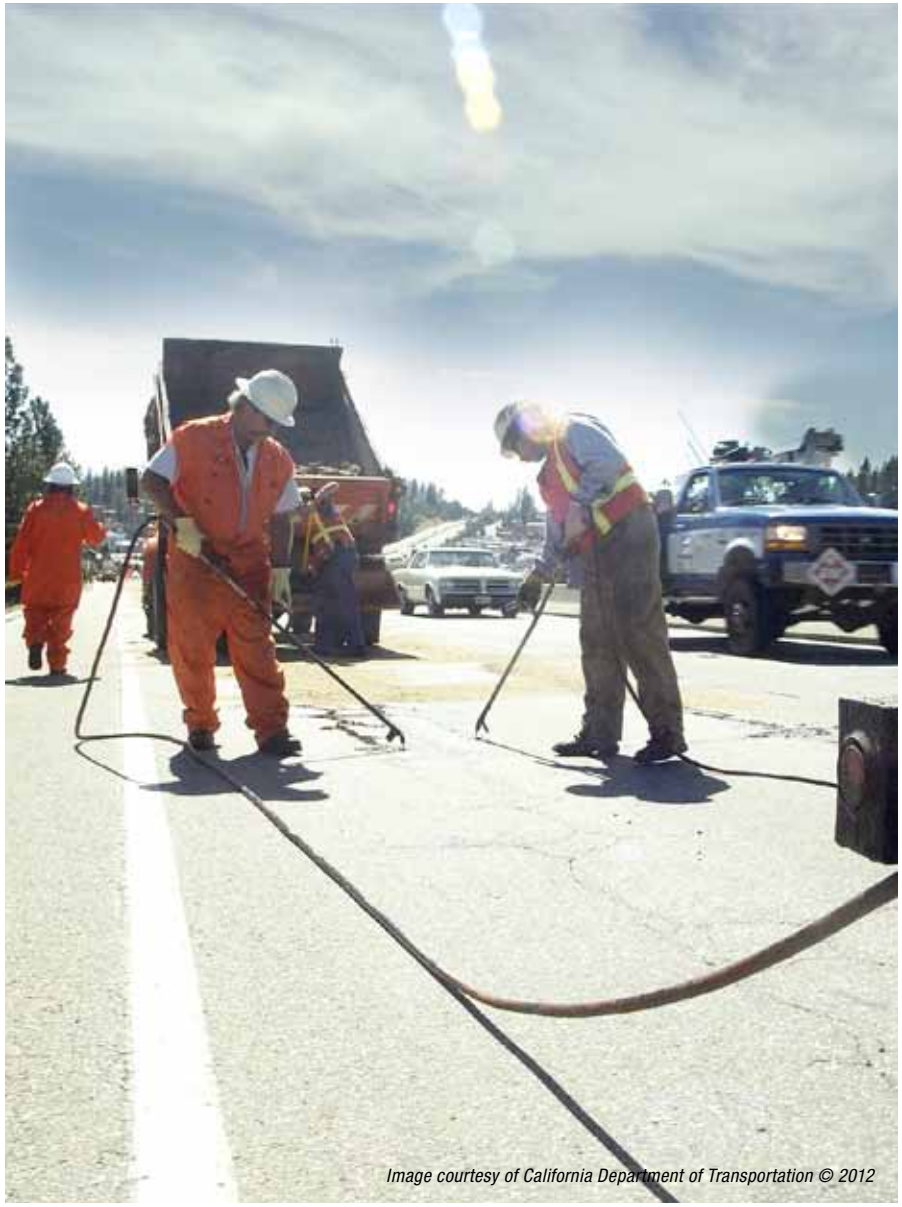
08 ECONOMIC AND JOB CREATION ANALYSIS



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Economic Advisors: *Wallace Walrod, PhD, Christine Cooper, PhD, John Husing, PhD and Marlon Boarnet, PhD*

Southern California's transportation infrastructure paves the way for economic recovery and job creation.

Executive Summary

Southern California faces its toughest economic climate in modern times. High unemployment, lack of job growth, waning competitiveness, aging infrastructure and environmental challenges have combined to present today's leaders with unparalleled challenges. Never before have the crucial linkages and interrelationships between the economy, the regional transportation system, and land use been as important as now. SCAG has thus chosen to view the 2012 RTP/SCS as an economic development strategy as well as a transportation, infrastructure and sustainability strategy.

For the first time, SCAG's RTP includes a significant consideration of the economic impacts and opportunities provided by the transportation infrastructure plan set forth in the 2012–2035 RTP/SCS. This analysis considers not only the economic and job creation impacts of the direct investment in transportation infrastructure, but also the efficiency gains in terms of worker and business economic productivity and goods movement. The 2012–2035 RTP/SCS outlines a transportation infrastructure investment strategy that will beneficially impact Southern California, the state, and the nation in terms of economic development, competitive advantage, and overall competitiveness in the global economy in terms of attracting and retaining employers in the Southern California region.

Implementation of SCAG's RTP/SCS will create or sustain jobs today to build transportation infrastructure projects for tomorrow. SCAG's 2012–2035 RTP/SCS, totaling more than $500 billion in transportation investments, will put thousands of Southern Californians back to work in much needed jobs, not only in construction, but in a broad cross-section of industries. To quantify the economic impact of the plan's implementation, SCAG used data and software from Regional Economic Models, Inc. (REMI) to produce county-level and statewide models depicting the economic and demographic

activity of the region. All of the economic analysis of the plan was conducted using REMI models. The findings show that over the twenty-five year period and six-county SCAG region, the plan will generate significant employment. An annual average of 174,500 new jobs will be generated by construction and operations expenditures that are specified in the RTP program, and the indirect and induced jobs that flow from those expenditures. An additional 354,000 annual jobs will be created by the SCAG region's increased competitiveness and improved economic performance that will result from congestion reduction and improvements in regional amenities due to implementation of the 2012–2035 RTP/SCS. The rest of the state of California and nation will benefit from spillover impacts of additional accrued jobs.

