Appendix T:

Network Development and Performance

Final

December 2021

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Appendix T:
Network Development and Performance

This appendix describes how the transportation system for San Diego Forward: The 2021 Regional Plan (2021 Regional Plan) was developed and details its anticipated performance.

Developing the Vision

The Vision for the 2021 Regional Plan was developed through application of key strategies known as the 5 Big Moves. Chapter 1 and Appendix A: Transportation Projects, Programs, and Phasing describe the 5 Big Moves.

The development of the Vision started from scratch with a data-driven approach to understand travel flows. The projects, programs, and services developed through this process are the product of this effort and provide a blueprint for increased mobility in the San Diego region through 2050.

At the same time, the resulting transportation system was coupled with already in-progress or recently completed projects (referred to as "No-Build" projects), and the Regional Arterial System (RAS).

The Vision is mindful of anticipated regional growth and the need to address congestion, improve social equity, and achieve both state and federal mandates and goals for reducing greenhouse gases (GHGs) and protecting the environment.

No-Build Projects

No-Build projects are projects that would be built in the region in absence of the 2021 Regional Plan because they are in progress or have recently been completed. A list of No-Build projects is included in this appendix to ensure the transparency of those projects that are included with the background inputs for future phase years (including 2025, 2035, and 2050). Comparisons of performance between future years strikes a contrast between No-Build and Build to demonstrate the contribution of the projects and programs included in the 2021 Regional Plan. The No-Build projects for the 2021 Regional Plan are shown in Table T.1.

Table T.1: No-Build Projects

No-Build Projects			
Category	**Project**	**Description/Jurisdiction**	**Note**
Active Transportation	Bayshore Bikeway: Segments 4B and 5	San Diego, 32nd Street Naval Station, National City	Completed
Active Transportation	Inland Rail Trail: Phase 1	San Marcos, Palomar College	Completed
Active Transportation	SR 15 Commuter Bike Facility	Mission Valley, Kensington	Completed
Active Transportation	Coastal Rail Trail Encinitas: E Street to Chesterfield Drive (Chesterfield–Santa Fe)	Cardiff	Completed
Active Transportation	Inland Rail Trail: Phase 2	San Marcos, Palomar College	Completed
Active Transportation	Coastal Rail Trail San Diego: Rose Creek	Pacific Beach, Bay Ho, University City	Completed
Active Transportation	North Park/Mid-City Bikeways: Georgia–Meade Bikeway	Hillcrest, North Park, University Heights, Normal Heights	Under Construction
Active Transportation	North Park/Mid-City Bikeways: Landis Bikeway	North Park, City Heights	Under Construction
Active Transportation	Uptown Bikeways: Fourth and Fifth Avenue Bikeways	Downtown, Bankers Hill, Hillcrest	Under Construction
Active Transportation	Bayshore Bikeway: Barrio Logan	Barrio Logan, Downtown, 32nd Street Naval Station	Final Design
Active Transportation	Border to Bayshore Bikeway	Imperial Beach, San Ysidro	Final Design
Active Transportation	Coastal Rail Trail: Santa Fe Undercrossing to E Street	Encinitas	Final Design
Active Transportation	Imperial Avenue Bikeway	East Village, Sherman Heights, Grant Hill, Mountain View	Final Design
Active Transportation	Inland Rail Trail: Phase 3	Vista	Final Design
Active Transportation	North Park/Mid-City Bikeways: University Bikeway	City Heights, Rolando, La Mesa	Final Design
Active Transportation	Uptown Bikeways: Eastern Hillcrest Bikeways	Hillcrest	Final Design
Active Transportation	San Diego River Trail: Stadium Segment	Mission Valley, San Diego State University West	Under Construction
Active Transportation	Chollas Creek Bikeway to Bayshore Bikeway	Encanto, Southeastern San Diego, Barrio Logan, and Mid-City	Final Design

No-Build Projects			
Category	**Project**	**Description/Jurisdiction**	**Note**
Active Transportation	Coastal Rail Trail – Gilman Connector	La Jolla, City of San Diego	Under Construction
Active Transportation	North Coast Bike Trail	Gilman Drive to San Luis Rey River Trail (remaining segments)	Final Design
Complete Corridors	I-5 North Coast Corridor (I-5/I-805 Merge to SR 78)	One high-occupancy vehicle lane in each direction	CAL09 – Sept 2022
Complete Corridors	SR 94/SR 125	South to east connector	CAL68 – Feb 2025
Complete Corridors	SR 52 Operational Improvements (I-805 to SR 125)	Westbound Mast to Santo Road Truck Climbing, Santo to I-15 eastbound auxiliary lanes	CAL536 – Dec 2023
Complete Corridors	SR 11 (SR 125 to Mexico) + Port of Entry (POE)	New roadway between SR 125 and Mexico, plus POE facility	V11 (SANDAG ID: 1201101, 1201102, 1201103, 1201105)
Complete Corridors	SR 11/SR 905	Connectors	CAL325A/38C
Transit	Mid-Coast Trolley	Old Town to University City	SAN25 SAN23 – Sep 2021
Transit	South Bay *Rapid*	Otay Mesa to Downtown San Diego	SAN47 – Jan 2019
Transit	Los Angeles – San Diego – San Luis Obispo (LOSSAN) Rail Corridor Double Tracking	San Diego to Oceanside	SAN29, 64, 66, 73, 114, 119, 132

The Regional Arterial System

The RAS constitutes part of the local street and road network that, in conjunction with the system of highways and transit services, provides for a significant amount of mobility throughout the region. Regional arterials are longer contiguous routes that provide accessibility between communities within the region and that may also allow subregional trips to avoid freeway travel. The RAS includes roads eligible for the Regional Transportation Congestion Improvement Program included in the *TransNet* Ordinance and other funding. The RAS was last updated through an extensive process as part of the 2030 Regional Transportation Plan (RTP) (November 2007). Minor adjustments were requested and incorporated in subsequent Regional Plans and in the 2021 Regional Plan. An RAS has been included as part of the RTP since 1989 and includes over 1,000 miles of roads.

Regional Arterial System Screening Criteria

To qualify for the updated RAS, arterials must meet at least one of four approved criteria shown below. The first criterion is that the arterial is already included in the existing RAS. Any additions to the network must meet one of the remaining three criteria:

- Provides parallel capacity in high-volume corridors to supplement freeways, state highways, and/or other regional arterials (Corridor)
- Provides capacity and a direct connection between freeways or other regional arterials, ensuring continuity of the freeway, state highways, and arterial network throughout the region without duplicating other regional facilities (Cross-Corridor)
- Provides all or part of the route for existing or planned regional and/or corridor transit service that provides headways of 15 minutes or less during the peak period

There are certain design characteristics that can help facilitate regional trip movements on the RAS. These characteristics include:

- Interconnection and systems management of traffic signals
- Raised or striped medians
- Limitation and separation of left-turn movements
- Limited driveway access and other access controls
- Grade separations at rail crossings
- Shoulders and bikeways to accommodate bike movement
- Pedestrian treatments at intersections
- Priority traffic signal systems for transit service
- Bypass or “queue-jumper” lanes for transit service at critical intersections
- Enhanced transit stops
- Pedestrian facilities designed according to the Regional Pedestrian Design Guidelines
- Modern roundabouts and alternate intersection design where appropriate
- Freeway interchange modifications in accordance with Caltrans standards

A complete listing of the RAS is provided in Attachment 2, Table T2.1.

2021 Regional Plan Components

To develop the 2021 Regional Plan revenue-constrained transportation network, staff considered various factors and inputs in both the development and phasing of the projects, programs, and services included in the network. Multimodal evaluation criteria, anticipated revenues, and social equity were all used to develop the project phasing. The intent of the project phasing was to advance as many transit projects first along with their associated

supportive roadway improvements (e.g., Managed Lanes) based on the anticipated revenues. Additional project components included:

- **Project Readiness:** A review and understanding of project readiness helps to ensure that projects are ready for development and implementation as planned. Costs are spread over estimated project development and construction timelines. These estimated timelines vary by mode and type of project and were developed based on current or previous projects. The construction timeframes used in the 2021 Regional Plan by project type are as follows:

  Transit Leap

  - Commuter Rail: 14 years
  - Light Rail Transit Improvements – Enhancements, Extensions, and Grade Separations: 8 Years
  - *Rapid* and Tram: 8 Years
  - Regional Transit Centers: 8 Years
  - Transit Maintenance Facilities: 6 Years

  Complete Corridors

  - Managed Lanes, Managed Lane Connectors, and Rural Highways: 6 Years

  The estimated costs, distributed over the construction timeframes, take into account different expenditure levels for different phases of the projects. Initial start-up costs for project planning, environmental clearance, and project design are relatively low. The later phases of the project including right-of-way acquisition (if needed), construction, and testing (if needed) account for the bulk of the total project costs.

  Since RTPs are required to demonstrate escalated costs (i.e., "year-of-expenditure" costs), how costs are distributed over the project delivery timeline is important.

- **Project Connectivity:** Project connectivity is considered largely to ensure that projects are not phased in non-consecutive segments. Timelines of adjacent supporting projects are also relevant from a project connectivity standpoint, as is land use change.
- **Evaluation Criteria:** Evaluation criteria is a helpful tool to showcase the merits of projects or of groups of projects. For the 2021 Regional Plan, SANDAG applied a project "bundle" evaluation criteria approach to rank those corridors according to anticipated benefit. A more detailed methodology of this evaluation criteria is in the "2021 Regional Plan Components" introduction.

Project Bundle Evaluation Criteria

An extensive effort to update the transportation project evaluation criteria was undertaken during the development of the 2021 Regional Plan, which involved a different approach than those developed for prior RTPs. In the past, SANDAG used transportation project evaluation criteria to prioritize projects by modal category (e.g., individual criteria for highway, transit service, active transportation, etc.). For the 2021 Regional Plan, multimodal bundles of projects were created to better reflect choices travelers face when traveling to and from regional destinations. For example, projects along the I-5 North Coast Corridor were grouped and included both transit and Managed Lane improvements. Evaluation criteria were developed to reflect plan goals and applied to each project bundle in the Vision network.

Background

Evaluation criteria were developed in three key areas:

1. Mobility and Safety
2. Environment and Quality of Life
3. Economy

The categories align with 2021 Regional Plan goals, which are:

- **Fast:** The efficient movement of people and goods
- **Fair:** Access to affordable, reliable, and safe mobility options
- **Clean:** Healthier air and reduced GHG emissions

Methodology

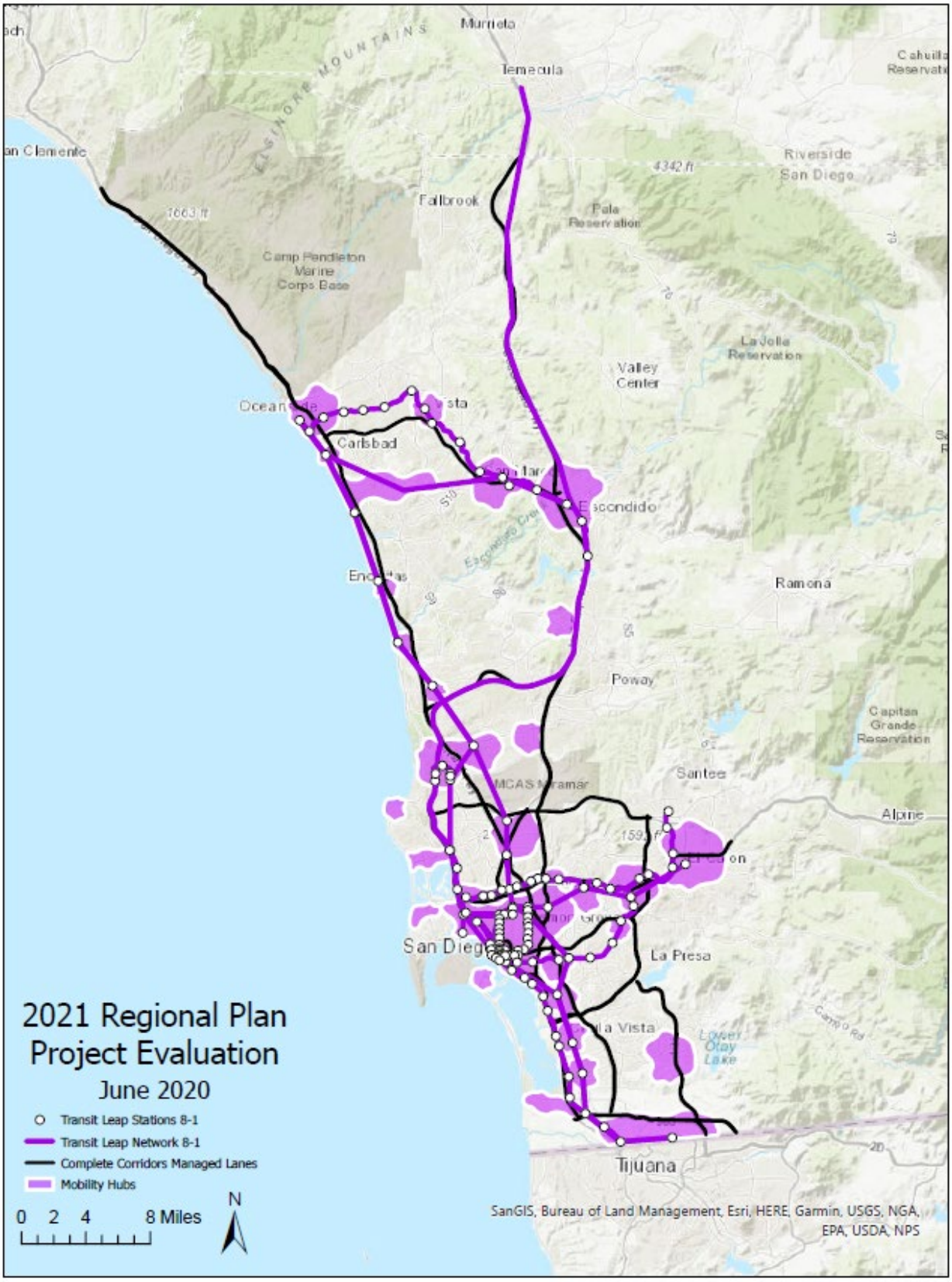
Travelers are increasingly making travel decisions based on a suite of transportation choices and linking these transportation modes together to improve trip experience (e.g., biking to the transit station or driving to the Park & Ride). The traditional approach of evaluating projects by modal category does not take the multimodal nature of the transportation system into account. For the 2021 Regional Plan, SANDAG developed a new methodology with multimodal evaluation criteria and projects.

Following the 5 Big Moves data-driven approach to develop a comprehensive and integrated transportation system, the project-evaluation criteria methodology relied on regional data and information analyzed with geospatial tools (ArcGIS) and spreadsheets (Excel).

Development of Project Bundles

The first step was to bundle the Unconstrained Transportation Network projects into project bundles that captured multimodal travel choices for regional routes. A two-phase process was followed first for the creation of the bundles and then for validation.

Figure T.1: Initial Evaluation Criteria Bundle Analysis



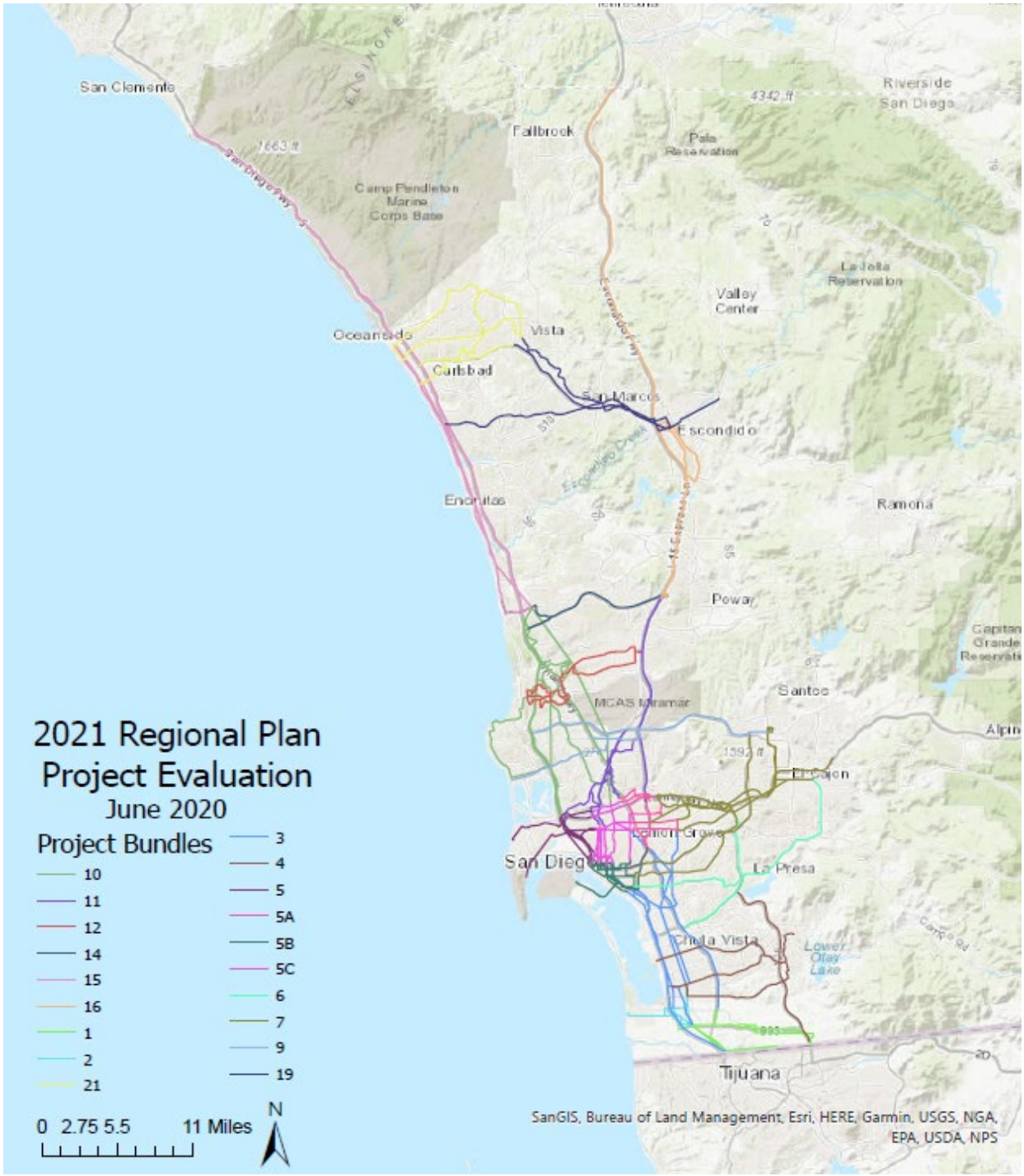
During the first phase, the following steps were followed to generate the project bundles:

1. With the understanding that the 2021 Regional Plan Vision was developed to connect key origins and destinations, the work began by overlaying the highway network (Managed Lanes projects), Transit Leap, and Mobility Hub layers from the layer. See Table T3.1 in Attachment 3 to this appendix for further detail on data sources.
2. The network was then divided by major north–south (e.g., I-5 corridor, I-15 corridor, etc.) and east–west connections (e.g., SR 56, SR 52, SR 78, etc.).
3. Longer routes were separated at key regional destinations and Mobility Hubs, such as Sorrento Valley, Downtown, and El Cajon.
4. Parallel transit and arterial routes serving a similar north–south and east–west movement were grouped together to create bundles.
5. Areas with unique internal travel patterns and characteristics were separated (e.g., border crossing area, Imperial Beach, Downtown, and Oceanside).
6. Transit routes were separated at major station locations.
7. Complete Corridor Managed Lanes were separated in alignment with transit or at the point where they crossed into a different geography.
8. Although not reflected in Figure T.2, regional arterial projects within the bundle area are part of each bundle.
9. The project bundles were reviewed by staff and refined into the final GIS layer (for a total of 19 bundles). See Attachment 3.

In the second phase, regional origin and destination trip data acquired from Teralytics was used to validate travel patterns for each bundle. Teralytics determines origins and destinations based on cell tower data. These data are aggregated to Census tract geography and determine a trip to be completed when dwell time is longer than 30 minutes (no intermediate destinations or linked trips).

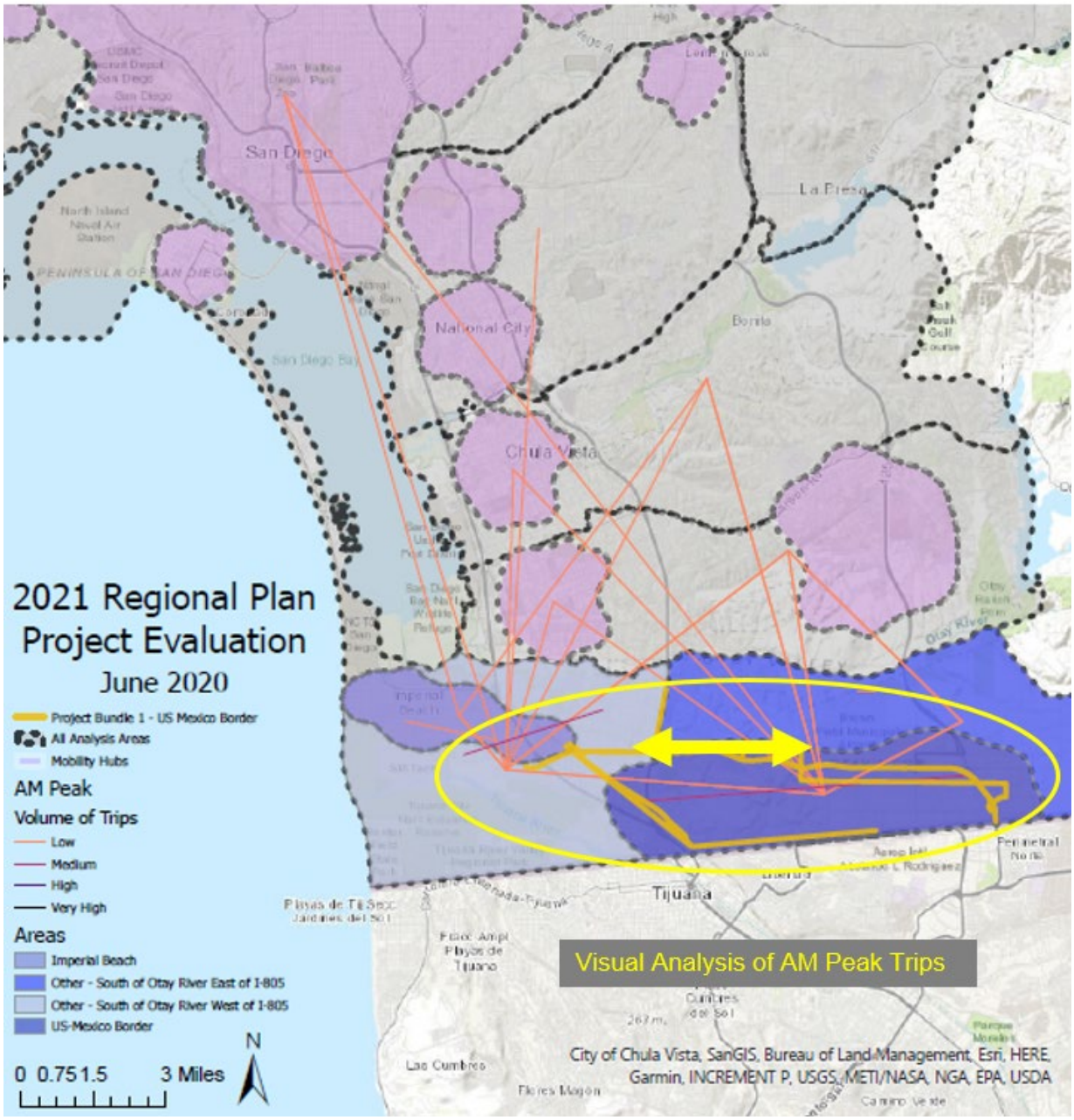
For processing feasibility, Teralytics data was filtered to weekday a.m. peak trip volumes, 6 a.m. to 9 a.m. Teralytics data was aggregated by Mobility Hub. The remaining trips were aggregated into larger “other” geographies delineated at Census tract boundaries to represent similar areas such as a jurisdiction. Natural breaks in the trip data (as identified by ArcGIS software) were used to aggregate trips into five trip-volume thresholds. For clarity, the lowest threshold (very low) is not displayed on the maps (sample shown in Figure T.3).

Figure T.2: Project Bundle Evaluation Corridors



For each bundle, trip data were filtered to show only trips that begin and end within each bundle area. A visual analysis was performed for each bundle. Most of the bundles clearly align with high volume travel patterns. Some of the bundles have lower trip volumes in general but are supporting routes or communities that are affected by regional travel patterns, including trips that have origins and destinations outside of the bundle area but use the corridor identified in the bundle. An example of this analysis is shown in Figure T.3.

Figure T.3: Project Bundle Analysis Example – Project Bundle #1 – U.S.–Mexico Border



Project Bundle Evaluation

The evaluation criteria were developed in parallel to the project bundles. Once project bundles were finalized and validated, the evaluation criteria were applied to each project bundle.

Evaluation Criteria

Indicators were developed for three categories: Environment and Quality of Life (EQL), Mobility and Safety (MS), and Economy (EC). Seventeen separate measures were defined. A weighting was assigned to each indicator (see Table T.2) based on the contribution and alignment of the criteria to the category along with a recognition of evaluation criteria weightings from prior efforts.

Table T.2: Evaluation Criteria

Evaluation Criteria		
Criteria	**Description**	**Weighting**
Environment and Quality of Life		**35**
EQL1 Access to Transit	People and jobs within a half mile of a transit station or within a Mobility Hub[1]	10
EQL2 Activity Centers	Activity Centers within a quarter mile of a transit station	3
EQL3 Network Connectivity	Number of direct connectors and direct access ramps	2
EQL4 Mode Availability	Measure of mode availability (in miles) for transit, Managed Lanes, and general-purpose lanes	2
EQL5 Bike and Pedestrian Access	Portion of projects that are located within a Mobility Hub[2]	3
EQL6 Communities of Concern	Communities of concern (seniors, minorities, low-income residents) within a half mile of a transit station or within a Mobility Hub	10
EQL7 Transit Access to Future Density	Number of transit stations located within Mobility Hubs[3]	5
Mobility and Safety		**30**
MS1 Person Peak Throughput Capacity (PTC)	Transit PTC (MS2) + Vehicle PTC (MS3) times vehicle occupancy	5
MS2 Transit PTC	Peak transit capacity (transit rider capacity per number of vehicles/headways per hour)	3
MS3 Vehicle PTC	Peak vehicle capacity (vehicles per lane per hour)	2

[1] Mobility Hubs offer increased services and infrastructure improvements to access transit.
[2] Captures concentration of bicycle and pedestrian improvements focused in Mobility Hub areas.
[3] Mobility Hub areas are used as a proxy for future density.

Evaluation Criteria		
Criteria	**Description**	**Weighting**
MS4 Congestion	Travel time reliability and average peak hour of excessive delay per lane (NPMRDS data)	10
MS5 Safety	Safety incidents (fatalities, serious injuries, and visible injuries)	5
MS6 Transit Reliability	Transit reliability measured by miles of dedicated guideway and transit priority investments	5
Economy		**15**
EC1 Transportation Affordability	Estimated cost of travel	5
EC2 Jobs	Access to employment center	5
EC3 Freight	Relevance to National Highway Freight Network and other freight corridors; proximity to land uses relevant to freight movements (agriculture, industrial, commercial, etc.)	5
Cost–Benefit (Cost Effectiveness)		**20**
	Total	**100**

Evaluation Methodology

The evaluation of the bundles was performed over two phases. First, a geospatial analysis was performed for each indicator. Data results were exported to an Excel evaluation matrix that scored and ranked each bundle per the criteria in Table T.2. Detailed methodology performed for each indicator is found in Attachment 4. Results of this analysis are shown in Table T.3. The scores in Table T.3 represent the cumulative totals assigned per the criteria weightings shown in Table T.2. The highest possible score was 100 points, and the project bundles scored between 23.53 and 65.41. Since cost effectiveness (the measure of all the criteria divided by the cost of the projects in the bundle) can represent a significant weighting, scores are displayed both with and without the cost-effectiveness criteria.

Table T.3: Evaluation Results

Evaluation Results					
Project Bundle	Name	Without Cost Effectiveness		With Cost Effectiveness	
		Score	Rank	Score	Rank
1	U.S.–Mexico Border	36.00	16	30.80	17
2	Imperial Beach	26.91	18	23.53	19
3	Border to Urban Core North–South	73.64	4	60.91	6
4	Otay Ranch–Chula Vista	41.82	13	53.46	10
5	Urban Core	67.37	5	57.90	8
5A	Urban Core	58.18	9	58.54	7
5B	Urban Core	74.26	3	65.41	1
5C	Urban Core	64.33	6	55.47	9
6	El Cajon–National City	31.28	17	35.03	16
7[4]	El Cajon–Urban Core	76.30	2	65.04	3
9	El Cajon–Pacific Beach	41.94	12	49.55	11
10	Urban Core–Del Mar	79.21	1	65.37	2
11	Urban Core–Sabre Springs	63.98	7	61.18	5
12	Mira Mesa–University Community	51.92	11	41.54	13
14	Poway–Carmel Valley	19.67	19	23.74	18
15	Del Mar–Oceanside	54.63	10	45.70	12
16	Sabre Springs–Escondido	41.42	14	41.13	14
19	Escondido–Vista	60.23	8	62.19	4
21	Oceanside–Vista	38.74	15	40.99	15

[4] During bundle refinement, bundles 8, 13, 17, 18, and 20 were combined with other bundles. Bundle 5 was split into four (5, 5A, 5B, and 5C).

Network Phasing

The project bundle scores were used to help phase the individual projects in the transportation network according to project type. As stated in the introduction of the Evaluation Criteria section, the project bundle evaluation information was not the only data considered. Other information considered included an assessment of connectivity, project readiness, and funding availability. Also, early travel modeling results were used to consider model performance of individual routes to further clarify project phasing. The detailed listing of projects is included in Appendix A: Transportation Projects, Programs, and Phasing, while the summation of costs and revenues are displayed in Appendix U: Cost Estimation Methodology and Appendix V: Funding and Revenues, respectively.

2021 Regional Plan Policies and Programs

In addition to the transportation network projects, the 2021 Regional Plan includes policies and programs organized around three core strategies: a reimagined transportation system, sustainable growth and development, and innovative demand and system management. Appropriate policies and programs are applied in the travel demand model and contribute to the performance of the transportation system. Attachment 5 includes two tables that describe the quantification approach for each and the underlying inputs to ABM2+.

Performance Measures

The project bundle evaluation process helped inform the effectiveness of the various project bundles relative to each other. The next step was to take the entire network of projects and see how they performed together. This is accomplished with modeled performance measures.

To understand how changes to the transportation system can impact our region, SANDAG uses an advanced travel demand model called an activity-based model. The activity-based model simulates trips throughout the region and calculates the types of transportation options people choose, travel times, and much more. The future performance of the transportation system can be better understood from these simulated trips. This section summarizes the modeled performance of the 2021 Regional Plan.

A performance measure is a way of reporting results that are meaningful across multiple years and geographic areas. The modeled results are presented for four years: 2016, 2025, 2035, and 2050. The 2016 year serves as the existing transportation network, and the performance outcomes reflect the current function of the region's transportation system. Years 2025, 2035, and 2050 are significant phases in the 2021 Regional Plan when projects and programs are planned. These phase years are included twice for each performance measure. They are included first without any 2021 Regional Plan projects—also called the No-Build network, which only includes existing and in-progress projects as detailed in Table T.1—and second with the revenue-constrained 2021 Regional Plan network as described in Appendix A: Transportation Projects, Programs, and Phasing. The differences

in the performance between the No-Build network and 2021 Regional Plan network are the expected changes from the strategies included in the 2021 Regional Plan.

The 2021 Regional Plan's goals are as follows:

- **Fast:** Efficient movement of people and goods
- **Fair:** Access to affordable, reliable, and safe mobility options
- **Clean:** Healthier air and reduced GHG emissions

The 2021 Regional Plan performance measures support the plan's goals by providing insights to the anticipated impacts of the future network. Each performance measure supports multiple goal areas. For instance, the "access to basic needs" performance measure supports the efficient movement of people and goods goal by showing the percentage of the population that can access retail and parks in an efficient time of 15 minutes. This performance measure also supports access to affordable, reliable, and safe mobility options by quantifying the potential use of several mobility options. Table T.4 illustrates the multiple goals each performance measure supports.

