PLAN PERFORMANCE

ECONOMIC AND JOB CREATION ANALYSIS

SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS

CONNECT SoCal

TECHNICAL REPORT

AS ADOPTED ON MAY 7, 2020

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Economic and Job Creation Analysis

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EXECUTIVE SUMMARY

The economic and job creation analysis estimates the economic impact of the 2020 Regional Transportation Plan and Sustainable Communities Strategies (2020 RTP/SCS, Connect SoCal) at the regional and county levels. Connect SoCal impacts our economy 1) by creating jobs through transportation expenditure of direct investment in construction, maintenance and operation and 2) by making our region a more attractive place to live and to do business through enhancing network efficiency.

Transportation expenditures throughout the planning horizon are provided by each of the county transportation commissions and the network efficiency is estimated by SCAG's transportation demand model. SCAG's economic team used the input data and TranSight, a software from Regional Economic Models, Inc. (REMI) to estimate the economic impact of Connect SoCal. TranSight models the direct, indirect and induced effects of the transportation expenditure of Connect SoCal by combining input-output approaches with demographic and economic migration.

Over the FY2020-21 through FY2044-45 period, our region is expected to invest more than $603 billion on transportation improvement projects through Connect SoCal. The findings show that over the 25-year period and six-county SCAG region, the plan will generate an annual average of more than 168,400 jobs from the construction, maintenance and operations expenditures. An

additional 264,500 annual jobs will be created by the increased competitiveness and improved economic performance that will result from enhanced network efficiency due to implementation of Connect SoCal.

Connect SoCal could bring benefits to our region beyond the economic outcome described above. The contribution of Connect SoCal to GHG emission reduction and climate risk mitigation could bring economic benefits by avoiding future costs and smoother transition to a low-carbon economy. Connect SoCal aims to build transportation projects and effectively distribute resources and investment to reach Vehicle Miles Traveled (VMT) reduction goals while enhancing mobility across the region. Such efforts to meet GHG emissions targets will serve to mitigate the risks posed by a rapidly warming globe and furthering both economic vitality and sustainability of the region.

INTRODUCTION

For the past two cycles in 2012 and 2016, SCAG had developed economic impact assessments of the Regional Transportation Plan/Sustainable Communities Strategy (Connect SoCal). It is becoming increasingly clear that transportation investments – particularly programs as ambitious as the SCAG region's – contribute importantly to economic growth.

The economic impact of transportation infrastructure spending can be broadly divided into two parts:

1. **Construction, Maintenance and Operations:** The direct spending in Connect SoCal will provide jobs for people in highway and rail construction, transportation and transit operations, and maintenance.
2. **Network Efficiency Enhanced Economic Competitiveness:** Connect SoCal will make the SCAG region a more attractive place to do business. By reducing congestion, commuters can save time and money, and reduce stress. This in turn attracts more investment while helping firms and employees to interact more seamlessly, and improving air quality and the quality of life.

Each path is described briefly in the next section.

CONSTRUCTION, MAINTENANCE AND OPERATIONS

Connect SoCal will employ people to build, operate and maintain transportation projects as a result of the regional infrastructure investment outlined in the Connect SoCal Financial Plan. Those jobs are called the direct effect in the jargon of economic impact modeling. Direct effects – new jobs in entities that construct and operate rail lines or that build and maintain highways, for example – ripple through the economy, creating additional jobs in two ways.

- **Indirect Effects:** Indirect effects are the jobs in companies that supply inputs for the direct jobs created by Connect SoCal spending. The firms and agencies that build and maintain the transportation system with Connect SoCal funding buy materials, office supplies and business services. All of those supply purchases that are necessitated by Connect SoCal spending are indirect effects – the jobs required to supply inputs (both goods and services) to support the direct investment in Connect SoCal.
- **Induced Effect:** Additionally, employees of the firms and agencies that build, operate and maintain the Southern California regional transportation system use their wages to buy all manner of goods – housing, food, clothing, entertainment and the like – and that supports additional jobs. That ripple effect is called the induced effect; the employees who build, operate and maintain Connect SoCal transportation projects will have income to buy goods and services associated with daily living.