- **Job growth from building the RTP infrastructure projects: average of 174,500 jobs per year**

  Over the 2012–2035 period, the RTP/SCS calls for the spending of over $500 billion on transportation improvement projects. The economic analysis shows this will create an average of 174,500 jobs per year across SCAG's six county region. The main beneficiaries will be construction workers, placing an employment floor under this volatile sector. However, job increases will also include workers in professional, supply and service firms that support the effort. Further, workers throughout the economy will feel the impact as construction-related workers and firms increase their spending in sectors like retailing and consumer services.

- **Increases in economic competitiveness and efficiency from completion of the projects: an average of 354,000 jobs per year**

  When investments are made in the transportation system, the economic benefits go far beyond the jobs created building it. Today's regional economy would be impossible if routes like Foothill Boulevard, rather than the Interstate system, were the only way to move people and goods within Southern California or to the rest of the U.S. In addition, unlike spending to satisfy current needs, infrastructure delivers benefits for decades. The increased long term efficiency of the system is thus a crucial result, delivering higher economic activity and job creation from three sets of activities:
  - **Reduced travel time.** Whether it is a commuter, a truck driver, a tourist or a firm awaiting crucial goods, lost time due to congestion is a cost to the economy. Reducing congestion thus adds economic activity and jobs.
  - **Increased labor access.** Southern California is a huge geographic area. The friction of distance means employers in one sub-area cannot easily access workers living in another. A more efficient transportation system, with increased mass transit systems, will create a more efficient and competitive labor market and add economic activity and jobs into the economy.
  - **Enhanced Transportation.** Supply chain managers favor Southern California because of the speed and reliability that goods can be moved around the region and from it to the rest of the U.S. As the economy expands, congestion robs the area of this competitive advantage. Increasing the efficiency of throughput would maintain and enhance these advantages and create extra economic activity and jobs.

- **Amenities and infrastructure system operations: an average of an additional 64,000 jobs per year**
  - **Amenities.** As the infrastructure system becomes increasingly completed, including its sustainable community provisions and pollution reductions, amenities such as lower health costs from improved air quality will add 46,000 jobs per year on average.
  - **Operations.** As investments are made in an enhanced Southern California transportation system, its operation will add an average of 18,000 jobs per year over the 2012–2035 period as transit systems come online and road maintenance and repair becomes necessary.

Looking forward, the socio-economic forecasts for the SCAG 2012–2035 RTP/SCS show that the region must not only recover from the devastation of the Great Recession, it must also prepare for the area's long term growth. Without making the investments in Southern California's transportation system outlined in this plan, economic recovery and job creation will be markedly slower throughout the region. The area would not enjoy the benefits of the long term competitiveness, efficiency and sustainability of modern infrastructure. In the longer term, failure to make sufficient regional transportation investments will cost Southern California economically and the region's business competitiveness will be at risk.

Introduction

Never before have the crucial linkages and interrelationships between the economy, regional transportation system, and land use been as apparent or important as now. For the first time, this RTP includes a significant consideration of the economic impacts and opportunities provided by the transportation infrastructure plan set forth in the 2012–2035 RTP/SCS, specifically considering not only the economic and job creation impacts of the direct investment in transportation infrastructure, but also the efficiency gains in terms of improved worker and business economic productivity and goods movement. The Goods Movement, Logistics & Distribution, Tourism, Manufacturing, and many other transportation reliant sectors are heavily dependent on efficient transportation infrastructure and are key Southern California job generators for all six SCAG-region counties. To illustrate this point, this chapter later drills down on the importance of goods movement to the SCAG regional economy. Also, the 2012–2035 RTP/SCS outlines a transportation infrastructure investment strategy that will beneficially impact Southern California, the state, and the nation in terms of economic development, competitive advantage, and overall competitiveness in the global economy in terms of attracting and retaining employers in the Southern California region.

During the 2007–2009 time period, the nation experienced the deepest and longest recession since the 1930's. Two years after the recession was officially determined to have ended, nearly 13 million Americans are still out of work, including more than 5.5 million who have been jobless for over six months. Job seekers outnumber available jobs by more than four-to-one. Most economists forecast that the nation will not generate enough jobs to return unemployment to 5 percent until the end of 2018, possibly 2020.

California has been hit even harder, enduring a jobs crisis not seen since the Great Depression. As the epicenter of the subprime mortgage industry and housing bubble, California entered the Great Recession earlier than most states, suffers from the second highest unemployment rate in the country (behind only Nevada), and is in the midst of one of the slowest economic and job recoveries in the nation. According to the state Employment Development Department (EDD), nearly 2 million Californians are officially unemployed, and the real number is likely much higher. California has 964,000 people who have been unemployed more than six months, with the majority of those (718,000) out of work a year or longer.

Southern California Economic Challenges

In Southern California, job losses have been devastating. In the 6-county SCAG region, over 1 million residents are officially unemployed. Although the real unemployment rates are probably much higher, as of January 2012, unemployment levels for the 6-county SCAG region are as follows:

Imperial County	26.4%
Los Angeles County	12.1%
Orange County	8.0%
Riverside County	12.5%
San Bernardino County	12.3%
Ventura County	9.7%

Source: California Employment Development Department

Several factors are responsible for Southern California's slower growth coming out of the 2007–2009 recession:

- Housing markets are not rebounding due to the overhang of foreclosures, "shadow inventory," and weak demand. UCLA economists recently predicted that Southern California home prices will not reach previous peaks until the 2017–2020 time period
- Rising oil prices
- End of federal stimulus programs
- The prospect of Government layoffs

Muted demand from Southern California consumers (consumer spending represents at least two-thirds of economic activity) who are still worried about their individual employment, home values, and financial situations.

The consequences of the Great Recession have battered the Southern California economy and impacted major economic sectors which traditionally have been key job generators throughout the SCAG region:

- Construction, finance and insurance, and management; and the professional and business services group performed much worse than the nation.
- Manufacturing and employment agencies had large absolute declines, but their percentage job losses were only a little larger than the nation.
- The large logistics sector lost a significant number of jobs, but that represented only a single digit percentage decrease.

Recovery has been slow and uneven throughout the SCAG region, resulting in Southern California facing both short and long term economic challenges.