Table T.4: 2021 Regional Plan Goals and Performance Measures

2021 Regional Plan Goals and Performance Measures	
Goal Area	**Performance Measure**
Efficient movement of people and goods	Ability to access basic needs Access to opportunities Vehicle miles traveled
Access to affordable, reliable, and safe mobility options	Access to basic needs Access to opportunities Vehicle miles traveled
Healthier air and reduced GHG emissions	GHG reductions Access to basic needs Vehicle miles traveled

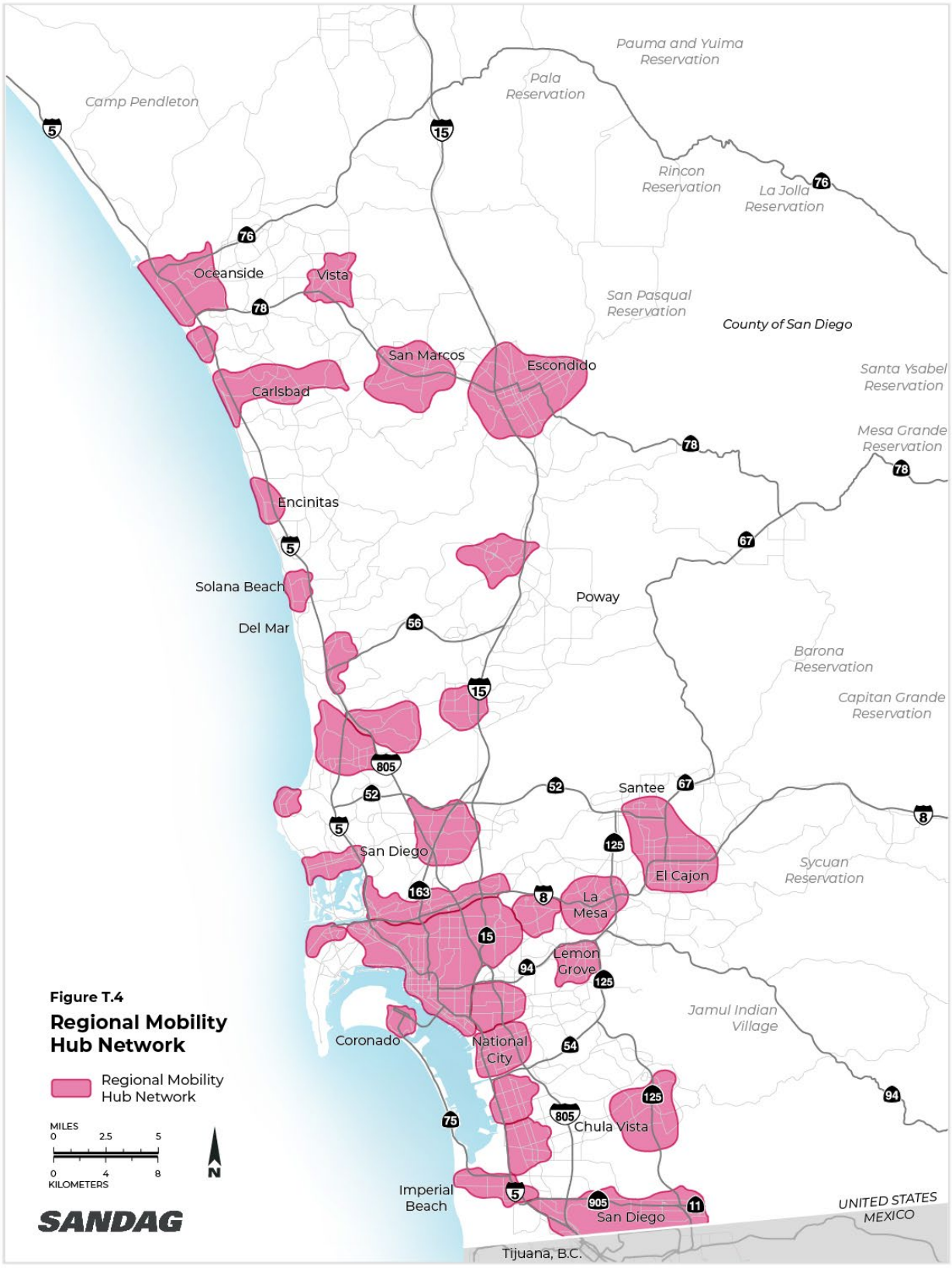
Performance measures are calculated for different geographies: Regionwide (the entire county of San Diego), Mobility Hubs (specific to residents of Mobility Hub areas), and for Social Equity Focus populations (low-income, minority, and senior populations). See Appendix H: Social Equity: Engagement and Analysis for more information on the analysis and results of the social equity review of the 2021 Regional Plan. The county-level, or regionwide, performance outcomes show the 2021 Regional Plan's performance across the entire transportation system. Mobility Hubs are communities with a high concentration of people, destinations, and travel choices. Table T.5 summarizes the geography that each performance measure covers.

Table T.5: Geographic Areas of Performance Measures

Geographic Areas of Performance Measures		
Performance Measures	**Regionwide**	**Mobility Hubs**
Access to Basic Needs: travel to a park or retail within 15 minutes, or medical facility within 30 minutes	✓	✓
Access to Opportunities: travel by transit to employment centers or higher education institutions within 30 or 45 minutes	✓	✓
GHG Emission Measures: reduction in exhaust from vehicles that contributes to GHG regionwide and per person	✓	
Vehicle Miles Traveled Measures: amount of vehicle travel regionwide and per person	✓	

Figure T.4 illustrates the location and distribution of the Mobility Hubs across the region. The 2021 Regional Plan includes access improvements to and within Mobility Hubs through Flexible Fleets, Complete Corridors, and the Next Operating System.

Figure T.4: Regional Mobility Hub Network



These maps show generalized regional Mobility Hub boundaries for planning purposes and are not intended to be binding or precise. Mobility Hub boundaries are subject to refinement in close coordination with the affected jurisdiction(s).

Access Measures

Access measures look at the percentage of residents that can travel to a destination within a defined period of time by different travel options. The 2021 Regional Plan performance measures include access to basic needs such as retail, parks, and medical facilities and access to areas of opportunity, such as high concentrations of employment and higher education institutions. More details on the access measures are included below.

Access to Basic Needs Methodology

This measure considers the percentage of the population within 15 minutes of retail and parks and 30 minutes of medical facilities. Population values use the forecasted figures from Series 14 Version 38 2050 Regional Growth Forecast. The sum of the population that can travel to a retail location within 15 minutes is divided by the total forecasted population. This process is repeated for access to parks. This measure is calculated regionwide and for Mobility Hubs. The transit travel time includes in-vehicle travel time, access and egress walk time to and from station to origin or destination, and initial and transfer wait time. Modes included in this measure are as follows:

- Walk
- Bike
- Transit accessed by walk or Flexible Fleet
- Drive alone

This process is repeated with populations that have 30-minute access to medical facilities. For access to medical facilities, the travel time is increased to account for medical facilities being more dispersed throughout the region. Transit accessed by walk or Flexible Fleet and drive alone are the two modes included in this measure.

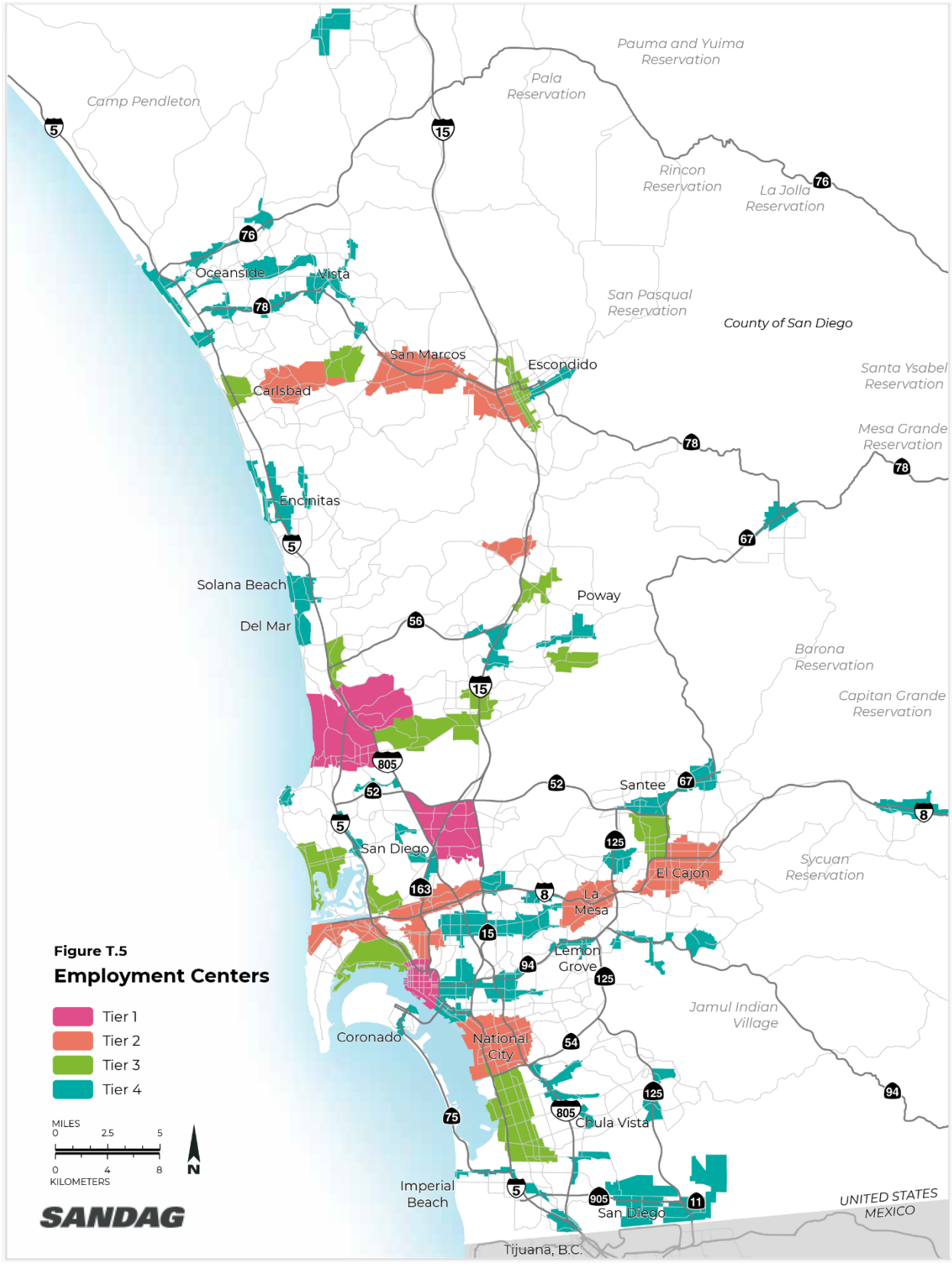
Access to Opportunities Methodology

This measure considers the percentage of the working-age population—18 years of age or older—that can access three sets of employment centers and higher education institutions via transit. The transit travel time includes in-vehicle travel time, access and egress walk time to and from station to origin or destination, and transfer wait time. The measure is calculated for 30- and 45-minute travel times and at the regionwide and Mobility Hub geographies. Figure T.5 illustrates the employment center tiers in the San Diego region. The employment centers included in this measure are as follows:

- Tier 1 employment centers are areas with concentrations of more than 50,000 employees. Three employment centers are included in this tier: Sorrento Valley, Kearny Mesa, and Downtown San Diego.
- Tier 2 employment centers are areas with concentrations of 25,000 to 50,000 employees. Ten employment centers are included in this tier: Mission Valley, Carlsbad–Palomar Airport, National City, San Marcos Civic Center, Escondido–Palomar, Hillcrest, El Cajon, Ocean Beach, West Bernardo, and La Mesa.
- All employment centers – Tiers 1, 2, 3, and 4, totaling 84 employment centers regionwide.

This process is repeated for access to higher education institutions. Higher education includes public and private colleges, universities, community colleges, and vocational training centers.

Figure T.5: San Diego Region Employment Center Tiers



Greenhouse Gas Emission Measures

GHG emissions performance measures for the 2021 Regional Plan focus on emissions from passenger vehicles and follow the regulatory requirements outlined in California Senate Bill 375 (Steinberg, 2008) (SB 375). GHG emissions are summarized as regionwide values and per capita. Unlike the other performance measures for the 2021 Regional Plan, SB 375 GHG per capita has a target that must be met to maintain compliance with regulations established by the State of California. For the San Diego region, the 2035 target is a 19% per capita reduction in GHG emissions compared to 2005 emissions.

Transportation network performance data from the activity-based model is input to the Emission Factor (EMFAC) model developed by the California Air Resources Board. EMFAC[5] calculates the total regional carbon dioxide (CO_2) emissions. There are GHG-reducing programs that the activity-based model and EMFAC cannot quantify. These include the SANDAG iCommute programs supporting vanpool, carshare, carpool, and Transportation Demand Management. Off-model calculations are applied to the EMFAC outputs to capture the GHG reductions from these programs. For the per capita calculation, the regionwide GHG is divided by the total population. Population values use the forecasted value from Series 14 Version 38 2050 Regional Growth Forecast.

Vehicle Miles Traveled Measures

Vehicle miles traveled (VMT) is a measure of how much travel is occurring on our roadways. For the 2021 Regional Plan, VMT is calculated for all types of vehicle travel regionwide and per capita. Daily modeled vehicle volumes are measured for each link of the transportation network and added together. For the per capita calculation, the regionwide VMT is divided by the population. Population values use the forecasted value from Series 14 Version 38 2050 Regional Growth Forecast.

Results Tables

The following pages summarize the performance measure results to the 2021 Regional Plan revenue-constrained transportation network. Table T.6 includes the regionwide results, and Table T.7 includes the results for the Mobility Hubs. Attachment 6 includes the complete performance measure tables that were produced by ABM2+.

[5] EMFAC2014 is the required Emission Factors model for SB 375 GHG emissions.

Table T.6: Regionwide – Performance of Revenue-Constrained Transportation Network

Regionwide – Performance of Revenue-Constrained Transportation Network							
Performance Measure	**2016**	**2025 No-Build**	**2035 No-Build**	**2050 No-Build**	**2025 Build**	**2035 Build**	**2050 Build**
Percentage of residents that can access retail within 15 minutes							
Walk	69.0%	72.8%	74.6%	76.1%	71.6%	74.0%	74.7%
Bike	95.6%	96.8%	96.8%	97.2%	96.3%	97.1%	97.5%
Transit	60.3%	61.7%	63.7%	63.4%	63.2%	66.5%	67.4%
Percentage of residents that can access parks within 15 minutes							
Walk	51.0%	52.3%	53.1%	53.0%	52.7%	53.3%	53.5%
Bike	93.5%	93.7%	93.8%	93.9%	94.7%	95.1%	95.7%
Transit	39.0%	39.5%	41.0%	40.9%	41.8%	44.7%	45.5%
Percentage of residents that can access medical facilities within 30 minutes							
Transit	81.0%	81.4%	82.5%	82.3%	82.3%	84.5%	85.4%
Percentage of residents that can access Tier 1 employment centers							
Within 30 minutes by transit	21.1%	23.3%	25.8%	25.4%	24.9%	31.1%	35.9%
Within 45 minutes by transit	37.2%	40.2%	42.8%	42.6%	43.4%	51.8%	58.3%
Percentage of residents that can access Tier 2 employment centers							
Within 30 minutes by transit	46.9%	48.9%	50.5%	50.2%	51.7%	57.3%	59.7%
Within 45 minutes by transit	67.1%	68.2%	69.6%	68.8%	72.1%	77.5%	79.7%
Percentage of residents that can access any employment center (Tiers 1–4)							
Within 30 minutes by transit	80.5%	81.2%	82.4%	82.2%	82.3%	84.7%	85.6%
Within 45 minutes by transit	82.0%	82.5%	83.6%	83.4%	83.5%	85.7%	86.7%
Percentage of residents that can access higher education institutions							
Within 30 minutes by transit	43.6%	46.0%	47.4%	47.2%	48.9%	54.1%	55.5%
Within 45 minutes by transit	68.3%	69.4%	70.2%	70.1%	73.6%	78.4%	80.4%

Regionwide – Performance of Revenue-Constrained Transportation Network							
Performance Measure	**2016**	**2025 No-Build**	**2035 No-Build**	**2050 No-Build**	**2025 Build**	**2035 Build**	**2050 Build**
On-road CO_2 emissions (change from 2005 levels)[6]							
Total tons CO_2	-390	1,052	3,541	5,982	-1,315	-2,848	-1,842
Pounds CO_2 per capita	-2.36	-2.16	-1.78	-1.30	-3.52	-5.30	-5.47
Vehicle miles traveled							
All vehicle classes regionwide	83,614,704	88,268,330	94,374,791	100,071,163	84,538,406	85,412,968	88,133,934
Per capita	25.6	25.8	26.4	27.1	24.7	23.9	23.8

[6] Change in on-road CO_2 emissions from 2005 values (EMFAC 2014). Negative values indicate emission reductions. These measures quantify changes in total tons and pounds per capita and are used to calculate the percent reduction per capita required in SB 375.

Table T.7: Mobility Hub Areas – Performance of Revenue-Constrained Transportation Network

Mobility Hub Areas – Performance of Revenue-Constrained Transportation Network							
Performance Measure	**2016**	**2025 No-Build**	**2035 No-Build**	**2050 No-Build**	**2025 Build**	**2035 Build**	**2050 Build**
Percentage of residents that can access retail within 15 minutes							
Walk	91.2%	93.5%	93.8%	94.6%	93.1%	94.3%	94.6%
Bike	99.8%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Transit	84.3%	85.6%	86.4%	84.5%	87.1%	89.5%	89.7%
Percentage of residents that can access parks within 15 minutes							
Walk	63.9%	65.3%	65.3%	64.5%	65.1%	64.3%	64.1%
Bike	99.8%	99.6%	99.2%	99.3%	99.5%	98.7%	98.8%
Transit	59.4%	59.7%	60.6%	59.4%	62.8%	65.2%	65.4%
Percentage of residents that can access medical facilities within 30 minutes							
Transit	95.5%	96.0%	96.5%	95.6%	96.1%	97.8%	98.1%
Percentage of residents that can access Tier 1 employment centers							
Within 30 minutes by transit	34.1%	37.7%	40.6%	39.2%	40.1%	48.7%	55.8%
Within 45 minutes by transit	59.8%	62.8%	64.9%	63.5%	65.4%	71.4%	77.7%
Percentage of residents that can access Tier 2 employment centers							
Within 30 minutes by transit	71.0%	72.8%	73.6%	72.0%	74.9%	78.4%	80.0%
Within 45 minutes by transit	87.6%	88.3%	88.6%	86.6%	91.5%	93.8%	95.4%
Percentage of residents that can access any employment center (Tiers 1–4)							
Within 30 minutes by transit	95.9%	96.3%	96.7%	95.9%	96.6%	98.4%	98.5%
Within 45 minutes by transit	96.0%	96.3%	96.7%	95.9%	96.6%	98.4%	98.7%
Percentage of residents that can access higher education institutions							
Within 30 minutes by transit	64.0%	65.6%	66.5%	65.3%	68.0%	72.6%	73.8%
Within 45 minutes by transit	88.8%	89.4%	88.9%	87.9%	93.0%	94.5%	96.0%

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Figures T.6 and T.7 show the areas within the region that have 30-minute transit access to Tier 1 and Tier 2 employment centers. These figures display the new areas that gain 30-minute access with each phase year.

Figure T.6: Thirty-Minute Access by Transit to Tier 1 Employment Centers

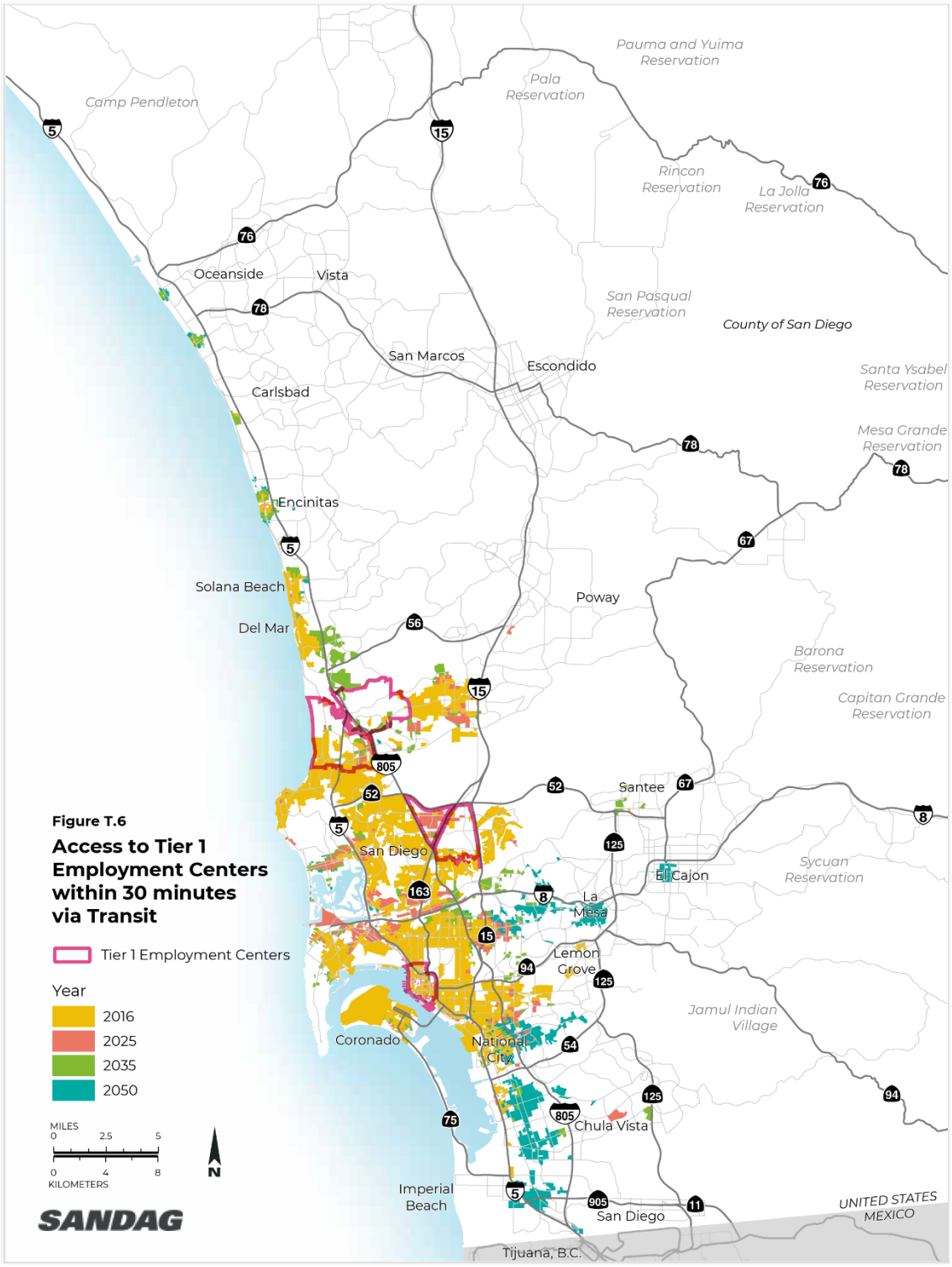
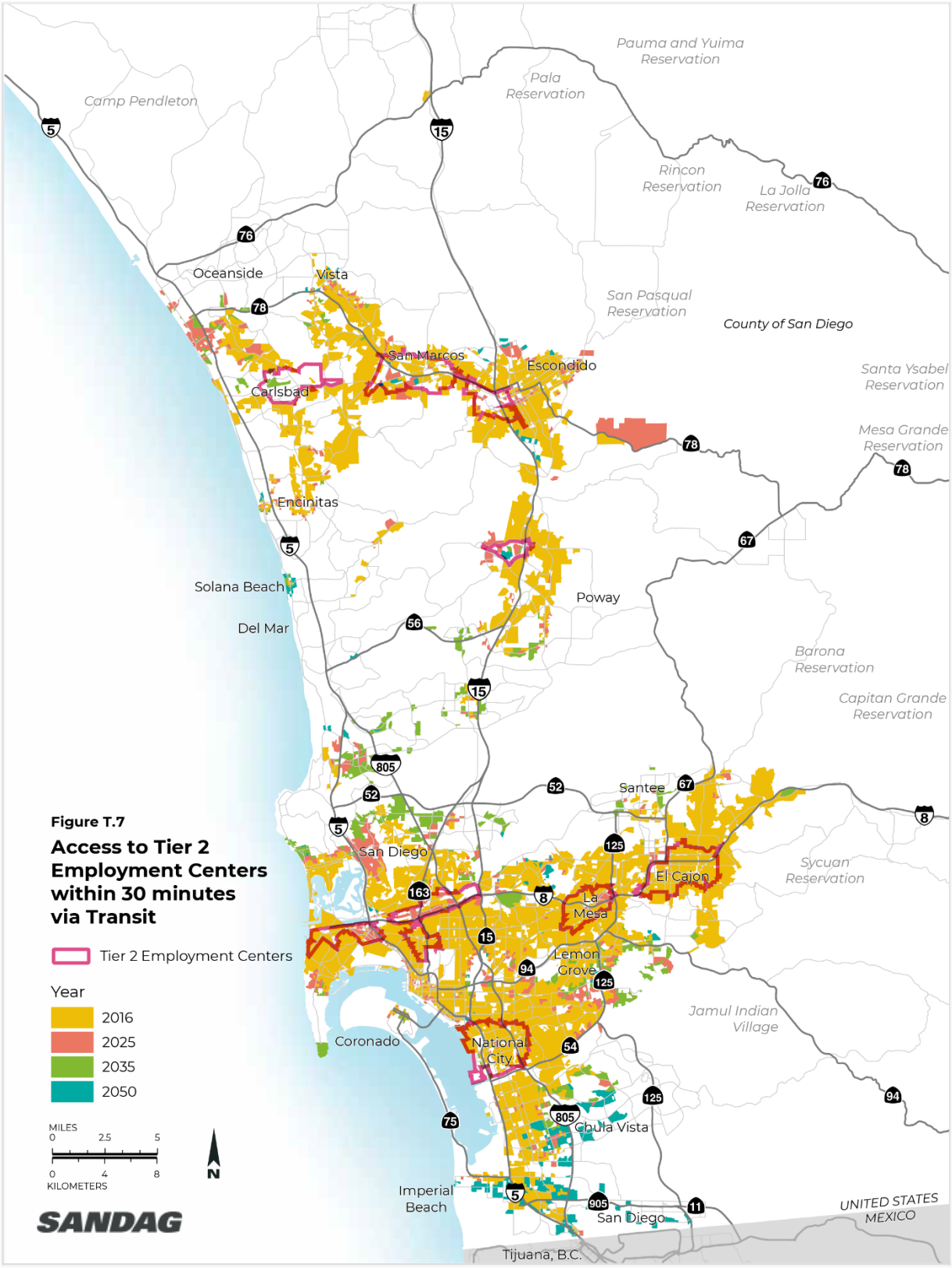


Figure T.7: Thirty-Minute Access by Transit to Tier 2 Employment Centers



Attachments

Attachment 1: San Diego Forward: Vision for the 2021 Regional Plan Network Development Summary Report

Attachment 2: Regional Arterials by Jurisdiction

Attachment 3: Evaluation Criteria Data Sources

Attachment 4: Evaluation Criteria Detailed Calculation Methodology

Attachment 5: Strategies Applied in ABM2+

Attachment 6: Performance Measure Results Tables

Appendix T Attachment 1:

San Diego Forward: Vision for the 2021 Regional Plan Network Development Summary Report

San Diego FORWARD

Vision for the 2021 Regional Plan Network Development Summary Report

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Introduction

This report describes how the San Diego Association of Governments (SANDAG) developed the Vision for the 2021 Regional Plan transportation network. This Vision will be a fundamental part of the forthcoming San Diego Forward: The 2021 Regional Plan, which will provide a blueprint for increased mobility in the San Diego region through 2050. By mid-century, our region is projected to be home to 3.75 million people, and the health of our regional economy, our state mandated goals for reducing greenhouse gases and protecting the environment, and maintaining and improving the overall quality of life for everyone will depend heavily on enhancing personal mobility.

The Vision for the 2021 Regional Plan was developed through application of key strategies known as the 5 Big Moves, which together reimagine how our region will grow and how people and goods will get around. New investments in the regional transportation network will enhance connectivity, increase safety and sustainability, and improve the everyday lives of millions of people. The Vision, if fully realized, would add tremendous capacity to the transportation system and offer people compelling alternatives to driving alone.

SANDAG developed the Vision based on a data-driven process—analyzing where people live and work, how they get around, what transportation infrastructure exists, what is needed to serve future growth, and more. But SANDAG did not build it on data alone: the Vision reflects the views of real residents from around the region, the professional judgments of a number of planning professionals at the agency, and extensive knowledge of diverse communities across our region.

SANDAG conducted its work in distinct sprints,[1] each lasting about three weeks. These sprints were organized into three overall phases shown in Figure 1.

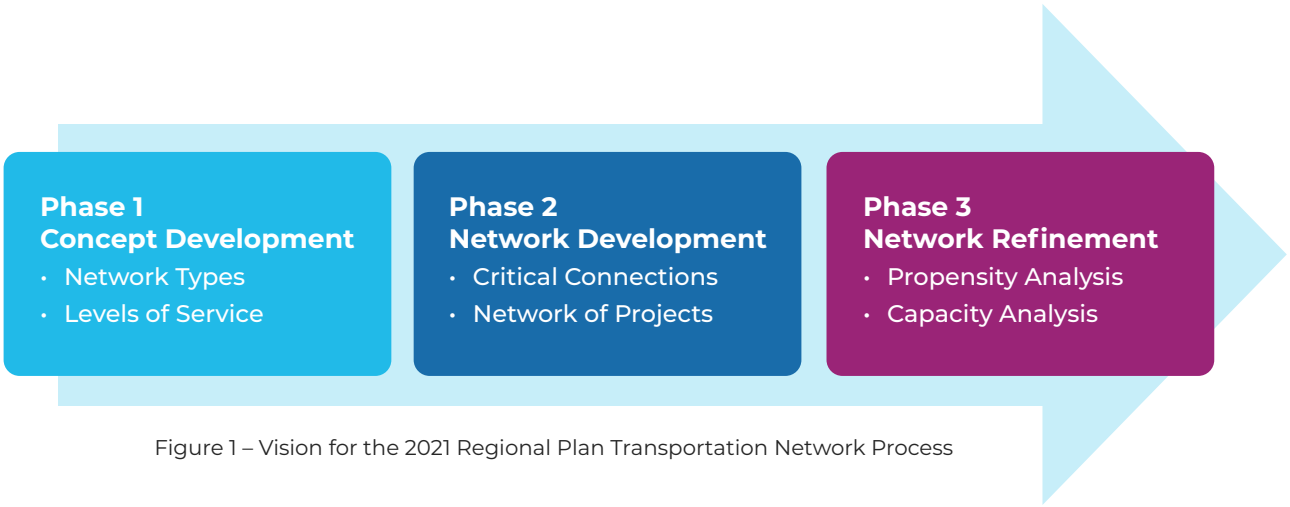


Figure 1 – Vision for the 2021 Regional Plan Transportation Network Process

1 The word "sprint," commonly used in project management, refers to a set period of time during which specific work has to be completed.

5 Big Moves Overview

The Vision for transportation in San Diego County completely reimagines mobility in the 21st century—how we get around every day for work, school, shopping, recreation, and more, as well as how goods are transported in the region. This Vision is fundamentally shaped by five key strategies for mobility that we call the "5 Big Moves." Below we describe each of the 5 Big Moves, but in short, they would result in vastly more efficient and accessible major corridors of travel; a completely new high-speed and high-capacity public transit network; a new network of Mobility Hubs where people and multiple mobility options come together; Flexible Fleets of vehicles that offer people quick mobility options when and where they need them; and a regionwide digital platform that unifies the 5 Big Moves to offer people the most efficient, safe, and time-saving travel options possible.