While the construction, maintenance and operation jobs are important, improving the functioning of the SCAG region by improving transportation access brings additional benefits, described below.

NETWORK EFFICIENCY AND ECONOMIC COMPETITIVENESS

A well-planned, well-functioning transportation system, with land use strategies that complement transportation investments, can improve the economy of a metropolitan area. Recent studies have focused on ways that traffic congestion can reduce employment growth (Hymel, 2009, Sweet, 2014a, Sweet 2014b, Jin and Rafferty, 2017) and impede economic productivity (Boarnet, 1997; Sweet, 2014b). Hence congestion reduction can stimulate economic growth. The studies have highlighted several ways that congestion relates to employment growth, productivity and economic competitiveness. We summarize those paths here:

- Regional traffic congestion typically reduces employment growth. As drivers require more time to travel from place to place, the market area for firms' products shrinks, employees find it more difficult to access jobs throughout the metropolitan area, and the benefits of interactions across different firms and employees is reduced as they are stuck in traffic rather than engaged in productive activity.
- Local congestion, on the other hand, is associated with more employment growth. This is because places with high congestion – downtowns or pedestrian-oriented neighborhoods – are high-amenity locations that often attract businesses. Localized (neighborhood) reductions in VMT can further improve the neighborhood economy.
- Broader co-benefits, including greenhouse gas emission reductions, climate adaptation, healthy lifestyles, and quality of life are influenced by a region's transportation infrastructure and transportation planning.

Consider the first two effects: Regional congestion reduces employment growth, while local congestion (less than a five-minute drive in Sweet, 2014a) is associated with increased employment growth. This suggests the importance of a hierarchical view of transportation, as discussed in Boarnet et al. (2017). In neighborhoods, reducing VMT can benefit pedestrian-oriented businesses. Those small neighborhoods might be vibrant business locations while also being places with localized congestion. Downtown Los Angeles, Venice and Santa Monica all have vibrant streets and the car congestion associated with urban places, and all are desirable business addresses. For some neighborhoods, reduced driving brings amenities that can be an economic development tool. Yet, an economically thriving metropolitan region cannot be comprised wholly of congested neighborhoods with no good regional backbone transportation system. The small, often pedestrian- or transit-oriented neighborhoods need to be connected by a regional network of well-functioning transit lines, highways and arterial streets. Hence, at the regional level, congestion can impede economic growth. Both paths – the effect of regional and local congestion – are described in the next section.

BACKGROUND

REGIONAL CONGESTION REDUCTION AND ECONOMIC GROWTH

A growing body of research shows that what was once just a nuisance for drivers – traffic delays – now inhibits job growth. A precursor to this research was Boarnet (1997), who studied economic output in California counties, showing that counties with higher congestion had, controlling for other factors, lower economic output. A more intuitive link is from congestion to employment growth. Hymel (2009) used a regression analysis to estimate the effect of congestion reduction on new job creation. Hymel concluded that from 1990 to 2003, a 10 percent congestion reduction in the Los Angeles-Long Beach-Santa Ana metropolitan area would have resulted in an 8.2 percent increase in employment growth. For the Los Angeles metropolitan area, actual employment growth from 1990 to 2003 was 567,983 new jobs, and Hymel estimates that with 50 percent congestion reduction, the metropolitan area's employment growth, 1990 to 2003, would have been 700,235 new jobs, implying an elasticity of -0.466.

Hymel's study suggested that the effect of congestion on employment growth is larger for more congested metropolitan areas – a finding confirmed by later literature. Sweet (2014b) studied 88 U.S. metropolitan areas, from 1993 to 2008, and examined how employment growth (in non-overlapping five-year periods) was related to base year traffic congestion in those metro areas.