- Significant job losses
- High unemployment rates
- Declining incomes
- Increased poverty

Most local and regional economic forecasts such as those produced by the Los Angeles County Economic Development Corporation, University of California Los Angeles Anderson School, California State University, Long Beach, California State University, Fullerton, and other leading institutions, do not project significant local/regional job growth until at least the 2014–2015 time period, and some particularly hard hit areas of Southern California will likely remain under economic pressure until the end of the decade.

Many Southern Californian's ask—when recovery finally takes hold, where will the region's job growth likely come from?

Implementation of SCAG's 2012–2035 RTP/SCS will create or sustain jobs today to build transportation infrastructure projects for tomorrow. The more than $500 billion in transportation investments of the 2012–2035 RTP/SCS will put thousands of Southern Californian's back to work in much needed jobs, not only in construction, but in a broad cross-section of industries highlighted later in this chapter. Without making these investments in Southern California's transportation system, economic recovery and job creation will be markedly slower throughout the region. In the longer term, failure to make sufficient regional transportation investments will cost Southern California economically and the region's business competitiveness will be at risk.

The SCAG region is home to approximately 18 million people, and supplies nearly 7.75 million jobs—making the SCAG region California's largest population and economic territory. Between now and 2035, SCAG forecasts project that job growth will increase nearly 1.2 percent a year, outpacing the rate of population growth over the same period. The SCAG region will grow to 22.1 million people by 2035, a 22.3 percent increase from 2010, or an average of 0.9 percent growth per year. Employment will grow to 9.4 million jobs by 2035, a 30.6 percent increase over 2010.

INFRASTRUCTURE INVESTMENT, ECONOMIC DEVELOPMENT, AND QUALITY OF LIFE

As indicated, SCAG has chosen to view the 2012–2035 RTP/SCS as an economic development strategy as well as a transportation, infrastructure and sustainability strategy. It has done so to deal with the profound challenges affecting the employment, prosperity, long term growth and air quality issues facing Southern California.

Fundamental to using the 2012–2035 RTP/SCS as an economic development strategy is an understanding of the relationship between infrastructure investment and the competitiveness, costs and efficiency of an economy. When a large region is knitted together by relatively uncongested freeway corridors and transit systems, economic life can be smoother and faster:

- Workers, otherwise in lengthy commutes, spend more leisure time with families and friends or more productive time at work.
- Companies have access to employees living throughout the region.
- Professionals and retailers can efficiently access clients in a wider geographic area.
- Importers, exporters, warehouses and producers see their supplies and products moving with the speed and reliability their schedules require.
- Amenities like concert halls, theaters, sports arenas or recreation areas are more easily accessed by residents from throughout the region and by tourists.
- Lower congestion means lower levels of pollution and the costs they impose on a society.

Whether measured in dollars, time or health, the benefits to workers, families and companies located in a region can be measured by investments in its transportation infrastructure. Given these additional economic benefits, more advanced economic models such as REMI are used to estimate the impacts on economic activity and job creation.

Often, Southern Californians are reminded of the importance of infrastructure to the cost and efficiency of their economy when one of the region's major arteries is shutdown. This occurred when the 1994 Northridge earthquake caused an overpass to collapse closing the Santa Monica freeway. The result was to slow down economic and personal life in the affected area. Infrastructure investment is unique in that it improves the lives of people and businesses from the moment it is available in addition to the activity generated by its construction and operations.

As a result of these considerations, in the analysis of measuring the economic impact of the over $500 billion infrastructure investment proposed for the 2012–2035 RTP/SCS, important attention is paid to several measurable impacts and the jobs it would create:

- Reduction of time lost to congestion
- Ability of employers to access a larger and deeper labor force
- Ability of goods to move with speed and reliability
- Reduction in costs related to air quality difficulties
- Enhanced quality of life

INFRASTRUCTURE INVESTMENT AND CONSTRUCTION RELATED IMPACTS

If the SCAG region invests over $500 billion on projects that can increase the efficiency of its transportation system, the most obvious economic impact will be the creation of construction jobs in the six county region. Here, standard regional economic modeling allows the determination of the full impact of such activity:

- Direct jobs are created with the companies that design and construct the facilities.
- Indirect jobs are created when those companies buy professional services, supplies, equipment and non-professional services from other firms to complete their work.
- Induced jobs are created when the firms and workers who directly build the project or indirectly supply goods and services to it, in turn, spend the money they receive in the general economy to support themselves and their families.

Each tier of this activity can be measured. The amounts of money going directly into construction activity are the beginning point. Economic impact models such as the sophisticated REMI model for this project can then determine the extent to which that direct spending will set off the rounds of indirect and induced spending and job creation. This work is explained below. A similar calculation was made for the funds that would flow to operate and maintain the transit and road systems once they have been created.

INFRASTRUCTURE INVESTMENT, COST, AND NET IMPACT

During the deliberations about the economic impact of SCAG's 2012–2035 RTP/SCS, a key issue was the extent to which additional local revenues, over those already flowing into the region's infrastructure investment, would be needed to finance the over $500 billion in projects. These were carefully assessed as to what measures would be used to raise these funds and during what time period. Because such added taxes or fees would tend to reduce local spending by businesses and/or consumers, estimates were then made of the job level reductions such measures would cause.

With the job losses from the added revenue measures estimated, they were deducted from the job creation from the construction and operation of the expanded transportation system plus the job creation due to the enhanced efficiency and quality of life created for the region's economy. The result was the net potential economic impact of SCAG's 2012–2035 RTP/SCS.

In the next section, the quantitative impact which the investments proposed in SCAG's Regional Transportation Plan will have on the region's economic performance, job creation, prosperity and quality of life are estimated and explained in detail.

Economic Impact of SCAG's Policies and Strategies

As implementation of the 2012–2035 RTP/SCS involves large financial investments in the region's transportation infrastructure, it has become increasingly important to understand both the short and long term economic impacts that the plan will have on the SCAG region. Fundamentally, the 2012–2035 RTP/SCS is designed to increase the efficiency and decrease the environmental impact of the region's transportation system.

