complete) recognize that there are some costs due to reducing congestion.

- Fewer collisions and maintenance costs for vehicles that become revenue for auto body and vehicle-repair businesses; and
- Reduced use of public transportation.

When congestion falls, workers and travelers and households tend to use mass transit or shared options because the cost of doing so is more than the benefit. Such costs include the lack of control over one's transportation fate. As a result, the ridership for public transportation likely falls, even if ticket prices were reduced. This has a ripple effect on infrastructure investment in public transportation and in the operations. The express lanes provide a second layer of congestion relief, even if the other improvement generate less than expected congestion relief. The free flow of commuters, including those using carpool, vanpool and mass transit, diversify the ways these projects reduce congestion and provide time savings and broad economic impacts after construction ends.

More traffic has the dubious gain of more brake repair, more tire repair, more clutch replacements, more auto-body work, and other vehicle maintenance costs become revenue for local businesses that work on cars. Hence, fewer collisions and reduced times in the vehicle (including trucking) means a reduction in business revenues for industries that use such demand as one of their main markets. The gain goes to vehicle operators who continue to commute to and from work by automobile can also through lower automobile-operating costs. Households can use the savings to purchase other consumer products and services as desired (and have more leisure time).

There are other costs and benefits not measured here explicitly; due to a lack of precise data, we do not provide a numerical estimate. The following is a summary of the operational benefits to measure from reduced travel time for commuters and trucking based on a reduction in congestion:

- Increased productivity means more business revenues;
- Reduced time in the car commuting for workers means more time with family and spending on goods and services; and
- More efficient delivery times and production processes for congestion sensitive businesses.

In the next section, data are provided as a baseline by which to estimate of how congestion reduction affects each of the bullets above. The sum of those parts is our baseline

estimate to begin the economic impact analysis more broadly. The economic impacts and estimates over a five-year window of operations comes next.

4. Data for Solano County and Its Regional Economy

Economic and social data for Solano County are available from multiple sources. This section narrows down the data to just those variables that help value changes from reducing congestion once the new infrastructure is in place. These include:

- Wages across industries at the median for what employees earn and on average for employers pay;
- Value of goods and services, where trucking is a "value-added" service; and
- A statement of the total flow of workers along these corridors on a work-day basis.

Wages: Commuting Workers

To begin estimating the gain from reducing congestion, we need more data items. First, the wages earned by each industry from a regional standpoint provide information about Solano County's laborshed and what industries are going outbound and what industries are coming into Solano County that describe the likely commuter ranks of workers.

Sharing the road with non-commuters is the large competitive issue on roadways; this is why specific times of the day are considered as "commute" times. The possible movements of people and commerce (where people are simply available hours to work and goods are revenue in waiting for a storefront) for businesses provides an overall value to act as the base number for the **direct** economic impacts from these projects. Figure 8 shows the value per hour for workers across many occupations in quarter 1 2017. Figure 9 shows the same wage data (dollars paid per hour) in quarter 1 2011.

Figure 8: Median Wages, Dollars per Hour, 2017, Occupations by Solano County Laborshed

Occupation Category	CA	**Solano**	Alameda	Napa	Sac	San Francisco	Santa Clara	San Joaquin
Average of All Occupations	$20.01	**$19.65**	$23.25	$19.19	$20.61	$28.03	$29.20	$17.25
Management	55.39	**47.99**	60.58	52.36	50.06	71.23	76.81	45.84
Business and Financial Operations	36.05	**34.71**	39.38	36.64	34.18	42.92	44.34	31.47
Computer and Mathematical	48.28	**43.17**	51.18	39.07	41.14	55.65	59.05	32.71
Architecture and Engineering	45.62	**42.88**	46.59	41.65	45.96	48.00	54.57	38.09
Life, Physical, and Social Science	35.79	**44.30**	40.12	43.70	35.79	43.44	39.75	30.23
Community and Social Services	23.93	**23.50**	25.34	28.34	22.29	25.33	25.10	18.37
Legal	49.60	**44.43**	44.57	39.00	46.29	67.30	69.18	32.84
Education, Training, and Library	25.89	**22.77**	25.43	26.10	23.25	28.71	29.64	24.13
Arts, Design, Entertainment, Sports, and Media	28.36	**19.40**	22.52	23.94	23.51	33.04	30.14	18.26
Healthcare Practitioners and Technical	40.52	**48.93**	48.06	46.77	47.00	53.49	50.34	40.85
Healthcare Support	16.46	**18.30**	18.24	17.33	18.24	20.10	19.16	17.01
Protective Service	22.61	**37.66**	22.07	23.40	20.25	20.67	20.48	24.10
Food Preparation and Serving-Related	11.72	**11.78**	12.14	12.72	11.46	14.03	12.37	11.37
Building and Grounds Maintenance	13.71	**13.63**	16.36	13.64	14.06	16.10	13.99	13.33
Personal Care and Service	12.02	**11.28**	12.50	12.43	11.49	14.43	12.42	11.50
Sales and Related	14.12	**12.44**	15.26	16.65	13.63	18.73	18.66	12.66
Office and Administrative Support	18.43	**18.92**	20.53	19.36	18.61	23.15	22.23	16.52
Farming, Fishing, and Forestry	10.93	**12.03**	13.84	13.83	11.25	14.40	11.06	11.20
Construction and Extraction	25.61	**26.78**	29.40	29.11	25.03	32.37	29.54	25.33
Installation, Maintenance, and Repair	23.27	**22.97**	26.32	24.55	22.97	28.55	26.19	23.25
Production	15.12	**17.34**	17.07	18.88	15.59	18.30	18.27	15.50
Transportation and Material Moving	$14.95	**$14.86**	$18.00	$15.35	$15.44	$18.05	$16.61	$16.95

Source: California EDD (http://www.labormarketinfo.edd.ca.gov/data/oes-employment-and-wages.html#OES)

Business Productivity Benefit

The business productivity benefits of reduced congestion depend on how much businesses affected by current congestion see relief. There are two stages to this part of the calculation. The first is to make assumptions and determine the types of industries that are "congestion-sensitive" versus others, and to what extent that sensitivity affects their income. This latter measure is controversial in the literature as it is about an economic concept called "elasticity". In essence, the elasticity measure here would be how much income is lost by one additional minute of congestion. The second elasticity issue is substitution of labor for capital or inbound commuting labor (which is congestion sensitive) for local labor (which is marginally less sensitive).