As SANDAG began developing this Vision, it divided planning professionals into teams that studied how to best implement each of the 5 Big Moves. They worked individually within their own teams, and together with other 5 Big Moves teams. The result was an overall vision that unifies and integrates all the 5 Big Moves. In this Vision, each strategy becomes fully realized only to the extent that the other four become fully realized. As you read further about the 5 Big Moves and how SANDAG developed the Vision, this integrated approach should become evident.

Here is a brief summary of each of the 5 Big Moves that have shaped the Vision:

COMPLETE CORRIDORS

Complete Corridors provide a variety of travel choices and use technology to manage how highways and local streets and roadways are used in real time. They provide a dedicated, safe spaces for everyone, including freight vehicles as well as people who walk, bike, drive, ride transit, and use Flexible Fleets. Key features and benefits of Complete Corridors include Managed Lanes that offer priority access to transit, carpool, and vanpool users, and access to single-occupant drivers for a fee; Active Transportation and Demand Management (ATDM) technology that enables transportation operators to modify how infrastructure and services are used based on changing traffic conditions; high-speed communication networks that allow connected vehicles, smartphones, and smart roads to share data to reduce collisions, increase network capacity, and improve travel times; priority access to roadways for public transit, active transportation, and shared mobility services; managed curb space that accommodates different uses based on levels of traffic at varying times of the day; and electric vehicle (EV) infrastructure, including public charging and hydrogen fueling stations.

TRANSIT LEAP

The Transit Leap will create a complete network of high-speed, high-capacity, and high-frequency transit services that connect major residential areas with employment centers and attractions throughout the San Diego region. Transit Leap services will connect to supporting Flexible Fleets in Mobility Hubs. New high-speed transit services—covering longer distances with limited stops—may be separated from vehicle traffic with bridges, tunnels, or dedicated lanes. Improvements to existing transit services—such as the Trolley, COASTER, SPRINTER, and *Rapid*—may include additional rail tracks, more frequent service, dedicated transit lanes, and traffic signal priority to keep transit moving quickly.

MOBILITY HUBS

Mobility Hubs are communities with a high concentration of people, destinations, and travel choices. They offer on-demand travel options and supporting infrastructure that enhance connections to high-quality Transit Leap services while helping people make short trips around the community on Flexible Fleets. Mobility Hubs can span one, two, or a few miles based on community characteristics and are uniquely designed to fulfill a variety of travel needs while strengthening sense of place.

FLEXIBLE FLEETS

Flexible Fleets are shared, on-demand transportation services that provide convenient and personalized travel options. While they build on the popularity of services such as rideshare, bikeshare, and scootershare, fleets can also include neighborhood shuttles and delivery services. These fleets provide services for all types of trips, 24/7, which can reduce the need to own a car. They also provide important connections between high-speed Transit Leap services and key destinations such as work or home, making it easier for commuters to choose transit. Flexible Fleets are primarily accessible through mobile apps and can be operated by public and private agencies or through partnerships.

NEXT OPERATING SYSTEM (NEXT OS)

Next OS is the "brain" of the entire transportation system. It is a digital platform that compiles information from sources such as passenger vehicles, buses, ridesharing vehicles, delivery trucks, bikes, and scooters into a centralized data hub. Analysis of this data will improve how transportation is planned, operated, and experienced. Transportation operators will be able to better manage supply and demand by modifying how infrastructure and services are used throughout the day. The result will be a modernized transportation system with roads and transit services that operate smoothly and serve people better. This report discusses how SANDAG has planned for *physical* transportation networks—envisioning fully realized corridors of travel, next-generation public transit, Mobility Hubs where people and mobility options come together, and Flexible Fleets that serve people with innovative and tailor-made mobility options when and where they need them. But Next OS is the *digital* network that will analyze data in real time from these physical networks and make them all work better—more integrated, more efficient, and most of all more responsive to people's immediate needs.

Concept Development (Phase 1)

The general concept for the Vision was informed significantly by early work on the 2019 Regional Plan, which led to the 2019 Federal Regional Transportation Plan (RTP). This work included reviewing case studies and best practices, consulting with transportation operators in the region, interviewing private sector providers, and gathering other perspectives, including significant community input gained through two outreach programs in 2018. Insights gained from these previous efforts, as well as more recent work, have served as the foundation for the 2021 Regional Plan.

SANDAG also conducted a series of focus groups, each with a diverse cross-section of the region's residents, to gather feedback on how each of the 5 Big Moves could improve their own lives (Figure 2). In this sense, the Vision reflects the views and opinions of real people from communities throughout the region. SANDAG *designed* the Vision based on both data analysis and what people told the agency in these focus groups. This process is known as "Human Centered Design." For example, individuals in focus groups were asked what they thought about SANDAG's ideas for "Flexible Fleets," and then what *they* thought would make Flexible Fleets a viable alternative to driving alone. As we discuss later in this report, many residents said they would view a Flexible Fleet service as a real alternative to driving if it could get them from their home to a public transit station within ten minutes. SANDAG professionals relied on this feedback as they built the Vision.

Figure 2 – Focus Group

Meanwhile, a Vision Advisory Panel convened to gain insights from private industry leaders about how emerging technology might enhance personal mobility, and how public-private partnerships might accelerate their adoption in the region. The Panel consisted of Southern California-based executives and thought leaders in the fields of wireless communications, intelligent transportation systems, original equipment manufacturing (auto, bus, truck), data analytics, artificial intelligence and automation, fleet management systems, and venture funding.

All this information served to develop an initial set of services and transportation infrastructure types considered for each of the 5 Big Moves and operating assumptions to guide SANDAG's development of the Vision. These services and infrastructure types evolved throughout the development of the Vision for a new transportation network as additional information was gathered and analyses were conducted.

Type descriptions for the 5 Big Moves are shown in Appendix A.

Network Development (Phase 2)

Once SANDAG developed a conceptual idea for what a future regional transportation network might look like, it was time to actually build the network. This required a series of iterative analyses, in which data related to population, employment, and demographics were repeatedly analyzed in order to reach the best answer to a given question—where a new commuter rail line might be needed most, or where to situate a Mobility Hub, for example. As we've mentioned, decisions about how to build each network were based on data analysis as well as feedback from residents, professional judgments, and SANDAG's deep knowledge of the region's diverse communities.

SANDAG gathered data from numerous sources, including surveys by the federal government on the location of employees and employers, the U.S. Census Bureau; land use information from local jurisdictions, individual traveler data from cellular devices; goods movement data from trucking and other commercial transport operations, and citizen feedback. Data was primarily analyzed using the geographic information system (GIS) tool, ArcGIS, and geospatial statistical methods. GIS in transportation planning can take numerous sources of data and visualize them on maps to model traffic patterns, plan new routes and services, and assess the environmental impacts of new transportation infrastructure. ArcGIS is a GIS tool maintained by the Environmental Systems Research Institute (ESRI), and all SANDAG'S geospatial analyses use the ArcGIS platform.

IDENTIFYING THE CRITICAL CONNECTIONS

A key part of SANDAG's early analyses as it built the network was to identify how and where people travel every day. At the most basic level, they had to figure out where people live, where they work, and how they get from one place to the other. The routes that most people take every day are known as "critical connections." SANDAG's early goal was to identify these connections first, so it could eventually decide how to build a transportation network—embodying the 5 Big Moves—that would best serve the daily travel patterns of people in the region.

People travel every day to work, school, shopping, recreation, and other destinations. But it's clear that commutes to and from jobs place the greatest daily demands on the regional transportation system. This reality drove the development of critical connections.

SANDAG began its work by focusing on 15 of the top employment centers in San Diego County (there are more than 70 employment centers[2] in the region). The agency focused on these 15 employment centers (Figure 3) because collectively they account for 40% of civilian jobs in the region. As a result, they account for a significant proportion of daily congestion on roads and highways.

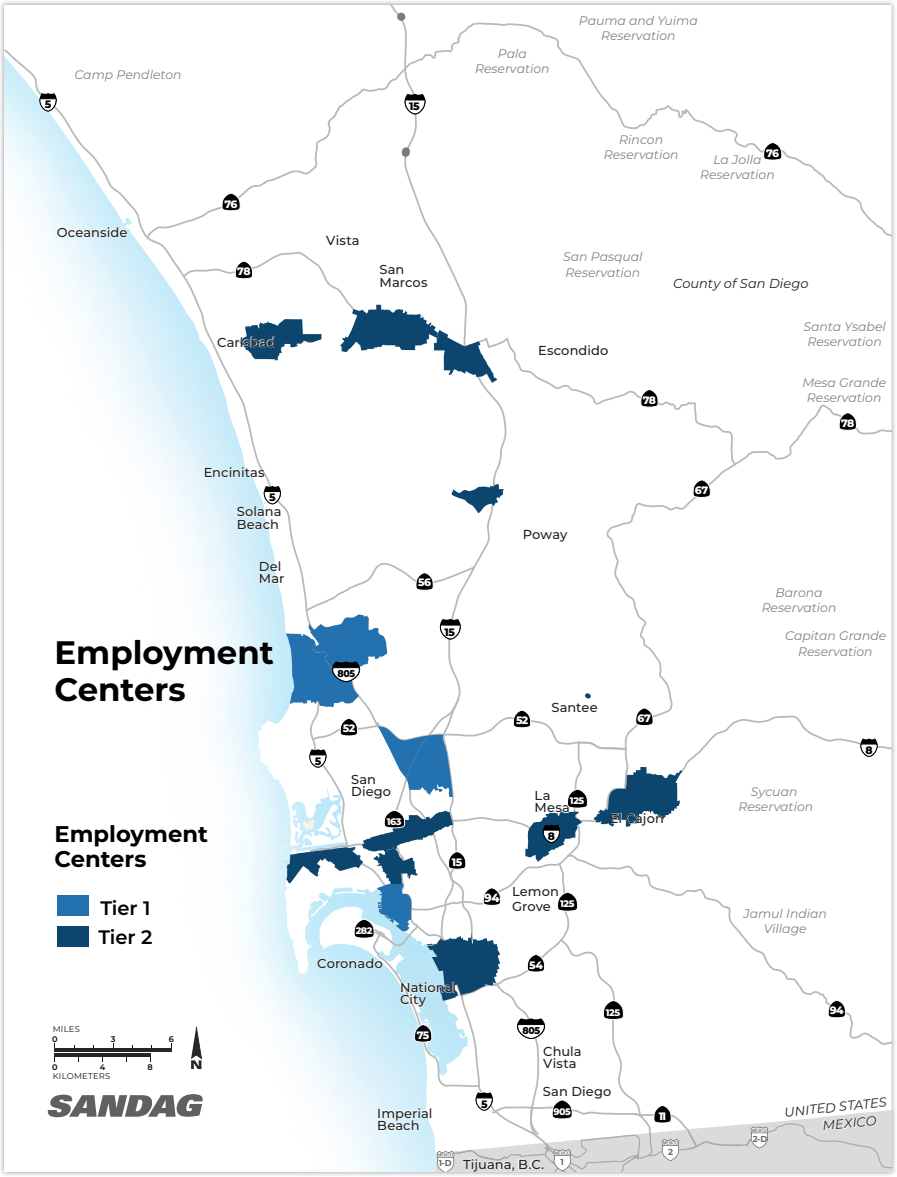


Figure 3 – Employment Centers

2 Thirteen Tier 1 and Tier 2 Employment Centers were identified by SANDAG. For the purpose of developing the Vision for the 2021 Regional Plan, the Sorrento Valley and Kearny Mesa Employment Centers were each split into two centers, resulting in 15 centers. For an in depth look at research and data development efforts on employment centers refer to SANDAG's employment centers webpage at: sandag.org/employmentcenters

Developing critical connections based on where people live and work also makes sense when you consider a few more powerful statistics: about 33% of all trips in the entire region are for work or are work related, and people throughout the region consider 64% of their daily trips as mandatory—whether for work, school, or for other purposes—and not discretionary.

Identifying critical connections required several steps. First, SANDAG created 100-acre hexbins[3](so named because they're in the shape of hexagons) that defined the concentration of jobs throughout the region. Demographic and employment data were then aggregated for each hexbin (Figure 4) in order to study where people live (origins) and where they work (destinations).

SANDAG then conducted a density analysis (kernel analysis)[4] of commute data in order to find concentrations of employees who commute to each of the 15 individual employment centers. These represented the "origins" where employees for each employment center live, as opposed to the employment centers which represent "destinations." These points on a map—origins and destinations—became the initial nodes of critical connections representing significant commute patterns in the region.

Using ArcGIS as an analytic tool, SANDAG then generated a series of maps, each one showing one of the 15 employment centers, as well as all the places where employees who work there live, and therefore where they begin their daily commutes. For each of these 15 employment center maps, origin-destination desire lines were generated from hexbins where people live to hexbins where people work (Figure 5).

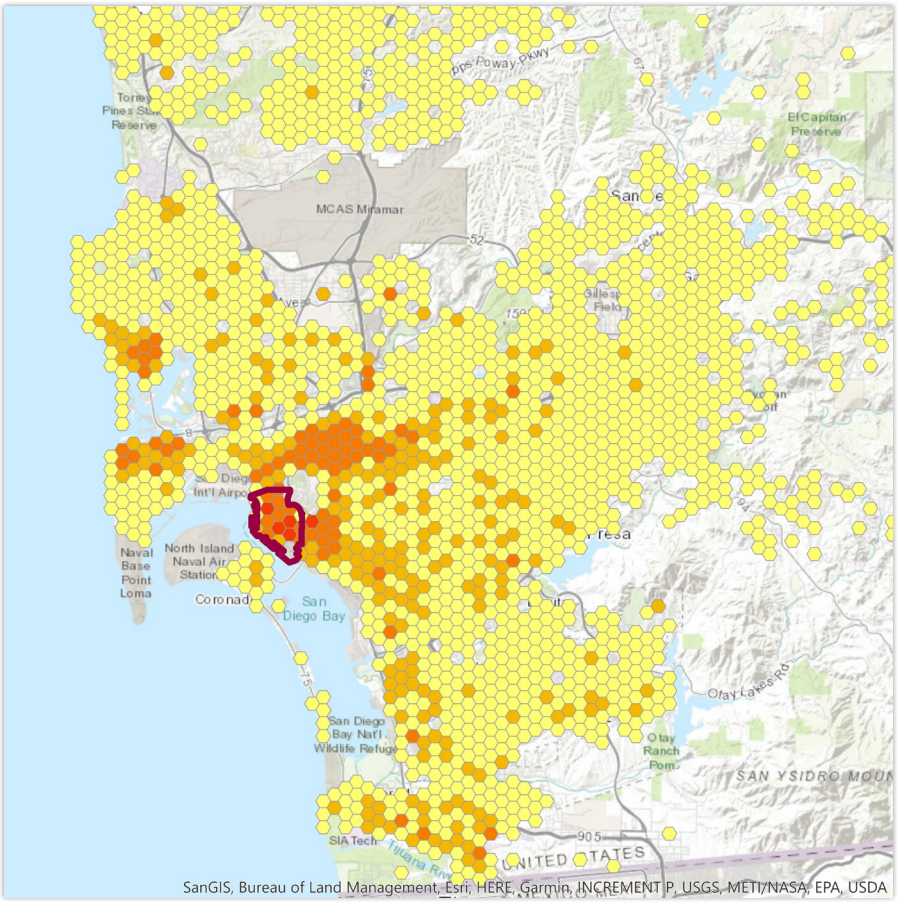


Figure 4 – Downtown San Diego Employment Center with Hexbins

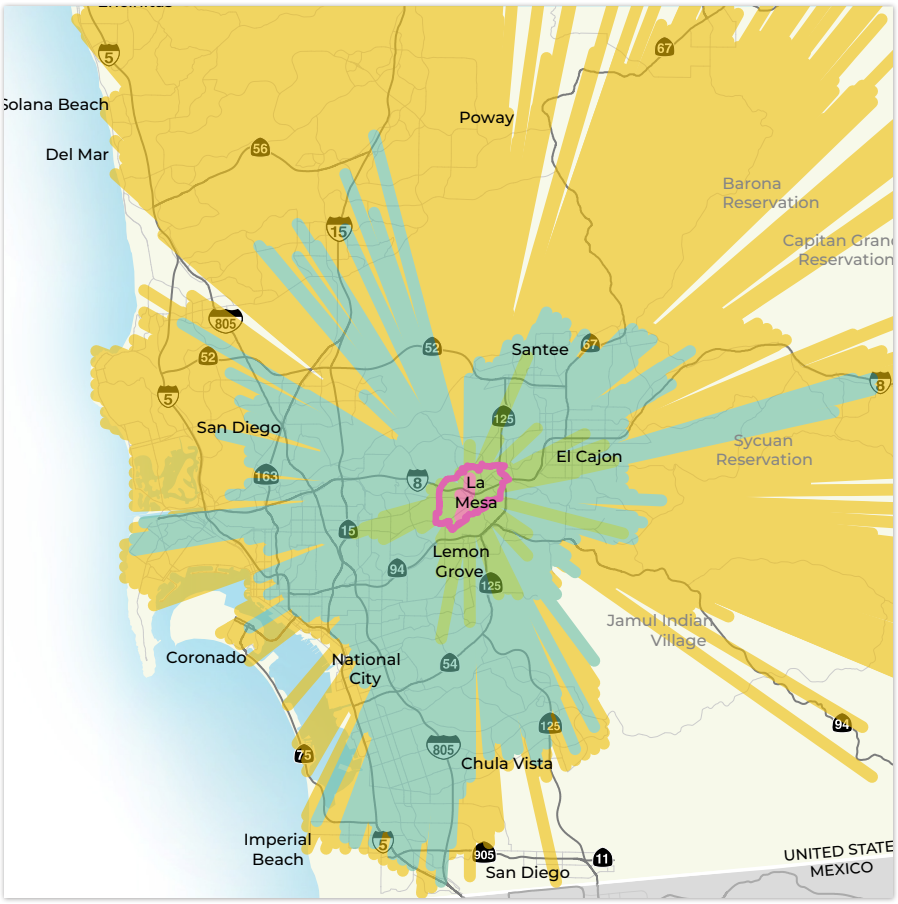


Figure 5 – Origin–Destination Lines to and from the La Mesa Employment Center

3 Hexbins are geographic areas in the shape of hexagons, used for geospatial analysis. For the Vision for the 2021 Regional Plan, 100-acre hexbins were created and overlaid over San Diego County, and demographic and other data were assigned to each hexbin.

4 pro.arcgis.com/en/pro-app/tool-reference/spatial-analyst/how-kernel-density-works.htm

The next step in the analysis was to use ArcGIS to "overlay" the origin-destination maps for these 15 employment centers, so the most heavily used commute routes could be visualized. Figure 6 shows a map of initial critical nodes and potential connections generated by the density analyses just described. Each employment center and commute origin is indicated on the map as a circle, and these are referred to as nodes. These nodes, and the initial critical connections that join them, reveal core travel patterns that the Vision for a transportation network is designed to support.

With initial nodes and potential critical connections identified, SANDAG then began to build its overall transportation network, which evolved iteratively—each analysis considering new information and moving the network closer to its final version. Successive analyses conducted over several sprints considered land use, communities of concern (seniors, minorities, and low-income residents), current traffic patterns, and highway and transit performance data. One critical dataset that SANDAG has introduced into the development of the Vision for the 2021 Regional Plan is anonymous cellular tower based origin-destination data from *Teralytics*,[5] an information technology firm that provides insights related to transportation. This data helped guide network development beyond the traditional commute trip because it also allowed SANDAG to consider longer interregional and intraregional trips and trips to special activity centers. The early goals of network development focused on fast connections between nodes via transit and a network of Managed Lanes that leverages technology to maximize use of existing roadway infrastructure.

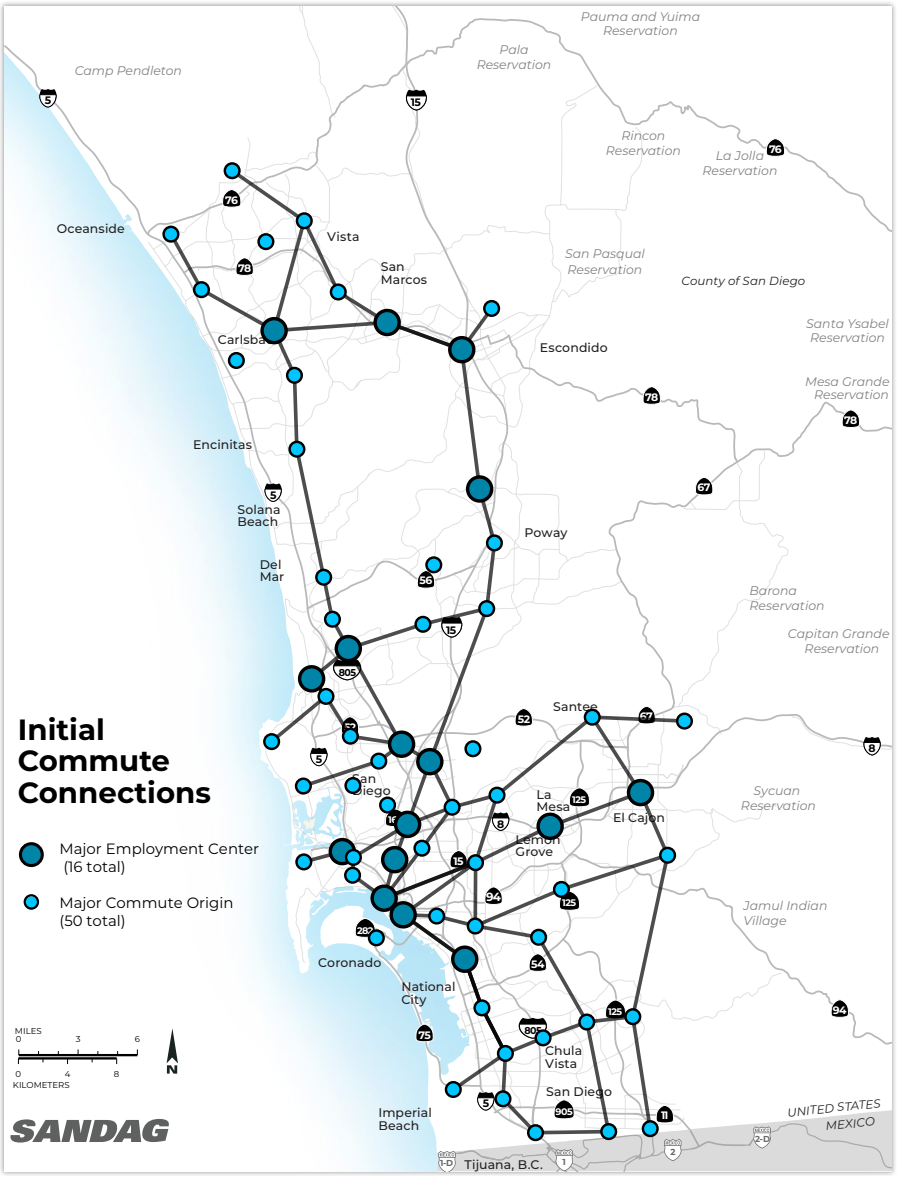


Figure 6 – Initial Commute Connections

The next section of this report provides a detailed account of network development as it pertains to the 5 Big Moves. Because the success of one relies so heavily on the success of another, development of the 5 Big Moves was closely coordinated. Information generated for Transit Leap, for example, informed the development of Mobility Hubs. This interrelationship is shown in Figure 7.

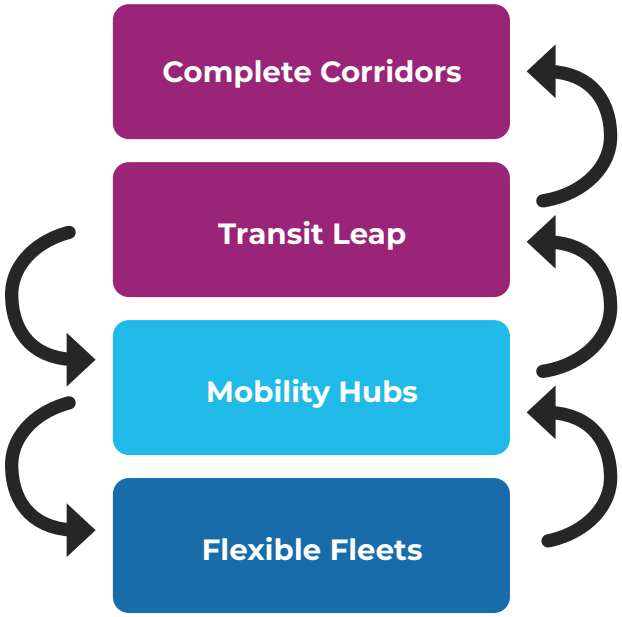


Figure 7 – Relationship of 5 Big Moves during Phase 2

5 SANDAG procured *Teralytics* data for Calendar Year 2018 for use on the Regional Plan. uses cell tower data from one of the top three cell carriers in the region to determine trip-making patterns. This cellular data represents a sample of "no less than 10%" for the region. Trips are defined as movements occurring between 30-minute dwell periods in cellular activity. This trip data is aggregated into census tracts.

TRANSIT LEAP NETWORK DEVELOPMENT

Of all the 5 Big Moves, Transit Leap is the most fundamental to the region's goals for reducing traffic congestion, achieving state-mandated cuts in greenhouse gas emissions, protecting the environment, and improving everyone's overall quality of life. The success of Transit Leap is also intimately tied to the success of the other 5 Big Moves. We will not reach our goals for Complete Corridors, Mobility Hubs, and Flexible Fleets unless we build a network of high-speed, high-capacity, and frequent transit services that connect major residential areas with employment centers and local attractions. The importance of achieving our Transit Leap goals cannot be overstated. They are the foundation for improving personal mobility in our region.

In order to develop the first iteration of a Transit Leap network, SANDAG used ArcGIS tools to develop logical transit route segments through the highest traveled critical connections. Because the goal of Transit Leap is to provide high-speed and frequent transit services (such as commuter rail and light rail) that are comparable to the automobile, travel times between employment centers and commute origin nodes were analyzed in ArcGIS. SANDAG computed these travel times based on a transit vehicle operating speed of 80 mph, with stop delays at each node, and compared them with the time it takes to drive.

This analysis provided a set of all potential new transit routes, approximately 5,000 combinations of routes regionwide. SANDAG initially ranked these transit routes based on population and employment densities around transit nodes serving each route. SANDAG then evaluated each transit route in a series of successive analyses in order to pare down the total number of routes. Each evaluation considered a route's potential to draw riders, its alignment with Mobility Hubs, its access to key activity centers and points of interest (beyond employment centers), and how well the overall combination of routes would result in a Transit Leap network that serves communities of concern. SANDAG's Transit Leap analysis, which also relied on *Teralytics* data, allowed it to pare down the 5,000 combinations of transit routes to an initial Transit Leap network of potentially viable high capacity routes for Transit Leap services (See Figure 8).

This initial Transit Leap network, however, only included higher-speed, higher-capacity routes such as commuter rail and light rail. To complete the overall Transit Leap network, SANDAG then added Next Generation (Next Gen) *Rapid* bus service routes detailed in previous Regional Plans, as well as local bus routes which reflect existing local bus service in the region.

In later sprints, SANDAG adjusted the location of Transit Leap stations for all types of service, as well as routes for Next Gen *Rapid* bus service. The entire Transit Leap network was developed in continuous coordination with the development of the regional networks for Mobility Hubs and Flexible Fleets.

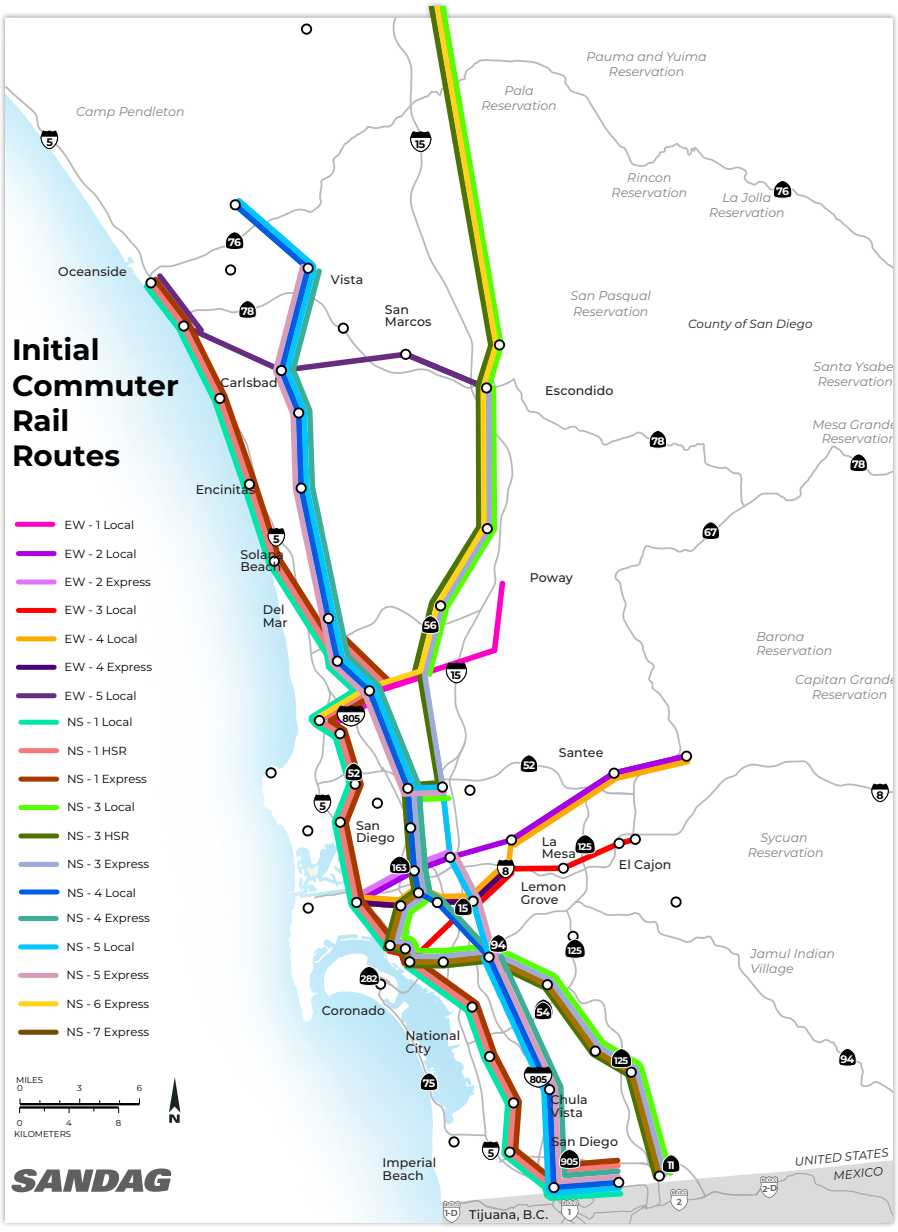


Figure 8 – Initial Commuter Rail Routes

MOBILITY HUB NETWORK DEVELOPMENT

SANDAG developed the regional Mobility Hub network based on the initial critical connection nodes. Each employment center node and commute origin node was evaluated as a potential site for a mobility hub by considering land use, population density (including communities of concern), employment density, activity centers of regional significance, and unique local characteristics. SANDAG then used ArcGIS to evaluate a selection of initial Mobility Hub coverage areas—1, 2, or 4 miles from each node. The location and size for each Mobility Hub was determined as a direct result of a propensity analysis (discussed later in this report). The network map for Mobility Hubs will show the location of each Mobility Hub and the size that meets the needs for that location.

Mobility Hubs offer people convenient and efficient access to Transit Leap services—making these two Big Moves closely paired. In fact, the analysis that informed the development of the Transit Leap network also informed the placement of transit stations and surrounding Mobility Hubs. Meanwhile, analyses conducted during the development of Flexible Fleets (such as the market potential analysis described below) and bike routes information were also used to assess the best locations for Mobility Hubs. Additionally, data from *Teralytics* was used to evaluate non-commute trips. SANDAG considered the top destinations people traveled to in 2018 as it developed the initial Mobility Hub network (Figure 9).