GOODS MOVEMENT, THE ECONOMY, AND SOUTHERN CALIFORNIA'S TRANSPORTATION SYSTEM

Southern California's goods movement dependent sectors create considerable economic impact due to the wide variety of activities involved in moving goods within and through the region. According to analysis of EDD data, in 2011 these sectors directly employed 638,252 workers in the area. The facilities involved include the region's four ports (Los Angeles, Long Beach, Port Hueneme, San Diego), its numerous airports led by Los Angeles International Airport (LAX), its two long-haul (Burlington Northern Santa Fe Railway; Union Pacific Railroad) and four short-haul rail lines, several intermodal rail yards, hundreds of cross-docks and thousands of warehouses. The system is largely tied together by trucks that move most goods the "last mile" to retailers or consumers. Trucks also transfer cargo from the ports and airports to the intermodal yards, cross-docks and warehouses.

Challenges

While Southern California has the best logistics network in the United States, it does face two serious challenges. The first of these is the 2014 expansion of the Panama Canal. This doubling of capacity will allow ships carrying up to 13,000 TEUs versus the current 4,500 TEU's, to go directly from Asia to the East Coast rather than using West Coast ports. As a result, ports and corridors on the Gulf and East Coast are investing over $30 billion in their infrastructure to draw cargo directly to them, bypassing Los Angeles and Long Beach. The local response has been the "Beat the Canal" strategy to ensure that Southern California's competitive position is retained, if not enhanced. This has included:

- Serious efforts by the ports to reach out to their beneficial cargo owners to make sure they are being responsive to their needs, and that those companies understand the cost savings of using Southern California's ports.
- Continuation of the Clean Truck Program at the ports which has significantly lowered the adverse environmental impact they have had on the surrounding communities.
- Continued planning and investment in landside infrastructure to allow cargo to efficiently move through the region. Most recently, efforts have included release of the Draft Environmental Impact Report for the Southern California International Gateway (SCIG) near-dock rail project of BNSF Railway. Also, the ports have been deepening their channels, building on-dock rail facilities and are about to replace the Gerald Desmond Bridge. The region has also undertaken considerable work (EIR /EIS underway) to provide for the expansion of the I-710 freeway.

Meanwhile, a second major difficulty for the logistics sector is the fact that Southern California's transportation infrastructure frequently becomes clogged by traffic congestion. This is a crucial problem for supply chain managers since the speed and reliability with which they can move their cargo to the appropriate national markets is a critical determinant of where they choose to import, export and store their cargo.

Implementing solutions to improve the timeliness and efficiency of the region's goods movement throughput is a key economic development necessity.

Macro-Economic Impact

In the SCAG region, goods movement-dependent industries comprise 34 percent of the region's GDP, and 34 percent of regional jobs. Five industries comprise the vast majority of these benefits: manufacturing, construction, retail trade, wholesale trade, and transportation and warehousing. These five industries dominate the region in terms of contribution to GDP, employment, and prospects for growth.

Regional GDP Contribution

In terms of GDP, goods movement-dependent industries contribute a total of $253 billion to the region's economy. The top five goods movement-dependent industries in terms of GDP contribution are:

- Manufacturing ($84 billion);
- Retail trade ($54 billion);
- Wholesale trade ($53 billion);
- Construction ($27 billion); and
- Transportation and warehousing ($21 billion).

Employment Contribution

Goods movement-dependent industries contribute a total of 2.96 million jobs to the region's economy. The top five goods movement-dependent industries in terms of employment are:

- Retail trade (950,000 jobs);
- Manufacturing (744,000 jobs);
- Construction (431,000 jobs);
- Wholesale trade (429,000 jobs); and
- Transportation and warehousing (330,000 jobs).

Even when isolating the sectors that rely solely on the movement of goods, the impacts are significant. For the seven Southern California counties (Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura), the output of the sectors related to these industries totaled $130.1 billion out of the region's full output of $1.76 trillion in 2009.

Using the IMPLAN model to analyze the economic activity attributed to the $130.1 billion output associated with goods movement in Southern California, the model demonstrated the following results.

TABLE 8.1 Logistics Contribution to Southern California's Economy, 2009

Metric	Southern California	Logistics	Logistics Share
Gross Regional Product	$1,045,341,256,738	$146,699,940,876	14.0%
Total Employment	11,307,735	1,387,728	12.3%
Employee Compensation	$543,707,789,826	$86,753,281,440	16.0%
Proprietor Income	$92,433,783,666	$14,386,878,484	15.6%
Other Property Type Income	$330,967,058,325	$39,778,255,582	12.0%
Indirect Business Taxes	$78,232,624,920	$20,168,403,854	25.8%
Total Output	**$1,760,981,224,092**	**$238,503,892,404**	**13.5%**

Source: IMPLAN, analysis by Economics & Politics, Inc.

Project Expenditures – Mapping the RTP's Investment Plan

A mix of transportation projects are planned in each of the six counties over the twenty-five year span of the plan.

Of the total RTP expenditures exceeding $500 billion, more than half will be spent on projects in Los Angeles County.

Not all expenditures will have an economic impact. We have deducted expenditures estimated to be associated with debt service and right-of-way acquisition, which represent exchange of assets and are excluded from our analysis in **TABLE 8.2**.

ECONOMIC AND JOB IMPACTS

Net expenditures are categorized by function into three broad industries: construction, transit operations, and architectural and engineering services. Highway operations and maintenance expenditures are included with construction given their similarity. The total employment impact of the transportation plan is shown in **TABLE 8.3**.

Over the twenty-five year period, the plan will generate an annual average of 593,500 annual jobs in the six-county region. Almost 54 percent of these will fall in Los Angeles County, with 21 percent in Orange County and 12.5 percent in Riverside County.

In addition to the SCAG region, the rest of the state of California and U.S. will benefit from spillover impacts of additional jobs.