Figure 9: Median Wages, Dollars per hour, 2011, Occupations by Solano County Laborshed

Occupational Category	CA	**Solano**	Alameda	Napa	Sac	San Francisco	Santa Clara	San Joaquin
Total all	$16.64	**$18.32**	$21.74	$18.21	$19.56	$23.49	$25.34	$16.88
Management	51.26	**45.07**	52.98	47.06	47.16	61.15	67.40	43.20
Business and Financial Operations	32.65	**31.32**	35.18	31.72	30.67	38.85	39.82	29.24
Computer and Mathematical	41.23	**35.67**	40.91	34.60	38.12	46.91	53.07	32.89
Architecture and Engineering	41.37	**36.72**	42.77	37.28	41.91	41.09	48.07	37.29
Life, Physical, and Social Science	33.21	**36.67**	36.12	34.64	33.73	38.97	38.58	33.19
Community and Social Services	22.41	**26.40**	24.18	19.24	24.13	22.97	19.02	23.04
Legal	47.89	**45.19**	44.66	39.36	41.46	57.92	60.12	43.48
Education, Training, and Library	25.54	**23.59**	26.02	28.51	24.28	25.97	25.71	24.23
Arts, Design, Entertainment, Sports, and Media	24.71	**19.35**	23.49	19.63	21.00	29.67	28.22	17.35
Healthcare Practitioners and Technical	36.70	**42.04**	43.53	42.82	40.26	40.60	48.24	35.33
Healthcare Support	13.55	**13.53**	14.55	15.87	14.18	16.49	15.55	13.38
Protective Service	22.83	**36.04**	23.18	23.71	23.65	21.29	24.25	30.70
Food Preparation and Serving-Related	9.40	**9.26**	9.58	10.34	9.33	11.10	9.61	9.33
Building and Grounds Cleaning and Maintenance	11.74	**12.09**	13.58	13.63	11.96	14.36	12.27	12.28
Personal Care and Service	10.92	**10.42**	11.43	11.64	11.00	13.39	11.74	9.71
Sales and Related	12.92	**11.41**	14.70	14.98	12.06	16.10	14.89	11.18
Office and Administrative Support	16.92	**17.33**	19.19	18.03	17.43	20.19	20.00	16.12
Farming, Fishing, and Forestry	9.13	**9.03**	10.36	11.54	9.31	20.58	9.19	8.95
Construction and Extraction	23.80	**25.58**	27.79	24.72	23.67	28.98	27.16	24.71
Installation, Maintenance, and Repair	21.75	**25.98**	25.39	23.88	22.15	26.34	24.95	21.22
Production	13.87	**16.48**	16.10	17.51	15.06	16.03	16.35	13.73
Transportation and Material Moving	$14.01	**$14.41**	$16.07	$15.75	15.05	17.00	14.96	$16.71

Source: California EDD (http://www.labormarketinfo.edd.ca.gov/data/oes-employment-and-wages.html#OES)

The final stage is to determine the income allocated to how businesses use trucking services. The change of one minute of congestion applied to trucking levels and the connection of those trucks to regional businesses help determine the direct effects on business productivity.

Businesses and their economic relationship to trucking

Directly or indirectly, all businesses face some sensitivity to congestion. The way we look at the income potentially gained from congestion reduction through these projects is in the following steps:

1. Determine the percentage of trucking services purchased by these industries (and overall) in the Solano County economy;
2. Consider any adjustment due to the literature-based "elasticity" estimates or how industries may switch to more localized suppliers as congestion rises;

3. Use AADT data on truck counts through the corridors and scales to determine a value per AADT;
4. Determine a value per hour of travel and an aggregate value per year of trucking moving through these corridors; and
5. Use these data to determine an amount of direct economic impact per minute of congestion reduction.

The literature suggests that such estimates on trucking should be based mainly on driver wages, but the value-added by trucking to local businesses in Solano County may be more insightful and also capture trucker wages. These gains are parallel to gains for commuters, as labor also adds value to local businesses. Figure 10 provides a list of industries, their percentage of value-added paid to trucking businesses as a service, as a way to help determine the baseline savings from new scales and roadways to reduce congestion. The total value added in Solano County comes from IMPLAN® and is an analog to gross county product.

Figure 10: Industry Income, 2016 and Trucking

Industry	Value Added by Trucking	Total Value Added in Solano	% Trucking
Trucking	$121,666,041	$164,019,469	100.0%
Logistics	$12,245,687	$124,066,733	9.9%
Leasing	$3,131,750	$89,529,821	3.5%
Admin and Waste Services	$4,157,908	$343,802,071	1.2%
Financial Services	$16,117,231	$1,343,077,984	1.2%
Retail	$11,072,022	$1,148,033,650	1.0%
Wholesale	$6,780,246	$867,019,816	0.8%
Other Services	$3,555,683	$495,125,322	0.7%
Education	$637,975	$92,826,705	0.7%
Rental Properties	$8,598,301	$1,251,748,871	0.7%
Accommodation and Food Services	$3,367,562	$492,873,623	0.7%
Information	$1,278,110	$206,174,685	0.6%
Mining	$835,503	$163,346,024	0.5%
Arts, Entertainment, and Recreation	$602,552	$126,726,072	0.5%
Management of Companies	$406,442	$96,429,709	0.4%
Health Care and Social Assistance	$8,771,841	$2,095,379,398	0.4%
Professional Services	$1,723,077	$731,201,459	0.2%
Durable Manu - Wood/Mineral/Plastic	$10,399,652	$5,246,962,999	0.2%
Federal Govt	$4,239,382	$2,327,847,341	0.2%
Utilities	$468,377	$281,885,363	0.2%
Construction	$1,600,251	$1,038,886,620	0.2%
Ag	$432,084	$302,685,135	0.1%
Non-Durable Manu	$489,385	$506,341,837	0.1%
Durable Manu - Iron/Steel	$289,112	$390,143,084	0.1%
State and Local Government	$1,008,774	$1,804,583,826	0.1%
Totals	**$223,874,000**	**$21,703,307,000**	**0.1%**

Source: IMPLAN® and Author's Calculations

The value-added idea is important. Trucking adds value to a business by providing transportation (delivery of goods for retail from a warehouse is a simple example). The good's or service's price includes the cost of trucking; reducing trucking costs implies more business revenues and hiring. The next concern is the number of trucks on the road.