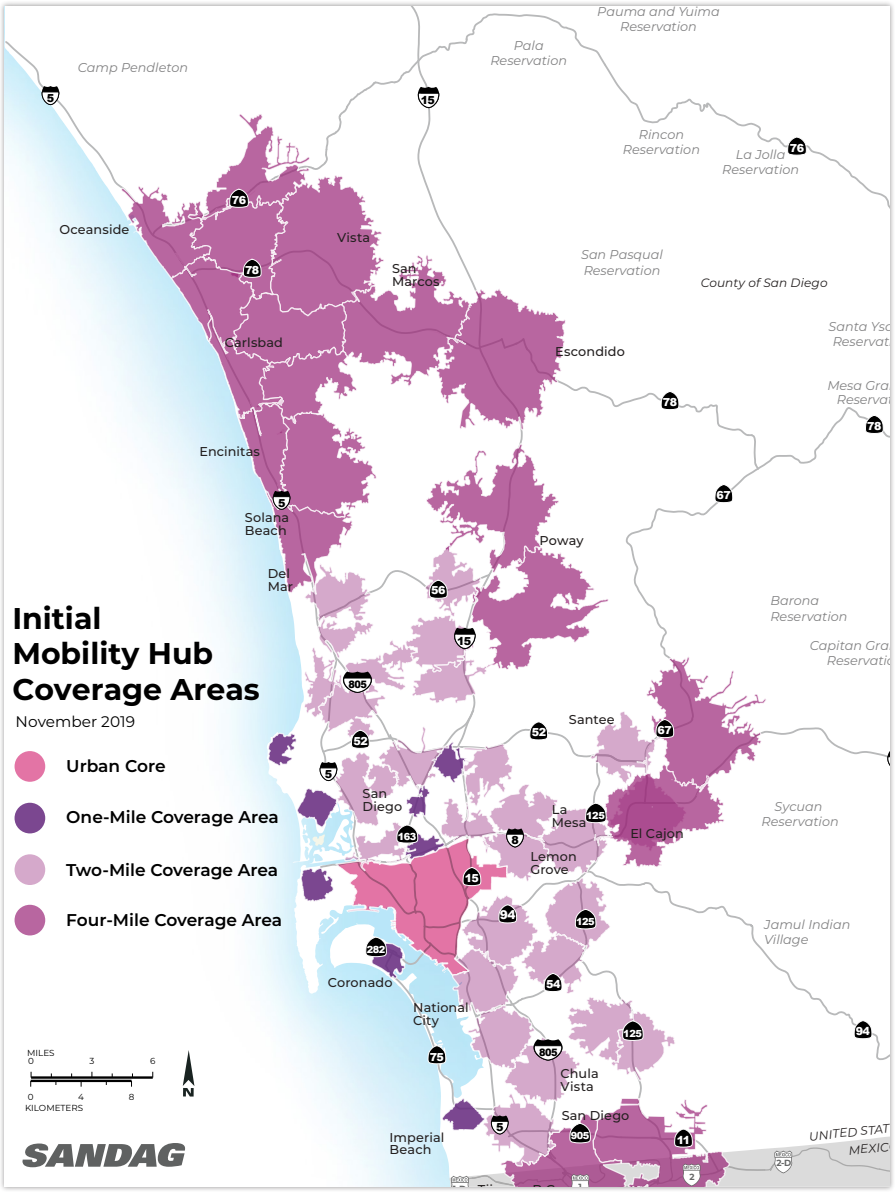


Figure 9 – Initial Mobility Hub Coverage Areas

FLEXIBLE FLEETS NETWORK DEVELOPMENT

Along with identifying the region's critical connections, building a regional network of Mobility Hubs, and determining the best Transit Leap routes, SANDAG has planned for how Flexible Fleets can best offer people mobility options for short individual trips, and importantly, for connecting easily to and from transit. The 2021 Regional Plan envisions five Flexible Fleet services that will serve people throughout the region:

1. Micromobility
2. Carsharing/Ridehailing
3. Ridesharing
4. Microtransit
5. Last Mile Delivery

Table A-4 in the Appendix provides a detailed description of these five Flexible Fleet services. Together, they will provide people with connections to regional transit services, alternatives for short trips around neighborhoods, and mobility options in areas that may not have access to high-speed transit. Flexible Fleets will travel within and between Mobility Hubs and provide people with connections to Transit Leap services using "priority treatments" on Complete Corridors. These priority treatments include designated or shared lanes with transit for more rapid travel by Flexible Fleet vehicles and offering them priority at traffic signals.

Offering Flexible Fleet vehicles priority treatments will require dedicated infrastructure to ensure that walking, biking, scooting, and riding transit are safe and convenient. SANDAG has developed the Flexible Fleet network concurrently with the Mobility Hub, Complete Corridor, and Transit Leap networks, and its success is closely tied to the success of the other three.

SANDAG considered two primary characteristics of an effective Flexible Fleet network:

1. How well it connects with the region's network of Mobility Hubs and Transit Leap routes
2. The operating characteristics of each Flexible Fleet service

Flexible Fleets could be operated by both public and private agencies, as well as through public-private partnerships. It is anticipated that Flexible Fleet services will be deployed in coordination with transit agencies, local jurisdictions, non-profits, employers, tribal nations, and other stakeholders. This would ensure that Flexible Fleet options are more closely tailored to the specific needs of a given community.

Determining the optimal operating environment for each type of Flexible Fleet service is based on case study research and a synthesis of interviews with Flexible Fleet operators. SANDAG also conducted interviews with public agencies in order to understand their experience operating these services, and to gain insights on lessons learned from partnering with the private sector. This case study research and synthesis of interviews served as baseline data to determine which services operate best in a given condition, and where each service should be deployed.

Flexible Fleets can operate throughout the region. Service areas for Flexible Fleets will vary based on the service type, community needs, community context, and service objectives. Flexible Fleets are also concentrated at mobility hubs, and therefore provide people with fast and convenient connections to Transit Leap services. The service areas for Flexible Fleet services are shown in the Appendix Table A-5.

SANDAG determined where particular Flexible Fleet services would be needed based on how they operate and what specific service they provide. SANDAG also considered how a given Flexible Fleet service could best interact with and support the Transit Leap, Mobility Hub, and Complete Corridor networks. Based on this work, SANDAG developed ideal operating scenarios for Flexible Fleets. These are described in Table A-6 in the Appendix.

COMPLETE CORRIDORS NETWORK DEVELOPMENT

The goal of Complete Corridors is to provide travelers with a comprehensive roadway network that uses technology to support the diverse mobility needs of people throughout the region, while also supporting the other 5 Big Moves. To define a Complete Corridors network, SANDAG first studied the region's existing freeway system as a baseline for analysis.

SANDAG first analyzed the performance of key corridors in the region. It did this by using the Caltrans Performance Measurement System (PeMS) tool, which

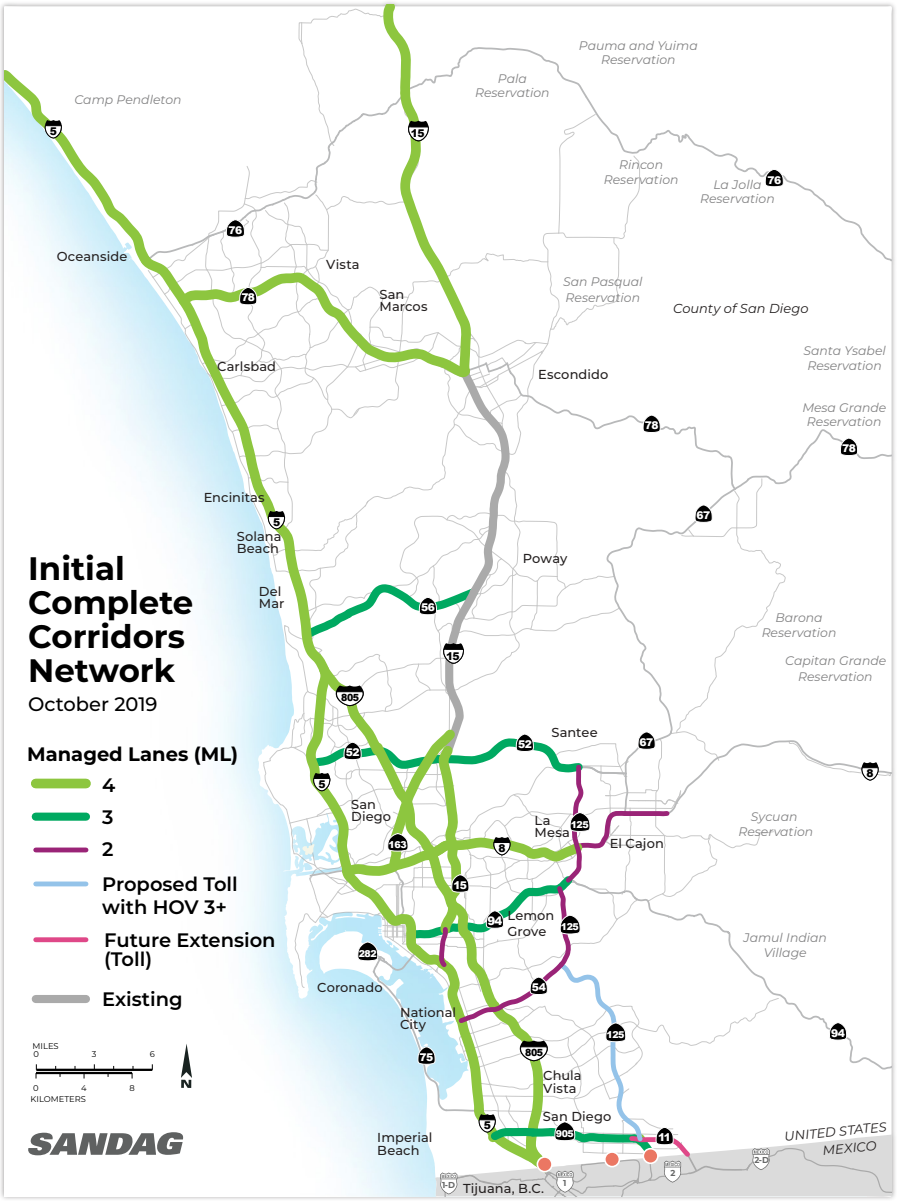


Figure 10 – Initial Complete Corridors Network

identifies vehicle miles traveled, freeway delays, average trip distances, and other characteristics along specific corridors; considering the functional characteristics of each corridor (for example, commuting, the movement of freight, and the prevalence of active transportation); and considering the geographical coverage of each corridor (for example, the extent to which the corridor provides people with access to rural or urban areas, the typical length of commutes, etc.).

SANDAG then estimated needed improvements in capacity along the region's key corridors. It did this by comparing corridor capacity with traffic volumes—using a measure known as the volume to capacity (V/C) ratio. SANDAG then estimated peak traffic volumes along the key corridors in 2050, using forecasted[6] 2050 traffic volumes and the number of lanes that exist today on the region's freeways. These analyses, along with detailed discussions between SANDAG and staff from Caltrans, District 11, helped define future capacity constraints. SANDAG then addressed these constraints by developing a system of Managed Lanes throughout the region that would increase corridor capacity. This initial Managed Lane network (see Figure 10) also included a limited number of existing or proposed Managed Lane connectors and direct access ramps that support local and regional connectivity.

SANDAG's development of a regional system of Managed Lanes was guided by the following principles:

- One or two Managed Lanes would operate in each direction in the middle of existing freeway corridors. A single, additional reversible Managed Lane may operate in the desired peak direction during peak periods, as needed.
- For vehicles to use Managed Lanes, high-occupancy vehicle (HOV) requirements would apply—in other words, three occupants per vehicle (HOV3+). This HOV policy is assumed to be in place on all Managed Lane roadways by 2025.
- New Managed Lanes are situated either along freeway shoulders that have adequate widths, or along converted general-purpose lanes that already exist.
- The expansion of freeways was limited to locations only where there were no freeway shoulders available, or where converting general-purpose lanes was not feasible.
- The reconfiguration of freeway infrastructure to accommodate Manages Lanes will require technology enhancements and operational improvements, so that travelers on general-purpose lanes do not experience delays because of the new Managed Lane system.

The principles described below guided the development of additional elements of the Complete Corridors network.

1. *Freeway Managed Lanes Connectors*

   Managed Lanes connectors are critical to the Complete Corridor network because they provide seamless connectivity between Managed Lanes corridors, helping travelers fully realize the potential of Managed Lanes to minimize delays on the freeway network. SANDAG situated Managed Lanes connectors using the following guiding principles and considerations:

   - They should support logical trip patterns.
   - They should meet the recommended minimum volume operating guidelines for Managed Lanes.
   - There should be direct connections between the Managed Lanes to maintain optimal operations.
   - The feasibility of Managed Lanes should be based on a high-level visual engineering assessment requiring more detailed analysis during the project development phase.
   - The placement of Managed Lanes should support Transit Leap services proposed for freeways.

Also considered were the total number of Managed Lanes needed for the region; the availability of freeway medians; physical constraints on freeways that might hinder the addition of Managed Lanes; traffic volumes on the region's freeways; planned Transit Leap services; a preliminary engineering visual assessment; and logical traffic movement.

2. *Freeway Managed Lanes Direct Access Ramps (DARs)*

   Like Managed Lanes connectors, direct access ramps support the Managed Lanes network. They do this by providing travelers with direct access off the freeway network and into surrounding communities without impacting the parallel freeway facility. SANDAG based its decisions on where to situate direct access ramps in the region according to the following guiding principles and considerations:

   - Direct access ramps should support proposed Transit Leap services on the region's freeways.
   - Direct access ramps should provide travelers with direct connections to the Central Mobility Hub.
   - Direct access ramps should provide critical connections to regionally significant activity centers.
   - The placement of new direct access ramps should consider those that already exist and received environmental approval.

6 Traffic forecasts were based on annual growth rates of 1.3% and 0.9% for north-south and east-west freeways, respectively.

3. Rural Highways

State highways outside the urbanized portion of San Diego County provide local and regional access to major freeway corridors and activity centers, and they support interregional travel to surrounding counties and to Mexico. All rural highways on the State Highway System were identified in the Complete Corridors network.

4. Arterial Network

The main goal of the arterial network is to establish a local roadway network that connects communities to one another and to the greater region. The network aligns with federal and national networks to facilitate future funding. SANDAG's development of an arterial network was based on the following guiding principles and considerations:

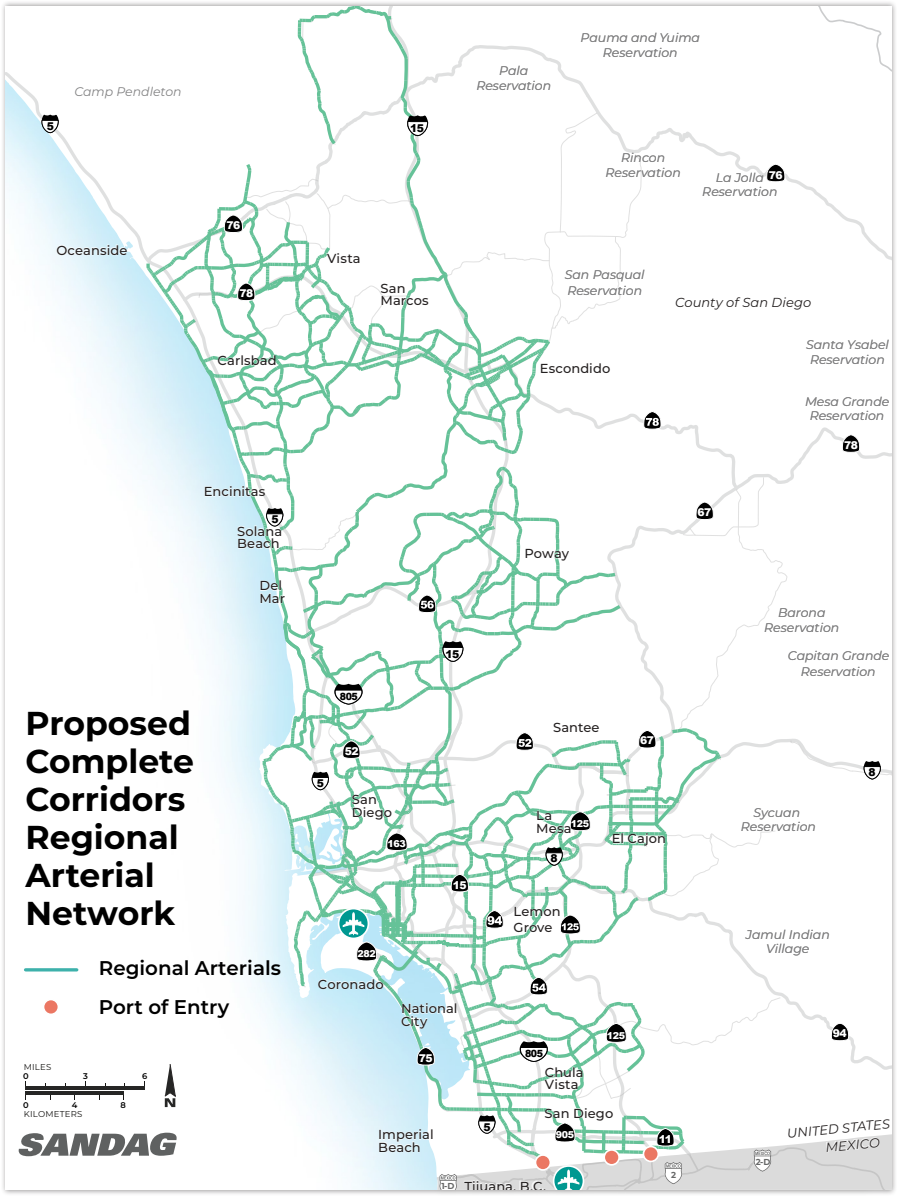


Figure 11 – Proposed Complete Corridors Regional Arterial Network

- The arterial network should provide travelers with mobility throughout the region.
- The arterial network should provide connections to the highway network.
- The arterial network should provide travelers with connections to major destinations.
- The arterial network should provide travelers with access to and from Mobility Hubs.
- The arterial network should provide travelers with continuity and access to Transit Leap, Mobility Hubs, active transportation, and freight transportation facilities.
- The arterial network should provide connectivity to the National Highway System (NHS).
- The arterial network should provide connectivity to the National Freight Network (NFN).

SANDAG considered numerous factors during its development of an arterial network. These included the number of lanes; location; limits; importance; corridor type; the location of Mobility Hubs and their surrounding areas; Transit Leap routes; bikeway network; accident information; national highway and freeway references; and average daily travel (ADT). The Regional Arterial Network is shown in Figure 11.

Network Refinement (Phase 3)

The final steps in the development of the Vision for the 2021 Regional Plan were to refine critical elements of the network and to verify that the Vision network would meet future mobility needs. With the Transit Leap and Mobility Hubs networks developed, a process known as a *propensity analysis* was conducted to ensure that each service would be located where it would be needed most—based on the area's demographics and how people in that particular area travel. Transit Leap and Complete Corridors networks were evaluated to ensure that enough freeway and transit capacity would be available to meet future travel demands on every major corridor in the region.

PROPENSITY ANALYSIS

A propensity analysis uses demographic data, travel data, and other information to evaluate the suitability of services throughout a network. The data used in a propensity analysis is based on research and best practices, reflecting the suitability of a *service*, such as public transit, to a *characteristic*, such as population density. As SANDAG developed its Transit Leap and Mobility Hub networks, propensity analyses conducted for each network helped reveal where in the region certain mobility services—and what combination of services—were most needed to most effectively enhance personal mobility, while also promoting regional goals for economic development and social equity, reducing greenhouse gases, and protecting the environment.

Transit Leap Propensity Analysis

SANDAG conducted this analysis to identify which transit routes, and which segments within each route, were most likely to meet the needs of transit riders now and in the future (Figure 12). Propensity factors are well-developed in the transit industry, based on decades of market studies, customer surveys, and industry research. Certain demographic and travel characteristics, as well as the proximity of Transit Leap routes and nodes to certain activity centers, increase transit use. As SANDAG developed its Transit Leap network, it considered the following propensity factors:

- Total Employment for 2018, 2035, and 2050.
- Weighted Population Density – This measure helped exclude undeveloped and/or vacant land from SANDAG's calculation of population densities throughout the region. Population densities were analyzed for 2018, 2035, and 2050.

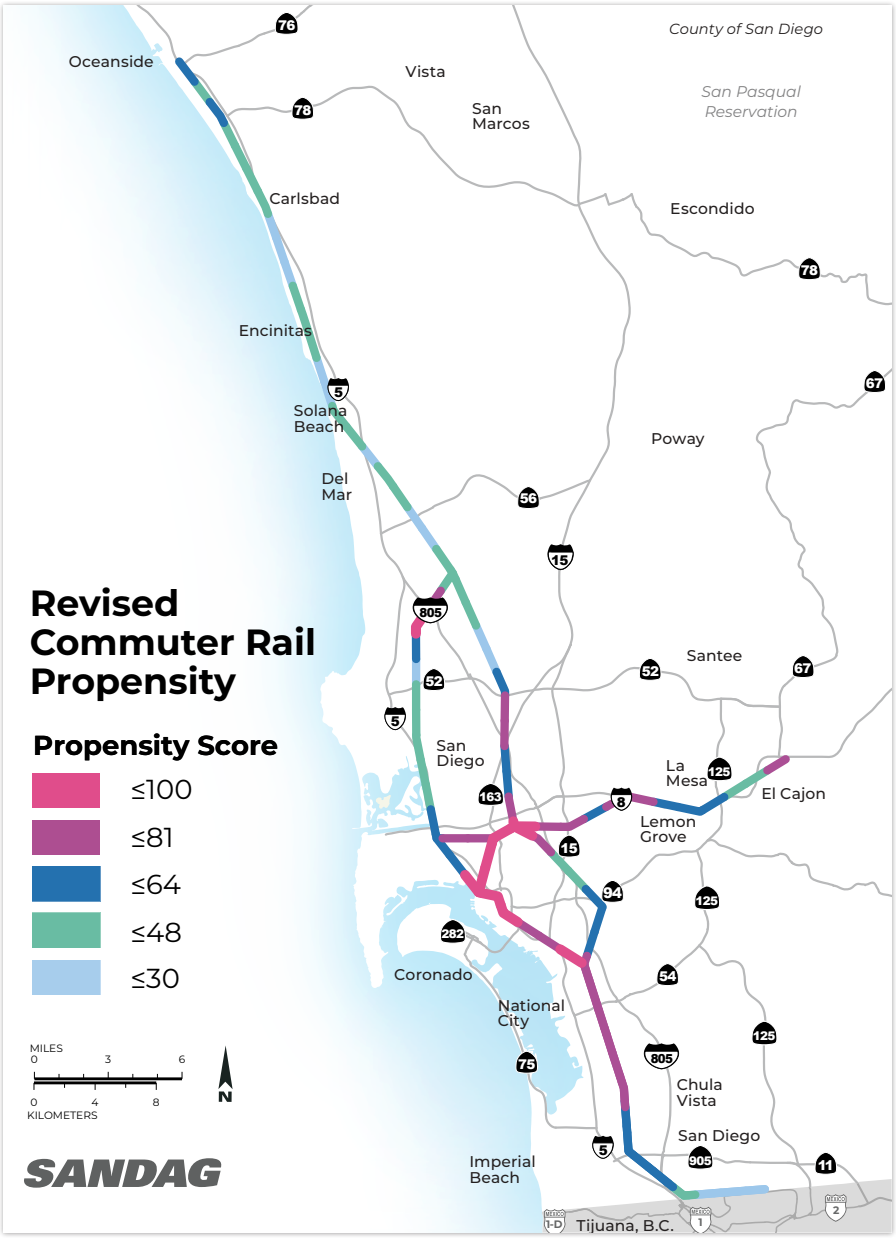


Figure 12 – Revised Commuter Rail Propensity

- The proximity of transit routes to "Activity Centers" – Defined as the total number of airports, government centers, hospitals, hotels, major attractors (such as amusement parks, sports arenas, and music venues), military installations, shopping centers, and universities/colleges.
- Connectivity – Commutes of 30 minutes or longer.
- The location of *communities of concern*, including senior, minority, and low-income populations.
- Population Counts by Age Group, including under 18, 18–24, 25–39, 40–74, and 75 plus.
- VMT per Capita – Year 2016 vehicle miles traveled, normalized by population.

Each factor was weighted to reflect the likelihood of transit use, with higher weights going to areas with higher densities, younger and older populations, minority and low-income populations, etc. The analysis used GIS and other tools to calculate a composite propensity score for each transit route, as well as each one-mile transit segment across the region. The propensity score reflects the weighted factors within a given distance (e.g., one mile) from each transit segment. The results of the propensity analysis helped inform the Phase 3 Transit Leap network that SANDAG developed. This network is represented in Figure 13.

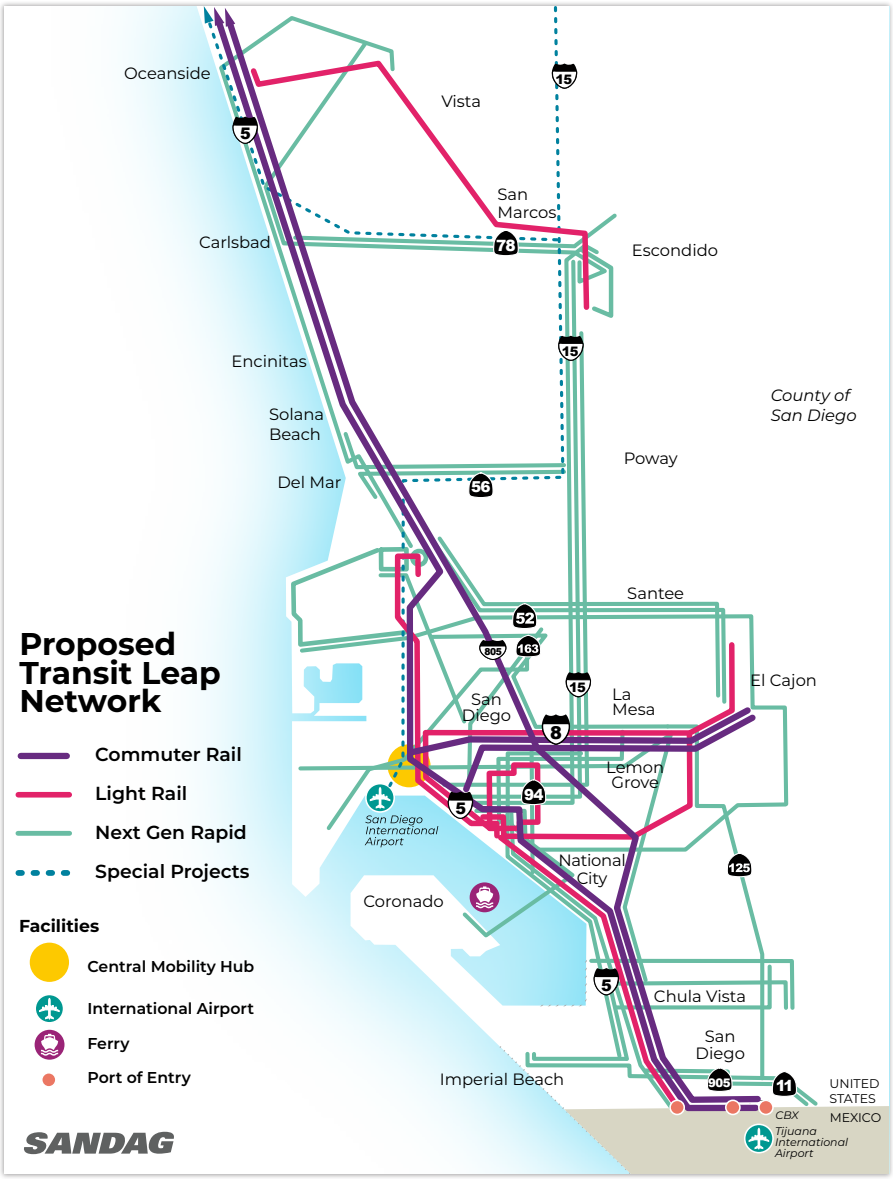


Figure 13 – Proposed Transit Leap Network

Mobility Hubs Propensity Analysis

As noted earlier, SANDAG also conducted a propensity analysis to identify which communities were most suitable for Mobility Hubs. A combination of demographic, travel data, and land use factors were examined to evaluate the communities served by Transit Leap services. Many factors used for the Transit Leap propensity analysis were also used for the Mobility Hubs propensity analysis. However, the propensity analysis for Mobility Hubs also examined the demand in individual communities for short trips within those communities—a demand that Mobility Hubs could meet. To identify the places where Mobility Hubs would be most needed, SANDAG collected and weighted the following data to determine a composite score for every Census Block Group in the region.

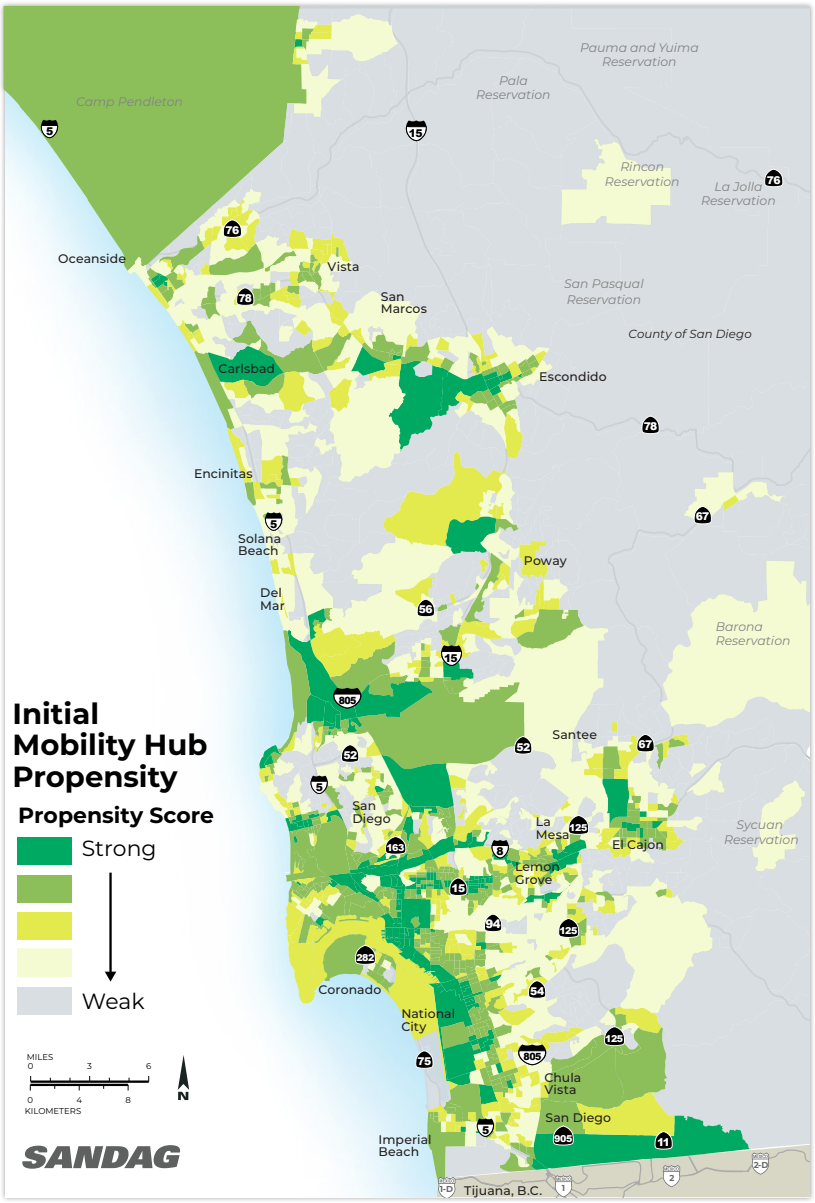


Figure 14 – Initial Mobility Hub Propensity

- Total Employment for 2018, 2035, and 2050.
- Weighted Population Density – This measure helped exclude undeveloped and/or vacant land from the density calculation. SANDAG calculated population densities for 2018, 2035, and 2050—aggregated up to each Census Block Group level and normalized by Census Block Group population.
- Population-Employment Composite Score – This was based on the Total Employment and Weighted Population scores for 2018, 2035, and 2050.
- Proximity of Mobility Hubs to "Activity Centers" – Defined as the total number of airports, government centers, hospitals, hotels, major attractors (such as amusement parks, sports arenas, and music venues), military installations, shopping centers, and universities/colleges.
- Intersection Density – The number of local street intersections per square mile, as of 2019.
- Communities of Concern (as of 2018) – Senior, minority, and low-income populations.
- Population Counts by Age Group (as of 2018) – Under 18, 18–39, and 40–74.
- Short Tours (i.e., short trips) – Year 2016 person tours of three miles or less.
- VMT per Capita – Vehicle miles traveled in 2016, normalized by population.