TABLE 8.2 Net Expenditures (in Millions of Nominal Dollars)

	FY2011–15	FY2016–20	FY2021–25	FY2026–30	FY2031–35	Total	% of SCAG Total
Total	$ 53,046,850	$ 63,210,971	$ 88,778,040	$ 120,811,690	$ 127,547,303	$ 453,394,855	100.0

TABLE 8.3 Employment Impact from Construction and Maintenance Expenditures (Per Year)

	2011–2015	2016–2020	2021–2025	2026–2030	2031–2035	Total
Los Angeles	112.2	89.1	90.1	93.4	76.4	92.2
Orange	36.1	34.0	35.5	37.8	32.3	35.1
Riverside	23.5	22.0	25.0	28.0	23.7	24.4
San Bernardino	18.0	15.5	18.5	21.4	18.0	18.3
Ventura	3.8	3.4	3.0	3.6	3.2	3.4
Imperial	0.7	0.7	1.1	1.6	0.9	1.0
	194.4	**164.7**	**173.2**	**185.7**	**154.4**	**174.5**

METHODS

Short Term impact

The most commonly used tool for conducting economic impact analysis is input-output modeling. Using detailed data on the distribution of sales and purchases between industries and households (available from the U.S. Census Bureau and the Bureau of Economic Analysis), the regional economy is mathematically represented as a series of flows of employees, goods and services, and capital between economic agents.

Using this model, the analyst can provide an initial increase in activity, such as a new transportation infrastructure investment, and trace the route that the project expenditures make through the supply chain, from the construction contractor to his employees (direct impacts), to his suppliers and to their employees and suppliers (indirect impacts), and so on; and from the employees to their household purchases (induced impacts). The original spending is thus multiplied by the additional activity it motivates.

Of course, not all needs in the supply chain can or should be filled locally. A construction company that purchases specialized equipment may order this from a manufacturer in another state or country. It may also choose to buy supplies from other areas if more competitive prices are offered elsewhere. The workers themselves may commute from outlying suburbs, representing an import of labor. Similarly, not all household spending occurs locally. Employees may purchase home insurance from Connecticut, table wine from France, and cigars from Cuba. Spending that occurs outside of the economic region is a leakage from the system and reduces the local economic impact.

To simplify analysis, regional models that have already been constructed by analysts or consultants are reduced to their multipliers, which are then more easily used by planners, engineers or policymakers to estimate the job impacts of their proposed projects.

Users of such multipliers should be cautioned that the underlying models depend on the economic region that is defined and the vintage of the data used to construct the model. For example, multipliers for the Southern California region are quite different from multipliers for the nation as a whole, and can be different from year to year, particularly during

periods of technological or structural change. This leads to a confusion of job creation estimates, some of which range dramatically.

Rather than rely on externally-sourced multipliers, we use models constructed using data and software from Regional Economic Models, Inc. (REMI).

In our input-output analysis, we assume that the initial project spending occurs within the SCAG region, and allow the model to estimate the leakage from the region based on historical data and estimated trade flows among neighboring counties. In addition to the flows of goods and services, the model incorporates estimates of workers who commute from other regions—the household spending of these workers would in large part occur close to their residences as opposed to their place of employment.

Because supply chains differ across industries, the transportation project expenditure data is sorted by category, such as construction services, operations and maintenance for transit operations, and architectural and engineering services. The allocation of expenditures among these categories was estimated by knowledgeable transportation planners. Right-of-way acquisition costs are excluded since these represent a transfer of assets and are generally considered to have no economic impact. Each category of spending was modeled separately and their impacts summed. Employment estimates are measured on a job-count basis for wage-and-salary workers and for self-proprietors regardless of the number of hours worked, and are reported on an annual basis, i.e., the number of full and part time jobs generated in one year.

In our REMI analysis, we allocate the construction spending to counties in proportion to their relative output shares in the region. Expenditures for transit operations are expected to occur in the counties in which the projects are located.

Long-Term Impacts and Efficiency Improvements

Input-output analysis is useful for estimating the immediate economic impacts of a project. However, because this modeling is based upon fixed production relationships and does not incorporate behavioral decisions made by households or businesses to price signals, it is incapable of estimating dynamic responses such as businesses substituting towards capital in the face of rising labor costs, or labor migrating into the region as wage rates rise. To capture these full general equilibrium impacts a more complex methodology is needed.

In addition to these considerations, there are longer term impacts on the efficiency of the transportation system. The infrastructure, once built, can enhance the economic competitiveness of a region. Projects that reduce congestion may help firms produce at lower cost, or allow those firms to reach larger markets or hire more capable employees. An economy with a well-functioning transportation system can be a more attractive place for firms to do business, enhancing the economic competitiveness of the SCAG region. The RTP/SCS can boost employment in two ways—providing jobs for persons in highway and rail construction, operation, and maintenance, and boosting the economic competitiveness of the SCAG region by making it a more attractive place to do business. As an example, policies that could reduce congestion while creating no or minimal construction jobs can still increase the economic competitiveness of the region. Congestion pricing is one possible example.

Competitiveness and New Jobs: Results from REMI Model

SCAG's regional travel forecasting model was used to generate inputs for the REMI model. The forecasting model from REMI includes historical data from public, government sources like the Bureau of Economic Analysis (BEA), the Bureau of Labor Statistics (BLS), the Energy Information Administration (EIA), and the United States Census Bureau. The model relies on four different quantitative methodologies of regional analysis: input-output tabulation (which captures inter-industry relationships), econometrics (which estimates behavioral responses), computable general equilibrium (which will estimate long-term effects), and New Economic Geography (which relates economic growth to market areas as measured based on travel times and shipping or travel costs.) SCAG worked closely with REMI experts to run over 20 complex simulations of the region's economy with different elements of the RTP/SCS plan, compared to a "no build" or "no project" scenario. Using vehicle miles traveled (VMT), vehicle hours traveled (VHT), and number of trips from a travel demand model, REMI's TranSight module calculated how consumer, household, and business behavior responds to changes within a travel network. This allowed forecasts of future economic impacts. The model inputs were from SCAG's travel model and analysis. Inputs included reductions in commuting costs, accessibility costs, transportation costs, and operations costs and improvements in amenities or reductions in externalities. Each are defined below:

COMMUTING COSTS

REMI TranSight quantifies changes to commuting patterns from the travel demand data as a change in "commuting costs." The primary interaction is VHT/trips—that is, the average length of trip for personal automobiles. Shorter trips assume a greater ease of commute throughout the region and between different regions. From there, TranSight quantifies an increase in labor productivity as an increase in "labor pooling" and a better match between employees and employers. This leads to an expanded labor productivity throughout the SCAG regions, which initially reduces the amount of employment. Businesses will do "more with less"; however, in short order, lower labor costs creates a competitive advantage for the Southern California region, which leads to expanded market shares and increased output for local businesses. From there, employers continue to expand and hire more workers into the future, which forms a large bulk of the economic gains in the SCAG region.