As shown in Figure 7 above, the annual average daily traffic (AADT) data on trucks suggest that a range of truck counts going into or through Solano County is approximately 7,934 trucks per day. The range of truck counts for 2015 (the latest data from CalTrans) is from 1,680 to 12,170 trucks. The range starts at the SR 12 junction with I-80 to the SR 113 connection with I-80. This covers the range of potential traffic patterns associated with these projects for Solano County.

Figure 4 shows the ascension of truck counts from 2010 to 2015 as the Solano County and California's economy recovered from the recent recession. An increase of 2 minutes of commute time since 2010 has taken place according to the Census Bureau. In 2010, the AADT truck count was an average of 7,387 per day with a range of 1,629 to 10,560 along the I-80 corridor for the projects in question. In 2015, this number was 7,934 trucks.

Given the data above, the following logic provides the baseline value of savings:

- With 7,934 truck trips per day and $223,875,000 of value add for trucking services in Solano County for 2015 from IMPLAN® in Figure 10, each truck trip has a value add of approximately $77. Not all truck trips are in congested situations.
    - In 2010, the value of trucking was $195 million at 7,387 truck trips per day and 33 minutes average time through Solano County;
    - Equilibrated truck traffic is 55/65 to vehicle times, such that delays affect trucking by 65/55 due to speed limits;
    - In 2015, the value of trucking was $223 million at 7,934 trucks per day and 35.4 minutes of commute time.
    - In 2015, if 7,934 trucks per day spent an average of 35.4 minutes on the road in Solano County, at $223 million of value added, then each minute is worth $796 per minute.

The value added for trucking is the revenue earned by businesses from using trucking that remains in Solano County (for example, some costs are paid to businesses and labor that live outside of Solano County and not counted here). We are assuming that the average truck load has a value to the production process and the annual average goal for the first five years is to reduce congestion by one minute. That average value is $796 per minute x 7,934 trucks per day or **$6.314 million per year**.

Business Gain from More Productive Workers: Value Added from Labor

The gains from labor are similar to the gains from trucking. As workers become more productive due to a reduction in time spent in traffic, local businesses are able to generate more revenue from marking up the additional work time and productivity. This adds to the commuting worker's value of reducing traffic, and how the worker adds value beyond wage gains is the business' gain. The assumption here is that the mark-up on marginal labor gains is approximately 49.9% on average, as shown in Figure 11 for Solano County in 2017. Each hour of time savings for workers generates another 49.9 percent of itself for the employers of those more productive workers.

Figure 11: Labor Payments to Total Value Added, Solano County, 2015, By Industry

Industry	Labor Payments	Total Value Added	Percent of Labor in Value Added
Accommodation and Food Services	$304,088,017	$492,873,623	61.7%
Admin and Waste Services	$265,301,299	$343,802,071	77.2%
Ag	$166,321,034	$302,685,135	54.9%
Arts, Entertainment, and Recreation	$86,935,066	$126,726,072	68.6%
Construction	$717,601,465	$1,038,886,620	69.1%
Durable Manu - Iron/Steel	$268,090,342	$390,143,084	68.7%
Durable Manu - Wood/Mineral/Plastic	$1,210,194,461	$5,246,962,999	23.1%
Education	$86,164,369	$92,826,705	92.8%
Federal Govt	$1,022,662,539	$2,327,847,341	43.9%
Financial Services	$486,284,841	$1,343,077,984	36.2%
Health Care and Social Assistance	$1,723,301,208	$2,095,379,398	82.2%
Information	$77,983,590	$206,174,685	37.8%
Leasing	$41,682,495	$89,529,821	46.6%
Logistics	$95,330,923	$124,066,733	76.8%
Management of Companies	$80,711,121	$96,429,709	83.7%
Mining	$36,123,638	$163,346,024	22.1%
Non-Durable Manu	$213,146,833	$506,341,837	42.1%
Other Services	$349,581,599	$1,746,874,193	20.0%
Professional Services	$607,352,256	$731,201,459	83.1%
Retail	$658,322,612	$1,148,033,650	57.3%
State and Local Government	$1,670,573,673	$1,804,583,826	92.6%
Transport	$126,249,469	$164,019,469	77.0%
Utilities	$139,331,802	$281,885,363	49.4%
Wholesale	$420,486,445	$867,019,816	48.5%
Total	**$10,853,821,096**	**$21,730,717,617**	**49.9%**

Source: IMPLAN and Author Calculations

Now that we have all the assumptions and baseline data, putting the data together and calculating the economic impacts concludes this study.

5. Putting it All Together: The Broader Economic Impacts

In the previous sections, the literature and some basic logic provided a "direct" economic estimate of the gains from congestion being reduced on regional workers and businesses. Workers gain from being more productive and implicitly gaining back lost time, where wages help value that time per hour (and ultimately per minute gained). Businesses gain from this productivity also by the margins they make on more productive workers and on reduced costs of logistics, estimated through approximate trucking values shown above.

- Worker savings = $18.32/60 minutes x 90% x AADT for commuters x 365
- Business productivity gains as mark-up = Worker savings x 0.499
- Truck traffic gains = 7,934 trucks per day x one minute of savings x $796/minute of average value to Solano County economy

The data above act as a way to see the broader economic impacts, but there is a chain of logic that needs to hold firm for this work. Figures 12 and 13 provide these logic chains for workers and for trucking.

