



SOUTHERN CALIFORNIA  
ASSOCIATION of GOVERNMENTS

# Economic Benefits from Accelerating Transportation Infrastructure Investment

---

Dr. Marlon G. Boarnet & Dr. Wallace Walrod  
Orange County Business Council

Appendix by Scott Nystrom  
REMI, Inc.



December 2012

[www.scag.ca.gov](http://www.scag.ca.gov)

# Economic Benefits of Accelerating Five Years of Projects

## BACKGROUND

In April of 2012, the Southern California Association of Governments unanimously approved the 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy.

The 2012-2035 RTP/SCS is a long-range plan that improves overall mobility, reduces greenhouse gases and enhances the quality of life for the region's residents and will create approximately 500,000 jobs per year over the life of the plan by increasing the global competitiveness of Southern California.

But with the region's economy in a slow recovery, how can transportation investments accelerate Southern California's Economic Recovery.

## THE QUESTION

Transportation projects face many hurdles to faster project delivery methods, including funding availability challenges, environmental review process issues, and other process uncertainties such as agency coordination. Many opportunities exist for transportation project delivery streamlining and expediting (such as "Breaking Down Barriers", "America Fast Forward", Process Reforms, Updating CEQA, etc.). According to Caltrans, the average major transportation project takes 17 year to complete. What are the economic benefits of accelerating the building of these projects faster, construction jobs now and increasing the regions competitiveness sooner? In short, what is the real cost of delay?

## THE METHODOLOGY

SCAG engaged prominent economists from throughout the SCAG region to answer the question. Without focusing on the how the projects were moved forward, the economic team developed methods to analyze the impacts to the economy of moving a 5 year tranche of the 2012-2035 RTP/SCS forward 5 years. Investment planned for 2021-2025, were added to the investments committed in 2016-2020. And the benefits the plan achieved in 2025, air quality, greenhouse gas reduction, mobility, were assumed to be realized in 2020. The team used the REMI TranSight Model to analyze the results, the same economic impact model that was used to estimate the economic benefits of the SCAG 2012-2035 RTP/SCS.

## Benefits of Accelerated Project Delivery:

### CONSTRUCTION – JOB CREATION

- ▶ Direct – Number of construction jobs created during the construction and maintenance period.
- ▶ Indirect – Creation of additional jobs when construction firms contract for materials or services.
- ▶ Induced – Additional job creation resulting from the expenditure of wages earned.

### NETWORK – INFRASTRUCTURE ENHANCEMENT LEADS TO ENHANCED EMPLOYER/EMPLOYEE MATCH

- ▶ Commuting – Increased employee productivity resulting from a decrease in commuting time.
- ▶ Access – Improved movement of goods within the region.
- ▶ Transport – Enhanced transportation of goods from production to point of sale.

### OPERATIONS – IMPACT OF IMPROVED TRANSPORTATION SYSTEM

- ▶ Reduction in travel time, emissions, fuel consumption and vehicle operating costs. In addition, an increase in road safety and preservation of system infrastructure.

### CONSTRUCTION COST SAVINGS

- ▶ Advancing five years of projects results in a decrease in construction cost by \$1.25 – 1.95B (or 5-9% per year).

## QUICK FIGURES

	JOBS PER YEAR	5 YEAR GDP GROSS
<b>CONSTRUCTION JOBS</b> 	102,143	\$35.1B
<b>NETWORK BENEFITS</b> 	120,639	\$71.2B
<b>OPERATIONS</b> 	83,654	\$49.8B

CONSTRUCTION COST SAVINGS		
	\$1.25-1.95B <i>per year average</i>	\$6.8-9.9B <i>5 year period</i>

# Economic Benefits from Accelerating Transportation Infrastructure Investment



## Contents

<b>I. BACKGROUND .....</b>	<b>2</b>
<b>II. THE CASE FOR INFRASTRUCTURE ACCELERATION: ECONOMIC BENEFITS FROM CHANGES TO TRANSPORTATION SPENDING.....</b>	<b>2</b>
<b>III. BENEFITS OF RTP ACCELERATION .....</b>	<b>3</b>
<b>IV. FINANCING COST OF ACCELERATION.....</b>	<b>5</b>
<b>V. AN EXAMPLE.....</b>	<b>5</b>
<b>VI. AN EXAMPLE, JOB GROWTH FROM PROJECT ACCELERATION.....</b>	<b>9</b>
<b>VII. SUMMARY .....</b>	<b>10</b>
<b>METHODOLOGICAL APPENDIX, ORIGINAL DRAFT BY SCOTT NYSTROM, REMI.....</b>	<b>11</b>

# Economic Benefits from Accelerating Transportation Infrastructure Investment

---

## I. BACKGROUND

The 2011 Caltrans Statewide Transportation System Needs Assessment (2011 Caltrans Needs Assessment) and the 2012 Caltrans Program Review identified two key issues facing California’s transportation infrastructure:

- a statewide funding gap of approximately \$295 billion for the 10-year time period through 2020, and
- the need for mechanisms to “Accelerate Project Delivery.”