Congestion was measured using the Texas Transportation Institute's (TTI's) data on annual hours of commuter travel delay (see Schrank et al., 2015.) Sweet's results confirm Hymel's earlier work. Sweet found that congestion reduces employment growth – but only in highly congested metropolitan areas. For average annual congestion commuting delays at 37.5 hours or higher (about a 4.5 minute one-way delay each work day), congestion reduces employment growth. In the 1980s and 1990s, many large metropolitan areas were below that threshold. For example, by TTI's calculations, in 1982, the average delay in their "very large" metropolitan areas (population exceeding 3 million persons) was approximately 35 hours per year. By 2014, that had almost doubled, to just above 60 hours of delay on average in those largest metropolitan areas (Schrank et al, 2015). Based on Sweet's results, many metropolitan areas – even very large ones – were below the threshold at which traffic congestion reduces employment growth in 1982, but by 2014, all fifteen of the "very large" metropolitan areas in the country (more than three million persons) and 31 of 32 "large" metro areas (population between one million and three million persons) had exceeded the 37.5 - hour delay threshold level for employment-reducing congestion (Schrank, et al., 2015 and Schrank, et al., 2010). In short, the negative effects of congestion on metropolitan employment growth are a new problem – something that was arguable rare thirty years ago, but that is common today.

As one of the nation's most congested metropolitan areas, it is imperative that the SCAG region model how transportation investments, by reducing congestion, can improve economic competitiveness. While the analysis here includes the link from traffic congestion to employment growth, it goes beyond that, providing a comprehensive view of the effect of congestion on economic competitiveness.

We use an advanced economic model, developed by REMI, to understand how transportation improvements increase regional economic competitiveness. Cities are centers of productivity, and economists formally describe that using a concept called "agglomeration economies." Agglomeration economies occur when firms are more productive by co-locating near other firms. Because transportation can "shrink distance", a well-functioning transportation system tied to sound land use planning can support the access and interaction that facilitates agglomeration benefits. Conversely, traffic congestion, by making it more difficult and costly to travel between locations, can reduce the potentially beneficial interactions between, for example, the technology firms in Silicon Beach and the region's engineering talent in the South Bay, at universities, and in Pasadena (Caltech, Jet Propulsion Lab.). More generally, the key ways that transportation can influence regional economic competitiveness are described below. These pathways are modeled in REMI, with the exception of learning (#5 below), which is likely not fully captured in the model.

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 access to many more potential employees. Increasing the size of the labor pool allows firms to find a better employee match for its needs. By hiring employees who better suit their needs, the firm can produce more for the same cost (employees are more productive), allowing the firm to be more competitive and 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., Finney and Kohlhase, 2008).

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 for more efficient commutes and hence a larger labor market pool, and if that larger employee pool allows firms to hire better employees, eventually firms, especially those that rely on a skilled workforce, will move into the region in response to those improved hiring prospects. Therefore the increases in firm productivity that initially come from improved labor market matching will result in firms moving into the SCAG region from other locations over longer time horizons.

Reduced congestion increases labor supply: 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 (e.g. Roback, 1982). This increases the supply of available labor. Reduced congestion can attract more workers to a region, allowing a firm to hire workers from a diversely- skilled workforce.

Increased market for firms' products: Reductions in travel time can allow firms to supply a larger market area. In some cases, that larger market area can be supplied by larger firms, or more firms of the same size, and there are no net economic competitiveness gains from the larger market area. In the jargon of economics, such a case is production that is constant returns to scale. For many locally- serving products – eating establishments, consumer products, services – production is likely to be constant returns to scale, and larger firms likely have no particular cost advantage over smaller firms. There are, however, important exceptions – cases where larger market areas lead to increased economic competitiveness and hence regional job growth. One example is the goods movement/freight traffic that moves through the Ports of Los Angeles and Long Beach. Larger ports can build infrastructure that allow faster and hence lower cost processing of freight movements. Supply chain managers favor Southern California because of the speed and reliability at which 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. Reductions in landside freight shipping times from the ports to points within and beyond the SCAG region can contribute to shipping volumes that could allow lower costs and hence lead to higher productivity, making the Los Angeles area ports more cost effective than other competitive points of entry.

