TRANSPORTATION IMPACT ANALYSIS

16234 FOLGER STREET

HACIENDA HEIGHTS, LOS ANGELES COUNTY, CALIFORNIA

LSA

November 2021

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Project Case Number: 2019-000181
Vesting Tentative Tract Map: 82159
RPPL: 2019000320

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LSA

November 2021

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LIST OF ABBREVIATIONS AND ACRONYMS

Bicycle Master Plan	County of Los Angeles Bicycle Master Plan
CalEEMod	California Emissions Estimator Model
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CC&Rs	Covenants, Conditions and Restrictions
CEQA	California Environmental Quality Act
CMP	Congestion Management Program
County	County of Los Angeles
County Guidelines	*Transportation Impact Analysis Guidelines*
District	Hacienda La Puente Unified School District
EIR	Environmental Impact Report
GHG	greenhouse gas
HHIA	Hacienda Heights Improvement Association
HOA	Homeowners Association
ITE	Institute of Transportation Engineers
Lennar	Lennar Homes of California
Metro	Los Angeles County Metropolitan Transportation Authority
mph	miles per hour
OCTA	Orange County Transportation Authority
OPR	Office of Planning and Research
OPR Guidance	December 2018 Vehicle Miles Traveled Technical Advisory
PDF	Project Design Feature
project	16234 Folger Street Project
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
SR-60	State Route 60
TDM	Transportation Demand Management
TPA	Transit Priority Area
traffic model	Regional Travel Demand Model
VMT	vehicle miles traveled

INTRODUCTION

The Los Angeles County (County) Public Works *Transportation Impact Analysis Guidelines* (County Guidelines) (DPW 2020) updated and replaced the County *Traffic Impact Analysis Report Guidelines* (DPW 2013). The County Guidelines establish a methodology for analyzing the transportation impacts of projects that is consistent with Senate Bill 743 and recent updates to the California Environmental Quality Act (CEQA). The County Guidelines describe the methodology for analyzing project impacts according to vehicle miles traveled (VMT) for the CEQA analysis and provide a methodology for analyzing site access, which may occur outside of CEQA. LSA has prepared the following analysis of the 16234 Folger Street Project (project) in Hacienda Heights, an unincorporated community in Los Angeles County, consistent with the County Guidelines. As specified in the County Guidelines, data were queried from the Southern California Association of Governments (SCAG) Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) Regional Travel Demand Model (traffic model).

The purpose of this analysis is to identify potential conflict or consistency with *State CEQA Guidelines* section 15064.3, subdivision (b)(1). The project proposes to replace an existing vacant elementary school structure (Glenelder Elementary School) with 85 single-family residential units in the unincorporated community of Hacienda Heights (Supervisorial District 4). The project is generally located north of State Route 60 (SR-60), south of Gale Avenue, east of Stimson Avenue, and west of Azusa Avenue. Figure 1 shows the location of the project and the study intersections included in a separate site access study.

METHODOLOGY

The following methodology is prescribed by the County Guidelines.

Screening Criteria

The County Guidelines establish screening criteria for development projects to determine whether an analysis of VMT is required. The County Guidelines provide four screening criteria:

- *Non-Retail Project Trip Generation Screening*—If a development project generates a net increase of fewer than 110 daily vehicle trips, then no further analysis is required.

- *Retail Project Site Plan Screening*—Local serving retail uses are assumed to have a less than significant VMT impact, generally determined for retail uses of 50,000 square feet (sf) or less.

- *Proximity to Transit Based Screening*—Projects located within a 0.5-mile radius of a major transit stop or an existing stop along a high-quality transit corridor would have a less than significant impact if the following cases apply:

    - The project has a Floor Area Ratio greater than 0.75.

    - The project provides no more parking than required by the County Code.

    - The project is consistent with the SCAG RTP/SCS.

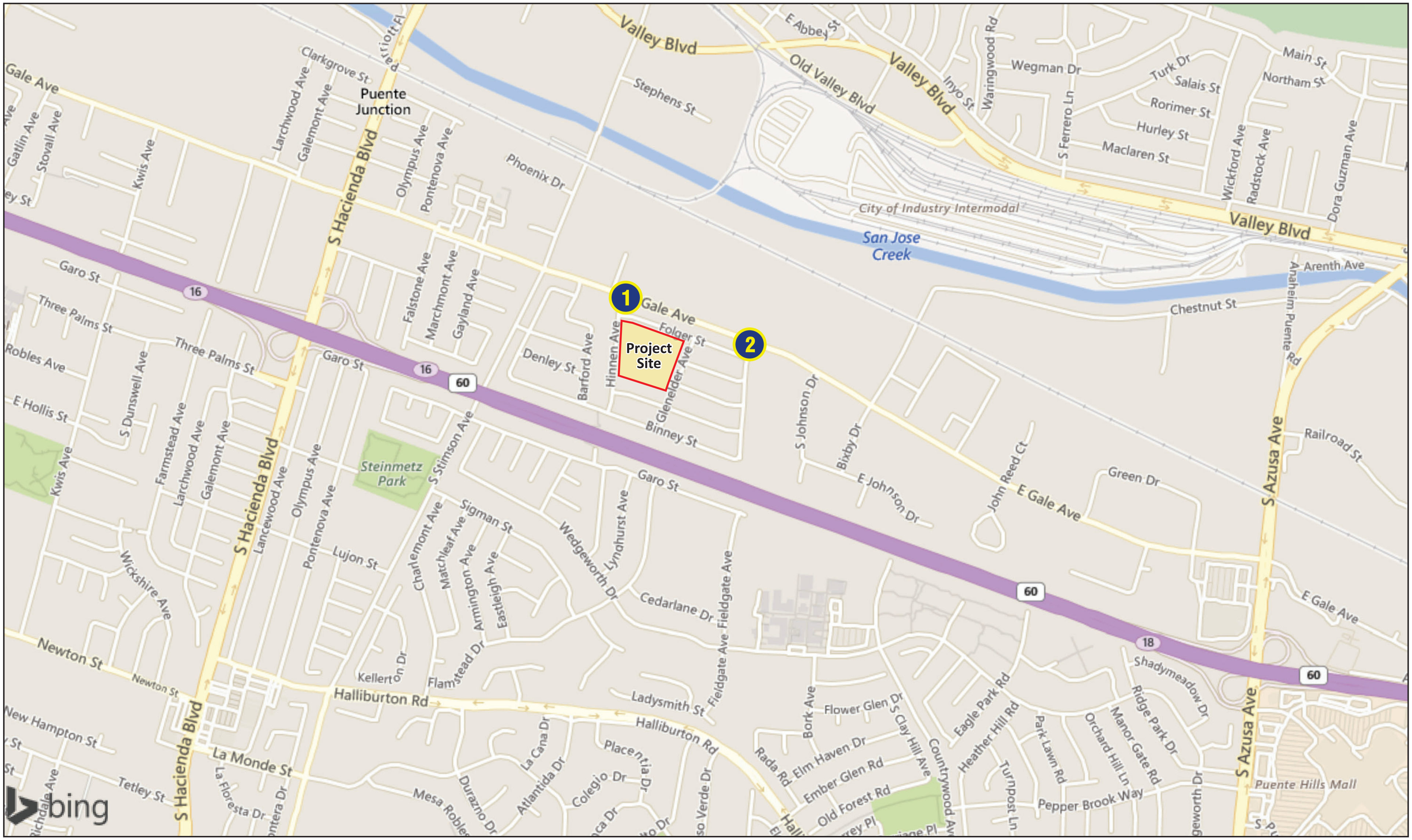

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FIGURE 1

LEGEND

- Project Site
- Study Area Intersections

N

0 750 1500

FEET

SOURCE: Bing Maps

16234 Folger Street

Project Location and
Study Area Intersections

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- The project does not replace residential units set aside for lower-income households with a smaller number of market-rate residential units.

- *Residential Land Use Based Screening*—If a residential project sets aside 100 percent of the units for lower-income households, then the project is presumed to have a less than significant impact on VMT.

Project Impact Determination—Residential Projects

Daily vehicle trips, daily VMT, and daily residential VMT per capita may be estimated using the SCAG RTP/SCS traffic model. VMT is a metric combining the vehicle trips generated by a project and the distance traveled by those vehicles. Transportation Demand Management (TDM) strategies to be included as Project Design Features (PDFs) to reduce the number or length of vehicle trips should be considered in the estimation of the project's daily vehicle trips and VMT.

Cumulative effects on VMT are determined through consistency with the SCAG RTP/SCS. Inasmuch as the SCAG RTP/SCS is a regional plan demonstrating compliance with greenhouse gas (GHG) reduction targets, projects that are consistent with the plan in terms of development location, density, and intensity are part of the demonstrated regional solution. Projects inconsistent with the SCAG RTP/SCS may require further evaluation to determine whether they would result in a significant cumulative impact on VMT.

The County Guidelines include a list of TDM strategies that could be included as PDFs or as mitigation. The County Guidelines do not provide guidance on mitigation effectiveness and request that analyses provide substantial evidence of effectiveness. The table below presents examples provided in the County Guidelines. The County Guidelines explicitly state that additional TDM measures beyond these specific examples may be considered.

Category	Measure
Commute Trip Reduction	• Commute Trip Reduction Programs with Required Monitoring • Ride Sharing Programs • Subsidized or Discounted Transit Programs • Telecommuting • Alternative Work Schedules
Land Use/Location	Increase Transit Accessibility
Parking Policy/Parking	Unbundle Parking
Neighborhood/Site Enhancement	• Pedestrian Network Improvements • Traffic Calming Measures • Car-Sharing Programs

Source: *Transportation Impact Analysis Guidelines.* Table 3.1.5-1: TDM Strategies (DPW 2020).

PROJECT DESCRIPTION

Lennar Homes of California, Inc., (Lennar) proposes to develop a new single-family residential community on a portion of the approximately 10-acre lot at 16234 Folger Street in Hacienda Heights. The project site is designated H-9 residential in both the County General Plan and the Hacienda Heights Community Plan, which allows for residential development up to a maximum density of 9 dwelling units per acre. The project would include 85 detached single-family dwelling units, one common Homeowners Association (HOA) open space Lot A, and one park site. The proposed density would be 8.5 dwelling units per acre, which is consistent with the land use regulations. Figure 2 displays the site plan for the project.

The project includes the following PDFs:

- Enhanced remote work and telework—features within the home that would encourage and facilitate working from home similar to California Air Pollution Control Officers Association (CAPCOA) publication *Quantifying Greenhouse Gas Mitigation Measures* (CAPCOA Manual) (CAPCOA 2010) strategy TRT-6

- On-site parks—increased diversity of the suburban development through inclusion of parks accessible to the public similar to CAPCOA Manual strategy LUT-3

- Pedestrian network improvement through the project site—sidewalks connecting the project site to the existing pedestrian network and through the site providing more efficient pedestrian travel paths in line with CAPCOA Manual strategy SDT-1

- On-site bicycle parking—bicycle parking provided in private garages and in common areas consistent with CAPCOA Manual strategy SDT-7

- A car-sharing program—a forum for car-sharing tailored to the community that will be created similarly to CAPCOA Manual strategy TRT-9

- A ride-sharing program—a forum for ridesharing tailored to community needs including midday trips that will be created similarly to CAPCOA Manual strategy TRT-3

- A school pool program—a forum that will be created and resources that will be provided to facilitate carpooling and organizing "walking school buses" to schools consistent with CAPCOA Manual strategy TRT-10

The project also includes the following improvements in the surrounding neighborhood to remove signage and striping related to the vacant elementary school to be replaced.

- Removal of "School" or "School Xing" signs at the following locations:
    - South side of Hinnen Avenue at Gale Avenue
    - North side of Hinnen Avenue at Denley Street

Community Stats

	PLAN 1	PLAN 2	PLAN 3
SIZE (S.F.)	2,245	2,465	3,035
BED	3	4	5
BATH	2.5	3	3
GARAGE *TWO ADDITIONAL SPACES IN DRIVEWAY	2	2	2
HOMES	23	28	34
TOTAL	85 HOMES		

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FIGURE 2

N

0 80 160
FEET

SOURCE: Lennar

16234 Folger Street

Site Plan

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- West side of Glenelder Avenue at Shadybend Drive
- North side of Glenelder Avenue at Denley Street
- South side of Glenelder Avenue at Denley Street
- North side of Glenelder Avenue at Binney Street
- Binney Street east of Hinnen Avenue

- Removal of "Slow School Xing" pavement markings at the following locations:
  - Glenelder Avenue at Shadybend Drive
  - Binney Street east of Barford Avenue
  - Binney Street east of Hinnen Avenue
  - Glenelder Avenue north of Binney Street

- Repainting yellow (i.e., school) crosswalks to white at the following locations:
  - South leg of Hinnen Avenue at Gale Avenue
  - East leg of Hinnen Avenue at Folger Street
  - North leg of Hinnen Avenue at Binney Street
  - Across Binney Street west of Hinnen Avenue
  - South leg of Glenelder Avenue at Folger Street
  - North leg of Glenelder Avenue at Denley Street

- Adding crosswalk or restriping to high-visibility crosswalks at the following locations:
  - West leg of Glenelder Avenue at Denley Street
  - East leg of Hinnen Avenue at Denley Street
  - Across Binney Street
  - North leg of Wedgeworth Drive at Glenelder Avenue
  - North leg of Wedgeworth Drive at Fieldgate Avenue

SITE CONDITIONS

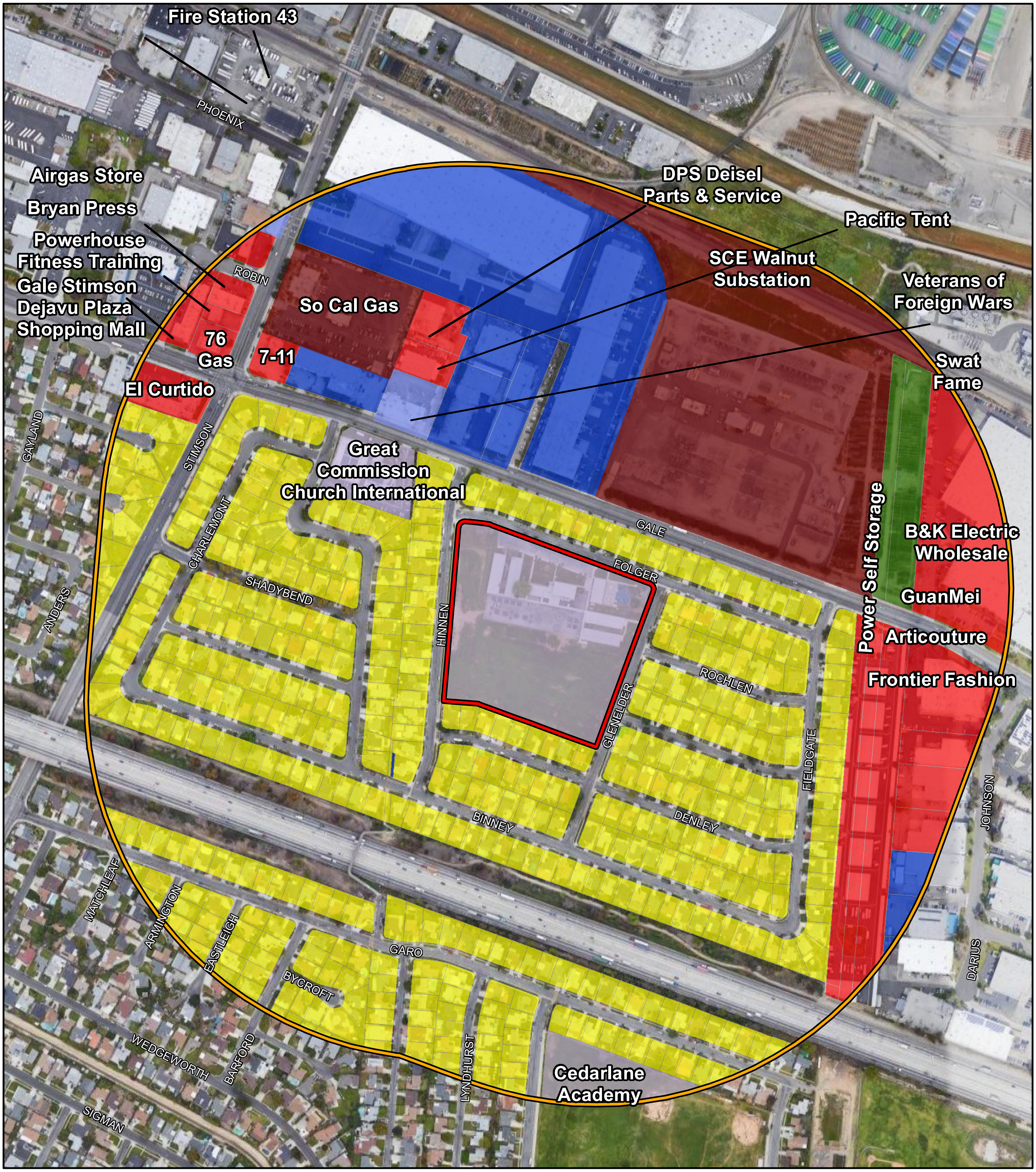
Neighboring Land Uses

Figure 3 illustrates land uses within approximately 0.25 mile of the project site. Potential pedestrian destinations include a church, a school, and a small retail development.

Existing Circulation System

Regional travel to and from the project site is most likely to be accommodated by State Route 60 (SR-60). The nearest on- and off-ramps are located on Hacienda Boulevard, approximately 0.9 mile from the project site. Key roadways in the vicinity of the project are as follows:

- **SR-60** is south of the project site. This freeway is an east-west State facility that extends from East Los Angeles to Beaumont. SR-60 is also classified as a State freeway in the County CMP. Direct access to the project site from SR-60 is provided via the Hacienda Boulevard and Azusa Avenue interchanges.



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LEGEND

Project Location
Land Use Study Area
Land Uses
Single Family Residential
Commercial and Services
Facilities
Education
Industrial
Transportation, Communications, and Utilities
Agriculture
Vacant

0 250 500
FEET

SOURCE: BING Maps (~2016)

FIGURE 3

16234 Folger Street

Land Uses Surrounding Project Site

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- **Hacienda Boulevard** is west of the project site. This roadway is classified as a six-lane principal arterial in the County CMP. The roadway also provides direct access to SR-60. Sidewalks are provided on both sides of the street in the vicinity of the project study intersections. The posted speed limit is 40 miles per hour (mph). A raised median is provided along this roadway.
- **Folger Street** is north of the project site. This roadway is two lanes (one lane in each direction) along the project site. The posted speed limit is 25 mph. Sidewalks are available on the south side of the street adjacent to the project site. Striped bicycle lanes are not provided on Folger Street.
- **Gale Avenue** is north of the project site. This roadway is four lanes—two lanes in each direction—and runs east-west with a two-way left-turn lane median. Sidewalks are provided on both sides of the street in the vicinity of the project site. The posted speed limit is 35 mph.
- **Azusa Avenue** is east of the project site. This roadway is classified as a six-lane principal arterial in the County CMP. The roadway also provides direct access to SR-60. Sidewalks are provided on both sides of the street in the vicinity of the project study intersections. The posted speed limit is 40 mph. A raised median is provided along this roadway.

Existing Transit Service

The project area is served by a single regional bus transit provider: Foothill Transit. Within the immediate area of the project site (0.5 mile), bus stops are currently located near the intersections of Hinnen Avenue/Gale Avenue and Fieldgate Avenue/Gale Avenue. Bus service on this route is frequent, but this path does not qualify as a high-quality transit corridor.

Foothill Transit provides fixed-route bus service in the vicinity of the project. There are bus stop locations for Lines 281 and 285, which run along Hacienda Boulevard, Gale Avenue, Azusa Avenue, and the Puente Hills Mall Transit Center, which is near the project site. Lines 185 and 282 run along Colima Road, Halliburton Road, Azusa Avenue, and the Puente Hills Mall Transit Center. Line 194 runs along Valley Boulevard to the north of the project site.

SCREENING ANALYSIS

This section considers whether any of the screening criteria apply to the project.

Non-Retail Project Trip Generation Screening

The project is a nonretail project. This criterion considers the net increase in daily vehicle trips. Table A shows the daily and peak-hour trips generated using trip rates contained in the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 10th Edition (ITE 2017). While an active school site would generate significantly more daily traffic than the project, the school site being replaced is inactive. Because the school site is inactive, no credit for existing trip generation is taken. As Table A shows, the project is anticipated to generate 802 daily trips. The trip generation is anticipated to be higher than 110 daily trips; therefore, this screening criterion does not apply.

Table A: Trip Generation Summary

Land Use	Size	Unit	ADT	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Trip Rates (Land Use Code)[1]									
Single-Family Detached Housing (210)		DU	9.44	0.19	0.55	0.74	0.62	0.37	0.99
Elementary School (520)		TSF	19.52	3.83	3.14	6.97	0.62	0.75	1.37
Existing Trip Generation									
Elementary School (520)—Decommissioned		TSF	0	0	0	0	0	0	0
Proposed Project Trip Generation									
Proposed Single-Family Detached Housing	85	DU	802	16	47	63	53	31	84
Net New Trip Generation			**802**	**16**	**47**	**63**	**53**	**31**	**84**

[1] Trip rates referenced from the *Trip Generation Manual*, 10th Edition (ITE 2017).
ADT = average daily traffic (measured in trips)
DU = dwelling unit
ITE = Institute of Transportation Engineers
TSF = thousand square feet

Retail Project Site Plan Screening

The project is nonretail. Therefore, this screening criterion does not apply.

Proximity to Transit Based Screening

The project is consistent with the County General Plan (and the SCAG RTP/SCS) and does not replace affordable residential units. Transit service within 0.5 mile of the project site is frequent but does not qualify as a high-quality transit corridor. Therefore, this screening criterion does not apply.

Residential Land Use Based Screening

The project would construct new residential dwelling units at the maximum density permitted by the County General Plan, furthering the State and County's housing goals. However, the project does not set aside 100 percent of the units for lower-income households. Therefore, this screening criterion does not apply.

VMT CALCULATION

LSA used the SCAG RTP/SCS traffic model to query the VMT per capita of the existing neighborhoods surrounding the project site. According to the SCAG RTP/SCS traffic model, the existing residential development surrounding the project site generates 18.9 VMT per capita. Because infill projects would likely generate the same travel demand as the existing neighborhood, the project (with no PDFs) would be expected to have the same 18.9 VMT per capita as its neighbors.

The County Guidelines have established a significance threshold of 16.8 percent below the existing baseline. For the South County Baseline Area, the existing average is 12.7 VMT per capita, and the threshold after applying the 16.8 percent reduction is 10.6 VMT per capita. The existing homes (and the project with no PDFs to reduce VMT) generate VMT at a rate 49 percent above the regional average. Therefore, it is anticipated that without PDFs or mitigation to reduce VMT, the project would have a significant impact on VMT.

Table B displays VMT per capita and total VMT calculations for the project. Calculating total project VMT requires the project population. The County has an established methodology for estimating the future population of a residential project. The County Department of Parks and Recreation calculates a project's park obligation by estimating 3.51 people per single-family detached dwelling unit, which the County determined based on United States Census data. For the 85-unit development, the projected population would be 298 persons (85 homes x 3.51 people per home).

Table B: VMT Generation Summary

	VMT Per Capita	Total VMT (298 persons[1])
Glenelder Neighborhood	18.9	5,632
VMT Impact Criteria[2]	10.6	3,159
Excess VMT	8.3	2,473

[1] 85 dwelling units x 3.51 persons per unit = 298 persons.
[2] The data are from *Transportation Impact Analysis Guidelines,* Table 3.1.3-2 (DPW 2020).
VMT = vehicle miles traveled

As Table B shows, without PDFs or mitigation to reduce VMT, the project would exceed the VMT impact criteria by 8.3 VMT per capita, which is a total of 2,473 VMT. Therefore, the PDFs and mitigation measures would need to reduce at least 2,473 VMT to reduce the project impact to less than significant.

LEGAL FRAMEWORK FOR EVALUATING VMT REDUCTIONS FOR THE PROJECT

The project includes a combination of PDFs that reduce VMT and suggested mitigation measures that further reduce VMT. Under CEQA, the effectiveness of both categories of VMT reductions is to be supported by substantial evidence.[1] Courts have generally deferred to an agency's assessment of the effectiveness of a mitigation measure, even if others argue that the measure is ineffective (*Laurel Heights Improvement Ass'n v. Regents of Univ. of Cal* [1988] 47 Cal3d 376, 407).

VMT is a new metric for determining CEQA impact, and the most detailed statewide resources on VMT mitigation are the Office of Planning and Research (OPR) Technical Advisory on Evaluating Transportation Impacts in CEQA (OPR Guidance) (OPR 2018) and the nonregulatory CAPCOA Manual.[2] The OPR Guidance repeatedly cites the CAPCOA Manual and includes summary descriptions of VMT reduction measures included in the CAPCOA Manual.

[1] The substantial evidence standard for mitigation effectiveness applies to both Environmental Impact Reports and Negative Declarations under CEQA, although the less deferential "fair argument" standard of judicial review applies to the overall adequacy of a Negative Declaration.
[2] The CAPCOA Manual expressly states that it should not be used for any regulatory purpose.

There are three overarching constraints imposed by the combination of the OPR Guidance, the County's adopted VMT reduction threshold, and the CAPCOA Manual:

1. The OPR Guidance prescribes a recommended analytical methodology for calculating "average" VMT in a county by combining VMT averages from the county's unincorporated lands with the VMT averages from the cities in the county. Given the size, density, and availability of transit in Los Angeles and other jurisdictions, for the South County this methodology means that VMT in most unincorporated existing county communities is higher than the OPR-compliant county average. In existing suburban-scale communities such as Glenelder, the average VMT is 49 percent higher than the OPR-compliant methodology county average. OPR has carved out only three exceptions for residential projects: (1) projects located in existing Transit Priority Areas (TPAs), not planned new TPAs; (2) small projects (less than 110 trips/day); and (3) projects consisting of exclusively affordable-housing units.

2. The County adopted a VMT reduction threshold of 16.8 percent below the County average based on a California Air Resources Board (CARB) recommended VMT reduction threshold. For Glenelder, this threshold means that project residents must have 44 percent lower VMT than their neighbors in this infill location.

3. The CAPCOA Manual includes a "maximum" VMT reduction of 15 percent for projects in suburban-scale communities from all VMT measures identified in the CAPCOA Manual combined. As many commenters pointed out to OPR, it is not possible for occupants of a new residential project in an infill location to have dramatically different transportation patterns than their preexisting neighbors.

Within this framework, all nonscreened residential projects in existing infill communities within the unincorporated County, based on the 15 percent global maximum VMT reduction criteria established in the CAPCOA Manual, would result in a significant and unavoidable VMT impact requiring an EIR. Fortunately, the CAPCOA Manual is only one of the available sources of substantial evidence for VMT reduction effectiveness, and on-site VMT reduction is not the only source of VMT reduction available to a project. Below are three additional available sources of substantial evidence:

1. Updated Analyses of CAPCOA Measure Effectiveness:

    a. The CAPCOA Manual references peer review studies going back a decade or more. Newer analyses of CAPCOA measures completed by experts also constitute substantial evidence of VMT reduction effectiveness. For example, bike pathway studies referenced in the CAPCOA Manual did not differentiate between VMT effectiveness rates under the current bicycle pathway classification system, and newer studies do so.

    b. The CAPCOA Manual includes in many cases a broad range (e.g., from 0 to 10 percent) of VMT reduction effectiveness under any given circumstance. Newer analyses of CAPCOA measures by the County and other jurisdictions constitute substantial evidence in support of refinements to the CAPCOA Manual ranges of VMT mitigation effectiveness. For example, SCAG has developed pre-COVID-19 remote/telework mode share data that are specific to the region and were updated as of 2019. The project includes a mixed-use element (a neighborhood park) and various other PDFs and mitigation measures using these more refined VMT reduction metrics.

2. Certified CEQA Documents with VMT Reduction Metrics:

   a. The Bicycle Master Plan Final Program Environmental Impact Report (EIR) (DPW 2012b) established VMT reduction calculation methodologies for each completed mile of planned bike pathways in various subregions of the County.

   b. Other jurisdictions, such as the City of Long Beach and the City of Los Angeles, have adopted VMT reduction calculation methodologies for various multimodal transportation strategies, including Complete Streets, various classes of bicycle facilities, and land use mixes.

3. Fee Payment for VMT Reduction Plan Implementation:

   a. CEQA also recognizes the mitigation effectiveness of requiring projects to make fair-share payments for an impact that is primarily cumulative in nature (e.g., transportation) to help fund "part of a reasonable plan of actual mitigation that the relevant agency commits itself to implementing" (*Anderson First Coalition v. City of Anderson* [2005] 130 CA4th 1173, 1187; *Save Our Peninsula Comm. v. Monterey County Bd. of Supervisors* [2001] 87 CA4th 99, 141). CEQA does not require the establishment of a formal fee program, only that the agency has committed itself to a "plan of actual mitigation" (14 California Code of Regulations § 15130(a)(3)). If the plan does not itself include fee amounts, the mitigation measure should explain what plan activity is intended to be funded by the fee to cover the project's fair share.

   b. In evaluating the sufficiency of fair-share payments for such plans, courts are to assume that an agency will implement its own plan in compliance with its own ordinance and will spend mitigation fees for "the purposes for which it collects them" (*Save Our Peninsula Comm. v. Monterey County Bd. of Supervisors* [2001] 87 CA4th 99, 141).

Within this legal framework, a summary of the VMT reductions for the project, in relation to relevant average VMT and significance thresholds, follows in Tables C and D below. A more detailed description of these VMT reduction measures is set forth herein.

Table C: VMT Reduction Calculation

	Value	Percentage
South Los Angeles County Average VMT	12.7	–
VMT Reduction Required for Less Than Significant VMT Impact under the Los Angeles County Threshold	10.6	16.8% below the South Los Angeles County Average VMT
Glenelder Project Location Traffic Analysis Zone VMT	18.9	49% above the South Los Angeles County Average VMT
Total VMT Reductions Required for Less Than Significant VMT Impact	8.3	44% below the Project Location Traffic Analysis Zone Average VMT

VMT = vehicle miles traveled

Table D: VMT Reductions from Project Design Features and Mitigation Measures

	Value	Percentage of 2,473 VMT over the County Threshold
CAPCOA Manual Maximum On-Site VMT Reduction from All Measures	726	13%
Project/Neighborhood VMT Reductions (car-sharing, ride-sharing, and school pool programs and on-site parks)	1,509	27%
Funding for Approved Bicycle Master Plan Projects	283	5%
Total VMT Reductions from the Project	2,518	45% (greater than the 44% reduction required for the project to be less than significant)

CAPCOA = California Air Pollution Control Officers Association
VMT = vehicle miles traveled

VMT REDUCTION MEASURES—PROJECT DESIGN FEATURES

The applicant team reviewed the TDM strategies identified in the County Guidelines and the transportation strategies identified in the CAPCOA Manual to determine which could be applied to the project. In some cases strategies applied to the project are similar to, but not exactly identical to, those described in the CAPCOA Manual. This is due to the CAPCOA Manual describing strategies for larger or other types of land uses and adaption of those strategies to the infill residential project. A table detailing whether each strategy is applicable is provided in Appendix A. The measures identified as feasible and proposed by the project as PDFs are the following:

- Enhanced remote work and telework
- On-site parks
- Pedestrian network improvement through the project site
- On-site bicycle parking
- A car-sharing program
- A ride-sharing program
- A school pool program

On-Site VMT Reduction Strategies

PDFs will support enhanced remote work and telework, on-site parks, pedestrian network improvement, and on-site bicycle parking. The effectiveness of each of these features is described below based on guidance presented in the CAPCOA Manual, which provides substantial evidence of each PDF's effectiveness. For most PDFs, the CAPCOA Manual provides a range of effectiveness. In some cases, information in addition to what was presented in the 2010 CAPCOA Manual is used to inform the estimated effectiveness. Excerpts from the CAPCOA Manual are provided in Appendix B. Combined together, the following PDFs are anticipated to reduce the VMT generated by the project by 15 percent in comparison to the surrounding existing neighborhood average VMT.

Enhanced Remote Work and Telework Features (Similar to CAPCOA Manual Strategy TRT-6)

This measure is identified to be applicable to retail, office, industrial, and mixed-use projects, but measures can also be taken by the proposed residential project to facilitate increased remote work and telework. Even before the COVID-19 pandemic, from 2000 to 2019, California's remote workforce had grown steadily to approximately 6 percent of statewide workers. SCAG reported that approximately 6.2 percent of the region's workforce worked from home (SCAG 2021)[3]. An additional approximately 14.9 percent telecommuted in lieu of commuting to their workplace between 1 and 4 days per week (Orange County Transportation Authority [OCTA] 2020). (Reports related to remote work and telework are provided in Appendix C.) SCAG has projected that in the Professional/ Business Services sector, "rapid adoption of telework" has resulted in these companies being able to maintain more than 80 percent of their productivity even during shelter-in-place restrictions (SCAG 2020).[4] Broadband utilization also more than doubled (133 percent above prepandemic levels), likewise attributed by SCAG to telework. SCAG has also shown that remote work (from both home-based offices and telecommuters who still sometimes commute to the office) correlates to income, with median-income and above-median-income households being more likely to telework (SCAG 2020).[5]

The OCTA released the results from an employment and travel survey (included in Appendix C) that further support the wider survey results presented by SCAG. The OCTA survey of Orange County residents found that 11.5 percent worked from home exclusively before the pandemic, that 23.3 percent telecommuted 1 or more days per week, and that, on average, telecommuting accounted for 15.1 percent of days worked. On average, 50.9 percent of people expected to remain telecommuters post-COVID-19. These surveys suggest an even higher rate of telecommuting than the SCAG report.

Remote workers were not, however, included in modeled projections of the region's VMT, nor was remote work credited as a VMT (or GHG) reduction by SCAG. Since the pandemic began, remote work has become a necessity for many nonessential workers and has continued for many months under workplace restrictions for these workers. Major employers, from both the public sector (e.g., SCAG and the State of California) and private sector, see remote work as potentially permanent. For example, as of November 2020, recruiting website ZipRecruiter.com advertised 7,895 remote-worker jobs as available in Los Angeles, with a pay range between $53,000 and $158,000 (ZipRecruiter.com 2020).[6] Nineteen major companies have announced long-term remote-work programs for their employees, including a range of Los Angeles employers such Google and REI.

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3 Southern California Association of Governments (SCAG). 2021. 2021 SCAG Regional Pocket Guide. Website: http://scag.ca.gov/regionalguide (accessed August 2021).

4 SCAG. 2020. Potential Economic Impacts of COVID-19 in the SCAG Region. May 14. Table 6. Website: https://scag.ca.gov/sites/main/files/file-attachments/scag-covid-19-white-paper_final_2020-0514.pdf?1604196350 (accessed September 2021).

5 Ibid.

6 ZipRecruiter.com. 2020. Query: Remote Jobs in Los Angeles. Website: https://www.ziprecruiter.com/Jobs/Remote/-in-Los-Angeles,CA (accessed August 2020).

Remote work is also flourishing among small businesses (57 percent of small business owners believe that remote work will continue) (Rahtore 2020).[7]

In addition to the research showing remote work/telecommuting trends before the COVID-19 pandemic, all of the homes in the project would include the following standard features that would further enhance and encourage remote work:

- Floor plans that are designed to accommodate a home office
- Certification from the Wi-Fi Alliance that ensures excellent wireless Internet connection throughout the home
- Standard installation of commercial-grade equipment (e.g., Ruckus wireless equipment)

In addition, as part of the TDM program, the project would post on the Glenelder HOA website and work to add links to the Hacienda Heights Improvement Association (HHIA) and/or other community group websites for information and support materials to encourage telecommuting (e.g., those recently compiled by the San Diego Association of Governments [SANDAG] [SANDAG 2020],[8] which is prioritizing telecommuting as the most significant VMT reduction strategy in the region [iCommute 2020]).[9]

Based on survey results identifying telework preference after the onset of the COVID-19 pandemic (OCTA 2020), the project conservatively estimates that the enhanced features of the homes will facilitate an increase in telecommuting to at least 3 days per week. Increased telework would result in at least 15.1 percent of workdays not generating commute VMT, which was the identified average pre-COVID-19 (OCTA 2020). This is not to say that project VMT could be reduced by 15.1 percent. The increase in home-based work and telework would decrease the VMT generated by the home-work commute portion of project VMT. A review of the California Emissions Estimator Model (CalEEMod) identifies that approximately 40 percent of residential trips are home-work trips[10], so this estimate applies the 15.1 percent reduction in VMT to 40 percent of the project VMT. This is in excess of the estimate provided in the 2010 CAPCOA Manual, which anticipated time-of-day strategies rather than more aggressive telework strategies. As a result of improved collaboration technology, updated information on telework behavior, updated information on telework preference described above and the design of the dwelling units specifically accommodating telework (which is anticipated to attract those inclined to telework to these dwelling units), a higher rate of telework is expected at the proposed project than the 2010 CAPCOA Manual anticipated

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7 Rahtore, Sandeep. 2020. 57% of Small Business Owners Believe Remote Work Will Continue after Stay-at-Home Orders Lifted. *Small Business Trends.* July 22. Website: https://smallbiztrends.com/2020/05/remote-work-after-pandemic-survey.html (accessed September 2020).

8 San Diego Association of Governments (SANDAG). 2020. SANDAG Response to COVID-19. Website: https://www.sandag.org/index.asp?newsid=1196&fuseaction=news.detail (accessed September 2020).

9 iCommute SANDAG Program. 2020. Telework. Website: https://www.icommutesd.com/telework/telework-default.

10 California Emissions Estimator Model (CalEEMod) Users Guide, Prepared for: California Air Pollution Control Officers Association (CAPCOA) Prepared by: BREEZE Software, A Division of Trinity Consultants in collaboration with South Coast Air Quality Management District and the California Air Districts. May 2021.

(range up to 5.5 percent) could be induced from an employer. Table E below details the calculation of VMT reduction.

Table E: Calculation of VMT Reduction for Remote Work/Telecommuting

	Glenelder Project
Total Project VMT	5,632
Home-Work Commute VMT (40%)	2,253
Mitigation Effectiveness	15.1%
VMT Reduction from Remote Work	**340**

VMT = vehicle miles traveled

Based on pre-COVID-19 and post-COVID-19 remote-work data and trends as described above coupled with this project's design features, remote work is expected to reduce a total of 340 VMT.

On-Site Parks (Similar to CAPCOA Manual Strategy LUT-3)

The addition of recreational land use is consistent with the CAPCOA Manual strategy to increase the diversity of land uses, but the CAPCOA Manual does not present a formula specifically to address park usage and VMT reduction. This report presents evidence below to calculate and support the anticipated VMT reduction from the on-site parks.

During the County's development review process, the Parks and Recreation Department emphasized that the Hacienda Heights area suffers from a lack of park space. Based on the recommendations of the Parks and Recreation Department, the Glenelder site design incorporates an on-site park/open space area that is to be open to the residents and the public for recreation activities. This PDF will have the effect of reducing VMT from project residents.

Currently, the nearest park to the project site is William Steinmetz Park, approximately 1 mile away. By providing a new park within the project, the 2-mile round trip would be eliminated for park users. Therefore, to estimate the VMT-reducing benefits of the new on-site parks, LSA multiplied the 2-mile round-trip distance reduced because of the new parks by the estimated number of daily park visitors. A study of park use in Southern California (reports related to park use are provided in Appendix D) collected data from 3,249 people identifying that 28.7 percent of them visit a park at least once per week and that the average number of visits per week is 1.8. These data indicate 1,678 weekly park visits (3,249 x 0.287 x 1.8 = 1,678), which is 240 daily park visits (1,678 ÷ 7 = 240) among the 3,249 surveyed, for an average of 7.4 percent daily visits per resident (240 ÷ 3,249 = 0.074) (Cohen et al. 2012).[11] Additional research into park usage clearly shows a link between proximity and quality of parks and park usage (Mowen et al. 2007; Neuvonen 2007).[12, 13] While the

[11] Cohen, Deborah, et al. 2012. Neighborhood Poverty, Park Use, and Park-Based Physical Activity in a Southern California City. *Social Science and Medicine*. 75(12):2317-–2325.

[12] Mowen, Andrew, et al. 2007. The Role of Park Proximity and Social Support in Shaping Park Visitation, Physical Activity, and Perceived Health among Older Adults. *Journal of Physical Activity and Health*. 4(2):167–179.

improved proximity of the park may lead to increased usage, an estimate of daily park visitation by residents of 7.4 percent of the area dwelling units was chosen.

Each visitation from an area dwelling unit would replace a vehicle trip. For the 85 dwelling units, it is estimated that approximately 6 daily trips would travel to the park (85 x 0.074 = 6.3), for a savings of 12 VMT daily (6 x 2 miles = 12). Providing an on-site park would therefore reduce project VMT by 0.2 percent (12 ÷ 5,632 = 0.002).

Pedestrian Network Improvements (CAPCOA Manual Strategy SDT-1)

The Glenelder neighborhood includes a new park open to the public that provides pedestrian connections from surrounding streets through the new community. The park is located in the middle of the community. The park is connected by walkways to both Folger Street and Glenelder Avenue.

The proposed community also features contiguous sidewalks with a landscaped parkway between the curb and sidewalk. The separation created by the landscaped parkway allows a pedestrian experience that is both safer and pleasing, complemented further by a home design that uses an eye-on-the-street approach with living spaces on the first floor of homes.

As identified in the project description, the project includes improvements to five crosswalks within the surrounding neighborhood. The pedestrian connectivity, landscaped parkways, highly visible crosswalks, and on-site park all contribute to an enhanced pedestrian experience that encourages walking by new residents of Glenelder. The enhanced pedestrian connectivity may also encourage residents to walk within the existing adjacent neighborhoods by providing a more pleasing experience as well as a shorter route through the neighborhood. This type of pedestrian network is consistent with the Site Design, Transportation-1 (SDT-1) strategy provided in the CAPCOA Manual. The CAPCOA Manual provides a range of effectiveness based on empirical evidence. For SDT-1, a range of 0 to 2 percent reduction in VMT is identified. Because the improvements are mostly within the project site, a 1 percent VMT reduction is anticipated, and this PDF would reduce 56 VMT (5,632 x 0.01 = 56).

On-Site Bicycle Parking (CAPCOA Manual Strategy SDT-7)

The project will provide bicycle parking in common areas in addition to private garages. This is consistent with CAPCOA Manual strategy SDT-7. This is a grouped strategy and does not have an independent VMT reduction associated with it.

On-Site Benefits from Off-Site TDM Programs

In addition to the on-site VMT reduction measures described above, the project site would also benefit from the TDM strategies in the surrounding neighborhood, thereby further reducing VMT. These TDM strategies in the surrounding neighborhood are described in more detail in the *Off-Site VMT Reduction Strategies from PDFs* section below. The TDM strategies include a car-sharing and ridesharing program and a school pool program.

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[13] Neuvonen, Marjo. 2007. Access to Green Areas and the Frequency of Visits—a Case Study in Helsinki. *Urban Forestry and Urban Greening* 6(4):235–247.

The CAPCOA Manual provides a range of 0.4 to 0.7 percent VMT reduction for a car-sharing program and a range of 1 to 15 percent VMT reduction for a ride-sharing program. These programs would be similarly administered by the project. The project is able to directly market these programs to project residents, and this increased awareness of the programs would likely result in a greater use by project residents. Table F anticipates that these programs could reduce 5 percent of project VMT (consistent with the CAPCOA Manual recommendation for low density suburbs), for a total of 282 VMT (5,632 x 0.05 = 282).

Table F: Project Site VMT Reduction Range of Effectiveness

Measure	VMT Reduction Range	Estimated Project Reduction	
		Percentage	VMT
Enhanced Remote Work and Telework Features	15.1% of commute VMT	15.1	340
On-Site Parks	0.2%	0.2	12
Pedestrian Network Improvements	0% to 2%	1	56
On-Site Bicycle Parking	Grouped strategy	0	0
Car-Sharing/Ridesharing Program	0.4% to 0.7%; 1% to 15%	5	282
School Pool Program	7.2% to 15.8% of school VMT	15.8	36
TOTAL	**10.1% to 36.9%**		**726**
Global Maximum for Suburban Sites	15% of 5,632 project VMT	15	845

VMT = vehicle miles traveled

The CAPCOA Manual identifies a range of 7.2 to 15.8 percent reduction in school VMT for a school pool program. This program could be implemented through direct marketing to new homeowners. The availability of school pool and walking school bus options for school age children would be promoted as an amenity of the neighborhood. Because this program would be aggressively implemented for project residents, it is anticipated that the high end of the range would apply to the project site. LSA reviewed SCAG RTP model output for residential land use in similar suburban settings and found that school VMT is about 4 percent of total VMT[14], so this TDM would reduce project VMT by 36 VMT (5,632 x 0.04 x 0.158 = 36).

Total On-Site Project VMT Reduction from PDFs

Table F shows the potential VMT reduction ranges for the on-site PDFs. The total estimated VMT reduction is 726 VMT. Many of the PDFs and TDM measures address different sources of travel demand. Because they are independent and discrete, their effectiveness would not be reduced when combined as much as if the measures addressed similar sources of travel demand. However, as mentioned previously, the CAPCOA Manual states that various strategies to reduce VMT can interact and that combining multiple strategies is subject to a global maximum project VMT reduction. For projects in suburban areas, the global maximum project reduction is 15 percent (CAPCOA Manual, page 61). The PDFs would reduce VMT by 726, which is less than the global maximum (5,632 x 0.15 = 845).

14 Based on a comparison of total home-based trips to home-based school trips.

Off-Site VMT Reduction Strategies from PDFs

In addition to the on-site PDFs described above, the project will implement the following TDM PDFs to further reduce VMT from off-site sources. The project would create a website in multiple languages describing and coordinating the following three programs for the project site that would be available to the greater Hacienda Heights community. The website will function as a resource for encouraging and implementing these VMT reduction measures by providing one consolidated location for people to connect with others within the community. The website will be managed and maintained by the property management company for the project.

Car-Sharing Program (Similar to CAPCOA Manual Strategy TRT-9)

The 2010 CAPCOA Manual predates widespread adoption of on-demand and peer-to-peer car-sharing, which results in differences between the strategy as presented in the CAPCOA Manual and the strategy presented in this report. The website would encourage and facilitate car-sharing by those individuals who wish to offer their car for sharing. The website would also provide information and links to companies offering on-demand rideshare services. This strategy is similar to CAPCOA Manual strategy TRT-9, which is stated to result in a 0.4 to 0.7 percent VMT reduction due to lowering private car ownership. However, Table G anticipates a nominal contribution to VMT reduction.

Ride-Sharing Program (CAPCOA Manual Strategy TRT-3)

The website would encourage and facilitate ridesharing and would be available for use by the entire Hacienda Heights community. Although the Los Angeles County Metropolitan Transportation Authority (Metro) offers commute rideshare matching through ridematch.info, the community-specific program established by the project may appeal to members of the community, who would be matched with other members of the community and would include matches for midday trips for shopping and medical appointments. The service would operate on demand. No designated parking spaces would be provided. Similar to commercial rideshare operations, the brief pickup/drop-off of passengers could be accomplished in any available parking space or passenger loading zone in the community. Even though roadways within the proposed project are private, the public would be permitted to drop off and pick up in the parallel parking spaces and driveways. It is anticipated that sufficient curbside space is available in the community to facilitate the brief pickup/drop-off of passengers. This strategy is similar to CAPCOA Manual strategy TRT-3, which is stated to result in a 1 to 15 percent VMT reduction.