Despite increasing demands on Southern California’s transportation systems, transportation funding has not kept pace. The purchasing power of traditional funding sources, such as the gasoline tax, has decreased over time because of increased fuel efficiency and rising construction costs. The 2011 Caltrans Needs Assessment estimated that the California transportation system has only about 43% of funding capacity for system preservation over the next 10 years and only 48% for system management and expansion, amounting to almost \$30 billion per year and over \$295 billion for the ten year period.

“Accelerate Project Delivery” is one of 9 stated Policy Recommendations in the 2011 Caltrans Needs Assessment:

“Extended processing time for environmental clearances, federal permits, and reviews increases project costs and delays the creation of thousands of jobs. These delays need to be addressed, without undermining the intent of the requirements. With resources constrained, now is the time to modernize current processes so that transportation systems can be improved faster (2011 Caltrans Needs Assessment, Chapter 7, pages 9-10), listing mechanisms such as simplification of federal approval processes, encouragement of agency partnerships to cut time, and elimination of duplicative regulations.

The Southern California Association of Governments (SCAG) asked the SCAG economic team to analyze the economic benefits of project acceleration and potential costs savings associated with expediting project delivery. In late 2012, the SCAG economic team analyzed the economic benefits of accelerating the Southern California Association of Governments (SCAG) 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy (RTP) expenditures. For simplicity, the SCAG economic team modeled a five-year acceleration timeframe. While the time period for possible accelerations may vary in actual policy settings, the results presented here are illustrative of the potential benefits from more rapid delivery of the 2012-2035 RTP.

There are, broadly, two mechanisms that could lead to accelerated delivery of the RTP program: (1) regulatory reform, most pertinently expedited project delivery as outlined in the 2011 Caltrans Statewide Transportation System Needs Assessment, or (2) accelerated financing, likely by borrowing against future tax revenues to build projects more rapidly than would otherwise be possible. The SCAG economic team focused on the benefits of project acceleration, and so do not distinguish between the possible mechanisms or methods for acceleration, both of which may have policy or financial costs.

## II. THE CASE FOR INFRASTRUCTURE ACCELERATION: ECONOMIC BENEFITS FROM CHANGES TO TRANSPORTATION SPENDING

The acceleration of project implementation and delivery has a great impact on the economy. In Particular, as documented in a recent study by the Federal Reserve Bank of San Francisco, found the benefits are more impactful during the periods of recession, slow recovery, and slow growth and can have large multipliers on state economies.[1] The Federal Reserve Bank study used impulse response functions to examine the role of sudden infusions of infrastructure spending. The multiplier effect from shocks to highway spending was roughly 3 in early years (an extra dollar of infrastructure spending was associated with an additional three dollars in state economic output), growing to a multiplier that is almost 8 from six to eight years after the initial shock to infrastructure spending. The importance of this result is twofold: the multiplier effect reaches a peak several years (six to eight years) after the initial shock, and the peak multiplier is large.

This result is part of a growing body of evidence that transportation infrastructure spending is associated with two distinct sources of economic growth – initial construction jobs and later improvements in economic productivity that flow from the completion of new transportation projects. Recent academic studies give evidence for both effects – short-term construction jobs and longer-term productivity improvements – from highway spending. For example, Hymel found evidence that lower traffic congestion was associated with higher employment levels.<sup>1</sup>

<sup>1</sup> Kent Hymel, “Does traffic congestion reduce employment growth?” Journal of Urban Economics, 2009, vol. 65, pp. 127-135.

The San Francisco Federal Reserve Bank study found that the largest simulative effects from highway infrastructure were from the spending authorized in the 2009 American Recovery and Reinvestment Act (ARRA), and the authors speculated that highway spending might be particularly simulative during periods of slack economies.[2] On net, the San Francisco Federal Reserve Bank study suggests that an abrupt increase in highway spending can bring two effects – near-term economic boosts from the construction spending and medium-term economic boosts from higher productivity and hence increased economic competitiveness. The evidence suggests that the multiplier effect from unanticipated increases in highway spending.

### III. BENEFITS OF RTP ACCELERATION

The benefits of accelerated RTP delivery are twofold: avoiding inflation in project construction costs, and realizing project benefits sooner.