Learning: In a progressively more knowledge-based economy, cities are increasingly engines of economic innovation. Virtually all economic advances – in consumer products, technology, medicine, consumer services, retailing and logistics, entertainment and fine arts – are created in metropolitan areas. U.S. patents data show that 63 percent of U.S. patents are developed by people living in just 20 metro areas (Rothwell et al., 2013). A large and growing body of 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. Glaeser, 2011, Storper and Venables, 2004). The engineers in Silicon Valley interact regularly, within and across different firms, creating a world-class hub of knowledge and innovation that is unrivaled in the computing, advanced electronics and software industries. The movie industry in Los Angeles provides the same center for knowledge and learning in the entertainment industry. Such learning effects are central to many industries, including manufacturing processes and services that increasingly rely on innovations to remain competitive. (For empirical evidence on productivity gains that accrue to firms that locate in very close proximity to concentrations of employment in their own industry, see, e.g., Rosenthal and Strange, 2003.) Transportation investments that reduce traffic congestion can allow people to interact more readily with a larger pool of like-minded experts, increasing the learning and innovation in a regional economy.

LOCAL (NEIGHBORHOOD) CONGESTION AND ECONOMIC COMPETITIVENESS

While the regional system is important, small neighborhoods are often both places with substantial congestion and places of high economic productivity. Examples include mid-town Manhattan, Chicago within the loop, and the most vibrant and largest employment centers in the SCAG region. Often times the density and interaction needed to create strong agglomeration benefits also create congestion.

Sweet (2014a) devised a way to separately test the effect of regional congestion on regional employment growth and local congestion on local (neighborhood) employment growth. Using data from metropolitan Philadelphia, from 2003

to 2007, he studied how firm relocations are associated with both regional and local congestion measures. The regional congestion measure was based on the difference between peak-period and "free flow" travel time from all Transportation Analysis Zones (TAZ) in the region – weighting the sum of the resulting job access measured from all zones. The local congestion penalty, starting at any one TAZ, is the difference between the peak period and "free flow" job access only for trips that are less than five minutes during the peak period. Both the regional and local measures are based on car travel times. Note that the local measure – the congestion penalty for car trips less than five minutes – is very localized, and will likely represent areas of a mile or even less in dense urban areas.

Sweet (2014a) found that firms were more likely to move away from locations with high regional congestion, but firms were more likely to stay in places with high local congestion. Sweet (2014a) interprets this in a way that is quite similar to the interpretation in Boarnet et al. (2017, pp. 28-30). Small neighborhoods can increase their economic competitiveness by reducing VMT, adopting multi-model transportation options including non-motorized travel and often permanently slowing car travel speeds. There is a growing body of evidence that walkable, transit-oriented neighborhoods are associated with higher house prices, for example (Boarnet et al., 2017, Table 2.) Additionally, some survey evidence shows that businesses in pedestrianized locations – including places where streets were closed to car traffic – experienced improvements in their sales (Boarnet et al., 2017**,** Table 3), although those effects appear to depend on the specific context and type of firm. Yet not every location can be a low-speed, congested place, or the overall benefits of "shrinking distance" via regional transportation links would not be realized. Hence, the evidence in Sweet (2014a) suggests a hierarchical approach, with regional backbones that quickly move persons and goods throughout the metropolitan area, while some small neighborhoods would improve their economic position with the high densities and multiple-modes (including non-motorized modes) that are associated with local congestion.

The modeling analysis of Connect SoCal captures many ways that regional transportation, through Connect SoCal plan, increases regional economic competitiveness. The model is not granular enough to also capture the effect of localized VMT reduction on neighborhood economic outcomes, but we emphasize that the literature suggests that such effects are important in specific places.