ACCESSIBILITY COSTS

Accessibillity is the concept of the availability of intermediate inputs for businesses. That is, increased access means a better match for businesses in terms of their intermediate suppliers, which leads to increased productivity, larger market shares, and a greater clustering effect within a region. The travel demand interaction in this case is number of trips/VHT—again, this being the "average number of deliveries per hour" via truck. The model assumes that a faster rate of delivery means a greater ease of access in a region or between regions, which means better and cheaper access to the intermediate goods that businesses need.

TRANSPORTATION COSTS

Transportation costs are a similar concept to accessibility, but these quantify the expenses involved in the delivery of finished goods, rather than the movement of intermediate inputs amid different businesses and industries. The travel interaction is VMT/VHT, or the average system speed, for trucks, assuming that a higher system speed means a higher ease of transportation for sellers to buyers between regions. This builds on the gravity concepts of trade flows in the model, and also the concept of "relative delivered prices." That is, the model includes both a "relative cost of production" (RCP, which access lowers) and a "relative delivered price" (which is the RCP plus the cost of transporting a good to the shelf. The differences are transportation costs, which a higher speed for the system makes cheaper for the region inside of the TranSight model.

AMENITY/EXTERNALITY

Under normal circumstances, TranSight automatically quantifies the user- and agency-costs of transportation from travel demand data. However, in this case, as SCAG had an internal estimate of the same, REMI used the same information as the estimation of amenity benefits inside of the model. The variable in question, which is non-pecuniary amenity, goes into the model as an increase in the attractiveness of a region to migrants. For instance, people are willing to locate themselves in Florida for lower wages given the high overall attractiveness of the area's culture and climate. With this variable, we can enter a calculated number of externality benefits into specific regions. This will move migrants into the region, lower wages, and create a bigger cluster of labor for businesses to choose from. By extension, this is rather important to the industrial competitiveness of a region, as employers can charge less money for the same (or better) work from employees. SCAG's estimates included the cost of emissions, lost travel time due to congestion, and safety benefits. These all, in sum, add to the attractiveness of a region, which amenity quantifies in REMI.

OPERATIONS COSTS

Transportation improvements can have a big influence on business/household economies in terms of their fuel and vehicular repair purchases. TranSight normally quantifies this, but SCAG had an external estimate in provided data. To illustrate the influence of fuel savings on the economy, this goes into the model as reduced consumer or business spending on gasoline and oil. As an extension, saving an entity $50/year on fuel "frees up" $50 to spend on other priorities. For households, this means an increase in consumer spending and a decrease in the cost of living. For a business, this would mean increased competitiveness, as enterprises in SCAG counties no longer have to pay as much for fuel in the future. This allows them to expand their market shares and eventually have more output and hire more workers in the out years.

The results of the model effort yielded network benefits (flowing from reduced commuting, accessibility, and transport costs as defined above) and amenity and operations benefits (from the changes in amenities and the reductions in operations costs.) The

network benefits summarize the bulk of the economic competitiveness impacts from improvements to the transportation system that result from the plan, while the amenity benefits are largely the impact of measurable quality of life changes or increased consumer spending power that results from lower transportation costs.

The REMI model results showed that the network benefits would result in an annual average of 512,000 jobs in the SCAG region during the 2011–2035 time period. Note that those jobs are in addition to construction jobs, and the jobs are economic opportunities available to SCAG region residents as a result of increased competitiveness that would flow from full implementation of the 2012–2035 RTP/SCS.

SCAG believes the REMI model results constitute a high end of the possible network benefits, as some behavioral responses, such as increases in telecommuting as an adaptation to high congestion levels, likely are not fully captured in the REMI model. SCAG validated the REMI results against a comparison with the literature and believes a better estimate of job gains from the network benefits of fully implementing the RTP are 354,000 jobs per year, on average. This is described in the last section of this chapter.

Full Results

The full economic results of the RTP/SCS investment are summarized below, with millions of new jobs (annual average) resulting from the plan in five year time periods and an annual average for 2011–2035 shown. The construction job gains (direct, indirect, and induced) effects are shown on the top row. The network benefits and amenity and construction benefits are also shown, and the full program economic impact—construction impacts and changes in the region's economic competitiveness, are shown on the bottom row.

TABLE 8.4 Total Employment Impact

	2011–2015	2016–2020	2021–2025	2026–2030	2031–2035	Annual Average
Construction	194	165	173	186	154	174.5
All Network Benefits	21	71	263	543	852	354
Amenity & Operations	17	40	65	88	108	64
Draft 2012–2035 RTP/SCS	232	276	501	819	1,114	593.5

Impact of Economic Gains Versus Revenue Required to Implement 2012–2035 RTP/SCS

593,500 jobs – 67,000 jobs = 526,500 net gain in jobs per year

Implementing the 2012–2035 RTP/SCS would create an average of 593,500 jobs a year over the 2012–2035 period. However, infrastructure investment is not free. It requires fees and taxes from within the region plus added state and federal revenue. Some, but not all, of these flows of funds exist. The modeling carefully traced them to determine the negative impact that increased local taxes and fees would have on the ability of Southern California's consumers and businesses to spend locally. The net cost from these taxes and fees is estimated to be a loss of 67,000 jobs on average per year. Implementation of the 2012–2035 RTP/SCS's net gain would thus average 526,500 jobs per year.

Should the 2012–2035 RTP/SCS not be implemented, the cost to Southern California would be immense. The area would forfeit long term competitiveness, efficiency and sustainability of modern infrastructure. It would face stiff penalties for being out of compliance with federal environmental law.

How Transportation Improves Economic Competitiveness

Transportation can improve economic competitiveness in several ways. Canvassing the literature and available economic models gives five possible paths through which transportation improvements can increase regional economic competitiveness.