#### A. Inflation Costs

Caltrans forecasts inflation costs for transportation projects in California.<sup>2</sup> In the past several decades, the cost of urban transportation projects has increased faster than consumer price indices. For example, the Caltrans highway construction cost index increased at an annual average rate of 5.3 percent from 1972 through 2011, while the U.S. Bureau of Labor Statistics consumer price index (all urban consumers, Los Angeles metropolitan area) increased at an annual average rate of 4.5 percent during that time period.<sup>3</sup>

The SCAG economic team modeled a five-year acceleration in RTP construction. Assume that the average annual inflation rate during the five year period is “i”, and construction of a five-year program will cost \$Y<sub>t</sub> each year, and let “t” index each of five years in the construction program. Moving each year forward by five years saves the amount shown below:

$$\sum_{t=1}^5 Y_t - \frac{Y_t}{(1+i)^5}$$

The savings, in each year, would be one fifth of the value above if expenditures were originally a constant \$Y each year. As an example, if construction inflation costs average 3 percent per year, moving construction forward five years will save 13.74 percent each year, and if construction inflation is 2 percent per year, moving projects five years forward saves 9.4 percent in each year.<sup>4</sup> Putting some realistic numbers behind that, the second five-year tranche of projected RTP expenditures averages \$18.9 billion per year.<sup>5</sup> Assuming a construction cost inflation rate of 2 percent implies that moving that entire tranche five years forward could save \$1.78 billion in current (accelerated year of expenditure) dollars. The estimates from a REMI economic impact model, described later, show savings from avoided inflation that are similar in magnitude.

Building projects sooner can save money if construction costs are increasing faster than available tax revenues will increase. Predicting the rate increase in tax revenues for transportation projects is beyond the scope of this report. We note that local sales tax revenues comprise 39 percent of forecast RTP revenues during the 25-year life of the program.<sup>6</sup> More generally, the rate of increase of tax revenues over time will depend on the mix of tax revenues, price and wage inflation, and the growth of the tax base. Because those factors were outside of the scope of this study, we focus on the historical pattern of highway construction cost increases.

<sup>2</sup> See <http://www.dot.ca.gov/hq/oppd/costest/Construction-Cost-Indices-and-Forecast-07-2012.pdf>, accessed Nov. 12, 2011.  
<sup>3</sup> See Appendix A, Price Index for Selected Highway Construction Items, Third Quarter ending Sept. 30, 2012, California Department of Transportation, [http://www.dot.ca.gov/hq/esc/oe/contract\\_progress/cost-index-summary.pdf](http://www.dot.ca.gov/hq/esc/oe/contract_progress/cost-index-summary.pdf), accessed Nov. 12, 2012. For the consumer price index, see U.S. Bureau of Labor Statistics, <http://www.bls.gov/cpi/#tables>.  
<sup>4</sup> The cost savings in any year is  $(1 - 1/(1+c)^5)$  for a constant inflation rate, “c”.  
<sup>5</sup> This is in nominal dollars. See 2012-2035 RTP, Transportation Finance appendix, p. 6, Southern California Association of Governments, adopted April, 2012, Table 7, p. 24, available at <http://rtpscs.scag.ca.gov/Pages/2012-2035-RTP-SCS.aspx>, accessed Nov. 12, 2012.  
<sup>6</sup> See 2012-2035 RTP, Transportation Finance appendix, p. 6, Southern California Association of Governments, adopted April, 2012, available at <http://rtpscs.scag.ca.gov/Pages/2012-2035-RTP-SCS.aspx>, accessed Nov. 12, 2012.

# Economic Benefits from Accelerating Transportation Infrastructure Investment

Caltrans has tracked a highway construction cost index annually since 1972. Table 1 shows the average annual rate of change in the California highway construction cost index for several time periods. Table 1 shows those average annual rates for several time periods. As a point of comparison, Table 1 also shows consumer price inflation increases measured by the rate of increase in the consumer price index for all urban consumers (CPI-U) for the Los Angeles metropolitan area.

Note that from 1972 through 2011, highway construction costs in California increased faster than consumer price inflation. The difference in the increase in highway costs and consumer prices during that period is an annual rate of 0.76 percent. There are variations in highway and consumer price inflation across different time periods. For example, in the low price inflation decades of the 1980s and 1990s and again from 2005 through 2010, consumer prices increased faster than highway construction costs. The most rapid increases in highway construction costs were during the rapid homebuilding years of the 1970s and the first half of the 2000s. Looking forward, the past few years have seen declines in the cost of highway construction, reflecting the deep recession in construction more generally and slack demand for the commodities and labor that are inputs to highway construction. Yet there are signs that the residential construction sector may soon recover, and if that recovery leads to renewed growth in the housing and homebuilding markets, as was the case following the housing market busts of the early 1970s and the early 1990s, then periods of more rapid highway construction cost will likely again be part of California's future. Forecasting the time path of changes in infrastructure construction costs is uncertain and, again, not within the scope of this research, but the data in Table 1 suggest that over the long-term periods of slowly increasing highway costs have been followed by periods of more rapid highway cost increases in California.