The analysis used GIS and other tools to calculate a composite score for each Census Block Group in the San Diego region. Census Block Groups with composite scores greater than 29 (Figure 14) were selected and examined for their proximity to the Transit Leap network of commuter rail, light rail, and Next Generation *Rapid* services. Mobility Hub boundaries were drawn around the portion of Census Block Groups that exhibited higher Mobility Hub propensity and contained Transit Leap stops.

The resulting Mobility Hub network that SANDAG developed is comprised of the region's urban core and 30 more Mobility Hubs situated across the region that will span one, two, or more miles to enable people to connect to Transit Leap services and access an array of Flexible Fleet services (see Figure 15). SANDAG has customized the size of each Mobility Hub so that it will meet the specific travel needs of each individual community where it is situated. The urban core includes higher density residential and commercial areas; various employment centers, including downtown and Naval Base San Diego; and popular activity centers such as Balboa Park and other tourist attractions. Also included in the urban core is the Central Mobility Hub where several Transit Leap services will converge to provide people with rapid and convenient access to and from the airport.

By 2050 is it anticipated that the regional Mobility Hub network will serve approximately half of the region's population and more than two-thirds of the region's jobs. Additionally, approximately 60% of low-income households, half of all seniors, and more than half of all minority residents will have access to Mobility Hub services and amenities. The regional Mobility Hub network is designed to serve communities as they grow in density, offering people convenient, safe, and seamless mobility options to get to and from work, school, shopping, and more. Nearly half of all trips in the region are three miles or less, making this network a prime opportunity to reduce the number of miles that people travel driving alone while helping the region meet state mandated goals for cutting greenhouse gas emissions.

CORRIDOR CAPACITY ANALYSIS

The final validation step in the development of the Vision for the 2021 Regional Plan was an analysis of demand on the region's major corridors of travel. The methodology for this analysis was to forecast future travel demand (in 2035) on the freeway network, and to assess the capacity of freeway managed lanes as well as Transit Leap services to meet future corridor demand. SANDAG conducted this analysis for selected locations on every major freeway corridor where travel demand was highest in 2016. Traffic data for 2016 was collected at each freeway location, in order to understand the capacity of a given freeway corridor to move people and goods reliably.

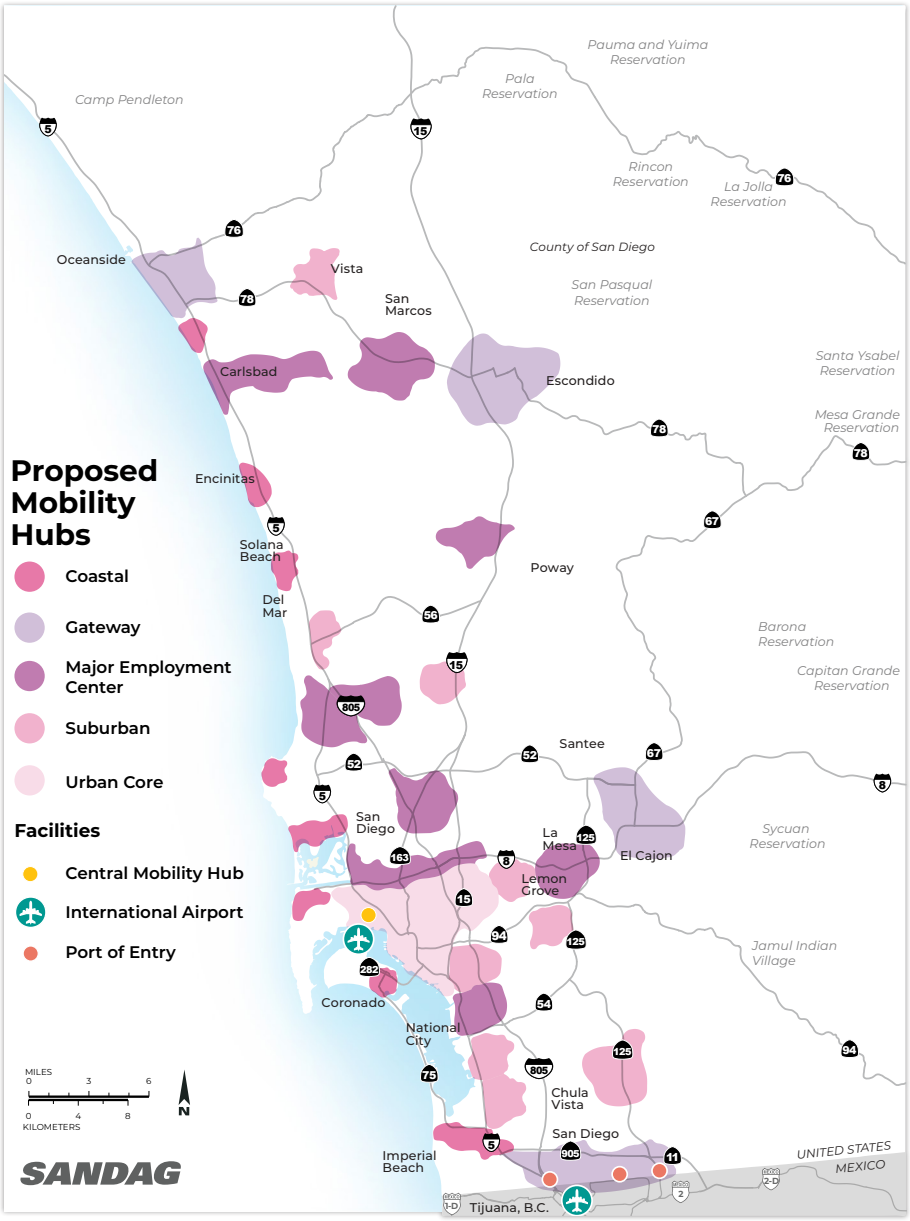


Figure 15 – Proposed Mobility Hubs

Using travel forecasts from the 2019 Federal RTP, SANDAG estimated travel demands in the Year 2035 at each freeway location. These demands were then compared with future freeway capacity for that particular segment, in order to assess the segment's performance.

For example, a segment of I-805 may have an estimated demand in 2035 of 8,000 vehicles during the peak hour. However, that segment may only have a capacity for 5,000 vehicles on its general-purpose freeway lanes in 2035. Each freeway, and each managed lane on that freeway, have different capacities to move people based on different operational characteristics.

Finally, the freeway analysis assessed unmet demand (in terms of the number of individuals) at each freeway segment (if any), along with the number of hours in which demand exceeded capacity. In the previous example, the unmet demand would be 3,000 vehicles or 3,300 individuals at 7 a.m., and demand exceeds capacity from 6 a.m. to 9 a.m. in 2035.

For those freeway segments with future unmet demand, parallel transit services were identified from future Transit Leap concepts in each freeway corridor.[7] Based on available Transit Leap services and their respective vehicle configuration and design and comfort capacities, an aggregate transit capacity was calculated for the selected peak period.

7 Future unmet demand was further reduced, as any future managed lanes were assumed to meet 20% of overall freeway demand.

The available transit capacity[8] in the corridor in Year 2035 was then compared with unmet freeway demand. Based on the analysis conducted, SANDAG found that all freeway segments identified with unmet person demand also had a sufficient amount of Transit Leap capacity available in order to meet the excess corridor demand. The proposed Complete Corridors network is shown in Figure 16.

Figure 16 – Proposed Complete Corridors

Table 1 – Passenger Loading Assumptions for Transit Leap Vehicles

Mode	Vehicles/ Consists	Design Capacity	Comfort Load	Max Capacity	Vehicle
Commuter Rail	5	355	355	1775	Bombardier Bi-Level Coach
LRT	3	225	150	450	Siemens S70
Tram	1	226	150	450	Siemens Desiro VT642
Next Gen *Rapid*	1	125	125	125	New Flyer Articulated
Local Bus	1	82	82	82	New Flyer Excelsior

8 Maximum transit capacity in Year 2025 was reduced to account for preexisting transit demands in the corridor that exist today that will continue into future years.

Next Steps

As we approach mid-century, our region will see many changes related to where we live and work, how we get around, how our economy grows, how we protect our environment, and how we preserve our high quality of life. One of the biggest challenges we will face is a projected growth in population to 3.75 million—more than 400,000 people than today. In 2050, personal mobility will be critical to everyone's quality of life.

The Vision for the transportation ecosystem in the 2021 Regional Plan, shaped by the transformative 5 Big Moves, has come together through a careful and deliberate analysis of real data related to where people live, where they work, how they get around, and what combination of mobility options would make their lives easier. Not every answer came from the analysis of data, however. SANDAG also built the Vision based on conversations with real people in cities and neighborhoods throughout the region, the judgments of SANDAG professionals, and a deep knowledge of local communities and their unique needs.

The work described in this report led SANDAG to its Vision—a vision of possibilities. Now, as the agency continues its work developing San Diego Forward: The 2021 Regional Plan, it will have to make the hard decisions about what it can build with the resources it is projected to have over the next 30 years, leading up to 2050. The ultimate transportation network chosen for our region will also have to show that it can perform—that is, achieve our mobility and environmental goals. The Vision will guide this upcoming work, pointing us in the right direction like a guide star leading us toward a better future.

APPENDIX A – 5 BIG MOVES DESCRIPTIONS

Table A–1 – Complete Corridor Types

Type	Travel Shed/ Trip Purpose/ Characteristics	Functionality/ Multimodal Elements	Key Performance Characteristics
Regional and Interregional	Regional and Interregional commuting Serves long distance commute trips (>20 miles), regional employment and industrial centers and primary regional freight backbone	High-speed transit, regional freight, active transportation	About 65–70% of freeway VMT (total for all type A) 60% of trips >20 miles 66% of total regional freeway delay
Urban Connectivity	Regional urban commuting Serves long and medium distance commute trips (>5 miles), part of primary regional freight backbone	Transit, regional freight, and active transportation	25–30 % of total freeway VMT 80–90% of trips > 5 miles 35% of regional freeway delay
Rural Access and Connectivity	Provide rural access and connectivity: non commuting long stretches of rural roadway connecting nearby rural towns and lands to the interstate system Serves long and medium distance trips (>5 miles) with mountainous terrain and limited transit option	Transit: Rural bus, commuter bus, local bus International/Cross Border/ subregional freight Active Transportation	About 5% of regional freeway VMT 80% of trips lengths 5–20 miles About 1% of regional freeway delay
CC Regional Arterial Network	Local commuting: primary arterial network connecting employment and industrial centers to residential neighborhoods Trip distance 5–20 miles with bus and light rail providing transit backbone	Transit: LRT/BRT/*Rapid* bus/ Express bus Short haul trips (local delivery) Active transportation: urban network, first and last mile to Mobility Hubs	Generally represents 65% of trips <5 miles

Table A–2 – Transit Leap Service Types

Type of Service	Purpose	Speed	Distance and Station Spacing	Infrastructure
Commuter Rail	Commuter rail lends itself to longer trips and interregional travel.	Operates with speeds up to 110 mph.	Routes can exceed distances of over 100 miles, with spacing of 10 miles or more between stations.	Transit Leap Commuter Rail operates exclusively on fully grade separated guideways, similar to high-speed rail.
Light Rail	Facilitate shorter, more regional trips than Commuter Rail.	These services operate at average speeds of up to 30 mph, with a maximum speed of 55 mph.	LRT routes generally have station spacing of 1 mile at minimum.	Light Rail Transit (LRT) services are partially grade separated guideways, such as the current light rail service in the region (MTS Trolley and the SPRINTER).
Next Generation Rapid	Next Generation *Rapid* services seek to improve existing premium or express bus services by leveraging technology and dedicated bus infrastructure to improve operating speeds.	Next Generation *Rapid* services operate at average speeds of up to 35 mph, with a maximum of 65 mph.	Route range from 10 to 40 miles in length with station spacing from 0.5 to 5 miles.	These services run in a fixed guideway or a dedicated lane during peak periods on major arterial corridors and freeway managed lanes, requiring vehicle priority to reduce or minimize conflicts.
Local Bus Routes and Flexible Fleets	These services better facilitate local, short distance trips. Future services may be supplied using on-demand Flexible Fleet vehicles (for more detail see Flexible Fleets section).	Local Bus and Flexible Fleet services operate at average speeds up to 25 mph, with a maximum speed of 65 mph.	These local routes can have route distances of various lengths, with stations spaced from 0.25 to over 1 mile in length.	Buses receive vehicle priority at critical spots along the route, as well as at major signalized intersections. Flexible Fleets services are similar to existing local bus services in that they run on major roadways and local streets.

Table A–3 – Proposed Regional Mobility Hubs

Mobility Hub	Type	Transit Leap Services	Flexible Fleet Services
Carlsbad Palomar	Major Employment Center	Commuter Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Carlsbad Village	Coastal	Commuter Rail, Next Gen *Rapid*	Micromobility, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Carmel Valley	Suburban	Commuter Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
College Area	Suburban	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Coronado	Coastal	Next Gen *Rapid*	Micromobility, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Downtown Chula Vista	Suburban	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Rideshare, NEV Microtransit, Last-Mile Delivery
El Cajon	Gateway	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Encinitas	Coastal	Commuter Rail, Next Gen *Rapid*	Micromobility, Rideshare, Microtransit, NEV Microtransit
Escondido	Gateway	Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Imperial Beach	Coastal	Commuter Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Kearny Mesa	Major Employment Center	Commuter Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
La Jolla	Coastal	Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
La Mesa	Major Employment Center	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Lemon Grove	Suburban	Light Rail	Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Mira Mesa	Suburban	Next Gen *Rapid*	Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Mission Valley	Major Employment Center	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
National City	Major Employment Center	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Ocean Beach	Coastal	Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Oceanside	Gateway	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Otay Ranch	Suburban	Next Gen *Rapid*	Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Pacific Beach	Coastal	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
San Marcos	Major Employment Center	Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Solana Beach	Coastal	Commuter Rail, Next Gen *Rapid*	Micromobility, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Sorrento Valley	Major Employment Center	Commuter Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Southeast San Diego	Suburban	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Southwest Chula Vista	Suburban	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery

Mobility Hub	Type	Transit Leap Services	Flexible Fleet Services
U.S.–Mexico Border	Gateway	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
University Community	Major Employment Center	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Urban Core	Urban	Commuter Rail, Light Rail, Next Gen *Rapid*	Micromobility, Carshare, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
Vista	Suburban	Light Rail, Next Gen *Rapid*	Micromobility, Rideshare, Microtransit, NEV Microtransit, Last-Mile Delivery
West Bernardo	Major Employment Center	Next Gen *Rapid*	Carshare, Rideshare, Microtransit, Last-Mile Delivery

Table A–4 – Flexible Fleet Services Descriptions

Flexible Fleets Services	
	**Micromobility** Small, low-speed vehicles such as e-scooters, bikes, and other rideables support short trips around a community.
	**Ridehailing/Carsharing** On-demand ridehailing services allow someone to request a ride or vehicle in real time using a mobile app. Ridehailing services link the passenger with available drivers based on their trip length, number of passengers, origin, and destination. Carsharing service provides members with access to a shared vehicle. Ridehailing services will be automated in the future and operate as subscription-based services, allowing users to reserve a ride any type of vehicle for their trip.
	**Ridesharing** Drivers and passengers headed in a similar direction can share the ride in a vehicle. This includes carpool, vanpool, and pooled ride hailing services such as uberPOOL and Lyft Shared. Eventually these services will operate as automated and shared taxis that will be designed to meet passenger needs.
	**Microtransit** Multi-passenger shuttles can carry up to 15 passengers and provide rides within a defined service area. This technology-enabled transit service allows users to reserve a ride ahead of time or on demand, and it may be a more efficient option for suburban areas of the region. Smaller, all-electric shuttles, also known as neighborhood electric vehicles (NEV), also are a form of microtransit that provide a sustainable and convenient solution for short trips around communities.
	**Last-Mile Delivery** Driverless vehicles, e-bikes, drones, and bots will deliver a range of goods from a distribution hub to individual consumers, businesses, or smart lockers at Mobility Hubs. Some last mile delivery services can consolidate trips by carrying passengers and goods at the same time.

Table A–5 – Flexible Fleets Service Areas Descriptions

Flexible Fleets Service Areas	
	**Micromobility** Mobility Hubs with high population and/or employment densities; other hubs that support micromobility include those designated as a "Gateway" or "Coastal," presence of major universities and commuter rail service.
	**Ridehailing/Carsharing** Mobility Hubs with high population and/or employment densities; other hubs that support micromobility include those designated as a "Gateway" or "Major Employment Center".
	**Ridesharing** All ridesharing deemed suitable to operate throughout Mobility Hub network as carpool, vanpool, dynamic ridesharing and pooled ridehailing is already prevalent throughout the region.
	**Microtransit** There are two types of Microtransit services: 1. *Microtransit* This category pertains to higher occupancy, on-demand shuttle services in the region that operate similar to demand-responsive local bus. This includes hubs with high population and employment densities; other hubs that support microtransit include those designated as a "Gateway", those without commuter or light rail Transit Leap services, and hubs within the North County Transit District (NCTD) area which plans to transition local bus to on-demand microtransit as early as 2021. 2. *NEV Microtransit* This category pertains to small, low-speed, all-electric shuttles that operate in the region. Mobility hubs deemed suitable for micromobility are also suitable for NEVs due to the low-speed nature of the service; other hubs that support NEV microtransit include those with a high walkability index and communities with planned/existing NEV infrastructure.
	**Last-Mile Delivery** This includes hubs with high population and employment densities, high commercial and industrial land uses, and hubs that include major activity centers (e.g., universities, major shopping centers, major attractors, airport, hospitals, hotels).

Table A–6 – Flexible Fleets Operating Environments

Flexible Fleet	Transit Leap Interaction	Mobility Hub Interaction	Complete Corridor Interaction
Micromobility	Connections to/from: -Commuter Rail -Light Rail -Next Generation Rapid -Local Bus	Intra-hub trips; inter-hub (or neighborhood-to-neighborhood) trips Shared micromobility fleets sited and centered around commuter and light rail Transit Leap service and/or downtown, village centers	Complete Corridor Type D & E
Ridehailing and Carshare	Connections to/from: -Commuter Rail -Light Rail -Next Generation Rapid	Intra-hub trips; point-to-point Site ridehailing pick-up/drop-off locations at Transit Leap stations, curb, and where Park & Pool opportunities exist. Site carsharing vehicles where Park & Pool exists.	Complete Corridor Type A- E
Rideshare	Connections to/from: -Commuter Rail -Light Rail -Next Generation Rapid	Intra-hub trips; inter-hub trips; point-to-point Site rideshare pick-up & drop-off at commuter and light rail Transit Leap stations, curbs within hubs, and where Park & Pool opportunities exist	Complete Corridor Type A- E
Microtransit	Connections to/from: -Commuter Rail -Light Rail -Next Generation Rapid Opportunity to augment: -Local Bus	Point-to-point trips; inter-hub trips; intra-hub trips Site microtransit fleets where Park & Pool opportunities exist. NEV shuttles sited and centered around commuter and light rail Transit Leap service and/or downtown, village centers	Complete Corridor Type A- E. NEV shuttles use Complete Corridor Type D & E only
Last Mile Delivery	No connections to/ from Transit Leap but opportunities to leverage transit to deliver goods or to pick up packages at transit stations exist	Package lockers and drone landing zones/pads sited around commuter and light rail Transit Leap service and/or downtown, village centers, and Park & Pool lots	Ground services use Complete Corridor Type D- E only. Aerial services do not apply

APPENDIX B – DATA SOURCES USED IN VISION DEVELOPMENT

Table B–1 – Data Sources

Data	Data Source	Geography	Time Period	Comments
Land Use				
Activity Centers	SANDAG	San Diego Region, Point layer	Year 2019	Draft dataset
Dwelling Units	SANDAG	San Diego Region, Polygon layer	Year 2018	SANDAG Land Inventory System (SPACECORE)
Housing Unit Forecast	SANDAG	San Diego Region, by Jurisdiction, Employment Centers	Years 2016 and 2050	SANDAG Draft Regional Growth Forecast Data Source ID-28, used for Surplus Capacity analysis
Land Use, Existing	SANDAG	San Diego Region, by Polygon and Employment Center	Year 2018	
Port of Entry (POE) Boundaries	SANDAG	Polygon layer	Year 2019	Polygon feature class depicting generalized boundaries for international ports of entry along the San Diego and Imperial County border with Baja California
Smart Growth Opportunity Areas	SANDAG	San Diego Region, Polygon layer	Year 2016	
Unincorporated Communities	SanGIS	San Diego Region, Polygon layer	Year 2016	Community Planning Group areas within the County of San Diego
Transportation				
Bike Network, Proposed	SANDAG	San Diego Region, Line layer	Year 2019	Proposed network developed on September 24th, 2019 and finalized on September 25th, 2019
Bike Routes, Existing	SANDAG	San Diego Region, Line layer	Year 2019	Existing bike routes merged by bike class and road name
Journey-to-Work Travel Time data	American Community Survey (ACS), Five-year averages.	San Diego Region, Block group	Year 2017	U.S. Census
Jurisdiction Boundaries	SanGIS	San Diego Region, Polygon layer	Year 2019	
Major Roads	SANDAG	San Diego Region, Line layer	Year 2019	
Park and Ride Lots	SANDAG	San Diego Region, Point layer	Year 2018	
Peak Period Traffic Volumes	SANDAG	San Diego Region, Line layer	Year 2016	2016 AM and PM peak period traffic flows based on ABM v14.0.1
Person Origin and Destination by Time-of Day, Trip Purpose, Day Type	Teralytics	San Diego Region, Trips from origin census tract to destination tract	Year 2018	Trip Purpose include “To Work”, “To Home”, and “To Other”; Day Types include “Weekday” and “Weekend”
Regional Arterial System	SANDAG	San Diego Region, Line layer	Year 2016	Network of regional arterials

Data	Data Source	Geography	Time Period	Comments
Regional Bikeways	SANDAG	San Diego Region, Line layer	Year 2050	Riding to 2050 Regional Bikeway corridor alignments, names, and classifications
Roadway Traffic Volumes	SANDAG	San Diego Region, Line layer	Base Year (2016)	Traffic volumes from SANDAG ABM Scenario 358 (Federal RTP Update)
Short Tours (under 3 Miles), Destination MGRA	SANDAG	San Diego Region, Polygon by MGRA	Year 2016	Count of tours by destination MGRA
Short Tours (under 3 Miles), Origin MGRA	SANDAG	San Diego Region, Polygon by MGRA	Year 2016	Count of tours by origin MGRA
Street Intersections	SANDAG	San Diego Region, Point layer	Year 2016	
Transit (Rail and Bus), Existing	SANDAG	San Diego Region, Line layer	Years 2018 and 2019	From SANDAG ABM v.14.0.1
Transit Ridership by Stop. Weekdays	SANDAG, MTS, NCTD, GTFS	San Diego County, Point Layer	FY 2018	
Transit Routes (Bus and Rail), Future	SANDAG	San Diego County, Line layer	Years 2025 and 2050	2015 Regional Plan and 2019 Federal RTP
TransNet Projects	SANDAG	San Diego County	Year 2019	
Commercial Vehicle Origin-Destination	StreetLight	San Diego County	Year 2017	Trip data from 66 zones to/from various destinations in San Diego County and northern Baja California
Vanpool Trips	SANDAG	Vanpools destined within San Diego County, Census Block Group	Year 2017	Origin-destination data based on SANDAG's 2017 Vanpool Passenger Survey
Vehicle Miles Traveled	SANDAG	San Diego County	Base Year 2016	From SANDAG ABM v.14.1.1, Scenario 376
Socioeconomic Data				
Employment Estimates	SANDAG	San Diego Region, Polygon layers by MGRA, Census Block	Year 2018	SANDAG Annual Estimates
Employment Estimates	SANDAG	San Diego Region, Polygon layer by Employment Centers and Hexbins	Year 2016	SANDAG Employment Inventory
Employment Estimates	Longitudinal Employer-Household Dynamics Dataset, (LEHD)	San Diego Region, Hexbins	Year 2016	Center for Economic Studies, U.S. Census
Employment Forecasts	SANDAG	San Diego Region, Polygon layers by MGRA, Census Block	Years 2035 and 2050	SANDAG Draft Regional Growth Forecast Data Source ID-28
Population by Age	SANDAG	San Diego Region, Polygon layers by MGRA	Year 2018	SANDAG Annual Estimates

Data	Data Source	Geography	Time Period	Comments
Population by Income	SANDAG	San Diego County, Polygon layers by MGRA	Year 2016	From SANDAG ABM v.14.1.0 Scenario 330
Population Estimates	SANDAG	San Diego Region, polygon layers by MGRA, Census Block Group, Employment Center	Year 2018	SANDAG Annual Estimates
Population Forecasts	SANDAG	San Diego Region, polygon layers by MGRA, Census Block	Years 2035 and 2050	SANDAG Draft Regional Growth Forecast Data Source ID-28

APPENDIX C – GLOSSARY

A

active transportation
Active Transportation includes any method of travel that is human-powered, but most commonly refers to walking and biking. With technological advances, the definition has expanded to include things like e-scooters and e-bikes.

activity centers
Places that attract a significant number of people or vehicles daily, including employment centers, shopping centers, business parks, hospitals, major tourist attractions, colleges/universities, and other destinations.

ADT
see **average daily traffic**

arterial
Streets with traffic lights that serve primarily to carry traffic through an area as quickly and efficiently as possible.

Active Transportation and Demand Management
Active Transportation and Demand Management (ATDM) is the dynamic management, control, and influence of travel demand, traffic demand, and traffic flow of transportation facilities.

ATDM
see Active Transportation and Demand Management

autonomous vehicles
Vehicles that are computer driven and do not require a human to safely operate the vehicle. Sensors collect data about nearby objects (like size and speed) and categorize these objects to determine how the vehicle should react.

average daily traffic
The average number of vehicles that travel through a specific point of a road over a short duration of time (often seven days or less).

B

bikeshare
Bikeshare services provide low-cost, on-demand, and convenient access to a fleet of shared bikes for short-term use. Services can be accessed by using a smartphone app.

C

capacity
A measure of the number of vehicles or people that can be carried by a roadway segment or via transit during a period of time.

carsharing/ridehailing
Carshare services offer access to vehicles 24 hours a day, seven days a week. These cars can be found within a specified service area, at transit stations, or other locations, and people can find them through a smartphone app or provider's website.

Census Block Group
A geographical unit used by the United States Census Bureau. Typically, Block Groups have a population of 600 to 3,000 people. This is the smallest geographical unit for which the Census Bureau publishes sample data (i.e., data that are only collected from a fraction of all households).

connectivity
The general ability for people to reach destinations. In the transportation context, enhanced connectivity is achieved by increasing the options and opportunities for travel to various destinations.

communities of concern
see **disadvantaged communities**

commuter rail
Conventional rail passenger service within a metropolitan area. Service is primarily in the morning (home-to-work) and afternoon (work-to-home) travel periods.

congestion
Travel time or delay in excess of what is experienced under free-flow traffic conditions. Congestion is typically accompanied by lower speeds, stop-and-go travel conditions, or queuing, such as behind ramp meters or heavily used intersections.

corridor
A broad geographical band that follows a general directional flow connecting major trip origins and destinations. A corridor may contain several streets and highways as well as bike routes and transit route alignments.

D

DARs
see **direct access ramps**

data hub
In transportation systems, a data hub is the central location of data storage, analysis, and transport. It includes datainput channels; high-speed, high-volume computing platforms; and data storage technologies. Data hubs are used to receive field data from local and regional data providers; process, analyze, and verify quality of received data; message and communicate data within the system; store data; and provide security measures for stored data.

delay
see **congestion**

density analysis
A method that overlays limited points of data (e.g., population or employment) over a geographic area (e.g., San Diego County) for visualization.

direct access ramps
Freeway ramps that provide direct access between HOV lanes or Managed Lanes and local communities. Direct access ramps (DARs) provide the benefits of local connectivity, shorter freeway access times, and minimal conflicts with general-purpose freeway lanes.

disadvantaged communities
Disadvantaged communities are identified as minority, low-income, and senior populations. The term “minority” is described by the Federal Highway Administration as: Black (having origins in any of the black racial groups of Africa); Hispanic (of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race); Asian American (having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands); or American Indian and Alaskan Native (having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition). Low-income populations are those with income levels below 200% of the Federal Poverty Rate, and senior populations include anyone 75 years old and older.

E

e-scooters
see **electric scooters**

electric scooters
Kick scooters are equipped with an electric motor, making it easier for people to travel to work or other destinations when topography is challenging. E-scooters typically have two small wheels and can travel at a maximum speed of 15 to 20 mph.

emerging technology
New technologies that demonstrate opportunities for improving transportation by reducing congestion and emissions, and improving safety. An example of an emerging technology is app-enabled transportation services.

F

Flexible Fleets
On-demand, shared services that provide different mobility options and vehicles for all types of trips, reducing the need own a car. Vehicle types can range from small, low-speed scooters to a 12-passenger shuttles. These services can make it easier to connect to high-speed transit and other important destinations by providing a last-mile connection or fulfilling a complete trip.

G

gateway mobility hub
A mobility hub that provides an entry point into the 5 Big Moves network. These mobility hubs are situated near the starting point of many Transit Leap routes while featuring a robust set of Flexible Fleet services to help the outlying community connect to/from transit. Gateway mobility hubs include Oceanside, Escondido, El Cajon, and the US-Mexico Border.

general purpose lanes
Term used to refer to traditional mixed-flow freeway lanes. Used to distinguish between high-occupancy vehicle (HOV) lanes, Express Lanes, or toll lanes.

geographic information system
A framework for gathering, managing, and analyzing data. Rooted in the science of geography, a geographic information system (GIS) integrates many types of data. It analyzes spatial location and organizes layers of information into visualizations using maps and three-dimensional scenes. With this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations, helping users make smarter decisions.

GIS
see **geographic information system**

H

hexbin
Hexagon-shaped geographic areas used for geospatial analysis. To develop the Vision for the 2021 Regional Plan, 100-acre hexbins were used to represent the San Diego region.

high-occupancy vehicle
A vehicle that carries more than one person, such as a carpool, vanpool, shuttle, or bus.

HOV
see **high-occupancy vehicle**

HOV lane
An exclusive road or traffic lane that typically has a higher operating speed and lower traffic volumes than a general-purpose or mixed-flow lane. In California, vehicles that can use HOV lanes include carpools, vanpools, buses, other multi-passenger vehicles, motorcycles, and emergency vehicles, as well as decaled low-emission vehicles.

human-centered design
A customer-focused approach to solving problems. A human perspective is taken into consideration in every step of the problem-solving process, from determining the true needs of the people who are served to verifying that the solution designed for them is actually meeting their needs.

I

J

K

kernel analysis
see **density analysis**

L

last-mile delivery
The delivery of goods (e.g., small packages or food) by a person or by using semi- or fully automated vehicles, ebikes, drones, and bots to make deliveries from the distribution center to a user's home or smart lockers at Mobility Hubs. Shared vehicles can make efficient trips by carrying passengers and goods at the same time.

level of service
A performance measure used to determine how well a transportation facility is operating from a traveler's perspective. Typically, six levels of service are defined, each assigned a letter designation from A to F, with LOS A representing the best operating conditions and LOS F the worst. Various statistics or metrics are associated with each level of service depending on the transportation system or mode.

light rail
Dedicated rail service that serves longer commute trips and shorter local trips (e.g., the MTS San Diego Trolley and NCTD SPRINTER rail service). Light rail is generally integrated into the street network much more than commuter rail.

LOS
see **level of service**

M

Managed Lanes
Managed Lanes, such as those along the Interstate 15 corridor, offer priority access to people using transit, carpooling, or vanpooling. People driving alone can access these lanes for a fee. When paired with technology, this can help move more people, reduce traffic congestion, and increase transit ridership.

managed lane connectors
Freeway connectors that provide direct access between one high-occupancy vehicle lanes or Managed Lanes facility with another. Managed Lane connectors provide the benefits of shorter freeway travel times and minimal conflicts with the general-purpose freeway lanes.

master geographic reference area
The basic geographic unit in SANDAG's Master Geographic Reference File system for storing demographic, economic, and other information. MGRAs are small—comparable to census blocks in size. Currently, there are more than 23,000 MGRAs used to represent the San Diego region.