Figure 12: Logic of Productivity Gains, Workers with Faster Commute Times

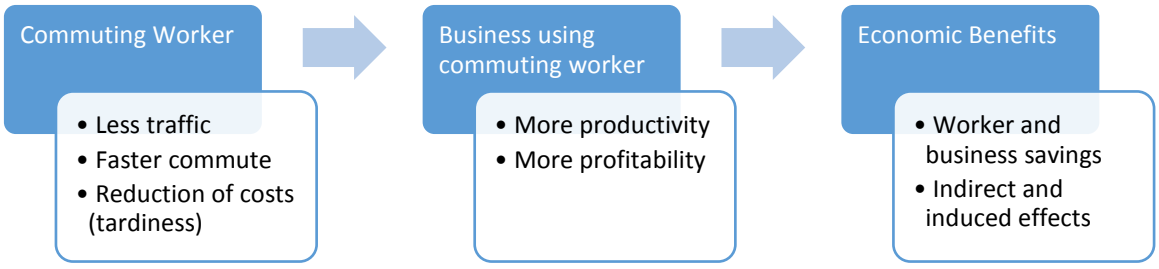
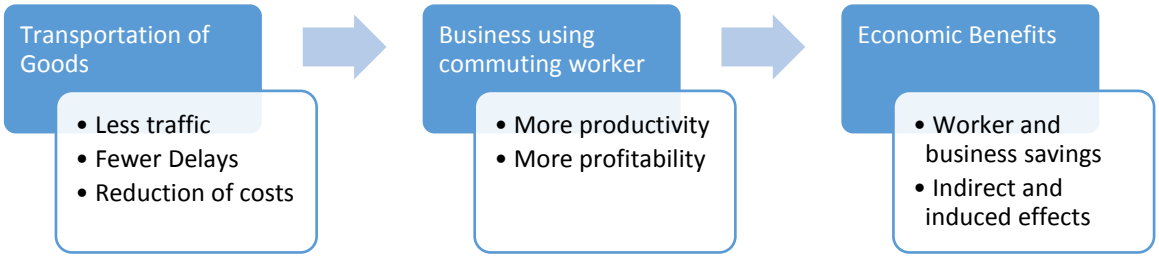


Figure 13: Logic of Logistics Businesses Gains, Trucking with Fewer Delays

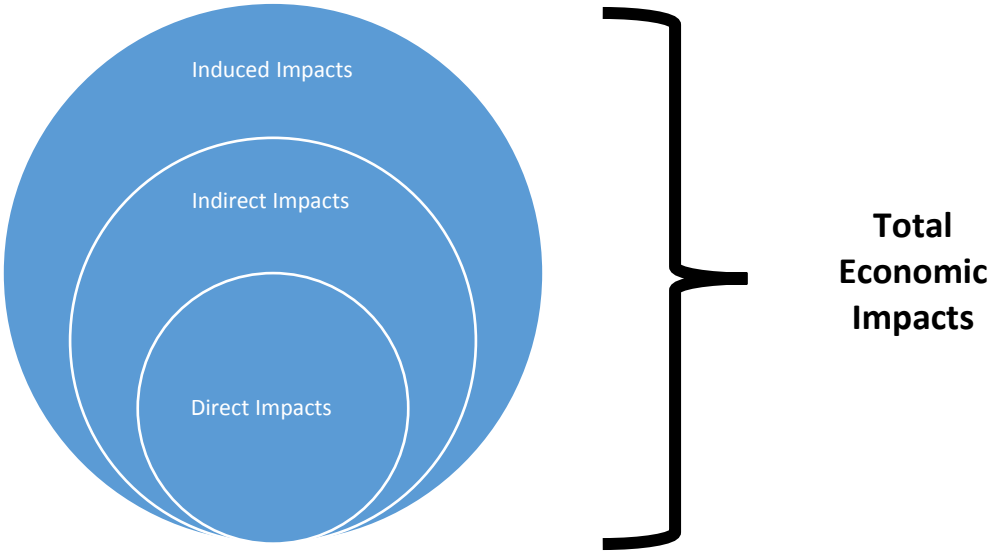


Economic Impacts Methods and Meanings

There are broader effects of these projects' construction and subsequent congestion relief on Solano County's economy and beyond through Solano County's regional networks due to commuting workers and truck travel across the county corridors in the least.

Economic impacts come in three "flavors" starting with the same way ripples come from throwing a rock into a still pond; the rock illustrates the construction and use of the new infrastructure spending, which ripples out as additional economic impacts from those choices. **Direct** effects come from these projects and subsequent business and worker gains and then there are **indirect** effects. Those indirect effects come from workers spending more income due to being more productive at work and saving time from congestion otherwise; businesses that generate gains spend more on vendors, which becomes broader spending. For example, a business may purchase more furniture for offices due to growth from more productive workers or trucking flows as congestion falls. This spending supports an office furniture store and its employees. This type of indirect spending becomes **induced** effects on the broader economy. The furniture store's employees spend wages on groceries, medical visits, restaurant meals, and various other industries that have nothing to do with the original businesses affected. Figure 14 shows the multiplier effect of these rounds of new spending.

Figure 14: Economic Impacts



Figures 15 through 23 show the estimated economic impacts based on the estimated costs of each project and the different project components. Notice that there are different aspects of each project as line items in the business revenue (what businesses throughout Solano County make based on contracting to deliver the construction or services) and employment (workers to perform the tasks) results.

Each project has three figures; the same as true for the results below once construction ends and the operational impacts begin.

Westbound Cordelia Truck Scales

Figure 15: IMPLAN Results for I-80 Westbound Cordelia Truck Scales, FTE workers

Industry	Direct	Indirect	Induced	Totals
Construction of new highways and streets	714.5			714.5
Maintenance and repair construction	139.7			139.7
Construction of new power and communication structures	101.8			101.8
Architectural, engineering, and related services	20.8	20.9	0.7	42.5
Real estate		9.8	14.8	24.6
Limited-service restaurants		2.8	21.3	24.1
Retail - Clothing and clothing accessories stores		16.5	4.3	20.8
Wholesale trade		15.9	4.5	20.3
Full-service restaurants		3.9	15.8	19.8
Retail - Miscellaneous store retailers		11.5	3.9	15.4
Commercial and industrial machinery/equipment rental and leasing		15.0	0.1	15.1
Individual and family services			14.9	14.9
Retail - General merchandise stores		3.6	10.6	14.2
Hospitals			13.6	13.6
Retail - Food and beverage stores		0.8	11.4	12.1
Employment services		8.9	3.1	12.0
Retail - Building material and garden equipment and supplies stores		6.9	4.9	11.8
Automotive repair and maintenance, except car washes		4.7	6.2	11.0
All Others		89.1	148.3	237.4
Totals	**976.8**	**210.3**	**278.4**	**1,465.6**

For jobs supported, these are full-time equivalent (FTE) workers with jobs that come from revenues derived from the construction impacts (hence they last as long as the projects last), and the revenue is also for the entire project. We see later annualized revenues and tax receipts from ongoing savings due to reduced congestion, with an amount of FTE workers supported.