**TABLE 1: CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX AND CPI-U (LOS ANGELES), PERCENT ANNUAL CHANGE**

Time Period	Highway Construction Cost Index	CPI-U, Los Angeles Metro Area
<b>1972-2011</b>	5.28%	4.52%
<b>1972-1980</b>	13.03%	9.20%
<b>1980-1990</b>	3.89%	4.97%
<b>1990-2000</b>	1.95%	2.36%
<b>2000-2010</b>	3.68%	2.79%
<b>2000-2005</b>	12.89%	3.30%
<b>2005-2010</b>	-4.78%	2.28%

Source: Price Index for Selected Highway Construction Items, California Department of Transportation, available at: [www.dot.ca.gov/hq/esc/oe/contract\\_progress/cost-index-summary.pdf](http://www.dot.ca.gov/hq/esc/oe/contract_progress/cost-index-summary.pdf), accessed Dec. 18, 2012, and CPI-U, Los Angeles, from U.S. Bureau of Labor Statistics, [www.bls.gov](http://www.bls.gov).

## B. RTP Benefits Delivered Sooner

If the RTP is delivered more quickly, the program's benefits – such as congestion reduction or economic boosts from construction spending– will be realized sooner. The RTP benefits can be divided into two groups – construction spending, which employs persons and increases economic activity, and the transportation benefits that flow from the RTP itself (reduced congestion, improved air quality, and broader economic benefits from a well-functioning transport system.)

**Construction Spending:** The economic benefit of RTP spending has been modeled as direct, indirect, and induced benefits of the spending program.<sup>7</sup> The direct benefits are the spending (and hence jobs) created by employing persons to build or maintain the RTP projects. The indirect benefits are the jobs created when firms involved in construction or maintenance purchase inputs from other firms – e.g. when engineering companies purchase business services or when a construction firm buys raw materials or equipment. The induced benefits are the job-creation effect when the wages paid in direct and indirect benefits percolate through the economy as persons have more income and hence buy more of all kinds of goods and services. Note that these benefits have been calculated as part of the economic analysis of the RTP, and those calculations account for the fact that some spending will stay within the SCAG region (and hence boost the SCAG economy) and some spending will be purchases of goods and services from outside the SCAG region. Moving a five-year tranche of RTP spending forward will accelerate the economic benefits, direct, indirect, and induced, of the construction program. That is part, but not all, of the RTP's economic benefits.

<sup>7</sup> For details, see Chapter 8 of the 2012-2035 RTP, available at <http://rtpscs.scag.ca.gov/Documents/2012/final/f2012RTPSCS.pdf>, accessed Nov. 12, 2012.

---

**Network Benefits:** The RTP will also produce benefits for users of the transportation system and the RTP will enhance the economic competitiveness of the SCAG region more generally by allowing firms to access larger market areas for labor, intermediate inputs, and output. All of these have been modeled in the RTP economic analysis. The network benefits are a permanent flow, although they can vary year to year.

The benefit of moving a five-year tranche of RTP projects forward is realizing construction benefits (direct, indirect, and induced) and network benefits sooner. Given the choice between, for example, reducing their daily commute by ten minutes each day now, and getting the same travel time savings a year from now, most persons would prefer to realize the benefit now. The discount rate incorporates that time preference. Discount rates are a way to measure how persons differentially value benefits today versus benefits in the future. If persons have a discount rate of 5 percent, a benefit that is worth \$100 next year is worth \$95.24 now. Equivalently, persons would have to be paid to wait – if they value something by \$95.24 today (e.g. reducing their commute time), they would be indifferent between getting the \$95.24 benefit today or the \$100 benefit next year. Given that benefits in the future are less valuable than benefits realized today, moving RTP benefits forward is an advantage.