OTHER CO-BENEFITS AND GREENHOUSE GAS EMISSION REDUCTION

Good regional transportation planning brings benefits beyond the regional and local benefits described above. Vibrant, multi-modal places could, for example, foster increased physical activity and contribute to reducing criteria air pollutants (e.g. Ozone, particulates) and greenhouse gas (GHG) emissions. These benefits will sometimes not be reflected completely in house prices or local business activity (the measures of local economic benefits described above), but they are real nonetheless, and are often called co-benefits. There is a large body of literature that discusses the link between active transportation to physical activity (e.g. Boarnet, Greenwald, and McMillan, 2008), and several SCAG reports on the topic (see the Environmental Justice Technical Report and the Public Health Technical Report).

The contribution of Connect SoCal to GHG emission reduction and climate risk mitigation could bring economic benefits. Adjustment costs to cope with a warming climate are estimated to be substantial and higher if regulatory action is delayed (e.g. Bianco, et al., 2014), and avoiding those costs – either by reducing GHG emissions, adapting early to future warming, or both – can bring benefits. Recent research has documented that workers are more productive in places and on days when air quality (in terms of criteria pollutants) is better (Graff Ziven and Neidell, 2012). Given the impact of heat on quality of life, in addition to the fact that GHG emissions are usually correlated with emissions of other criteria pollutants, it is sensible to believe that locations with lower GHG emissions could be, all else equal, places where employees are more productive. California's climate change goals are ambitious, and early adoption of transportation and land use planning that is consistent with GHG reductions will smooth the transition cost to those new built environments, lowering the cost compared to later and hence more rapid (and usually more costly) regulatory adaptation. Recent events have demonstrated that California's

climate is at risk of extreme weather events that contribute to more severe droughts and wildfires, and GHG reduction that contributes to less warming can potentially limit the impact of future climate-related extreme or adverse events.

For all these reasons, the contribution of Connect SoCal to GHG reduction can produce benefits, in the form of avoided future economic costs, smoother transition to a low-carbon economy, and increased employee productivity from improved air quality. Some of these effects, such as the value of improved air quality, are modeled in REMI and hence are in the economic benefit analysis described below. Yet, not all of these impacts will be in the economic analysis, and for that reason, we include below additional assessments of the economic benefit of GHG reduction from Connect SoCal.

BENEFITS OF MITIGATING RISK EXPOSURE TO CLIMATE CHANGE

Annual fire-suppression costs reported by the U.S. Forest Service have exceeded $1 billion for 13 of the 18 years between 2000 and 2017, while in 2017 alone, the costs totaled nearly $3 billion. The risk to property owners is particularly acute in areas at the "wildland-urban interface"; in California, this area includes more than 5 million homes in coastal southern California, the Bay Area, and northeast of Sacramento (Westerling and Bryant, 2017).

California's Fourth Climate Change Assessment, published in 2018, found that if GHG emissions were to continue to rise, the frequency of extreme wildfires would increase, translating into a 77 percent increase in average area burned statewide by 2100. In areas most at risk, wildfire insurance costs are estimated to rise 18 percent by 2055. Additional sea level rise attributed to climate change will likely exacerbate economic impacts – an estimated $17.9 billion worth of residential and commercial buildings could be inundated statewide by 2050 due to a projected 50 cm rise in sea levels. A significant coastal flooding event would nearly double these costs (Bedsworth et al., 2018).

In the absence of significant adaptation efforts, sustained GHG emission levels are projected to contribute to massive damage to the U.S. economy through the end of this century. However, concerted efforts to curb emissions can prevent much of the damage, potentially cutting the annual economic toll in some sectors by more than half (Martinich and Crimmins, 2019). In targeting VMT reduction and reducing GHG emissions, Connect SoCal aims to build transportation projects and effectively distribute resources and investment to reach VMT reduction goals while enhancing mobility across the region. Such efforts to meet GHG emissions targets set by the state will serve to mitigate the risks posed by a rapidly warming globe and to furthering both economic vitality and sustainability of the region.