1. **Improved Labor Market Matching:** Reducing travel time allows firms to hire from a larger geographic catchment area. This effectively increases the firm's labor market—particularly so in a large urban area like the SCAG region, where reductions in commuting time can yield possibly many more potential employees. Increasing the size of the labor pool allows the firm to hire better employees, as the firm can find a better match for its needs. By hiring employees who better suit their needs, the firm can produce more (employees are more productive) for the same cost, allowing the firm to capture a larger market share. That, in turn, can lead to increased hiring if the increase in market share countervails the fact that the firm can produce more with fewer employees due to the improved employer-employee job match. (See e.g., Kohlhase and Finney, 2008.)
2. **Firms Move into the SCAG Region in Response to Enhanced Economic Competitiveness:** This effect flows in part from the first effect. If the SCAG region's transportation system allows longer commutes and hence a larger labor market pool, and if that larger employee pool allows firms to hire better employees, eventually, firms will move into the region in response to those improved hiring prospects. Hence, the increases in firm productivity that initially result from improved labor market matching result in firms moving into the SCAG region from other locations over longer time horizons.
3. **Reduced Congestion Reduces Employees' Asking (or Reservation) Wage:** Employees have a reservation wage—a wage below which they will not work in a particular job. Congestion reductions can lower reservation wages in two ways. First, metropolitan areas compete for mobile labor, and metropolitan regions with lower traffic congestion will, all else equal, lure more migrants into the region due to the amenity value of lower traffic congestion. This increases the supply of available labor—an advantage for firms looking for to hire employees. Second, employees typically have to be compensated for undesirable characteristics of particular locations. In metropolitan areas with high traffic congestion, the labor pool will have to be compensated either in the form of higher wages, lower house prices, or both (e.g. Roback, 1982). These two effects are one and the same—the higher wages in high congestion metropolitan areas reflect the need to lure in a labor pool that otherwise might choose to locate in lower congestion locales. Reduced congestion can attract more workers to a region, allowing a firm to hire quality workers at lower reservation wages. Note that this does not mean that congestion reduction will lower wages paid. The effect of congestion on wages flows through multiple channels. As firms move into the SCAG region in response to the metropolitan area's enhanced competitiveness, that competition for labor will drive wages up. On net, employee wages may increase in the long run. Each of the paths described here are illustrations of isolated links from a complex economic system with multiple feedback loops, and the description here is intended to illustrate, in part, how advanced computer models can forecast the economic and job creation impacts of congestion reduction. Saying that employee reservation wages will be lower if their commute is less costly does not imply that, in the long run after the economy has fully adjusted, those employees are paid less. This information is provided as an explanation to the

results of economic impact modeling results and is not intended to be a policy statement on wages.

4. **Increased Market for Firms' Products:** Reductions in travel time can allow firms to supply a larger market area. If production exhibits constant returns to scale, this will not increase employment per se. Instead, local markets might be served by fewer, larger firms that can reach a larger customer base as congestion delays are reduced. The exception occurs when production exhibits increasing returns to scale, which means that larger firms can produce at lower cost. For many locally serving products—eating establishments, consumer products, services—production is likely to have constant returns to scale, and larger firms likely have no particular cost advantage over smaller firms. An important exception might be the shipping traffic through the Ports of Los Angeles and Long Beach. Larger ports can build infrastructure that may allow faster and hence lower cost processing of freight movements. Reductions in landside freight shipping times from the ports to points within and beyond the SCAG region may contribute to shipping volumes that could allow lower costs and hence lead to higher productivity, making the SCAG ports more cost effective than other points of entry.
5. **Learning:** Cities are engines of economic innovation. Virtually all economic advances—in consumer products, electronics, biotechnology, consumer services, entertainment, and fine arts—are created in metropolitan areas. A large and growing literature argues that much of the economic advantage of cities is the learning that is possible when persons and firms are in close proximity (e.g., Puga, 2010, Glaeser, 2011, Storper and Venables, 2004). The engineers in Silicon Valley interact regularly, within and across different firms, creating a hub of knowledge and innovation that is unrivaled in the computing industry. The movie industry in Los Angeles provides the same center for knowledge and learning. Such learning effects are central to many industries, including manufacturing processes and services that increasingly rely on innovations to remain competitive. Transportation investments that reduce traffic congestion can allow persons to interact more readily with a larger pool of like-minded experts, increasing the learning and innovation in a regional economy. That can allow local firms to innovate in ways that lowers costs, improves products, and leads to larger market share. Over time, improved innovation environment will attract mobile labor and capital (workers and firms) from other regions, further boosting economic activity.

Overall, these five effects paint a rich picture of the regional economy—one in which firms can access larger labor and product markets as congestion is reduced, and those effects can translate in the short-run into higher productivity, lower costs, larger market share, and higher employment and, in the longer run new firms may move into the metropolitan region in response to that enhanced competitiveness. Beyond those "market size" effects, learning and innovation can be enhanced by policies that allow persons to interact more quickly and easily with a broad range of economic collaborators and competitors, reducing traffic congestion—the range of movement of workers and business owners—can enhance that learning environment. The nature of any one of these effects, and whether employment would increase or decrease in particular sectors or specific locations within the SCAG region, requires assessing complicated details of the magnitudes of each effect and the tradeoffs that ensue.

Quantified Estimates of Gains from Economic Competitiveness

To capture productivity effects, the results of SCAG's travel model were used in conjunction with REMI to estimate employment impacts that would result not from direct construction jobs and the multiplier effect of those jobs, but instead from the enhanced economic competitiveness of the SCAG region that results from the reductions in congestion delays and improvements in air quality that will be fostered by the plan. Estimating efficiency gains from transportation projects is a frontier topic in practice, and REMI is an advanced model that allows the sophisticated ability to measure some of the channels through which transportation improvements can lead to job growth from increased regional competitiveness. The list below compares how REMI can address each of the five economic competitiveness channels described in the previous section.

1. **Improved labor market matching:** REMI models how metropolitan labor markets expand when network travel times decrease. Changes in highway and transit travel times are both modeled. From increases in labor market catchment areas, REMI estimates improved employer-employee job matches and hence improved firm labor productivity and lower production costs. This channel is modeled well in REMI.
2. **Firms move into the SCAG region in response to enhanced economic competitiveness:** REMI's market share models allow it to estimate how changes in production costs affect firm market shares. That effectively addresses the question of firm in- or out-migration. REMI does not model the number of firms, but the key question

is the size of particular industry sectors, and REMI models market share effects that include changes in the location of production in response to changes in wages and the productivity of intermediate inputs.