## IV. FINANCING COST OF ACCELERATION

There are two possible paths for acceleration – regulatory reform or borrowing against future revenue streams. This research did not analyze regulatory reform in detail, but we note that the 2011 Caltrans needs assessment cited accelerated project delivery as a policy recommendation. Similarly, a detailed analysis of borrowing costs is beyond the scope of the current research. We note, though, that in general terms borrowing to accelerate project delivery will create societal benefits if the effect of moving benefits forward in time (e.g. congestion reduction, improved air quality, increase economic competitiveness) outweighs the financing costs. If the benefits of more rapid delivery exceed the costs of borrowing, a region or state is better off by borrowing to deliver the project more quickly. Given the limited scope of the current analysis, the SCAG economic team only quantified the benefits of project acceleration. Note that the estimates in this report are upper bounds of net benefits, in effect assuming costless RTP acceleration.

## V. AN EXAMPLE

To give a more concrete example, the SCAG economic team used the REMI economic impact software to model the effect of moving a five-year tranche of the RTP forward five years. The SCAG economic team modeled the effect of moving RTP spending which was originally scheduled for years 2021 through 2025 forward to the 2016-2020 time period and reported two sets of benefits – the benefits from avoided construction inflation and the effect of moving the project delivery, and hence project benefits, forward five years.

# Economic Benefits from Accelerating Transportation Infrastructure Investment

## A. Avoided Construction Inflation

The Table 2 shows results of moving each year of the 2021 to 2025 program forward five years. The savings, indicated in the table, are from avoiding construction inflation.

**TABLE 2: AVOIDED CONSTRUCTION INFLATION, SCAG REGION, IN MILLIONS OF 2012 DOLLARS**

Move spending forward:	2021 to 2016	2022 to 2017	2023 to 2018	2024 to 2019	2025 to 2020
SCAG Region Savings	\$2,128	\$2,047	\$1,970	\$1,896	\$1,820

Source: REMI model estimates. See appendix for details.

## B. Moving Benefits Forward

Using the REMI model, the SCAG economic team subtracted the savings from avoided inflation from the expenditures in each year, 2021 through 2025, and then moved that amount forward to 2016 to 2020. That avoids double counting inflation savings, moving forward only the amount needed to build in, e.g., 2016 the same projects that would have been built in 2021. The SCAG economic team then used REMI to calculate the benefits from expenditures in three groups, construction impacts (from direct, indirect, and induced effects of the expenditure plan), network benefits (from improved labor market matching, in-migration of persons and firms into the region due to improved economic competitiveness, and the like), and operations benefits (reduced environmental externalities and reduced fuel costs due to faster travel.) The values shown in Table 3 are the incremental benefits, in each year, beyond the benefits of implementing the RTP.

**TABLE 3: INCREASED BENEFITS FROM MOVING RTP FORWARD, IN BILLIONS OF 2000 DOLLARS**

Benefits	2021 to 2016	2022 to 2017	2023 to 2018	2024 to 2019	2025 to 2020
Construction	8.211	7.614	7.076	6.424	5.773
Network	4.298	8.933	13.99	19.423	24.555
Commute	-0.053	-0.167	-0.351	-0.613	-1.257
Access	2.126	4.409	6.904	9.601	12.476
Transport	2.216	4.655	7.354	10.283	13.12
Externalities & Fuel Costs	4.104	6.75	9.629	12.705	15.983
<b>Total</b>	<b>16.613</b>	<b>23.297</b>	<b>30.695</b>	<b>38.552</b>	<b>46.311</b>
Percent of RTP baseline benefits	1.00%	1.37%	1.75%	2.14%	2.49%
<b>Percent of Net Benefits from:</b>					
Construction	49.43%	32.68%	23.05%	16.66%	12.47%
Network	25.87%	38.34%	45.58%	50.38%	53.02%
Externalities & Fuel Costs	24.70%	28.97%	31.37%	32.96%	34.51%

Source: REMI model estimates. See appendix for details.

Note: Benefits are the increment above the nominal benefit realized in, e.g., 2021, from moving expenditure forward to 2016.

Note that, on net, the total benefits in each year of moving the RTP forward ranges from 1 to 2.49 percent of the base year RTP benefits. For example, the incremental increase in RTP benefits from moving year 2021 spending forward to 2016 are 1 percent of the year 2021 RTP benefits. The SCAG economic team suggests focusing on those percentage changes. The REMI model requires several assumptions when calculating benefits, but comparing only the percentage change in benefits over the non-accelerated RTP baseline (1 to 2.49 percent increases) includes those assumptions in both the numerator and denominator, and hence is likely less sensitive to specific assumptions than the dollar value changes in benefits.