School Pool Program (CAPCOA Manual Strategy TRT-10)

The website would encourage and facilitate carpooling to schools. The website would also assist the community in organizing a “walking school bus” program and coordinating volunteers. This strategy is consistent with CAPCOA Manual strategy TRT-10, which is stated to result in a 7.2 to 15.8 percent reduction in school-related VMT. The project would start with a pilot program at 6 of the 20 public schools in Hacienda Heights to be selected in coordination with the Hacienda La Puente Unified School District (District). The District is the current property owner and has agreed to assist in the distribution of information about the school pool program.

On-Site Parks (Similar to CAPCOA Manual Strategy LUT-3)

As stated previously, the addition of recreational land use is consistent with the CAPCOA Manual strategy to increase the diversity of land uses, but this report presents evidence to calculate the anticipated VMT reduction from the on-site parks. Previously, this memorandum described the effect of the on-site parks on VMT generated by the project itself. According to the County General Plan, neighborhood parks such as the proposed parks serve a community with a radius of approximately 0.25 mile. Figure 4 illustrates an estimated benefit area of the on-site parks. These are homes within a 0.25-mile radius of the parks and closer to the project's parks than the next nearest park (William Steinmetz Park). The park benefit area is estimated to contain approximately 417 homes (not including the project homes). As described previously, a study of park use in Southern California identified that 28.7 percent of residents visit a park at least once per week and that the average number of visits per week is 1.8. These data indicate 1,678 weekly park visits (3,249 x 0.287 x 1.8 = 1,678), which is 240 daily park visits (1,678 ÷ 7 = 240) among the 3,249 surveyed, for an average of 7.4 percent daily visits per resident (240 ÷ 3,249 = 0.074) (Cohen et al. 2012).[15] Therefore, an average of 31 of the adjacent homes (417 x 0.074 = 30.9) would walk to the new parks rather than drive to the next nearest park (Manzanita Park). This would save 2 miles per round for the 31 daily park visits, for a 62 VMT reduction.

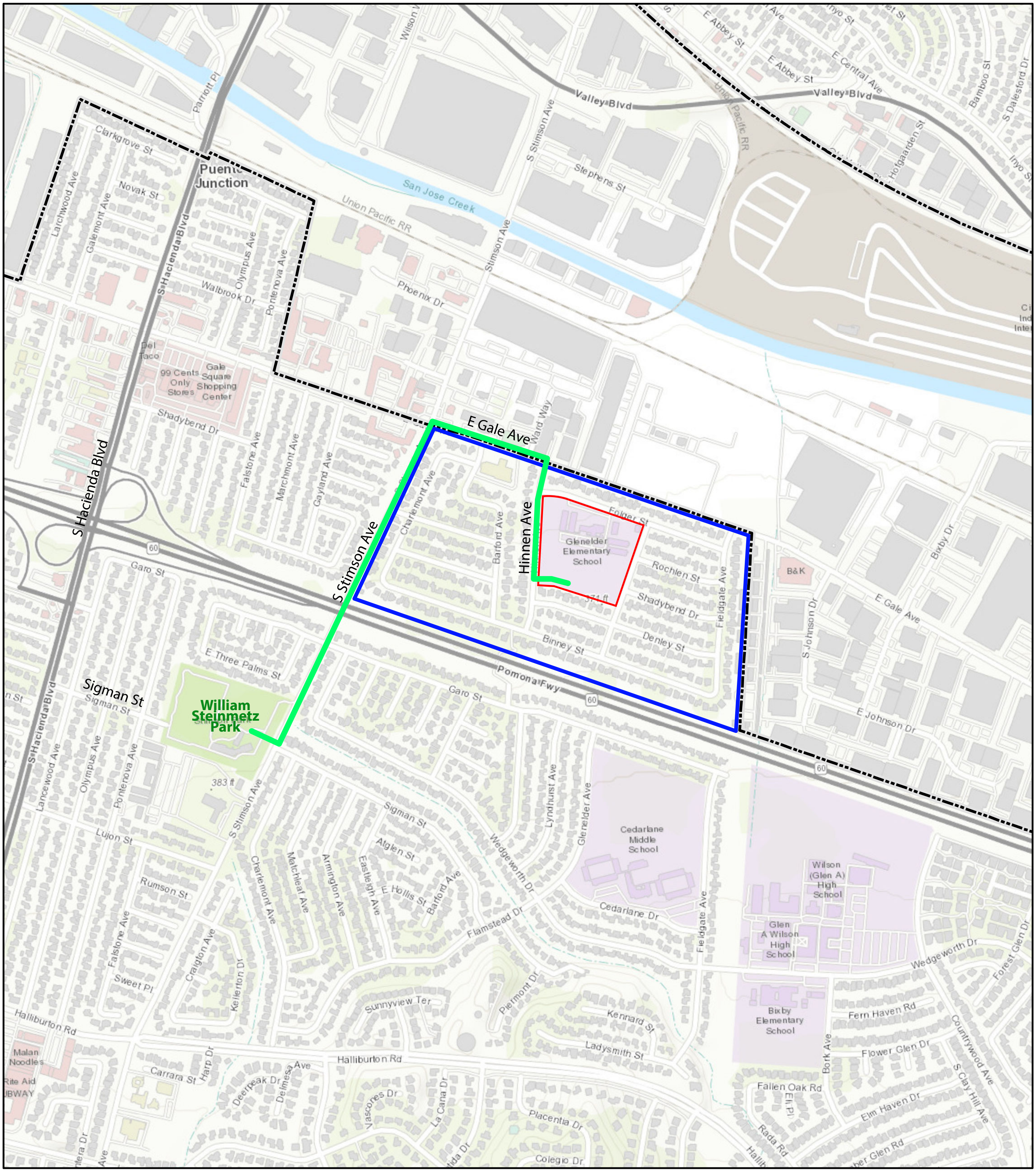
Total Off-Site VMT Reduction from TDM Project Design Features

As mentioned above, the CAPCOA Manual suggests that a car-sharing program could result in a 0.4 to 0.7 percent VMT reduction, and that a ride-sharing program could result in a 1 to 15 percent VMT reduction. Because these programs are similarly aimed at reducing private vehicle ownership, LSA anticipates that the programs will have a combined effect. Car-sharing and ride-sharing programs in Los Angeles County are not entirely new, but the focus on a specific community (i.e., the community of Hacienda Heights) and inclusion of midday ridesharing will have an additional effect. LSA conservatively estimates that the combined effect would be a 0.1 percent VMT reduction. Because the costs may be shared with an additional HOA in the future, this analysis applies half of the potential reduction to the project.

The car-sharing and ride-sharing programs (using any available curbside parking space) would be available to the entire Hacienda Heights community. The SCAG RTP/SCS traffic model shows that the average VMT per capita for all of Hacienda Heights is 19.0. Population surveys conducted in 2019 show that the population of Hacienda Heights is 55,188. Total VMT in Hacienda Heights is 1,048,572 (19.0 x 55,188 = 1,048,572) per day. The VMT reduction credited to the project is therefore 524 VMT (1,048,572 x 0.0005 = 524).

The school pool program would produce a 7.2 to 15.8 percent reduction in school-related VMT according to the CAPCOA Manual. Because the program would be moderately implemented with the wider community, LSA estimates a 7.2 percent reduction rate. The project would include a pilot program at 30 percent of Hacienda Heights schools (i.e., 30 percent of Hacienda Heights school families). Therefore, LSA conservatively estimates that the project would reduce 2.2 percent of school VMT (7.2 percent x 30 percent). LSA reviewed SCAG RTP model output for a residential

[15] Cohen, Deborah, et al. 2012. Neighborhood Poverty, Park Use, and Park-Based Physical Activity in a Southern California City. *Social Science and Medicine*. 75(12):2317-–2325.



LSA

LEGEND

- Project Site with On-Site Parks
- Park Benefit Area
- 1 Mile Walking Distance to William Steinmetz Park
- City Boundary

FIGURE 4

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0 500 1000
FEET

16234 Folger Street

Park Benefit Area

SOURCE: ArcGIS Online Topographic Map (2020)

I:\LHC1802\G\On-Site_Park_Benefit_Area.ai (5/6/2021) project and found that school VMT is approximately 4 percent of total VMT, so the anticipated VMT credit is 923 VMT (1,048,572 x 0.04 x 0.022 = 923).

In total, the TDM VMT reduction measures from PDFs, which facilitate and encourage people to reduce VMT on multiple levels, would reduce the 1,048,572 daily VMT in Hacienda Heights by 1,447 VMT. As calculated above, the on-site parks have the potential to reduce 62 VMT from the surrounding neighborhood. Table G summarizes the VMT reductions anticipated from PDFs that can be implemented by the project. As Table G shows, total VMT reduction from PDFs (including on-site and off-site VMT reduction) is 2,235 VMT.

Table G: Summary of VMT Reduction from Project Design Features

	VMT
Total VMT in Excess of Threshold	**2,473**
On-Site Project Design Features	
All Features (less than Global Maximum 15% of Project VMT[1])	726[2]
Off-Site TDM Project Design Features	
Car-Sharing/Ride-Sharing Program	524[3]
School Pool Program	923[4]
On-Site Park	62[5]
Total VMT Reduction Prior to Mitigation	**2,235**

[1] Per CAPCOA Manual page 61.
[2] See Table F.
[3] 1,048,572 Hacienda Heights VMT x 0.05%.
[4] 4% of 1,048,572 Hacienda Heights VMT is school VMT, of which 2.2% would be reduced.
[5] 7.4% of the 417 homes closer to the project's parks would save a 2-mile round trip.
CAPCOA Manual = *Quantifying Greenhouse Gas Mitigation Measures* (CAPCOA 2010)
TDM = Transportation Demand Management
VMT = vehicle miles traveled

The VMT reduction associated with on-site and off-site PDFs would not sufficiently reduce VMT to a less than significant level. With implementation of the PDFs, the project VMT would continue to exceed the County VMT threshold by 238 VMT (2,473 - 2,235 = 238). Therefore, further mitigation is necessary to reduce VMT impacts to less than significant.

MITIGATION MEASURES

In addition to the PDFs described above that can be implemented by the project, mitigation measures are recommended that could be implemented by the County. In 2012 the County Board of Supervisors approved the Bicycle Master Plan (DPW 2012a). The neighborhood surrounding the project has several proposed facilities in the Bicycle Master Plan. The project would provide funding for the construction of 2.4 miles of new Class III bicycle facilities. If no funding program is available at the time of project construction, the project will cause the construction of 2.4 miles of new Class III bicycle facilities including surveys of payment condition. The project has identified and is suggesting four projects near the project's neighborhood. These are Las Lomitas Drive/Newton Street from Vallecito Drive to Angelcrest Drive (Project 19); Las Robles Avenue from Turnbull Canyon Road to Kwis Avenue (most of Project 20); Kwis Avenue from Three Palms Street to Newton Street (Project 24); and Three Palms Street from Kwis Avenue to Farmstead Avenue, then Farmstead Avenue to Lujon Street, and then Lujon Street to Hacienda Boulevard (most of Project 33).

Figure 5 illustrates these facilities. These projects would provide approximately 2.4 miles of new bicycle facilities that would improve connections to schools, shopping, and transit.

Bicycle Master Plan (Similar to CAPCOA Manual Strategy SDT-5)

The CAPCOA Manual describes the construction of bicycle infrastructure (and identifies it as an applicable measure for residential projects) in strategy SDT-5 but does not provide a range of effectiveness for the VMT reduction of these improvements. The studies of bicycle utilization summarized in the CAPCOA Manual are a 1997 analysis of biking to work as a function of bicycle lanes per population and a 2003 update to that study analyzing biking to work as a function of bicycle lanes per square mile. Neither of those studies includes distance traveled, and neither presents a methodology for estimating VMT reduction.

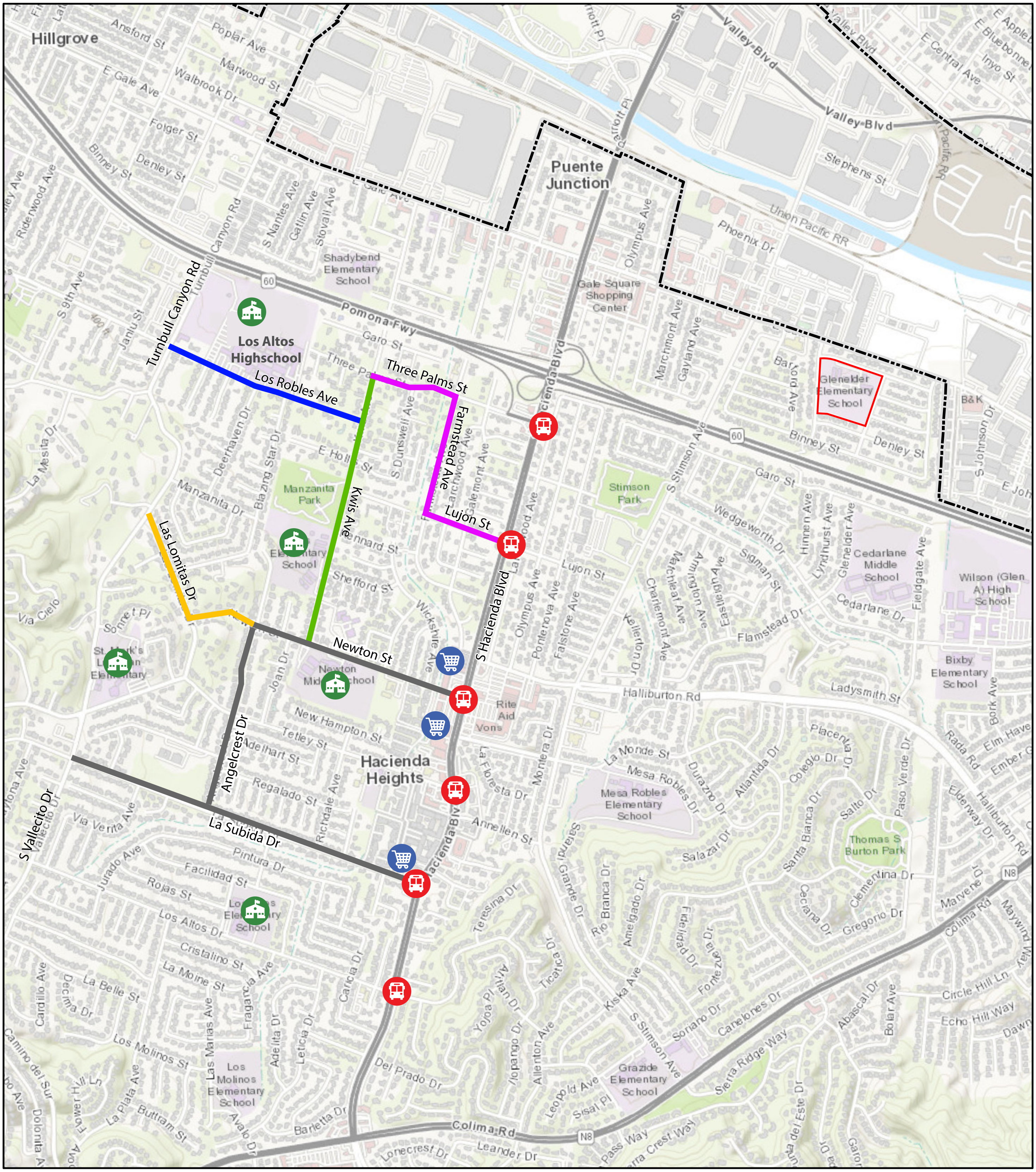
The Bicycle Master Plan applied a methodology appropriate for Los Angeles County for estimating VMT reduction for the proposed bicycle facility improvements, carefully considering several factors affecting peak-hour commuting and midday bicycle behavior, such as transit bicycle commuters, accessibility to schools, and use of bicycle facilities by students (DPW 2012a). Appendix B in the Bicycle Master Plan presents the current and future (with implementation of the plan) estimated reduced vehicle miles per weekday for each planning area (DPW 2012a). Details of the effects of the plan in the East San Gabriel Valley Planning Area (where the project is located) are provided on Table B-2 of the Bicycle Master Plan (DPW 2102). Table H summarizes data provided in the Bicycle Master Plan regarding reduced vehicle miles.

Table H: Bicycle Facility Effect on VMT in the East San Gabriel Valley Planning Area

	Current (2010)	Future (2035)[1]	New as a Result of the Bicycle Master Plan	Effect in 2021[2]
Reduced Vehicle Miles per Weekday	19,500[3]	43,994[3]	24,494	10,777
Miles of Bicycle Facilities	24.5[4]	115.6	91.1[5]	-
Weekday Vehicle Miles Reduced per Mile of Bicycle Facilities	795.9	380.6	268.9	118.4

[1] 2035 is the future year used in Appendix B, according to page 40 of the Bicycle Master Plan.
[2] Interpolated as 11/25 of the value between 2010 and 2035.
[3] Bicycle Master Plan Table B-2.
[4] Bicycle Master Plan Table 3-6.
[5] Bicycle Master Plan Table 3-8.
Bicycle Master Plan = County of Los Angeles Bicycle Master Plan (DPW 2012a)
VMT = vehicle miles traveled

The Bicycle Master Plan calculated VMT reductions due to bicycle infrastructure that were partially dependent on population growth between the report year (2010) and the build out year (2035) (DPW 2102). Table H includes interpolation between the 2010 and 2035 VMT reductions. Interpolation accounts for the effect a larger population has on the potential number of bicycle riders and VMT reduction potential as a result of additional bicycle riders. As Table H shows, by applying interpolation to the Bicycle Master Plan methodology, the VMT reduction of 380.6 VMT per mile of bicycle facility in the future year is population adjusted in 2021 to a 118 VMT reduction per mile of bicycle facility.



LSA

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Project Site
City Boundary
School
Bus
Retail

Proposed Bicycle Facilities
Project 19
Project 20
Project 24
Project 33
Cumulative Bicycle Improvements

0 900 1800
FEET

FIGURE 5

16234 Folger Street

Proposed Bicycle Master Plan Facilities

SOURCE: ArcGIS Online Topographic Map (2020)

I:\LHC1802\G\Proposed_Bicycle_Master_Plan_Fac.ai (5/7/2021)

The project would fund the implementation of or cause the construction of 2.4 miles of Class III bicycle facilities including remediation of pavement deficiencies on the identified routes. Figure 5 illustrates the locations of the suggested projects. These projects are close to the project and make connections between trip origins in a residential neighborhood and likely destinations including schools, transit routes, and retail areas. The following four projects are suggested:

- Las Lomitas Drive/Newton Drive from Vallecito Drive to Angelcrest Drive (Project 19)
- Las Robles Avenue from Turnbull Canyon Road to Kwis Avenue (most of Project 20)
- Kwis Avenue from Three Palms Street to Newton Street (Project 24)
- Three Palms Street from Kwis Avenue to Farmstead Avenue, then Farmstead Avenue to Lujon Street, and then Lujon Street to Hacienda Boulevard (most of Project 33)

But if any of these are unavailable, the County or the project could construct an alternative 2.4 miles of Class III bicycle facilities

Lane markings for the proposed bicycle facilities would be consistent with the California Manual on Uniform Traffic Control Devices, as illustrated in Appendix E. An example of this type of facility on a residential street (4th Street in Los Angeles) is provided in Exhibit 1.

Exhibit 1: Class III Bicycle Facility on a Residential Street in Los Angeles

Source: Google Street View

In total, the project would fund the implementation of or cause to be constructed 2.4 miles of Class III bicycle facility as an off-site mitigation measure, which would result in 283 VMT reduced.

Total VMT Reduction

Table I summarizes the VMT reduced by on-site PDFs, off-site TDM strategies, and infrastructure improvements. The CAPCOA Manual states that measures independently anticipated to have a specified effectiveness would not combine to reduce more than 100 percent of GHG emissions. Formulas are provided in the CAPCOA Manual for calculating the combined effects between categories (e.g., transportation, building energy use, water) and within non-transportation categories. For transportation combinations, maximum reduction values for transportation category and project location are provided. This report chooses VMT reduction strategies that would reduce different sources of VMT (i.e., effecting trips to different destinations) and in different CAPCOA Manual categories so the dampening effect of combining the strategies should be minimized. Where strategies presented in this report have a similar travel purpose (i.e., car-sharing and ride-sharing), the anticipated effectiveness was calculated for the combined effect. No formula is provided for transportation strategies between transportation categories other than the maximum reduction values. For on-site VMT reductions, this report accounts for dampening by considering the Global Maximum VMT reduction for suburban projects identified in the CAPCOA Manual (i.e., 15 percent). The VMT reduction anticipated from the surrounding Hacienda Heights neighborhood (0.17 percent) does not approach the Global Maximum.

Table I: Summary of Total VMT Reduction

	Glenelder Project
Total VMT in Excess of Threshold	**2,473**
On-Site Project Design Features	
All Features (less than Global Maximum 15% of Project VMT[1])	726[2]
Off-Site TDM Project Design Features	
Car-Sharing/Ride-Sharing Program	524[3]
School Pool Program	923[4]
On-Site Park	62[5]
Total VMT Reduction Prior to Mitigation	**2,235**
Off-Site Mitigation	
Portions of Bicycle Master Plan	283[6]
Total VMT Reduced by Mitigation	**283**
Total VMT Reduction	**2,518**
Surplus VMT Reduction	**45**

[1] Per CAPCOA Manual page 61.
[2] See Table F.
[3] 1,048,572 Hacienda Heights VMT x 0.5%.
[4] 4% of 1,048,572 Hacienda Heights VMT is school VMT, of which 2.2% would be reduced.
[5] 7.4% of the 417 homes closer to the project's parks would save a 2-mile round trip.
[6] 2.4 miles of bicycle facilities reducing 118 VMT each per Bicycle Master Plan calculations.
Bicycle Master Plan = County of Los Angeles Bicycle Master Plan (DPW 2012a)
CAPCOA Manual = *Quantifying Greenhouse Gas Mitigation Measures* (CAPCOA 2010)
TDM = Transportation Demand Management
VMT = vehicle miles traveled

The project could reduce 726 VMT from the project site and 1,792 VMT from the surrounding community. This total 2,518 VMT reduction is greater than the 2,473 project VMT above the County's significance threshold. Therefore, the project would have a less than significant impact on VMT with mitigation.

CONCLUSION

The project proposes to develop a new single-family residential community on a portion of the approximately 10-acre lot at 16234 Folger Street in Hacienda Heights. The project would include 85 detached single-family dwelling units, one common HOA lot, and one park. The project also includes improvements in the surrounding neighborhood to remove signage and striping related to the vacant elementary school to be replaced. The project is anticipated to generate 802 new daily trips, is not a retail project, is not located in a transit priority area, and does not set aside 100 percent of the units for lower-income households. Therefore, none of the VMT screening criteria provided in the County Guidelines apply to the project.

Using the SCAG RTP/SCS traffic model, it was determined that the existing homes surrounding the project site generate 18.9 VMT per capita, which is 49 percent greater than the regional average. The County Guidelines establish a VMT impact criterion of 10.6 VMT per capita. Without PDFs or mitigation measures to reduce VMT generation, the project would be anticipated to generate VMT at the same rate as surrounding homes. Total VMT generated by the project's anticipated 298 residents is 5,632 VMT, which is 2,473 VMT above the VMT impact criteria.

TDM strategies identified in the County Guidelines and the transportation strategies identified in the CAPCOA Manual were reviewed, and eight measures were identified as feasible and proposed by the project as PDFs:

- Enhanced remote work and telework
- On-site parks
- Pedestrian network improvement through the project site
- On-site bicycle parking
- A car-sharing program
- A ride-sharing program
- A school pool program

These PDFs are anticipated to reduce on-site VMT by 726 VMT and by 1,509 VMT from the surrounding neighborhood. Funding or construction of Class III bicycle facilities identified in the Bicycle Master Plan is proposed as a mitigation measure, which could reduce 283 VMT in the surrounding neighborhood. In total, the PDFs and mitigation measures are anticipated to reduce 2,518 VMT, which is greater than the project's exceedance of the VMT impact criteria. Therefore, the impact of the project according to *State CEQA Guidelines* section 15064.3, subdivision (b)(1), would be less than significant with mitigation incorporated.

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APPENDIX A

VMT REDUCTION MEASURE APPLICABILITY WORKSHEET

CAPCOA Category	CAPCOA #		Description	CAPCOA Reduction Value		On-site Application to La Subida	VMT Reduction Value	Off-site Application to Hacienda Heights	VMT Reduction Value	Comments
				Min.	Max.					
Land Use / Location	3.1.1	LUT-1	Increase Density	0.8%	30.0%	N/A	-	N/A	-	The CAPCOA Manual states: "...where allowed by the General Plan and/or Zoning Ordinance..." The project is designed at the maximum density of 4.98 du/ac based on GP limit of 5 du/ac.
Land Use / Location	3.1.2	LUT-2	Increase Location Efficiency	10%	65%	YES, accounted for in RTP/SCS	0%	N/A	-	Suburban Center: 10% (representing VMT reductions for the average suburban center in California versus the statewide average VMT)
Land Use / Location	3.1.3	LUT-3	Increase Diversity of Urban and Suburban Developments (Mixed Use)	9%	30%	YES	part of 15% maximum	YES	67	The project site does not have the traffic or visibilty for commercial uses. However, the Project has included park space as an alternative use that is not available to the public in the surrounding area.
Land Use / Location	3.1.4	LUT-4	Increase Destination Accessibility	7%	20%	N/A	-	N/A	-	CAPCOA: "Destination accessibility is measured in terms of the number of jobs or other attractions reachable within a given travel time, which tends to be highest at central locations and lowest at peripheral ones." Cannot change project site location.
Land Use / Location	3.1.5	LUT-5	Increase Transit Accessibility	0.5%	24.6%	N/A	-	N/A	-	CAPCOA: "Locating a project with high density near transit will facilitate the use of transit by people traveling to or from the Project site. The use of transit results in a mode shift and therefore reduced VMT." The Project Site cannot change locations closer to transit and the denisty is at the max permitted by GPA.
Land Use / Location	3.1.6	LUT-6	Integrate Affordable and Below Market Rate Housing	0.04%	1.20%	N/A	-	N/A	-	The project is being purchased from the Hacienda La Puente Unified School District and the purchase price does not include affordable housing. Including affordable housing would require renegotiating the contract with the Dsictrict, resulting in less funds to be used on education and facilities.
Land Use / Location	3.1.7	LUT-7	Orient Project Twoard Non-Auto Corridor	grouped with LUT-3		N/A	-	N/A	-	CAPCOA: "A project that is designed around an existing or planned transit, bicycle, or pedestrian corridor encourages alternative mode use." The Project Site cannot change locations.
Land Use / Location	3.1.8	LUT-8	Locate Project near Bike Path / Bike Lane	grouped with LUT-4		N/A	-	N/A	-	CAPCOA: "A Project that is designed around an existing or planned bicycle facility encourages alternative mode use." The Project Site cannot change locations.
Land Use / Location	3.1.9	LUT-9	Improve Design of Development	3%	21.3%	YES	part of 15% maximum	N/A	-	The Project design includes elements to enhance walkability and connectivity to the surrounidng neighborhoods.
Neighborhood Site Enhancements	3.2.1	SDT-1	Provide Pedestrian Network Improvements	0%	2%	YES	part of 15% maximum	YES	part of 212	The Project design includes elements to enhance walkability and connectivity to the surrounidng neighborhoods.
Neighborhood Site Enhancements	3.2.2	SDT-2	Traffic Calming Measures	0.25%	1%	YES	part of 15% maximum	YES	part of 212	Within the Project boundaries, the design has incorporated traffic calming measures to slow traffic, discourage cut-through, and encourage walking.
Neighborhood Site Enhancements	3.2.3	SDT-3	Implement a Neighborhood Electric Vehicle (NEV) Network	0.5%	12.7%	N/A	-	N/A	-	CAPCOA: "The project will create local "light" vehicle networks, such as NEV networks." The project site is not large enough to create a network for NEV.
Neighborhood Site Enhancements	3.2.4	SDT-4	Urban Non-Motorized Zones	grouped with SDT-1		N/A	-	N/A	-	CAPCOA: "The project, if located in a central business district (CBD) or major activity center..." The project site is not located in a CBD.
Neighborhood Site Enhancements	3.2.5	SDT-5	Incorporate Bike Lane Street Design (on-site)	grouped with LUT-9		YES	part of 15% maximum	YES	part of 212	CAPCOA: "The project will incorporate bicycle lanes, routes, and shared-use paths into street systems, new subdivisions, and large developments." The private streets within the new subdivision will be striped as bicycle routes.
Neighborhood Site Enhancements	3.2.6	SDT-6	Provide Bike Parking in Non-Residential Projects	grouped with LUT-9		N/A	-	N/A	-	The Project is residential.
Neighborhood Site Enhancements	3.2.7	SDT-7	Provide Bike Parking in Multi-Unit Residential Projects	grouped with LUT-9		YES	part of 15% maximum	N/A	-	The project is a condominium project and will provide bicylce parking in common areas.
Neighborhood Site Enhancements	3.2.8	SDT-8	Provide EV Parking	grouped with SDT-3		N/A	-	N/A	-	Not a measure to reduce VMT.
Neighborhood Site Enhancements	3.2.9	SDT-9	Dedicate Land for Bike Trails	grouped with LUT-9		N/A	-	N/A	-	CAPCOA: "Larger projects may be required to provide for, contribute to, or dedicate land for the provision of off-site bicycle trails linking the project to designated bicycle commuting routes in accordance with an adopted citywide or countywide bikeway plan." The proposed project is not large enough to provide suggested facilities.
Parking Pricing	3.3.1	PDT-1	Limit Parking Supply	5%	12.5%	N/A	-	N/A	-	Parking requirements are regulated by the County's Zoning Code.
Parking Pricing	3.3.2	PDT-2	Unbundle Parking Costs from Property Cost	2.6%	13%	YES	part of 15% maximum	N/A	-	The proposed project would identify the cost of parking spaces as part of disclosure statement.
Parking Pricing	3.3.3	PDT-3	Implement Market Price Public Parking (On-Street)	2.8%	5.5%	N/A	-	N/A	-	Does not apply to a residential subdivision.
Parking Pricing	3.3.4	PDT-4	Require Residential Area Parking Permits	grouped with PPT-1, PPT-2, and PPT-3		N/A	-	N/A	-	Parking requirements are regulated by the County's Zoning Code.
Transit System	3.4.1	TRT-1	Implement Voluntary CTR Programs	1.0%	6.2%	YES	part of 15% maximum	YES	part of 524	The project will implement carpooling assistance and ride-share matching assistance.
Transit System	3.4.2	TRT-2	Implement Mandatory CTR Programs – Required Implementation/Monitoring	4.2%	21%	N/A	-	N/A	-	Mandatory programs can be implemented through employment arrangement. Not applicable to residential subdivisions.
Transit System	3.4.3	TRT-3	Provide Ride-Sharing Programs	1%	15%	YES	part of 15% maximum	YES	part of 524	The project will create a website, linked to the Hacienda Heights Community Association and Chamber of Commercie to encourage and facilitate ride sharing.
Transit System	3.4.4	TRT-4	Implement Subsidized or Discounted Transit Prog.	0.3%	20%	N/A	-	N/A	-	LA Metro charges $100 for a monthly bus pass. In order to achieve a daily VMT reduction of 1,757 VMT with an average trip length of 4.61 miles (based on LA Metro bus data) equates to 381 riders. Subsidizing a $100 monthly bus pass for 381 riders results in a monthly cost of $38,100 and an annual cost of $457,200, which would have to occur in perpetuity. Funding such a program would be done by non-wasting endowment. At a 3.5% cap rate, the endowment would total over $13 million, adding over $251,000 to the cost of each home.
Transit System	3.4.5	TRT-5	Provide End of Trip Facilities	grouped with TRT-1 through TRT-3		N/A	-	N/A	-	CAPCOA: "Non-residential projects will provide "end-of-trip" facilities for bicycle riders including showers, secure bicycle lockers, and changing spaces." Does not apply to residential subdivisions.
Transit System	3.4.6	TRT-6	Telecommuting and Alternative Work Schedules	0.07%	5.50%	YES	part of 15% maximum	N/A	-	Telecommuting is being encouraged through new home design and options for at home offices and enhanced technology. Residential subdivisions cannot control alternative work schedules.
Transit System	3.4.7	TRT-7	Implement Commute Trip Reduction Marketing	0.8%	4%	YES	part of 15% maximum	YES	part of 524	CAPCOA: "The project will implement marketing strategies to reduce commute trips." The project's website used to encourage and facilitate ride sharing (TRT-3) will include marketing strategies to reduce commute trips."
Transit System	3.4.8	TRT-8	Implement Preferential Parking Permit Program	grouped with TRT-1 through TRT-3		N/A	-	N/A	-	Applies to non-residential projects.

CAPCOA Category	CAPCOA #		Description	CAPCOA Reduction Value Min.	CAPCOA Reduction Value Max.	On-site Application to La Subida	VMT Reduction Value	Off-site Application to Hacienda Heights	VMT Reduction Value	Comments
Transit System	3.4.9	TRT-9	Implement Car-Sharing Program	0.4%	0.7%	YES	part of 15% maximum	YES	part of 524	The project will create a website, linked to the Hacienda Heights Community Association and Chamber of Commerce to encourage and facilitate car sharing by those individuals who wish to offer their car for sharing.
Transit System	3.4.10	TRT-10	Implement School Pool Program	7.2%	15.8%	YES	part of 15% maximum	YES	587	CAPCOA: "This project will create a ridesharing program for school children." The project will create a website, linked to the Hacienda Heights Community Association and Chamber of Commercie to encourage and facilitate ridesharing to schools.
Transit System	3.4.11	TRT-11	Provide Employer-Sponsored Vanpool/Shuttle	0.3%	13.4%	N/A	-	N/A	-	Does not apply to a residential subdivision.
Transit System	3.4.12	TRT-12	Implement Bike-Sharing Program	grouped with SDT-5 and LUT-9		N/A	-	N/A	-	CAPCOA: "This project will establish a bike sharing program. Stations should be at regular intervals throughout the project site." The project site is not large enough for bike sharing stations.
Transit System	3.4.13	TRT-13	Implement School Bus Program	38%	63%	YES	part of 15% maximum	YES	0%	CAPCOA: "The project will work with the school district to restore or expand school bus services in the project area and local community." The project will encourage the school district to provide bus service.
Transit System	3.4.14	TRT-14	Price Workplace Parking	0.1%	19.7%	N/A	-	N/A	-	Does not apply to a residential subdivision.
Transit System	3.4.15	TRT-15	Implement Employee Parking "Cash-Out"	0.6%	7.7%	N/A	-	N/A	-	Does not apply to a residential subdivision.
Commute Trip Reduction	3.5.1	TST-1	Provide a Bus Rapid Transit System	0.02%	3.2%	N/A	-	N/A	-	CAPCOA: "The project will provide a Bus Rapid Transit (BRT) system…" The project site is not large enough to provide a bus system.
Commute Trip Reduction	3.5.2	TST-2	Implement Transit Access Improvements	grouped with TST-3 and TST-4		N/A	-	N/A	-	CAPCOA: "This project will improve access to transit facilities through sidewalk/ crosswalk safety enhancements and bus shelter improvements" The Residential Subdivision does not have the abilty to make transit improvements.
Commute Trip Reduction	3.5.3	TST-3	Expand Transit Network	0.1%	8.2%	N/A	-	N/A	-	CAPCOA: "The project will expand the local transit network by adding or modifying existing transit service to enhance the service near the project site." The project is not large enough and does not have the abilty to modify the transit network.
Commute Trip Reduction	3.5.4	TST-4	Increase Transit Service Frequency/Speed	0.02%	2.5%	N/A	-	N/A	-	The Project, as a small residential subdivision, has no ability to modify the transit service frequency or speed.
Commute Trip Reduction	3.5.5	TST-5	Provide Bike Parking Near Transit	grouped with TST-3 and TST-4		N/A	-	N/A	-	Does not apply to a residential subdivision.
Commute Trip Reduction	3.5.6	TST-6	Provide Local Shuttles	grouped with TST-4 and TST-5		N/A	-	N/A	-	Applies only to large residential, retail, office, mixed use, and industrial projects.
Road Pricing / Management	3.6.1	RPT-1	Implement Area or Cordon Pricing	7.9%	22.0%	N/A	-	N/A	-	Does not apply to a residential subdivision.
Road Pricing / Management	3.6.2	RPT-2	Improve Traffic Flow	0%	45%	N/A	-	N/A	-	Not a measure to reduce VMT.
Road Pricing / Management	3.6.3	RPT-3	Require Project Contributions to Transportation Infrastructure Improvement Projects	grouped with TST-1 through 7		N/A	-	N/A	-	Not a measure to reduce VMT.
Road Pricing / Management	3.6.4	RPT-4	Install Park-and-Ride Lots	grouped with RPT-1, TRT-11, TRT-3, and TST-1 through 6		N/A	-	N/A	-	Does not apply to a residential subdivision.

APPENDIX B

EXCERPTS FROM *CAPCOA QUANTIFYING GREENHOUSE GAS MITIGATION MEASURES*

3.1.3 Increase Diversity of Urban and Suburban Developments (Mixed Use)

Range of Effectiveness: 9-30% vehicle miles traveled (VMT) reduction and therefore 9-30% reduction in GHG emissions.

Measure Description:

Having different types of land uses near one another can decrease VMT since trips between land use types are shorter and may be accommodated by non-auto modes of transport. For example when residential areas are in the same neighborhood as retail and office buildings, a resident does not need to travel outside of the neighborhood to meet his/her trip needs. A description of diverse uses for urban and suburban areas is provided below.

Urban:

The urban project will be predominantly characterized by properties on which various uses, such as office, commercial, institutional, and residential, are combined in a single building or on a single site in an integrated development project with functional interrelationships and a coherent physical design. The mixed-use development should encourage walking and other non-auto modes of transport from residential to office/commercial/institutional locations (and vice versa). The residential units should be within ¼-mile of parks, schools, or other civic uses. The project should minimize the need for external trips by including services/facilities for day care, banking/ATM, restaurants, vehicle refueling, and shopping.

Suburban:

The suburban project will have at least three of the following on site and/or offsite within ¼-mile: Residential Development, Retail Development, Park, Open Space, or Office. The mixed-use development should encourage walking and other non-auto modes of transport from residential to office/commercial locations (and vice versa). The project should minimize the need for external trips by including services/facilities for day care, banking/ATM, restaurants, vehicle refueling, and shopping.

Measure Applicability:

- Urban and suburban context
- Negligible impact in a rural context (unless the project is a master-planned community)
- Appropriate for mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of each land use type in the project (to calculate land use index)

Mitigation Method:

% VMT Reduction = Land Use * B [not to exceed 30%]

Where

Land Use = Percentage increase in land use index versus single use development

= (land use index – 0.15)/0.15 (see Appendix C for detail)

Land use index = -a / ln(6) (from [2])

$$a = \sum_{i=1}^{6} a_i \times \ln(a_i)$$

a_i = building floor area of land use i / total square feet of area considered

- a_1 = single family residential
- a_2 = multifamily residential
- a_3 = commercial
- a_4 = industrial
- a_5 = institutional
- a_6 = park

if land use is not present and a_i is equal to 0, set a_i equal to 0.01

B = elasticity of VMT with respect to land use index (0.09 from [1])

not to exceed 500% increase

Assumptions:

Data based upon the following references:

[1] Ewing, R., and Cervero, R., "Travel and the Built Environment - A Meta-Analysis." *Journal of the American Planning Association*, <to be published> (2010). Table 4.

[2] Song, Y., and Knaap, G., “Measuring the effects of mixed land uses on housing values.” *Regional Science and Urban Economics 34 (2004) 663-680.* (p. 669) http://urban.csuohio.edu/~sugie/papers/RSUE/RSUE2005_Measuring%20the%20effects%20of%20mixed%20land%20use.pdf

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[36]
CO_2e	9-30% of running
PM	9-30% of running
CO	9-30% of running
NOx	9-30% of running
SO_2	9-30% of running
ROG	5.4-18% of total

Discussion:

In the above calculation, a land use index of 0.15 is used as a baseline representing a development with a single land use (see Appendix C for calculations).

There are two separate maxima noted in the fact sheet: a cap of 500% on the allowable percentage increase of land use index (variable A) and a cap of 30% on % VMT reduction. The rationale for the 500% cap is that there are diminishing returns to any change in environment. For example, it is reasonably doubtful that increasing the land use index by a factor of six instead of five would produce any additional change in travel behavior. The purpose for the 30% cap is to limit the influence of any single environmental factor (such as diversity). This emphasizes that community designs that implement multiple land use strategies (such as density, design, diversity, etc.) will show more of a reduction than relying on improvements from a single land use factor.

[36] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Example:

Sample calculations are provided below:

90% single family homes, 10% commercial

- Land use index = -[0.9*ln(0.9)+ 0.1*ln(0.1)+ 4*0.01*ln(0.01)] / ln(6) = 0.3
- Low Range % VMT Reduction = (0.3 – 0.15)/0.15 *0.09 = 9%

1/6 single family, 1/6 multi-family, 1/6 commercial, 1/6 industrial, 1/6 institutional, 1/6 parks

- Land use index = -[6*0.17*ln(0.17)] / ln(6) = 1
- High Range % VMT Reduction (land use index = 1)
- Land use = (1-0.15)/0.15 = 5.6 or 566%. Since this is greater than 500%, set to 500%.
- % VMT Reduction = (5 x 0.09) = 0.45 or 45%. Since this is greater than 30%, set to 30%.

Preferred Literature:

- -0.09 = elasticity of VMT with respect to land use index

The land use (or entropy) index measurement looks at the mix of land uses of a development. An index of 0 indicates a single land use while 1 indicates a full mix of uses. Ewing's [1] synthesis looked at a total of 10 studies, where none controlled for self-selection[37]. The weighted average elasticity of VMT with respect to the land use mix index is -0.09. The methodology for calculating the land use index is described in Song and Knaap [2].

Alternative Literature:

- Vehicle trip reduction = [1 - (ABS(1.5*h-e) / (1.5*h+e)) - 0.25] / 0.25*0.03

Where :
h = study area housing units, and
e = study area employment.

Nelson\Nygaard's report [3] describes a calculation adapted from Criterion and Fehr & Peers [4]. The formula assumes an "ideal" housing balance of 1.5 jobs per household and a baseline diversity of 0.25. The maximum trip reduction with this method is 9%.

[37] Self selection occurs when residents or employers that favor travel by non-auto modes choose locations where this type of travel is possible. They are therefore more inclined to take advantage of the available options than a typical resident or employee might otherwise be.

Alternative Literature References:

[3] Nelson\Nygaard, 2005. Crediting Low-Traffic Developments (p.12).
http://www.montgomeryplanning.org/transportation/documents/TripGenerationAnalysisUsingURBEMIS.pdf

[4] Criteron Planner/Engineers and Fehr & Peers Associates (2001). Index 4D Method. *A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes*. Technical Memorandum prepared for US EPA, October 2001.

Other Literature Reviewed:

None

3.2 Neighborhood/Site Enhancements

3.2.1 Provide Pedestrian Network Improvements

Range of Effectiveness: 0 - 2% vehicle miles traveled (VMT) reduction and therefore 0 - 2% reduction in GHG emissions.

Measure Description:

Providing a pedestrian access network to link areas of the Project site encourages people to walk instead of drive. This mode shift results in people driving less and thus a reduction in VMT. The project will provide a pedestrian access network that internally links all uses and connects to all existing or planned external streets and pedestrian facilities contiguous with the project site. The project will minimize barriers to pedestrian access and interconnectivity. Physical barriers such as walls, landscaping, and slopes that impede pedestrian circulation will be eliminated.

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for residential, retail, office, industrial and mixed-use projects
- Reduction benefit only occurs if the project has both pedestrian network improvements on site and connections to the larger off-site network.

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The project applicant must provide information regarding pedestrian access and connectivity within the project and to/from off-site destinations.

Mitigation Method:

Estimated VMT Reduction	Extent of Pedestrian Accommodations	Context
2%	Within Project Site and Connecting Off-Site	Urban/Suburban
1%	Within Project Site	Urban/Suburban
< 1%	Within Project Site and Connecting Off-Site	Rural

Assumptions:

Data based upon the following references:

- Center for Clean Air Policy (CCAP) Transportation Emission Guidebook. http://www.ccap.org/safe/guidebook/guide_complete.html (accessed March 2010)
- 1000 Friends of Oregon (1997) "Making the Connections: A Summary of the LUTRAQ Project" (p. 16): http://www.onethousandfriendsoforegon.org/resources/lut_vol7.html

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[45]
CO_2e	0 - 2% of running
PM	0 - 2% of running
CO	0 - 2% of running
NOx	0 - 2% of running
SO_2	0 - 2% of running
ROG	0 – 1.2% of total

Discussion:

As detailed in the preferred literature section below, the lower range of 1 – 2% VMT reduction was pulled from the literature to provide a conservative estimate of reduction potential. The literature does not speak directly to a rural context, but an assumption was made that the benefits will likely be lower than a suburban/urban context.

Example:

N/A – calculations are not needed.

Preferred Literature:

[45] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

- 1 - 2% reduction in VMT

The Center for Clean Air Policy (CCAP) attributes a 1% reduction in VMT from pedestrian-oriented design assuming this creates a 5% decrease in automobile mode share (e.g. auto split shifts from 95% to 90%). This mode split is based on the Portland Regional Land Use Transportation and Air Quality (LUTRAQ) project. The LUTRAQ analysis also provides the high end of 10% reduction in VMT. This 10% assumes the following features:

- – Compact, mixed-use communities
- – Interconnected street network
- – Narrower roadways and shorter block lengths
- – Sidewalks
- – Accessibility to transit and transit shelters
- – Traffic calming measures and street trees
- – Parks and public spaces

Other strategies (development density, diversity, design, transit accessibility, traffic calming) are intended to account for the effects of many of the measures in the above list. Therefore, the assumed effectiveness of the Pedestrian Network measure should utilize the lower end of the 1 - 10% reduction range. If the pedestrian improvements are being combined with a significant number of the companion strategies, trip reductions for those strategies should be applied as well, based on the values given specifically for those strategies in other sections of this report. Based upon these findings, and drawing upon recommendations presented in the alternate literature below, the recommended VMT reduction attributable to pedestrian network improvements, above and beyond the benefits of other measures in the above bullet list, should be 1% for comprehensive pedestrian accommodations within the development plan or project itself, or 2% for comprehensive internal accommodations and external accommodations connecting to off-site destinations.

Alternative Literature:

Alternate:

- Walking is three times more common with enhanced pedestrian infrastructure
- 58% increase in non-auto mode share for work trips

The Nelson\Nygaard [1] report for the City of Santa Monica Land Use and Circulation Element EIR summarized studies looking at pedestrian environments. These studies have found a direct connection between non-auto forms of travel and a high quality pedestrian environment. Walking is three times more common with communities that have pedestrian friendly streets compared to less pedestrian friendly communities. Non-auto mode share for work trips is 49% in a pedestrian friendly community, compared to 31% in an auto-oriented community. Non-auto mode share for non-work trips is 15%, compared to 4% in an auto-oriented community. However, these effects also depend upon other aspects of the pedestrian friendliness being present, which are accounted for separately in this report through land use strategy mitigation measures such as density and urban design.

Alternate:

- 0.5% - 2.0% reduction in VMT

The Sacramento Metropolitan Air Quality Management District (SMAQMD) Recommended Guidance for Land Use Emission Reductions [2] attributes 1% reduction for a project connecting to *existing* external streets and pedestrian facilities. A 0.5% reduction is attributed to connecting to *planned* external streets and pedestrian facilities (which must be included in a pedestrian master plan or equivalent). Minimizing pedestrian barriers attribute an additional 1% reduction in VMT. These recommendations are generally in line with the recommended discounts derived from the preferred literature above.