METHODOLOGY

SCAG' economic team used data and software from REMI to estimate the economic impact of Connect SoCal. The REMI TranSight model is an advanced economic analysis model that combines input-output approaches coupled with a model of resident and firm migration into and out of the SCAG region to model the direct, indirect and induced effects of Connect SoCal spending. REMI also includes a general equilibrium model combined with New Economic Geography approaches to model changes in economic competitiveness. REMI TranSight is the most advanced tool commercially available for analysis that forecasts the total economic effects of changes to transportation systems. All of the economic analysis of the plan was conducted using REMI models.

INPUT VARIABLES

TRANSPORTATION CONSTRUCTION & OPERATIONS

Transportation construction projects represent government expenditures over the lifetime of the project, but also stimulate employment and private sector activity during the building and maintenance phases. Project construction costs, as well as project operations and maintenance costs, are entered into TranSight to be translated into demand policy variables. Increased demand for the construction industry is allocated accordingly based on projects across the region, thereby impacting sales, employment, and other variables. Construction

and operating costs may vary significantly based on the type of projects; public transit generally incurs large, continuous operating and depreciation costs, in contrast to road infrastructure projects that may require minimal upkeep.

NETWORK IMPROVEMENT

SCAG's regional travel forecasting model is used to generate inputs for the REMI TranSight model. Using Vehicle Miles Traveled (VMT), vehicle hours traveled (VHT), and number of trips from the Connect SoCal travel demand model, REMI TranSight calculates how consumer, household and business behavior responds to changes within a travel network. This allows forecasts of future economic impacts. REMI TranSight models economic competitiveness in five categories, listed below, which collectively can account for the economic competitiveness effects. Inputs included reductions in commuting costs, accessibility costs, transportation costs, and operations costs and improvements in amenities or reductions in externalities. Each is defined below:

- **Commuting Costs:** Reductions in commuting costs increase the ability of firms to draw from larger labor pools, while easier commuting leads to higher productivity due to improved quality of the employer-employee match and general stability throughout the network. 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 commuting trip time for commuters. 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 expanded labor productivity throughout the SCAG region creating 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:** Accessibility, in the REMI TranSight model, 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. In REMI, this effect models and quantifies how reductions in the cost of transport for business-to-business inputs within the region allows firms to produce at lower cost, or more productively, due to the ease of movement of intermediate goods between regions and the associated strength of local supply chains. 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 from sellers to buyers between regions. This effect, in REMI TranSight, models how reduced costs for transporting outputs allow firms to access larger markets and quantifies the cost of transportation between points of final production and final sale/consumption. 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:** REMI models how improvements in amenities, e.g. reduced congestion, improved safety or improved air quality, will draw in-migrants to a region. Access to this additional labor force provides incentives for industries to cluster and agglomerate in the region. While the culture, climate, and natural beauty of the SCAG

region already serves as a driver for skilled in-migrants, improving other amenities through transportation system investments will attract more migrants into the region and create a bigger cluster of labor for businesses to choose from. This is important to the economic competitiveness of the region, as employers can produce more for the same work from employees. These all, in sum, add to the attractiveness of a region, and are the basis for the amenity impacts in REMI TranSight.

- **Operating Costs:** Transportation improvements can have a big influence on business/household economies in terms of their fuel and vehicular repair purchases. REMI models how reductions in expenditures on fuel or vehicles, for example, frees up income for residents to spend elsewhere, and the associated impacts on the regional economy. 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 later years of projection.

RESULTS

PROJECT EXPENDITURES

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 Connect SoCal expenditures exceeding $603 billion, more than sixty percent 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 which are excluded from our analysis in **TABLE 1**. (See Transportation Finance Technical Report for detail information).