Consider the three categories of benefits in Table 3. Note, that the nominal value of construction benefits drops over the time period, constituting only 12.47% of the total net nominal value of the benefits in 2020. Network benefits are the competitiveness effects, which are, in the terminology of economics, characterized by increasing returns to scale. The network benefits include, for example, higher productivity from labor market effects and in-migration of persons and firms. If those occur earlier, the increase in competitiveness cumulates and can grow larger. The network benefits do grow larger, in nominal dollars, over time, constituting 53.02% of the total incremental benefits in 2020. Lastly, the external and fuel cost benefits are mostly the benefits that accrue to road users from more efficient operation of the transportation system (i.e. lower travel times.) Moving projects forward allows time saving infrastructure projects to be built in years when population in the region is (slightly) lower, when traffic is lower, and hence when the marginal impact of the projects can be larger. This is likely what is happening with the external and fuel cost benefits.

The changes in benefits in Table 3 do not reflect the fact that benefits are realized five years sooner – the values in Table 3 do not reflect the time value of money.

# Economic Benefits from Accelerating Transportation Infrastructure Investment

Table 4 provides some insights into the time value (or discounting) effect. The REMI model’s Transight module was used to calculate RTP transportation project benefits in 2021 through 2025, and those benefits are converted into equivalent present values in 2016 through 2020 at three different assumed discount rates of 3, 5, and 7 percent. Each of the values in Panel 1 of Table 4 shows the value of RTP benefits that are equal to the future value, five years later, from the original (not accelerated) RTP program. Those values are used as a baseline for Panel 2. In Panel 2, the incremental RTP benefits from Table 3 are shown as a percentage of the RTP benefits, moved forward five years as a present value. The effect of the five-year RTP acceleration is to deliver increased benefits that range from 1.8 to 5.5 percent of the equivalent present value of RTP benefits, depending on assumptions about the discount rate.

**TABLE 4: TIME VALUE OF THE INCREMENTAL CHANGE IN RTP PROGRAM FIVE-YEAR ACCELERATION**

<b>Panel 1: Equivalent five-year accelerated present value of RTP benefits, in billions of dollars</b>			
<b>Year</b>	<b>Discount Rates:</b>		
	<b>3%</b>	<b>5%</b>	<b>7%</b>
2016	906.538	823.428	749.2957
2017	931.0076	845.6543	769.521
2018	956.64	868.9368	790.7074
2019	983.2869	893.1407	812.7322
2020	1010.992	918.306	835.6319

<b>Panel 2: RTP five-year acceleration incremental benefits, as a percentage of the equivalent value of total RTP benefits moved five years forward</b>			
---	--	--	--

*Benefits are equivalent to future value equal to RTP benefits five years forward; Percent increase over base RTP benefits, at discount rate shown*

	<b>additional benefit</b>	<b>3%</b>	<b>5%</b>	<b>7%</b>
2016	16.613	1.83%	2.02%	2.22%
2017	23.297	2.50%	2.75%	3.03%
2018	30.695	3.21%	3.53%	3.88%
2019	38.552	3.92%	4.32%	4.74%
2020	46.311	4.58%	5.04%	5.54%

Source: REMI model and authors’ calculations.

## VI. AN EXAMPLE, JOB GROWTH FROM PROJECT ACCELERATION

The economic impacts from the REMI model can also be expressed in terms of increased job creation, as opposed to the dollar value of regional output. To give insights into job creation that flows from project acceleration, the results of REMI model simulations of moving the 2021-2025 tranche of RTP projects forward five years were also expressed in terms of increased employment in the SCAG region. Details of the REMI model approach are in the appendix to this report. The results, in terms of additional jobs per year (in 2016-2020) due to the five-year acceleration of the RTP, are described below. As before, the results are based on moving RTP investments originally scheduled for 2021-2025 forward five years to 2016-2020, while leaving all other aspects of the RTP the same.

The REMI model indicates that moving 2021-2025 projects forward five years will produce 102,143 new jobs per year during the 2016-2020 time period. Note, though, that some of the stimulative economic impact of the spending in 2021-2025 would be lost if the acceleration simply moves projects forward, leaving less spending that was originally envisioned in the 2021-2025 time period. Still, there will be benefits from realizing the economic stimulus and transportation improvements earlier (the time value of money) and from avoided inflation. Recent research from the Federal Reserve Bank of San Francisco suggests that one-time increases in transportation spending have multiplier effects that can last from six to eight years beyond the initial construction spending, implying that improvements in the transportation network cumulate and grow during those years.<sup>8</sup> The Federal Reserve Bank authors found that the multiplier effect from increases to transportation investment can grow larger than previously anticipated – in their estimates, the multipliers were as large as six to eight several years after the initial increase in investment.<sup>9</sup>