Figure 16: IMPLAN Results for I-80 Westbound Cordelia Truck Scales, Business Revenues

Industry	Direct	Indirect	Induced	Totals
Construction of new highways and streets	$154,500,000	$-	$-	$154,500,000
Maintenance and repair construction of highways, streets	27,800,000			27,800,000
Construction of new power and communication structures	17,000,000			17,000,000
Owner-occupied dwellings			7,745,200	7,745,200
Architectural, engineering, and related services	3,000,000	3,018,600	106,900	6,125,500
Petroleum refineries		4,740,700	438,100	5,178,800
Wholesale trade		4,024,400	1,130,000	5,154,400
Real estate		1,553,100	2,358,700	3,911,800
Commercial and industrial machinery/equipment rental		3,466,100	34,300	3,500,400
Hospitals			2,855,900	2,855,900
Limited-service restaurants		244,700	1,885,400	2,130,100
Monetary authorities and depository credit intermediation		863,700	1,032,100	1,895,800
Retail - Clothing and clothing accessories stores		1,322,800	341,700	1,664,500
Retail - Building material and equipment and supplies stores		713,600	509,500	1,223,100
Offices of physicians			1,209,400	1,209,400
Retail - General merchandise stores		304,000	886,100	1,190,100
Automotive repair and maintenance, except car washes		510,200	671,000	1,181,200
Commercial and industrial machinery/equipment repair		1,100,500	66,400	1,166,900
Retail - Motor vehicle and parts dealers		407,800	681,300	1,089,100
Truck transportation		828,100	136,000	964,100
All Others		8,978,800	15,434,700	24,413,500
Totals	**$202,300,000**	**$32,077,100**	**$37,522,700**	**$271,899,800**

Figure 17: IMPLAN Results for Cordelia Truck Scales, Tax Revenues

Taxes or Fees	Amount
Employment Taxes	$268,100
Sales taxes	2,573,900
Property taxes	2,234,300
Personal Income	3,132,800
Other Taxes and Fees	1,158,700
Total State and Local taxes	**$9,367,800**

I-80/I-680/SR 12 Interchange Impacts

Figure 18: IMPLAN Results for I-80/I-680/SR 12 Interchange Improvement Project, Jobs, FTE equivalent

Industry	Direct	Indirect	Induced	Totals
Construction of new highways and streets	1,314.7			1,314.7
Maintenance construction of highways, streets, bridges, and tunnels	381.8			381.8
Construction of new power and communication structures		17.2	25.9	43.1
Architectural, engineering, and related services		4.8	37.4	42.1
Real estate		39.6	1.3	40.9
Limited-service restaurants		28.6	7.5	36.0
Retail - Clothing and clothing accessories stores		28.2	7.8	36.0
Wholesale trade		6.5	27.7	34.2
Full-service restaurants		24.2	6.8	30.9
Retail - Miscellaneous store retailers		26.7	0.3	26.9
Commercial and industrial machinery and equipment rental and leasing		-	26.0	26.0
Individual and family services		16.1	8.6	24.7
Retail - General merchandise stores		5.9	18.5	24.4
Hospitals		-	23.8	23.8
Retail - Food and beverage stores		1.1	19.9	20.9
Employment services		8.9	10.9	19.9
Retail - Building material and garden equipment and supplies stores		14.3	5.4	19.8
Automotive repair and maintenance, except car washes		11.8	4.7	16.5
All Others		148.8	254.9	403.7
Totals	**1,696.5**	**382.7**	**487.4**	**2,566.3**

Figure 19: IMPLAN Results for I-80/I-680/SR 12 Interchange Improvement Project, Business Revenues

Industry	Direct	Indirect	Induced	Totals
Construction of new highways and streets	$284,300,000	$-	$-	$284,300,000
Maintenance construction of highways, streets	76,000,000			76,000,000
Construction of new power and communication structures			13,561,100	13,561,100
Owner-occupied dwellings		9,198,100	767,300	9,965,400
Architectural, engineering, and related services		7,148,900	1,978,500	9,127,400
Petroleum refineries		2,733,900	4,131,300	6,865,200
Wholesale trade		6,174,300	60,000	6,234,300
Real estate		5,714,200	187,100	5,901,300
Commercial equipment rental and leasing			5,001,200	5,001,200
Hospitals		419,700	3,301,300	3,721,000
Limited-service restaurants		1,587,800	1,807,000	3,394,800
Monetary authorities and depository credit intermediation		2,283,500	598,300	2,881,800
Retail - Clothing and clothing accessories stores		1,668,500	892,000	2,560,500
Retail - Building material stores		2,080,000	116,300	2,196,300
Offices of physicians		959,700	1,174,900	2,134,600
Retail - General merchandise stores			2,118,000	2,118,000
Automotive repair and maintenance, except car washes		492,600	1,551,400	2,044,000
Commercial equipment repair and maintenance		742,500	1,192,800	1,935,300
All Others		17,683,400	27,263,200	44,946,600
Totals	**$360,300,000**	**$58,887,100**	**$65,701,700**	**$484,888,800**

Figure 20: IMPLAN Results for I-80/I-680/SR 12 Interchange Project
Tax Revenues

Tax or Fee	Amount
Employment Taxes	$470,800
Sales taxes	4,628,700
Property taxes	4,016,500
Personal Income	5,468,800
Other Taxes and Fees	2,053,200
Total State and Local taxes	**$16,638,000**