MGRA
see **master geographic reference area**

micromobility
Small, low-speed, low-occupancy vehicles that fulfill short trips (e.g., bikeshare, scootershare, and neighborhood electric vehicles).

microtransit
Microtransit services use smaller vehicles that carry 5–12 passengers. Riders can typically request service through a mobile app that directs them to common locations along the service route for pick-up.

ML
see **Managed Lanes**

Mobility Hubs
Mobility Hubs are communities with a high concentration of people, destinations, and travel choices. They provide an integrated suite of mobility services, safe roads, and supporting amenities and technology to help people reach high-frequency transit or make short trips around a community. Mobility Hubs can span one, two, or few miles, and each hub is uniquely designed to fulfill a variety of travel needs while strengthening sense of place.

Mobility Hub network
Comprising "right-sized" Mobility Hubs that are situated close to major residential, job, and activity centers across the region. Each mobility hub enhances connections to and from Transit Leap services by offering an array of ondemand Flexible Fleet choices throughout a community. Mobility Hubs also integrate with Complete Corridors to ensure walking and biking are safe experiences while prioritizing the movement of shared mobility options over single-occupant vehicles.

N

National Highway Freight Network
A network of highways, including:

- the Primary Highway Freight System (PHFS), a network of highways identified as the most critical highway portions of the U.S. freight transportation system
- non-PHFS Interstate highway routes that provide important continuity and access to freight transportation facilities
- Critical Rural Freight Corridors (CRFCs), public rural roads that provide access and connection to the PHFS and the Interstate with other important ports, public transportation facilities, or other intermodal freight facilities
- Critical Urban Freight Corridors (CUFCs), urbanized public roads that provide access and connection to the PHFS and the Interstate with other ports, public transportation facilities, or other intermodal transportation facilities

National Highway System
An interconnected system of principal arterial routes that serve major population centers, international border crossings, ports, airports, public transportation facilities, and other intermodal transportation facilities and major travel destinations; meet national defense requirements; and serve interstate and interregional travel.

Next Generation *Rapid*
Next Generation (Next Gen) *Rapid* uses sleek and comfortable transit vehicles that can be configured to different sizes or coupled, can be automated in the future, and get priority on roads so they can travel at posted street speed limits. Service is provided every ten minutes all day.

Next Operating System
The proposed digital platform of the regional transportation system that compiles information from sources like passenger vehicles, buses, ridesharing vehicles, delivery trucks, bikes, and scooters into a centralized data hub. Analysis of these data will improve how transportation is planned, operated, and experienced. Transportation operators will be able to better manage supply and demand by modifying how infrastructure and services are used throughout the day.

Next OS
see **Next Operating System**

NHFN
see **National Highway Freight Network**

NHS
see **National Highway System**

O

on-demand transportation
A form of transportation where services are requested in real time by the traveler and fulfilled by services providers based on location and availability. On-demand rideshare services, for example, allow someone to request a ride in real time using a mobile app. Services match drivers and passengers traveling in the same direction based on their origin and destination while identifying the quickest route.

P

Performance Measurement System
The PeMS program uses urban freeway data collected through freeway loop detectors to provide current, ongoing data on freeway volumes and speeds that can be displayed graphically and exported to other monitoring applications.

PeMS
see **Performance Measurement System**

priority treatments
Improvements, modifications, or design features of either the operations or the environment in which selected transportation systems or modes operate that improve performance. The most prevalent priority treatment is for transit priority, which attempts to increase speeds, reduce delays, or otherwise benefit bus operations by improving reliability or attractiveness to patrons.

propensity analysis
A process in which observed data is used to predict the likelihood of a certain outcome. For example, transit propensity may assume that there are certain physical, locational, and socioeconomic factors that can potentially serve as predictors of where transit service may be successful. By assessing those factors in relationship to existing or future transit services, propensity models may be used to plan future transit routes.

public–private partnership
Any formal collaboration between a public agency and a private company to deliver a public service or facility.

Q

R

Rapid
Provides rapid and frequent transit service along arterials and express lanes. Arterial *Rapid* bus services use signal priority and queue-jumper lanes at major intersections, while freeway *Rapid* services use express lanes to maintain reliable, high-speed service (e.g., Mid-City *Rapid* transit service). All day, all-stop trunk *Rapid* services can be complemented with peak-period commuter express services designed to provide very limited stop connections to major employment centers (e.g., Interstate 15 *Rapid* transit).

rideshare/ridesharing
Shared trips for people with a common origin and destination. Technology enabled pooled ridehailing services to thrive in addition to traditional carpools and vanpools.

S

scootershare
Scootershare provides low-cost, on-demand, convenient access to a fleet of shared electric scooters for short-term use. Services may include kick scooters or mopeds and are typically dockless and can be accessed by using a smartphone app.

shared mobility
Transportation services that are shared among users, either concurrently or one after another. Services may include shared vehicle fleets (e.g., dockless bikes and scooters) or shared ride options (e.g., Lyft and Uber).

social equity
Social equity means ensuring that all people are treated fairly and are given equal opportunity to participate in the planning and decision-making process, with an emphasis on ensuring that traditionally disadvantaged groups are not left behind.

SPRINTER
The SPRINTER light rail train system, operated by NCTD, provides service between Oceanside and Escondido.

sustainability
Meeting current economic, environmental, and community needs without jeopardizing the ability of future generations to meet their needs.

T

traffic volumes
see **average daily traffic**

transit capacity
see **capacity**

transit signal priority
Technology that uses GPS along with bus route schedules and real-time performance data to give special treatment to transit vehicles at signalized intersections. This can involve holding or extending a green signal or shortening a red signal in order to minimize or eliminate delays to transit passengers.

Transit Leap
A complete network of high-speed, high-capacity, high-frequency transit services that connects major residential areas with employment centers and attractions. High-speed services, covering longer distances with limited stops, are separated from vehicle traffic with bridges, tunnels, or dedicated lanes. Improvements to existing transit services, such as the Trolley, COASTER, SPRINTER, and *Rapid*, may include additional rail tracks, more frequent service, dedicated transit lanes, and traffic signal priority.

travel demand
The general phenomenon of the movement of people and goods within a given area. Demand is typically measured in trips, characterized by a trip origin and either single or multiple trip destinations. For the purposes of travel forecasting and analysis, trip purpose, trip mode, time of day, and other travel factors are considered.

Trolley
The San Diego Trolley is the urban light rail transit service currently provided in the San Diego region. MTS operates three primary lines.

U

V

V/C ratio
see **volume to capacity ratio**

vehicle miles traveled
The total number of miles traveled on all roadways by all vehicles. Reducing vehicle miles traveled (VMT) can help ease traffic congestion and improve air quality.

VMT
see **vehicle miles traveled**

volume to capacity ratio
One of many measures used to assess roadway performance. It is the ratio of a roadway's volume to its capacity for a given time period (usually a peak hour). A V/C ratio of less than one generally reflects driving conditions with speeds greater than 50 miles per hour and traffic is flowing on a roadway, while a V/C ratio of greater than one generally reflects driving conditions with stop and go traffic on a roadway.

W

weighted population density
The average of the population densities of subareas (e.g., block groups) of a larger area (e.g., census tract) weighted by the populations of those subareas. Weighted population density is an alternative to the conventional population density measure—total population divided by total area.

X

Y

Z

Appendix T Attachment 2:

Regional Arterials by Jurisdiction

Appendix T Attachment 2: Regional Arterials by Jurisdiction

Table T2.1: Regional Arterials by Jurisdiction

Regional Arterials by Jurisdiction			
	Arterial	**Limits**	**Jurisdiction**
1	Alga Road	El Camino Real to Melrose Drive	Carlsbad
2	Aviara Parkway	Palomar Airport Road to El Camino Real	Carlsbad
3	Cannon Road	Carlsbad Boulevard to College Boulevard	Carlsbad
4	Carlsbad Boulevard	Eaton Street to La Costa Avenue	Carlsbad
5	Carlsbad Village Drive	I-5 to Coast Boulevard/Coast Highway	Carlsbad
6	College Boulevard	City of Oceanside city limits to Palomar Airport Road	Carlsbad
7	El Camino Real (S-11)	SR 78 to Olivenhain	Carlsbad
8	Faraday Avenue	Melrose Drive to College Boulevard	Carlsbad
9	La Costa Avenue	I-5 to El Camino Real	Carlsbad
10	Melrose Drive	City of Vista city limits to Rancho Santa Fe Road	Carlsbad
11	Olivenhain Road	Los Pinos Circle to Rancho Santa Fe Road	Carlsbad
12	Palomar Airport Road	Carlsbad Boulevard to Business Park Drive	Carlsbad
13	Poinsettia Lane	Carlsbad Boulevard to Melrose Drive	Carlsbad
14	Rancho Santa Fe Road	Melrose Drive to Olivenhain Road	Carlsbad
15	Bay Boulevard	E Street to Stella Street	Chula Vista
16	Beyer Way	Main Street to City of San Diego city limits	Chula Vista
17	Bonita Road	1st Avenue to I-805	Chula Vista
18	Broadway	C Street to Main Street	Chula Vista
19	E Street	H Street to Bonita Road	Chula Vista
20	East H Street	Hilltop Drive to Mount Miguel Road	Chula Vista
21	H Street	E Street to Hilltop Drive	Chula Vista
22	Hunte Parkway	Proctor Valley Road to Eastlake Parkway	Chula Vista
23	J Street	Marina Parkway to Broadway	Chula Vista
24	L Street	Bay Boulevard to I-805	Chula Vista
25	La Media Road	Telegraph Canyon Road to Main Street	Chula Vista
26	Main Street	West city limits to Eastlake Parkway	Chula Vista
27	Marina Parkway	H Street to J Street	Chula Vista
28	Olympic Parkway	I-805 to Hunte Parkway	Chula Vista
29	Orange Avenue	Palomar Street to I-805	Chula Vista
30	Otay Lakes Road	Bonita Road to Wueste Road	Chula Vista
31	Otay Valley Road	Main Street to East of SR 125	Chula Vista
32	Palomar Street	Bay Boulevard to Orange Avenue	Chula Vista

Regional Arterials by Jurisdiction

	Arterial	Limits	Jurisdiction
33	Paseo Ranchero (Heritage Road)	East H Street to City of San Diego city limits	Chula Vista
34	Proctor Valley Road	Mt. Miguel Road to Hunte Parkway	Chula Vista
35	Telegraph Canyon Road	I-805 to Otay Lakes Road	Chula Vista
36	Willow Street	Sweetwater Road to Bonita Road	Chula Vista
37	SR 75	City of San Diego city limits to City of Imperial Beach city limits	Coronado
38	Via de la Valle	Highway 101 to Jimmy Durante Boulevard	Del Mar
39	2nd Street	Greenfield Drive to Main Street	El Cajon
40	Avocado Avenue	Main Street to Chase Avenue	El Cajon
41	Avocado Boulevard	Chase Avenue to Dewitt Court	El Cajon
42	Ballantyne Street	Broadway to Main Street	El Cajon
43	Bradley Avenue	Cuyamaca Street to County of San Diego limits	El Cajon
44	Broadway	SR 67 to East Main Street	El Cajon
45	Chase Avenue	El Cajon Boulevard to Rancho Valle Court	El Cajon
46	Cuyamaca Street	City of Santee city limits to Marshall Avenue	El Cajon
47	E Main Street	Broadway to Lavala Lane	El Cajon
48	El Cajon Boulevard	Chase Avenue to West Main Street	El Cajon
49	Fletcher Parkway	City of La Mesa city limits to SR 67	El Cajon
50	Greenfield Drive	Ballantyne Street to I-8	El Cajon
51	Jamacha Road	Main Street to Grove Road	El Cajon
52	Marshall Avenue	Cuyamaca Street to Fletcher Parkway	El Cajon
53	Marshall Avenue	Fletcher Parkway to West Main Street	El Cajon
54	Marshall Avenue	West Main Street to Washington Avenue	El Cajon
55	Navajo Road	SR 125 to Fletcher Parkway	El Cajon
56	Washington Avenue	El Cajon Boulevard to Granite Hills Drive	El Cajon
57	West Main Street	I-8 to Marshall Avenue	El Cajon
58	Coast Highway	City of Carlsbad to City of Solana Beach	Encinitas
59	El Camino Real	Olivenhain to Manchester Avenue	Encinitas
60	Encinitas Boulevard	Coast Highway 101 to El Camino Real	Encinitas
61	La Costa Avenue	Coast Highway 101 to I-5	Encinitas
62	Leucadia Boulevard	Coast Highway 101 to El Camino Real	Encinitas
63	Manchester Avenue	El Camino Real to I-5	Encinitas
64	Olivenhain Road	El Camino Real to Los Pinos Circle	Encinitas
65	Barham Drive	City of San Marcos city limits to Mission Road	Escondido
66	Centre City Parkway	Country Club Lane (I-15) to South Escondido Boulevard/South Centre City Parkway (I-15)	Escondido
67	Citracado Parkway	Centre City Parkway to SR 78	Escondido
68	East Valley Parkway	Broadway to Valley Center Road	Escondido

Regional Arterials by Jurisdiction

	Arterial	Limits	Jurisdiction
69	East Via Rancho Parkway/Bear Valley Parkway	East Valley Parkway to Sunset Drive	Escondido
70	El Norte Parkway	Nordahl Road to East Valley Parkway	Escondido
71	El Norte Parkway	Woodland Parkway to Rees Road	Escondido
72	Felicita/17th Avenue	I-15 to SR 78	Escondido
73	Grand Avenue/ 2nd Avenue/ Valley Boulevard	West Valley Parkway to East Valley Parkway	Escondido
74	Hale Avenue	Washington Avenue to I-15	Escondido
75	Lincoln/Ash Parkway	Broadway to Washington Avenue	Escondido
76	Mission Avenue	Andreason Drive to Centre City Parkway	Escondido
77	Mission Road	Barham Drive to Andreason Drive	Escondido
78	Via Rancho Parkway	Del Dios Highway to Sunset Drive	Escondido
79	Washington Avenue	Mission Road to East Valley Parkway	Escondido
80	West Valley Parkway	Claudan Road to Broadway	Escondido
81	Valley Center Road	East Valley Parkway to County of San Diego limits	
82	SR 75	City of Coronado city limits to City of San Diego city limits	Imperial Beach
83	70th Street	University Avenue to Colony Road	La Mesa
84	70th Street	Saranac Street to I-8	La Mesa
85	El Cajon Boulevard	73rd Street to I-8	La Mesa
86	Fletcher Parkway	I-8 to City of El Cajon city limits	La Mesa
87	Grossmont Center Drive	I-8 to Fletcher Parkway	La Mesa
88	Jackson Drive	La Mesa Boulevard to north city limits	La Mesa
89	La Mesa Boulevard	University Avenue to I-8	La Mesa
90	Lake Murray	I-8 to Dallas Street	La Mesa
91	Massachusetts Avenue	SR 94 to University Avenue	La Mesa
92	Spring Street	I-8 to SR 125	La Mesa
93	University Avenue	69th Street to La Mesa Boulevard	La Mesa
94	Broadway	Spring Street to Lemon Grove Avenue	Lemon Grove
95	College Avenue	Livingston Street to Federal Boulevard	Lemon Grove
96	Federal Boulevard	College Avenue to SR 94	Lemon Grove
97	Lemon Grove Avenue	Viewcrest Drive to SR 94	Lemon Grove
98	Massachusetts Avenue	Broadway to SR 94	Lemon Grove
99	Massachusetts Avenue	Lemon Grove Avenue to Broadway	Lemon Grove
100	Sweetwater Road	Broadway to Troy Street	Lemon Grove

Regional Arterials by Jurisdiction

	Arterial	Limits	Jurisdiction
101	30th Street	National City Boulevard to 2nd Street	National City
102	Euclid Avenue	Cervantes Avenue to Sweetwater Road	National City
103	Harbor Drive	City of San Diego city limits to I-5	National City
104	National City Boulevard	Division Street to 30th Street	National City
105	Palm Avenue	I-805 to 18th Street	National City
106	Paradise Valley Road	8th Street to Plaza Boulevard	National City
107	Plaza Boulevard	National City Boulevard to 8th Street	National City
108	Sweetwater Road	2nd Street to Plaza Bonita Center Way	National City
109	Coast Highway	I-5 to Eaton Street	Oceanside
110	College Boulevard	North River Road to City of Carlsbad city limits	Oceanside
111	El Camino Real	Douglas Drive to SR 78	Oceanside
112	Melrose Drive	SR 76 to W. Bobier Drive	Oceanside
113	Mission Avenue	Coast Highway to Frazee Road	Oceanside
114	North River Road	Douglas Drive to SR 76	Oceanside
115	North Santa Fe Avenue	SR 76 to Melrose Drive	Oceanside
116	Oceanside Boulevard	Coast Highway to Melrose Drive	Oceanside
117	Rancho del Oro Drive	SR 78 to SR 76	Oceanside
118	Vandegrift Boulevard	North River Road to Camp Pendleton	Oceanside
119	West Vista Way	Jefferson Street to Thunder Drive	Oceanside
120	Camino del Norte	World Trade Drive to Pomerado Road	Poway
121	Community Road	Twin Peaks Road to Scripps Poway Parkway	Poway
122	Espola Road	Summerfield Lane to Poway Road	Poway
123	Pomerado Road	Stonemill Drive to Gateway Park Road	Poway
124	Poway Road	Springhurst Drive to SR 67	Poway
125	Scripps Poway Parkway	Springbrook Drive to Sycamore Canyon Road	Poway
126	Ted Williams Parkway	Pomerado Road to Twin Peaks Road	Poway
127	Twin Peaks Road	Pomerado Road to Espola Road	Poway
128	1st Avenue	Harbor Drive to I-5	San Diego City
129	4th Avenue	Market Street to Washington Street	San Diego City
130	5th Avenue	Market Street to Washington Street	San Diego City
131	6th Avenue	Ash Street to SR 163	San Diego City
132	10th Avenue	SR 163 to Park Boulevard	San Diego City
133	11th Avenue	G Street to SR 163	San Diego City
134	28th Street	I-5 to Harbor Drive	San Diego City
135	32nd Street	Harbor Drive to Wabash Boulevard	San Diego City
136	43rd Street	Meade Avenue to Thorn Street	San Diego City

Regional Arterials by Jurisdiction

	Arterial	Limits	Jurisdiction
137	47th Street	Fairmont Avenue to I-805	San Diego City
138	54th Street	Collwood Boulevard to Euclid Avenue	San Diego City
139	70th Street	Colony Road to Saranac Street	San Diego City
140	A Street	11th Avenue to Kettner Boulevard	San Diego City
141	Adams Avenue	Park Boulevard to I-15	San Diego City
142	Aero Drive	Heritage Road to SR 905	San Diego City
143	Airway Road	Caliente Avenue to SR 125	San Diego City
144	Ash Street	Harbor Drive to 10th Avenue	San Diego City
145	Auto Circle	Camino del Rio North to Camino del Rio South	San Diego City
146	Balboa Avenue	Mission Bay Drive to I-15	San Diego City
147	Balboa Avenue	Grand Avenue to Garnet Avenue	San Diego City
148	Barnett Avenue	Lytton Street to Pacific Highway	San Diego City
149	Bernardo Center Drive	Dove Canyon Road to I-15	San Diego City
150	Beyer Boulevard	City of Chula Vista city limits to East Beyer Boulevard	San Diego City
151	Beyer Way	4th Avenue to Picador Boulevard	San Diego City
152	Britannia Boulevard	Otay Mesa Road to Siempre Viva Road	San Diego City
153	Black Mountain Road	Carmel Valley Road to Carroll Canyon Road	San Diego City
154	Broadway	Harbor Drive to 11th Avenue	San Diego City
155	Cabrillo Memorial Drive	Cochran Street to Cabrillo National Monument	San Diego City
156	Camino del Norte	Rancho Bernardo Road to World Trade Drive	San Diego City
157	Camino de la Reina	Mission Center Road to Qualcomm Way	San Diego City
158	Camino del Rio North	Mission Center Road to Mission Gorge Road	San Diego City
159	Camino de Rio West	Rosecrans Street to I-8	San Diego City
160	Camino Ruiz	Mira Mesa Boulevard to Miramar Road	San Diego City
161	Camino Ruiz	SR 56 to Camino del Norte	San Diego City
162	Camino Santa Fe	Sorrento Valley Boulevard to Miramar Road	San Diego City
163	Canon Street	Rosecrans Street to Catalina Boulevard	San Diego City
164	Carmel Mountain Road	Camino del Norte to Rancho Peñasquitos Boulevard	San Diego City
165	Carmel Mountain Road	Sorrento Valley Road to El Camino Real	San Diego City
166	Carmel Valley Road	Del Mar Heights Road to Dove Canyon Road	San Diego City
167	Carmel Valley Road	Del Mar Heights Road to Dove Canyon Road	San Diego City
168	Carroll Canyon Road	I-805 to I-15	San Diego City
169	Catalina Boulevard	Canon Street to Cochran Street	San Diego City
170	Clairemont Drive	Clairemont Mesa Boulevard to West Mission Bay Drive	San Diego City

Regional Arterials by Jurisdiction

Arterial		Limits	Jurisdiction
171	Clairemont Mesa Boulevard	I-15 to Regents Road	San Diego City
172	College Avenue	Navajo Road to Livingston Street	San Diego City
173	Collwood Boulevard	Montezuma Road to 54th Street	San Diego City
174	Convoy Street	Linda Vista Road to SR 52	San Diego City
175	Cesar E. Chavez Parkway	I-5 to Harbor Drive	San Diego City
176	Dairy Mart Road	SR 905 to I-5	San Diego City
177	Del Mar Heights Road	I-5 to Carmel Valley Road	San Diego City
178	El Cajon Boulevard	Park Boulevard to 73rd Street	San Diego City
179	El Camino Real	Via de la Valle to Carmel Mountain Road	San Diego City
180	Euclid Avenue	54th Street to Cervantes Avenue	San Diego City
181	F Street	SR 94 to 10th Avenue	San Diego City
182	Fairmount Avenue	Mission Gorge Road to 47th Street	San Diego City
183	Friars Road	Sea World Drive to Mission Gorge Road	San Diego City
184	Front Street	I-5 to Market Street	San Diego City
185	G Street	SR 94 to 10th Avenue	San Diego City
186	Garnet Avenue	Balboa Avenue to I-5	San Diego City
187	Genesee Avenue	North Torrey Pines Road to SR 163	San Diego City
188	Gilman Drive	La Jolla Village Drive to I-5	San Diego City
189	Girard Avenue	Pearly Street to Torrey Pines Road	San Diego City
190	Grand Avenue	Mission Boulevard to Mission Bay Drive	San Diego City
191	Governor Drive	I-805 to Regents Road	San Diego City
192	Grape Street	North Harbor Drive to I-5	San Diego City
193	Harbor Drive	Pacific Highway to City of National City	San Diego City
194	Hawthorn Street	I-5 to North Harbor Drive	San Diego City
195	Heritage Road	Otay Mesa Road to Siempre Viva Road	San Diego City
196	India Street	Laurel Street to I-5	San Diego City
197	Imperial Avenue	Park Boulevard to Lemon Grove Avenue	San Diego City
198	Ingraham Street	West Mission Bay Drive to Grand Avenue	San Diego City
199	Jackson Drive	Mission Gorge Road to Dallas Road	San Diego City
200	Kearny Villa Road	Carrol Canyon Road to I-805	San Diego City
201	Kettner Boulevard	I-5 to India Street	San Diego City
202	La Jolla Boulevard	Pearl Street to Turquoise Street	San Diego City
203	La Jolla Parkway	Torrey Pines Road to I-5	San Diego City
204	La Jolla Shores Drive	Torrey Pines Road to North Torrey Pines Road	San Diego City
205	La Jolla Village Drive	North Torrey Pines Road to I-805	San Diego City
206	La Media Road	Lone Star Road to Siempre Viva Road	San Diego City

Regional Arterials by Jurisdiction

	Arterial	Limits	Jurisdiction
207	Lake Murray Boulevard	Dallas Street to Navajo Road	San Diego City
208	Laurel Street	North Harbor Drive to India Street	San Diego City
209	Lemon Grove Avenue	Lisbon Street to Viewcrest Drive	San Diego City
210	Linda Vista Road	Morena Boulevard to Convoy Street	San Diego City
211	Lone Star Road	La Media Road to City of San Diego/ county boundary	San Diego City
212	Lytton Street	Rosecrans Street to Barnett Avenue	San Diego City
213	Market Street	Harbor Drive to Euclid Avenue	San Diego City
214	Mercy Road	Black Mountain Road to I-15	San Diego City
215	Mesa College Drive	I-805 to Armstrong Drive	San Diego City
216	Midway Drive	West Point Loma Boulevard to Barnett Avenue	San Diego City
217	Mira Mesa Boulevard	I-805 to I-15	San Diego City
218	Miramar Road	I-805 to I-15	San Diego City
219	Mission Boulevard	Loring Street to West Mission Bay Drive	San Diego City
220	Mission Bay Drive	Grand Avenue to I-5	San Diego City
221	Mission Center Road	Camino del Rio North to Friars Road	San Diego City
222	Mission Gorge Road	Fairmont Avenue to Highridge Road	San Diego City
223	Montezuma Road	Fairmount Avenue to El Cajon Boulevard	San Diego City
224	Morena Boulevard	Balboa Avenue to West Morena Boulevard (north split)	San Diego City
225	Morena Boulevard	West Morena Boulevard (south split) to Taylor Street	San Diego City
226	Navajo Road	Waring Road to SR 125	San Diego City
227	Nimitz Boulevard	I-8 to Harbor Drive	San Diego City
228	Nobel Drive	I-5 to Miramar Road	San Diego City
229	Normal Street	Polk Avenue to Park Boulevard	San Diego City
230	North Harbor Drive	Rosecrans Street to Grape Street	San Diego City
231	North Torrey Pines Road (S-21)	Carmel Valley Road to La Jolla Village Drive	San Diego City
232	Ocean View Hills Parkway	I-805 to Dennery Road to Otay Mesa Road	San Diego City
233	Otay Mesa Road	Ocean View Hills Parkway to City of San Diego/ county boundary	San Diego City
234	Otay Valley Road	Heritage Road to Datsono Road	San Diego City
235	Pacific Highway	Sea World Drive to Harbor Drive	San Diego City
236	Palm Avenue	13th Street to Dennery Road	San Diego City
237	Paradise Valley Road	Munda Road to Meadowbrook Drive	San Diego City
238	Park Boulevard	Imperial Avenue to Adams Avenue	San Diego City
239	Pearl Street	La Jolla Boulevard to Girard Avenue	San Diego City
240	Picador Boulevard	Beyer Way to I-905	San Diego City

Regional Arterials by Jurisdiction

	Arterial	Limits	Jurisdiction
241	Pomerado Road	I-15 (north) to Bernardo Heights Parkway	San Diego City
242	Pomerado Road	Stonemill Drive to I-15 (south)	San Diego City
243	Poway Road	I-15 to Springhurst Drive	San Diego City
244	Qualcomm Way	I-8 to Friars Road	San Diego City
245	Rancho Bernardo Road	Camino Del Sur to Summerfield Lane	San Diego City
246	Rancho Carmel Drive	Carmel Mountain Road to Ted Williams Parkway	San Diego City
247	Rancho Peñasquitos Boulevard	SR 56 to I-15	San Diego City
248	Regents Road	Genesee Avenue to Rose Canyon	San Diego City
249	Regents Road	Rose Canyon to Clairemont Mesa Boulevard	San Diego City
250	Rosecrans Street	Pacific Highway to Canon Street	San Diego City
251	Ruffin Road	Kearny Villa Road to Aero Drive	San Diego City
252	Sabre Springs Parkway	Ted Williams Parkway to Poway Road	San Diego City
253	San Diego Mission Road	Mission Village Drive to Fairmount Avenue	San Diego City
254	San Ysidro Boulevard	Dairy Mart Road to East Beyer Boulevard	San Diego City
255	Scripps Poway Parkway	I-15 to Springbrook Drive	San Diego City
256	Sea World Drive	West Mission Bay Drive to Morena Boulevard	San Diego City
257	Siempre Viva Road	Heritage Road to Enrico Fermi Drive	San Diego City
258	Sorrento Valley Boulevard	Sorrento Valley Road to Camino Santa Fe	San Diego City
259	Sorrento Valley Road	Carmel Mountain Road to Sorrento Valley Boulevard	San Diego City
260	Sports Arena Boulevard	I-8 to Rosecrans Street	San Diego City
261	Sunset Cliffs Boulevard	I-8 to West Mission Bay Drive	San Diego City
262	Taylor Street	Pacific Highway to Morena Boulevard	San Diego City
263	Ted Williams Parkway	I-15 to Pomerado Road	San Diego City
264	Texas Street	I-8 to University Avenue	San Diego City
265	Torrey Pines Road	Girard Avenue to La Jolla Parkway	San Diego City
266	Twain Avenue	Fairmount Avenue to Mission Gorge Road	San Diego City
267	University Avenue	SR 163 to City of La Mesa	San Diego City
268	Valencia Parkway	Market Street to Imperial Avenue	San Diego City
269	Via de la Valle	Jimmy Durante Boulevard to El Camino Real	San Diego City
270	Vista Sorrento Parkway	Mira Mesa Boulevard to Carmel Mountain Road	San Diego City
271	Washington Street	Pacific Highway to Park Boulevard	San Diego City

Regional Arterials by Jurisdiction

Arterial		Limits	Jurisdiction
272	Waring Road	College Avenue to I-8	San Diego City
273	West Bernardo Drive	I-15 to Bernardo Center Drive	San Diego City
274	West Mission Bay Drive	Mission Boulevard to I-8	San Diego City
275	West Morena Boulevard	Morena Boulevard (north split) to Morena Boulevard (south split)	San Diego City
276	Woodman Street	SR 54 to Imperial Avenue	San Diego City
277	Alpine Boulevard	I-8/Dunbar Lane to I-8/Willows Road	San Diego County
278	Ashwood Street	Lake Jennings Park Road to Willow Road/ Wildcat Canyon Road	San Diego County
279	Avocado Boulevard	Dewitt Court to SR 94	San Diego County
280	Bear Valley Parkway	City of Escondido (north) city limits to City of Escondido (south) city limits	San Diego County
281	Bonita Road	I-805 to San Miguel Road	San Diego County
282	Borrego Springs/ Yaqui Pass Road (S-3)	Palm Canyon Drive (S-22) to SR 78	San Diego County
283	Bradley Avenue	Wing Avenue to Winter Garden Boulevard	San Diego County
284	Buckman Springs/ Sunrise Highway (S-1)	SR 94 to SR 79	San Diego County
285	Buena Creek Road	South Santa Fe Avenue to Twin Oaks Valley Road	San Diego County
286	Camino del Norte	Rancho Bernardo Road to City of San Diego city limits	San Diego County
287	Campo Road	Spring Street to Sweetwater Springs/SR 54	San Diego County
288	Citracado Parkway	Greenwood Place to I-15	San Diego County
289	Cole Grade Road	SR 76 to Valley Center Road	San Diego County
290	Deer Springs Road	Twin Oaks Valley Road to I-15	San Diego County
291	Dehesa Road	Jamacha Road to Harbison Canyon Road	San Diego County
292	Dehesa Road*	Harbison Canyon Road to Sycuan Road	San Diego County
293	Del Dios Highway	Via Rancho Parkway to Paseo de Delicias	San Diego County
294	Dye Road	SR 67 to San Vicente Road	San Diego County
295	Dye Street	SR 67 to Dye Road	San Diego County
296	East Vista Way	SR 76 to City of Vista city limits	San Diego County
297	El Norte Parkway	Rees Road to Nordahl Road	San Diego County
298	Euclid Avenue	City of National City limits to City of National City limits	San Diego County
299	Gamble Lane	Eucalyptus Avenue to City of Escondido city limits	San Diego County
300	Gopher Canyon Road	East Vista Way to Old Highway 395	San Diego County
301	Jamacha Road	City of El Cajon city limits to SR 94	San Diego County
302	Jamacha Road	SR 125 to SR 94	San Diego County