Preferred and Alternative Literature Notes:

[1] Nelson\Nygaard, 2010. City of Santa Monica Land Use and Circulation Element EIR Report, Appendix – Santa Monica Luce Trip Reduction Impacts Analysis (p.401). http://www.shapethefuture2025.net/

Nelson\Nygaard looked at the following studies: Anne Vernez Moudon, Paul Hess, Mary Catherine Snyder and Kiril Stanilov (2003), Effects of Site Design on Pedestrian Travel in Mixed Use, Medium-Density Environments, http://www.wsdot.wa.gov/research/reports/fullreports/432.1.pdf; Robert Cervero and Carolyn Radisch (1995), Travel Choices in Pedestrian Versus Automobile Oriented Neighborhoods, http://www.uctc.net/papers/281.pdf;

[2] Sacramento Metropolitan Air Quality Management District (SMAQMD) Recommended Guidance for Land Use Emission Reductions. (p. 11) http://www.airquality.org/ceqa/GuidanceLUEmissionReductions.pdf

Other Literature Reviewed:

None

3.2.5 Incorporate Bike Lane Street Design (on-site)

Range of Effectiveness: Grouped strategy. [See LUT-9]

Measure Description:

The project will incorporate bicycle lanes, routes, and shared-use paths into street systems, new subdivisions, and large developments. These on-street bike accommodations will be created to provide a continuous network of routes, facilitated with markings and signage. These improvements can help reduce peak-hour vehicle trips by making commuting by bike easier and more convenient for more people. In addition, improved bicycle facilities can increase access to and from transit hubs, thereby expanding the “catchment area” of the transit stop or station and increasing ridership. Bicycle access can also reduce parking pressure on heavily-used and/or heavily-subsidized feeder bus lines and auto-oriented park-and-ride facilities.

Refer to Improve Design of Development (LUT-9) strategy for overall effectiveness levels. The benefits of Bike Lane Street Design are small and should be grouped with the Improve Design of Development strategy to strengthen street network characteristics and enhance multi-modal environments.

Measure Applicability:

- Urban and suburban context
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Alternative Literature:

Alternate:

- 1% increase in share of workers commuting by bicycle (for each additional mile of bike lanes per square mile)

Dill and Carr (2003) [1] showed that each additional mile of Type 2 bike lanes per square mile is associated with a 1% increase in the share of workers commuting by bicycle. Note that increasing by 1 mile is significant compared to the current average of 0.34 miles per square mile. Also, an increase in 1% in share of bicycle commuters would double the number of bicycle commuters in many areas with low existing bicycle mode share.

Alternate:

- 0.05 – 0.14% annual greenhouse gas (GHG) reduction
- 258 – 830% increase in bicycle community

Moving Cooler [2], based off of a national baseline, estimates 0.05% annual reduction in GHG emissions and 258% increase in bicycle commuting assuming 2 miles of bicycle lanes per square mile in areas with density > 2,000 persons per square mile. For 4 miles of bicycle lanes, estimates 0.09% GHG reductions and 449% increase in bicycle commuting. For 8 miles of bicycle lanes, estimates 0.14% GHG reductions and 830% increase in bicycle commuting. Companion strategies assumed include bicycle parking at commercial destinations, busses fitted with bicycle carriers, bike accessible rapid transit lines, education, bicycle stations, end-trip facilities, and signage.

Alternate:

- 0.075% increase in bicycle commuting with each mile of bikeway per 100,000 residents

A before-and-after study by Nelson and Allen (1997) [3] of bicycle facility implementation found that each mile of bikeway per 100,000 residents increases bicycle commuting 0.075%, all else being equal.

Alternative Literature References:

[1] Dill, Jennifer and Theresa Carr (2003). “Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Tem, Commuters Will Use Them – Another Look.” *TRB 2003 Annual Meeting CD-ROM*.

[2] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

[3] Nelson, Arthur and David Allen (1997). “If You Build Them, Commuters Will Use Them; Cross-Sectional Analysis of Commuters and Bicycle Facilities.” *Transportation Research Record 1578.*

Other Literature Reviewed:

None

3.2.7 Provide Bike Parking with Multi-Unit Residential Projects

Range of Effectiveness: Grouped strategy. [See LUT-9]

Measure Description:

Long-term bicycle parking will be provided at apartment complexes or condominiums without garages. Refer to Improve Design of Development (LUT-9) strategy for effectiveness ranges in this category. The benefits of Bike Parking with Multi-Unit Residential Projects have no quantified impacts and should be grouped with the Improve Design of Development strategy to encourage bicycling by providing strengthened street network characteristics and bicycle facilities.

Measure Applicability:

- Urban, suburban, or rural contexts
- Appropriate for residential projects

Alternative Literature:

No literature was identified that specifically looks at the quantitative impact of including bicycle parking at multi-unit residential sites.

Alternative Literature References:

None

Other Literature Reviewed:

None

3.4.3 Provide Ride-Sharing Programs

Range of Effectiveness: 1 – 15% commute vehicle miles traveled (VMT) reduction and therefore 1 - 15% reduction in commute trip GHG emissions.

Measure Description:

Increasing the vehicle occupancy by ride sharing will result in fewer cars driving the same trip, and thus a decrease in VMT. The project will include a ride-sharing program as well as a permanent transportation management association membership and funding requirement. Funding may be provided by Community Facilities, District, or County Service Area, or other non-revocable funding mechanism. The project will promote ride-sharing programs through a multi-faceted approach such as:

- Designating a certain percentage of parking spaces for ride sharing vehicles
- Designating adequate passenger loading and unloading and waiting areas for ride-sharing vehicles
- Providing a web site or message board for coordinating rides

Measure Applicability:

- Urban and suburban context
- Negligible impact in many rural contexts, but can be effective when a large employer in a rural area draws from a workforce in an urban or suburban area, such as when a major employer moves from an urban location to a rural location.
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of employees eligible

- Location of project site: low density suburb, suburban center, or urban location

Mitigation Method:

% VMT Reduction = Commute * Employee

Where

Commute = % reduction in commute VMT (from [1])
Employee = % employees eligible

Detail:

- Commute: 5% (low density suburb), 10% (suburban center), 15% (urban) annual reduction in commute VMT (from [1])

Assumptions:

Data based upon the following references:

[1] VTPI. *TDM Encyclopedia*. http://www.vtpi.org/tdm/tdm34.htm; Accessed 3/5/2010.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[58]
CO_2e	1 – 15% of running
PM	1 – 15% of running
CO	1 – 15% of running
NOx	1 – 15% of running
SO_2	1 – 15% of running
ROG	0.6 – 9% of total

Discussion:

This strategy is often part of Commute Trip Reduction (CTR) Program, another strategy documented separately (see TRT-1 and TRT-2). The Project Applicant should take care not to double count the impacts.

Example:

Sample calculations are provided below:

[58] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

- Low Range % VMT Reduction (low density suburb and 20% eligible) = 5% * 20% = 1%
- High Range % VMT Reduction (urban and 100% eligible) = 15% * 1 = 15%

Preferred Literature:

- 5 – 15% reduction of commute VMT

The *Transportation Demand Management (TDM) Encyclopedia* notes that because rideshare passengers tend to have relatively long commutes, mileage reductions can be relatively large with rideshare. If ridesharing reduces 5% of commute trips it may reduce 10% of vehicle miles because the trips that are reduced are twice as long as average. Rideshare programs can reduce up to 8.3% of commute VMT, up to 3.6% of total regional VMT, and up to 1.8% of regional vehicle trips (Apogee, 1994; TDM Resource Center, 1996). Another study notes that ridesharing programs typically attract 5-15% of commute trips if they offer only information and encouragement, and 10-30% if they also offer financial incentives such as parking cash out or vanpool subsidies (York and Fabricatore, 2001).

Alternative Literature:

- Up to 1% reduction in VMT (if combined with two other strategies)

Per the Nelson\Nygaard report [2], ride-sharing would fall under the category of a minor TDM program strategy. The report allows a 1% reduction in VMT for projects with at least three minor strategies.

Alternative Literature References:

[2] Nelson\Nygaard, 2005. *Crediting Low-Traffic Developments* (p.12). http://www.montgomeryplanning.org/transportation/documents/TripGenerationAnalysisUsingURBEMIS.pdf

Criteron Planner/Engineers and Fehr & Peers Associates (2001). Index 4D Method. *A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes*. Technical Memorandum prepared for US EPA, October 2001.

Other Literature Reviewed:

None

3.4.6 Encourage Telecommuting and Alternative Work Schedules

Range of Effectiveness: 0.07 – 5.50% commute vehicle miles traveled (VMT) reduction and therefore 0.07 – 5.50% reduction in commute trip GHG emissions.

Measure Description:

Encouraging telecommuting and alternative work schedules reduces the number of commute trips and therefore VMT traveled by employees. Alternative work schedules could take the form of staggered starting times, flexible schedules, or compressed work weeks.

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for retail, office, industrial, and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of employees participating (1 – 25%)
- Strategy implemented: 9-day/80-hour work week, 4-day/40-hour work week, or 1.5 days of telecommuting

Mitigation Method:

% Commute VMT Reduction = Commute

Where

Commute = % reduction in commute VMT (See table below)

	Employee Participation				
	1%	**3%**	**5%**	**10%**	**25%**
	% Reduction in Commute VMT				
9-day/80-hour work week	0.07%	0.21%	0.35%	0.70%	1.75%
4-day/40-hour work week	0.15%	0.45%	0.75%	1.50%	3.75%
telecommuting 1.5 days	0.22%	0.66%	1.10%	2.20%	5.5%
Source: Moving Cooler Technical Appendices, Fehr & Peers Notes: The percentages from Moving Cooler incorporate a discount of 25% for rebound effects. The percentages beyond 1% employee participation are linearly extrapolated.					

Assumptions:

Data based upon the following references:

[1] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (p. B-54)
http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[60]
CO_2e	0.07 – 5.50% of running
PM	0.07 – 5.50% of running
CO	0.07 – 5.50% of running
NOx	0.07 – 5.50% of running
SO_2	0.07 – 5.50% of running
ROG	0.04 – 3.3% of total

Discussion:

This strategy is often part of a Commute Trip Reduction Program, another strategy documented separately (see TRT-1 and TRT-2). The Project Applicant should take care not to double count the impacts.

The employee participation rate should be capped at a maximum of 25%. *Moving Cooler* [1] notes that roughly 50% of a typical workforce could participate in alternative

▪ [60] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

work schedules (based on job requirements) and roughly 50% of those would choose to participate.

The 25% discount for rebound effects is maintained to provide a conservative estimate and support the literature results. The project may consider removing this discount from their calculations if deemed appropriate.

Example:

N/A – no calculations are needed.

Preferred Literature:

- 0.07% - 0.22% reduction in commuting VMT

Moving Cooler [1] estimates that if 1% of employees were to participate in a 9 day/80 hour compressed work week, commuting VMT would be reduced by 0.07%. If 1% of employees were to participate in a 4 day/40 hour compressed work week, commuting VMT would reduce by 0.15%; and 1% of employees participating in telecommuting 1.5 days per week would reduce commuting VMT by 0.22%. These percentages incorporate a discounting of 25% to account for rebound effects (i.e., travel for other purposes during the day while not at the work site). The percentages beyond 1% employee participation are linearly extrapolated (see table above).

Alternative Literature:

Alternate:

- 9-10% reduction in VMT for participating employees

As documented in *TCRP 95 Draft Chapter 19* [2], a Denver federal employer's implementation of compressed work week resulted in a 14-15% reduction in VMT for participating employees. This is equivalent to the 0.15% reduction for each 1% participation cited in the preferred literature above. In the Denver example, there was a 65% participation rate out of a total of 9,000 employees. *TCRP 95* states that the compressed work week experiment has no adverse effect on ride-sharing or transit use. Flexible hours have been shown to work best in the presence of medium or low transit availability.

Alternate:

- 0.5 vehicle trips reduced per employee per week
- 13 – 20 VMT reduced per employee per week

As documented in *TCRP 95 Draft Chapter 19* [2], a study of compressed work week for 2,600 Southern California employees resulted in an average reduction of 0.5 trips per week (per participating employee). Participating employees also reduced their VMT by 13-20 miles per week. This translates to a reduction of between 5% and 10% in commute VMT, and so is lower than the 15% reduction cited for Denver government employees.

Alternative Literature References:

[2] Pratt, Dick. Personal Communication Regarding the Draft of TCRP 95 Traveler Response to Transportation System Changes – Chapter 19 Employer and Institutional TDM Strategies.

Other Literature Reviewed:

None

3.4.9 Implement Car-Sharing Program

Range of Effectiveness: 0.4 – 0.7% vehicle miles traveled (VMT) reduction and therefore 0.4 – 0.7% reduction in GHG emissions.

Measure Description:

This project will implement a car-sharing project to allow people to have on-demand access to a shared fleet of vehicles on an as-needed basis. User costs are typically determined through mileage or hourly rates, with deposits and/or annual membership fees. The car-sharing program could be created through a local partnership or through one of many existing car-share companies. Car-sharing programs may be grouped into three general categories: residential- or citywide-based, employer-based, and transit station-based. Transit station-based programs focus on providing the “last-mile” solution and link transit with commuters’ final destinations. Residential-based programs work to substitute entire household based trips. Employer-based programs provide a means for business/day trips for alternative mode commuters and provide a guaranteed ride home option.

Measure Applicability:

- Urban and suburban context
- Negligible in a rural context
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Urban or suburban context

Mitigation Method:

% VMT Reduction = A * B / C

Where

A = % reduction in car-share member annual VMT (from the literature)

B = number of car share members per shared car (from the literature)

C = deployment level based on urban or suburban context

Detail:

- A: 37% *(per [1])*
- B: 20 *(per [2])*
- C:

Project setting	1 shared car per X population
Urban	1,000
Suburban	2,000
Source: *Moving Cooler*	

Assumptions:

Data based upon the following references:

[1] Millard-Ball, Adam. "Car-Sharing: Where and How it Succeeds," (2005) Transit Cooperative Research Program (108). P. 4-22

[2] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (p. B-52, Table D.3) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[62]
CO_2e	0.4 – 0.7% of running
PM	0.4 – 0.7% of running
CO	0.4 – 0.7% of running
NOx	0.4 – 0.7% of running
SO_2	0.4 – 0.7% of running
ROG	0.24 – 0.42% of total

[62] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Discussion:

Variable C in the mitigation method section represents suggested levels of deployment based on the literature. Levels of deployment may vary based on the characteristics of the project site and the needs of the project residents and employees. This variable should be adjusted accordingly.

The methodology for calculation of VMT reduction utilizes *Moving Cooler's* rule of thumb[63] for the estimated number of car share members per vehicle. An estimate of 50% reduction in car-share member annual VMT (from *Moving Cooler*) was high compared to other literature sources, and *TCRP 108's* 37% reduction was used in the calculations instead.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (suburban) = 37% * 20 / 2000 = 0.4%
- High Range % VMT Reduction (urban) = 37% * 20 / 1000 = 0.7%

Preferred Literature:

- 37% reduction in car-share member VMT

The *TCRP 108* [1] report conducted a survey of car-share members in the United States and Canada in 2004. The results of the survey showed that respondents, on average, drove only 63% of the average mileage they previously drove when not car-share members.

Alternative Literature:

Alternate – Residential or Citywide Based:

- 0.05-0.27% reduction in GHG
- 0.33% reduction in VMT in urban areas

Moving Cooler [2] assumed an aggressive deployment of one car per 2,000 inhabitants of medium-density census tracks and of one car per 1,000 inhabitants of high-density census tracks. This strategy assumes providing a subsidy to a public, private, or nonprofit car-sharing organization and providing free or subsidized lease for usage of public street parking. *Moving Cooler* assumed 20 members per shared car and 50% reduction in VMT per equivalent car. The percent reduction calculated assumes a percentage of urban areas are low, medium, and high density, thus resulting in a lower

- [63] See discussion in Alternative Literature section for "rule of thumb" detail.

than expected reduction in VMT assuming an aggressive deployment in medium and high density areas.

Alternate – Transit Station and Employer Based:

- 23-44% reduction in drive-alone mode share
- Average daily VMT reduction of 18 – 23 miles

TCRP 95 Draft Chapter 19 [3] looked at two demonstrations, CarLink I and CarLink II, in the San Francisco Bay Area. CarLink I ran from January to November 1999. It involved 54 individuals and 12 rental cars stationed at the Dublin-Pleasanton BART station. CarLink II ran from July 2001 to June 2002 and involved 107 individuals and 19 rental cars. CarLink II was based in Palo Alto in conjunction with Caltrain commuter rail service and several employers in the Stanford Research Park. Both CarLink demonstrations were primarily targeted for commuters. CarLink I had a 23% increase in rail mode share, a reduction in drive-alone mode share of 44%, and a decrease in Average Daily VMT of 18 miles. CarLink II had a VMT for round-trip commuters decrease of 23 miles per day and a mode share for drive alone decrease of 22.9%.

Alternate:

- 50% reduction in driving for car-share members

A UC Berkeley study of San Francisco's City CarShare [4] found that members drive nearly 50% less after joining. The study also found that when people joined the car-sharing organization, nearly 30% reduced their household vehicle ownership and two-thirds avoided purchasing another car. The UC Berkeley study found that almost 75% of vehicle trips made by car-sharing members were for social trips such as running errands and visiting friends. Only 25% of trips were for commuting to work or for recreation. Most trips were also made outside of peak periods. Therefore, car-sharing may generate limited impact on peak period traffic.

Alternative Literature References:

[3] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (p. B-52, Table D.3) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf

[4] Pratt, Dick. *Personal Communication Regarding the Draft of TCRP 95 Traveler Response to Transportation System Changes – Chapter 19 Employer and Institutional TDM Strategies.* Transit Cooperative Research Program.

Cervero, Robert and Yu-Hsin Tsai. *San Francisco City CarShare: Travel-Demand Trends and Second-Year Impacts,* 2005. (Figure 7, p. 35, Table 7, Table 12) http://escholarship.org/uc/item/4f39b7b4

Other Literature Reviewed:

None

3.4.10 Implement a School Pool Program

Range of Effectiveness: 7.2 – 15.8% school vehicle miles traveled (VMT) Reduction and therefore 7.2 – 15.8% reduction in school trip GHG emissions.

Measure Description:

This project will create a ridesharing program for school children. Most school districts provide bussing services to public schools only. SchoolPool helps match parents to transport students to private schools, or to schools where students cannot walk or bike but do not meet the requirements for bussing.

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for residential and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Degree of implementation of SchoolPool Program(moderate to aggressive)

Mitigation Method:

$$\% \text{ VMT Reduction} = \text{Families} * B$$

Where

Families = % families that participate (from [1] and [2])

B = adjustments to convert from participation to daily VMT to annual school VMT

Detail:

- Families: 16% (moderate implementation), 35% (aggressive implementation), (from [1] and [2])
- B: 45% (see Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] Transportation Demand Management Institute of the Association for Commuter Transportation. *TDM Case Studies and Commuter Testimonials*. Prepared for the US EPA. 1997. (p. 10, 36-38) http://www.epa.gov/OMS/stateresources/rellinks/docs/tdmcases.pdf

[2] Denver Regional Council of Governments (DRCOG). *Survey of Schoolpool Participants, April 2008.* http://www.drcog.org/index.cfm?page=SchoolPool. Obtained from Schoolpool Coordinator, Mia Bemelen.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[64]
CO_2e	7.2 – 15.8% of running
PM	7.2 – 15.8% of running
CO	7.2 – 15.8% of running
NOx	7.2 – 15.8% of running
SO_2	7.2 – 15.8% of running
ROG	4.3 – 9.5% of total

Discussion:

This strategy reflects the findings from only one case study.

Example:

Sample calculations are provided below:

- Low Range % School VMT Reduction (moderate implementation) = 16% * 45% = 7.2%
- High Range % School VMT Reduction (aggressive implementation) = 35% * 45% = 15.8%

[64] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Preferred Literature:

- 7,711 – 18,659 daily VMT reduction

As presented in the TDM Case Studies [1] compilation, the SchoolPool program in Denver saved 18,659 VMT per day in 1995, compared with 7,711 daily in 1994 – a 142% increase. The Denver Regional Council of Governments (DRCOG) [2] enrolled approximately 7,000 families and 32 private schools in the program. The DRCOG staff surveyed a school or interested families to collect home location and schedules of the students. The survey also identified prospective drivers. DRCOG then used carpool-matching software and GIS to match families. These match lists were sent to the parents for them to form their own school pools. 16% of families in the database formed carpools. The average carpool carried 3.1 students.

The SchoolPool program is still in effect and surveys are conducted every few years to monitor the effectiveness of the program. The latest survey report received was in 2008. The report showed that the participant database had increased to over 10,000 families, an 18% increase from 2005. 29% of participants used the list to form a school carpool. This percentage was lower than 35% in 2005 but higher than prior to 2005, at 24%. The average number of families in each carpool ranged from 2.1 prior to 2005 to 2.8 in 2008. The average number of carpool days per week was roughly 4.7. The number of school weeks per year was 39. Per discussions with the Schoolpool Coordinator, a main factor of success was establishing a large database. This was achieved by having parents opt-out of the database versus opting-in.

Alternative Literature:

None

Alternative Literature References:

None

Other Literature Reviewed:

None

APPENDIX C

SCAG AND OCTA REMOTE WORK AND TELEWORK REPORTS

POPULATION	2000		2021
TOTAL POPULATION	16 MILLION	↑	19 MILLION
PERCENT OF CALIFORNIA POPULATION	48.8%	↓	47.8%
ADULTS W/ HIGH SCHOOL DIPLOMA+	72.9%	↑	81.7%
ADULTS W/ BACHELOR'S DEGREE+	24.3%	↑	32.4%
FOREIGN BORN POPULATION	31.0%	↓	29.5%
HOUSEHOLDS	**2000**		**2021**
TOTAL HOUSING UNITS	5.4 MILLION	↑	6.6 MILLION
RENTER OCCUPIED UNITS	45.2%	↑	47.5%
MEDIAN HOUSEHOLD INCOME	$70,508	↑	$76,434
FAMILIES LIVING BELOW POVERTY	12.2%	↓	9.0%
RACE/ETHNICITY	**2000**		**2021**
NON-HISPANIC BLACK/AFRICAN AMERICAN	7.3%	↓	6.2%
NON-HISPANIC ASIAN/AMERICAN INDIAN/ OTHERS	13.4%	↑	16.7%
HISPANIC/LATINO	40.6%	↑	47.1%
NON-HISPANIC WHITE	38.9%	↓	30.1%
ECONOMY	**2000**		**2021**
GROSS REGIONAL PRODUCT	$984 BILLION	↑	$1,352 BILLION
RANKING AMONG ALL NATIONAL ECONOMIES	11TH	↓	15TH
SHARE OF U.S. INTERNATIONAL TRADE	11.5%	↑	12.7%
WAGE/SALARY JOBS	6.8 MILLION	↑	7.5 MILLION
UNEMPLOYMENT RATE	5.0%	↑	11.3%
TAXABLE SALES	$315 BILLION	↑	$342 BILLION
CALIFORNIA TAXABLE SALES (%)	44.7%	↑	46.7%
AIR QUALITY	**2000**		**2021**
SOUTH COAST $PM_{2.5}$ ANNUAL AVERAGE CONCENTRATION OVER FEDERAL STANDARD (%)	135%	↓	5.8%

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INNOVATING FOR A BETTER TOMORROW

2021 REGIONAL GUIDE

DIGITAL VERSION AVAILABLE AT
scag.ca.gov/regionalguide

HOW WE MOVE

COMMUTING

15.9 MILLION
REGISTERED VEHICLES

12.7 MILLION
LICENSED DRIVERS

32 MINUTES
AVERAGE COMMUTE TO WORK

76.0%
COMMUTERS WHO DRIVE ALONE

9.6%
COMMUTERS WHO CARPOOL

4.1%
COMMUTERS WHO USE PUBLIC TRANSIT

6.2%
WORK FROM HOME

4.1%
OTHERS (COMMUTERS WHO WALK, BIKE, ETC.)

ACTIVE TRANSPORTATION

5,075
MILES OF EXISTING BIKEWAYS

2.8%
SHARE OF COMMUTERS WHO WALK AND BIKE

AVIATION/PORTS

39.4
MILLION ANNUAL AIR PASSENGERS

200
NONSTOP AIRLINE DESTINATIONS

40%
SHARE OF U.S. CONTAINERIZED IMPORTS

25%
SHARE OF U.S. CONTAINERIZED EXPORTS

BUS

782,000
AVERAGE WEEKDAY BUS BOARDINGS

5,771
BUSES IN OPERATION

65
FIXED ROUTE TRANSIT PROVIDERS

LAND AREA

38,000
SQUARE MILES IN THE REGION

42,058
SQUARE FEET OF OPEN SPACE PER CAPITA

1,121
MILES OF INTERSTATE FREEWAY

510
MILES OF OTHER FREEWAY AND EXPRESSWAYS

18,636
MILES OF PRINCIPAL, MINOR AND ARTERIAL ROADS

RAIL

160,126
AVERAGE WEEKDAY URBAN RAIL BOARDINGS

93
TOTAL URBAN RAIL STATIONS

98
TOTAL URBAN RAIL ROUTE MILES

39,500
AVERAGE WEEKDAY COMMUTER RAIL BOARDINGS

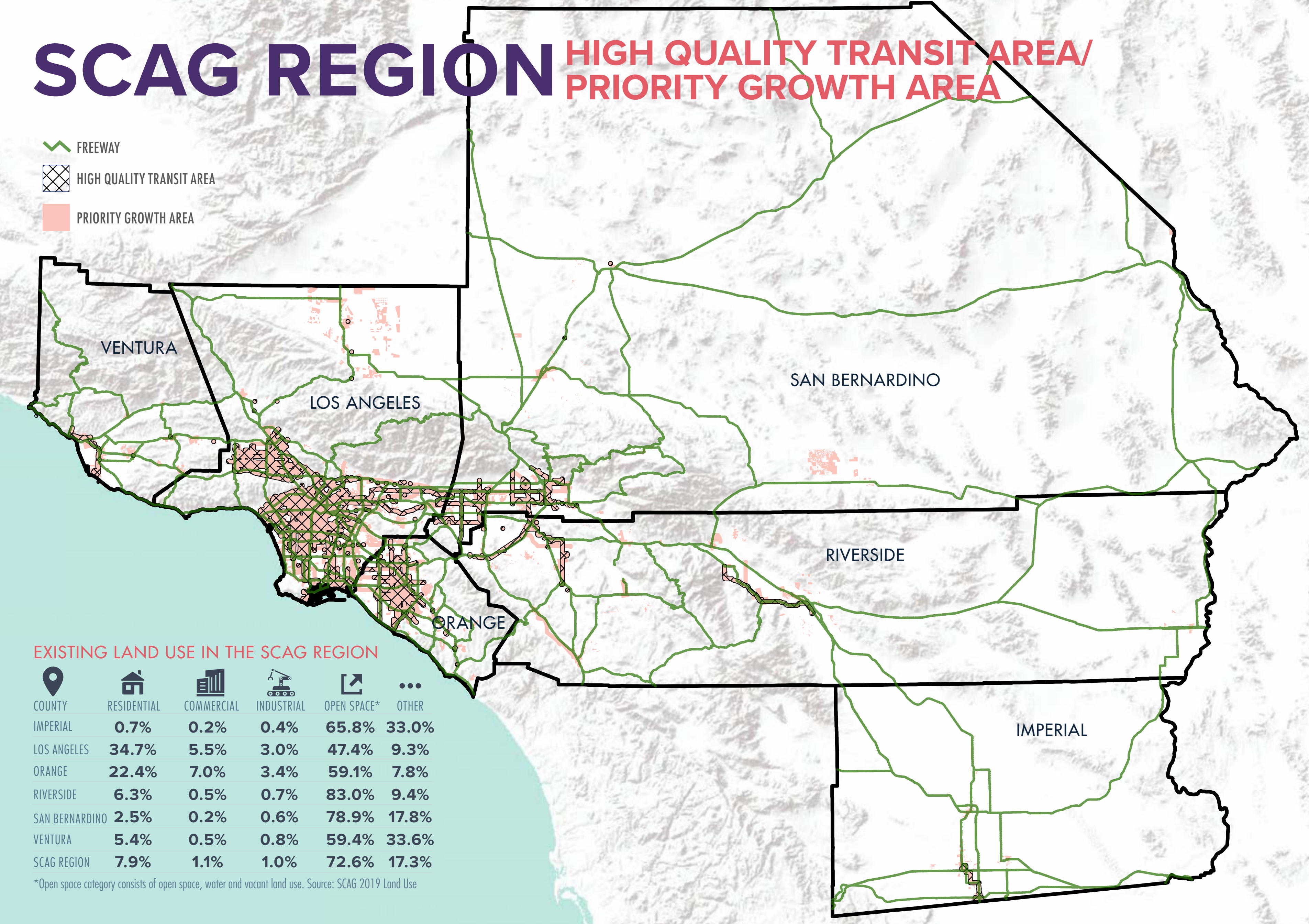
62
TOTAL COMMUTER RAIL STATIONS

538
TOTAL COMMUTER RAIL ROUTE MILES

Sources: POPULATION, HOUSEHOLD, and ETHNICITY: DOF, Census ACS 2019 (1-Year). ECONOMY: IMF, BEA, CA EDD, Census, CDTFA, gross regional product, taxable sales 2019; AIR QUALITY: SCAQMD. COMMUTING: CA DMV 2020 and ACS 2019. AVIATION: 2020 North American Airport Traffic Survey, PORTS: 2018 Journal of Commerce, San Pedro Bay Ports. RAIL/BUS: LA Metro and NTD. Urban rail stations and miles are 2021. Buses and fixed route transit providers are 2019. All dollars are converted to 2019 dollars.

SCAG REGION

HIGH QUALITY TRANSIT AREA/ PRIORITY GROWTH AREA



EXISTING LAND USE IN THE SCAG REGION

COUNTY	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	OPEN SPACE*	OTHER
IMPERIAL	0.7%	0.2%	0.4%	65.8%	33.0%
LOS ANGELES	34.7%	5.5%	3.0%	47.4%	9.3%
ORANGE	22.4%	7.0%	3.4%	59.1%	7.8%
RIVERSIDE	6.3%	0.5%	0.7%	83.0%	9.4%
SAN BERNARDINO	2.5%	0.2%	0.6%	78.9%	17.8%
VENTURA	5.4%	0.5%	0.8%	59.4%	33.6%
SCAG REGION	7.9%	1.1%	1.0%	72.6%	17.3%

*Open space category consists of open space, water and vacant land use. Source: SCAG 2019 Land Use

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Potential Economic Impacts of COVID-19 in the SCAG Region

May 14, 2020

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SCAG™

INNOVATING FOR A BETTER TOMORROW

ABOUT SCAG

SCAG is the nation's largest metropolitan planning organization (MPO), representing six counties, 191 cities and more than 19 million residents. SCAG undertakes a variety of planning and policy initiatives to encourage a more sustainable Southern California now and in the future..

MISSION STATEMENT

To foster innovative regional solutions that improve the lives of Southern Californians through inclusive collaboration, visionary planning, regional advocacy, information sharing, and promoting best practices.

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Potential Economic Impacts of COVID-19 in the SCAG Region

This white paper provides two separate analyses conducted by SCAG staff which present an initial assessment of potential employment and taxable sales implications of the COVID-19 pandemic. A discussion of data and information used in their development is also provided. The pandemic is having severe and unprecedented implications on a wide range of areas and the forecast toolkit of an economist is challenged because, in contrast to the Great Recession, this crisis is driven by a disease rather than financial factors.

While expert opinions vary widely about the depth of economic contractions, there is no doubt that U.S. and world economy is in recession. The Commerce Department's Bureau of Economic Analysis (BEA) released its advance estimate of first quarter 2020 GDP on April 29, and showed that the fallout from the COVID-19 pandemic caused the U.S. economy to contract by 4.8 percent—the largest decline since the great recession in 2008—and a time period which includes the unaffected months of January and February. The sharp declines in the first quarter GDP was led by negative contributions from consumer expenditure and business spending. Consumption by Americans tumbled by 7.6% and business investment shrank 8.6%. Unemployment claims, as another example, are orders of magnitude higher than ever before and as such any prediction of economic impacts (especially longer-range impacts) must be read with an understanding of the huge uncertainties which will be involved. While we have modeled the potential impacts on employment and taxable sales based on current information and assumptions, it is important to note that new data is being made available almost daily and we will work to provide updates as new information becomes available. **Preliminary estimates suggest a possible decrease in taxable sales of 26% to 38% over 2020-2021 and annual average unemployment rates of 19.3% in 2020 and 12.2% in 2021. These early figures, generated based on information available as of April 28, are provided as a starting point to catalyze further discussions among regional stakeholders.**

In collaboration with outside experts, SCAG staff will continue to provide economic status and recovery updates as new information becomes available.

This analysis proceeds as follows:

1. Discussion of key assumptions and timeline
2. Economic snapshot at the time of this writing
3. Analysis of potential impacts of COVID-19 on regional taxable sales in 2020 and 2021
4. Analysis of potential impacts of COVID-19 on regional employment in 2020 and 2021

DISCUSSION OF KEY ASSUMPTIONS AND TIMELINE

This section describes key assumptions about the nature and timeline of the economic impacts of the pandemic which are relied upon in the analysis of both taxable sales and employment. Due to differences in data availability and modeling strategies across both analyses conducted, additional assumptions which are specific to either analysis are described in later sections.

Initial impacts and stay at home orders

Since mid-March, most parts of the nation have been under a form of stay-at-home order. At the time of this writing it is generally understood that gradual reopening of certain public places and businesses will be possible upon the establishment of more specific and enforceable public health guidelines, testing protocols, and contact tracing but before a vaccine is widely available or herd immunity is achieved. **This dynamic makes a quick recovery to the conditions experienced at the beginning of 2020 unlikely.**

When will the low point be?

This analysis generally assumes a severe three-month impact due to the closures and distancing guidelines which have been necessary to prevent overwhelming medical treatment capacity and a major spike in COVID-19 deaths (i.e. "flattening the curve"). **For this analysis, we assume steep declines in March, April, and May 2020 with the low point occurring June 1st ("shutdown period").**

We assume that the various parts of the economy will gradually begin reopening, moving toward more "normal" levels of activity consistent with Governor Newsom's four-stage "pandemic roadmap." However, these are likely to result in reduced output levels which vary by industry. Industries more conducive to physical distancing, benchmarking, and contact tracing are likely to open more quickly and fully.

What will the shape of the recovery be?

As the depths of the shutdown period likely have longer-range effects throughout the economy such as reductions in demand due to unemployment, the challenge of restarting businesses which have been completely shuttered, or the impacts of depleting public and private reserves, we assume a longer recovery period. As some public health officials have noted an 18-month or more timeline needed for the development of a vaccine which may permit a return to full activity levels including conventions and sporting events, this analysis models economic impacts through the end of 2021.

At this time we do not have especially strong evidence to differentiate how a nearer "reopening period" and a longer "recovery period" will differ by industry sector as they are described above. The distinction between supply constraints needed to maintain public health and demand impacts such as aversion to in-person activities or delayed consumption due to layoffs will need to be analyzed further as more information becomes available. **Importantly, this analysis does not explicitly consider second or subsequent waves of infection which would necessitate subsequent shutdowns.**

Government intervention

It is fairly difficult to gauge the impact of government intervention—specifically federal funding—in mitigating the economic fallout from the pandemic. The roughly $2 trillion March 27th federal CARES act provided various grants and loans to businesses, expanded unemployment insurance, direct cash payments to households, public transit funding, and other benefits, while a $484 billion expansion is in progress at the time of this writing and further actions are expected. Early indications suggest that small business grants were oversubscribed, inaccessible, and would be slow to reach intended recipients. It is likely that tens of thousands of the 90% of California businesses with fewer than 19 employees completely closed in March 2020 leaving behind rents, utilities, inventory, and carrying minimal revenue. Firms of this size employ ¼ of the state's workers and as such many are unlikely to be able to carry employees through the end of the "shutdown period" when some revenue stability could return. Especially helpful to reducing 2020 and 2021 unemployment rates would be the rapid, efficient deployment of assistance which can carry businesses until they have a chance of revenue prospects during the "reopening" period. **Specific government interventions such as this are not explicitly modeled in this analysis.**

ECONOMIC SNAPSHOT AT THE TIME OF THIS WRITING

Estimating unemployment

At the end of February the US unemployment rate stood at 3.5%. Between March 14 and May 2, 33.5 million Americans filed for first time unemployment insurance.[1] **TABLE 1** analyzes initial unemployment claims data. Using non-farm wage and salary jobs in March 2020 as the base, SCAG estimates job loss rates based on these claims will reach 20% for the full month of April. The fast onset of these claims surpasses those experienced during the Great Depression, where the peak unemployment rate of 24.9% was not attained until 1933 and did not return to single digits until 1941. SCAG anticipates the number of new claims to decline through the rest of May with the unemployment rate continuing to rise. Should economic activity begin to resume in June as described above it is expected that some lost employment will be restored, but high unemployment rates are likely to continue through 2020 and 2021.

TABLE 1 Estimated U.S. Job Losses & Job Loss Rates

	US	CA	CA % of US
3/7/2020	211,000	43,385	20.6%
3/14/2020	282,000	58,208	20.6%
3/21/2020	3,307,000	186,333	5.6%
3/28/2020	6,867,000	878,727	12.8%
4/4/2020	6,615,000	918,814	13.9%
4/11/2020	5,237,000	655,472	12.5%
4/18/2020	4,427,000	533,568	12.1%
4/25/2020	3,846,000	325,343	8.5%
5/2/2020	3,169,000	318,064	10.0%
Total Since Week of 3/21/2020	**33,468,000**	**3,816,321**	**11.4%**
Non-farm Wage & Salary Employment (03/2020)	**151,786,000**	**17,505,000**	**11.5%**
Job Loss Rates for 04/2020	**22.0%**	**21.8%**	

Sources: US Department of Labor, BLS (DOL), CA EDD and SCAG estimates

Economic output

As indicated by the IHS Markit Flash US Composite Purchasing Manager's Index[2], private sector firm activity decline was unprecedented in April 2020 with manufacturing and service sectors both registering major contractions due to the pandemic. Service companies registered the steepest rate of decline in this market survey's history, while manufacturing declines were the steepest since the onset of the Great Recession in early 2009. **TABLE 2** provides a snapshot of several US and SCAG region economic indicators as of mid-April 2020:

1 https://www.dol.gov/ui/data.pdf
2 A market research service, see www.markiteconomics.com

TABLE 2 Mid-April 2020 Snapshot of US & SCAG Region Economy

	Mar 2020 month-over-month (i.e., vs. Feb 2020)	Mar 2020 year-over-year (i.e. vs. Mar 2019)
US Non-farm Jobs	-701,000	1,504,000
US Unemployment Rates (4.4%)	0.9%	0.6%
SCAG Region Non-farm Jobs	-99,500	150,400
SCAG Region Unemployment Rates (5.3%)	1.4%	1.1%
US Retail Trade	-8.7%	-6.2%
US Housing Permits	-6.8%	5.0%
US Housing Starts	-22.3%	1.4%
US Existing Home Sales	-8.5%	0.8%
US Exisiting Home Sale Prices	8.0%	3.8%
	CA Existing Home Sales	
Single Family Homes	-11.5%	-6.1%
Condo/Townhomes	20.0%	2.9%
	CA Exisiting Home Sale Prices	
Single Family Homes	5.6%	8.3%
Condo/Townhomes	3.1%	6.5%
Los Angeles Metro Area Existing Home Sales	20.4%	-0.1%
Los Angeles Metro Area Exisiting Home Sale Prices	1.1%	7.6%
	Ports of Los Angeles & Long Beach	
Loaded Inbound	-12.3%	-16.4%
Loaded Outbound	2.5%	-8.2%
Loaded Total	-7.4%	-13.6%
Air Cargo-LAX*	-6.42%	-8.3%
Air Passengers-LAX*	-2.3%	-3.9%
Air Cargo-Ontario	6.1%	19.7%
Air Passengers-Ontario	-55.7%	-46.5%
Rail^	-2.9%	-22.0%
Truck freight**	-8.3% to -18.0%	NA
Gas/VMT	-83%	NA

*Sources/Notes: *LAX reflects 2/2020 figures. ^Rail: 2nd quarter through 4/18/20. **Truck: from https://www.traffictechnologytoday.com/news/data; 3/16/20-03/27/20 baseined against 2/1/20-3/15/20. See also https://www.geotab.com/blog/impact-of-covid-19/*

Housing

Initial unemployment claims data alone indicate that the impact on the housing market may be large. After initial data indicated significant decline in new homebuyer traffic, the National Association of Homebuilders (NAHB)/Wells Fargo Housing Market Index (HMI) dropped from 72 in March to 30 in April—the lowest HMI score since 2012 and the largest monthly decline in the 35-year history of the index. Census data for March also indicate slowing construction in the months ahead with one-month drops of 18% for single-family construction and 30% for multifamily construction.

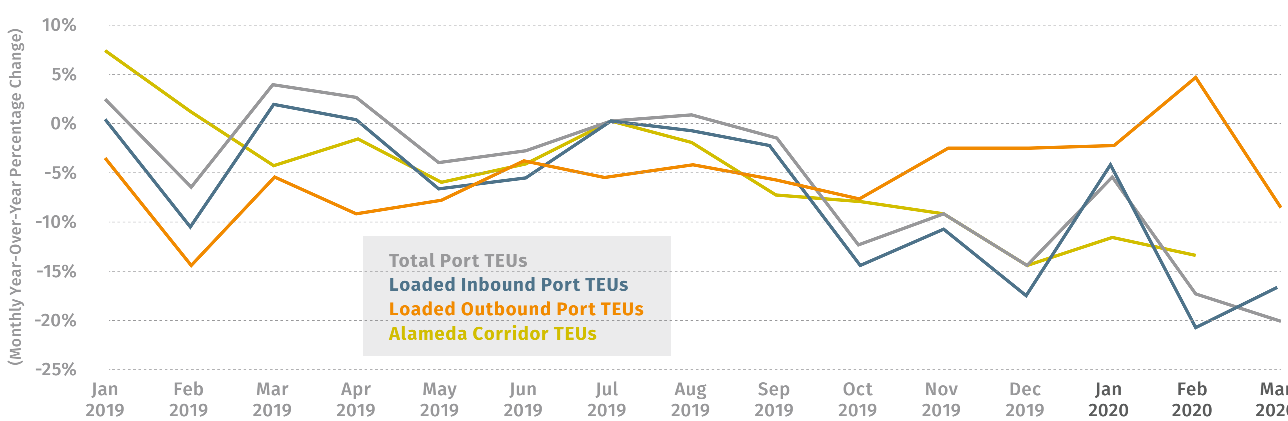
However, it is important to note that in contrast to the Great Recession prior to which housing had been overbuilt, housing supply is generally understood to be well below current demand. A National Association of Realtors states that six in ten buyers and sellers are stalling their transaction for a couple of months, but only one in ten are deciding not to buy or sell indefinitely suggesting only a delay of otherwise strong demand indicators. For this reason housing may play a major role in leading the economy out of recession once virus mitigation shows signs of progress.

Trade and freight

As COVID-19 has spread across the world, the U.S. has witnessed increasing challenges impacting its supply chains. This has ranged from substantial declines in import and export activity for discretionary cargo to surges in consumption of essential goods as consumers have rushed to purchase items of necessity in preparation of social distancing measures. The erratic shifts in consumer behavior has led to increasing storage needs for certain goods and extreme pressure on fulfillment and warehouse distribution facilities looking to accommodate the exponential increase in digital orders for home delivery. The uncertainties surrounding how local economies across the country will begin to re-open household and business activity complicates unknowns on how many variables will play out including the impact on freight rates, employment, business solvency, ability to meet consumer demand, etc.

Import and Export. The Ports of Los Angeles and Long Beach (San Pedro Bay Ports – SPBPs) have witnessed a substantial decline in twenty-foot equivalent container units (TEUs) during February and March of this year, particularly for imports (see **FIGURE 1**). While import shipments have been improving from March low points, overall performance in April is not anticipated to be better. Although manufacturing activity has been ramping back up in China, the pandemic's arrival in the U.S. has crippled America's demand for discretionary imported goods. With broad segments of the economy shut down, non-essential stores closed, and millions of U.S. consumers unemployed, depressed levels of import activity are likely to persist over the near-term, with uncertainty as to when demand will return to more normal levels. Many are forecasting double-digit declines for monthly retail imports in every month, at least through August 2020.

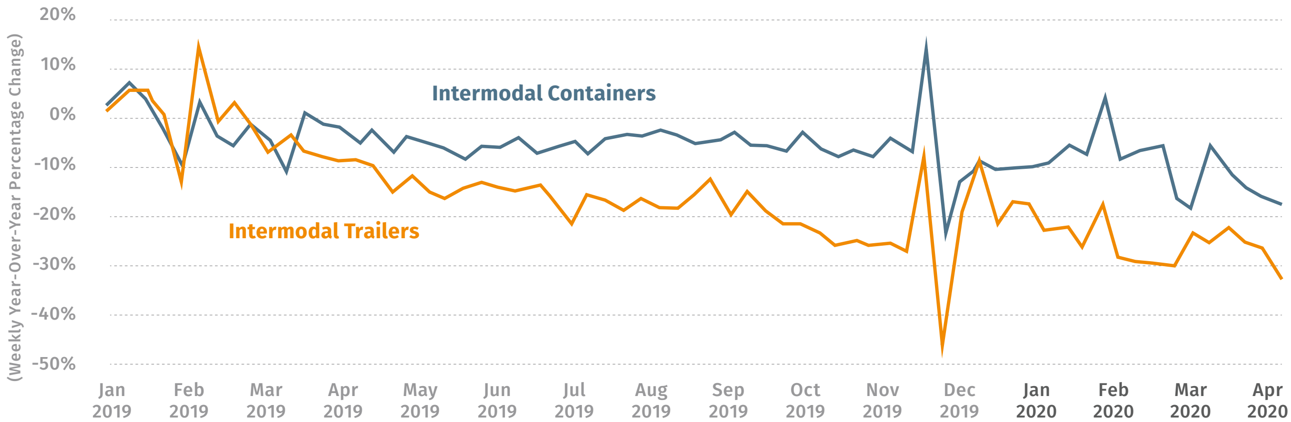
FIGURE 1A San Pedro Bay Ports & Alemeda Corridor TEU Performance



Sources: Ports of Los Angeles & Long Beach, & Alameda Corridor Transportation Authority

Rail traffic. National rail trends have displayed volatility since 2018. Despite lower performance throughout 2019, trends through mid-April have shown declines from COVID-19 disruptions. Both Union Pacific Railroad Company (UPRR) and BNSF Railway (BNSF) railroads, the largest rail operators in North America, serve the SCAG region. These rail operators have witnessed a 10% decline in international and domestic intermodal service and a 26% decline in trailer services through mid-April. The Alameda Corridor, which runs from the San Pedro Bay Ports to downtown Los Angeles, is one of the key rail infrastructure connections in the region and has reported declines through February 2020, with corridor total TEUs down 12% stemming from the declines in trade at the ports. This confirmation of April's continued woes is consistent with port data and has also illustrated how domestic intermodal freight is sensitive to the international declines which began earlier.

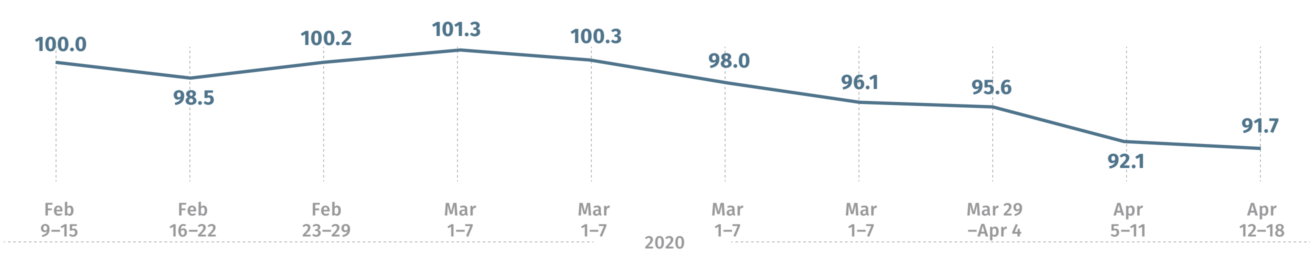
FIGURE 1B Railroad Intermodal Container/Trailer Performance



Sources: BNSF/Union Pacific carload/intermodal unit weekly reporting

Truck. Trucking performance nationwide has witnessed a brief bright spot during the COVID-19 pandemic. Notably, through mid-March, a surge in truck-related freight activity occurred as consumers flocked to retail stores to purchase essential goods as stay-at-home orders began. This led to a short-lived increase in freight demand, but demand has fallen off substantially through mid-April as consumption has focused explicitly on food and beverages, pet care, and many other household products. This has led to a narrower shift in freight that has severely affected truck freight rates due to an oversupply of drivers competing for this business.