I-80 Express Lanes

Figure 21: IMPLAN Results for I-80 Express Lanes, FTE Jobs

Industry	Direct	Indirect	Induced	Totals
Construction of new highways and streets	437.9			437.9
Maintenance construction of highways	249.5	4.0	0.5	253.9
Construction of new power and communication structures	190.4			190.4
Architectural, engineering, and related services	149.8	5.6	0.5	155.9
Real estate	106.1	23.7	0.7	130.5
Limited-service restaurants	30.9	1.2	0.2	32.3
Retail - Clothing and clothing accessories stores		15.4	14.9	30.3
Wholesale trade		5.5	21.5	27.0
Full-service restaurants		21.6	3.1	24.7
Retail - Miscellaneous store retailers		7.8	15.9	23.7
Commercial equipment rental and leasing		10.8	4.5	15.2
Individual and family services			15.0	15.0
Retail - General merchandise stores		10.3	4.3	14.6
Hospitals		10.3	3.9	14.2
Retail - Food and beverage stores			13.7	13.7
Employment services		2.8	10.6	13.4
Retail - Building material and supplies stores		4.9	7.7	12.7
Automotive repair and maintenance, except car washes		7.4	5.0	12.3
All Others		117.7	158.2	275.9
Totals	**1,164.6**	**249.0**	**280.2**	**1,693.6**

Figure 22: IMPLAN Results for I-80 Express Lanes, Business Revenues

Industry	Direct	Indirect	Induced	Totals
Construction of new highways and streets	$94,700,000	$-	$-	$94,700,000
Maintenance and repair construction of highways, streets	37,900,000			37,900,000
Construction of new power and communication structures	15,300,000	3,415,300	107,600	18,822,900
Owner-occupied dwellings	16,100,000	256,400	29,900	16,386,300
Architectural, engineering, and related services	10,800,000	400,900	35,800	11,236,700
Petroleum refineries			7,796,300	7,796,300
Wholesale trade		2,450,900	2,373,300	4,824,200
Real estate		3,518,600	440,900	3,959,500
Commercial and industrial machinery/ equipment rental and leasing		2,725,000	1,137,500	3,862,500
Hospitals			2,874,100	2,874,100
Limited-service restaurants		487,800	1,897,700	2,385,500
Monetary authorities and depository credit intermediation		2,257,400	34,500	2,291,900
Retail - Clothing and clothing accessories stores	2,170,000	85,700	16,400	2,272,100
Retail - Building material and garden equipment and supplies stores		1,052,500	1,038,900	2,091,400
Offices of physicians		1,340,500	194,400	1,534,900
Retail - General merchandise stores		765,700	512,800	1,278,500
Automotive repair and maintenance, except car washes			1,217,200	1,217,200
Commercial and industrial machinery and equipment repair and maintenance		825,400	344,000	1,169,400
Retail - Motor vehicle and parts dealers		231,700	891,900	1,123,600
Truck transportation		362,300	743,700	1,106,000
All Others		11,954,000	16,080,400	28,034,400
Totals	**$176,970,000**	**$32,130,100**	**$37,767,300**	**$246,867,400**

Figure 23: IMPLAN Results for I-80 Express Lanes, Tax Revenue

Tax or Fee	Amount
Employment Taxes	$268,900
Sales taxes	2,488,900
Property taxes	2,162,000
Personal Income	3,000,600
Other Taxes and Fees	1,137,300
Total State and Local taxes	**$9,057,700**

The next three sets of results are the operational impact numbers, the savings once the construction ends as workers and businesses begin to use the improvements. Each section is the annual average over five years; the five-year totals are simply the totals in each table multiplied by five. Each set of tables shows data, where Solano County's benefits from the new infrastructure are front and center, with the benefits for other parts of California also shown. Two key points come from these next nine tables: (1) the impacts of these projects, once operating, affect parts of California as tied to the transportation, housing, and employment networks that flow into and through Solano County; and (2) the most profound effects are on Solano County. Full-time equivalent (FTE) jobs estimates are ongoing jobs supported by annual business revenue gains from congestion reduction.

Economic Impacts of Productivity Gains from Reduced Congestion: Commuters

The first stop for gains from reducing commuting worker congestion is on their own time gains from spending less time in the car and making more income by having less paid time lost. This becomes more spending throughout the Solano County economy. Because these are labor income gains, the impacts are at the household level and thus only induced impacts are generated. The total jobs, business revenues and state and local taxes from these gains are shown in Figures 24 through 26.

Figure 24: IMPLAN Results for Reduced Congestion, Worker Gains, Solano and CA, Business Revenues, Annual Average over five years

Industry	Solano	Rest of CA
Hospitals	$2,767,224	$59,154
Real estate	2,299,444	1,943,708
Limited-service restaurants	1,817,348	
Offices of physicians	1,171,908	709,616
Wholesale trade	1,086,682	2,169,233
Banks and Credit Unions	992,713	473,102
Retail - Food and beverage stores	858,609	23,070
Retail - General merchandise stores	851,781	15,893
Full-service restaurants	712,262	373,433
Outpatient care centers	706,348	
Retail - Motor vehicle and parts dealers	654,891	842
Automotive repair and maintenance	648,233	61,412
Funds, trusts, and other financial vehicles	646,130	96,684
Offices of dentists	630,296	
Insurance carriers	561,766	733,644
Nursing and community care facilities	529,449	120,985
All Others	19,241,013	24,483,120
Total	**$36,176,099**	**$31,263,894**

Figure 25: IMPLAN Results for Reduced Congestion, Worker Gains, Solano and CA, Additional FTE Jobs Supported

Industry	Solano	Rest of CA
Limited-service restaurants	20.6	
Full-service restaurants	15.3	6.1
Real estate	14.4	3.9
Individual and family services	14.3	0.3
Hospitals	13.2	2.0
Retail - Food and beverage stores	10.9	0.0
Retail - General merchandise stores	10.2	0.2
Offices of physicians	7.7	4.7
Nursing and community care facilities	7.6	1.5
All other food and drinking places	7.4	3.2
Personal care services	7.0	1.0
Automotive repair and maintenance, except car washes	6.0	0.5
Home health care services	5.9	
Offices of dentists	5.0	
Retail - Building material and garden equipment and supplies stores	4.7	0.1
Retail - Motor vehicle and parts dealers	4.7	
All Others	113.4	117.5
Total	**268.3**	**140.9**

Figure 26: IMPLAN Results for Reduced Congestion, Worker Gains, Solano and CA, State and Local Taxes and Fees Revenues, Annual Average for Five Years

Tax of Fee	Solano	Rest of CA
Employment Taxes	$34,400	$24,600
Sales taxes	1,097,600	420,200
Property taxes	942,700	363,700
Personal Income	447,600	420,100
Other Taxes and Fees	311,300	169,800
Total State and Local taxes	**$2,833,600**	**$1,398,400**

Economic Impacts of Productivity Gains from Reduced Congestion: Truck Traffic

The next two stop for gains from reducing congestion for trucking and business gains from more productive workers. Trucking is more efficient in getting through the scales or moving from one point to the other, providing more value to businesses in Solano County and beyond that depend on trucking as part of their products or services. More productive workers have similar effects, as their increase in productivity/efficiency in getting to work leads to more revenues for affected businesses. The total jobs, business revenues and state and local taxes from these gains are shown in Figures 27 through 29 for trucking and Figures 30 to 32 for business gains from worker productivity.