Regional Arterials by Jurisdiction

Arterial		Limits	Jurisdiction
302	Keyes Road (southern traffic bypass)	Dye Road to SR 78 (Julian Road)	San Diego County
303	Lake Jennings Park Road	SR 67 to I-8	San Diego County
304	Lake Wohlford Road	Valley Center Road (north) to Valley Center Road (south)	San Diego County
305	Las Posas Road	City of San Marcos city limits to Buena Creek Road	San Diego County
306	Lone Star Road	City of San Diego city limits to Siempre Viva Road	San Diego County
307	Mapleview Street	SR 67 to Lake Jennings Road	San Diego County
308	Mar Vista Drive	City of Oceanside city limits to City of Vista city limits	San Diego County
309	Melrose Drive	City of Oceanside city limits to City of Vista city limits	San Diego County
310	Mission Road (S-13)	I-15 to SR 76	San Diego County
311	Mountain Meadow Road	I-15/Deer Springs Road to Valley Center Road	San Diego County
312	Montezuma Valley/ Palm Canyon (S-22)	SR 79 to Imperial County line	San Diego County
313	Nordahl Road	El Norte Parkway to City of San Marcos city limits	San Diego County
314	Old Highway 80	Buckman Springs Road to I-8 (In-ko-pah)	San Diego County
315	Old Highway 80	SR 79 to Sunrise Highway	San Diego County
316	Old Highway 395/ Champagne/ North Centre City	East Mission Road to City of Escondido	San Diego County
317	Otay Lakes Road	Wueste Road to SR 94	San Diego County
318	Otay Mesa Road	City of San Diego city limits to Lone Star Road	San Diego County
319	Pala Temecula Road	SR 76 to Riverside County limits	San Diego County
320	Paradise Valley Road	City of San Diego city limits to Sweetwater Road	San Diego County
321	Paseo Delicias	El Camino del Norte to Via de la Valle	San Diego County
322	Rancho Bernardo Road	City of San Diego (west) city limits to City of San Diego (east) city limits	San Diego County
323	San Felipe Road/ Overland Route (S-2)	County Route S-22 to Imperial County Line	San Diego County
324	San Vicente Road/ 10th Street	SR 67 (Main Street) to Wildcat Canyon Road	San Diego County
325	Scripps Poway Parkway	Sycamore Canyon Road to SR 67	San Diego County
326	Siempre Viva Road	City of San Diego city limits to Lone Star Road	San Diego County
327	South Santa Fe Avenue	City of Vista city limits to City of San Marcos city limits	San Diego County
328	Sunrise Highway	SR 79 to I-8	San Diego County

Regional Arterials by Jurisdiction

	Arterial	Limits	Jurisdiction
329	Sweetwater Road (Bonita)	Willow Street to City of National City limits	San Diego County
330	Sweetwater Road (Spring Valley)	Jamacha Boulevard to Broadway	San Diego County
331	Sweetwater Springs Boulevard	Jamacha Boulevard to SR 94	San Diego County
332	Valley Center Road	SR 76 to City of Escondido city limits	San Diego County
333	Valley Center New Northern E to W Road	Cole Grade Road to Old Highway 395	San Diego County
334	Via de la Valle	City of San Diego city limits to Paseo Delicias	San Diego County
335	Via Rancho Parkway	Del Dios Highway to City of Escondido city limits	San Diego County
336	Wildcat Canyon Road*	Ashwood Street to San Vicente Road	San Diego County
337	Willow Glen Drive	Jamacha Road to Dehesa Road	San Diego County
338	Willows Road	I-8 to Viejas Casino	San Diego County
339	Winter Gardens Boulevard	SR 67 to 2nd Street	San Diego County
340	Barham Drive	Twin Oaks Valley Road to Los Amigos	San Marcos
341	Borden Road	Las Posas Road to Woodland Parkway	San Marcos
342	Buena Creek Road	Twin Oaks Valley Road to Sunny Vista Lane	San Marcos
343	Discovery Street	San Marcos Boulevard to Twin Oaks Valley Road	San Marcos
344	Las Posas Road	West San Marcos Boulevard to North City Limits	San Marcos
345	Mission Road	Pacific Street to Barham Drive	San Marcos
346	San Elijo Road	Twin Oaks Valley Road to Rancho Santa Fe Road	San Marcos
347	Rancho Santa Fe Road	Mission Road to Melrose Drive	San Marcos
348	San Marcos Boulevard	Business Park Drive to Mission Road	San Marcos
349	South Santa Fe Avenue	Smilax Road to Pacific Street	San Marcos
350	Twin Oaks Valley Road	Deer Springs Road to Questhaven Road	San Marcos
351	Woodland Parkway	Barham Drive to El Norte Parkway	San Marcos
352	Cuyamaca Street	Mission Gorge Road to City of El Cajon city limits	Santee
353	Magnolia Avenue	Mast Boulevard to Prospect Avenue/SR 67	Santee
354	Mast Boulevard	SR 52 to Magnolia Avenue	Santee
355	Mission Gorge Road	City of San Diego city limits to Magnolia Avenue	Santee
356	Woodside Avenue	Magnolia Avenue to SR 67	Santee
357	Coast Highway	City of Encinitas city limits to City of Del Mar city limits	Solana Beach
358	Lomas Santa Fe Avenue	I-5 to Coast Highway	Solana Beach

Regional Arterials by Jurisdiction

	Arterial	Limits	Jurisdiction
359	Bobier Drive	North Melrose Drive to East Vista Way (S-13)	Vista
360	Branding Iron Drive	South Melrose Drive to SR 78	Vista
361	Business Park Drive	Sycamore Avenue to Palomar Airport Drive/ San Marcos Boulevard	Vista
362	Cannon Road (Mar Vista Drive)	County of San Diego limits to SR 78	Vista
363	Civic Center Drive	SR 78 to East Vista Way (S-13)	Vista
364	East Vista Way	Civic Center Drive to County of San Diego limits	Vista
365	Emerald Drive	Hacienda Drive to SR 78	Vista
366	Emerald Drive	SR 78 to Olive Avenue	Vista
367	Hacienda Drive	City of Oceanside city limits to Vista Village Drive	Vista
368	North Melrose Drive	SR 78 to Bobier Drive	Vista
369	North Santa Fe Avenue (S-14)	Main Street to North Melrose Drive	Vista
370	Olive Avenue	Emerald Drive to Vista Village Drive (S-13)	Vista
371	Shadowridge Drive	City of Oceanside city limits/Cannon Road to Sycamore Avenue	Vista
372	South Melrose Drive	City of Carlsbad to SR 78	Vista
373	South Santa Fe Avenue	Main Street to County of San Diego	Vista
374	Sycamore Avenue	South Santa Fe Avenue to South Melrose Drive	Vista
375	Thibodo Road	Mar Vista Drive (Cannon Road) to Sycamore Avenue	Vista
376	Vista Village Drive	SR 78 to Escondido Avenue	Vista
377	Vista Village Drive (S-13)	Hacienda Drive to SR 78	Vista
378	West Vista Way	Thunder Drive to Vista Village Drive	Vista

*Included in the Regional Arterial System contingent upon being designated as a four-lane arterial by the County of San Diego.

Figure T2.1 Regional Arterial System

Appendix T Attachment 3:

Evaluation Criteria Data Sources

Appendix T Attachment 3: Evaluation Criteria Data Sources

Data sources used for Project Bundle creation and evaluation were provided by SANDAG or created by HNTB in collaboration with SANDAG during 2021 Regional Plan network development and are listed in Table T3.1. Other data layers used for project evaluation were generated during Project Bundle creation and are listed in Table T3.2. Python Scripts generated to run ArcGIS calculations for each evaluation criteria are listed in Table T3.3.

Table T3.1: Source Data Layers and Tables

Source Data Layers and Tables		
Layer/Table Name	**Source**	**Processing Notes**
GoodsMovement_Routes (Lines)	SANDAG	Combined from SANDAG sources (GM_Data.gdb) – Added/ populated a 'RouteType' field • CaltransRouteDesignations • GM_Corridors
GoodsMovement_Areas (Polygons)	SANDAG	Combined from SANDAG sources (GM_Data.gdb) – Added/ populated a 'FacilityType' field • GM_Facilities • MarineTerminals • Military_Facilities • POE • Runways • SBX_Ops_Center • TruckParking
DS28_Series14_Pop_2016_2050 (Major Geographic Reference Area [MGRA] Polygons)	SANDAG	
DS28_Series14_Jobs_2016_2050 (MGRA Polygons)	SANDAG	
SANDAG_Coc_2018 (MGRA Points)	SANDAG	
LANDUSE_2018 County Boundary (Polygon)	SANDAG	Dissolved MGRA polygons into a single polygon Joined a lookup table from Grace Chung that applies 'MapCategory' field that was used to classify Land Use related to Goods Movement

Source Data Layers and Tables		
Layer/Table Name	**Source**	**Processing Notes**
Transportation Injury Mapping System (TIMS) Data	UC Berkeley	Downloaded 2016–2018 incident data from tims.berkeley.edu/tools/gismap as CSV format
ActivityCenters_Draft	SANDAG	
EC Outlines	SANDAG	
California (Line)	SANDAG NPMRDS[1]	
2018 Interstate Travel Time Reliability (CSV)	SANDAG NPMRDS	
2018 Non-Interstate National Highway System Travel Time Reliability (CSV)	SANDAG NPMRDS	
2018 Annual Hours of Peak Hour Excessive Delay (CSV)	SANDAG NPMRDS	
Transit_Leap_Refined_Stations_Iteration_8_1	HNTB/SANDAG (ArcGIS Online [AGOL])	
Transit_Leap_Refined_Network_Iteration_8_1	HNTB/SANDAG (AGOL)	
Complete_Corridors_Direct_Access_Ramp_DAR_V2_View	HNTB/SANDAG (AGOL)	
Complete_Corridors_Highway_Public_v4_View	HNTB/SANDAG (AGOL)	
MoHub_Amoeba_Stats_V2	HNTB/SANDAG (AGOL)	
MoHub_Census_BlockS (Polygon)	AGOL	Local copy of data downloaded, filtered for Census Blocks that have a 'MoHub' name assigned. These polygons were dissolved to create model input feature class called 'INPUT_MOHUB_CENSUS_BLOCKS_2020_05_11'

[1] National Performance Management Research Data Set (NPMRDS) on the National Highway System for use in its performance measures and management activities available to state departments of transportation and metropolitan planning organizations.

Table T3.2: Data Layers Generated During Task

Data Layers Generated During Task		
Layer Name	**Description**	**Content Notes**
Project Bundles (Line)	Draft SANDAG Regional Transportation Plan (RTP) Project Bundles Version 2 (AGOL)[2]	Transit projects, CC Managed Lanes projects
DAR Projects (Point)	Draft SANDAG RTP Project Bundles Version 2 (AGOL)	
Transit Projects (Line)	Draft SANDAG RTP Project Bundles Version 2 (AGOL)	Network files
Transit Stations (Point)	Draft SANDAG RTP Project Bundles Version 2 (AGOL)	
CC Managed Lane Projects (Line)	Draft SANDAG RTP Project Bundles Version 2 (AGOL)	
Urban Freeway Connectors V3	AGOL	

[2] AGOL files created in HNTB's AGOL space and transferred to SANDAG at end of project.

Table T3.3: Python Scripts and FME Workspace

Python Scripts and FME Workspace		
Script Name	**Method Name**	**Description**
project_bundle_criteria_execute.py	N/A	Passes input parameters into project_bundle_criteria.py, executes the Geoprocessing functions
project_bundle_criteria.py	N/A – General Overview	Script generates data for the following Criteria: EQL1, EQL4, EQL5, EQL6, EQL7, and EC3 (see Table T.5: Evaluation Criteria)
project_bundle_criteria.py	ProjectBundle()	Instantiation of ProjectBundle class
project_bundle_criteria.py	ProjectBunde() .generate_metrics()	Executes Geoprocessing sub-processes
project_bundle_criteria.py	ProjectBunde() ._process_data()	Processes Project Bundle Criteria, see Python Script file for detailed steps
SANDAG_ProjectBundle_Analysis.fmw	FME Workspace	Calculates MS2, MS3, MS4, and MS6; joins all other outputs into excel

Note: Scripts and other reference files are saved on SANDAG SharePoint site at the following link: sandag.sharepoint.com/:f:/r/regionalvision/Regional%20Vision/6.0%20Network%20Development/Evaluation%20Criteria/Bundle%20Evaluation%20Criteria%20Python%20Scripts?csf=1&web=1.

Appendix T Attachment 4:

Evaluation Criteria Detailed Calculation Methodology

Appendix T Attachment 4: Evaluation Criteria Detailed Calculation Methodology

This Appendix details the methodology used for calculating each evaluation criteria indicator. Each indicator includes a section (section A) on specific geospatial analysis and another section (section B) on any calculations performed on the scoring and ranking spreadsheet tool.

Methodology by Indicator

EQL1 Access to Transit

Description: People and jobs within ½ mile of a transit station or within a Mobility Hub.

Script: project_bundle_criteria.py

Script Method/s: _buffer_stations_merge_mohubs(), _process_demographics()

A. Geospatial Analysis Summary

1. Create a half-mile buffer around transit stations and merge with Mobility Hub areas.
2. Calculate demographics (Jobs & Population) within buffered areas.

B. Excel Scoring and Ranking

The population and jobs output were loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds utilizing natural breaks shown in Table T4.1.

Table T4.1 : EQL1 Access to Transit Score Thresholds

Score	Population (Upper Threshold)	Jobs (Upper Threshold)
10	34,861.8	13,475.5
20	68,932.1	24,306.0
30	102,023.1	46,810.1
40	137,225.3	78,279.1
50	168,889.2	148,507.5
60	241,027.2	193,864.2
70	359,892.6	312,602.8
80	390,283.2	347,032.0
90	401,659.3	401,932.4
100	598,426.4	430,370.8

Each Project Bundle was then assigned a 10 to 100 score for both population and jobs based on that project's total population and jobs.

EQL2 Activity Centers

Description: Activity Centers within a quarter mile of a transit station.

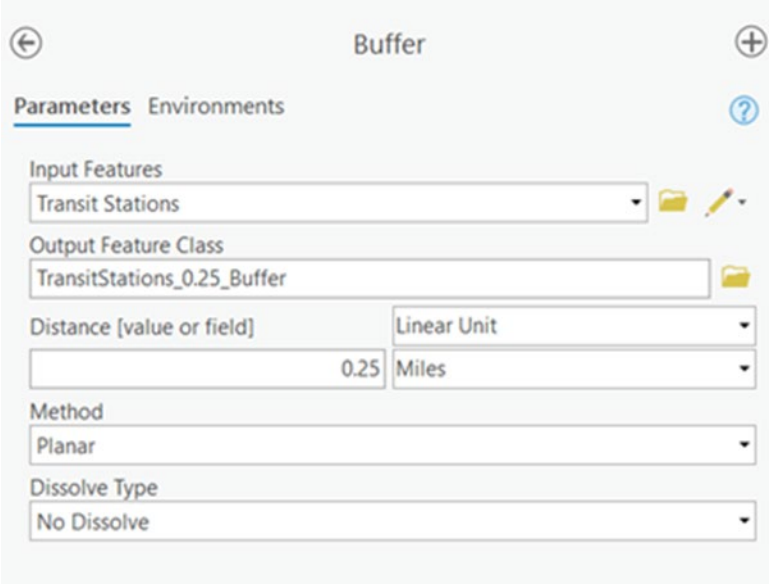
A. Geospatial Analysis Summary

Inputs (See Appendix A):

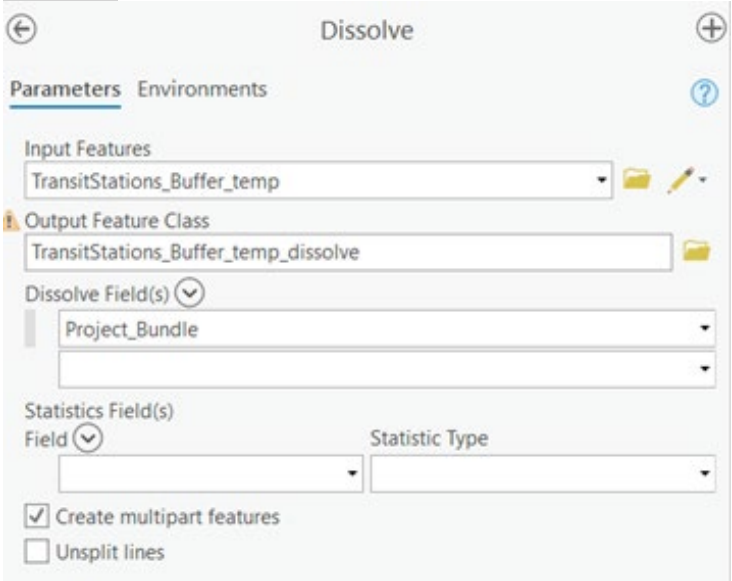
- ACTIVITYCENTERS_DRAFT
- TRANSIT STATIONS (POINT)

Calculation process:

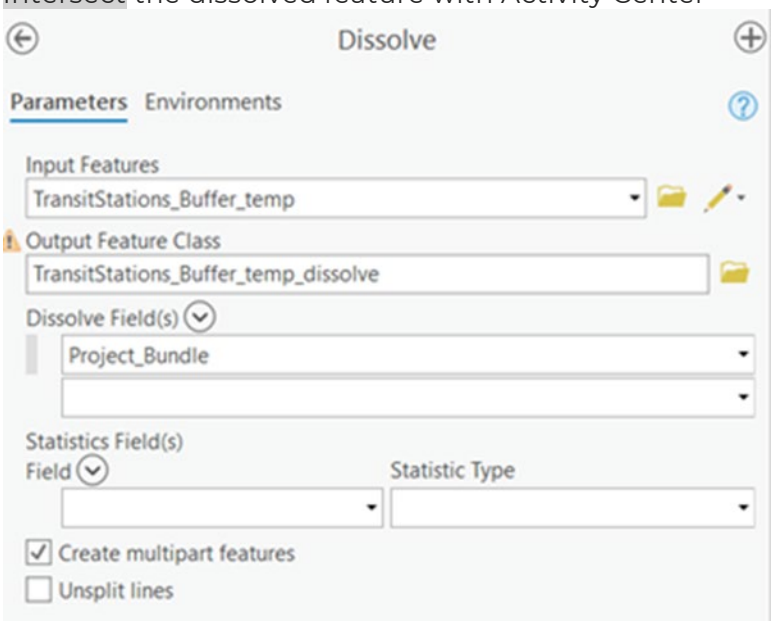
a. Buffer transit stations using 0.25-mile buffer



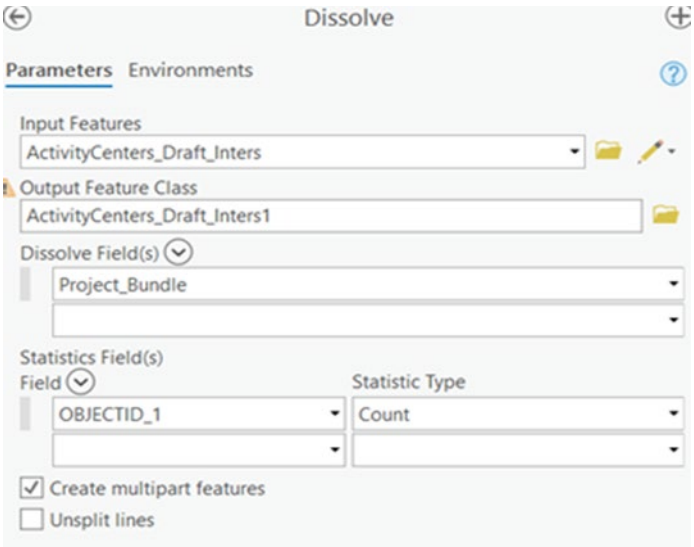
b. Dissolve the result buffer feature using "Project_Bundle"



c. Intersect the dissolved feature with Activity Center



d. Dissolve the result feature class using "Project_Bundle," and statistics field is the count of the different OBJECTID



e. The result file is the final output; use "Table to Excel" to export the attribute table to Excel format

B. Excel Scoring and Ranking

The activity center output were loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds utilizing natural breaks shown in Table T4.2.

Table T4.2: EQL2 Activity Centers

Score	Points of Interest (Upper Threshold)
10	0
20	2
30	6
40	8
50	12
60	15
70	22
80	35
90	53
100	381

Each Project Bundle was then assigned a 10 to 100 score based on the total number of activity centers associated with each project.

EQL3 Network Connectivity

Description: Number of direct connectors and direct access ramps per mile.

A. Geospatial Analysis Summary

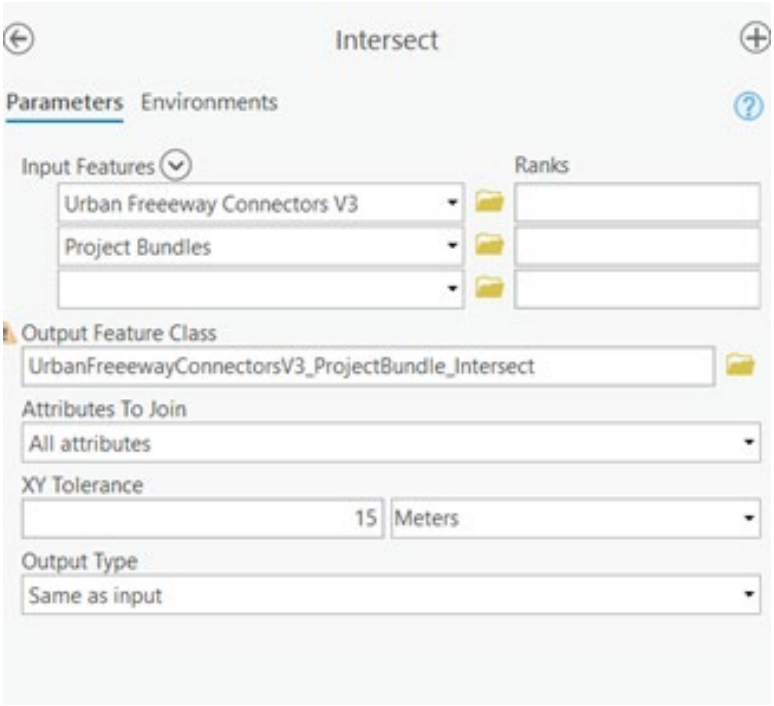
Inputs (See Appendix A):

- URBAN FREEEWAY CONNECTORS V3
- PROJECT BUNDLES (LINE)

Calculation process:

a. Intersect using inputs of Connector and Project Bundle.

Note: Set tolerance to 15 meters because the connectors are close by the Project Bundle lines, and one connector could belong to multiple Project Bundle lines.

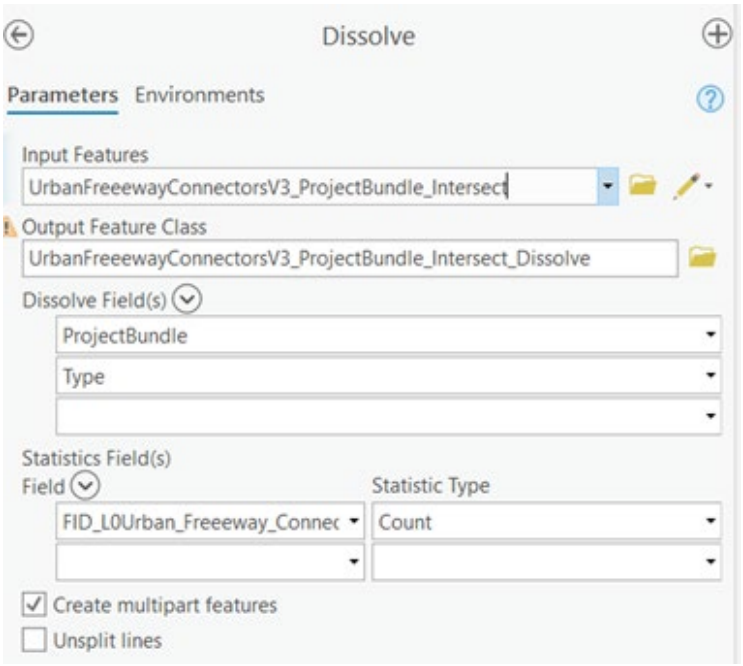


b. The “Intersect” operation generates output like the following:

FID	Shape	FID_I	Corridor Type	Glc	x	y	Type	Freeway	Intersecti
1	Point	30	3	{11...	-116.939854	32.555451	Direct Access Ramp	SR 905	Siempre V
2	Point	26	1	{d...	-117.073781	32.565727	ML Connector	I-5	SR 905
3	Point	26	1	{d...	-117.073781	32.565727	ML Connector	I-5	SR 905
4	Point	25	1	{8e...	-117.040436	32.568034	ML Connector	I-805	SR 905
5	Point	29	3	{30...	-117.063314	32.568332	Direct Access Ramp	SR 905	Beyer Blvd
6	Point	18	2	{60...	-117.037945	32.6148	Direct Access Ramp	I-805	East Palom
8	Point	33	1	{5e...	-117.016707	32.69173	ML Connector	SR 125	SR 54
9	Point	34	1	{07...	-117.121481	32.692761	ML Connector	I-5	SR 15
11	Point	34	1	{07...	-117.121481	32.692761	ML Connector	I-5	SR 15

Then manually examine the rows with duplicated Connector ID; e.g., Connector FID = 34 has 2 entries, examine the connector attributes and Project Bundle attributes to determine if both entries are valid. If not, make necessary changes.

c. Dissolve using the following settings:



d. This generates the final output of like this:

Field: Add Delete Calculate Selection: Zoom To Switch Clear Delete Copy

FID	Shape	Type	ProjectBundle	COUNT_FID_L0Urban_Freeeway_Connectors_V3
1	Multipoint	Direct Access Ramp	1	2
2	Multipoint	ML Connector	1	2
3	Multipoint	Direct Access Ramp	10	3
4	Multipoint	GP Connector	10	1
5	Multipoint	GP/ML Connector	10	1
6	Multipoint	ML Connector	10	5
7	Multipoint	Direct Access Ramp	11	3
8	Multipoint	ML Connector	11	3
9	Multipoint	GP/ML Connector	14	1

e. Table to Excel to export this attribute table to Excel format.

B. Excel Scoring and Ranking

The network connectivity output was loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds utilizing natural breaks shown in Table T4.3.

Table T4.3: EQL3 Network Connectivity

Score	DARS Per Mile (Upper Threshold)
10	0.000
20	0.012
30	0.026
40	0.031
50	0.045
60	0.060
70	0.067
80	0.088
90	0.095
100	0.131

Each Project Bundle was then assigned a 10 to 100 score based on the total number of DARS per mile associated with each project.

EQL4 Mode Availability

Description: Measure of mode availability (in miles) for transit, Managed Lanes, and general-purpose (GP) lanes.

Script: project_bundle_criteria.py

Script Method/s: _mode_availability_stats(), _managed_lane_miles()

A. Geospatial Analysis Summary

1. **Calculate total miles of Managed Lanes, general-purpose lanes, and transit by tier.**
    a. Managed Lane Miles – Calculate 'LaneMiles' and Summarize values.
    b. Transit Tier Miles – Calculate 'LaneMiles' and Summarize values.

B. Excel Scoring and Ranking

The network connectivity output was loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds utilizing natural breaks shown in Table T4.4.

Table T4.4: EQL4 Mode Availability

Score	Tier 1 Transit (Upper Threshold)	Tier 2 Transit (Upper Threshold)	Tier 3 Transit (Upper Threshold)	GP Lanes (Upper Threshold)	Managed Lanes (Upper Threshold)
10	0.00	0.00	7.05	0.00	3.84
20	1.25	1.44	13.89	11.53	15.15
30	1.46	2.83	18.27	24.22	16.04
40	2.50	3.76	22.92	32.09	24.22
50	4.94	5.77	23.79	43.98	28.08
60	6.02	8.39	24.37	57.75	33.50
70	6.26	9.82	25.52	67.69	43.31
80	9.50	10.05	33.33	114.28	84.26
90	18.64	12.20	40.66	150.79	100.52
100	24.88	22.87	52.18	243.25	121.47

Each Project Bundle was then assigned a 10 to 100 score based on the miles in each category associated with each project. The individual scores were then weighted to create an overall score for the EQL4 Mode Availability criteria. The weightings are shown in Table T4.5 below.

Table T4.5: EQL4 Mode Availability Weights

	Tier 1 Transit	Tier 2 Transit	Tier 3 Transit	GP Lanes	Managed Lanes
Weight	2	1.5	1	1	2

EQL5 Bike and Pedestrian Access

Description: Portion of projects that are located within a Mobility Hub.

Script: project_bundle_criteria.py

Script Method/s: _projects_within_mohub()

A. Geospatial Analysis Summary

1. **Calculate miles each Project Bundle intersects with a Mobility Hub (where pedestrian and bicycle access are concentrated).**
   a. Calculate Bundle Total Miles.
   b. Calculate Number of Bundle Miles within a Mobility Hub.

B. Excel Scoring and Ranking

The bike and pedestrian access output was loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds utilizing natural breaks shown in Table T4.6.

Table T4.6: EQL5 Bike and Pedestrian Access

Score	Percent in MoHub (Upper Threshold)
10	6.3%
20	14.6%
30	20.9%
40	38.6%
50	56.7%
60	65.6%
70	74.3%
80	87.9%
90	95.1%
100	100.0%

Each Project Bundle was then assigned a 10 to 100 score based on the percentage of the project within a Mobility Hub associated with each project.

EQL6 Communities of Concern

Description: Communities of concern (seniors, minorities, low-income residents) within a half mile of a transit station or within a Mobility Hub.

Script: project_bundle_criteria.py

Script Method/s: _communities_of_concern(), buffer_stations_merge_mohubs()

A. Geospatial Analysis

1. Calculate communities of concern within buffered areas.

a. Intersect the station buffers from EQL1 with SANDAG_Coc_2018 layer.

b. Summarize communities of concern values (pop_senior, pop_minority, and pop_low_income) for each Project Bundle station buffer.

B. Excel Scoring and Ranking

The communities of concern outputs were loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds for each community of concern utilizing natural breaks shown in Table T4.7.

Table T4.7: EQL6 Communities of Concern

Score	Seniors (Upper Threshold)	Minorities (Upper Threshold)	Low Income (Upper Threshold)
10	1,811	15,881	2,827
20	3,782	32,957	6,765
30	5,330	47,204	9,544
40	7,068	65,007	13,232
50	8,867	80,077	18,583
60	10,552	106,813	18,869
70	15,180	171,055	30,847
80	20,566	222,104	54,163
90	23,341	246,408	65,588
100	35,001	382,197	83,343

Each Project Bundle was then assigned a 10 to 100 score based on the percentage of the project within a Mobility Hub associated with each project. To get an overall community of concern score, each score was given a weight of one and an overall score was determined.

EQL7 Transit access to future density

Description: Number of transit stations located within Mobility Hubs.

Script: project_bundle_criteria.py

Script Method/s: _stations_within_mohubs()

A. Geospatial Analysis

1. **Calculate how many transit stations are in a Mobility Hub area.**
    a. Count number of stations by tier, Project Bundle, and Mobility Hub area.

B. Excel Scoring and Ranking

The transit access to future density output was loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds utilizing natural breaks shown in Table T4.8.

Table T4.8: EQL7 Transit Access to Future Density

Score	Stations in MoHub (Upper Threshold)
10	3
20	7
30	16
40	21
50	26
60	30
70	41
80	59
90	73
100	99

Each Project Bundle was then assigned a 10 to 100 score based on the total number of transit stations each project has within a Mobility Hub associated with each project.

MS1 Person Peak Throughput Capacity

Description: Transit Peak Throughput Capacity (PTC) (MS2) + Vehicle PTC (MS3) times vehicle occupancy.

A. Geospatial Analysis

None.

B. Excel Scoring and Ranking

1. Transit PTC plus Vehicle PTC multiplied by vehicle occupancy of 1.1.
2. The results of step one were then split into 10 score thresholds utilizing natural breaks shown in Table T4.9.
3. The results of step one were then assigned a 10 to 100 score.

Table T4.9: MS1 Person Peak Throughput Capacity

Score	Transit PTC (Upper Threshold)
10	7,950
20	15,815
30	21,483
40	25,131
50	41,148
60	50,726
70	63,001
80	87,269
90	116,417
100	137,794

MS2 Transit Peak Throughput Capacity

Description: Peak transit capacity (transit rider capacity per number of vehicles/headways per hour).

A. Geospatial Analysis

a. Calculate Project Bundles proportion of transit capacity.

i. Count number of stations by route located within the Project Bundle divided by total stations per route.

ii. Capacity per hour multiplied by percentage of stations within Project Bundle.

b. Summarize peak capacity by tier within each Project Bundle.