Part of the multiplier effect that the Federal Reserve Bank authors estimated is likely due to increases in economic competitiveness from transportation investment. In the REMI model, those increases in investment are network benefits and operations benefits. The network benefits flow from improved labor market matching and better transportation access from businesses to suppliers and customers, and the REMI estimate of network benefits from the five-year RTP acceleration is 120,639 new jobs per year in 2016-2020. The benefits from operations improvements (which include improvements in air quality, safety, congestion reduction, and resulting reductions in fuel expenditures) from the five-year RTP acceleration are estimated to be 83,654 new jobs per year from 2016 to 2020. For both the network and operations improvements, the estimates from the REMI model were adjusted downward by a factor of 0.69, based on comparisons of the REMI model results and econometric estimates in the literature, using a method described in the initial RTP economic analysis.<sup>10</sup> Table 5 uses the same approach as in the original RTP economic analysis to give low, high, and medium estimates of the economic impacts of the five-year RTP acceleration.

**TABLE 5: RANGE OF EMPLOYMENT IMPACTS, FIVE-YEAR RTP ACCELERATION, IN JOBS PER YEAR**

	high	medium	low
Construction jobs	148,033	102,143	56,253
Network benefits	174,839	120,639	66,439
Operations benefits	121,238	83,654	46,070

Source: REMI model estimates. See appendix for details.

Note: Results are jobs per year from moving the 2021-2025 RTP tranche forward five years, and the results are the additional employment, beyond the impact of the original RTP program, in years 2016-2020. The “high” estimates are from the REMI model, the “low” estimates adjust the REMI model downward based on a recent econometric study<sup>11</sup>, and the “medium” estimates are mid-way between high and low.

<sup>8</sup> Sylvain Leduc and Daniel Wilson, “Roads to Prosperity or Bridges to Nowhere? Theory and Evidence on the Impact of Public Infrastructure Investment,” Federal Reserve Bank of San Francisco, paper prepared for 2012 NBER Macroeconomics Annual Conference, available at <http://www.nber.org/chapters/c12750.pdf>, accessed December 18, 2012.

<sup>9</sup> Ibid.

<sup>10</sup> See Chapter 8 of the 2012-2035 RTP, available at <http://rtpscs.scag.ca.gov/Documents/2012/final/f2012RTPSCS.pdf>, especially pp. 223-227, accessed Nov. 12, 2012.

<sup>11</sup> Hymel, Kent. 2009. Does traffic congestion reduce employment growth? *Journal of Urban Economics* 65: 127–135.

# Economic Benefits from Accelerating Transportation Infrastructure Investment

---

## VII. SUMMARY

The effect of moving the RTP forward will be two classes of benefits – avoided inflation and earlier realization of program benefits. Avoided inflation can be expected to be on the order of a 9 to 13 percent reduction in nominal costs if inflation is at a rate of 2 to 3 percent and projects are moved forward five years. REMI model runs suggest that moving RTP spending five years forward results in a savings from 1.8 to 2.1 billion dollars (nominal dollars) in savings in each year that was modeled.

Moving the RTP forward also moves benefits forward. Some of those benefits, such as network effects, are increases in regional competitiveness that cumulate over time. Moving improvements in economic competitiveness forward will encourage immigration of productive workers and firms, and better labor market matches, and those effects will grow larger over time. In any one of the five years modeled, moving RTP benefits forward five years will increase the flow of RTP benefits by from 1 to 2.49 percent. Converting the original RTP benefits into an equivalent present value, the increase in benefits from moving the RTP forward five years is from 1.8 to 5.4 percent of total RTP benefits in the same year.

Expressing benefits in terms of jobs per year, a five-year acceleration yielded REMI estimates of 102,143 new construction jobs per year, 120,639 new jobs per year from network benefits, and 83,654 new jobs per year from operations benefits.

## METHODOLOGICAL APPENDIX, ORIGINAL DRAFT BY SCOTT NYSTROM, REMI

Edited by Dr. Marlon Boarnet and Dr. Wallace Walrod

The TranSight simulations for the original RTP had inputs from four major categories:

1. “Network effects” – these collectively illustrated the economic benefit of “closing the distance” between economic actors on the travel network. This process relies on data from a travel demand model (TDM), and comes in three forms...
  - a. Commuting = household-to-business transactions in the form of labor, and better commuting leads to higher labor productivity due to a better employer-to-employee match and general stability throughout the network
  - b. Access = business-to-business transactions, which quantifies the ease of movement of intermediate goods between regions and the associated strength of local supply chains and the propensity of the local economy to cluster
  - c. Transport = business-to-household transactions quantifying the cost of transportation between points of final production and final sale/consumption
2. Amenity/operations – this is a measurement of non-economic costs and benefits of a project (such as air quality, travel times, or safety) and the direct savings to liquid fuels costs and “wear ‘n’ tear” to vehicles from more efficient network operations
3. Construction, design, and transit inputs – these are the direct investments on the part of state, local, and federal governments to improve the network through construction projects, A&E support for those projects, O&M, and transit project operations
4. Financing (a combination of different taxes for #3)

For this acceleration of a five-year portion of the RTP, the SCAG economic team considered each of these subcategories in a different way per the data and this methodology (except for financing, which we left alone).