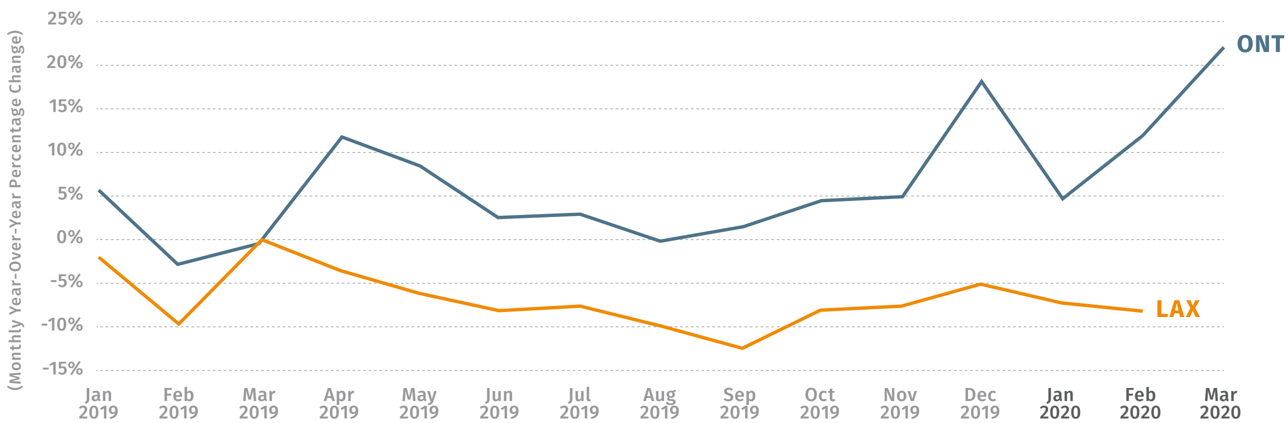
FIGURE 1C California Truck Activity Index



Sources: American Transportation Research Institute

Air cargo and passengers. Recent impacts on air freight has been mixed, primarily relating to domestic versus international performance. Domestic air freight has been much more associated with shipments from FedEx, UPS, and Amazon, which has been more correlated with household consumer deliveries of essential items. Los Angeles performance is indicative of its larger share of international freight, impacted similarly from declines in trade with Asia. For the year, Ontario freight tons are up 13% and Los Angeles are down 8%. Ontario's acceleration in March correlates with the strong rise in trucking demand shown above and may be indicative of a higher share of essential goods throughput.

FIGURE 1D Los Angeles & Ontario Airports Frieght Ton Performance



Sources: Los Angeles World Airports and Ontario International Airport

ANALYSIS OF POTENTIAL IMPACTS OF COVID-19 ON REGIONAL TAXABLE SALES IN 2020 AND 2021

Local vulnerability

The COVID-19 pandemic will impact different communities in different ways. However, evidence available to date suggests significant disruption of local and state revenue streams as taxable sales and tourism-based revenues are impacted. **TABLE 3** summarizes 2018 state Controller data on local jurisdictions' revenue sources across the counties of the SCAG region. An expanded list of economic, social, health, and housing variables across jurisdictions in the SCAG region can be found in Appendix A.

Analysis Background

This section presents a preliminary analysis of the potential impact of COVID-19 on taxable sales in the region. **Note that this is not a forecast or assessment of revenues in the region.** Given the uncertainty of the situation, SCAG has assessed a range in outcomes based on an array of assumptions that will be updated as new information becomes available. The impacts presented here are based on the latest data available to SCAG as of April 28, 2020. All figures below are presented in 2019 dollars.

This preliminary analysis should be used with caution. Information on the likely effects of the pandemic—and the governmental, business, and consumer responses to those effects—continues to change daily. Given the limited nature of relevant data that is available at this time, the preliminary forecast was developed using a top-down analysis at the regional level; overall findings about aggregate results may not translate directly to local jurisdictions. Staff is providing this first-cut assessment to help spur the conversation on appropriate actions to take at this time, but the forecast will necessarily change and become more detailed in the weeks and months ahead as more concrete data becomes available.

TABLE 3 Local Revenue Sources (2018)

		Total Revenues (Millions)	Secured and Unsecured Property Taxes (%)	Sales and Use Taxes (%)	Transient Occupancy (Hotel) Taxes (%)	Sales & Hotel Taxes Combined (%)
SCAG Region Local Jurisdictions (197)	Min.	$0.75	0.0%	0.0%	0.0%	0.3%
	Avg.	$119.55	21.1%	26.7%	6.3%	32.9%
	Max.	$6,359.45	73.8%	77.7%	48.9%	78.9%
Imperial County Jurisdictions (8)	Min.	$0.75	6.0%	0.0%	0.0%	2.1%
	Avg.	$14.78	15.3%	28.6%	2.7%	31.2%
	Max.	$50.69	32.0%	56.3%	7.9%	62.2%
Los Angeles County Jurisdictions (89)	Min.	$1.03	0.0%	0.3%	0.0%	0.3%
	Avg.	$176.69	20.1%	23.9%	5.3%	29.3%
	Max.	$6,359.45	73.8%	77.7%	48.9%	78.9%
Orange County Jurisdictions (35)	Min.	$3.20	4.3%	0.9%	0.0%	0.9%
	Avg.	$87.38	26.7%	28.3%	8.0%	36.3%
	Max.	$778.99	59.1%	48.4%	46.9%	71.6%
Riverside County Jurisdictions (29)	Min.	$4.62	2.3%	3.5%	0.0%	4.0%
	Avg.	$72.04	18.7%	29.3%	8.8%	38.1%
	Max.	$780.60	52.2%	51.1%	39.6%	66.1%
San Bernardino County Jurisdictions (25)	Min.	$3.52	0.0%	3.4%	0.0%	3.8%
	Avg.	$70.28	19.6%	29.6%	4.9%	34.5%
	Max.	$630.72	49.1%	56.9%	28.5%	60.4%
Ventura County Jurisdictions (110)	Min.	$6.30	8.1%	2.9%	0.0%	3.2%
	Avg.	$72.97	25.8%	28.7%	7.2%	35.9%
	Max.	$346.69	61.1%	43.7%	42.2%	60.3%

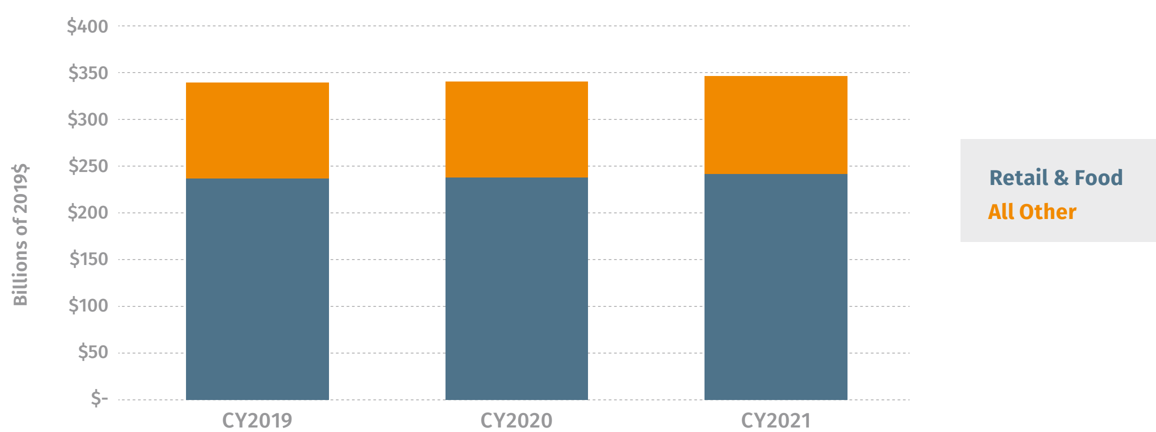
Source: CA State Controller

Methodology and Key Assumptions

SCAG developed a baseline estimate and a preliminary forecast for the value of taxable sales in the six-county region using historical actual data for CY2019, disaggregated by county and by industry group from the California Department of Tax & Fee Administration (CDTFA).[3] This data includes taxable sales from different types of retail and food services outlets as well as an "All Other Outlets" category that includes taxable sales from all other industry codes. The "All Other Outlets" category is dominated by wholesale trade (37% of the category in CY2019), manufacturing (22%), real estate (12%), and construction (5%).

The baseline assumes that, absent the pandemic, taxable sales would have grown at a composite rate of 1.34% per year in real terms.[4] In CY2019, the SCAG region had $238 Billion in taxable retail and food sales and $103 Billion in taxable sales from all other outlets, for a total of $341 Billion. Assuming continued growth, the SCAG region would have seen total taxable sales of $342 Billion and $348 Billion in CY2020 and CY2021, respectively, for a total of $690 Billion. The Baseline estimate of annual taxable sales for CY2019 through CY2021 is portrayed in **FIGURE 2**.

FIGURE 2 **Annual Taxable Sales in SCAG Region (Baseline Estimate)**



To develop a new forecast of taxable sales, SCAG relied on the following data sources:

- Analysis of retail and food service categories utilized the most recent data from the Monthly Advance Retail Trade Survey (MARTS), administered by the U.S. Census Bureau.[5] This regular sample of U.S. retail and food service establishments provides an early estimate of trends in retail sales each month before complete data for the entire month are available, and it is currently the only comprehensive published data set for these business types that reflects the impacts of the significant economic dislocations that began in March of this year. The Census will release additional retail data series over the next few weeks and months, and staff will be modifying the forecast based on this new information as it becomes available.

3 Available at https://www.cdtfa.ca.gov/dataportal/dataset.htm?url=TaxSalesAllCounties
4 This 1.34% figure is a placeholder based on the long-term annual growth rate in sales tax revenues in the SCAG region as a whole, in constant dollars, over the full 25-year forecast period in Connect SoCal, without taking economic cycles into account. Future analysis efforts will assess trends at the county-level and evaluate prior expectations for near-term taxable sales and associated tax revenues.
5 Available at https://www.census.gov/retail/index.html

- Analysis of all other taxable sales utilized the IHS US Markit Flash Composite PMI (Purchasing Manager Index).[6] This proprietary data series is computed based on surveys of private businesses and provides a monthly snapshot of the manufacturing and services sectors that roughly tracks U.S. GDP. The March data is now final and preliminary data for April has just been released; a revised estimate for April is expected in the first week of May. In addition to reviewing any updates in the IHS Markit index, staff will also monitor emerging trends using future Census data releases for the wholesale trade, manufacturing, and real estate sectors.

SCAG estimated taxable sales for each month of 2020 and 2021, for each industry grouping in the CDTFA data, based on a common timeline of impacts from COVID-19:

- Estimated taxable sales for January and February of 2020 are assumed to be relatively normal and consistent with recent history.
- March through May of 2020 are assumed to have a significant decrease in taxable sales due to the artificial suppression of economic activity; effects are assumed to intensify during these three months as the full impact of large-scale unemployment takes hold. Stay-at home orders currently in place are assumed to be relaxed at the end of May.
- From June 2020 through December 2021, taxable sales are assumed to slowly increase as economic activity gradually expands again; for simplicity, the pace of this recovery is modeled by estimating a December 2021 endpoint for each industry relative to its own CY2019 baseline, and then extrapolating a linear increase between the May-2020 value and the Dec-2021 endpoint.

Although the forecast of taxable sales assumes a consistent timeline across industries, the scale of the impact for each industry is determined separately, so as to reflect differences that are already visible in the MARTS data release for March 2020. For example, the significant decline in sales at bars and restaurants is partially offset by a surge in sales for grocery stores. Scaling factors were utilized in the calculations to reflect the following considerations:

- California was the first state to issue formal shelter-in-place orders at the statewide level. National trends will lag those experienced in California by a week or more. The industry-specific effects for March 2020 taken from the MARTS and IHS Markit data were intensified to 125% of the values reported at the national level to reflect the earlier onset of the changes in our state.
- The changes visible in the MARTS data for March 2020 only reflect a partial month and will intensify in the months that follow, because recent increases in unemployment will further decrease consumer spending which, in turn, decreases taxable sales for businesses; the scaling factors reflect stronger effects over the course of the three months from March to May.
- The effects will vary in magnitude by industry. For example, changes in purchases of durable goods such as cars and appliances are likely to be more pronounced over time than changes in purchases of clothing.
- Due to new public health requirements, some industries may not be able to return to their former sales volume within the timeframe of this analysis. For example, it is likely that new table-spacing requirements will limit the total revenue potential of the restaurant industry for the next year or more.

Preliminary estimates of all of these effects were based on industry-specific information available to staff at the time of this writing and current expectations for when stay-at-home orders may start to be reduced or eliminated. Going forward, these estimates will be supplemented with additional research in order to refine the understanding of expectations and most-likely outcomes. Further information about the industry-specific inputs used in this analysis is presented in the next section.

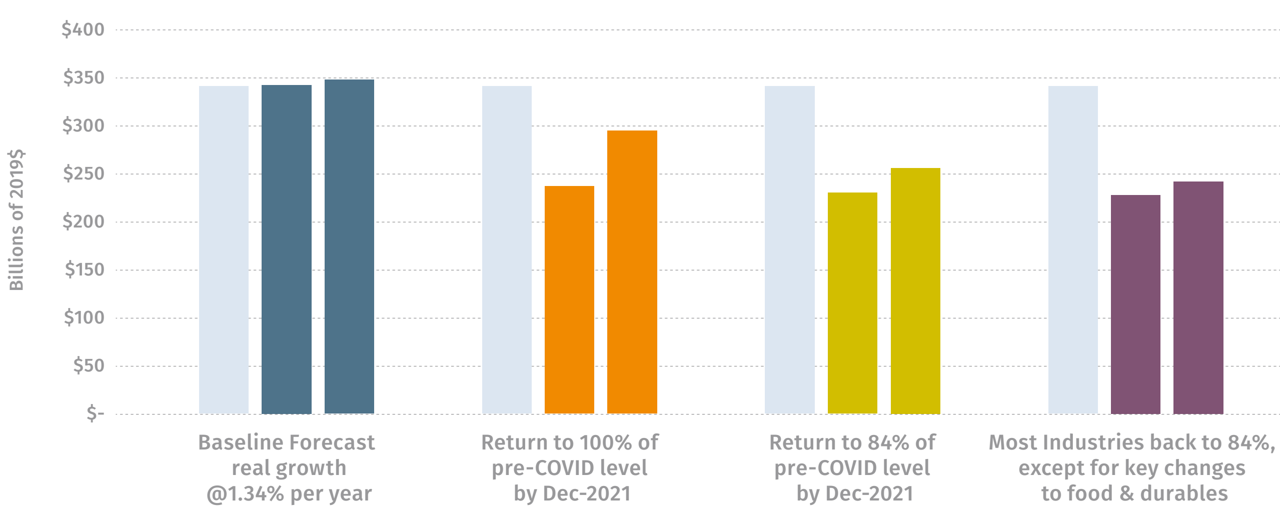
6 Available at www.markiteconomics.com

Preliminary Findings

At this early stage, staff opted to examine several possible recovery scenarios, in order to characterize a range of possible outcomes. Some of the tested scenarios are not considered plausible economic results; instead they help to illustrate the basis for arriving at the current forecast. In addition to the current Baseline estimate noted above, three exploratory scenarios were calculated:

- **Return to 100% of pre-COVID level by Dec-2021** – The first scenario assumed that the economy would manage to recover to the point that monthly taxable sales return to pre-COVID levels in all industries by the end of the two-year forecast period. This scenario seems overly optimistic at this stage, but as a point of reference, it would result in a loss of $158 Billion (in 2019 dollars) in taxable sales in the SCAG region over 2020 and 2021. This is a decrease of 23 percent compared to the $690 Billion in taxable sales in the Baseline estimate.
- **Return to 84% of pre-COVID level by Dec-2021** – A review of taxable sales data from the period that covers the Great Recession shows that six calendar quarters after the economy reached the bottom of the trough in June 2009, taxable sales in the SCAG region had returned to 84% of their pre-recession (2007-Q4) levels in constant dollar terms. As a benchmark, this scenario tested the results if all taxable sales categories were able to reach the same milestone by December 2021, six quarters after the assumed end of the shutdown period. This scenario results in a loss of $204 Billion (30 percent) in taxable sales over the two-year forecast period, compared to the Baseline estimate.
- **Most industries return to 84% of prior level, except for key changes to food & durables** – As a general matter, each industry will recover at different rates, and the public health issues unique to this crisis are likely to result in some long-term shifts in purchasing behaviors between industries. For example, we can expect significantly decreased activity in bars and restaurants and corresponding increases in grocery purchases relative to the prior condition. Also, given the scale of workers who are losing income, many households are likely to delay discretionary purchases of durable goods such as motor vehicles and appliances. This scenario alters the "84%" condition described above a step further by adjusting the Dec-2021 recovery targets for the industry categories mentioned above to reflect these possibilities. Total taxable sales lost under this scenario would be $220 Billion (32 percent below Baseline).

FIGURE 3 Annual Taxable Sales in the SCAG Region (Exploratory Scenarios, CY2019 to CY2021)



The total taxable sales by year for these exploratory scenarios are portrayed in **FIGURE 3**. The total taxable sales by month for each scenario are portrayed in **FIGURE 4**.

FIGURE 4 Total Taxable Sales in the SCAG Region by Month (Exploratory Scenarios, Jan-2020 to Dec-2021)

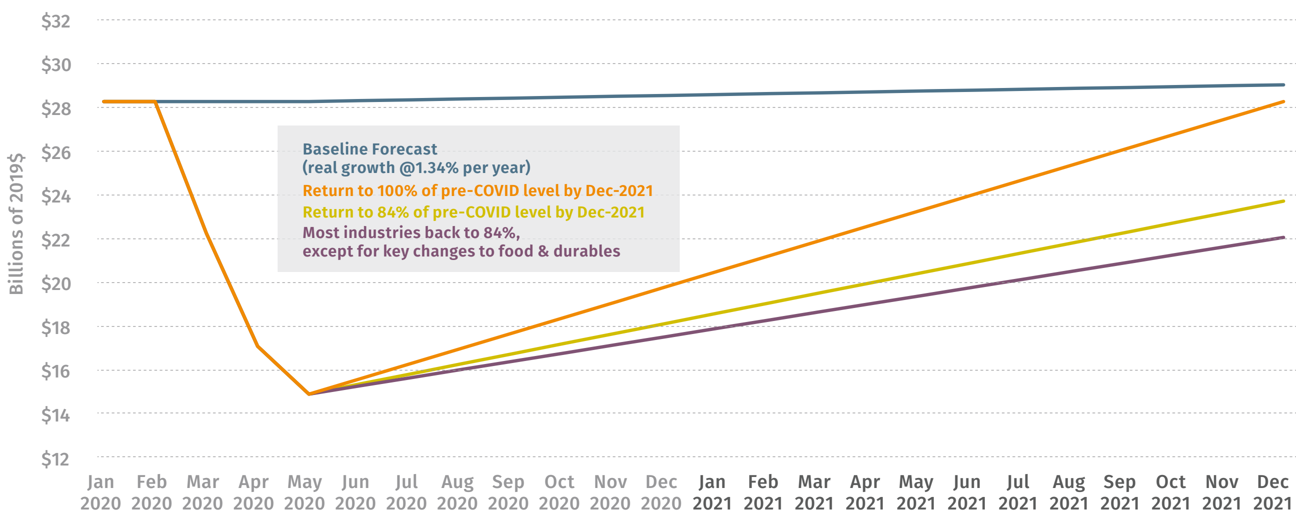


TABLE 4 Asserted Input Factors by Industry (Preliminary Forecast Midpoint)

	May-2020 as share of 2019 monthly level	Dec-2021 as share of 2019 monthly level
Motor Vehicle and Parts Dealers	41%	65%
Home Furnishings and Appliance Stores	51%	65%
Building Material and Garden Equipment and Supplies Dealers	108%	84%
Food and Beverage Stores	142%	125%
Gasoline Stations	28%	84%
Clothing and Clothing Accessories Stores	11%	84%
General Merchandise Stores	111%	84%
Food Services and Drinking Places	20%	50%
Other Retail Group	97%	84%
Sub-total: All Retail and Food Service	60%	76%
All Other Outlets	38%	84%
TOTAL, All Outlets	**53%**	**78%**

With the information currently available, the third (last) scenario described above is used as the preliminary forecast at this time. For reference, the key input factors used in the third scenario are presented below in **TABLE 4**. The values are presented relative to a typical month in CY2019, computed as a simple 1/12th of the annual total reported by CDTFA.

Given the significant uncertainty inherent in this simplified forecast method, range estimates were developed by varying the values of all asserted scaling factors by +/-10% from the levels described in **TABLE 4** to evaluate the results for lower impact (10% better) and higher impact (10% worse) conditions. The corresponding results over the two-year period for each industry category are presented below in **FIGURE 5** and **TABLE 5**.

FIGURE 5 Total Taxable Sales in the SCAG Region, by Month (Preliminary Forecast Range, Jan-2020 to Dec-2021)

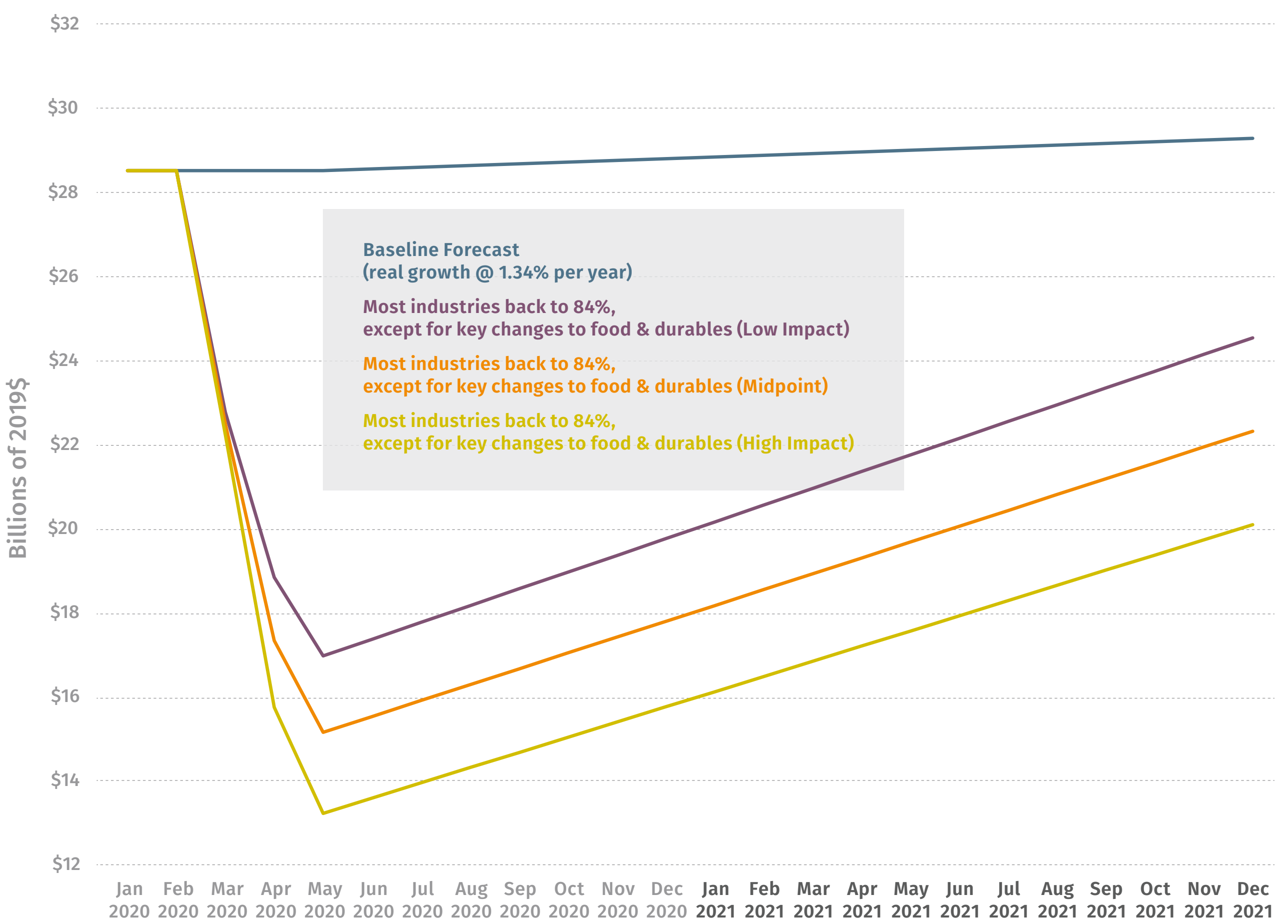


TABLE 5 Taxable sales in the SCAG Region by Industry Grouping (Preliminary Forecast Range, Jan-2020 to Dec-2021)

	Total Taxable Sales: 2020+2021 combined (in billions, 2019$)		Change vs. Baseline (in billions, 2019$)		Percent Change vs. Baseline	
	Lower Impact	Higher Impact	Lower Impact	Higher Impact	Lower Impact	Higher Impact
Motor Vehicle and Parts Dealers	$53	$44	($32)	($41)	-38%	-48%
Home Furnishings and Appliance Stores	$19	$16	($10)	($12)	-34%	-43%
Building Material and Garden Equipment and Supplies Dealers	$35	$33	$0	($2)	-1%	-7%
Food and Beverage Stores	$37	$35	$9	$7	33%	26%
Gasoline Stations	$33	$26	($17)	($24)	-35%	-48%
Clothing & Clothing Accessories Stores	$27	$20	($20)	($27)	-43%	-57%
General Merchandise Stores	$57	$53	$0	($3)	1%	-5%
Food Services and Drinking Places	$41	$31	($47)	($57)	-53%	-65%
Other Retail Group	$60	$56	($3)	($8)	-5%	-13%
Sub-total: All Retail and Food Service	**$362**	**$314**	**($120)**	**($168)**	**-25%**	**-35%**
All Other Outlets	**$150**	**$112**	**($58)**	**($96)**	**-28%**	**-46%**
TOTAL, All Outlets	**$515**	**$426**	**($178)**	**($264)**	**-26%**	**-38%**

Caveats and Next Steps

It should be noted that this estimate of impacts to taxable sales presented above is a first-order calculation of the direct effects of known and anticipated changes in economic activity. There will be significant economic interactions between industries over time, resulting in indirect and induced effects that can only be determined with detailed modeling of economic impacts using an input-output model; these cross-industry effects are not reflected in the starting point estimate described here. In particular, formal economic modeling could reveal that the re-opening period will initially be much slower than the linear interpolation suggests. And as noted elsewhere, this assessment does not reflect the possibility of further wave(s) of infection which could necessitate additional public health measures that constrain the economy.

In addition, these estimates do not formally incorporate the effects of government spending on relief efforts or fiscal stimulus. The latest available MARTS data was collected throughout the month of March, and many survey respondents may not have had information on whether they would be helped by the $2 Trillion CARES Act, which was not signed until the 27th of the month. An additional federal relief package has already been passed, other federal interventions are currently being debated, and state and local jurisdictions are tapping into reserve funding pools to support their communities. This government spending will surely affect future taxable sales over the next two years, but it is too early to know the timing and degree of impacts for different industries.

Finally, while this estimate provides insight on the scale of potential changes in total taxable sales by sector, it does not yet address key questions about the magnitude and timing of these changes on the associated government cash flow. A number of factors could influence the timing of when and whether the tax revenues associated with the taxable sales activity will actually be available to each jurisdiction. Governor Newsom has issued executive orders allowing for the deferral of multiple types of tax payments, and some local jurisdictions are deciding to waive penalties associated with late payment of property taxes as well.[7] At the same time, the pandemic has rapidly accelerated the trend towards online shopping and away from bricks-and-mortar retail establishments. The taxable sales trends computed above do not account for the possibility of intra-jurisdictional shifts associated with changes in the point-of-sale for these transactions. Although California has enacted several laws to enforce payment of sales taxes for online purchases as of October 1, 2019, it seems unlikely that enforcement will be a significant enough focus of the administration over the next two years to meaningfully reverse the trends that are already underway.[8]

ANALYSIS OF POTENTIAL IMPACTS OF COVID-19 ON REGIONAL EMPLOYMENT IN 2020 AND 2021

Background

The preceding analysis of taxable sales presents a first-order calculation of how certain assumptions about COVID-19's economic impact may be directly reflected in regional taxable sales through 2020 and 2021. In contrast, this analysis uses a structural economic forecasting model (REMI) to evaluate a similar yet distinct set of assumptions on employment in the region's six counties during 2020 and 2021. **This analysis captures economic interactions between industries over time, but relies on a greater number of assumptions.**

SCAG has long assessed the economic output and job creation impacts of the investments associated with its Regional Transportation Plan/Sustainable Communities Strategy (see the Economic and Job Creation Analysis Technical Report at www.connectsocal.org). The REMI model uses a system of equations based on county-specific information to forecast how the region's economy changes over time and reacts to new conditions by county and full year. SCAG staff developed assumptions of some of the direct shocks to output that certain industries are facing due to the COVID-19 pandemic, using them as inputs into the REMI model to evaluate some of the implications on the regional economy. The model then assesses downstream implications including the losses in supply chain spending that results from a decrease in output and the loss of consumption spending resulting from those now unemployed taking into account regional characteristics such as commuting patterns and regional trade relationships.

Caveats

Key assumptions are how much and how long each industry sector will be impacted, while the outputs shown take into account county-specific characteristics such as industrial composition. This analysis was conducted by SCAG staff in consultation with outside experts (including REMI staff) on April 28, 2020. In addition to reflecting the assumptions and time periods described at the beginning of this report, additional assumptions are made for specific industry sectors compared to 2019 levels.

7 See: (1) https://www.gov.ca.gov/2020/03/30/governor-newsom-signs-executive-order-providing-relief-to-california-small-businesses/, (2) https://www.gov.ca.gov/2020/04/02/governor-newsom-announces-new-help-for-small-businesses-workers-displaced-by-covid-19/, and (3) https://www.natlawreview.com/article/what-can-you-do-about-your-california-property-tax-payment-covid-19-s-impact

8 https://www.cdtfa.ca.gov/industry/MPFAct.htm

In contrast to the taxable sales analysis above which roots its assumptions in March 2020 data from MARTS and IHS Markit, this analysis necessitates assumptions on a broader range of industries for which similar data may not be readily available. For certain industries, reliable information or prognoses were not available and an assumption based on a related industry was used while in other instances there may not yet be an understanding of the shock of COVID-19. Some assumptions are informed by, but not directly based on an analysis conducted by USC's The National Center for Risk and Economic Analysis of Terrorism Events (CREATE).[9] Other assumptions mirror those presented in the background material and taxable sales analyses above; however, assumptions used in the REMI model may differ since they reflect direct output shocks rather than taxable sales impacts. Still other assumptions rely on the expertise on SCAG's Economic Bench, REMI, and SCAG research staff or reflect combinations of these information sources. Key assumptions are described in **TABLE 6**. As more information becomes available on the current and expected future trajectory of industry sectors, subsequent updates will be made to this analysis. Given the uncertainty of these inputs, we did not generate high and low scenarios. As such, interpretation of these preliminary results should take into account these substantial caveats.

Sector-based assumptions compared to 2019 levels:

Attempts are made to reflect, to the extent possible, the three impacted periods shown below. Assumptions by period are converted to total assumptions for the percentage of 2019 output which is expcted in 2020 and separately in 2021. Quicker or slower rebounds in specific sectors, or deeper low-points, will impact employment; however, the extent to which this is reflected in final figures depends on the prevalence of that industry in the county as well as the dynamic linkages captured through the REMI model.

Shutdown Period			Resuming Period							Recovery Period											
Mar 2020	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Apr 2021	May 2021	Jun 2021	Jul 2021	Aug 2021	Sep 2021	Oct 2021	Nov 2021	Dec 2021

Preliminary Findings

The results of this analysis are shown in **TABLE 7** and **FIGURE 6**. Employment change is the number of jobs compared to the previous year. Unemployment rate is expressed as an annual average. For example, the 19.3% regional estimate for 2020 would reflect a pre-pandemic period during January and February where unemployment rates were near 4%, a peak around June 1st at the end of the "shutdown" period, and a lower-than-average rate by the end of the year. For historical context, the highest unemployment rate recorded by the BLS was 24.9% in 1933, three years into the Great Depression. The highest annual unemployment rate in recent memory in the SCAG region was 12.3% in 2010 following the Great Recession. Furthermore, similar to the recovery from the Great Recession, employment growth may first manifest itself in a combination of part-time and temporary positions.

9 See Rose, A. and Wei, D. 2019. Modeling the Impact of COVID-19. Sol Price School of Public Policy Center for Risk and Economic Analysis of Terrorism Events, University of Southern California. Webinar, 19 March.

TABLE 6 **Description of selected industry-specific output assumptions used in REMI model**

Durables Manufacturing	Assume a severe drop during the shutdown period (10%). Notably, much of American auto manufacturing is currently shuttered. Assume a return to 70% by the recovery period.
Nondurables Manufacturing	Assume a severe drop during the shutdown period (10%). Assume a more complete return to 90% during the recovery period compared to durables as demand remains stronger.
Retail & Wholesale	Informed by MARTA, assume 61% during shutdown period, rebounding to 70% during the recovery.
Tourism	National RevPAR data in early April indicate hotel activity at 16% of last year's levels, returning to 70% during the recovery.
Food & drink	Estimate 27% of capacity during shutdown, returning to 70% by recovery period.
Professional/ Business Services	Due to rapid adoption of telework, assume double the amount of BLS' "telework capable jobs," suggesting 80.1% capacity during shutdown. Return to 90% while resuming and 95% during recovery.
Real Estate & Construction	NAHB West Region HMI index decrease implies a 39% level during shutdown period. Due to low existing supply, rebound quickly to 90-100% during resuming and recovery periods.
Telecom & Data Businesses	Indications that broadband usage has increased to 133% (see www.fiercetelecom.com); tapering off but remaining above 100% through 2021 as some of the increased teleworking may be here to stay.
Oil, Gas & Petroleum	Based on OPEC's 4/9 announcement of cuts in May and June, assume announced cuts in May/June, assume 92% during shutdown, 87% during resuming, and 93.5% during recovery period.
Air & Water Transport	Passenger traffic at LAX reported to have decreased by 95% as of mid-April; assume lower demand through the recovery period (to 70%). Use Port of Los Angeles mid-April reported capacity (80%) for shutdown period, increasing to 85% to roughly mirror manufacturing expectations in subsequent periods.
Local Government	Increased expectations for service coupled with lower tax revenue suggests lengthy impacts. Using one example of the City of Santa Monica's 38% FY21 shortfall expectation (while being 1.4 times as reliant on sales/hotel taxes as the average SCAG city) suggests an assumption of 73% during shutdown and 82% through 2021.
Federal & State Government	No change assumed.

FIGURE 6 Preliminary Estimate of Annual Average Unemployment Rate

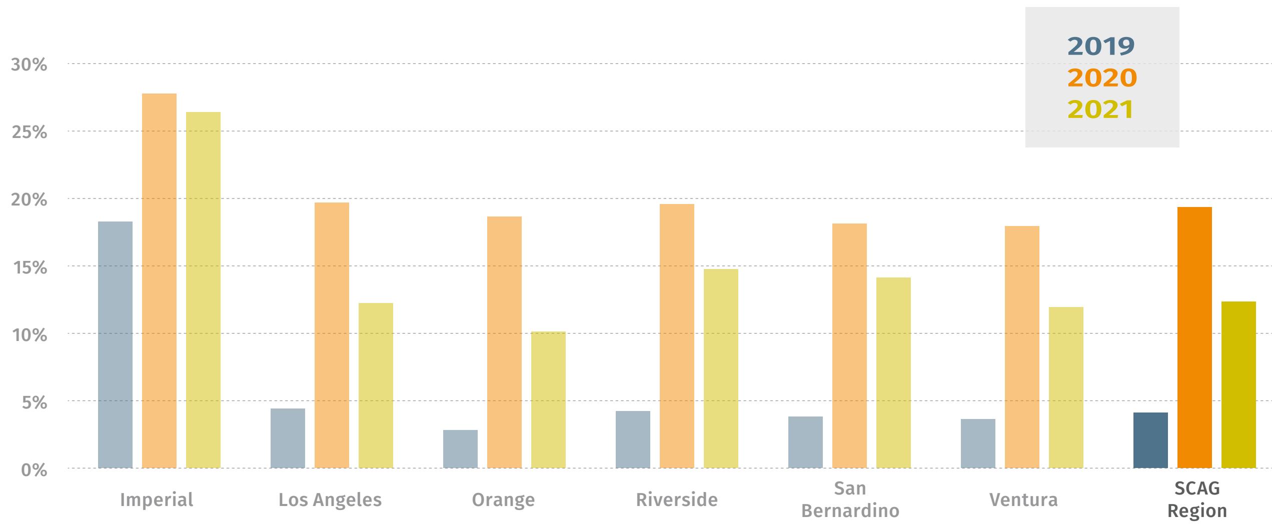


TABLE 7 Preliminary Assessment of Potential Impact of COVID-19 Output Shocks on Annual Employment, SCAG Region

	2019	2020		2021	
	Observed Unemployment Rate	Estimated Employment Change	Estimated Unemployment Rate	Estimated Employment Change	Estimated Unemployment Rate
Imperial County	18.2%	-8,800	27.6%	1,400	26.1%
Los Angeles County	4.4%	-760,900	19.5%	378,300	12.0%
Orange County	2.8%	-295,400	19.0%	158,100	10.3%
Riverside County	4.2%	-130,100	19.5%	41,000	14.7%
San Bernardino County	3.8%	-123,700	18.2%	34,300	14.2%
Ventura County	3.6%	-52,400	18.2%	20,700	12.4%
SCAG Region	4.1%	-1,371,300	19.3%	633,800	12.2%

NEXT STEPS

This preliminary analysis of taxable sales and employment impacts of the COVID-19 pandemic on the SCAG region is provided as a starting point to catalyze further discussions among regional stakeholders. As the situation unfolds and more information becomes available, SCAG will provide additional updates to these preliminary estimates. This will likely include:

- Reviewing forthcoming data that will provide a clearer picture of actual economic conditions during the shutdown period,
- Revising the timeline as necessary, including tracking a possible second wave of infections and reviewing industry sectors based on the extent to which they can increase activity following the shutdown period,
- Expanding from estimating the change in taxable sales to calculating the corresponding changes in tax revenues,
- Increased consideration of the differential impacts across counties, jurisdictions, or subpopulations including lower-resourced areas, and
- Monitoring the nature and extent of federal policy intervention, which is not explicitly included in these analyses.

This continual approach acknowledges that there is a high level of uncertainty in any estimates which could be developed at this time. However, initial estimates begin to suggest that the pandemic's economic impacts are likely to be severe and long-lasting. **Job losses are likely to be deeper than those experienced during the Great Recession, while the timeline described above would not suggest a quick return to normal tax revenues for local governments.**

APPENDIX A - SELECTED COVID-19 VULNERABILITY INDICATORS

The COVID-19 pandemic is having severe and unprecedented implications on a wide range of areas which SCAG plans for including public health, transportation, housing, public finance, and the economy more generally. This appendix provides several economic, social, health, and housing-related indicators of potential vulnerability at the jurisdictional level.

The purpose of these indicators is to provide context and insightful information for local jurisdictions and stakeholders to understand better the impacts of the pandemic in numbers. It is important to note that the variables can be updated and expanded based upon comments and new research available.

METHODOLOGY

A comprehensive list of vulnerability indicators is made up of more than 70 variables from various sources from the Census American Community Survey (ACS), California State Controller's Office, InfoUSA, and the California Tax Credit Allocation Committee/Department of Housing and Community Development (TCAC/HCD). This appendix provides a selection of 12 key economic, social, health, and housing vulnerability indicators:

Category	Indicator	Year	Source
Basic	**Total Population**	2014-2018	ACS
Basic	**Total Housing Units**	2014-2018	ACS
Basic	**Median Household Income ($2018)**	2014-2018	ACS
Basic	**Total Tax Revenues**	2018	State Controller
Basic	**Total Residence-Based Employees**	2014-2018	ACS
Basic	**Total Workplace-Based Employees**	2016	InfoUSA
Economic	**Residence-Based Employees in Highest Impacted Sectors (%)**	2014-2018	ACS
Economic	**Workplace-Based Employees in Highest Impacted Sectors (%)**	2016	InfoUSA
Economic	**Secured and Unsecured Property Taxes (%)**	2018	State Controller
Economic	**Sales and Use Taxes (%)**	2018	State Controller
Economic	**Transient Occupancy Taxes (%)**	2018	State Controller
Economic	**TCAC/HCD High Segregation & Poverty (%)**	2019	TCAC/HCD
Social & Health	**Senior Population (65+) (%)**	2014-2018	ACS
Social & Health	**Population below Poverty Level (%)**	2014-2018	ACS
Social & Health	**No Health Insurance Coverage (%)**	2014-2018	ACS
Social & Health	**Disability Status (%)**	2014-2018	ACS
Housing	**Severely Overcrowded Household (1.51 or More) (%)**	2013-2017	ACS
Housing	**Severely Cost-Burdened Household (50% or More) (%)**	2013-2017	ACS

It is important to understand the definition of each indicator as they are calculated differently. The table below provides a data description. Some of the indicators were calculated by combining multiple variables together such as the “Residence-Based Employees in Highest Impacted Sectors” and “Workplace-Based Employees in Highest Impacted Sectors.” Similarly, the percentage of severely overcrowded and cost-burdened households were a combination of renters and owners.