Figure 27: IMPLAN Results Trucking Gains, Solano and CA, Business Revenues, Annual Avg for Five Years

Industry	Solano	Rest of CA
Truck transportation	$6,353,069	$107,663

Petroleum refineries	$353,350	$530,051
Owner-occupied dwellings	$268,752	$71,107
Real estate	$189,573	$210,636
Couriers and messengers	$175,568	$164,399
Scenic and sightseeing transportation	$167,546	$176,465
Postal service	$166,797	$18,800
Wholesale trade	$130,322	$289,693
Warehousing and storage	$100,770	$30,900
Hospitals	$98,775	$34,345
Banks and Credit Unions	$96,490	$64,527
Retail - Motor vehicle and parts dealers	$78,787	$9,415
Insurance carriers	$76,010	$114,873
Limited-service restaurants	$75,217	$23,749
Retail - General merchandise stores	$57,056	$12,424
Employment services	$55,923	$62,664
All others	$979,423	$2,555,082
Total	**$9,423,430**	**$4,476,792**

Figure 28: IMPLAN Results, Trucking Gains, Solano and CA, FTE Jobs Supported

Industry	Solano	Rest of CA
Truck transportation	39.5	0.2
Couriers and messengers	1.7	1.2
Postal service	1.4	0.2
Real estate	1.2	0.5
Scenic and sightseeing transportation and support activities for transportation	1.0	0.8
Employment services	0.9	0.6
Limited-service restaurants	0.9	0.2
Warehousing and storage	0.8	0.3
Retail - General merchandise stores	0.7	0.2
Full-service restaurants	0.6	0.6
Retail - Motor vehicle and parts dealers	0.6	0.0
Individual and family services	0.5	0.2
Wholesale trade	0.5	1.1
Hospitals	0.5	0.2
Retail - Food and beverage stores	0.5	0.1
Monetary authorities and depository credit intermediation	0.4	0.1
Retail - Clothing and clothing accessories stores	0.4	0.1
All Others	8.3	11.9
Total	**60.5**	**18.6**

Figure 29: IMPLAN Results for Reduced Congestion, Trucking Gains, Solano and CA, State and Local Taxes and Fees Revenues, Annual Average for Five Years

Tax of Fee	Solano	Rest of CA
Employment Taxes	$8,800	$2,100
Sales taxes	$99,300	$64,300
Property taxes	$86,100	$55,600

Personal Income	$105,500	$62,200
Other Taxes and Fees	$42,200	$25,700
Total State and Local taxes	**$341,900**	**$209,900**

Economic Impacts: Value-Added from More Productive Labor

Figure 30: IMPLAN Results for Reduced Congestion, Value Added by More Productive Labor, Solano and CA, Business Revenues

Industry	Solano	Rest of CA
Owner-occupied dwellings	$1,418,314	$478,362
Wholesale trade	1,063,964	2,552,289
Real estate	625,042	1,143,902
Hospitals	525,920	223,159
Limited-service restaurants	459,610	183,188
Banks and Credit Unions	393,255	418,980
Miscellaneous professional, scientific, and technical services	225,689	392,276
Offices of physicians	222,725	275,938
Architectural, engineering, and related services	198,443	297,776
Maintenance and repair construction of nonresidential structures	174,293	155,802
Full-service restaurants	173,878	211,815
Retail - General merchandise stores	165,690	77,600
Retail - Motor vehicle and parts dealers	165,563	61,233
Retail - Food and beverage stores	164,078	73,524
Insurance carriers	151,734	347,528
Automotive repair and maintenance, except car washes	145,496	91,729
Advertising, public relations, and related services	144,376	303,685
All Others	41,824,985	23,468,182
Total	**$48,243,055**	**$30,756,967**

Figure 31: IMPLAN Results for Reduced Congestion, Value Added by More Productive Labor, Solano and CA, Employment

Industry	Solano	Rest of CA
Limited-service restaurants	5.2	1.8
Miscellaneous professional, scientific, and technical services	4.3	3.5
Wholesale trade	4.2	9.7
Real estate	3.9	3.7
Full-service restaurants	3.7	3.9
Individual and family services	2.7	1.2
Hospitals	2.5	1.5
Retail - Food and beverage stores	2.1	0.9
Retail - General merchandise stores	2.0	0.9
Banks and Credit Unions	1.6	0.8
All other food and drinking places	1.6	1.7
Employment services	1.5	3.3
Services to buildings	1.5	2.4
Offices of physicians	1.5	1.8
Nursing and community care facilities	1.4	1.0
Architectural, engineering, and related services	1.4	1.4
All Others	234.4	110.9
Total	**275.6**	**150.5**

Figure 32: IMPLAN Results for Reduced Congestion, Value Added by More Productive Labor, Solano and CA, State and Local Taxes and Fees Revenues

Tax of Fee	Solano	Rest of CA
Employment Taxes	$ 53,700	$ 16,700
Sales taxes	497,500	455,800
Property taxes	431,500	393,600
Personal Income	528,100	372,200
Other Taxes and Fees	214,700	168,700
Total State and Local taxes	**$1,725,500**	**$1,407,000**

6. Conclusions

Transportation infrastructure projects have economic impacts during construction and use once completed, trying to reduce congestion for Solano County. The projects include:

- I-80 Westbound Cordelia Truck Scales Improvements;
- I-80/I-680/SR12 Interchange Improvements; and
- I-80 Express Lanes Addition.