The results are shown in two parts: first, jobs that result from Connect SoCal expenditures (direct, indirect and induced effects), and then additional jobs that flow from the improvements to the transportation network, resulting in network efficiencies and related increases in regional economic and business competitiveness.

JOBS RESULTING FROM INVESTMENT SPENDING ON CONSTRUCTION, OPERATION AND MAINTENANCE, PLUS MULTIPLIER EFFECTS

TABLE 2 shows the annual average jobs from Connect SoCal Financial Plan spending. This is a traditional economic analysis, modeling the stimulus from new spending in the form of direct jobs and multiplier effects (indirect and induced effects). The job impact is reported as annual average jobs in five-year periods (starting with Fiscal Year (FY)2020-21 through FY2024-25), for each

TABLE 1 Net Project Expenditures (in Billions of Nominal Dollars)

	FY2020-21 to FY2024-25	FY2025-26 to FY2029-30	FY2030-31 to FY2034-35	FY2035-36 to FY2039-40	FY2040-41 to FY2044-45	Total
TOTAL	$72.1	$89.6	$125.4	$148.7	$167.5	$603.3

county and for the entire SCAG region. The last column in **TABLE 2** shows jobs, averaged over all plan years, from Connect SoCal construction, operations and maintenance spending.

Over the twenty-five year period, the plan will generate an annual average of 168,400 jobs in the SCAG region. More than 45 percent of these will fall in Los Angeles County, with 21 percent in Orange County and 19 percent in Riverside County.

We note that REMI's output is expressed in terms of job-years – a new job that lasts for five years is five job-years in REMI. Jobs are created and lost in an economy on an ongoing basis, and the job-year concept allows the REMI TranSight model to track jobs over time. When we express annual average jobs in the five-year period, that annual average would be equal to the number of new jobs in the five-year period if those jobs lasted, on average, five years. We note that REMI TranSight has an advanced ability to model economic dynamics, including year-to-year variations in job creation and destruction. The job-year concept reflects that advanced capability. To keep the language simpler, we refer to job impacts as averages over either five-year periods or the entire plan.

JOBS RESULTING FROM ENHANCED NETWORK EFFICIENCY, ECONOMIC COMPETITIVENESS AND AMENITY

Network efficiency in the form of improved transportation access is a second source of job growth. **TABLE 3** shows the jobs from improved economic competitiveness that result from network benefits (flowing from reduced commuting, accessibility, and transport costs as defined above) 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 264,500 jobs in the SCAG region during the FY2020-21 through FY2044-45 time period. Note that those jobs are in addition to

TABLE 2 Job Creation Impact from Construction, Operations, and Maintenance Spending, Annual Average Jobs (Relative to Baseline), Thousands

	FY2020-21 to FY2024-25	FY2025-26 to FY2029-30	FY2030-31 to FY2034-35	FY2035-36 to FY2039-40	FY2040-41 to FY2044-45	Average per year
Imperial	0.3	0.5	0.4	0.7	0.1	0.4
Los Angeles	80.4	72.9	90.9	78.6	63.4	77.2
Orange	32.2	31.2	36.1	37.6	38.7	35.1
Riverside	29.9	26.3	27.2	31.7	41.4	31.3
San Bernardino	17.0	14.3	15.4	22.5	24.4	18.7
Ventura	4.6	5.1	6.6	6.7	5.1	5.6
SCAG Region	164.4	150.2	176.5	177.8	173.2	168.4

Source: SCAG calculations from 2020 RTP/SCS financial plan input into REMI model. Note that the REMI model reports full and part-time jobs, and the job numbers include both full-time and part-time jobs.