Indicator	Detailed Description
Total Population	Total population
Total Housing Units	Total housing units
Median Household Income ($2018)	Median household income
Total Tax Revenues	Total tax revenues generated
Total Residence-Based Employees	Total employed civilian population 16 years and over who live in a jurisdiction
Total Workplace-Based Employees	Total employees who work in a jurisdiction
Residence-Based Employees in Highest Impacted Sectors (%)	Percentage of employed civilian population living in a jurisdiction who work in these industry sectors experiencing especially high impacts from COVID-19: 1) Food Preparation and Serving Related, 2) Personal Care and Service, and 3) Sales and Related Occupations
Workplace-Based Employees in Highest Impacted Sectors (%)	Percentage of employees who work in a jurisdiction and are employed in these industry sectors experiencing especially high impacts from COVID-19: 1) Accommodation and Food Services, 2) Arts, Entertainment, and Recreation, and 3) Retail Trade
Secured and Unsecured Property Taxes (%)	Percentage of jurisdiction's total revenue from secured and unsecured property tax
Sales and Use Taxes (%)	Percentage of jurisdiction's total revenue from sales and use tax
Transient Occupancy Taxes (%)	Percentage of jurisdiction's total revenue from transient occupancy (hotel) tax
TCAC/HCD High Segregation & Poverty (%)	Percentage of jurisdiction’s land area within a high segregation and poverty Census Tract as defined by the California Tax Credit Allocation Committee (see https://www.treasurer.ca.gov/ctcac/opportunity.asp)
Senior Population (65+) (%)	Percentage of population 65 years of age and over
Population below Poverty Level (%)	Percentage of population below 1.0 times the poverty level with poverty status (ratio of income to poverty level)
No Health Insurance Coverage (%)	Percentage of noninstitutionalized population with no health insurance coverage
Disability Status (%)	Percentage of noninstitutionalized population 18 to 64 years of age with disability status
Severely Overcrowded Household (1.51 or More) (%)	Percentage of households with more than 1.51 occupants per room
Severely Cost-Burdened Household (50% or More) (%)	Percentage of households pay more than 50% of income on housing costs

County	City	Total Population	Total Housing Units	Median Household Income ($2018)	Total Tax Revenues	Total Residence-Based Employees	Total Workplace-Based Employees	Residence-Based Employees in Highest Impacted Sectors (%)	Workplace-Based Employees in Highest Impacted Sectors (%)	Secured and Unsecured Property Taxes (%)	Sales and Use Taxes (%)	Transient Occupancy Taxes (%)	TCAC/ HCD High Segregation & Poverty (%)	Senior Population (65+) (%)	Population below Poverty Level (%)	No Health Insurance Coverage (%)	Disability Status (%)	Severely Overcrowded Household (1.51 or More) (%)	Severely Cost-Burdened Household (50% or More) (%)
	SCAG Region Totals	18,809,261	6,510,436	$69,827	$23,550,851,678	8,820,114	7,369,909												
		Basic Indicators						Economic Indicators						Social & Health Inidcators				Housing Indicators	
Imperial	Brawley	26,009	8,472	$42,687	$10,859,128	8,226	7,226	16%	17%	16%	21%	3%	0%	12%	32%	7%	14%	7%	43%
Imperial	Calexico	39,934	11,155	$40,925	$14,477,657	13,967	10,119	21%	29%	12%	51%	2%	0%	14%	25%	12%	10%	6%	48%
Imperial	Calipatria	7,458	1,400	$35,842	$927,584	930	1,610	13%	0%	6%	0%	2%	0%	6%	15%	7%	9%	7%	44%
Imperial	El Centro	43,898	13,769	$46,457	$31,482,328	15,324	22,730	19%	28%	11%	56%	6%	14%	13%	24%	9%	14%	7%	31%
Imperial	Holtville	6,458	2,126	$44,301	$1,923,225	2,101	1,596	16%	5%	18%	25%	0%	0%	12%	28%	8%	9%	4%	42%
Imperial	Imperial	17,175	5,502	$85,876	$7,085,032	6,919	4,731	19%	11%	18%	47%	0%	0%	8%	6%	4%	5%	2%	20%
Imperial	Westmorland	2,643	783	$33,846	$751,022	789	168	24%	21%	9%	18%	8%	0%	10%	36%	11%	18%	4%	46%
Imperial	Unincorporated	36,641	14,261	$36,318	$50,694,881	11,663	14,894	18%	15%	32%	10%	0%	0%	13%	20%	11%	13%	4%	34%
Los Angeles	Agoura Hills	20,636	7,787	$121,896	$18,491,359	10,687	11,529	20%	20%	15%	21%	15%	0%	14%	5%	4%	7%	0%	44%
Los Angeles	Alhambra	84,974	31,394	$57,117	$51,948,185	41,917	31,501	22%	19%	21%	32%	1%	0%	17%	14%	8%	5%	7%	46%
Los Angeles	Arcadia	58,207	21,198	$92,102	$50,426,132	26,884	28,233	19%	31%	29%	21%	7%	0%	18%	9%	5%	3%	3%	44%
Los Angeles	Artesia	16,817	4,853	$63,708	$7,394,113	7,698	5,320	21%	29%	12%	30%	4%	0%	15%	10%	11%	7%	9%	45%
Los Angeles	Avalon	3,763	2,330	$69,440	$9,477,892	2,088	2,138	29%	48%	11%	9%	49%	0%	14%	16%	11%	3%	13%	52%
Los Angeles	Azusa	49,544	13,767	$60,227	$31,758,282	23,899	16,534	21%	15%	15%	19%	2%	4%	10%	13%	9%	7%	7%	47%
Los Angeles	Baldwin Park	76,222	18,803	$62,227	$29,842,593	35,829	21,041	21%	27%	14%	20%	3%	0%	12%	14%	13%	7%	13%	43%
Los Angeles	Bell	35,809	9,095	$42,548	$18,542,778	15,752	7,792	19%	17%	4%	14%	2%	14%	8%	24%	16%	6%	15%	48%
Los Angeles	Bell Gardens	42,641	9,877	$41,355	$25,791,442	18,063	8,563	19%	39%	4%	12%	3%	62%	7%	30%	19%	6%	14%	52%
Los Angeles	Bellflower	77,529	25,209	$55,729	$29,220,082	35,436	15,208	17%	22%	11%	20%	3%	2%	11%	14%	12%	7%	6%	45%
Los Angeles	Beverly Hills	34,362	17,744	$103,403	$211,905,933	16,639	62,380	21%	32%	30%	16%	23%	0%	22%	9%	5%	5%	2%	55%
Los Angeles	Bradbury	916	394	$154,000	$1,032,360	454	198	20%	3%	42%	0%	0%	0%	22%	9%	5%	3%	0%	34%
Los Angeles	Burbank	104,275	43,595	$73,277	$131,019,749	53,850	96,873	18%	29%	25%	25%	9%	0%	15%	11%	7%	7%	3%	44%
Los Angeles	Calabasas	24,077	9,208	$119,926	$27,475,186	11,871	17,379	17%	33%	26%	19%	7%	0%	17%	7%	4%	5%	1%	56%
Los Angeles	Carson	92,517	26,113	$78,580	$66,772,081	43,920	54,782	16%	24%	11%	37%	3%	6%	16%	10%	8%	8%	9%	38%
Los Angeles	Cerritos	50,172	16,231	$99,528	$52,057,738	22,135	34,006	15%	36%	7%	65%	2%	0%	23%	5%	5%	5%	7%	38%
Los Angeles	Claremont	36,025	12,568	$97,363	$24,189,881	17,208	16,416	16%	16%	23%	19%	6%	0%	19%	7%	5%	6%	2%	39%
Los Angeles	Commerce	12,933	3,684	$47,083	$68,207,739	5,575	45,835	17%	29%	3%	42%	5%	0%	14%	16%	14%	10%	9%	39%
Los Angeles	Compton	97,301	24,939	$50,507	$73,854,851	39,367	24,528	16%	17%	5%	14%	0%	18%	9%	22%	13%	10%	15%	58%

	SCAG Region Totals	**18,809,261**	**6,510,436**	**$69,827**	**$23,550,851,678**	**8,820,114**	**7,369,909**												
		Basic Indicators						**Economic Indicators**						**Social & Health Indicators**				**Housing Indicators**	
County	**City**	**Total Population**	**Total Housing Units**	**Median Household Income ($2018)**	**Total Tax Revenues**	**Total Residence-Based Employees**	**Total Workplace-Based Employees**	**Residence-Based Employees in Highest Impacted Sectors (%)**	**Workplace-Based Employees in Highest Impacted Sectors (%)**	**Secured and Unsecured Property Taxes (%)**	**Sales and Use Taxes (%)**	**Transient Occupancy Taxes (%)**	**TCAC/ HCD High Segregation & Poverty (%)**	**Senior Population (65+) (%)**	**Population below Poverty Level (%)**	**No Health Insurance Coverage (%)**	**Disability Status (%)**	**Severely Overcrowded Household (1.51 or More) (%)**	**Severely Cost-Burdened Household (50% or More) (%)**
Los Angeles	Covina	48,403	15,897	$69,449	$32,226,807	23,670	23,001	21%	21%	20%	28%	1%	0%	14%	9%	7%	8%	4%	34%
Los Angeles	Cudahy	24,016	5,775	$43,381	$7,740,862	10,146	2,741	18%	17%	2%	19%	1%	61%	7%	28%	19%	7%	11%	51%
Los Angeles	Culver City	39,295	17,371	$90,183	$91,895,403	21,906	49,537	19%	21%	6%	23%	9%	0%	16%	7%	5%	5%	5%	38%
Los Angeles	Diamond Bar	56,434	18,232	$96,628	$21,943,614	27,198	14,412	18%	15%	23%	23%	5%	0%	16%	6%	6%	5%	4%	41%
Los Angeles	Downey	112,901	34,473	$71,948	$76,207,980	55,135	42,623	20%	19%	19%	36%	2%	0%	11%	10%	11%	6%	7%	38%
Los Angeles	Duarte	21,713	7,326	$73,429	$11,647,201	10,450	9,765	19%	24%	14%	45%	1%	0%	19%	11%	10%	8%	6%	43%
Los Angeles	El Monte	115,669	31,157	$47,121	$73,393,625	51,496	25,692	22%	19%	9%	30%	1%	11%	13%	21%	17%	7%	12%	52%
Los Angeles	El Segundo	16,850	6,975	$98,813	$65,155,349	8,993	41,585	15%	18%	12%	16%	21%	0%	12%	8%	4%	6%	3%	29%
Los Angeles	Gardena	59,924	21,441	$55,351	$46,768,214	28,562	25,244	22%	21%	15%	25%	3%	0%	16%	15%	11%	8%	8%	47%
Los Angeles	Glendale	200,372	77,781	$62,531	$176,910,053	96,763	97,645	19%	19%	19%	33%	4%	0%	17%	15%	8%	8%	4%	56%
Los Angeles	Glendora	51,773	17,687	$92,674	$27,896,002	24,507	19,083	19%	21%	23%	32%	1%	0%	16%	9%	5%	8%	2%	35%
Los Angeles	Hawaiian Gardens	14,411	4,016	$44,792	$4,338,350	6,068	6,895	27%	51%	0%	20%	4%	60%	10%	23%	14%	8%	16%	66%
Los Angeles	Hawthorne	87,370	30,656	$50,948	$63,063,818	43,685	22,930	22%	22%	9%	29%	9%	3%	9%	15%	14%	8%	13%	49%
Los Angeles	Hermosa Beach	19,650	10,049	$137,188	$28,862,884	12,290	8,053	21%	26%	50%	12%	11%	0%	12%	5%	3%	4%	2%	30%
Los Angeles	Hidden Hills	1,634	580	$216,786	$3,468,109	608	296	16%	3%	26%	1%	0%	0%	19%	3%	1%	5%	0%	30%
Los Angeles	Huntington Park	58,694	14,976	$40,638	$27,766,022	25,913	14,955	18%	25%	3%	24%	0%	33%	8%	26%	20%	6%	27%	51%
Los Angeles	Industry	344	91	$85,417	$107,482,198	145	69,356	18%	26%	2%	34%	1%	0%	8%	6%	7%	4%	3%	9%
Los Angeles	Inglewood	110,327	38,354	$50,335	$121,823,560	52,716	30,030	21%	21%	7%	16%	5%	6%	12%	18%	14%	11%	8%	49%
Los Angeles	Irwindale	1,405	415	$59,375	$20,620,986	618	13,919	22%	12%	2%	21%	0%	0%	14%	9%	5%	9%	0%	30%
Los Angeles	La Canada Flintridge	20,374	7,016	$161,517	$13,195,841	9,325	6,575	13%	19%	40%	20%	0%	0%	18%	3%	2%	4%	2%	41%
Los Angeles	La Habra Heights	5,383	2,079	$111,551	$2,625,737	2,552	520	14%	10%	55%	1%	0%	0%	28%	3%	5%	4%	1%	31%
Los Angeles	La Mirada	48,974	14,692	$87,778	$34,421,629	22,633	15,531	18%	19%	20%	52%	4%	0%	17%	6%	6%	6%	20%	37%
Los Angeles	La Puente	40,268	9,654	$61,054	$12,790,104	18,616	5,901	20%	30%	11%	25%	2%	0%	11%	17%	14%	7%	14%	44%
Los Angeles	La Verne	32,358	11,785	$85,769	$21,901,628	14,951	14,421	20%	18%	23%	22%	0%	0%	18%	8%	5%	10%	2%	37%
Los Angeles	Lakewood	80,771	27,177	$89,469	$36,541,737	40,654	18,208	20%	38%	14%	39%	0%	0%	13%	6%	6%	6%	4%	37%
Los Angeles	Lancaster	159,662	52,516	$52,504	$75,939,103	56,103	48,116	18%	19%	5%	28%	3%	12%	10%	23%	7%	9%	3%	37%
Los Angeles	Lawndale	33,007	10,372	$58,447	$13,350,453	16,981	6,332	27%	22%	8%	21%	5%	0%	9%	14%	15%	8%	12%	43%

	SCAG Region Totals	18,809,261	6,510,436	$69,827	$23,550,851,678	8,820,114	7,369,909												
		Basic Indicators						Economic Indicators						Social & Health Inidcators				Housing Indicators	
County	City	Total Population	Total Housing Units	Median Household Income ($2018)	Total Tax Revenues	Total Residence-Based Employees	Total Workplace-Based Employees	Residence-Based Employees in Highest Impacted Sectors (%)	Workplace-Based Employees in Highest Impacted Sectors (%)	Secured and Unsecured Property Taxes (%)	Sales and Use Taxes (%)	Transient Occupancy Taxes (%)	TCAC/ HCD High Segregation & Poverty (%)	Senior Population (65+) (%)	Population below Poverty Level (%)	No Health Insurance Coverage (%)	Disability Status (%)	Severely Overcrowded Household (1.51 or More) (%)	Severely Cost-Burdened Household (50% or More) (%)
Los Angeles	Lomita	20,628	8,431	$69,827	$7,230,108	10,746	4,967	19%	24%	24%	24%	2%	0%	16%	12%	10%	9%	4%	34%
Los Angeles	Long Beach	468,883	175,235	$60,551	$464,544,000	227,972	165,172	20%	19%	19%	15%	7%	9%	11%	18%	10%	8%	10%	42%
Los Angeles	Los Angeles	3,959,657	1,474,043	$58,385	$4,834,137,829	1,988,936	1,576,946	20%	20%	27%	11%	7%	11%	12%	19%	13%	7%	11%	51%
Los Angeles	Lynwood	71,022	15,871	$49,684	$32,933,038	29,424	11,081	19%	18%	8%	38%	0%	18%	7%	20%	17%	7%	17%	52%
Los Angeles	Malibu	12,846	7,771	$147,934	$26,124,000	6,393	8,035	18%	26%	41%	14%	18%	0%	24%	8%	6%	8%	2%	47%
Los Angeles	Manhattan Beach	35,573	15,363	$150,083	$51,536,668	16,560	18,594	16%	39%	49%	17%	9%	0%	17%	3%	2%	3%	1%	28%
Los Angeles	Maywood	27,542	6,874	$39,738	$9,387,373	12,362	3,301	17%	22%	3%	16%	1%	50%	7%	26%	18%	5%	23%	50%
Los Angeles	Monrovia	37,006	13,788	$73,170	$37,708,803	19,451	18,967	19%	23%	21%	28%	5%	0%	13%	8%	8%	6%	3%	36%
Los Angeles	Montebello	63,099	20,444	$53,677	$47,001,507	28,934	25,785	21%	23%	8%	28%	1%	0%	15%	13%	14%	9%	6%	47%
Los Angeles	Monterey Park	60,792	21,304	$57,265	$41,487,903	27,499	40,251	24%	9%	23%	13%	3%	0%	21%	14%	8%	5%	7%	53%
Los Angeles	Norwalk	105,886	28,475	$66,453	$44,819,840	48,617	22,549	20%	20%	16%	25%	4%	9%	12%	13%	11%	8%	16%	43%
Los Angeles	Palmdale	156,904	47,320	$60,428	$83,610,620	62,499	31,961	20%	36%	7%	34%	5%	7%	9%	17%	9%	11%	3%	48%
Los Angeles	Palos Verdes Estates	13,523	5,442	$175,000	$11,492,242	5,525	2,476	24%	9%	70%	3%	0%	0%	26%	5%	2%	4%	0%	44%
Los Angeles	Paramount	54,776	15,041	$53,031	$25,785,263	24,511	18,241	21%	15%	7%	30%	0%	0%	8%	19%	13%	7%	11%	49%
Los Angeles	Pasadena	141,246	60,396	$78,941	$189,718,545	73,119	99,016	17%	19%	26%	18%	8%	5%	16%	15%	8%	7%	4%	42%
Los Angeles	Pico Rivera	63,432	17,244	$65,666	$40,018,750	29,038	21,700	19%	23%	7%	22%	1%	0%	14%	10%	11%	7%	10%	39%
Los Angeles	Pomona	152,494	40,772	$55,115	$86,571,769	67,758	47,278	20%	13%	19%	20%	3%	14%	10%	20%	13%	8%	12%	49%
Los Angeles	Rancho Palos Verdes	42,271	16,777	$133,286	$30,232,750	18,376	7,238	16%	33%	27%	8%	19%	0%	26%	4%	3%	4%	3%	42%
Los Angeles	Redondo Beach	67,700	29,979	$112,271	$66,979,594	37,496	21,875	17%	32%	39%	15%	14%	0%	13%	5%	4%	6%	1%	35%
Los Angeles	Rolling Hills	1,630	712	$239,375	$1,469,245	547	189	16%	5%	74%	0%	0%	0%	32%	2%	3%	6%	0%	41%
Los Angeles	Rolling Hills Estates	8,187	3,134	$143,873	$5,716,573	3,381	6,509	18%	22%	38%	23%	0%	0%	26%	4%	5%	6%	0%	36%
Los Angeles	Rosemead	54,417	15,532	$52,057	$20,113,517	24,637	14,878	25%	24%	14%	29%	12%	12%	16%	16%	8%	5%	10%	48%
Los Angeles	San Dimas	34,239	12,184	$84,749	$21,625,750	16,535	19,962	18%	18%	19%	29%	8%	0%	19%	8%	4%	9%	3%	42%
Los Angeles	San Fernando	24,585	6,893	$53,353	$21,477,996	11,301	9,940	16%	19%	7%	38%	0%	0%	10%	15%	13%	8%	12%	52%
Los Angeles	San Gabriel	40,242	13,234	$57,863	$30,187,769	19,735	12,890	24%	23%	17%	14%	7%	0%	16%	12%	9%	4%	4%	47%
Los Angeles	San Marino	13,285	5,051	$159,509	$20,352,711	5,474	3,560	14%	19%	72%	2%	0%	0%	22%	9%	3%	4%	1%	45%
Los Angeles	Santa Clarita	209,478	69,272	$94,282	$119,677,719	104,338	78,301	19%	24%	20%	31%	3%	0%	11%	8%	7%	8%	5%	39%

	SCAG Region Totals	18,809,261	6,510,436	$69,827	$23,550,851,678	8,820,114	7,369,909												
		Basic Indicators						Economic Indicators						Social & Health Indicators				Housing Indicators	
County	City	Total Population	Total Housing Units	Median Household Income ($2018)	Total Tax Revenues	Total Residence-Based Employees	Total Workplace-Based Employees	Residence-Based Employees in Highest Impacted Sectors (%)	Workplace-Based Employees in Highest Impacted Sectors (%)	Secured and Unsecured Property Taxes (%)	Sales and Use Taxes (%)	Transient Occupancy Taxes (%)	TCAC/ HCD High Segregation & Poverty (%)	Senior Population (65+) (%)	Population below Poverty Level (%)	No Health Insurance Coverage (%)	Disability Status (%)	Severely Overcrowded Household (1.51 or More) (%)	Severely Cost-Burdened Household (50% or More) (%)
Los Angeles	Santa Fe Springs	17,791	5,383	$65,518	$44,048,585	7,963	48,977	18%	13%	6%	59%	0%	0%	14%	13%	8%	7%	14%	48%
Los Angeles	Santa Monica	92,078	50,901	$93,865	$280,646,701	52,410	90,224	17%	25%	11%	25%	22%	0%	17%	10%	5%	6%	2%	44%
Los Angeles	Sierra Madre	11,006	5,075	$96,630	$9,737,063	5,380	2,313	15%	17%	45%	3%	0%	0%	22%	6%	4%	5%	2%	32%
Los Angeles	Signal Hill	11,538	4,759	$75,684	$19,381,615	6,113	14,222	16%	23%	3%	78%	1%	0%	11%	13%	11%	7%	7%	35%
Los Angeles	South El Monte	20,727	5,306	$48,944	$12,096,825	8,967	14,393	17%	14%	7%	47%	2%	33%	12%	17%	16%	7%	8%	47%
Los Angeles	South Gate	95,103	24,385	$50,246	$40,104,868	42,468	19,303	19%	27%	7%	53%	1%	1%	9%	19%	17%	7%	16%	48%
Los Angeles	South Pasadena	25,824	10,893	$96,579	$22,881,513	13,612	9,258	16%	14%	47%	12%	0%	0%	14%	9%	5%	4%	2%	35%
Los Angeles	Temple City	36,137	12,049	$70,984	$11,804,163	16,360	6,099	22%	20%	36%	17%	1%	0%	18%	11%	6%	6%	7%	43%
Los Angeles	Torrance	146,392	58,283	$90,309	$169,018,348	72,573	108,209	18%	20%	20%	28%	7%	0%	17%	7%	5%	6%	4%	36%
Los Angeles	Vernon	90	38	$70,000	$37,319,606	48	33,522	4%	12%	7%	20%	0%	0%	7%	2%	7%	10%	4%	4%
Los Angeles	Walnut	30,008	9,567	$104,096	$11,193,120	14,158	7,625	18%	18%	19%	18%	0%	0%	19%	7%	5%	3%	3%	39%
Los Angeles	West Covina	107,242	31,946	$79,140	$56,343,252	51,697	27,256	21%	31%	24%	29%	3%	0%	15%	9%	8%	7%	5%	45%
Los Angeles	West Hollywood	36,384	25,781	$69,249	$74,330,244	25,919	27,632	21%	37%	22%	23%	33%	0%	15%	13%	7%	6%	1%	53%
Los Angeles	Westlake Village	8,424	3,518	$141,979	$12,548,959	3,772	14,287	14%	19%	18%	34%	31%	0%	26%	5%	3%	6%	0%	44%
Los Angeles	Whittier	86,523	28,628	$73,517	$43,109,330	41,438	29,986	17%	18%	13%	24%	2%	0%	14%	11%	8%	6%	8%	41%
Los Angeles	Unincorporated	1,050,740	313,895	$67,578	$6,359,450,812	473,660	227,540	19%	25%	54%	1%	0%	1%	13%	14%	11%	7%	10%	46%
Orange	Aliso Viejo	50,925	19,783	$108,558	$18,681,521	28,899	20,572	22%	16%	14%	35%	9%	0%	8%	4%	4%	5%	1%	35%
Orange	Anaheim	349,668	105,286	$69,443	$330,526,199	173,887	182,289	21%	34%	13%	25%	47%	3%	11%	15%	13%	6%	9%	44%
Orange	Brea	42,330	15,558	$93,703	$44,566,862	21,777	45,090	19%	24%	15%	43%	4%	0%	14%	6%	4%	5%	5%	34%
Orange	Buena Park	82,781	24,313	$72,814	$54,755,059	40,959	34,894	22%	35%	12%	38%	12%	9%	12%	13%	10%	6%	7%	44%
Orange	Costa Mesa	113,198	43,100	$79,207	$112,838,244	63,740	80,680	24%	30%	24%	48%	8%	3%	11%	13%	13%	6%	5%	43%
Orange	Cypress	48,955	16,328	$92,098	$34,086,309	24,242	21,755	18%	23%	27%	33%	8%	0%	15%	6%	6%	6%	2%	30%
Orange	Dana Point	33,913	17,317	$97,519	$35,271,763	17,652	12,565	22%	44%	24%	15%	39%	0%	22%	7%	7%	5%	2%	50%
Orange	Fountain Valley	56,372	19,019	$85,423	$48,088,953	27,125	30,096	21%	20%	26%	25%	3%	0%	19%	9%	6%	8%	3%	42%
Orange	Fullerton	139,866	48,095	$73,360	$74,623,124	68,479	63,548	21%	18%	38%	28%	4%	2%	13%	13%	8%	7%	7%	42%
Orange	Garden Grove	174,010	49,261	$65,591	$102,517,554	84,809	49,383	23%	23%	14%	20%	25%	0%	13%	15%	9%	7%	9%	47%
Orange	Huntington Beach	200,606	81,396	$91,318	$144,484,650	105,878	69,202	22%	29%	34%	21%	6%	4%	17%	9%	6%	6%	3%	39%

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County	City	Total Population	Total Housing Units	Median Household Income ($2018)	Total Tax Revenues	Total Residence-Based Employees	Total Workplace-Based Employees	Residence-Based Employees in Highest Impacted Sectors (%)	Workplace-Based Employees in Highest Impacted Sectors (%)	Secured and Unsecured Property Taxes (%)	Sales and Use Taxes (%)	Transient Occupancy Taxes (%)	TCAC/ HCD High Segregation & Poverty (%)	Senior Population (65+) (%)	Population below Poverty Level (%)	No Health Insurance Coverage (%)	Disability Status (%)	Severely Overcrowded Household (1.51 or More) (%)	Severely Cost-Burdened Household (50% or More) (%)
Orange	Irvine	265,502	101,434	$100,969	$212,719,735	128,029	256,701	16%	14%	20%	30%	7%	0%	10%	13%	5%	3%	3%	38%
Orange	La Habra	61,910	19,421	$76,452	$36,128,592	30,397	17,166	19%	28%	27%	43%	0%	0%	12%	11%	10%	7%	8%	40%
Orange	La Palma	15,733	5,062	$98,788	$10,566,409	7,584	5,692	19%	16%	20%	42%	4%	0%	18%	5%	6%	5%	1%	34%
Orange	Laguna Beach	23,147	13,487	$121,474	$58,884,445	11,778	14,967	22%	40%	54%	10%	25%	0%	23%	7%	4%	5%	0%	41%
Orange	Laguna Hills	31,185	10,980	$98,168	$19,562,797	16,348	21,882	24%	21%	36%	29%	7%	0%	16%	9%	6%	5%	6%	44%
Orange	Laguna Niguel	65,652	27,140	$103,910	$37,462,300	34,094	18,854	22%	27%	40%	30%	0%	0%	17%	8%	4%	5%	1%	44%
Orange	Laguna Woods	16,228	12,500	$41,928	$5,621,183	3,109	7,220	24%	9%	4%	16%	9%	0%	83%	12%	1%	14%	0%	68%
Orange	Lake Forest	82,911	29,995	$104,449	$55,197,369	45,762	36,053	22%	22%	17%	29%	7%	0%	13%	7%	7%	5%	5%	37%
Orange	Los Alamitos	11,628	4,326	$84,068	$10,526,370	5,690	12,986	27%	14%	20%	32%	2%	0%	16%	9%	7%	6%	2%	34%
Orange	Mission Viejo	96,124	34,664	$114,688	$56,487,868	50,071	37,439	21%	25%	41%	30%	2%	0%	19%	5%	5%	6%	2%	37%
Orange	Newport Beach	86,280	44,801	$122,709	$174,374,347	43,892	84,253	25%	24%	50%	20%	13%	0%	23%	7%	3%	5%	1%	45%
Orange	Orange	139,873	44,575	$86,027	$97,514,082	69,521	103,058	19%	17%	23%	42%	6%	0%	12%	12%	8%	6%	6%	39%
Orange	Placentia	52,049	17,063	$89,690	$28,161,206	26,456	16,246	22%	17%	29%	25%	3%	5%	14%	9%	7%	5%	7%	33%
Orange	Rancho Santa Margarita	48,792	17,628	$115,073	$16,275,984	26,978	14,620	22%	25%	15%	41%	0%	0%	8%	4%	4%	5%	2%	38%
Orange	San Clemente	65,045	27,868	$105,812	$50,976,522	32,264	24,433	25%	28%	48%	18%	6%	0%	17%	6%	5%	4%	6%	45%
Orange	San Juan Capistrano	35,952	13,116	$87,353	$25,610,526	16,343	14,511	27%	23%	25%	32%	4%	0%	19%	10%	10%	7%	7%	60%
Orange	Santa Ana	333,499	78,597	$61,774	$191,341,579	161,159	149,606	21%	15%	19%	24%	5%	8%	9%	17%	18%	6%	26%	45%
Orange	Seal Beach	24,364	13,774	$67,917	$23,723,189	10,005	11,387	20%	28%	34%	17%	7%	0%	39%	6%	3%	6%	3%	28%
Orange	Stanton	38,509	11,259	$56,506	$19,029,225	18,064	6,631	24%	25%	13%	44%	3%	14%	11%	19%	12%	8%	11%	50%
Orange	Tustin	80,140	27,489	$79,339	$55,832,418	42,448	41,769	20%	26%	17%	44%	3%	1%	10%	12%	9%	7%	7%	38%
Orange	Villa Park	5,912	2,107	$145,250	$3,201,056	2,416	1,534	21%	12%	59%	8%	0%	0%	28%	6%	3%	7%	8%	21%
Orange	Westminster	91,417	28,313	$61,834	$54,200,031	42,980	25,865	24%	36%	4%	30%	2%	4%	18%	16%	8%	8%	8%	51%
Orange	Yorba Linda	67,815	23,016	$129,391	$35,609,065	33,118	16,978	19%	22%	44%	21%	1%	0%	17%	4%	3%	5%	1%	39%
Orange	Unincorporated_OR	131,891	43,305	$124,250	$778,988,974	62,126	17,425	21%	18%	35%	1%	0%	0%	14%	7%	4%	5%	4%	42%
Riverside	Banning	30,942	11,815	$41,038	$10,978,780	9,761	6,518	23%	35%	23%	30%	8%	9%	26%	22%	8%	13%	6%	43%
Riverside	Beaumont	45,403	14,394	$78,111	$17,306,312	19,385	8,160	20%	29%	25%	28%	2%	0%	14%	10%	6%	9%	2%	39%
Riverside	Blythe	19,581	6,314	$43,141	$6,450,479	5,226	4,314	15%	29%	13%	27%	18%	9%	10%	19%	9%	15%	4%	33%

		Basic Indicators						Economic Indicators						Social & Health Indicators				Housing Indicators	
County	City	Total Population	Total Housing Units	Median Household Income ($2018)	Total Tax Revenues	Total Residence-Based Employees	Total Workplace-Based Employees	Residence-Based Employees in Highest Impacted Sectors (%)	Workplace-Based Employees in Highest Impacted Sectors (%)	Secured and Unsecured Property Taxes (%)	Sales and Use Taxes (%)	Transient Occupancy Taxes (%)	TCAC/ HCD High Segregation & Poverty (%)	Senior Population (65+) (%)	Population below Poverty Level (%)	No Health Insurance Coverage (%)	Disability Status (%)	Severely Overcrowded Household (1.51 or More) (%)	Severely Cost-Burdened Household (50% or More) (%)
	SCAG Region Totals	18,809,261	6,510,436	$69,827	$23,550,851,678	8,820,114	7,369,909												
Riverside	Calimesa	8,651	3,724	$53,366	$4,623,157	3,248	1,473	14%	30%	52%	19%	1%	0%	27%	11%	6%	11%	0%	43%
Riverside	Canyon Lake	11,106	4,489	$97,237	$4,728,093	5,055	1,316	23%	15%	36%	6%	1%	0%	17%	5%	3%	9%	0%	43%
Riverside	Cathedral City	54,037	22,679	$46,370	$45,733,061	23,026	10,906	30%	41%	2%	33%	8%	4%	16%	21%	16%	9%	8%	50%
Riverside	Coachella	44,849	15,405	$33,870	$17,512,893	21,210	7,600	27%	19%	4%	43%	1%	41%	7%	23%	17%	6%	4%	66%
Riverside	Corona	165,355	51,504	$79,081	$96,252,439	80,196	69,936	20%	22%	28%	37%	3%	2%	10%	10%	10%	6%	4%	48%
Riverside	Desert Hot Springs	28,430	12,110	$34,814	$13,092,287	10,313	3,179	25%	28%	6%	13%	17%	13%	12%	33%	15%	14%	7%	55%
Riverside	Eastvale	61,337	15,310	$114,230	$25,260,349	28,774	6,414	19%	34%	34%	36%	0%	0%	8%	6%	5%	8%	1%	39%
Riverside	Hemet	84,069	33,113	$39,179	$44,587,789	26,973	20,088	22%	27%	12%	51%	2%	1%	22%	21%	9%	17%	4%	51%
Riverside	Indian Wells	5,317	5,694	$104,522	$20,135,476	1,697	4,438	24%	65%	13%	6%	39%	0%	59%	7%	2%	4%	2%	46%
Riverside	Indio	88,291	37,734	$50,824	$60,326,978	37,151	23,428	26%	30%	11%	20%	11%	8%	18%	17%	11%	8%	5%	47%
Riverside	Jurupa Valley	103,784	26,083	$67,002	$30,675,375	44,554	24,370	16%	16%	16%	37%	1%	12%	10%	15%	14%	10%	11%	45%
Riverside	La Quinta	40,704	25,143	$79,889	$46,539,689	17,180	14,385	25%	53%	15%	41%	23%	13%	25%	11%	9%	9%	2%	35%
Riverside	Lake Elsinore	64,037	18,059	$67,668	$26,495,483	26,981	12,760	22%	35%	10%	37%	2%	0%	7%	16%	9%	8%	5%	44%
Riverside	Menifee	88,515	30,533	$65,757	$42,542,507	35,589	11,759	21%	27%	29%	42%	1%	0%	18%	10%	7%	11%	3%	43%
Riverside	Moreno Valley	205,034	53,885	$63,572	$96,422,328	87,817	32,846	18%	29%	18%	24%	2%	4%	8%	16%	12%	9%	5%	43%
Riverside	Murrieta	111,427	33,890	$84,817	$55,126,076	47,936	28,329	25%	26%	35%	32%	2%	0%	12%	8%	7%	8%	3%	38%
Riverside	Norco	26,569	7,438	$95,441	$14,710,502	11,220	12,890	19%	19%	9%	47%	4%	0%	13%	7%	7%	9%	2%	38%
Riverside	Palm Desert	52,124	39,800	$57,578	$56,284,025	21,933	37,606	29%	38%	10%	33%	33%	0%	34%	13%	7%	11%	4%	44%
Riverside	Palm Springs	47,525	37,434	$50,361	$111,447,309	19,536	28,020	27%	39%	21%	12%	31%	0%	31%	17%	9%	12%	3%	46%
Riverside	Perris	76,276	17,661	$59,141	$73,848,994	31,253	14,231	15%	28%	7%	28%	0%	16%	6%	20%	13%	7%	7%	48%
Riverside	Rancho Mirage	18,075	15,555	$71,227	$25,636,586	5,879	14,834	21%	41%	12%	25%	40%	0%	53%	12%	5%	9%	0%	57%
Riverside	Riverside	323,935	96,797	$65,313	$237,739,102	149,034	131,208	21%	20%	9%	50%	3%	10%	10%	15%	11%	9%	5%	40%
Riverside	San Jacinto	47,474	14,225	$50,483	$11,883,776	17,894	5,915	18%	21%	15%	24%	0%	5%	11%	18%	12%	14%	5%	41%
Riverside	Temecula	112,230	35,936	$90,964	$102,770,431	51,576	49,110	24%	30%	7%	47%	3%	0%	10%	7%	7%	8%	1%	37%
Riverside	Wildomar	36,162	10,583	$73,282	$9,578,296	16,073	5,664	21%	13%	40%	19%	0%	0%	13%	11%	9%	11%	3%	42%
Riverside	Unincorporated	382,047	136,295	$66,136	$780,595,925	151,325	63,462	19%	33%	31%	4%	0%	4%	15%	16%	10%	10%	5%	43%
San Bernardino	Adelanto	33,416	8,626	$40,018	$8,842,082	9,898	4,786	18%	15%	4%	20%	0%	96%	6%	32%	11%	12%	7%	64%

	SCAG Region Totals	**18,809,261**	**6,510,436**	**$69,827**	**$23,550,851,678**	**8,820,114**	**7,369,909**												
		Basic Indicators						**Economic Indicators**						**Social & Health Indicators**				**Housing Indicators**	
County	**City**	**Total Population**	**Total Housing Units**	**Median Household Income ($2018)**	**Total Tax Revenues**	**Total Residence-Based Employees**	**Total Workplace-Based Employees**	**Residence-Based Employees in Highest Impacted Sectors (%)**	**Workplace-Based Employees in Highest Impacted Sectors (%)**	**Secured and Unsecured Property Taxes (%)**	**Sales and Use Taxes (%)**	**Transient Occupancy Taxes (%)**	**TCAC/ HCD High Segregation & Poverty (%)**	**Senior Population (65+) (%)**	**Population below Poverty Level (%)**	**No Health Insurance Coverage (%)**	**Disability Status (%)**	**Severely Overcrowded Household (1.51 or More) (%)**	**Severely Cost-Burdened Household (50% or More) (%)**
San Bernardino	Apple Valley	72,359	26,119	$53,023	$28,755,697	26,030	14,377	19%	26%	16%	23%	0%	5%	17%	18%	5%	15%	1%	42%
San Bernardino	Barstow	23,812	9,390	$39,585	$25,043,006	8,101	9,400	27%	36%	22%	30%	13%	13%	11%	36%	8%	18%	3%	37%
San Bernardino	Big Bear Lake	5,229	9,778	$51,014	$18,780,564	2,206	3,827	27%	45%	38%	12%	28%	0%	22%	17%	13%	12%	4%	43%
San Bernardino	Chino	87,735	21,895	$79,477	$57,199,194	34,867	40,430	19%	22%	16%	45%	1%	0%	11%	9%	9%	6%	2%	41%
San Bernardino	Chino Hills	79,298	25,588	$104,590	$30,044,563	38,704	12,932	19%	32%	15%	27%	4%	0%	11%	7%	5%	5%	3%	32%
San Bernardino	Colton	54,415	18,864	$50,063	$24,360,431	22,813	15,509	18%	25%	15%	38%	4%	19%	10%	16%	10%	9%	5%	40%
San Bernardino	Fontana	208,943	55,561	$70,789	$108,743,388	96,001	44,973	18%	25%	14%	34%	1%	2%	7%	14%	11%	6%	8%	43%
San Bernardino	Grand Terrace	12,482	4,635	$66,912	$4,332,487	6,051	2,782	11%	12%	13%	17%	0%	11%	15%	9%	5%	11%	3%	37%
San Bernardino	Hesperia	93,609	27,951	$53,402	$35,984,078	34,284	18,401	21%	26%	13%	26%	4%	2%	10%	21%	8%	9%	4%	41%
San Bernardino	Highland	54,859	16,891	$59,395	$22,092,410	22,953	5,557	19%	26%	28%	12%	1%	11%	9%	20%	10%	9%	6%	46%
San Bernardino	Loma Linda	24,078	9,421	$53,371	$13,410,471	10,368	20,110	15%	5%	9%	57%	3%	13%	18%	17%	6%	9%	1%	37%
San Bernardino	Montclair	38,865	10,693	$58,012	$27,631,882	17,689	14,881	22%	38%	11%	56%	0%	19%	10%	17%	13%	7%	8%	40%
San Bernardino	Needles	4,962	2,930	$31,843	$3,515,111	1,643	1,654	25%	25%	39%	16%	25%	0%	19%	28%	11%	26%	2%	30%
San Bernardino	Ontario	173,580	52,063	$61,602	$223,880,702	83,270	90,676	18%	26%	13%	38%	7%	12%	9%	15%	12%	7%	7%	44%
San Bernardino	Rancho Cucamonga	175,679	58,649	$86,355	$127,548,784	85,379	69,755	18%	23%	25%	25%	3%	0%	11%	8%	6%	7%	2%	38%
San Bernardino	Redlands	71,012	26,327	$72,523	$55,102,155	31,427	34,188	17%	19%	35%	29%	2%	4%	15%	13%	6%	8%	3%	36%
San Bernardino	Rialto	102,873	27,100	$58,061	$63,338,151	43,786	20,747	19%	17%	9%	27%	0%	8%	9%	18%	12%	8%	7%	44%
San Bernardino	San Bernardino	215,182	62,760	$43,136	$112,622,195	81,687	81,433	18%	22%	0%	38%	4%	34%	9%	27%	13%	12%	9%	48%
San Bernardino	Twentynine Palms	26,109	10,102	$41,668	$9,708,803	6,487	3,508	26%	25%	20%	13%	15%	0%	6%	20%	6%	17%	0%	29%
San Bernardino	Upland	76,382	27,795	$68,551	$33,131,214	37,178	28,119	20%	22%	18%	41%	1%	5%	15%	14%	7%	8%	3%	42%
San Bernardino	Victorville	121,861	35,599	$50,691	$57,986,946	41,794	33,147	21%	31%	15%	46%	2%	29%	9%	22%	9%	10%	3%	47%
San Bernardino	Yucaipa	53,264	19,683	$63,657	$18,863,739	23,687	8,244	20%	21%	33%	19%	0%	0%	15%	12%	6%	9%	3%	39%
San Bernardino	Yucca Valley	21,543	9,964	$45,277	$15,285,162	7,910	6,199	21%	32%	17%	49%	4%	0%	20%	20%	8%	18%	1%	49%
San Bernardino	Unincorporated	303,866	137,787	$53,379	$630,716,092	118,222	45,486	19%	23%	49%	3%	0%	1%	14%	18%	10%	12%	5%	39%
Ventura	Camarillo	67,543	25,601	$92,913	$39,454,801	33,223	35,690	19%	28%	24%	35%	6%	0%	20%	7%	4%	7%	1%	37%
Ventura	Fillmore	15,598	4,593	$67,636	$6,296,286	7,143	2,718	15%	18%	8%	36%	2%	0%	12%	13%	9%	9%	7%	53%
Ventura	Moorpark	36,274	11,796	$104,839	$16,928,101	19,209	10,564	19%	27%	28%	25%	0%	0%	12%	4%	4%	7%	5%	35%

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County	City	Total Population	Total Housing Units	Median Household Income ($2018)	Total Tax Revenues	Total Residence-Based Employees	Total Workplace-Based Employees	Residence-Based Employees in Highest Impacted Sectors (%)	Workplace-Based Employees in Highest Impacted Sectors (%)	Secured and Unsecured Property Taxes (%)	Sales and Use Taxes (%)	Transient Occupancy Taxes (%)	TCAC/ HCD High Segregation & Poverty (%)	Senior Population (65+) (%)	Population below Poverty Level (%)	No Health Insurance Coverage (%)	Disability Status (%)	Severely Overcrowded Household (1.51 or More) (%)	Severely Cost-Burdened Household (50% or More) (%)
Ventura	Ojai	7,555	3,414	$70,403	$7,939,592	3,477	5,270	19%	33%	20%	18%	42%	0%	26%	8%	6%	14%	0%	51%
Ventura	Oxnard	207,568	55,148	$68,303	$126,648,408	98,652	59,197	17%	21%	27%	23%	5%	14%	10%	14%	17%	8%	13%	39%
Ventura	Port Hueneme	22,215	7,754	$65,243	$8,756,628	9,833	13,150	14%	5%	18%	24%	7%	0%	11%	12%	12%	10%	5%	41%
Ventura	San Buenaventura	110,234	43,463	$76,076	$96,628,875	53,606	63,113	20%	22%	26%	38%	7%	0%	16%	10%	7%	9%	3%	38%
Ventura	Santa Paula	30,258	9,374	$56,875	$13,576,959	12,992	6,119	18%	18%	24%	44%	1%	35%	13%	15%	13%	10%	7%	44%
Ventura	Simi Valley	126,199	43,272	$95,543	$63,874,199	65,367	44,463	19%	27%	29%	28%	3%	0%	14%	7%	6%	8%	2%	42%
Ventura	Thousand Oaks	128,481	47,749	$105,485	$75,874,594	63,346	77,369	21%	22%	19%	40%	6%	0%	18%	5%	5%	6%	2%	39%
Ventura	Unincorporated	96,187	35,334	$79,731	$346,690,533	45,380	29,422	18%	11%	61%	3%	0%	1%	17%	8%	8%	8%	4%	41%

INNOVATING FOR A BETTER TOMORROW

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REGIONAL OFFICES

IMPERIAL COUNTY
1503 North Imperial Ave., Ste. 104
El Centro, CA 92243
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ORANGE COUNTY
OCTA Building
600 South Main St., Ste. 741
Orange, CA 92868
Tel: (213) 236-1997

RIVERSIDE COUNTY
3403 10th St., Ste. 805
Riverside, CA 92501
Tel: (951) 784-1513

SAN BERNARDINO COUNTY
1170 West 3rd St., Ste. 140
San Bernardino, CA 92410
Tel: (213) 236-1925

VENTURA COUNTY
4001 Mission Oaks Blvd., Ste. L
Camarillo, CA 93012
Tel: (213) 236-1960

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Emerging Technology and the Future of the Workplace

An overview of recent SCAG initiatives and research findings

Kevin Kane, PhD
Senior Regional Planner
Research & Analysis

July 24, 2019

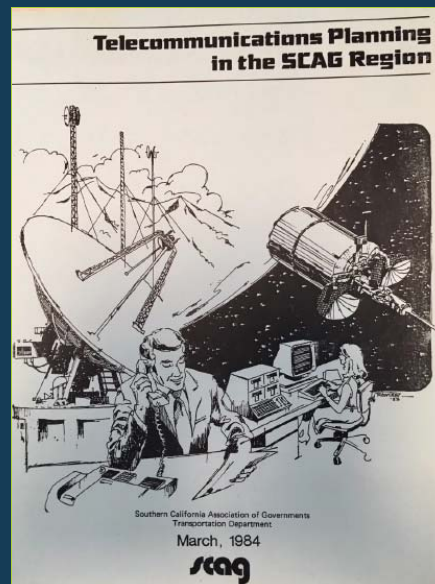
INNOVATING FOR A BETTER TOMORROW
WWW.SCAG.CA.GOV

Today's discussion

- Link emerging technology discussion more closely with:
  - Aspects of SCAG's 2020 RTP/SCS (Connect SoCal)
  - Trip replacement potential
  - Changing nature of the workplace
  - Not comprehensive – touches on *some* of these
- Outline
  - Telecommuting
  - Co-working spaces
  - E-commerce & infill potential
  - Replacing other types of trips
  - Automation potential and the gig economy
- This comes from:
  - Research & Analysis in-house work
  - SCAG *Future of the Workplace* consultant project

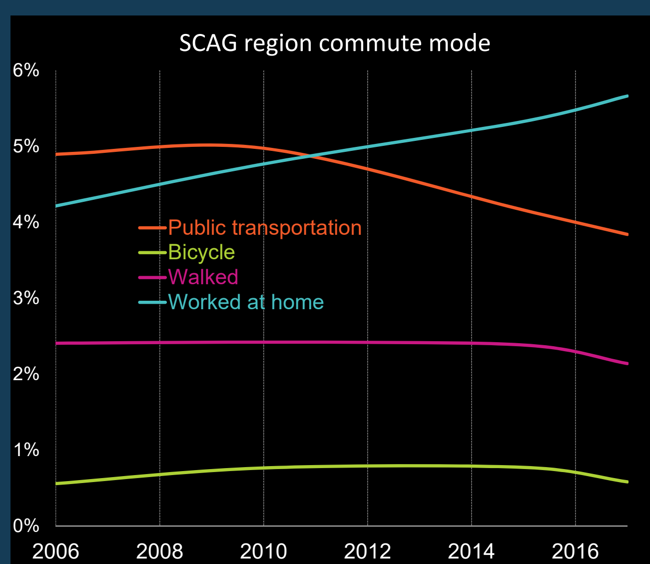
Telework in the SCAG region

- Long history in regional planning
- Segmented into:
  - Telecommuters
  - Home workers
- Deep dive into data to support regional plan assumptions



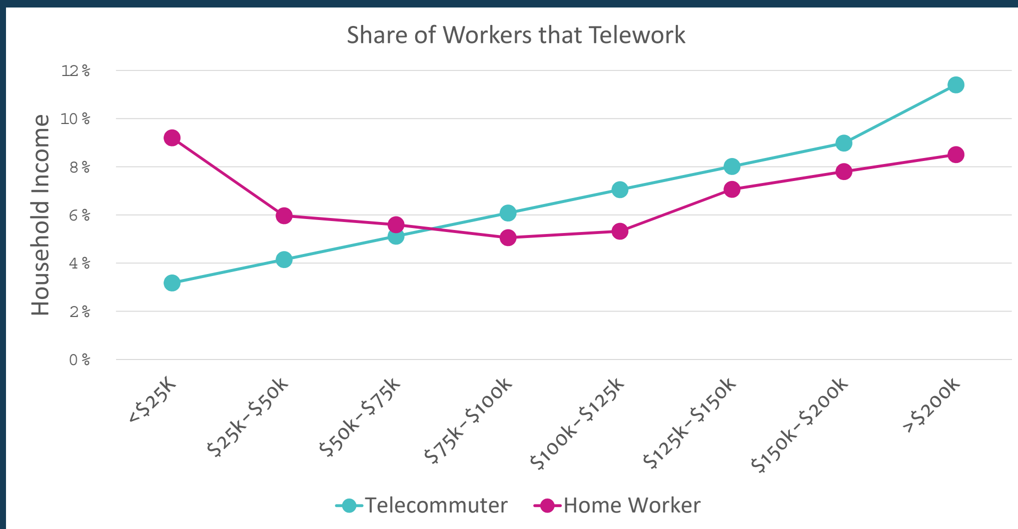
Telework in the SCAG region

- Technology enables more working from home
- Increasingly promoted by employers
- Fastest growing commute mode



*Source: US Census Bureau's American Community Survey

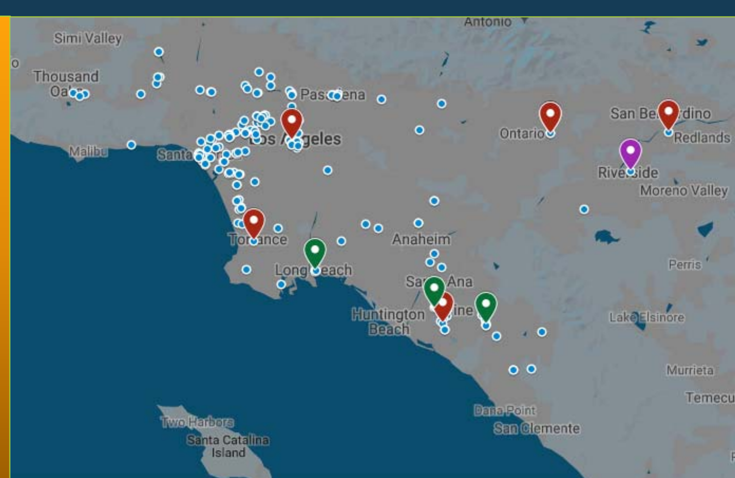
Telework in the SCAG region



*Source: National Household Travel Survey (NHTS)

Co-working spaces in the SCAG region

4% of Americans have worked in a coworking site.

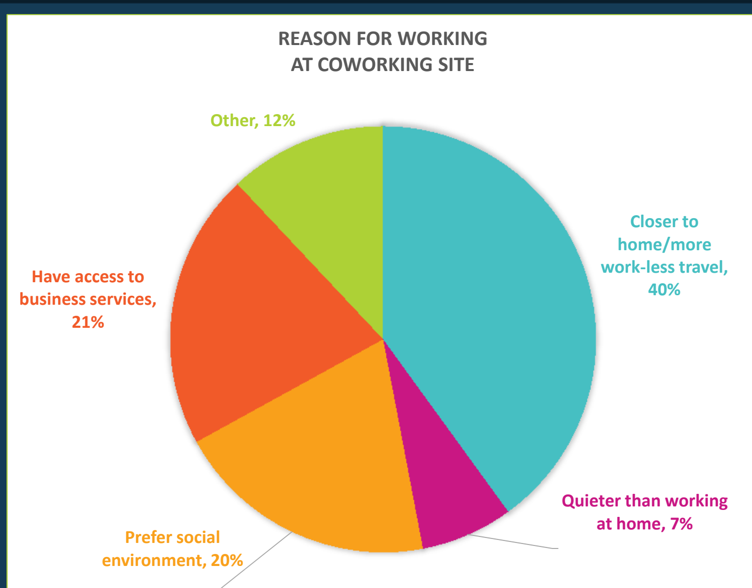


*Source: *Pew Research Center*.