We show here that the construction projects that sum to over $740 million in spending create over $1.002 billion in local economic impacts during construction, supporting over 5,720 full-time equivalent (FTE) workers during construction and generating over 35 million in state and local tax revenue. Subsequent gains for Solano County businesses from more efficient workers and trucking generates another $93.8 million per year on average for five years after completion, supporting 603 more jobs and $4.89 million in state and local taxes under our assumptions above. This study uses the IMPLAN® model to estimate the economic impacts. Two key issues in the literature are how workers and businesses are sensitive to congestion levels and how to value commuter times and trucking to determine how reducing congestion by one minute can affect commuting worker and business economic outcomes.

Commuting workers provide the largest gains, affecting the Solano County economy in two ways. The first is in saving time getting to work by achieving more tasks during the day by moving more efficiently around the county. This savings helps local businesses also, as businesses are able to generate more revenue from more productive workers. Additional time saved in trucking leads to faster logistics, less wasted time for production processes in manufacturing businesses, and simply makes businesses more efficient. These three gains are the focus of broader economic impacts after construction ends and use begins.

Summary of Estimated Construction Impacts, Life of Each Project

Project	Direct Spending	Business Revenues	Jobs Supported	State/Local Taxes
WB Cordelia Scale	$202.3 million	$271 million	1,465 FTE jobs	$9.37 million
I-80/I-680/SR 12	$360.3 million	$484 million	2,566 FTE jobs	$16.60 million
I-80 Express Lanes	$176.9 million	$247 million	1,693 FTE jobs	$9.06 million
Totals	**$739.5 million**	**$1.002 Billion**	**5,724 FTE Jobs**	**$35.03 million**

Summary of Est. Improvements Impacts, Annual Average for Five Years, Solano/Rest of CA

Category of Gain	Business Revenues	Jobs Supported	State/Local Taxes
Worker Time	$48.2/$30.7 million	275/150 FTE Jobs	$1.72/$1.4 million
Trucking	$9.4/$4.5 million	60/18 FTE jobs	$0.34/$0.21 million
Business Value Add from Labor	$36.2/$31.2 million	268/141 FTE Jobs	$2.83/$1.4 million
Totals	**$93.8/$66.4 million**	**603/309 FTE Jobs**	**$4.89/$3.01 million**

Appendix

Housing unit data for this study come mainly from the California Department of Finance. Data are compiled by city and county in all 58 counties of California and reported. Housing unit growth is more important than the current number. In some cases, such as Solano, Marin, and Contra Costa counties, housing units have been estimated to 2040 by the Association of Bay Area Governments (ABAG) and Metropolitan Transportation Authority (MTA) in a study called Plan Bay Area. There are also short-term housing forecasts in what is known as Regional Housing Needs Assessments.

The housing units to be built, based on a jobs to housing ratio, provide some feel of how many more workers would be on the roads, and hence would be helped by a reduction of congestion.

Figure A1: Population, housing and vehicle registration growth, 2006-2030

Year	Population	Vehicles Reg (000s)	Households (000s)	New Homes
2006	411,351	380	140	1300
2007	412,636	375	140.5	973
2008	413,167	371	141.1	562
2009	412,488	372	140.9	559
2010	413,129	371	141.8	441
2011	414,268	365	142.4	388
2012	419,064	368	142.8	529
2013	422,899	381	143.3	800
2014	427,743	389	143.9	666
2015	432,611	395	144.5	983
2016	437,971	400	145.4	1280
Forecast				
2017	443,249	404	146.6	1508
2018	448,274	408	148	1603
2019	453,218	411	149.5	1610
2020	458,006	414	150.9	1605
2021	462,840	416	152.4	1565
2022	467,732	418	153.9	1519
2023	472,718	420	155.3	1492
2024	477,616	421	156.6	1491
2025	482,301	423	158	1464
2026	486,879	425	159.3	1409
2027	491,269	427	160.6	1363
2028	495,635	429	161.9	1319
2029	499,928	432	163.1	1293
2030	504,098	434	164.3	1278

Source: CalTrans (2017)

Figure A2: Where Workers Live, 2008 to 2015

County	2008	2009	2010	2011	2012	2013	2014	2015
Solano	63,547	59,348	59,782	59,964	59,567	60,915	62,431	66,899
Sacramento	7,704	7,488	8,969	8,191	8,200	8,421	8,568	13,582
Contra Costa	9,627	9,576	10,079	10,505	10,492	10,317	10,706	11,142
Yolo	4,709	4,698	4,604	4,627	4,606	4,636	4,830	10,649
Alameda	5,037	4,686	5,166	4,752	5,012	5,208	5,303	5,542
Napa	4,451	4,255	4,554	4,583	4,714	4,694	4,862	5,086
Sonoma	3,282	3,148	3,267	3,352	3,254	3,372	3,465	3,534
San Joaquin	2,768	2,548	2,866	2,831	2,785	3,114	3,030	3,256
Santa Clara	2,969	3,030	3,111	3,079	3,006	3,022	2,931	3,061
San Francisco	2,060	2,142	2,100	2,206	2,140	2,135	2,329	2,282

Figure A3: Where Residents Work, 2008 to 2015

County	2008	2009	2010	2011	2012	2013	2014	2015
Solano	63,547	59,348	59,782	59,964	59,567	60,915	62,431	66,899
Contra Costa	24,015	21,298	21,165	21,778	21,752	22,397	22,412	23,431
Alameda	15,436	13,372	14,110	13,802	14,129	14,932	15,037	15,720
Sacramento	9,583	9,007	11,318	11,436	11,847	11,824	12,065	12,288
Napa	9,696	8,945	9,613	9,740	10,091	10,877	11,397	12,207
San Francisco	10,968	10,034	10,506	10,693	11,171	11,076	11,355	11,635
Santa Clara	6,305	5,679	5,364	5,679	5,739	5,800	6,097	6,432
Sonoma	4,155	3,967	3,851	4,003	3,909	4,224	4,731	5,514
San Mateo	5,474	4,696	4,844	4,664	4,815	5,007	5,293	5,300
Marin	4,382	4,295	4,327	4,435	4,694	4,772	4,791	5,001

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