### Network Effects

REMI did not run a whole new set of travel demand simulations for this project. Instead, the SCAG economic team estimated the relative difference in network effects from the previous “all or nothing” RTP data. TranSight calculates its network effects based on the proportional differences in a few transportation factors—system speed (VMT/VHT), rate of deliveries (trips/VHT), and average length of trip (VHT/trips). The SCAG economic team estimated the new network effects using an interpolative methodology from the old data.

### Travel Demand Methodology

This study involves three simulations, business as usual (BAU), the original RTP, and a five-year acceleration of RTP expenditures moving 2021-2025 into 2016-2020. This gives us two deltas, from BAU to the original RTP (RTP impact) and from RTP to acceleration (Acceleration impact.)

# Economic Benefits from Accelerating Transportation Infrastructure Investment

---

The original SCAG travel demand data included three *de facto* points of data:

- The present day (all zeroes)
- 2020
- 2035

REMI followed the standard procedure of interpolating between these points in a linear fashion. For moving the RTP projects of 2021 to 2025 up to 2016 to 2020, we explicitly assumed that the network achieves the same efficiency in 2020 under the acceleration *that it would have under the old plan in 2025*. In practice, we “drew a parallel” line (the blue) from 2025 on the gold graph to 2020, fixed that as a point, fixed 2015 on the gold line as a point (where they would diverge), and drew a new interpolation from 2016 to 2020 in the form of the green line. In essence, the acceleration’s network effects are the difference between the green line and the gold line from 2016 to 2020.

This is not as perfect of a simulation as another travel demand run; however, it is a good estimation. The SCAG-wide economy and population will not look the same in 2025 as they do in 2020. A higher population in 2025 will mean that these network efficiencies will effect more people and create a greater economy of scale. This would argue for an overestimation of the benefits of moving things up, in a linear fashion, to 2020. However, at the same time, a smaller population from 2016 to 2020 under the acceleration will enjoy greater benefits on the same projects and corridors as a larger population later on (simply due to capacity issues), so there is a reason to argue for *underestimation*, as well. The net of the two is impossible to determine without another weeklong travel demand simulation, so REMI and the SCAG economic team made the most reasonable and conservative “middle” assumption in the data here.

## Amenity/Operations

For these categories, REMI converted the original savings from the RTP into fixed dollars and moved them forward by five years for those savings from 2021 to 2025. This movement and assumption is consistent with the assumptions about the travel demand data and network, which is the source for these savings (travel time, safety, emissions, fuel costs, and depreciation of capital), too.

## Construction, Design, and Transit

REMI TranSight endogenously estimates the internal rate of inflation by industry and by region based on the costs of production (the costs for intermediate goods, labor, capital, and fuel). Using these price indices (PI), the SCAG economic team took the original spending and multiplied it by this factor:

$$\text{Original Spending}_t * (PI_{t-5} / PI_t) = \text{New Spending}_{t-5}$$

Thereby:  $\text{Inflation Savings} = \text{Original Spending} - \text{New Spending}$

.....



**SOUTHERN CALIFORNIA  
ASSOCIATION of GOVERNMENT**

818 West 7th Street, 12th Floor  
Los Angeles, CA 90017  
(213) 236-1998 | [www.scag.ca.gov](http://www.scag.ca.gov)

**REGIONAL OFFICES**

**Imperial County**

1405 North Imperial Avenue, Suite 1  
El Centro, CA 92243  
Phone: (760) 353-7800  
Fax: (760) 353-1877

**Orange County**

OCTA Building  
600 South Main Street, 9th Floor  
Orange, CA 92863  
Phone: (714) 542-3687  
Fax: (714) 560-5089

**Riverside County**

3403 10th Street, Suite 805  
Riverside, CA 92501  
Phone: (951) 784-1513  
Fax: (951) 784-3925

**San Bernardino County**

Santa Fe Depot  
1170 West 3rd Street, Suite 140  
San Bernardino, CA 92418  
Phone: (909) 806-3556  
Fax: (909) 806-3572

**Ventura County**

950 County Square Drive, Suite 101  
Ventura, CA 93003  
Phone: (805) 642-2800  
Fax: (805) 642-2260