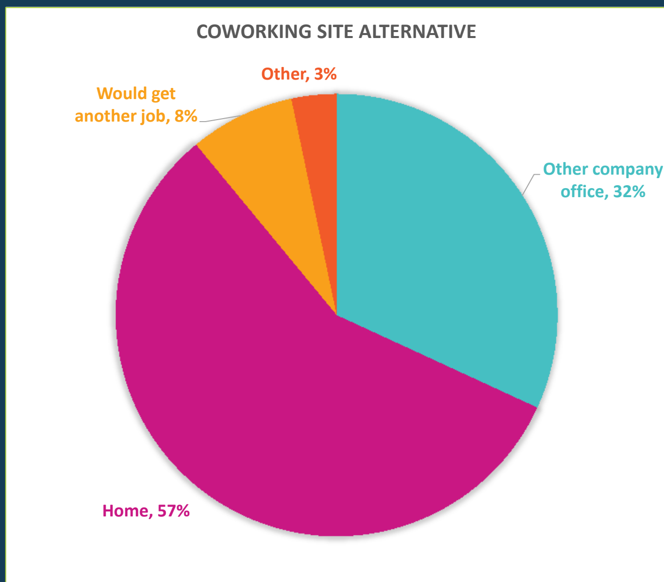
SCAG Co-working space survey

- 273 co-working space users at 10 sites across the region
- Sites:
  - WeWork (3)
  - Regus (6)
  - Mind & Mill (1)
- Asked about travel patterns and employment characteristics
- *Focus: trip-reduction potential*

SCAG Co-working space survey



SCAG Co-working space survey

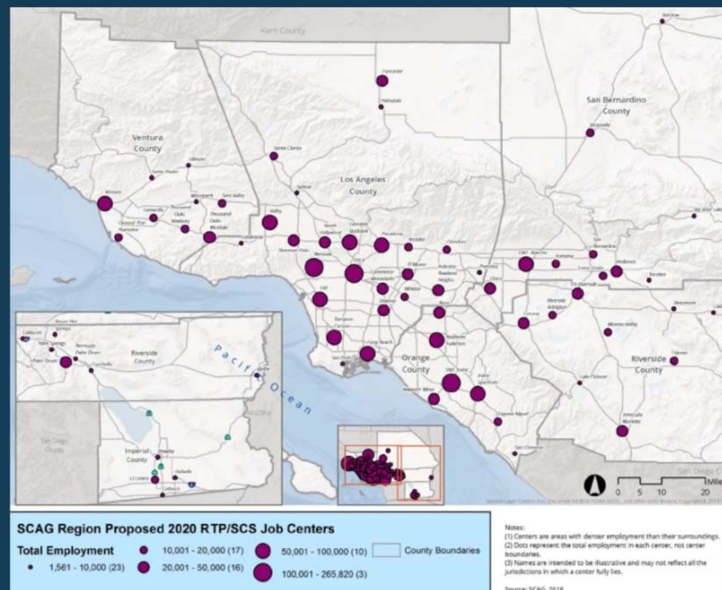


Surveyed co-working space users also tend to:

- Younger
- ~ 40% make over $100,000/yr.
- Overrepresented in IT and consulting
- Generally work full-time
- Over ¾ are *not* freelancers or entrepreneurs

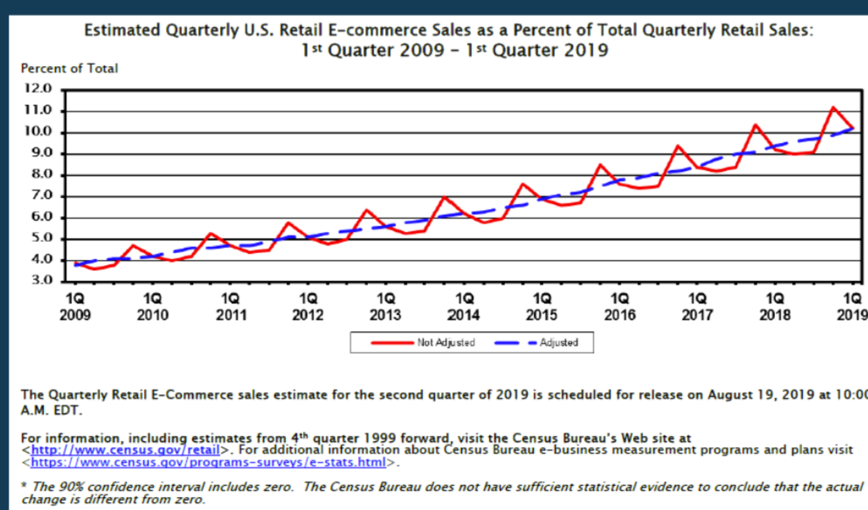
How can SCAG promote co-working?

- Developing potential strategy for Connect SoCal
- VMT/GHG benefits limited to long-distance commuters in key industries
- Focus likely on promoting co-working in job centers

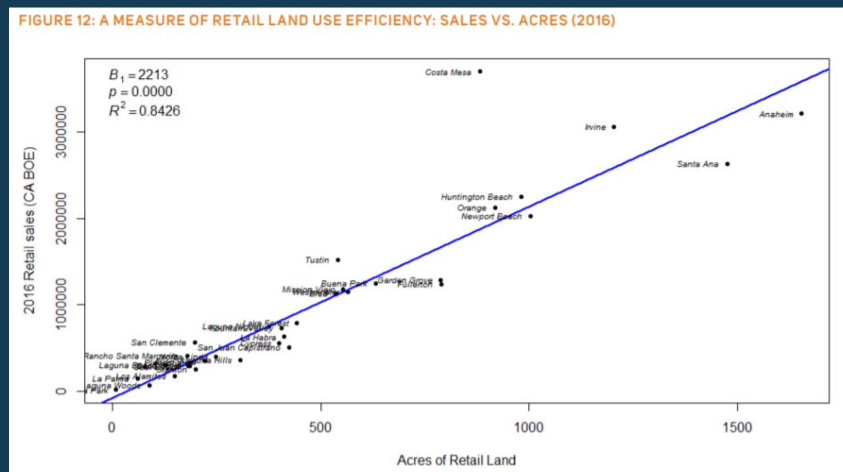


E-commerce and infill development potential

- E-commerce is transformational:
  - Shopping trips
  - Delivery trips
  - Impact on retail land use
  - *Likely decrease in taxable sales*



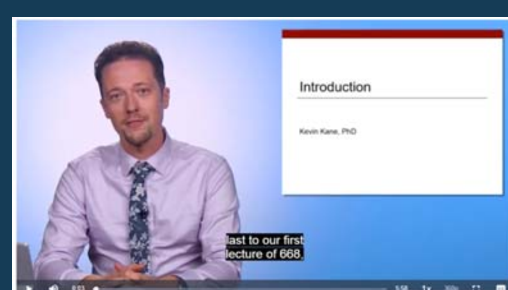
SCAG/Orange County Business Council Collaborative Research



http://scag.ca.gov/Documents/RetailLandUseReportInOC.pdf

Additional Trip Replacement through Technology

- Telemedicine
  - Dramatic recent growth due to:
    - Enabling legislation +
    - Technological advancement +
    - Patient satisfaction
- Distance Learning
  - US Department of Education higher education data (2012-2017):
    - Completely online programs grew from 12.5% to 15.4%
    - Students with at least one online course grew from 13.3% to 17.6%



See, e.g. Barnett, Ray, Souza, and Mehrotra 2018. Trends in telemedicine use in a large commercially insured population, 2005-2017. Journal of the American Medical Association 320 (20).

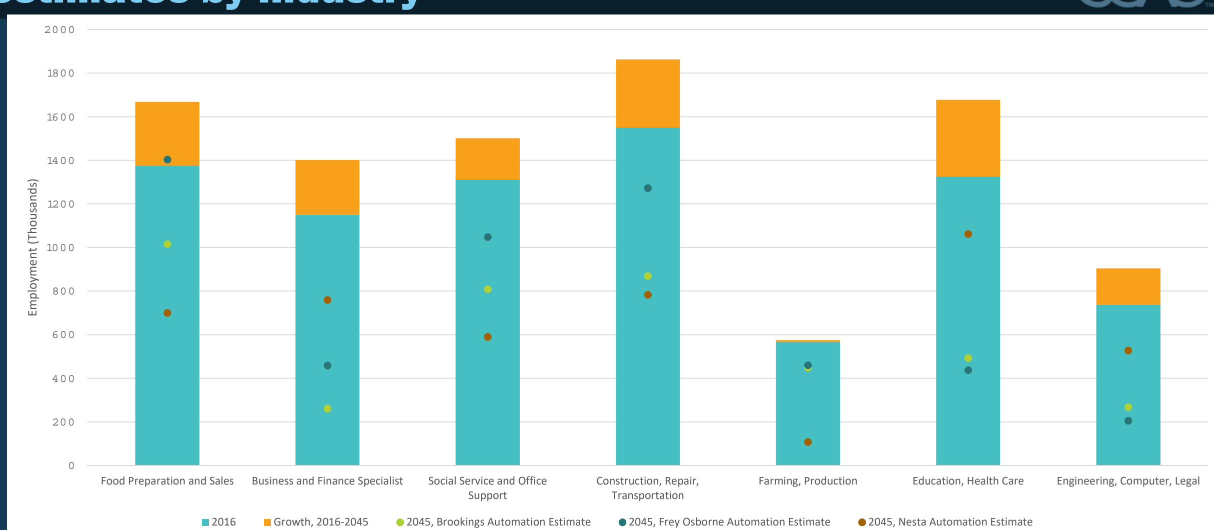
Automation Potential

Automation will vary heavily by occupation and industry.

How might this impact a forecast of jobs in 2045?

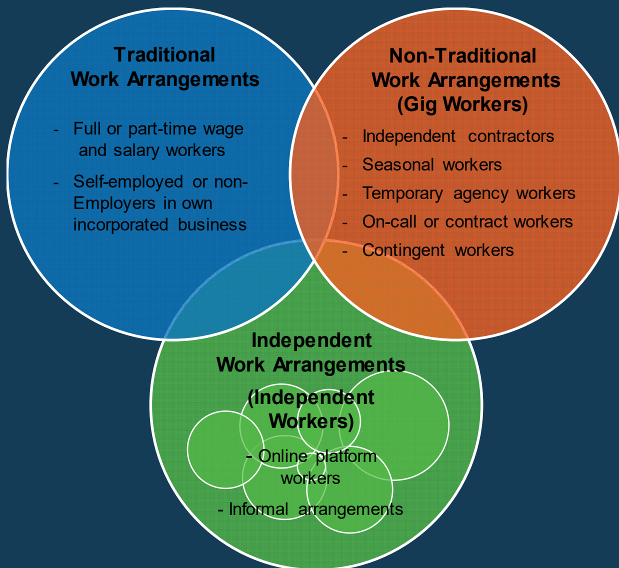
Growth	Healthcare, social assistance, education High skill, creativity, social intelligence
Decline	Administrative, manufacturing, driving tasks

Compare SCAG region jobs forecast to 3 automation estimates by industry

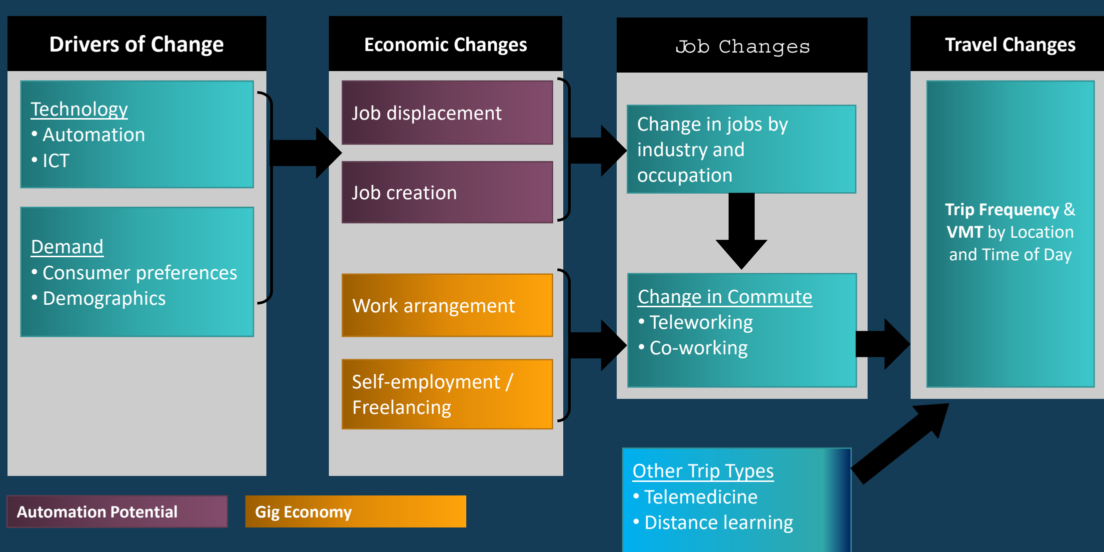


Sources: Working SCAG 2020 RTP/SCS Employment Forecast.
Frey, Carl Benedikt and Obsborne, Michael A. The future of employment: How susceptible are jobs to computerization? Technological Forecasting and Social Change 114 (2017) 254-280.
Muro, M., Maxim, R., & Whiton, J. (2019, January). Automation and artificial intelligence: How machines are affecting people and places. *Brookings Report: Metropolitan Policy Program*. Washington, D.C.: Brookings Institute.
Bakhshi, H., Downing, J., Osborne, M. & Schneider, P. (2017). The Future of Skills: Employment in 2030. London: Pearson and Nesta.

Defining the Gig Economy



Workplace changes: How does this impact travel?



SCAG Future Communities – Related Opportunities

- Data Science Federation
  - SCAG + City of LA partnership
  - Links cities/agencies with local university partners to complete 6-12 month "shovel ready" data science projects
  - http://dsf.lacity.org
  - *Contact* kane@scag.ca.gov *ASAP if your city has a project idea for 2019-2020*

- SCAG Data Science Fellows
  - Collaboration with *Partners for Better Health*
  - SCAG recruits *and helps fund* graduate student fellows with a data science specialization
  - 2019: LA County Public Works, City of Santa Ana, & SCAG
  - Open application link for cities and prospective fellows: http://p4bhealth.org/get-involved/

Thank you

Kevin Kane, PhD

kane@scag.ca.gov

213-236-1828

INNOVATING FOR A BETTER TOMORROW

WWW.SCAG.CA.GOV

Employment and Travel Survey

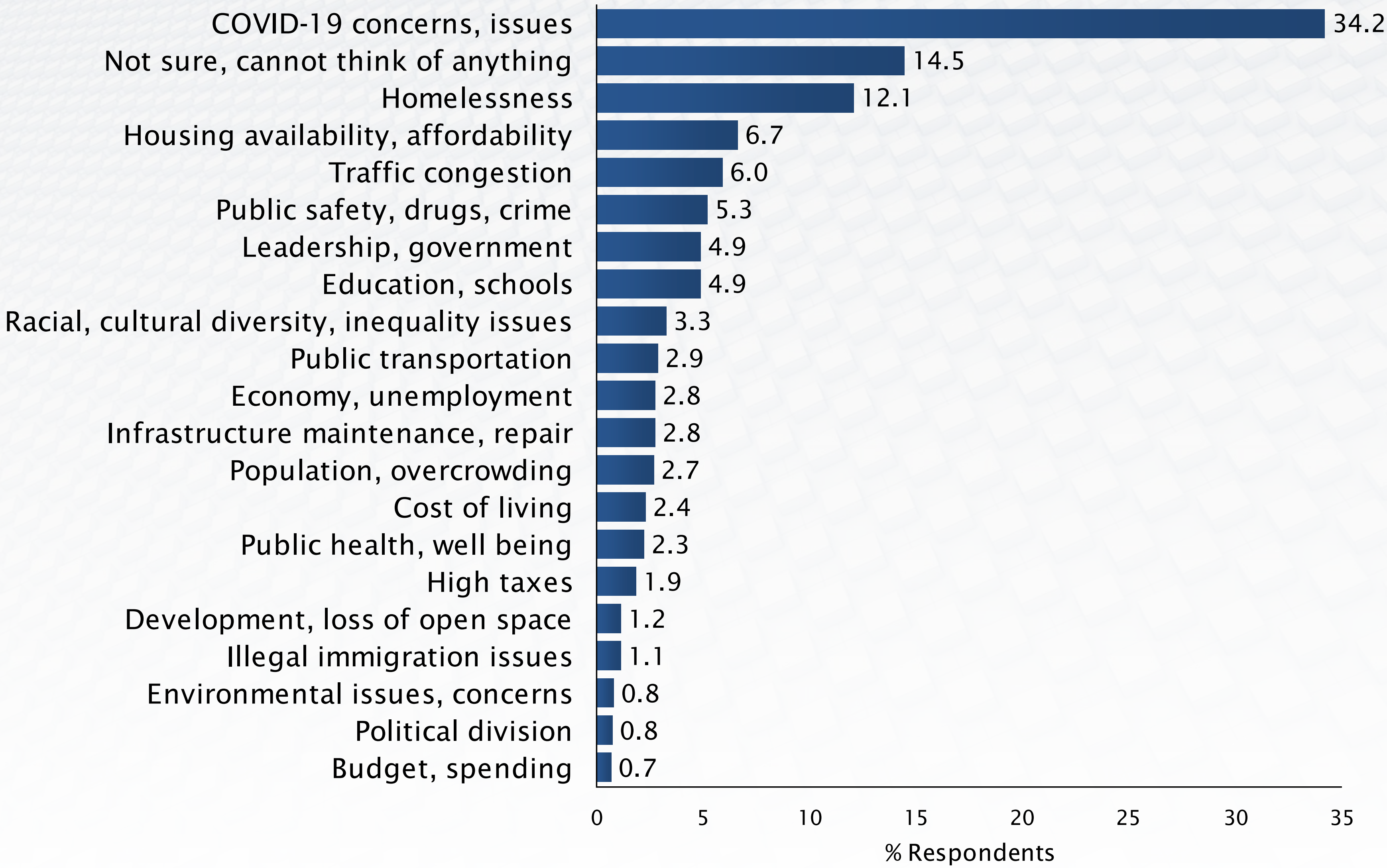
Purpose of Study

- Measure how the coronavirus (COVID-19) and the temporary closure of non-essential businesses in California has altered public attitudes, working arrangements, travel behaviors, mode choice, rideshare, and trips in the short-term.
- Establish baseline metrics against which a future tracking survey can be employed to identify enduring, long-term impacts.

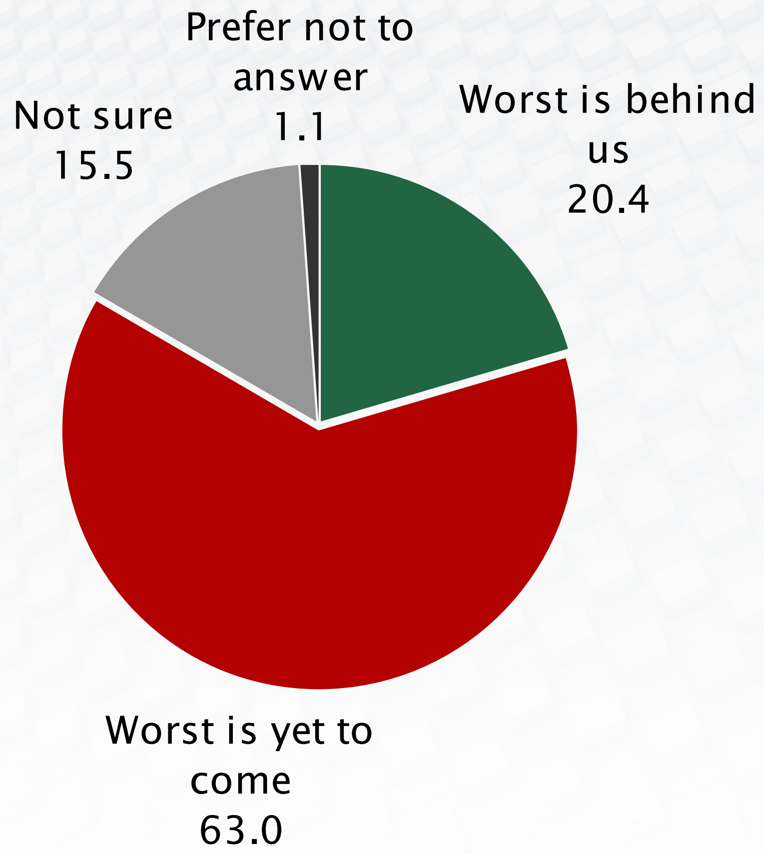
Methodology of Study

- Conducted July 10 to July 22, 2020
- Mixed-Methodology Survey
  - Stratified random sample of OC Households
  - Multiple recruiting methods (telephone & email) and data collection options (telephone & online)
  - Completed 2,548 interviews
  - English, Spanish & Vietnamese
- Overall margin of error: ± 1.94%

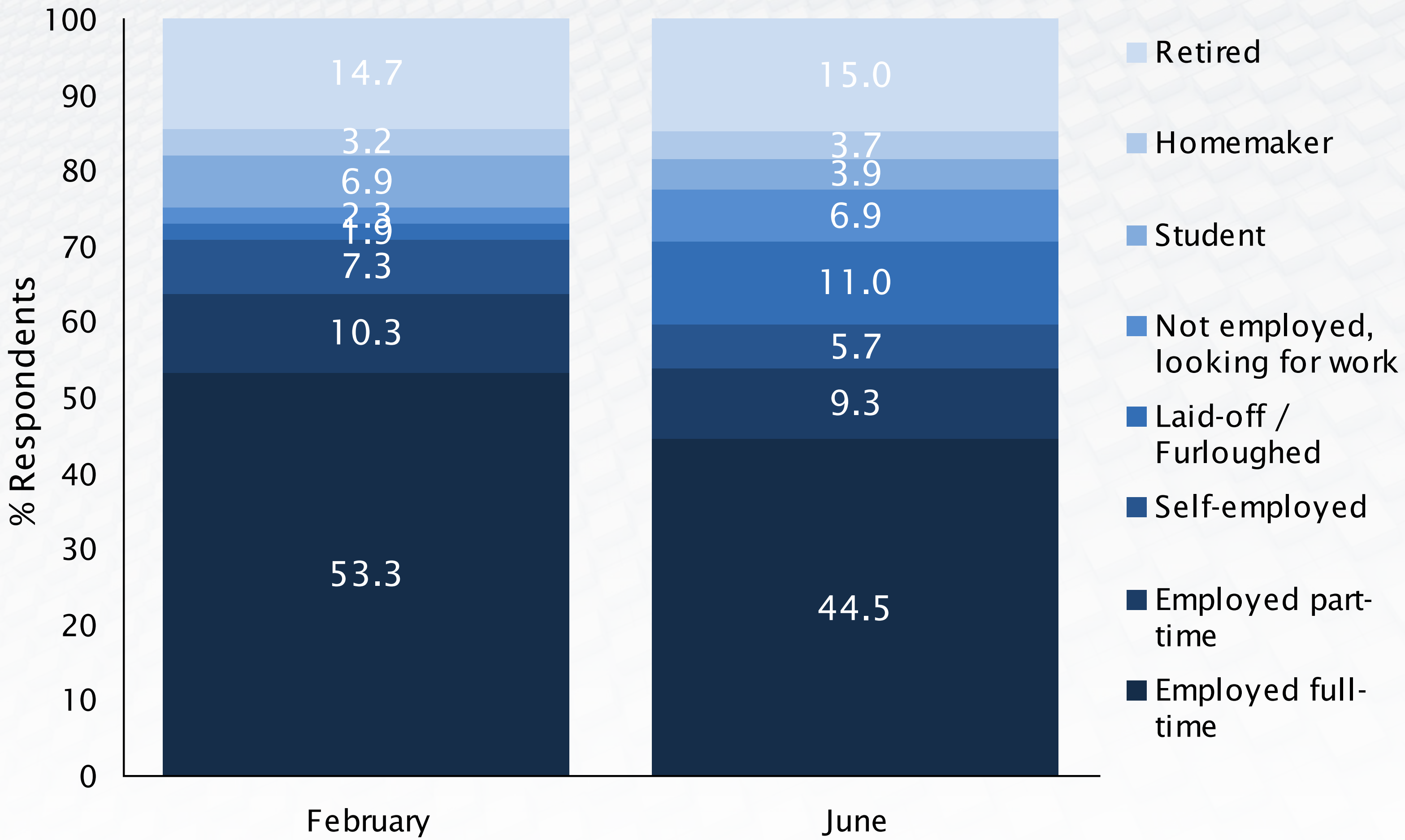
Most Important Issues



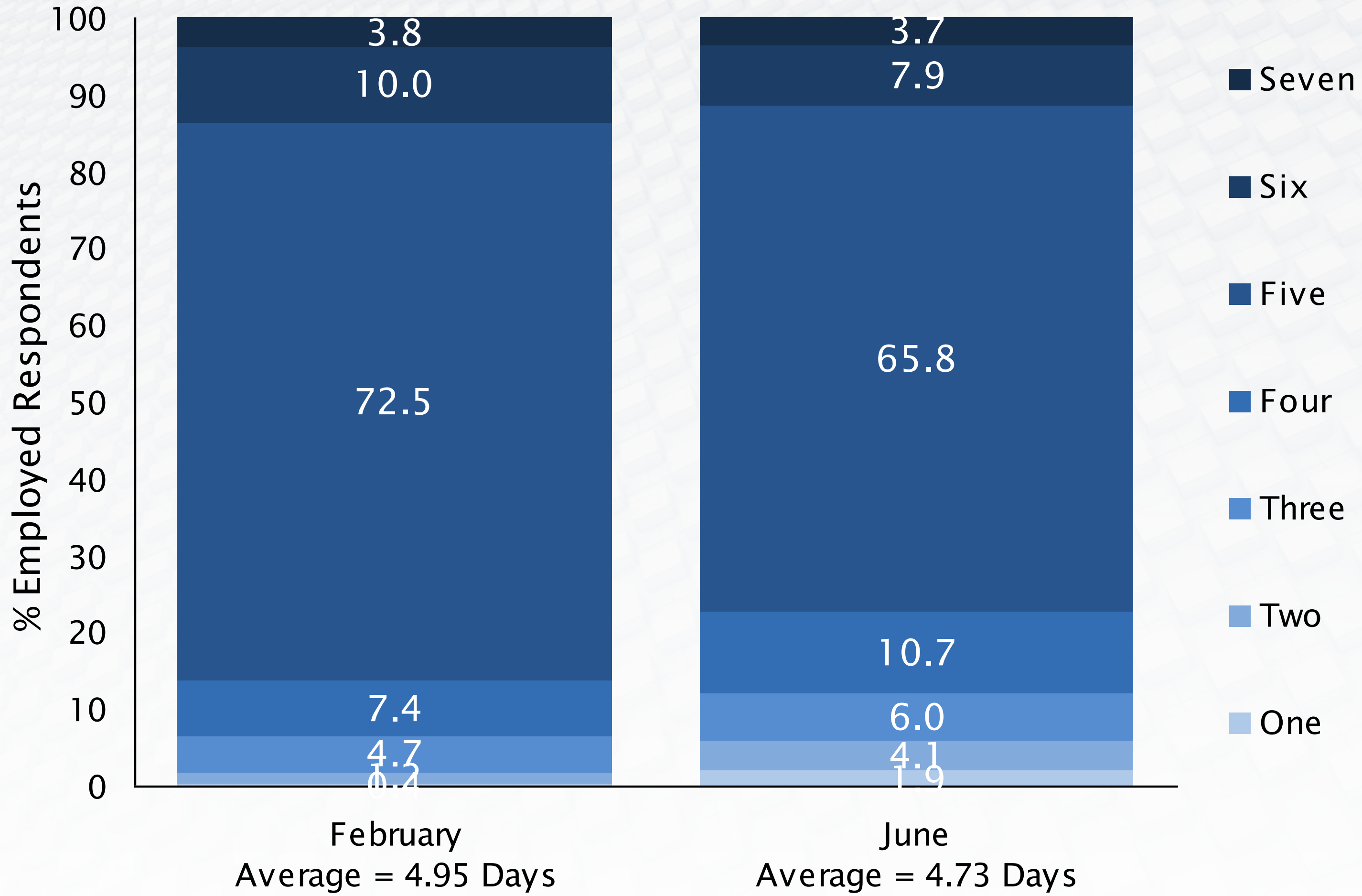
Opinion of Covid-19



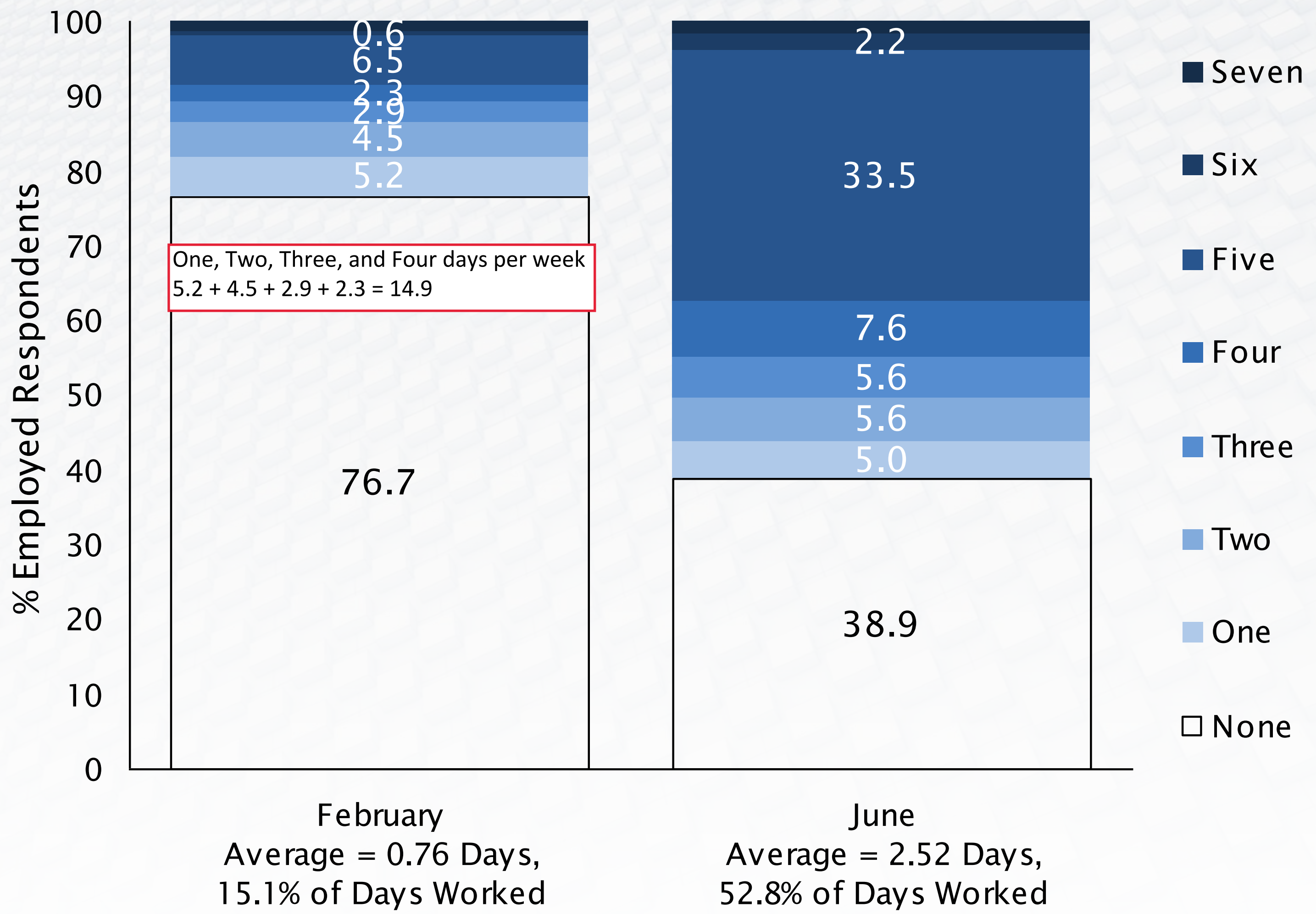
Employment Status: February and June



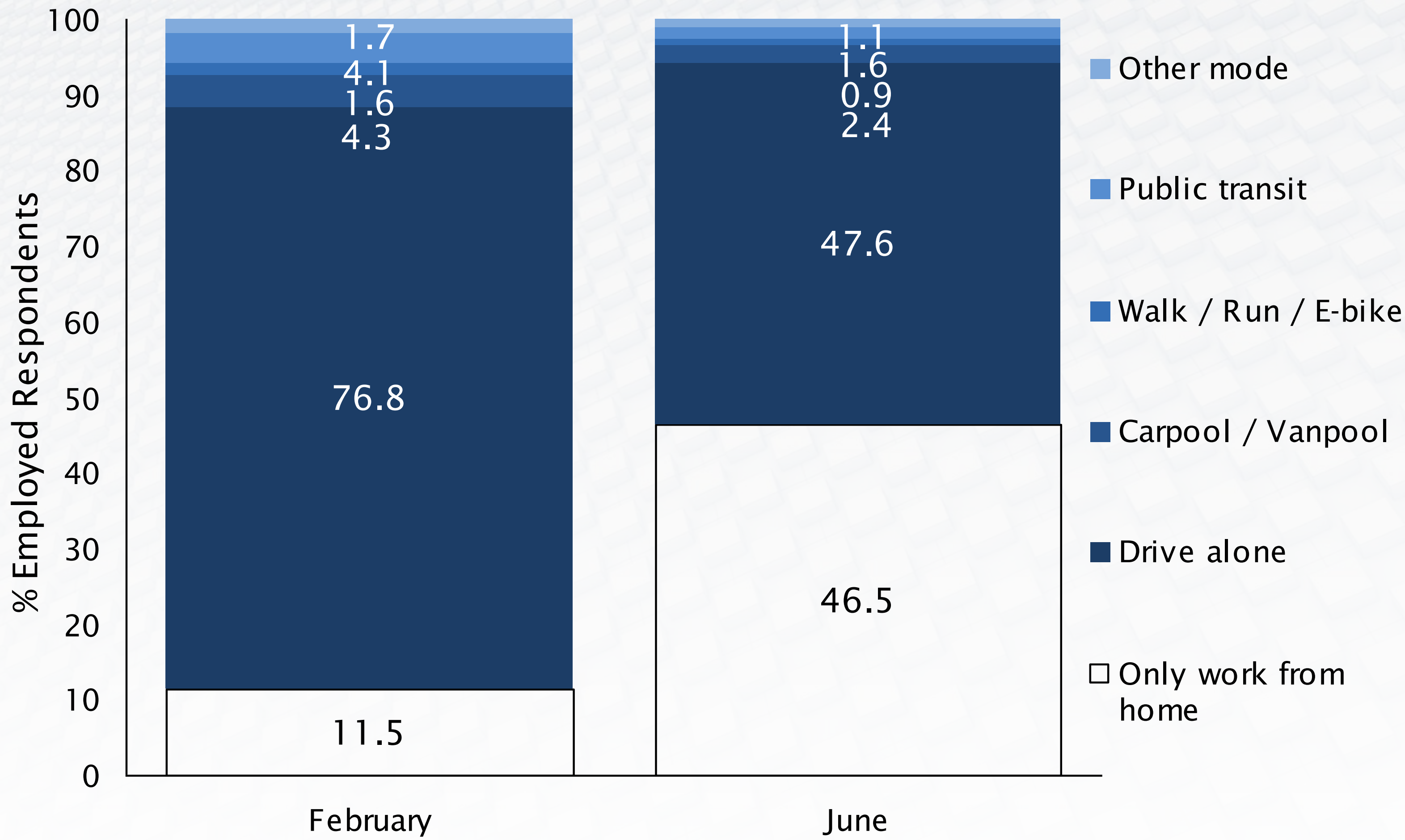
Workdays Per Week: February and June



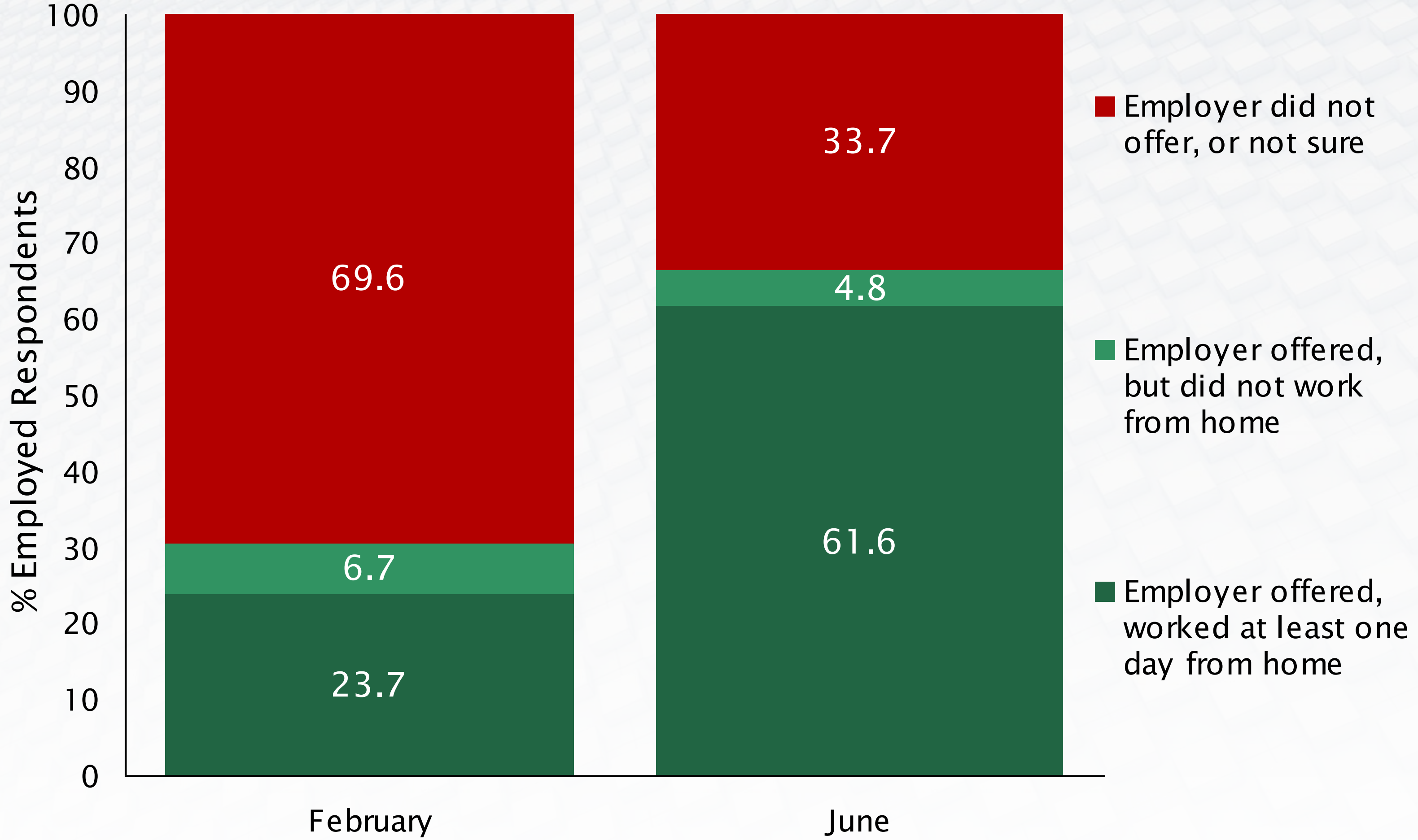
Telework Days Per Week: February and June