3. **Reduced Congestion Reduces Employees' Asking (or Reservation) Wage:** REMI's approach captures some but possibly not all of this effect. When employees migrate into a metropolitan area in response to changes in employment opportunities, that expansion of labor supply and the resulting downward pressure on wages will be captured by REMI. A second effect is that employees are willing to work for lower wages when their commuting costs fall—a phenomenon predicted by economic theory. REMI's ability to capture that may be incomplete, as migration across metropolitan areas in the REMI model is more in response to wages and job opportunities in different metropolitan areas and migration for local amenities, including lower traffic congestion, is apparently not modeled in REMI. Recall that other competitiveness effects, including larger market areas and in-migration of firms into the SCAG region, will increase demand for labor. On net, wages may go up after all adjustments in the economy are accounted for. REMI has an ability to model some of those feedback channels, including the geographic market size for firm output and in-migration of firms due to the increased economic competitiveness of the SCAG region.
4. **Increase market size for firms' products:** The REMI model balances supply and demand within metropolitan areas, and in the broader economy, and so accounts for ways that transportation access changes firms' market size. As noted earlier, a key question for "market size" impacts is whether firms experience increasing returns to scale. Here the ability of the REMI model to capture productivity improvements due to market size is unclear, and particular issues of interest to the region, including the economically important ports, will require additional modeling and analysis in the future.
5. **Learning:** The REMI model has virtually no ability to capture learning improvements that lead to innovations in production processes or, in the extreme, to new products. Forecasting such effects at a regional level is difficult, yet such effects exist and are increasingly important in knowledge based economies.

The Literature

While there is a large academic literature that studies the effect of transportation infrastructure on economic productivity, only a few of those studies draw links to congestion reduction and economic gains. The bulk of the academic literature is focused on estimating relationships between a region's stock of highway or transportation infrastructure and economic productivity. That larger strand of the literature cannot illuminate how transportation infrastructure relates to productivity gains, and the effect of congestion reduction in particular is not modeled. Because congestion reduction is a key path through which transportation investment in the SCAG region could improve economic competitiveness, we focus on the relatively few studies that have drawn links from congestion to regional economic performance. Note that those studies typically aimed to test a hypothesis using retrospective data, often asking whether measures of economic performance are statistically related to traffic congestion. The goal in the academic literature, to date, has not been to forecast magnitudes of economic impacts from future congestion reduction, but instead to use retrospective data to test for a relationship.

Boarnet (1997) estimated labor productivity and output in the 58 counties in California with annual data from 1977 to 1988. He developed a congestion measure for each county based on peak hour measures of traffic volume relative to highway capacity. Boarnet found that congestion is negatively associated with county output (or gross county product.) Converting the regression estimates into elasticities, Boarnet found an effect only for the most congested counties in the state, typically the counties that comprised the San Francisco Bay Area and SCAG region. During the time period being studies, those were typically the only counties that had highway networks with meaningful levels of congestion. The elasticity of output with respect to a measure of congestion suggested that a 10 percent reduction in highway congestion was associated with county output increases in a range from 2 percent to 5 percent.

Hymel (2009) used data from the 85 largest U.S. metropolitan areas from 1982 through 2003. He used regression analysis to examine how employment growth is influenced by several factors, including congestion. Highway congestion measures were drawn from annual reports produced by the Texas Transportation Institute. Hymel found that congestion reduces employment growth, and the effect is non-linear. More congested metropolitan areas experienced larger employment penalties for increases in congestion. Hymel's estimates imply an elasticity of employment growth, from 1990 to 2003, with respect

to congestion of -0.466 for the Los Angeles-Orange County metropolitan area, suggested that a 10 percent reduction in traffic congestion is associated with a 4.66 percent increase in employment growth during that 14-year period. Note that the Los Angeles-Orange County elasticity is almost twice the size of the elasticity for San Diego, which is -0.248. In San Diego, during this time period, a 10 percent reduction in traffic congestion is associated with a 2.48 percent increase in employment growth. This illustrates the non-linear nature of congestion's economic penalty. Mildly congested regions experience more moderate reductions in employment growth, but as congestion grows the reduction in employment, based on Hymel's estimates, grows faster than linearly.

Literature Comparison

Because this exercise—estimating economic benefits and competitiveness gains that result from transportation system improvements – is somewhat new, the SCAG economic team cross-checked the result with the academic literature. Hymel's (2009) paper, which uses regression analysis to estimate retrospectively the job gains that would result from congestion reduction, is the best comparison point in the literature. Hymel's results are based on the 1990 to 2003 time period—a shorter time period than the analysis here which focuses on 2011 to 2035. More importantly, Hymel's results suggest that the economic gains from congestion reduction grow larger as congestion increases, and so a simple application of Hymel's results from the less congested time period of the 1990s to the more congested circumstance in 2035 if the "no project" future were to occur (no RTP/SCS related transportation improvements) needs to account for the faster-than-linear growth of the economic gains from congestion reduction. SCAG used Hymel's results, adjusted to reflect the more congested network that would result if the RTP/SCS is not implemented, and estimated that Hymel's regression analysis implies that the RTP/SCS, if fully implemented, would generate 196,000 annual jobs from improved competitiveness.

SCAG considers the REMI estimate of 512,000 annual jobs a reasonable upper bound for network benefits and the Hymel method which estimates 196,000 annual jobs a reasonable lower bound for network benefits. Hymel's estimates, based on econometric analysis from 1990 to 2003, could easily understate the network benefits of the 2012–2035 RTP/SCS in 2035. The congestion levels in the 2011–2035 timeframe for the no project case will be outside of (and more congested than) anything Hymel observed in his 1990-2003 observations of U.S. metro areas. The REMI results, on the other hand, likely exclude some behavioral responses (e.g. increases in telecommuting) that would mitigate the impacts of increased traffic congestion. SCAG judges that a mid-point between the two estimates, 354,000 annual jobs from network benefits, is the most reasonable estimate.

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