TABLE 3 Job Creation Impact from Enhanced Economic Competitiveness, Annual Average Jobs (Relative to Baseline), Thousands

	FY2020-21 to FY2024-25	FY2025-26 to FY2029-30	FY2030-31 to FY2034-35	FY2035-36 to FY2039-40	FY2040-41 to FY2044-45	Average Per Year
Imperial	0.2	0.5	0.7	1.0	1.4	0.8
Los Angeles	46.9	119.8	195.2	252.3	299.1	182.6
Orange	10.8	19.4	28.4	36.3	44.5	27.9
Riverside	12.9	27.7	41.7	55.8	70.4	41.7
San Bernardino	1.7	3.8	6.1	13.3	23.7	9.7
Ventura	0.6	1.2	1.7	2.3	2.8	1.7
SCAG Region	73.2	172.4	273.9	361.1	441.9	264.5

Source: SCAG calculations from 2020 RTP/SCS travel model results input into REMI TranSight model.

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 Connect SoCal. The economic competitiveness jobs grow over time, as the effect of SConnect SoCal plan relative to baseline results in cumulative network efficiencies, over the course of Connect SoCal.

TOTAL JOBS RESULTING FROM THE INVESTMENT SPENDING AND ENHANCED NETWORK EFFICIENCY

The full economic impact from Connect SoCal investment is summarized below, with thousands of jobs (annual average) resulting from Connect SoCal in five-year time periods and an annual average for FY2020-21 through FY2044-45 shown. The total combined jobs from the two effects, plan investment (construction, operations and maintenance spending) and network efficiency/ economic competitiveness, are shown summed together in **TABLE 4** to highlight the total economic impact of Connect SoCal. Implementing Connect SoCal would create an average of 432,900 jobs a year over the FY2020-21 through FY2044-45 period.

CONCLUSION

The economic analysis shows that the implementation of Connect SoCal will result in:

Job growth from building, operating and maintaining the regional transportation infrastructure projects, averaging over 168,400 jobs per year;

Increases in economic competitiveness, efficiency of the transportation system and amenity-- reduced congestion, improved safety, and improved air quality-- from completion of the projects and operations, averaging an additional 264,500 jobs per year.

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. Connect SoCal outlines a transportation infrastructure investment strategy that will beneficially impact Southern California, the state, and the nation in terms of economic development, job creation and economic growth, and overall business and economic competitive

TABLE 4 Job Creation Impact from All Sources Including Construction, Operations and Maintenance, and Network Benefits, Annual Average Jobs (Relative to Baseline), Thousands

	FY2020-21 to FY2024-25	FY2025-26 to FY2029-30	FY2030-31 to FY2034-35	FY2035-36 to FY2039-40	FY2040-41 to FY2044-45	Average per year
Imperial	0.5	1.0	1.2	1.7	1.5	1.2
Los Angeles	127.3	192.7	286.0	330.9	362.5	259.9
Orange	43.0	50.6	64.5	74.0	83.1	63.1
Riverside	42.8	53.9	69.0	87.5	111.8	73.0
San Bernardino	18.8	18.2	21.5	35.8	48.2	28.5
Ventura	5.2	6.3	8.3	9.0	7.9	7.3
SCAG Region	237.6	322.7	450.5	538.9	615.1	432.9

Source: SCAG calculations from 2016 RTP/SCS travel model results input into REMI TranSight model

advantage in the global economy in terms of job creation and economic growth throughout the Southern California region. Over the FY2020-21 through FY2044-45 period, Connect SoCal calls for the spending of more than $603 billion on transportation improvement projects. The findings show that over the 25-year period and six-county SCAG region, the plan will generate significant employment gains. Connect SoCal boosts 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.

The economic analysis shows that across SCAG's six-county region, an annual average of more than 168,400 jobs will be generated by the construction, maintenance and operations expenditures that are specified in Connect SoCal program and the indirect and induced jobs that flow from those expenditures. When investments are made in the transportation system, the economic benefits go far beyond the jobs created by building it, operating it and maintaining it. Unlike spending to satisfy current needs, infrastructure delivers benefits for decades. The infrastructure, once built, can enhance the economic competitiveness of a region. Projects that reduce congestion may help firms produce at lower costs, 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. An additional 264,500 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 Connect SoCal.

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