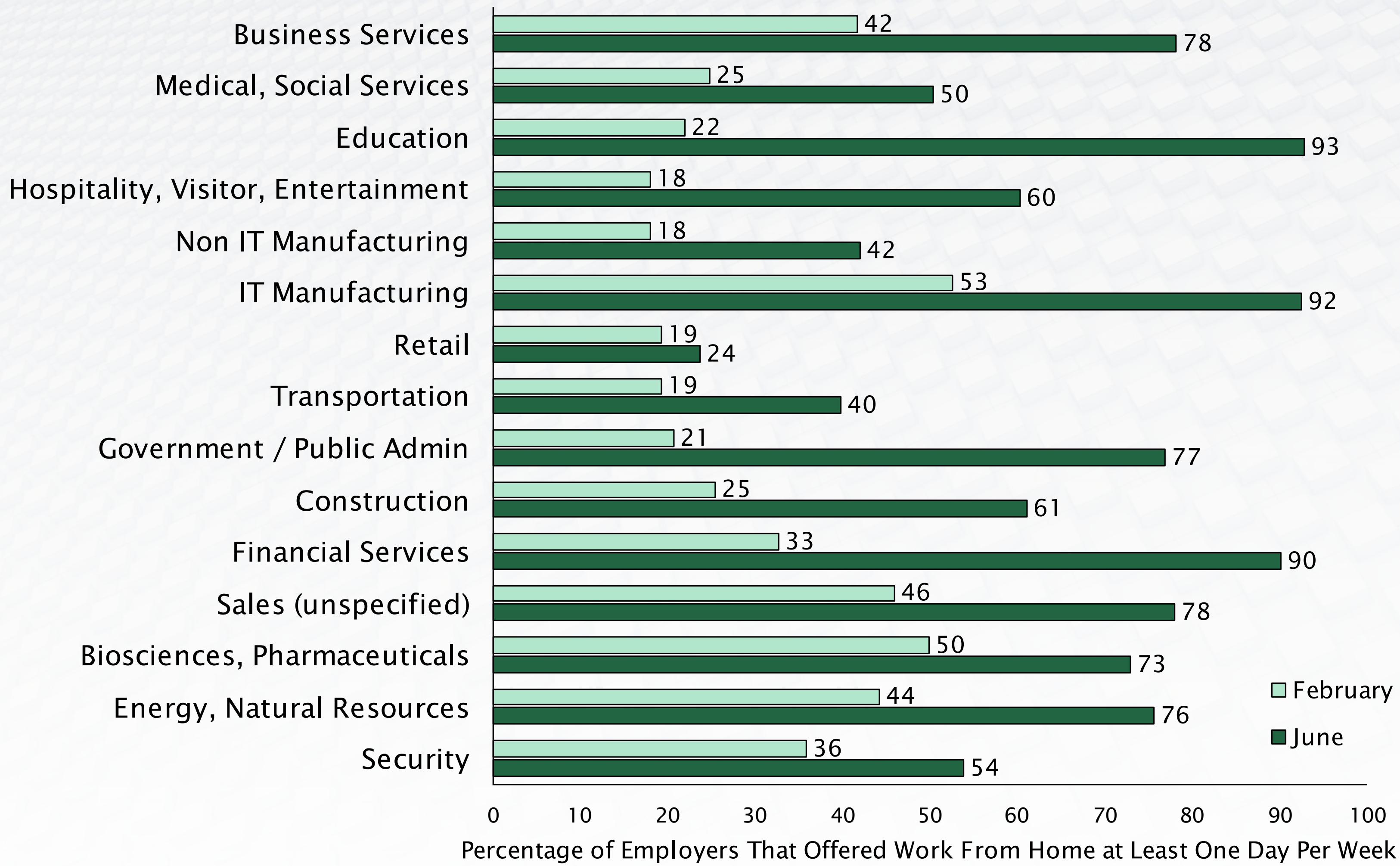
Work Commute Mode: February and June



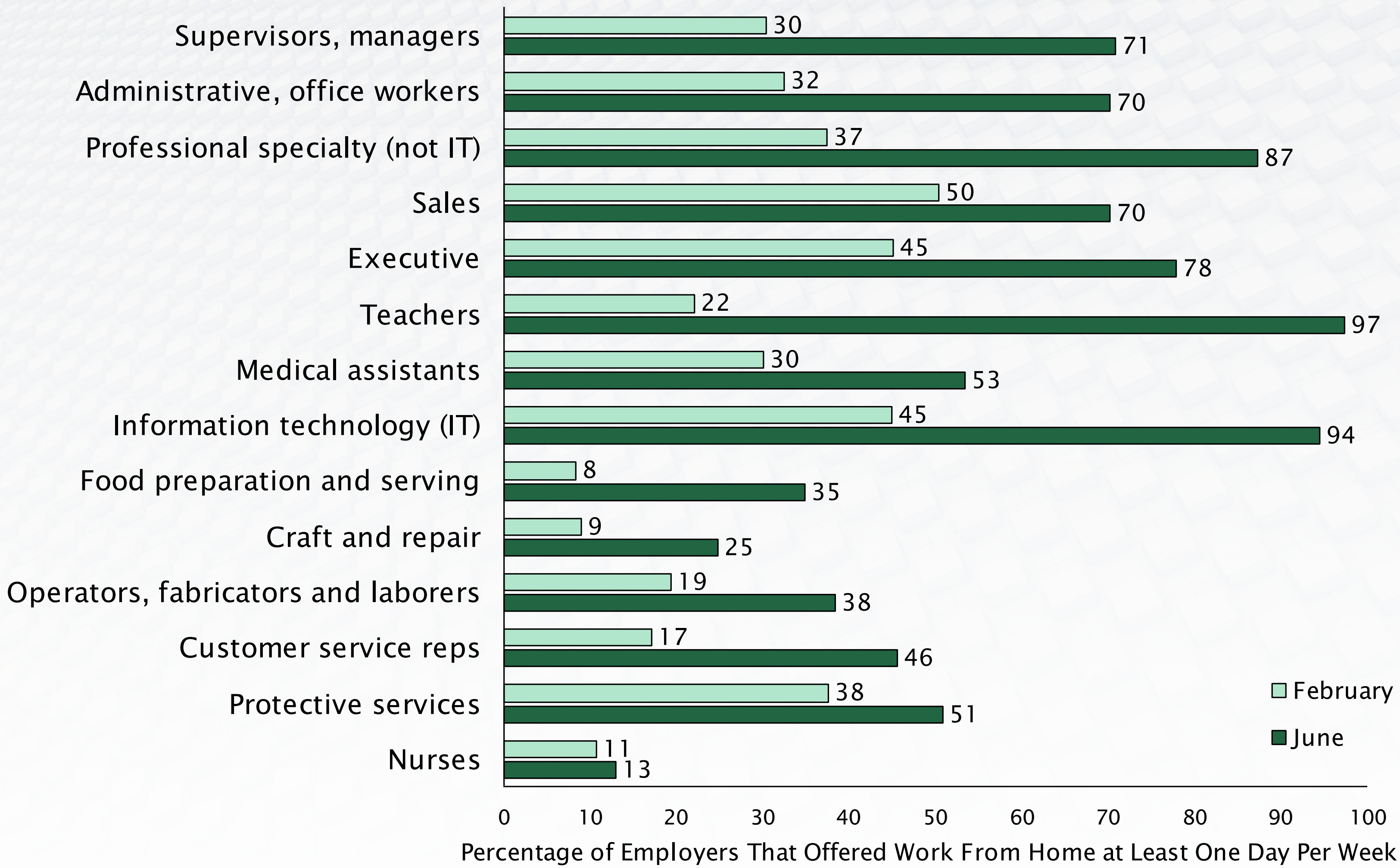
Telework Allowed?: February and June



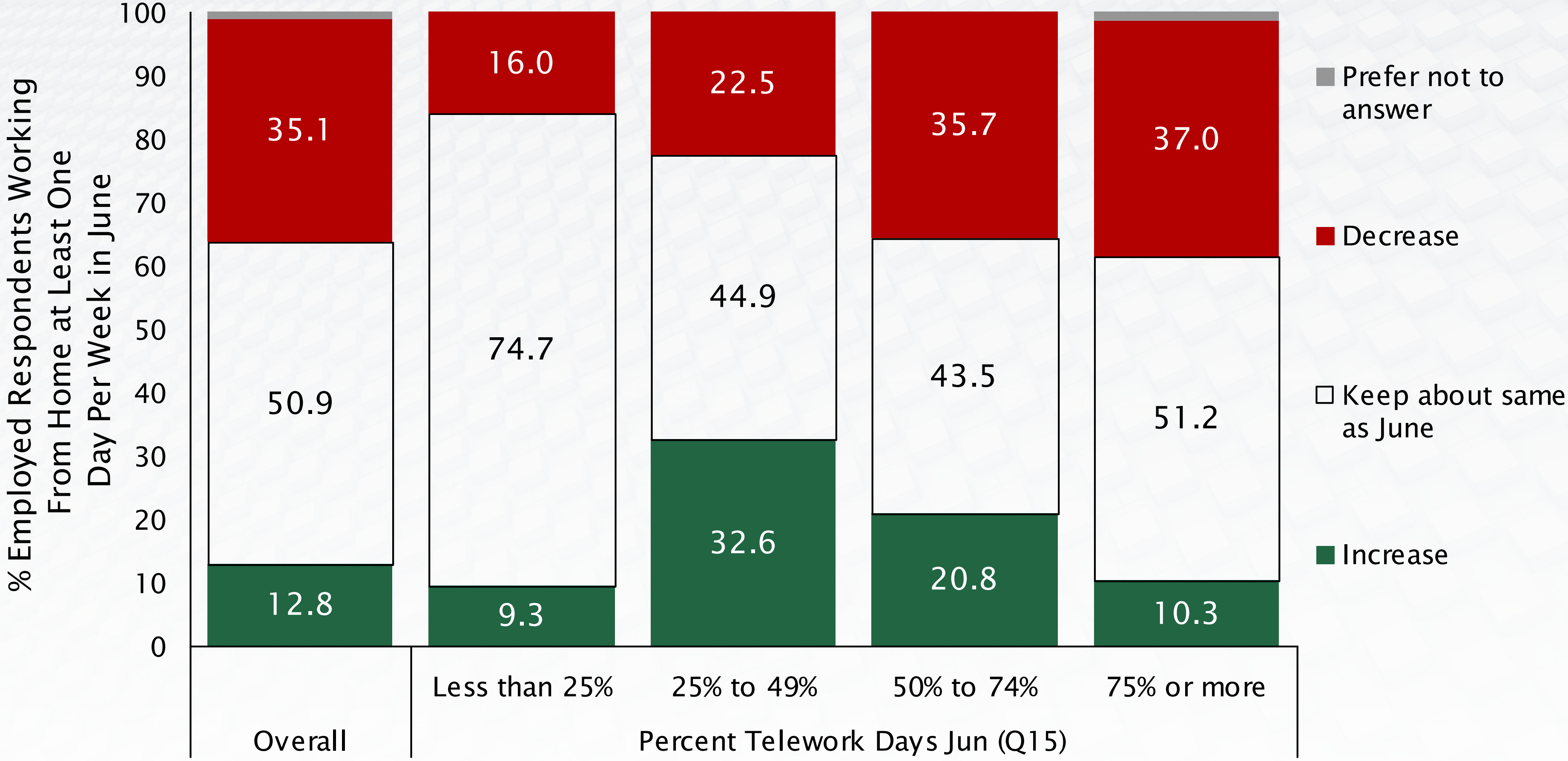
Telework Allowed By Industry



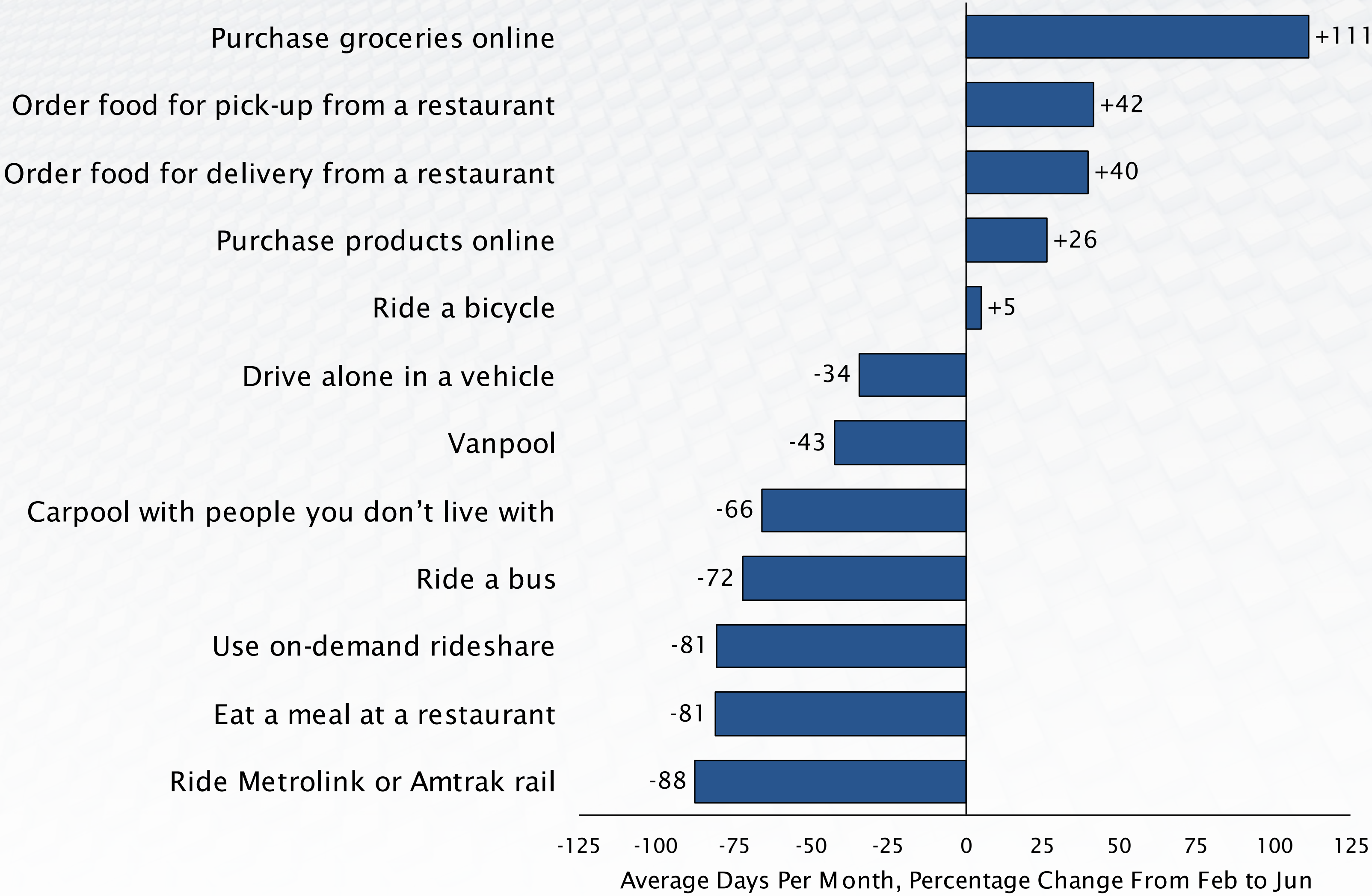
Telework Allowed By Occupation



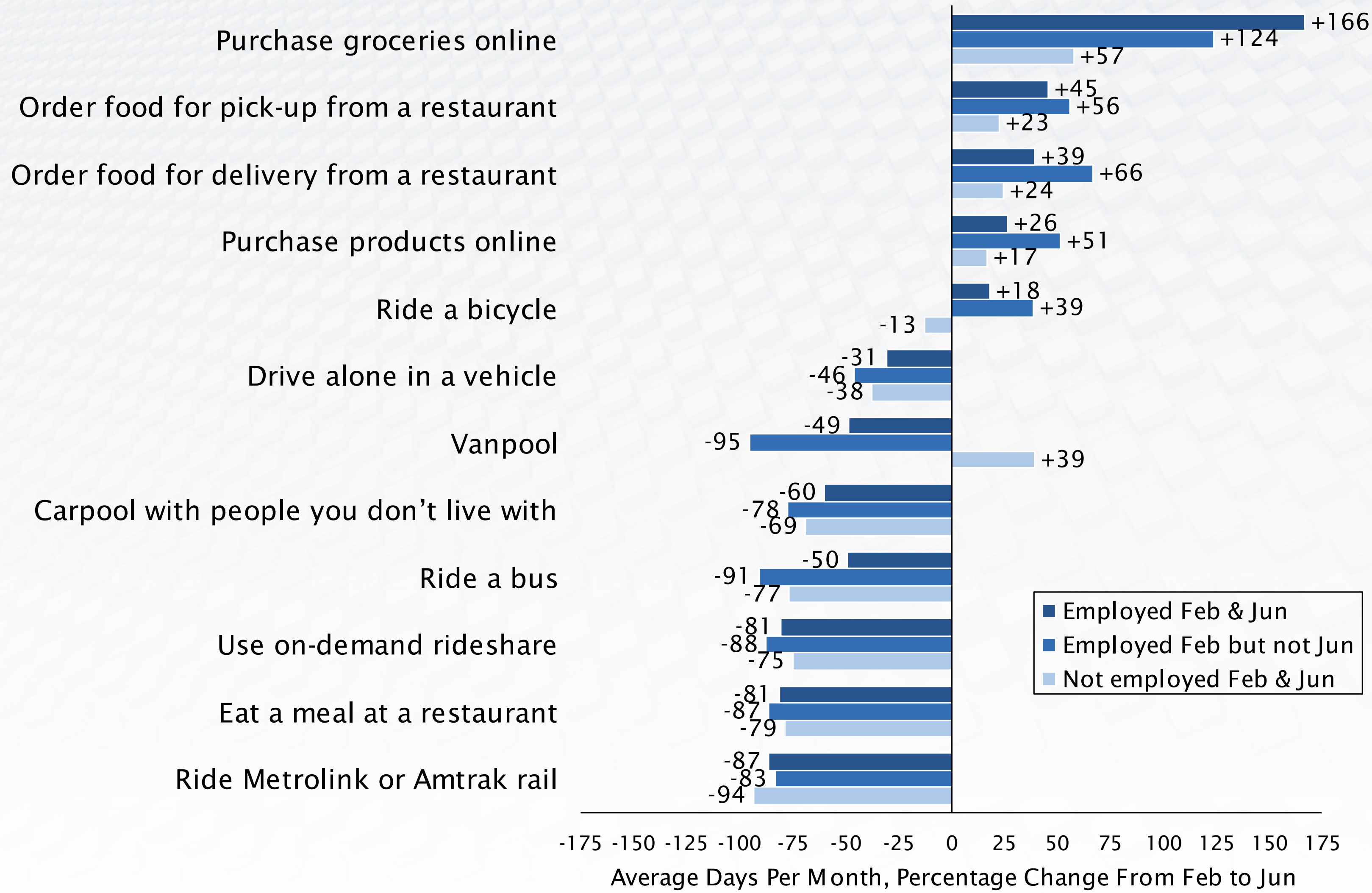
Telework Days Preference Post-COVID-19



Personal Activities: February vs June



Personal Activities: February vs June By Employment



Key Takeaways

- **The COVID-19 pandemic has had *dramatic* impacts on employment, working arrangements, and travel behavior in Orange County**
  - Unemployment increased from 4% to 18% between February and June.
  - Working from home increased from 0.76 days per week to 2.56 days per week for the *average* employee.
  - Working exclusively from home increased from 12% to 47% of employees.
  - Reductions in commute and non-work trips have resulted in large reductions in use of transit, active transportation, and rideshare.
  - Reductions in use of transit, active transportation, rideshare, and driving are occurring for a mix of reasons – higher unemployment, remote work, and fewer opportunities for non-work trips.

57% of Small Business Owners Believe Remote Work Will Continue After Stay-at-Home Orders Lifted

Published: May 20, 2020 Last Updated: Jul 22, 2020 by Sandeep Rathore In Small Business News 10

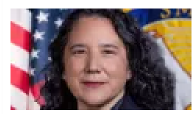
Are you thinking about allowing your employees to work from home post the COVID-19 pandemic? If yes, then you are among more than half of small business owners who are planning to do the same.

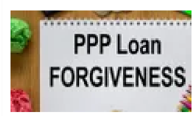
According to the latest **survey** from Intermedia, 57% of SMB owners said they are likely to continue increased remote working options for employees in the long term. What's more, SMB owners have observed that employee availability has increased by 19% by shifting to remote work.

Remote Work After Pandemic

Needless to say, **remote working policies benefit small businesses** in many ways, but not all small businesses have tried remote working policies before the coronavirus pandemic.

However, due to the COVID-19 pandemic, most small businesses had to voluntarily or mandatorily allow their employees to work from home. As a result, more small ·ısiness owners have realized the advantages of remote working and planned to .plement it post the pandemic.





Key Findings of the Survey

Early findings of the survey indicate that small businesses are getting benefits from remote working. And more than half (57%) of SMBs plan to adopt remote working options for employees in the long term.

Being a small business owner yourself, you should also offer your employees an option to work remotely if it is feasible. Doing so can make your employees happier.

SMB owners have found that, after shifting to remote working, employee availability has gone up by 19% and life satisfaction by 7%, the survey states. What's more, SMB owners have also witnessed falling in overhead costs.

According to the survey, business owners said that workers' attitudes have improved, and employees are happier while working remotely.

However, most small businesses (94%) said that in-person meetings played an important role in growing business in the last two years.

The survey also indicates that SMBs are turning to technology for face-to-face interactions amid the coronavirus pandemic.

Only 57% of SMBs relied on video conferencing pre-pandemic time, while 84% of business owners are using video conferencing now to offer face-to-face interactions in COVID-19 world, the survey points out.

Intermedia said in its prepared **statement**, "embracing remote work has been a love-hate relationship for many SMB owners. With new technology allowing workers to work from wherever and whenever more than ever before, employers have had to balance this reality against having the peace of mind that frequently comes from being in the same physical space as your employees.

"COVID-19 has certainly made us reexamine the entire concept of work, illustrating that many jobs can be done remotely without sacrificing productively. More business owners realize that employee availability and job satisfaction can remain high, if not increase, within a remote working environment…even after the pandemic passes," the company's statement concluded.

How to Make Your Remote Team Feel Connected

My friend, remote working is not just a temporary fix. Owing to multiple benefits remote working offers, more and more small business owners are going to implement remote working policies.

However, **remote employees can sometimes feel lonely and left out**, which can affect their productivity. So you should go extra miles to make your remote team feel connected to boost productivity.

Following are some tips that can help:

- Start using state-of-art communication tools
- Hold weekly video meetings
- Implement fun activities virtually
- Plan half-yearly or annually company retreat
- Organize online video games for remote players
- Encourage video calls as much as possible

Remote working doesn't have to be isolating. Give your remote workers tools and resources to connect. This will eventually increase the productivity of your remote team.

About the Survey

The survey included 250 business owners or senior decision-makers from organizations having between 5 to 250 employees. The survey was conducted online.

The organizations included in the survey had at least 50% of their staff on-site before Covid-19. But now these organizations have reduced office-based working due to the coronavirus pandemic. You can click **here** to know more about the survey.

READ MORE:

- **Small Business News**

Image: Depositphotos.com

More in: **Statistics**

10 Comments ▼

EDITOR'S PICKS

30% of Business Owners Are Deluding Themselves

Splashtop Gives Small Buinesses Remote Access to At Least 2 Computers

Why Small Business Owners Should be Watching Puerto Rico

Remote Workers Build Tools to Make Remote Work Even Easier

Make Your Next Event More Engaging with Engagify

8 Amazing Early Morning Habits of Successful People Small Business Owners Should Try

SANDEEP RATHORE

News

SANDAG Response to COVID-19

The health and safety of the San Diego region, including our partners and stakeholders, is a priority for SANDAG.

As we plan to reopen our main office to the public on September 7, 2021, SANDAG continues to monitor COVID-19 development to provide timely and appropriate responses related to our regional responsibilities and programs.

Essential information is available on SANDAG's social media channels - @SANDAGregion on Facebook and Instagram, and @SANDAG on Twitter.

We are following guidance from the Centers for Disease Control and Prevention, Cal/OSHA Emergency Temporary Standards, California Public Health Department, and San Diego County Health and Human Services Agency.

Telework Resources

The SANDAG iCommute team periodically hosts free telework webinars to support regional employers and employees in the shift to teleworking.

Recording: Telework Assistance Program – How to formalize your organization's telework program for long-term success

Recording: Returning to Work? Commute Considerations

Recording: Telework Wellness - How to nurture teams and boost morale

Recording: New to Telework Culture? How to overcome challenges and prepare employees for success

Recording: Seasoned Telework Programs - Expanding and adapting for company-wide remote work

To learn more about resources for employers and teleworkers, including sample policies, guidelines, case studies, and articles, visit iCommuteSD.com/telework.

Construction Projects

Public works construction is deemed essential and work continues during the pandemic. Our partners, contractors, and workers are following U.S. Center for Disease Control, Cal/OSHA Emergency Temporary Standards and California Department of Public Health guidelines. For more information about COVID-19 visit covid19.ca.gov.

State of California Executive Order N-33-20

Essential Critical Infrastructure Workers List (as of March 22, 2020)

Public Meetings and Events

Until our offices reopen on September 7, 2021, SANDAG is conducting meetings and other important outreach virtually. To receive the latest information about upcoming meetings and events, visit sandag.org/calendar or subscribe to receive meeting agendas and email updates.

SANDAG Office Closure

SANDAG continues to operate, and employees continue to work to provide essential services to the public and make progress on critical regional projects.

To protect the health and safety of staff, partners, and the general public, the main SANDAG offices at 401 B Street are closed to the public through September 3, 2021, and most employees are teleworking.

The FasTrak Customer Service Center in Otay Mesa for I-15 Express Lanes and South Bay Expressway customers is open for walk-in service. Per California Department of Public Health guidelines, masks are not required if you are fully vaccinated. If you're not vaccinated, you need to wear a mask.

Customers are encouraged to call (619) 661-7070 or visit 511sd.com/FasTrak to reach a customer service representative.

On April 10, 2020, the SANDAG Board of Directors approved temporary suspension of the monthly account maintenance fee, also known as the Minimum Monthly Toll (MMT), for all SANDAG FasTrak accounts opened through the I-15 Express Lanes and South Bay Expressway, as well as the temporary suspension of toll violations for the South Bay Expressway.

On December 18, 2020, the SANDAG Board of Directors approved the reinstatement of toll violations effective January 5, 2021. SANDAG will offer three temporary COVID-19 relief measures: the FasTrak account maintenance fee requiring minimum monthly toll usage will continue to be waived; the timeframe to use Pay-by-Plate to pay a toll before receiving a violation will extend from four to ten days; and the timeframe to pay a first violation notice will extend from 30 to 60 days.

On June 15, 2021 with the reopening of the State, reversal of temporary relief measures began. FasTrak customers will be assessed MMT fees beginning August 1, 2021 – with the first fees posted in their September statements. Pay-by-Plate payments will again be required within 4 days and violation payments will again be due in 30 days.

Motorists are encouraged to visit SBXthe125.com to make a payment or contact Customer Service for assistance.

Other Resources

For information about how public transportation providers are responding to COVID-19, visit the MTS or NCTD websites.

For specific information on the COVID-19 virus, visit:

- Centers for Disease Control and Prevention

- California Department of Public Health

- San Diego County Health and Human Services Agency

Project Manager(s)

For media inquiries, please contact the SANDAG Public Information Office at (619) 699-1950 or pio@sandag.org.

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SANDAG, 401 B Street, Suite 800, San Diego, CA 9
(619) 699-1900, fax: (619) 699-1905, webmaster@sandag

telework

The SANDAG iCommute program can help you set up or supplement your telework program for success. Whether you're a supervisor, HR professional, or employee, we've gathered resources to help you transition to working remotely.

EMPLOYERS

View sample policies, guidelines, case studies, and FAQs.

TELEWORKERS

View tips and articles to help you adjust to working from home.

For more information about telework or our employer program, call 511 and say "iCommute" or email iCommute@sandag.org.

Resources for Employers

Resources for Teleworkers

Telework FAQs

Telework Assistance Program

program spotlight

telework

The SANDAG iCommute program has compiled telework resources - including sample policies, guidelines, case studies, articles, and FAQs – to support organizations and employees with both short and long-term telework arrangements.

Table 4.2 Mobile Trip Characteristics Dependent on Location

Location Type	Name	Rural Trip Length (miles)						Urban Trip Length (miles)						Residential Trip Type Percentage		
		C-C	C-NW	C-W	H-O	H-S	H-W	C-C	C-NW	C-W	H-O	H-S	H-W	H-W	H-S	H-O
Air Basin	Great Basin Valleys	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Lake County	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Lake Tahoe	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Mojave Desert	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	40.2	19.2	40.6
	Mountain Counties	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	37.3	20.7	42
	North Central Coast	6.6	6.6	14.7	13.6	9.8	17.1	7.3	7.3	9.5	7.2	6.2	12.3	23	15	62
	North Coast	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Northeast Plateau	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Sacramento Valley	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	32.9	18	49.1
	Salton Sea	6.2	6.2	13.8	8.1	6.9	14.6	4.2	5.4	12.5	4.5	3.5	11	40.2	19.2	40.6
	San Diego	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	41.6	18.8	39.6
	San Francisco Bay Area	6.6	6.6	14.7	5.7	4.8	10.8	7.3	7.3	9.5	5.7	4.8	10.8	31	15	54
	San Joaquin Valley	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	45.6	19	35.4
	South Central Coast	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	37.5	15	47.5
	South Coast	10.1	7.9	18.5	12.9	9.6	19.8	8.4	6.9	16.6	8.7	5.9	14.7	40.2	19.2	40.6
Air District	Amador County APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	37.3	20.7	42
	Antelope Valley APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	40.2	19.2	40.6
	Bay Area AQMD	6.6	6.6	14.7	5.7	4.8	10.8	7.3	7.3	9.5	5.7	4.8	10.8	31	15	54
	Butte County AQMD	10.5	10.5	10.5	8	4.9	11.1	6	6	6	7.9	3	7.3	35	17	48
	Calaveras County AQMD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	37.3	20.7	42
	Colusa County APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	El Dorado County AQMD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.6	21	36.4
	Feather River AQMD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.6	21	36.4
	Glenn County APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Great Basin UAPCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Imperial County APCD	9.5	11.9	16.4	8.1	11.7	10.2	5	8.9	6.7	3.7	3.9	7.3	40.2	19.2	40.6
	Kern County APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	46.4	16.4	37.2
	Lake County AQMD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Lassen County APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Mariposa County APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	37.3	20.7	42
	Mendocino County AQMD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Modoc County APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Mojave Desert AQMD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	40.2	19.2	40.6
	Monterey Bay Unified APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	44	18.8	37.2
	North Coast Unified APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.3	19.6	38.1
	Northern Sierra AQMD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	37.3	20.7	42
	Northern Sonoma County APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.9	19.5	37.6
	Placer County APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	42.6	21	36.4
	Sacramento Metropolitan AQMD	7.5	8.5	15	8.5	7.5	15	5	6.5	10	6.5	5	10	46.5	12.5	41
	San Diego County APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	41.6	18.8	39.6
	San Joaquin Valley Unified APCD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	45.6	19	35.4
	San Luis Obispo County APCD	13	13	13	13	13	13	5	5	13	5	5	13	35.8	21	43.2
	Santa Barbara County APCD	5.5	6.4	6.6	4.9	4.5	8.3	5.5	6.4	6.6	4.9	4.5	8.3	25.6	9.9	64.5
	Shasta County AQMD	6.6	6.6	14.7	7.9	7.1	16.8	7.3	7.3	9.5	7.5	7.3	10.8	41	21.2	37.8

APPENDIX D

REPORTS ON PARK USAGE

Soc Sci Med. Author manuscript; available in PMC 2013 Dec 1.
Published in final edited form as:
Soc Sci Med. 2012 Dec; 75(12): 2317–2325.
Published online 2012 Sep 12. doi: 10.1016/j.socscimed.2012.08.036

PMCID: PMC3646794
NIHMSID: NIHMS457718
PMID: 23010338

Neighborhood Poverty, Park Use, and Park-Based Physical Activity in a Southern California City

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Abstract

A rich literature indicates that individuals of lower socio-economic status engage in less leisure time physical activity than individuals of higher socio-economic status. However, the source of the difference is believed to be, in part, due to differential access to resources that support physical activity. However, it has not been shown as to whether equal access to parks can mitigate differences in leisure time physical activity. Using systematic direct observation, we quantified physical activity in neighborhood parks in a large Southern California city located in areas with high, medium, and a low percentage of households in poverty. We documented how neighborhood parks are managed and programmed and also interviewed both a sample of park users and a random sample of households within a mile radius of the parks. We found that parks are used less in high-poverty areas compared to medium- and low-poverty area parks, even after accounting for differences in size, staffing, and programming. The strongest correlates of park use were the number of part time staff, the number of supervised and organized programs, and knowing the park staff. Perceptions of safety were not relevant to park use among those interviewed in the park, however it had a small relationship with reported frequency of park use among local residents. Among park users, time spent watching electronic media was negatively correlated with the frequency of visiting the park. Future research should test whether increasing park staffing and programming will lead to increased park use in high-poverty neighborhoods.

Keywords: Physical activity, parks, Southern California, socio-economic status, poverty, park management

Among a wide variety of health risk factors, including diet, obesity, smoking, hypertension, high cholesterol, and diabetes, the largest attributable fraction for all-cause mortality is due to physical inactivity, accounting for 16% of all-cause deaths (Blair, 2009). This is somewhat surprising, because compared with most other health behaviors, physical activity requires minimal financial cost, since people can walk, jog, or run in the streets and recreate in public parks without charge. Nonetheless, many studies document substantial disparities in leisure time physical activity between low- and high income groups (Boone-Heinonen, Evenson et al., 2010; Cerin & Leslie, 2008; Drenowatz, Eisenmann et al., 2010; Kamphuis, van Lenthe et al., 2009; McNeill, Kreuter et al., 2006; McNeill, Wyrwich et al., 2006; Wilson, Kirtland et al., 2004).

The urban public parks movement was born partly in response to the crowded and substandard housing and working conditions of the urban poor in the late 19th century. This was in the midst of the Sanitary Revolution, a time when it became increasingly clear that the conditions in which people lived explained disparities in morbidity and mortality between the rich and the poor. New legislation mandated systems for clean water, disposal of sewage, and upgrades of substandard housing. As an adjunct to these efforts, parks were intended for people of all classes, so they could breathe air purified by sun and trees (Olmstead FL, 1870). Frederick Olmstead, the designer of New York City's Central Park, wrote extensively about the benefits of parks and envisioned them as oases in the midst of the industrialized urban landscape in which the lower classes, in particular, might find respite from the crowding, filth, and incivilities of city life.

Olmstead's belief that parks would ameliorate health problems was prescient, as we now understand that a variety of chronic diseases are associated with a lack of time spent outdoors. Heart disease and diabetes, for example, are associated with insufficient physical activity (Lee, Paffenbarger et al., 1997; Oldridge, 2008; Yu, Yarnell et al., 2003). Additionally, deficits of Vitamin D, manufactured by the body as a byproduct of sun exposure, are associated with poor health; in African Americans lower levels of Vitamin D have been associated with higher rates of cardiovascular disease (Fiscella & Franks, 2010; Harris, 2011), kidney disease (Diaz, Mainous et al., 2009; Williams, Malatesta et al., 2009), low birth-weight (Bodnar & Simhan, 2010; Leffelaar, Vrijkotte et al., 2010), and pediatric asthma (Hill, Graham et al., 2011). Indeed, beyond having reduced exposure to the sun, staying indoors has been found to exacerbate asthma from exposure to indoor pollution (Ahluwalia & Matsui, 2011; Rabito, Carlson et al., 2011). Moreover, high levels of television viewing are associated with obesity (Crespo, Smit et al., 2001; Robinson, 1999).

In the 1950's, as American society prospered after WWII and cities expanded beyond their core, more parks were built with facilities for sports, especially because land on the periphery was less expensive. City departments of recreation and parks were created to staff, manage, and run these facilities for the benefit of local citizenry. Today, parks throughout the US are extensively supported with infrastructure and are a major venue for physical activity. According to the National Recreation and Parks Association (NRPA), approximately 75% of all Americans live within two miles of a park (ICMA & NaCO, 2006).

Although parks have become a standard infrastructure in most American cities and populations have unfettered access, many obstacles to park use have developed. The development of rigorous housing standards has led to the building of attractive indoor home environments, reducing the motivation for many to spend time outdoors. As well, low-income groups often hold unpleasant perceptions of neighborhood conditions, high perceptions of crime, and unleashed dogs (Cerin & Leslie, 2008; Kamphuis, van Lenthe, Giskes et al., 2009; Wilson, Kirtland, Ainsworth et al., 2004) naming them as factors reducing their park use. Individual factors have also been identified as restricting park use, including low self-efficacy for physical activity and limited perceived benefits and social support for physical activity. In one study, these subjective factors were shown to be key mediators that explained virtually all the differences in leisure time physical activity between persons of higher and lower socio-economic status (Cerin & Leslie, 2008). However, a limitation of these studies of leisure time physical activity has been the reliance on self-reported physical activity, which has been shown to have poor validity when compared to more objective measures (Fogelholm, Malmberg et al., 2006; Hagströmer, Oja et al., 2006).

Park facilities and scheduled, supervised activities are important resources for physical activity, particularly in urban, minority communities (Babey, Brown et al., 2005). Parks are also destinations to which people can walk – even though they may be sedentary after arriving there (MacDonald, Stokes et al., 2010). In some states, parks have been found to be more equitably distributed across neighborhoods of different socioeconomic status and racial-ethnic composition than commercial recreational facilities (Moore, Diez Roux et al., 2008). What is not known, however, is to what extent parks are used equitably across various communities, particularly for physical activity.

The mere existence of a park does not guarantee its use. Jane Jacobs recognized that parks could be harmful to safety and well-being as well as being helpful and that they did not automatically confer a boon on deprived urban populations (Jacobs, 1961). In her view, parks would only be well used if they were located in areas that supported heavy traffic and multiple uses. They would also more likely attract users if they provided "demand goods," specialized features such as facilities like baseball fields and events such as concerts that draw people with unique interests. Jacobs noted that magnificent views and handsome landscaping alone are seldom sufficient to capture people's leisure time, but they could be adjuncts to unique and attractive activities that add excitement and variety to an otherwise dull or inconvenient location.

This paper examines the use of 50 community parks, which we documented using systematic, direct observation and by surveying park users and local residents in neighborhoods of diverse socio-economic status and race/ethnicity. We conceptualized three different sets of factors affecting park use and park-based physical activity, including individual, park, and neighborhood characteristics. We examined the importance of neighborhood poverty in relationship to park-based physical activity.

Methods

We selected a sample of 50 neighborhood parks (27%) from 183 of those eligible in a large Southern California city. Eligible parks included those with recreation centers, at least one full time staff member and no excessive security concerns that limited park use, such as the local police precinct placing it under a gang injunction. (We excluded 3 for this reason.) Parks were selected to represent varied geographic areas in the city, and we sorted them based on the race/ethnicity composition of neighborhood census tracts (2000 US Census). Leisure time activities are likely influenced by cultural backgrounds and acculturation(Abraido-Lanza, Chao et al., 2005), and we wanted to observe park based activities among the diverse populations in the city. Given a predominantly Latino and non-Hispanic white populace, we oversampled parks in neighborhoods with higher percentages of Asians and African Americans. We also included parks where the population was diverse, where neither Whites, Latinos, African American, or Asians constituted a majority. We calculated the percentage of households living under the poverty level within a 1-mile radius around the park, interpolating block group data from the 2000 US Census. The percentage of households in poverty was calculated by the US Census Bureau, based upon the Federal poverty level. We also categorized the location of a park as commercial if it had a 4 lane commercial street and/or bordered on at least one retail establishment; other parks were categorized as residential.

Observation Instrument

We inventoried park facilities and directly observed park use using the System for Observing Play and Recreation in Communities (SOPARC) for 7 days, 4 times/day in each park over a two-year period, between April 2008 and March 2010. If weather was inclement, we rescheduled park visits during the same time on the next matching clement day to ensure observations were conducted on each day of the week. SOPARC provides data on each individual (i.e., gender, age-grouping; race/ethnicity grouping, and physical activity) observed in a park activity area. During an area scan (i.e., an observation sweep moving from left to right) of the area, the physical activity of each individual present is coded using momentary time sampling as sedentary (i.e., lying down, sitting, or standing), walking, or vigorous (e.g., jogging, running). These activity codes have been validated using heart rate monitoring and by accelerometry in physical education classes and leisure time with children and youths in kindergarten through twelfth grade.(McKenzie, Sallis et al., 1991; Sallis, McKenzie et al., 2003) We counted females and males (all ages) during separate scans and recorded the predominant activity for each gender.

In addition to recording information on people in an activity area, during each visit to an activity area entries were made to describe whether the space was accessible, usable, equipped, supervised, and provided organized activities. An area was coded as accessible when there were no locked doors, gates, or fences to impede entry. It was coded as supervised when park or adjunct personnel (e.g., park rangers, playground supervisors, volunteers, sport officials, teachers) are present and appeared to be available to direct park users or respond to emergencies. It was coded as providing organized physical activity when a scheduled physical activity, exercise class, or sport practice or competition was being lead by park staff or adjunct personnel.

Survey data

In addition to collecting observational data in each park, we also aimed to survey 75 park users recruited from the most busy and least busy target areas and 75 local residents, stratified by the distance they lived from the park: 1/3 from each of 3 buffers: within ¼ mile, ¼–½ mile, and ½–1 mile. We selected these two different groups of people because residents are representative of the local population that could potentially use the park and the park users are the subpopulation that actually uses the park. An important goal was to see how these two groups differed. Households were selected randomly from the universe of addresses within the three buffers. In neighborhoods where access to homes was constrained due to security (e.g., gates, locked apartment complexes) or when residents were repeatedly not at home (and thus we were not able to complete the 75 resident surveys), we conducted intercept interviews in front of busy locations (e.g., shop, bus stops), interviewing only those who reported residing within the park one-mile buffer. We asked people about their use and perceptions of the park and about their health and exercise routines.

We also surveyed and interviewed the park directors of each park to collect data on staffing and park-based programming. All methods were approved by the RAND Human Subjects Protection Committee.

Data analyses

About 2% of the planned observations in the park were missing data, and about 10% of survey respondents missed one or more survey items needed in our main analysis, including distance living from parks, knowing the staff, frequency visiting other parks, and perception of safety. To impute missing observations, we used a single round of imputation based on the mean-imputation or model-based strategy (Gelman & Hill, 2007). First, we examined the raw park observations at each target area of a park and in four observation periods. If the missing observation was in the middle of the day, and the condition of the target area (accessibility and activities) did not change before and after the missing period, the missing observation was imputed by interpolating adjacent observations. In all other cases, the missing observation was imputed by the sample mean at the same period across all days (weekend and weekdays processed separately). To impute missing survey data we used a set of GLM models that relied on highly correlated non-missing survey items and park-level characteristics to predict the missing data. For example, the distance living from the park was predicted mainly by the transportation mode and relative difficulty of getting to parks. Perception of safety was predicted mainly by local poverty level, frequency of visiting the park, and whether one knows the park staff. For each park we ran two imputation models for park users and residents separately. There were still 3% of respondents whose missing information could not be imputed by the model-based strategy due to missing information in the auxiliary variables. These cases were imputed by the sample means (for continuous variables) or mode (for discrete variables) in each park and for park users and residents separately.

Tables 1–3 present descriptive statistics with the missing data imputed and provide unadjusted comparisons among parks. To explore the data, we divided parks into tertiles based upon the percentage of households below the federal poverty level in the 1-mile radius around each park, categorizing their poverty levels as high, medium, and low. In our models, however, we used the percentage of households in poverty as a continuous variable. We ran all model analyses based on the subset of data with no missing information and the imputed data. There were no notable differences in results. Results presented in Tables 4 and 5 are based on the imputed data.

Table 1

Park Characteristics(N=50), Management Practices, and Observed Users

Variable	High Poverty ≥30% n=19	Medium Poverty 15%–<30% n=16	Low poverty <15% n=15	P value
Average park acres	8.7	15.9	15.4	0.26
Average # of sports fields	2.2	4.2	6	0.001
Mean # full time staff*	2.5	2.2	2.1	0.11
Mean # part-time staff*	10	13	18.	0.02
Average # PAB members*	5.9	6.6	7.2	0.74
Mean # unique programs*	8.4	11.3	10.3	0.02
Mean # of participants*	800	1360	2823	0.30
% offering snacks for youth*	73.7%	75.0%	26.7%	0.007
% offering snacks for seniors*	0.0%	12.5%	6.67%	0.30
% with after school program*	88.2%	75.0%	26.7%	0.001[1]
Banners*	57.9%	43.7%	33.3%	0.35
Website/email	5.3%	12.5%	46.7%	0.007 [1]
% parks in residential areas	42.11%	56.25%	66.67%	0.35
Park Observations				
Average number observed/park	1710	2382	2234	0.21
Average number per acre	303	281	194	0.25
Avg # of organized activities	9.7 (range: 2–21)	17.3 (range: 1–31)	17.9 (range: 5–54)	0.046
Average # supervised activities	15.7	25.6	30.7	0.03
Average # (%areas accessible	85.7%	90.7%	93.3%	0.0008
Average areas empty	63.9%	61.0%	56.7%	0.23
Primary Activity by Gender				
Types of activities, Female				
Sitting	36.8%	35.9%	33.7%	0.89
Playground activities	14.4%	14.7%	13.7%	0.98
Walking	10.1%	8.3%	10.2%	0.88
Standing	10.9%	11.8%	10.0%	0.92
Types of activities, Male				
Sitting	28.0%	20.5%	19.0%	0.26
Basketball	11.0%	13.2%	13.1%	0.87
Baseball/Softball	4.0%	12.0%	12.1%	0.08
Soccer	14.9%	7.4%	9.3%	0.20
Standing	10.7%	11.1%	7.8%	0.69

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*Only 17 High poverty area parks provided this data
[1]chi-square might not be valid due to small cell size

Table 3

Differences Among Residents ' Reports by Neighborhood Poverty (unadjusted) (N=3249)

	Residents			
	High poverty n=1308	**Medium Poverty n=1063**	**Low poverty n=878**	**P value**
Gender (% male)	36.8	32.6	33.6	0.08
Average age	42.3	42.0	43.0	0.29
% Hispanic	82.6%	71.3%	19.9%	<.0001
% African American	12.1%	13.9%	3.3%	<.0001
% White	1.3%	11.3%	61.6%	<.0001
% Asian	2.8%	0.5%	3.2%	<.0001
Distance living from the park (miles) (median)	0.5 (0.4)	0.5 (0.4)	0.4 (0.4)	<.0005
Frequency of park use (at least once/week)	24.6%	30.7%	32.3%	<.0001
Average # of visits in past 7 days	1.8	1.7	1.9	0.36
Average length of stay (hours)	1.6	1.7	1.6	0.30
% walking to the park	47.3%	39.8%	32.6%	<.0001
% seeing people they know often/sometimes	64.2%	58.1%	60.1%	0.10
% participating in park sponsored program	5.0%	7.8%	6.2%	0.02
% user fees prohibit participation	6.8%	5.7%	3.8%	0.01
% perceive park safe/very safe	72.2%	83.3%	95.2%	<.0001
% visiting other parks (at least once/week)	11.9%	6.7%	8.8%	<.0001
% who exercise at park	13.7%	19.2%	17.9%	0.0008
% exercise at home	18.3%	15.3%	16.2%	0.13
% exercise at health club	5.0%	8.4%	17.4%	<.0001
% don't exercise	48.9%	48.0%	38.2%	<.0001
Mean Frequency of exercise (sessions/week)	2.1	2.1	2.5	<.0001
Mean screen time	3.0	2.9	2.7	<.0001
Engage in physical activity at work	25.4	24.4	14.3	<.0001
Doesn't know park staff	64.3%	52.6%	54.3%	<.0001
Average grade for park staff	3.6	3.6	3.8	<.0001
% of individuals who don't find out what is happening in the park	55.9%	48.0%	46.2%	0.0017
Never goes to local park	56.7%	44.4%	47.6%	<.0001
Never goes to local park or any other park	38.0%	35.8%	38.0%	0.49
Average BMI	26.1	25.8	24.3	<.0001
% overweight	44.8%	47.4%	35.1%	<.0001
% obese	13.8%	10.3%	4.0%	<.0001

total n = 3249

24.6% x 1308 = 322

30.7% x 1063 = 326

32.3% x 878 = 284

total 932
932/3249 = 28.7%

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Table 4

Mixed-effect Model Estimates for Log of Park Use and Park based Energy Expenditure (METS). Significance levels are at .001 (***), .01 (**), and .05 (*).

Predictors	log(# park users)		log(METs)	
	With modifiable factors Estimate (SE)	Without modifiable factors Estimate (SE)	With modifiable factors Estimate (SE)	Without modifiable factors Estimate (SE)
Intercept	4.99 (1.05)***	6.92 (1.18)***	5.71 (1.06)***	7.95 (1.17)***
Season (Fall)	−0.13 (0.28)	0.11 (0.28)	−0.10 (0.27)	0.08 (0.28)
Season (Spring)	−0.04 (0.30)	0.12 (0.29)	−0.02 (0.27)	0.10 (0.27)
Season (Summer)	0.34 (0.26)	0.63 (0.29)*	0.37 (0.24)	0.59 (0.28)*
Size of park (acres)	0.01 (0.01)	0.03 (0.01)***	0.01 (0.01)&	0.03 (0.01)***
Park in residential (as opposed to commercial) areas	0.30 (0.13)*	0.15 (0.18)	0.31 (0.13)*	0.20 (0.17)
#full time staff	0.06 (0.10)		0.03 (0.10)	
#part time staff	0.01 (0.01)*		0.02 (0.01)**	
#facilities for team sports	−0.04 (0.04)		−0.02 (0.04)	
#other facilities	0.01 (0.02)		0.02 (0.02)	
#accessible areas	0.005(0.002)***		0.005(0.001)***	
#inaccessible areas	−0.01 (0.01)*		−0.01 (0.01)	
#organized activities	0.04 (0.01)**		0.03 (0.02)*	
#supervised activities	0.07 (0.02)***		0.07 (0.02)***	
Total population within 1 mile radius (in 10,000)	0.10 (0.03)***	0.13 (0.03)**	0.11 (0.03)***	0.13 (0.03)***
Proportion of poverty in the park's neighborhood	−2.40 (0.95)*	−4.12 (1.35)**	−2.44 (0.92)**	−4.62 (1.28)***
Proportion of residents doing physical activities at work	−0.17 (0.71)	−0.10 (0.77)	0.13 (0.71)	0.19 (0.78)
Proportion of residents who feel park is safe	0.21 (0.53)	0.10 (0.76)	−0.03 (0.57)	−0.19 (0.83)
Proportion of users doing physical activities at work	1.08 (0.66)	0.59 (0.85)	0.80 (0.69)	0.50 (0.91)
Proportion of users who feel park is safe	−1.94 (1.05)	−2.45 (1.35)	−1.70 (1.08)	−2.39 (1.39)
Weekend	0.55 (0.07)***	0.48 (0.08)***	0.55 (0.06)***	0.48 (0.08)***

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Table 5

Generalized Mixed-effect Model Estiamtes for Self -report of Park Visit, Safety Perception and Exercise. Significance levels are at .001 (***), .01 (**), and .05 (*). All effects are on the logit scale.

RESIDENTS	Frequency of visiting neighborhood park in the past 7 days Estimate (SE)	Consider neighborhood park safe Estimate (SE)	# Exercise sessions in the past 7 days Estimate (SE)
Intercept	−3.96 (0.30)***	3.42 (0.67)***	−0.64 (0.22)**
Survey season (Fall)	0.19 (0.17)	0.27 (0.39)	−0.01 (0.15)
Survey season (Spring)	0.38 (0.18)*	−0.66 (0.39)	−0.16 (0.13)
Survey season (Summer)	0.32 (0.17)	−0.09 (0.32)	−0.32 (0.11)**
Survey on weekend	0.03 (0.09)	0.40 (0.16)*	−0.09 (0.06)
Gender (female)	−0.19 (0.09)*	−0.29 (0.15)*	−0.21 (0.06)***
Race (Hispanic)	−0.35 (0.21)	0.56 (0.34)	−0.42 (0.15)**
Race (Black)	−0.30 (0.15)	−0.35 (0.28)	−0.43 (0.11)***
Visiting other parks ≥1x/wk	0.22 (0.08)**	0.21 (0.21)	0.25 (0.10)**
Doing physical activities at work	0.13 (0.09)	−0.37 (0.14)**	0.71 (0.09)***
Time watching screen(hours/day)	−0.03 (0.04)	0.04 (0.05)	−0.22 (0.03)***
Distance live from park (miles)	−0.20 (0.14)	0.08 (0.16)	0.19 (0.07)**
Know the park staff	2.48 (0.12)***	1.01 (0.15)***	−0.13 (0.08)
Self-rated health	0.19 (0.11)	0.34 (0.13)**	0.71 (0.11)***
% households in poverty	1.14 (0.52)*	−7.20 (1.43)***	−0.23 (0.48)
Consider park safe	0.31 (0.14)*	------	0.08 (0.11)
# park visits in past 7 days	------	------	0.14 (0.02)***
PARK USERS			
Intercept	−1.02 (0.21)***	3.95 (0.57)***	−0.33 (0.21)
Survey season (Fall)	0.17 (0.11)	0.05 (0.34)	−0.08 (0.13)
Survey season (Spring)	0.22 (0.11)	−0.71 (0.33)*	−0.08 (0.14)
Survey season (Summer)	0.30 (0.10)**	−0.12 (0.34)	−0.13 (0.12)
Survey on weekend	−0.35 (0.05)***	0.19 (0.17)	−0.07 (0.05)
Gender (female)	0.01 (0.05)	−0.35 (0.15)*	−0.24 (0.06)***
Race (Hispanic)	−0.13 (0.16)	1.43 (0.59)*	−0.07 (0.14)
Race (Black)	−0.27 (0.12)*	−0.39 (0.41)	−0.53 (0.09)***
Visiting other parks ≥ 1x/wk	−0.01 (0.07)	0.07 (0.17)	0.08 (0.07)
Doing physical activities at work	0.09 (0.06)	0.13 (0.17)	0.48 (0.07)***
Time watching screen(hours/day)	−0.04 (0.02)*	0.17 (0.06)**	−0.20 (0.02)***
Distance live from park (miles)	−0.01 (0.01)	−0.06 (0.05)	−0.02 (0.01)*

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We estimated energy expended in the park by using METs, the ratio of work metabolic rate to standard resting metabolic rate. (One MET is equivalent to 1 hour at rest or about 20 minutes walking briskly.) We assigned MET levels as 1.5 for sedentary, 3 for walking, and 6 for vigorous activity as listed in Ainsworth et al. (Ainsworth, Haskell et al., 2000). We fitted statistical models to compare the three categories of parks while adjusting for observed covariates. First, we fitted the park observations (# users and total METs) by mixed-effect models. We examined park use by place and time, with day as the unit of analysis, and aggregated the two outcomes to generate a longitudinal data set with 50 parks and 7 days of observations per park. We implemented robust standard errors to account for potential model misspecifications in drawing the formal statistical inference. Because the preliminary analysis indicated there was a nonlinear relationship between the observational outcomes and predictors, we used the log transformation for the raw outcome to handle nonlinearity as well as to stabilize error variances. Among several alternative means to modeling nonlinearity (i.e., various polynomial regressions and the Poisson regression), we found that the log transformation had the most ideal performance.

To account for the distinct park-level trajectories observed in exploratory analysis, we further used the random intercept, seasonal and weekend effects within each park, where the two random effects were assumed to be correlated. In these models we adjusted for fixed time effect (season and weekend), a rich list of park characteristics including the number of full and part-time staff, facilities for sports and other types of physical activity, areas that were open to the public, the number of observed organized or supervised activities, and location in a residential vs. commercial area. We entered two predictors from survey data separately for park users and residents: the percentage who said the park is safe or very safe and the percentage of users and residents who reported engaging in physical activity at work. We ran two models, one with all the predictors and one excluding potentially modifiable characteristics, which we defined as the number of supervised/organized activities that occurred during the observations, the number of park target areas that were accessible, the number of full and part-time staff, and the number of facilities in the park (like basketball and tennis courts). We considered them modifiable since their levels can be altered with reasonable efforts.

Second, we used a set of repeated-measure logit models to fit the survey responses. These survey responses are binomial counts (e.g., number visiting parks in the past 7 days) or Bernoulli trials (feeling the park is safe/unsafe). To account for the intra-class correlation among survey respondents within each park, we used the repeated measure approach accounting for clustering at the level of the park. The repeated-measure logit model is fit by the generalized estimating equation method. In these models we controlled for the same set of park characteristics as we did for analyzing the park observations. In addition, in order to control for oversampling based upon race/ethnicity we further controlled for the person-level characteristics, including gender, race/ethnicity, distance respondents lived from park, whether they know the park staff, self-rated health, time spent watching electronic media, frequency of visiting other parks, and whether they engaged in physical activity at work. Because the sample recruited from the park was very different than the household sample, we analyzed them separately. (Park users reported using parks at much higher rates than residents, but residents comprised a more representative sample of the general neighborhood population). The differences between the two groups are notable in the results of our statistical models.

Results

Park Characteristics, Park Management and Park Use (Table 1)

Of the 50 parks, 19 were in neighborhoods with >30% of households in poverty, 16 were from neighborhoods with 15–30% of households in poverty, and 15 were in neighborhoods with < 15% of households in poverty. Parks in the higher poverty neighborhoods were smaller (mean=9 acres) than those in medium and lower poverty neighborhoods (mean=16 acres) and they had fewer sport facilities. Parks in the higher poverty communities, for example, had about one-third as many sports fields as those in the lowest poverty areas.

All parks had a similar number of full-time staff, but those in higher poverty neighborhoods had fewer part-time staff and they offered fewer programs than those in lower poverty neighborhoods. Although all parks were required to have Park Advisory Boards (PABs) comprising local stakeholders to provide input into park activities, higher poverty area parks had fewer PAB members, although the difference was not statistically significant. Higher poverty parks were also less likely to use email to market their programs, but they were more likely to offer after school programs and snacks for youth.

On average we observed fewer park users in the higher poverty neighborhoods than in lower poverty neighborhoods, but there were more people per acre indicating the space is more densely used. Parks in high poverty neighborhoods had fewer organized and supervised activities per park compared to medium and low poverty parks, with almost a two-fold difference between the highest and lowest poverty area parks. In addition, high poverty area parks were more likely to have areas that were inaccessible, due to locked doors, fences or facilities.

The types of activities that park users engaged in differed substantially by gender, with females more likely to be sitting or using the playground area, while males were much more likely to be participating in sports like basketball, soccer or baseball. Among females, there were few differences between the type and prevalence of activities across neighborhood poverty levels. However, males in high poverty area parks were observed sitting more often than males in middle or high-income parks. In high poverty area parks, fewer played baseball, but more played soccer (Table 1).

There were no differences among observed park user characteristics in the highest, medium, and lowest poverty area parks: on average 62% were male, 32.5% were children, 15.2% teens, 48.1% adults, and 4.2% seniors. The proportions of observed park users engaging in the three activity levels were also similar in high, medium and low poverty parks (68% sedentary, 17% walking, and 14% vigorous).

Reports of Park Use and Physical Activity

We surveyed 3,654 park users and 3,249 residents. Compared to residents, park users were more likely to be Latino (74.8% vs. 62.0%, $p<.0001$), younger (median age 38 yrs vs. 42 yrs, $p < .0001$), reporting more visits to the park in the past 7 days (2.8 vs. 0.9, $p < .0001$) and living further from the parks (1.16 miles vs. 0.5 miles).

Park Users (Table 2)

Table 2

Differences among Park Users' Reports by Neighborhood Poverty (unadjusted) (N=3654)

	Park Users			
	High poverty n=1363	Medium Poverty n=1143	Low poverty n=1148	P value
Gender (% male)	40.3	36.8	35.9	0.05
Average age	37.8	37.0	39.3	<.0001
% Hispanic	90.5%	83.1%	47.9%	<.0001
% African American	4.0%	9.1%	4.1%	<.0001
% White	0.7%	6.2%	40.4%	<.0001
% Asian	3.5%	0.8%	1.9%	<.0001
Distance living from the park (miles) (median)	0.83 (0.33)	0.77 (0.42)	2.0 (0.62)	<.0001
Frequency of park use (at least once/week)	82.3%	83.8%	80.1%	0.14
Average # of visits in past 7 days	2.9	2.8	2.6	0.0003
Average length of stay (hours)	1.8	1.8	1.9	0.07
% walking to the park	54.0%	42.4%	27.0%	<.0001
% seeing people they know often/sometimes	66.5%	63.6%	57.27%	<.0001
% participating in park sponsored program	10.2%	9.6%	10.1%	0.84
% user fees prohibit participation	11.4%	8.8%	7.0%	0.0007
% perceive park safe/very safe	84.1%	90.9%	97.6%	<.0001
% visiting other parks (at least once/week)	10.4%	7.5%	11.5%	<.0001
% who exercise at park	40.5%	43.4%	34.4%	<.0001
% exercise at home	10.1%	8.5%	10.4%	0.26
% exercise at health club	2.9%	4.0%	9.3%	<.0001
% don't exercise	35.8%	36.2%	35.1%	0.86
Mean Frequency of exercise (sessions/week)	2.7	2.7	2.7	0.95
Mean screen time	2.7	2.6	2.6	0.14
Engage in physical activity at work	33.3	27.1	19.5	<.0001
Doesn't know park staff	34.8%	31.2%	31.3%	0.07
% of individuals who don't find out what is happening in the park	25.5%	30.0%	21.7%	0.006
Average grade for park staff	3.7	3.7	3.9	<.0001
Average BMI	26.4	26.3	25	<.0001
% overweight	49.7%	49.0%	37.2%	<.0001
% obese	13.8%	13.5%	8.0%	<.0001

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Although there were no differences across different poverty levels in terms of the proportion reporting usual visits to the park of at least once a week, park users in higher poverty areas reported having visited the park more in the last seven days than those in low poverty areas ($p < .0003$). Compared to park users in low and medium poverty areas combined, those in higher poverty neighborhoods tended to live much closer to the park (0.8 miles vs. 1.4 miles, $p<0.0001$). The median distance from the parks was .33 miles in high poverty parks, .42 miles in medium poverty parks and .62 miles in low poverty area parks. Accordingly, park users in high poverty areas were more likely to walk to the park than in medium and low poverty areas combined (54% vs. 34.7%, $p < 0.0001$). Additionally, they were more likely to report seeing people they know often or sometimes (67% vs. 60% $p < 0.0003$). They also were more likely to report exercising at the park but were less likely to exercise in a health club.

High poverty area park users rated park staff less favorably than those from medium and low poverty areas. High poverty area park users also perceived parks as less safe and were more likely to say that user fees presented barriers to their participation in park programs. There was no difference among high, medium, and low poverty area park users on the average amount of time they reported watching television or other visual electronic media.

Residents (Table 3)

Residents in low poverty neighborhoods were more likely to report usual visits to the park at least once a week or more than those in high poverty neighborhoods (32% vs. 25%, p<.0001), yet there were no differences in their reports of the number of visits in the previous seven days. Similar to the park users, residents in high poverty neighborhoods were more likely to report walking to the park, but no more likely to see people they knew when visiting there. Residents in high poverty areas were less likely to exercise in general, and especially at a private health club. Compared to low poverty area residents, those in high poverty area residents were less likely to find out what is happening in their park and to know the park staff. They also rated the performance of park staff lower. Additionally, high poverty area residents reported spending more time watching electronic media and were less likely to perceive their local parks to be safe than those from low poverty neighborhoods.

Models of Park Use (Table 4)

Neighborhood poverty level was a strong negative correlate of the number of park users and park-based energy expenditure. After controlling for other non-modifiable factors such as season, park size, population density, and average park user/resident perception of safety, we found that for every additional 10% of households in poverty, there was a 34% decline in the number of park users observed and a 37% decline in the METs expended in the park. Our model also estimated that a typical park in the high poverty category (9 acres, 37% poverty, and 58,000 people in 1-mile radius) had 40% fewer users (p=.01) and 45% fewer METs (p<.01) expended than a typical park in medium poverty category (16 acres, 22% poverty, and 36,000 people in 1-mile radius). However, the relationship between poverty and park use and energy expenditure was attenuated when considering the modifiable factors, including the staff, the number of facilities, the number of organized/supervised activities, as well as when accounting for areas of the parks that were accessible or not during the measurement periods. When these potentially modifiable factors were also controlled, the impact of additional 10% of households in poverty was associated with a reduction in park use and METs expended by 21% and 22%, respectively.

Each accessible area accounted for an additional 0.5% more park users and each inaccessible area was associated with 1% fewer park users per day. Each additional part-time park staff member was associated with 1% increase in the number of park users. On average, lower poverty parks had 8 more part-time staff, which if allocated to a high poverty park might translate to an additional 124 users counted during the 4 observation periods per day over 7 days. Each organized and supervised activity was associated with 4% and 7% more users per week, respectively. If the same number of organized and supervised activities were scheduled in the higher poverty area parks as in the low poverty area parks, this might translate to observing an additional 495 and 868 park users per week under the same setting as above, respectively.

Parks were used 73% more on the weekends than the weekdays, and those in residential areas were used 35% more than those in commercial areas.

Poverty's influence on self-reported park use, exercise and perception of park safety

The strongest correlate of park use for both residents and park users was knowing the park staff (Table 5). For a local resident who hypothetically had a 0.10 chance of visiting the park, knowing the park staff was associated with a substantial increase in the probability of visiting the park (i.e., to 0.57). However, for a park user whose hypothetical chance of visiting the park was 0.10, knowing the park staff was associated with a much smaller increase in the probability of visiting the park (to just 0.18). Among both residents and users, there was strong negative association between neighborhood poverty levels and perception of safety. There was a moderately weak association between perception of safety and park use among residents; however, this association did not exist among park users. For residents with a hypothetical 0.10 probability of visiting the park, a higher perception of safety would increase the probability to 0.13, a relatively small impact.

While it appears that being in a high poverty neighborhood was associated with a greater probability of going to the park for both residents and park users, the magnitude of the association was quite small (increasing the probability of use by only 0.01 for a resident or user whose hypothetical probability of use was 0.10). Among residents, the negative effect of perception of safety nullified the positive effect of poverty level on park use. Hence, when we consider the effect of perception of safety, our model suggests that a resident in a high poverty neighborhood still likely visits the park less often than those in low poverty neighborhood, providing the difference in poverty level is not excessively large.

Among residents, women and non-whites reported using parks less and exercising less frequently than males and whites. Those who did not engage in physical activity at work and spent more time watching electronic media were more likely to rate their health status as poor and less likely to use parks and to exercise. Among park users there was also a significant negative relationship between distance from home to the park and frequency of park use. However, this relationship was not significant among residents, as all residents sampled lived within a 1 mile radius of the parks.

Discussion

Neighborhood poverty level has a strong association with park use and park-based physical activity in this large Southern California city. The local environment and/or park characteristics could be primary determinants of park use, with fewer park resources and staffing leading to lower park use, or perhaps residents in high poverty areas choose to use park-based resources less. Additional possibilities are that a) both relationships are true, b) neither is true, or c) one or more unmeasured variables are responsible.

The evidence that the availability or characteristics of parks influence leisure time physical activity is limited. Only a few longitudinal studies of parks and playgrounds have measured park-based physical activity before and after elements of the park facilities have changed. Some very careful school-based studies using objective measures of physical activity have shown that children are more active when the characteristics of playgrounds and equipment are improved (Ridgers, Fairclough et al., 2010; Ridgers, Stratton et al., 2007; Stratton & Mullan, 2005). Other studies documented increases in physical activity (Cohen, Sehgal et al., 2009; Tester J & Baker R, 2009), but one study did not (Cohen, Golinelli D et al., 2009). In the latter study, the lack of increased physical activity following improvements in park facilities such as gymnasiums and indoor recreational space were accompanied by decreases in programming and other "demand" goods at parks. Meanwhile studies of school-based physical activity show that improved supervision of physical education classes (along with better curricula) and improved supervision of recess can result in increased physical activity (Connolly P & McKenzie T., 1995; McKenzie, Stone et al., 2001).

Part-time staff and supervised and organized activities were the modifiable factors most strongly associated with increased park use and energy expenditure. This finding is mirrored by the models based upon parks users and residents, which showed that knowing the staff was an important predictor of residents visiting parks in the past 7 days. Part-time staff may be more publicly visible than full time staff, since they generally are the people who direct or lead sports practices and special classes, which may constitute the "demand" goods that attract users. Individuals who reported knowing the park staff mostly rated these staff as performing at an "A" or "B" level, indicating they were generally liked and respected.

An important limitation of our study was its' cross-sectional nature, in that we cannot determine the direction of relationships among our variables. For example, we found that knowing the park staff who are at the park on a regular basis was associated with an increased perception of park safety. However, we cannot say with certainty whether this is because getting to know the staff makes people feel that the park is safer or whether people who go to the park also think it is safe and thus get to know the park staff. Our experience with parks in this geographic area is that staff turnover is greater in parks in high poverty areas, so it may be more difficult for local residents who use the park to get to know the staff. In addition, the reduced number of park staff and programming in high poverty parks could be either a reflection of demand and/or a reflection of the lack of ability of local residents to pay program fees that residents in higher income neighborhoods can afford.

The disparity in resources, staffing, and organized and supervised activities in high poverty area parks is also likely to be driven in part by their smaller acreage and fewer park facilities. However, this study indicates that lower use of parks in high poverty areas is proportional across all existing facilities, in other words, even when high poverty area parks have a gymnasium, classroom, or basketball court, they are still used less than parks in low poverty areas with similar facilities. The lower use may also be a manifestation of the reported greater time residents spend watching electronic media.

Other than average age and race/ethnicity, there were small differences among park users across neighborhoods. In high poverty neighborhoods, there were fewer regular park users, but those using the park lived closer and went more often. Parks in high poverty neighborhoods may function more as an extension of residents' backyard. In contrast, park users in wealthier neighborhoods traveled further to their parks and were more sporadic users. As a result, they may be less likely to meet others they know in the park. There were no differences among park users in the three socio-economic neighborhoods as to their exercise frequency and whether they knew the park staff. Although our focus was on the neighborhood, we did not have information about the socio-economic status of the park users and residents that were surveyed, which could vary considerably from the neighborhood average, which is another limitation.

Self-rated health was not associated with the frequency of park visits by residents, although it was for park users. Surprisingly, reports of better health were associated with perceptions of park safety, a finding that has been shown in another study (Tucker-Seeley, Subramanian et al., 2009). Perhaps there is a tendency for individuals to generalize how they feel about their neighborhoods to how they feel about their own well-being.

In contrast to Jane Jacobs' theory that a mixed use area attracts more park users (Jacobs, 1961), we found that parks in residential areas attracted more users than in commercial areas. Jacobs' theories were developed based upon experience primarily with the East coast urban areas, which have more mixed use. There are few mixed-use areas in the city and people seldom use public transportation, so parks in residential areas may be more conveniently located for regular use and have more parking available than those in commercial settings.

The disparities in park use and park-based physical activity associated with neighborhood levels of poverty might be addressed through policy interventions, if they are truly due to differences in resources rather than individual preferences. For example, it has been suggested that a reasonable policy goal would be to focus public resources on providing parks in high poverty areas with quality programs and activities (Abercrombie LC, Sallis JF et al., 2008; Babey, Brown, & Hastert, 2005; Godbey, Caldwell et al., 2005; Moore, Diez Roux, Evenson et al., 2008). Perhaps interventions focusing on making sure staff are more visible, such as wearing name tags and easily recognizable uniforms, might be useful. However, if people who live in high poverty areas are substituting park-based leisure time with time spent viewing electronic media, it may be very difficult to realize any changes, regardless of the efforts to improve parks.

Research is needed to determine what specifically will attract residents in high poverty areas to parks and support more physical activity in park settings. Given that local public parks can serve the majority of Americans, the potential impact of effective park-based interventions could be substantial.

Acknowledgments

Support/Funding Source: This study was supported by NHLBI # R01HL083869

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Journal of Physical Activity and Health, 2007, **4**, 167-179

The Role of Park Proximity and Social Support in Shaping Park Visitation, Physical Activity, and Perceived Health Among Older Adults

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Background: Health scholars purport that park proximity and social support promotes physical activity and health. However, few studies examine the combined contributions of these constructs in shaping physical activity and health. *Purpose*: In this study, the contributions of environmental and social characteristics in shaping park use, physical activity, and health are examined. *Methods*: A survey was distributed to 1515 older adults in Cleveland, Ohio. Results: Path analysis indicated that social support was directly related to health. Perceived park walking proximity was related to physical activity and health through park use frequency. Park proximity was directly related to park use duration. *Conclusions*: Results suggest that environmental and social characteristics contribute to physical activity and health, but perceptions may also be a prerequisite to park use, daily physical activity, and health.

Key Words: leisure, proximity, recreation, the built environment

The incidence of chronic diseases continues to increase across a broad spectrum of the US population. According to the Behavioral Risk Factor Surveillance System, the prevalence of obesity across the nationwide adult population has increased from 12% in 1990 to 22% in 2001.[1] But, according to *Healthy People 2010*, physical activity is the most modifiable aspect of a lifestyle that could improve health across the population.[2] According to Bouchard and Shephard's[3] physical activity and health framework, heredity, lifestyle, traits, physical environments, and social environments can *all* impact habitual physical activity patterns and health. A body of literature is now documenting the role of environmental characteristics in shaping physical activity and health.[4] While several studies have documented the

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relative strength of both social and environmental attributes in their relationship to physical activity and health, fewer have examined these relationships specific to public park environments and behaviors. In other words, less is known about the relative/unique contributions of park-based environmental, social, and behavioral characteristics in shaping physical activity and perceived health. An exploration of such relationships would inform social support and environmental strategies to promote active park visitation.

Study Purpose

Based on the relationships outlined in Bouchard and Shephard's[3] framework, our purpose was to examine the relative contributions of physical environmental characteristics (perceived and geocoded proximity to a public park) and social environmental characteristics (social support level and satisfaction with social support) in shaping the relationship between park-based physical activity (frequency and duration), daily physical activity, and perceived health.

Background Literature

Environmental Correlates to Park Visitation and Leisure Activity

Several studies have explored the contributions of built environment characteristics (e.g., street design, connectivity) in shaping activity and health. In particular, parks have been suggested as important settings for physical activity. Findings related to park proximity (e.g., the "closeness" of parks to residents) generally support a direct relationship between proximity and visitation and, to a lesser degree, an indirect relationship (through physical activity) between proximity and health. For example, numerous studies have documented the role of distance and proximity as they relate to park visitation, use of trails, and recreation activity.[5,6,7] These authors concluded that people who reside closer to recreation facilities are more likely to use them and use them on a more frequent basis. However, studies linking proximity to parks, exercise facilities, and physical activity have demonstrated mixed results. Sallis and colleagues[6] examined the distance between home and exercise facilities and found that people who lived in neighborhoods with a higher concentration of fee-based exercise facilities were more likely to report exercising three or more times per week. However, other studies[8] have not found a relationship between proximity to free facilities and increased physical activity. In terms of park proximity, findings more consistently support the notion that close proximity is associated with higher activity levels.[9,10] For example, Addy and colleagues found that neighborhood environments such as parks, playgrounds, sports facilities, and schools were significant predictors of physical activity and should be targeted in future interventions.

Social Support and Its Influence on Leisure, Physical Activity, and Health

In addition to physical environmental characteristics, psychosocial characteristics such as social support can also influence park-based and daily physical activity. Two models of social support have been developed to examine its influence on activity, health, and well-being: the main effect model and the stress buffering model (positing that social support protects people from the harmful effects of stress).[11] Reviews of the stress buffering effects on health have yielded inconsistent results. However, there has been evidence for a direct effect of social support on well-being and health.[11] In this main effect model, social support directly impacts illness or health, which may positively or negatively impact the risk for disease. The model also proposed that social support can influence physical activity and thus have an indirect effect on health.[12]

In epidemiological studies, social support has been related to physical activity across a variety of different populations using multiple measures.[13, 14] Few investigations have examined the role of social support in contributing to physically active leisure in outdoor environments (e.g., public parks). A recent study by Krenichyn[15] examined the role of social support in women's physical activity in an urban park. In that study, women stated that the social support provided by friends, acquaintances, and family members led to feelings of safety and enjoyment along with continued participation in organized park activities.

Relationships Between Physical Activity, Leisure, and Health

Positive relationships between physical activity and physical health are well-documented.[16] However, there is considerable debate concerning the relative influence of environmental and social strategies to increase physical activity across populations. Recently, Godbey, Orsega-Smith, and Payne[17] contended that the greatest potential for increasing physical activity levels (in the short term) will be through activities and settings that are inherently enjoyable and widely accessible to a broad population. Public parks often provide opportunities for inherently pleasurable leisure experiences and include low- or no-cost activity opportunities in virtually every community, making them an attractive asset in modifying a population's activity. In a study exploring relationships between stress, park-based leisure, and physiological health, Orsega-Smith, Mowen, Payne, and Godbey[18] found that, among high-stress respondents, length of time spent in a park was positively associated with physiological health conditions such as lower blood pressures. Overall, these early investigations suggest that leisure activities (many of which occurred in public park settings) are positively associated with health.

Despite the emerging research linking environmental and psychosocial characteristics with physical activity and health, there is a dearth of research concerning the combined role of environmental and social factors in relation to park-based leisure activity and health.[19] Recently, however, Giles-Corti and Donovan[20] investigated the relative efficacy of environmental, individual, and social characteristics in relating to physical activity. They found that individual and social determinants outweighed the influence of environmental characteristics in the visitation of recreational facilities. While their investigation provided key insights, they did not examine the role of environmental and psychosocial characteristics across a wider range of park visitation characteristics (e.g., frequency and duration). Moreover, they did not test whether the contributions of environmental and psychosocial characteristics on daily physical activity and perceived health would be mediated *through* park visitation frequency and duration. To build on their work, our study examined the relationships between both environmental (e.g., park proximity) and psychosocial (e.g., social support) characteristics, park visitation, daily physical activity, and perceived health.

Methods

Study Setting and Sample

The study setting was Cuyahoga County, Ohio (e.g., Greater Cleveland). Trained staff distributed self-administered questionnaires in parks, grocery stores, shopping malls, and senior centers across various regions of the county. Researchers strategically selected these data collection sites to represent different levels/types of sociodemographic and socioeconomic status. In parks, field staff set up tables with signs announcing the study and offering free blood pressure checks. The table was set up in high traffic areas such as trails and parking lots. In shopping malls, the table was placed near information kiosks. In supermarkets, field staff were stationed just inside or outside store entrances/exits to systematically intercept and distribute questionnaires to shoppers. A systematic sampling technique (nth person sampling) was used at these data collection sites to obtain a demographically diverse sample evenly distributed geographically across the county. Interviewers approached every other group of people who appeared to be age 50 or over, asked a screening question to verify their age, and offered a free blood pressure screening and other incentives to encourage participation. In senior centers, the questionnaire was administered to groups of up to 30 people in conjunction with congregate meal programs. A total of 3374 questionnaires were distributed during the data collection period, and 1515 completed questionnaires were returned using a business reply envelope (45% response rate).

Measurement

Independent Variables. Two psychosocial variables, two environmental variables, and one socioeconomic variable served as the independent (exogenous) variables in our path analyses. For our psychosocial variable of social support, we used the Social Support Questionnaire (SSQ).[12] This six-item scale measured two constructs: the number of people available to provide support to a respondent and the degree of satisfaction with that support. The SSQ measured social support by asking respondents whom they can count on for help in a variety of situations. For each of the six situations presented, respondents were also asked to list how satisfied they were with the support they would get for this item. For each type of support, respondents listed their relation to the individuals he or she could count on for help. Responses were measured on a six-point scale where 1 = *very dissatisfied* and 6 = *very satisfied*. Both a mean social support network size and a mean social support satisfaction score were then calculated for each respondent. Alpha reliability scale analyses yielded acceptable scores of 0.85.

For our environmental characteristics, we used both an objective and a perceived (self-reported) measure of park proximity. For the perceived measurement of park proximity, respondents were asked whether a public park was perceived to be within walking distance of their home (0 = *no*, 1 = *yes*). For the objective measure of park proximity, we geocoded the respondents' home addresses and calculated the straight-line distance (in 0.001 mile increments) from their house to the nearest park. Addresses that listed only a post office box ($N = 110$) were assigned a centroid location in the postal box region and geocoded to the nearest park. Furthermore, addresses outside of the county (2% of the respondent sample) were excluded from our sample. Missing distance data was excluded from subsequent analyses.

Exploratory analyses comparing gender across other study constructs (park proximity, physical activity, perceived health) revealed few differences. Socioeconomic status, however, has consistently been associated with park visitation, physical activity, and health status.[21,22] Analyses of our study data revealed that income was related to park visitation and physical activity. Based on these findings, only income was included along with proximity and social support as exogenous variables in our subsequent path model. Respondents were asked to report their household income from the previous year. The nine ordinal response categories used ranged from less than $10,000 to $120,000 or more.

Mediator Variables: Park Visitation and Daily Physical Activity. Measures of park visitation and daily physical activity were hypothesized to mediate the relationships between park proximity and social support on perceived health. Two dimensions of park-based leisure activity included frequency of visitation and duration of visit. These dimensions served as both independent and dependent variables depending on the path model stage.

Park visitation frequency was measured by asking respondents how often they visited local parks (1 = *not at all*, 2 = *occasionally*, 3 = *frequently*). Park visitation duration was measured by asking respondents how long they stayed during their most recent visit to their local park. Participants were asked to indicate (in hours and minutes) their length-of-stay from their most recent park visit.

Measurement of daily physical activity was derived from a single, ordinal item that queried respondents about their activity level (sedentary, moderate, or active) within an average day where a "1" was sedentary activity—"I spend most of my time sitting or standing, drive or take public transportation rather than walk, and I'm more likely to use an elevator than take the stairs," a "2" was moderate activity—"While my daily routine involves mainly sitting or standing, I take opportunities to get exercise by taking the stairs rather than the elevator, walking or cycling rather than using the car or public transportation," and a "3" was considered vigorous activity—"My daily routine involves a great deal of physical activity including a lot of walking, lifting, etc." This measure was used in prior studies examining overall physical activity levels.[23]

Dependent Variables. Perceived physical health was the dependent variable examined in our path analysis. This variable was derived from a sub-scale of the Rand Medical Outcomes Study (MOS) 20-Item Short Form Health Survey (SF-20).[24] Survey respondents were asked to describe the extent to which the following four statements were true: 1) "I am somewhat ill," 2) "I am as healthy as anybody I know," 3) "My health is excellent," and 4) "I have been feeling bad lately." Responses were coded on a five-point scale in which 1 = *definitely true* and 5 = *definitely false*. Following the procedures outlined by the scoring manual, we converted this five-point scale into a 100-point scale where 1 = *poorest health*, and 100 = *best health*. A mean score was then calculated from our four-item scale. Past use of the SF-20 indicates that it has a moderately high reliability ranging from 0.81 to 0.87 for the perceived physical health sub-scale across older adult and general population studies.[24] In our study, reliability analyses yielded a Cronbach's alpha of 0.78 for perceived physical health.

Data Analysis

Descriptive analyses (e.g., frequencies) were conducted for all independent, mediator, and dependent variables hypothesized in our model. Potential direct and indirect relationships between constructs were tested using path analysis. Path analysis was selected in lieu of structural equation modeling because several constructs (e.g., park proximity, and park-based physical activity) were measured by single items. According to Nunnally and Bernstein[25] structural equation analysis becomes less appropriate when the constructs of interest are measured with single items. We were interested in the nature of construct relationships (e.g., their relative strength and direction) for physical activity and perceived health. We posited a path relationship where park proximity, income, and social support would be positively related to levels of park visitation, physical activity, and perceived health. We also predicted that park visitation (e.g., frequency and duration) would mediate the relationships between park proximity, social support, physical activity, and perceived health. Our path analysis involved a calculation of standardized beta coefficients from a series of regression equations between the dependent, mediator, and independent variables. These beta coefficients reflect the strength of the relationships between study variables and are illustrated in the third column of Table 1 and in the model paths of Figure 1. Path analyses modeling involves a two-stage approach. First, all variables are entered into the model to determine initially significant relationships (initial model). Second, if the model is significant, the data is reanalyzed with insignificant variables (from the initial model) excluded. This final model is known as the trimmed model and is illustrated in Figure 1.

Results

The mean age of respondents was 67.4 y (range = 50 to 99 y, standard deviation = 9.0 y) and 66% were female. The sample was mostly white (88%) with about 10% African American, and the rest Hispanic, Asian, and other racial/ethnic groups. Thirty-eight percent reported household incomes of less than \$20,000. Almost 60% indicated that they were retired and 9% reported being a homemaker. Respondents were moderately active with only 27% reporting that most of their day is sedentary

Table 1 Regression Analyses of Path Coefficients (Initial Model)

Outcome variable	R^2	Independent variables	*β*	*P*
Perceived physical health	0.161	Daily physical activity level	0.267	0.000
		Household income	0.123	0.004
		Park visitation frequency	0.097	0.026
		Social support satisfaction	0.090	0.030
		Social support network size	0.089	0.036
		Distance to the closest park [a]	0.051	0.233
		Length of park stay	–0.042	0.311
		Park within walking distance [b]	0.016	0.712
Physical activity	0.048	Park visitation frequency	0.136	0.003
		Distance to the closest park [a]	–0.042	0.354
		Household income	0.028	0.538
		Park within walking distance [b]	0.025	0.581
		Social support network size	0.014	0.751
		Length of park stay	0.011	0.805
		Social support satisfaction	0.007	0.866
Park visitation frequency	0.098	Park within walking distance [b]	0.193	0.000
		Household income	0.198	0.000
		Distance to the closest park [a]	–0.067	0.122
		Social support network size	0.056	0.206
		Social support satisfaction	–0.016	0.706
Park visitation duration	0.040	Distance to the closest park [a]	0.140	0.002
		Household income	–0.132	0.003
		Park within walking distance [b]	–0.046	0.300
		Social support network size	0.023	0.611
		Social support satisfaction	–0.014	0.754

[a]objective park proximity measure; [b]perceived park proximity measure

with a lot of sitting/standing, 43% indicating that they get some daily opportunities for exercise, and 30% noting that their day involves a great deal of physical activity. In terms of park visitation, 53% indicated that they were occasional visitors of local parks while 33.1% reported that they were frequent park visitors. For our measure of perceived park proximity, 51% indicated that a park was within walking distance of their home. The average geocoded distance from respondents'

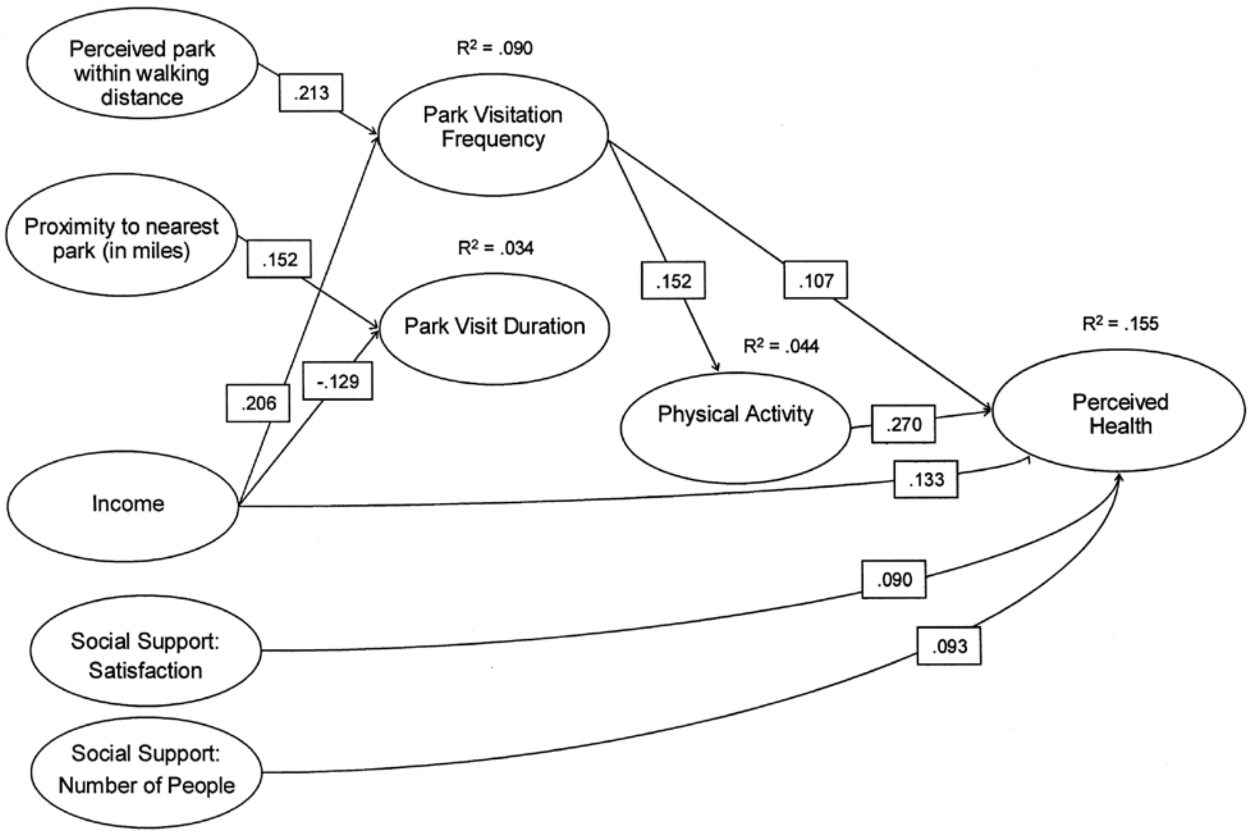

Figure 1—The role of proximity, income, and social support in relation to park visitation, physical activity, and health (trimmed model)

households to the nearest park was 1.34 miles (range = 0 to 4.54 miles, standard deviation = 0.98). Satisfaction with social support network was moderate with an average score of 5.3 (out of a possible score of 7.0) and the average number of individuals within respondents' social support network was 2.32 individuals. Finally, perceived health scores, as calculated by the SF-20, indicated moderate perceived physical health for this age group (50 + y) with average scores of 70.66 out of a total score of 100.

Path coefficients were estimated by simultaneously entering independent variables for each hypothesized dependent variable in the model using ordinary least squares regression. Collectively, the overall model was significantly related to perceived health. While the model was statistically significant, its overall explanatory power was relatively weak (R^2 = 0.161) (Table 1). This estimated model offered evidence concerning the relative strength of both environmental and social characteristics to park-based leisure activity, daily activity, and perceived health. Consistent with prior research, physical activity had a direct positive effect on perceived physical health (β = 0.267). Park visitation frequency had an indirect effect on perceived health through its effect on daily physical activity (β = 0.136) (Table 1). Of the park visitation variables, only park visitation frequency was directly related to positive perceived health (β = 0.097). Those who visited parks more frequently were more likely to report higher levels of perceived physical health. Household income (β = 0.123) and both domains of social support (i.e., social support network size and satisfaction) had direct and positive relationships with perceived health (β = 0.090 for social support satisfaction and β = 0.089 for size of the support network, respectively). However, neither the perceived park proximity measure (walking distance to a park) nor the objective park proximity measure (geocoded distance to the park) measure was directly related to perceived health. Across all study constructs, daily physical activity level had the strongest direct relationship to perceived health. There were no direct effects between park proximity, income, social support, or park visitation length of stay on daily physical activity. However, park visitation frequency had a direct and positive significant relationship on daily physical activity. In terms of indirect effects, park visitation frequency mediated the relationship between perceived park proximity and daily physical activity. However, there were no other significant mediating effects found in our analyses.

When using park visitation measurements as outcome variables, both the frequency and length-of-stay paths were significantly, but modestly related to the independent variables (R^2 = 0.098 and 0.040, respectively). Significant and positive relationships existed between a perceived park proximity (β = 0.193), household income (β = 0.198), and park visitation frequency. Positive relationships also existed between objective park proximity (β = 0.140) and park visitation length of stay while a negative relationship was found between income (β = –0.132) and park length-of-stay. In addition, perceived park proximity was not significantly related to park visitation duration and objective park proximity was not significantly related to park visitation frequency. Finally, it should be noted that social support measures were not significantly related to either of the two sub-domains of park visitation. Figure 1 summarizes the reduced path model with non-significant paths deleted. Given that all study constructs had at least one significant path, all variables from the hypothesized model remained in this trimmed model. The importance of income, daily physical activity, and social support and their direct relationships with perceived physical health are evident in this reduced model.

Discussion

Results from this study indicate significant, but weak indirect relationships between park proximity, park visitation, daily physical activity, and perceived health *and* direct, but moderate relationships between social support and perceived health. The strength of the model was modest, supporting the need to explore the collective explanatory contributions of other individual, social, and environmental constructs (e.g., self-efficacy, perceived neighborhood "walkability," objective elements of community design and density) in relation to park-based leisure activity and perceived health.

Similar to prior health indicator models,[26] we found that daily physical activity and household income were the strongest correlates to perceived health. A direct and positive relationship between social support satisfaction, size of the social support network, and perceived health was also demonstrated. Social support outweighed the influence of environmental characteristics (e.g., perceived and objective park proximity variables) in their direct relationship to perceived health. However, our measures of park proximity were more robust than social support measures in their relationship to park visitation behaviors and their indirect relationships with daily physical activity. These findings contradict an earlier study by Giles-Corti and Donovan[20] who found that individual and social characteristics were more influential than environmental characteristics in relating to recommended exercise activity behaviors. However, our results are consistent with Giles-Corti and Donovan's[27] subsequent study of walking in which public open space was specifically examined. In that study, Giles-Corti and Donovan found that the relative influence of individual, social, and physical factors were of equal importance in explaining physical activity. Nevertheless, the reader is cautioned that our measure (SSQ) was a more global characterization of social support and was not specifically tied to exercise and physical activity behavior. Future studies should address this limitation by examining the role of social support for physical activity in its relationship to park-based leisure activity, physical activity, and perceived health.

We also found that perceived park proximity (e.g., whether a park was perceived to be within walking distance to their house) was directly related to the frequency of park visitation but not the duration of the park visit. As expected, respondents who reported that they lived within walking distance to a park were more likely to be frequent park visitors.

According to public health researchers, investigations that use objective (as opposed to perceived) environmental and physical activity measures are needed. Recall accuracy, over-estimation and social desirability biases are often cited as deficiencies in such self-reported measurements. However, our findings indicated that perceived park proximity was more robust than objective park proximity in relation to self-reported park visitation frequency and daily physical activity. Here, perceived park proximity had significant direct and indirect relationships with reported park visitation frequency, daily physical activity, and perceived health. Our objective measure of park proximity (e.g., straight-line mileage to the nearest park edge) was related only to respondents' length of park stay. Visitors who lived farther from parks were more likely to stay longer. Such findings suggest that while objective distance measures are an important global correlate to physical activity behavior and perceived health, individual awareness and perceptions of such environments may also be important prerequisites to physical activity.

Our findings also indicated that park-based leisure activities played a small, but significant role in relating to perceived health through daily physical activity. Park length of stay, which had been linked to positive physiological health outcomes (e.g., lower blood pressure) in prior park-based health research,[18] did not contribute to daily physical activity nor to perceived health. One explanation could be that longer park visits were associated with more sedentary park behaviors such as picnicking, driving, etc. and, thus should not be expected to influence perceived physical health. However, logic might also suggest that longer park visits could still be positively related to *mental* health (e.g., providing more time to cope with stressful life events).

Study Limitations and Conclusions

This study was subject to a number of limitations that influence its generalization and interpretation. First, its design was cross-sectional and not longitudinal. As such, the relationships could be reciprocal rather than predictive. Second, our measure of social support was global and was only related to another global variable (perceived health). Future research should build on our findings and explore the role of social support for leisure in its relationship to health. Third, with the exception of our geocoded distance measure, study constructs were operationalized using self-reported measures. Future attempts to extend our analyses should incorporate additional objective measures of physical activity (e.g., accelerometer and observational data) and health (e.g., physiological measures such as blood pressure, cortisol levels, etc.). Fourth, the objective measure of park proximity (e.g., geocoded distance between residences and parks) had a relatively narrow range (0 to 5 miles). Given the predominantly motorized travel mode used by the sample, such a compressed range may not be sensitive enough to differentiate degrees of park proximity. Future studies that allow a wider range of access possibilities and travel distances are encouraged. Finally, our measure of park visitation duration was less global (e.g., length of their *most recent* park visit) than the park visitation frequency measure. Assessing the average visit duration across a longer time frame would have been more consistent with other park-based activity variables used in this study and, as such, should be addressed in future research. It should also be noted that participants' most recent visit may not have been indicative of their typical length-of-stay across the year (e.g., summer visits may be longer than winter visits).

Our analyses indicated that social and environmental characteristics were related to perceived health in an older adult population. Efforts to promote population health should follow a multi-pronged approach; focusing on proximity to physical activity opportunities, awareness of those opportunities, and promotion of social networks to support activity at those opportunities. Given the ubiquity of public parks in the United States, their latent potential for increasing a population's physical activity is promising. As interdisciplinary research teams coalesce in their efforts to examine the role of environments in shaping physical activity, research in park settings should continue.

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Urban Forestry & Urban Greening
Volume 6, Issue 4, 15 November 2007, Pages 235-247

Access to green areas and the frequency of visits – A case study in Helsinki

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https://doi.org/10.1016/j.ufug.2007.05.003

Abstract

Environmental considerations concerning physical activity and health relate to accessibility, and this accessibility is directly influenced by how recreation areas and facilities are provided and managed. This study aims to provide some evidence to support the general argument that a good supply of recreation opportunities encourages people's participation in outdoor recreation. The study's data are compiled from an outdoor recreation survey of Finnish 15- to 74-year olds, conducted between 1998 and 2000, which focused on the recreational behaviour of people living in Helsinki (n=367), and their visits to close-to-home outdoor recreation areas. Almost all (97%) of the Helsinki residents surveyed participated in outdoor recreation during the year. Half of them embarked on a recreational outing daily or every other day. The most typical close-to-home activity was walking for pleasure or fitness. Other popular activities were cycling, jogging, dog walking and outings with children. Physical or fitness activities represented about 90% of all close-to-home outings. Those who lived in the suburbs of Helsinki participated in close-to-home recreation significantly more often than those living in the city centre, and had done so more recently in terms of when the survey was conducted. The amount of green areas in the vicinity of the participant's residence and the short distance to green areas suitable for recreational use increased the number of close-to-home outings among Helsinki residents. This supports the argument that a good provision of opportunities promotes an active lifestyle. Thus, recreation areas and facilities should be located close to residential areas, and provide safe, comfortable and year-round access for daily outings.

Previous

Next

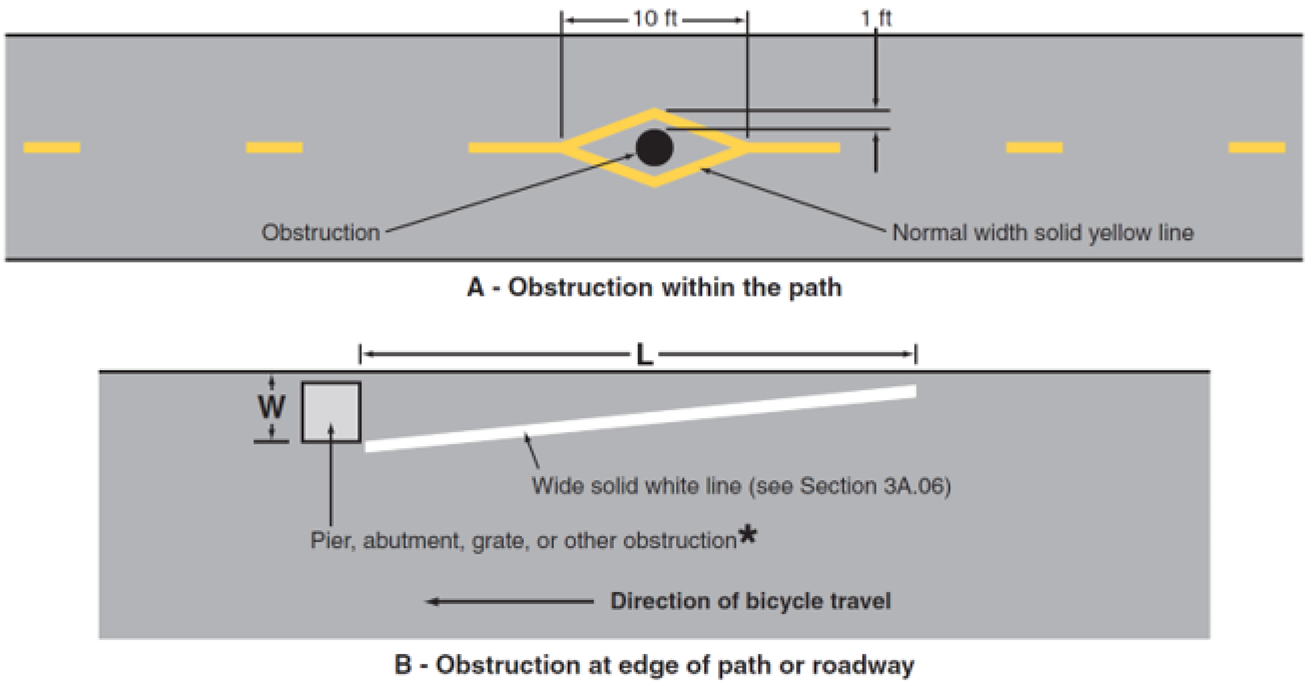
Keywords

Accessibility; Close-to-home recreation; Daily recreation; Outdoor recreation; Recreation area; Visitation

APPENDIX E

EXCERPT FROM THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

Figure 9C-8. Examples of Obstruction Pavement Markings



L = WS, where W is the offset in feet and S is bicycle approach speed in mph

* Provide an additional foot of offset for a raised obstruction and use the formula L = (W+1) S for the taper length

Figure 9C-9. Shared Lane Marking

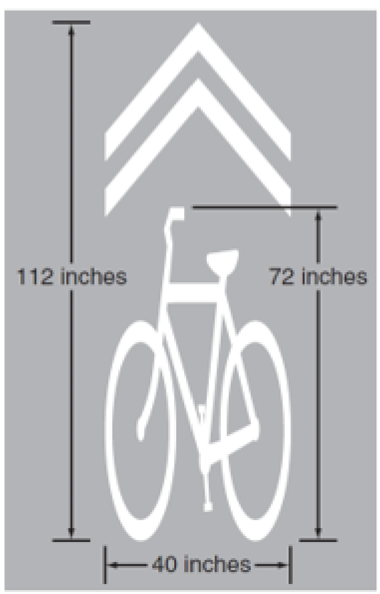


Figure 9C-108 (CA). Example of Placement of Shared Lane Markings