B. Excel Scoring and Ranking

The transit capacity output was loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds utilizing natural breaks shown in Table T4.10.

Table T4.10: MS2 Transit Peak Throughput Capacity

Score	Transit PTC (Upper Threshold)
10	821
20	1,951
30	3,325
40	4,277
50	5,829
60	7,009
70	8,368
80	10,522
90	15,694
100	20,542

Each Project Bundle was then assigned a 10 to 100 score based on the total number of transit stations each project has within a Mobility Hub associated with each project.

MS3 Vehicle Peak Throughput Capacity

Description: Peak vehicle capacity (vehicles per lane per hour).

A. Geospatial Analysis

a. Calculate existing and future lane miles.
   i. Segment length in miles multiplied by the number of GP lanes, Managed Lanes, and toll lanes.

b. Calculate existing capacity.
   i. Lane miles from step 1 multiplied by 1,530 for GP lanes.
   ii. Lanes miles from step 1 multiplied by 1,925 for Managed Lanes and toll lanes.

c. Calculate future capacity.
   i. Lane miles from step 1 multiplied by 1,800 for GP lanes.
   ii. Lanes miles from step 1 multiplied by 1,925 for Managed Lanes and toll lanes.

d. Calculate change in capacity.
   i. Future capacity minus existing capacity.

B. Excel Scoring and Ranking

The vehicle capacity output was loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds utilizing natural breaks shown in Table T4.11.

Table T4.11: MS3 Vehicle Peak Throughput Capacity

Score	Vehicle PTC (Upper Threshold)
10	0
20	14,900
30	16,575
40	22,100
50	33,150
60	37,000
70	55,500
80	70,150
90	92,500
100	111,000

Each Project Bundle was then assigned a 10 to 100 score based on the future vehicle capacity of each project.

MS4 Congestion

A. Geospatial Analysis

1. Join Level of Travel Time Reliability (LOTTR) and Peak Hour of Excessive Delay (PHED) to NPMRDS roadway segments.
2. Join NPMRDS data to Project Bundles.
    i. Project Bundles buffered by 800 feet.
    ii. Project Bundles overlaid on NPMRDS data, where overlap occurs Project Bundle number assigned to NPMRDS data.
3. Summation of NPMRDS segments (total count of segments).
4. LOTTR
    i. Filtered segments with LOTTR greater than 1.5.
        1. Results assigned to bins in 0.1 increments (e.g., 1.5 to 1.6) to 2 and then greater than 2.
        2. Total segment count determined for each bundle for each bin.
    ii. Determine percent of LOTTR segments within each bundle.
        1. LOTTR counts divided by total NPMRDS segments in each bundle.
5. PHED
    i. Calculate PHED per lane.
        1. PHED divided by through lanes.
        2. Average for all segments within the Project Bundle.

B. Excel Scoring and Ranking

The congestion outputs were loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds for each congestion criteria utilizing natural breaks shown in Table T4.12. For LOTTR, the score threshold was assigned by the proportion of the bundle network in each LOTTR range.

Table T4.12: MS4 Congestion

Score Threshold	LOTTR 1.5 to 1.6	LOTTR 1.6 to 1.7	LOTTR 1.7 to 1.8	LOTTR 1.8 to 1.9	LOTTR 1.9 to 2	LOTTR > 2.0	Average PHED Per Lane
10	0.000	0.018	0.030	0.000	0.000	0.021	1,465.80
20	0.077	0.031	0.036	0.020	0.006	0.091	3,292.93
30	0.116	0.044	0.041	0.025	0.013	0.101	4,101.86
40	0.204	0.060	0.051	0.028	0.016	0.115	4,983.95
50	0.244	0.064	0.063	0.032	0.021	0.127	5,984.70
60	0.308	0.075	0.073	0.041	0.027	0.141	6,545.50
70	0.407	0.085	0.086	0.047	0.029	0.148	7,438.45
80	0.452	0.096	0.093	0.063	0.043	0.163	8,162.99
90	0.549	0.105	0.103	0.122	0.051	0.171	10,215.80
100	0.594	0.125	0.200	0.146	0.083	0.178	11,943.78

Each project was then assigned a 10 to 100 score based on the results for each criterion. To get an overall congestion score, each travel time reliability score was given a weight of shown in Table T4.13. The PHED score was given a weight of 1. To get an overall congestion score, the reliability score was given a weight of 1 and averaged with the PHED score.

Table T4.13: MS4 Congestion Weights

	LOTTR 1.5 to 1.6	LOTTR 1.6 to 1.7	LOTTR 1.7 to 1.8	LOTTR 1.8 to 1.9	LOTTR 1.9 to 2	LOTTR > 2.0	Average PHED Per Lane
Weight	1	1.5	2	2.5	3	3.5	1,465.80

MS5 Safety

Description: Safety incidents (fatalities, serious injuries, and visible injuries).

A. Geospatial Analysis

Inputs (See Appendix A):

- TIMS DATA
- PROJECT BUNDLES (LINE)

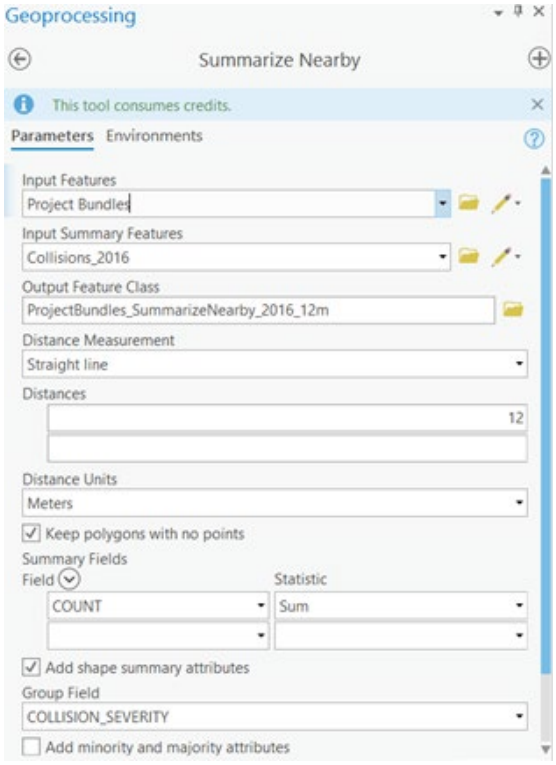
Calculation process:

a. Download incident data from tims.berkeley.edu/tools/gismap as CSV format.

b. Map the incident data from the latitude and longitude to GIS point layer.

c. Separate the incident data by year to 3 GIS point layers, Collision_2016, Collision_2017, and Collision_2018.

d. For each year of incident data, use the incident data and Project Bundle data as inputs, run "Summarize Nearby" in ArcGIS Pro, example parameter settings below of using Collision_2016:



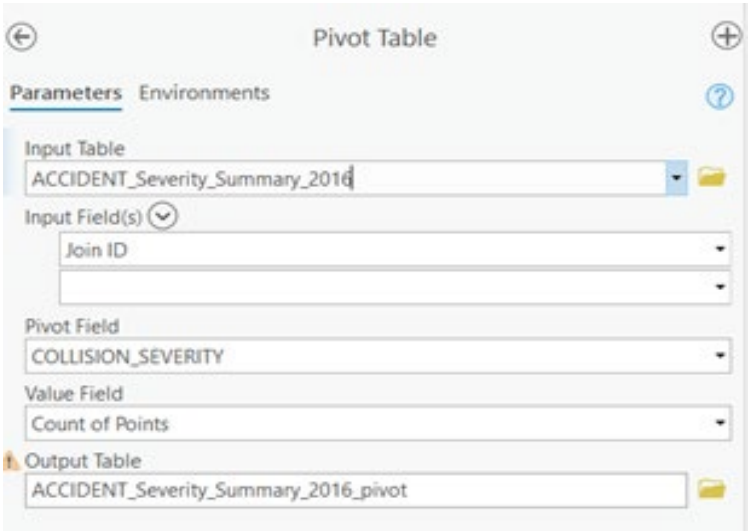
Note: Search distance is set to 12 meters because most of the data points are located close by the Project Bundle lines, 12 meters is found to best capture the majority of the incidents but not over buffering.

e. The process above generates 2 outputs, a feature class with point count, and a table with point count by Collison Severity:

ProjectBundle	Count of Points	JOIN ID
1	3	1
10	34	2
11	12	3
12	6	4
14	3	5
15	41	6
16	8	7
19	25	8
2	4	9
21	21	10

OBJECTID	Join ID	COLLISION_SEVERITY	Count of Points
1	1	1	2
2	1	3	1
3	2	1	1
4	2	2	9
5	2	3	24
6	3	1	3
7	3	2	1
8	3	3	8
9	4	2	2
10	4	3	4

Then the second table is transformed using the "Pivot Table" tool in ArcGIS Pro:



Which generates an output table like the following:

OBJECTID	Join ID	COLLISION_SEVERITY1	COLLISION_SEVERITY2	COLLISION_SEVERITY3
1	1	2	<Null>	1
2	2	1	9	24
3	3	3	1	8
4	4	<Null>	2	4
5	5	<Null>	<Null>	3
6	6	5	8	28
7	7	<Null>	1	7
8	8	1	4	20
9	9	<Null>	<Null>	4
10	10	5	2	14

In the last step, this table is joined to the first table based on the "Join ID" field using "Join Field" tool. The final output looks like the following:

ProjectBundle	Count of Points	COLLISION_SEVERITY1	COLLISION_SEVERITY2	COLLISION_SEVERITY3
1	3	2	<Null>	1
10	34	1	9	24
11	12	3	1	8
12	6	<Null>	2	4
14	3	<Null>	<Null>	3
15	41	5	8	28
16	8	<Null>	1	7
19	25	1	4	20
2	4	<Null>	<Null>	4

f. Repeat the same process for each year.

g. The output from GIS is then exported to Excel using the "Table to Excel" tool.

A. Excel Scoring and Ranking

The safety outputs were loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds for each crash type utilizing natural breaks shown in Table T4.14.

Table T4.14: MS5 Safety

Score	Fatalities (Upper Threshold)	Severe Injury (Upper Threshold)	Visible Injury (Upper Threshold)
10	0	1	1
20	1	3	11
30	2	5	23
40	3	6	29
50	5	8	37
60	6	11	56
70	7	12	58
80	9	14	68
90	10	19	87
100	12	22	107

Each project was then assigned a 10 to 100 score based on the results for each criterion. To get an overall safety score, each criterion was given a weight of shown in Table T4.15.

Table T4.15: MS5 Safety Weights

	Fatalities	Severe Injury	Visible Injury
Weight	2	1.5	1

MS6 Transit Reliability

Description: Transit reliability measured by miles of dedicated guideway and transit priority investments.

A. Geospatial Analysis

1. Miles calculated for each route within the Project Bundle.
    i. Total route miles summed and added to the Project Bundle.
2. Route segments denoted as fixed guideway filtered.
    i. Miles of fixed guideway by tier within each bundle summed.
3. Total route miles within Project Bundle.
    i. Miles of each route by tier summed.

4. Fixed guideway percent.
    i. Fixed guideway miles divided by total route miles.
5. Priority percent.
    i. Priority route miles divided by total route miles.

B. Excel Scoring and Ranking

The transit reliability outputs were loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds for each criteria utilizing natural breaks shown in Table T4.16.

Table T4.16: MS6 Transit Reliability

Score	Dedicated Guideway (Upper Threshold)	Transit Priority (Upper Threshold)
10	0.0%	40.6%
20	7.7%	45.1%
30	11.6%	54.8%
40	24.4%	57.9%
50	30.8%	61.7%
60	38.3%	69.2%
70	40.7%	70.0%
80	43.1%	79.6%
90	46.6%	94.5%
100	59.4%	100.0%

Each project was then assigned a 10 to 100 score based on the results for each criterion. To get an overall transit reliability score, each criterion was given a weight of shown in Table T4.17.

Table T4.17: MS6 Transit Reliability Weights

	Dedicated Guideway	Transit Priority
Weight	3	1

EC1 Transportation Affordability

Description: Estimated cost of travel.

A. Geospatial Analysis

None.

B. Excel Scoring and Ranking

1. The estimated cost of travel for each bundle was calculated using the following formula based on data calculated in other evaluation criteria. The calculation is: ([RouteFare ($2.50)/RouteMiles]*SegmentMiles + $0.55*RoadwayLaneMiles)/Total Bundle Miles
2. The results of step one were then split into 10 score thresholds for each criteria utilizing natural breaks shown in Table T4.18.

Table T4.18: EC1 Transportation Affordability

Score	Transportation Affordability (Upper Threshold)
10	$51.88
20	$96.32
30	$128.25
40	$162.45
50	$249.78
60	$320.13
70	$408.68
80	$569.53
90	$726.12
100	$1,442.76

3. Each project was then assigned a 10 to 100 score based on the results for each criterion.

EC2 Jobs

Description: Employment centers with X miles of a project area.

A. Geospatial Analysis

Inputs (See Appendix A):

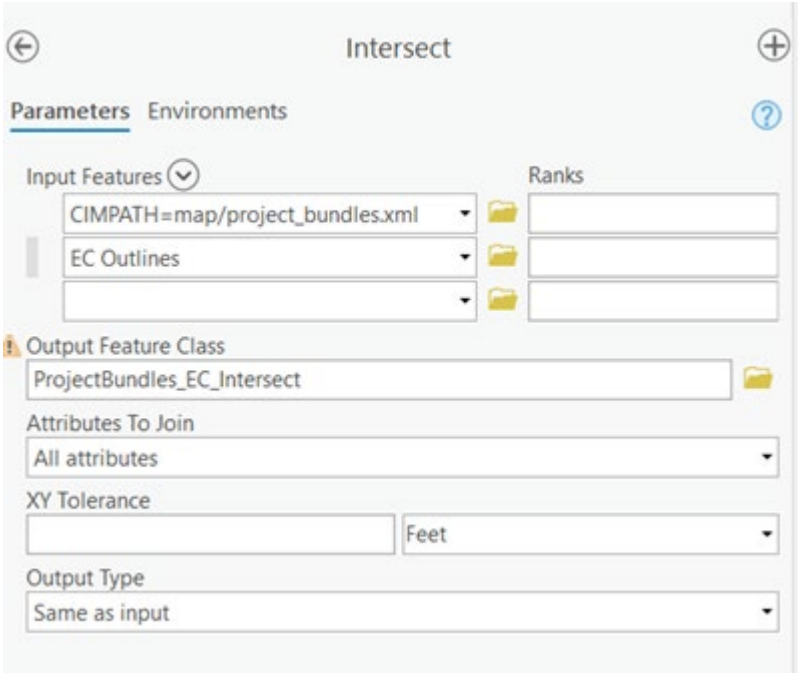
- EC OUTLINES

  Note: Tier 1 & Tier 2 Employment centers only

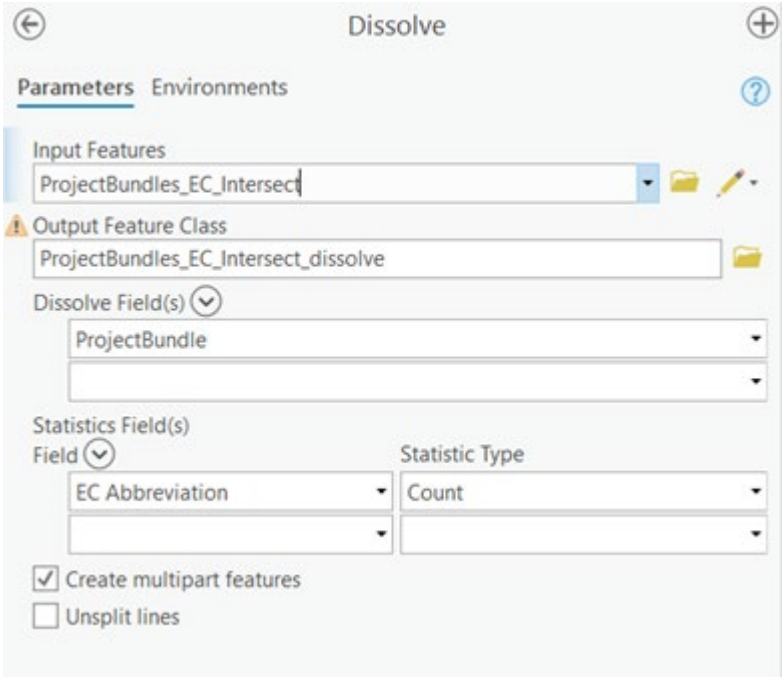
- PROJECT BUNDLES (LINE)

Calculation process:

a. Intersect using employment center and Project Bundle:



b. Dissolve using the following setting:



This generates the final output like this:

OBJECTID	Shape	ProjectBundle	COUNT_EC_Abbrev
1	Polyline	10	16
2	Polyline	11	8
3	Polyline	12	5
4	Polyline	16	3
5	Polyline	19	9
6	Polyline	3	4
7	Polyline	5	7
8	Polyline	5A	1
9	Polyline	5B	4

Table to Excel to export to Excel format.

B. Excel Scoring and Ranking

The employment center output was loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds utilizing natural breaks shown in Table T4.19.

Table T4.19: EC2 Jobs

Score	Employment Centers (Upper Threshold)
10	0
20	1
30	2
40	3
50	4
60	5
70	6
80	7
90	9
100	16

Each project was then assigned a 10 to 100 score based on the results.

EC3 Freight

Description: Relevance to National Highway Freight Network and other freight corridors. Proximity to land uses relevant to freight movements (agriculture, industrial, commercial, etc.).

Script: project_bundle_criteria.py

Script Method/s: _goods_movement_facilities(), _goods_movement_corridors()

A. Geospatial Analysis

1. Goods Movement/Freight Corridors
    a. Calculate the land use percentage types within a quarter mile of complete corridors Managed Lanes.
2. Goods Movement Areas/Facilities (polygons)
    a. Count the number and type of GoodsMovement_Areas within a quarter mile of Project Bundles.
3. Goods Movement Routes (lines)
    a. Calculate the number of Project Bundle miles (by route type) that correspond with GoodsMovement_Routes.

B. Excel Scoring and Ranking

The freight outputs were loaded into the spreadsheet for each Project Bundle. Once loaded into the spreadsheet, the results were then split into 10 score thresholds for each criteria utilizing natural breaks shown in Table T4.20.

Table T4.20: EC3 Freight

Score	Freight Facilities (Upper Threshold)	Freight Land Use (Upper Threshold)	Caltrans Route (Upper Threshold)	Goods Movement Route (Upper Threshold)
10	0	0.00	0.90	0.00
20	1	5.23	3.78	15.37
30	2	6.63	9.71	40.35
40	3	8.77	13.73	52.96
50	4	10.05	19.50	68.70
60	5	13.29	29.32	90.25
70	6	18.19	34.96	152.37
80	7	21.58	38.04	193.58
90	9	23.98	56.16	206.23
100	16	27.99	76.88	324.33

Each project was then assigned a 10 to 100 score based on the results for each criterion. To get an overall freight score, each criterion was given a weight of shown in Table T4.21.

Table T4.21: MS6 Transit Reliability Weights

	Freight Facilities	Freight Land Use	Caltrans Route	Goods Movement Route
Weight	1	1	1	1

Appendix T Attachment 5:

Strategies Applied in ABM2+

Appendix T Attachment 5: Strategies Applied in ABM2+

Table T5.1: Quantification Approach for 2021 Regional Plan Strategies

Quantification Approach for 2021 Regional Plan Strategies		
Strategy	**Inclusion in Prior Sustainable Communities Strategy?**	**Quantification Approach**
Transportation System Infrastructure and Operations		
Complete Corridors and Transit Leap: • Managed Lanes • High-occupancy vehicle (HOV)/ High-occupancy toll (HOT) policies • Regional Bike Network • Commuter rail • Light rail • Next Generation *Rapid* • Local bus	Yes. 2021 Sustainable Communities Strategy (SCS) expands on these strategies.	Coded as transportation network improvements in ABM2+.
Mobility Hubs and Flexible Fleets: • Local complete streets • Parking management • Microtransit • Micromobility • Pooled transportation network companies (TNCs) • E-bikes	Mobility Hubs were introduced in the prior SCS, but investment and specific geographic information was limited, as were associated strategies and fleet assumptions.	Mobility Hubs are used as a geographic area for applying complete streets, parking, microtransit, and micromobility strategies in ABM2+. Pooled TNCs and e-bikes are reflected in mode choices in ABM2+.
Next Operating System (Next OS): • Active Transportation Demand Management (ATDM) • Smart signals	Yes. 2021 SCS expands on these strategies.	ATDM reflected as improved travel reliability in ABM2+. Smart signals reflected as reduced intersection delays in ABM2+.

Quantification Approach for 2021 Regional Plan Strategies

Strategy	Inclusion in Prior Sustainable Communities Strategy?	Quantification Approach
Demand Management		
Telework	Yes. Ability to capture primarily and occasional telework is new.	Primarily and occasional teleworker assumptions applied in ABM2+.
Pooled rides (private)	Yes, off-model in prior SCS.	Off-model
Vanpool	Yes, off-model in prior SCS.	Off-model
Carshare	Yes, off-model in prior SCS.	Off-model
Regional TDM Ordinance	No, new off-model calculator.	Off-model
Pricing Strategies: • Road usage charge • Transit fare subsidies • Congestion pricing/toll rates • Parking • TNC fees	Carryover pricing strategies include congestion pricing/toll rates, parking pricing. New pricing strategies include road usage charge, transit fare subsidies, and TNC fees.	Pricing strategies reflected in ABM2+ as follows: • Road usage charge: per-mile charge added to the auto operating cost • Transit fare subsidies: one-way and daily transit fares defined for each service type • Congestion pricing/tolled rates: per-mile tolls defined by time of day for each Managed Lane corridor and fixed-fee tolls for the SR 125 toll road • Parking: hourly, daily, and monthly rates applied to certain Mobility Hub areas and charged to auto trips destined for those specified areas • TNC fees: applied as fixed fee per trip
Land Use		
SCS land use pattern that considers: • Job–Housing Balance • Mixing of uses • Transit-oriented development • Regional Housing Needs Assessment	Yes. The 2021 SCS includes expanded land use policies reflected in the SCS land use pattern.	Mobility Hub areas used as a framework for the allocation of housing and jobs in the land use pattern developed in Integrated Land Use, Demographic, and Economic Model (I-LUDEM) and impact modeled in ABM2+.
Zero-Emission Vehicles		
Regional electric vehicle (EV) charger program	Yes, off-model in prior SCS. The 2021 SCS includes an expanded EV charger program.	Off-model
Regional EV Incentive Program	No. The EV incentive program is a new SCS strategy.	Off-model

Table T5.2: Regional Plan Strategies Applied in ABM2+

Regional Plan Strategies Applied in ABM2+				
Category	**Input Description**	**2025**	**2035**	**2050**
Managed Lanes (MLs)	HOV and toll assumptions	HOV3+ (No Pricing on HOV). ML3+ (ML Facilities are Priced) – Vehicles carrying three or more persons are allowed and pay no toll for use. Single-occupant vehicles (SOVs) and two-person vehicles that pay a toll are permitted to use the facility.	ML3+ (All ML Facilities are Priced) – Vehicles carrying three or more persons are allowed and pay no toll for use. SOVs and two-person vehicles that pay a toll are permitted to use the facility.	ML3+ (All ML Facilities are Priced) – Vehicles carrying three or more persons are allowed and pay no toll for use. SOVs and two-person vehicles that pay a toll are permitted to use the facility.
Pricing ($2020)	Managed Lane/ HOT rates	Existing HOT toll rates on I-15.	$0.30/mile a.m. and p.m. peak $0.30/mile off-peak	$0.30/mile a.m. and p.m. peak $0.30/mile off-peak
	Regional road usage charge	None.	3 cents/mile	3 cents/mile
Parking Cost ($2020)	Urban shed, major employment centers, U.S.–Mexico border	Hourly: $2 Daily: $20 Monthly: $300	Hourly: $3.25 Daily: $25 Monthly: $350	Hourly: $6 Daily: $34 Monthly: $450
	Central Mobility Hub	Hourly: $2 Daily: $20 Monthly: $300	Hourly: $5 Daily: $39 Monthly: $450	Hourly: $6.50 Daily: $43 Monthly: $550
	Coastal communities	Hourly: $1.50 Daily: $12 Monthly: $200 (All coastal sheds except for Imperial Beach, Coronado, and La Jolla)	Hourly: $2.25 Daily: $16 Monthly: $250 (Add in Imperial Beach, Coronado, and La Jolla)	Hourly: $4.50 Daily: $24 Monthly: $350
	Suburban communities	Hourly: $1 Daily: $8 Monthly: $100	Hourly: $1.50 Daily: $12 Monthly: $150	Hourly: $3 Daily: $20 Monthly: $250
Telework	Target rates for primary and occasional teleworkers	Primary telework: 9.7% Occasional telework: 8.8%	Primarily telework: 10.9% Occasional telework: 11.8%	Primarily telework: 12.7% Occasional telework: 14.8%
TNCs ($2020)	TNC fee (single)	0	Fixed: $1.25/trip	Fixed: $1.25/trip
	TNC fee (shared)	0	Fixed: $0.65/trip	Fixed: $0.65/trip

Regional Plan Strategies Applied in ABM2+				
Category	**Input Description**	**2025**	**2035**	**2050**
Micromobility	Speed	15 mph average	15 mph average	15 mph average
	Cost ($2020)	Micromobility cost: $1 fixed +$0.20/min $0 for access/egress to transit	Micromobility cost: $1 fixed +$0.20/min $0 for access/egress to transit	Micromobility cost: $1 fixed +$0.20/min $0 for access/egress to transit
	Wait time	3 minutes in urban, 5 minutes suburban	3 minutes in urban, 5 minutes suburban	3 minutes in urban, 5 minutes suburban
	Constant	60 minutes	60 minutes	60 minutes
	Value of time ($2020)	$15	$15	$15
E-Bikes	Personally owned e-bike	14% of privately owned bikes are e-bikes	36% of privately owned bikes are e-bikes	64% of privately owned bikes are e-bikes
Microtransit	Speed	17 mph	17 mph	17 mph
	Flat fare ($2020)	$2.50	$1.25 one way/$3 day	$1.25 one way/$3 day
	Wait time	4 minutes	4 minutes	4 minutes
	Access time	0 minutes	0 minutes	0 minutes
	Constant	120 minutes	120 minutes	120 minutes
	Max distance	3 miles	3 miles	3 miles
Transit Fares	Local bus, arterial *Rapid*, some non-express freeway *Rapid*s, Express Bus, Trolley, SPRINTER	$2.50 one way/$6 day	$1.25 one way/$3 day	$1.25 one way/$3 day
	Express Freeway *Rapid*	$5 one way/$12 day	$2.50 one way/$6 day	$2.50 one way/$6 day
	Commuter rail	$6 one way/$12 day	$3 one way/$6 day	$3 one way/$6 day
	COASTER connection, automated people mover	Free, N/A	Free	Free
ATDM	Capacity increase from Integrated and Cooperative Management of roadway system yielding increase in travel reliability.	N/A	7% unreliability reduction	7% unreliability reduction
Smart Signals	Benefits from reduced intersection delays.	Delay at signalized intersections decreased by 20% (arterials).	Delay at signalized intersections decreased by 20% (arterials).	Delay at signalized intersections decreased by 20% (arterials).

Appendix T Attachment 6:

Performance Measure Results Tables

Appendix T Attachment 6: Performance Measure Results Tables

Table T6.1: Primary Measures

Table T6.1: Primary Measures		2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
Access to Basic Needs	**% of Population within 15 Minutes of Retail**							
Regionwide	Walk	69.0%	72.8%	74.6%	76.1%	71.6%	74.0%	74.7%
	Bike	95.6%	96.8%	96.8%	97.2%	96.3%	97.1%	97.5%
	Walk, Micromobility, Microtransit	70.0%	73.7%	75.4%	77.0%	74.5%	79.9%	80.4%
	Transit – Accessed by Walk and Flexible Fleet – Speed One	60.3%	61.7%	63.7%	63.4%	63.2%	66.5%	67.4%
	Driving (drive alone)	99.0%	99.1%	99.1%	99.3%	99.1%	99.2%	99.3%
Mohub	Walk	91.2%	93.5%	93.8%	94.6%	93.1%	94.3%	94.6%
	Bike	99.8%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Walk, Micromobility, Microtransit	91.8%	94.0%	94.4%	95.2%	97.8%	97.7%	97.9%
	Transit – Accessed by Walk and Flexible Fleet – Speed One	84.3%	85.6%	86.4%	84.5%	87.1%	89.5%	89.7%
	Driving (drive alone)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Access to Basic Needs	**% of Population within 15 Minutes of Parks**							
Regionwide	Walk	51.0%	52.3%	53.1%	53.0%	52.7%	53.3%	53.5%
	Bike	93.5%	93.7%	93.8%	93.9%	94.7%	95.1%	95.7%

Table T6.1: Primary Measures		2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
	Walk, Micromobility, Microtransit	54.2%	55.5%	56.5%	56.4%	69.5%	74.4%	74.5%
	Transit – Accessed by Walk and Flexible Fleet – Speed One	39.0%	39.5%	41.0%	40.9%	41.8%	44.7%	45.5%
	Driving (drive alone)	98.6%	98.6%	98.7%	98.7%	98.7%	98.8%	98.8%
Mohub	Walk	63.9%	65.3%	65.3%	64.5%	65.1%	64.3%	64.1%
	Bike	99.8%	99.6%	99.2%	99.3%	99.5%	98.7%	98.8%
	Walk, Micromobility, Microtransit	68.8%	70.1%	70.3%	69.5%	98.5%	97.2%	96.2%
	Transit – Accessed by Walk and Flexible Fleet – Speed One	59.4%	59.7%	60.6%	59.4%	62.8%	65.2%	65.4%
	Driving (drive alone)	100.0%	100.0%	100.0%	99.8%	100.0%	100.0%	100.0%
Access to Basic Needs	**% of Population within 30 Minutes of a Medical Facility**							
Regionwide	Transit – Accessed by Walk and Flexible Fleet – Speed One	81.0%	81.4%	82.5%	82.3%	82.3%	84.5%	85.4%
	Driving (drive alone)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mohub	Transit – Accessed by Walk and Flexible Fleet – Speed One	95.5%	96.0%	96.5%	95.6%	96.1%	97.8%	98.1%
	Driving (drive alone)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table T6.1: Primary Measures		2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
Change in Greenhouse Gas Emissions[1] **Change in On-Road CO_2 Emissions from 2005 Values (EMFAC 2014)**								
Senate Bill 375 (Steinberg, 2008) (SB 375) on-road CO_2 emissions (tons/day)		-390	1,052	3,541	5,982	-1,315	-2,838	-1,826
SB 375 on-road CO_2 emissions (pounds/day) per capita		-2.36	-2.16	-1.78	-1.30	-3.52	-5.30	-5.46
Vehicle Miles Traveled								
All vehicle classes regionwide		83,614,704	88,268,330	94,374,791	100,071,163	84,538,406	85,412,968	88,133,934
All vehicle classes regionwide per capita		25.6	25.8	26.4	27.1	24.7	23.9	23.8
Access to Opportunities via Transit	**Tier 1 Employment Centers**							
30 minutes – regionwide	Transit – Accessed by Walk and Flexible Fleet – Speed One	21.1%	23.3%	25.8%	25.4%	24.9%	31.1%	35.9%
45 minutes – regionwide	Transit – Accessed by Walk and Flexible Fleet – Speed One	37.2%	40.2%	42.8%	42.6%	43.4%	51.8%	58.3%
30 minutes – Mohub	Transit – Accessed by Walk and Flexible Fleet – Speed One	34.1%	37.7%	40.6%	39.2%	40.1%	48.7%	55.8%
45 minutes – Mohub	Transit – Accessed by Walk and Flexible Fleet – Speed One	59.8%	62.8%	64.9%	63.5%	65.4%	71.4%	77.7%

[1] These measures quantify reductions in total tons and pounds per capita and are used to calculate the percent reduction per capita required in SB 375. Negative values indicate emission reductions.

Table T6.1: Primary Measures		2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
Access to Opportunities via Transit	**Tier 2 Employment Centers**							
30 minutes – regionwide	Transit – Accessed by Walk and Flexible Fleet – Speed One	46.9%	48.9%	50.5%	50.2%	51.7%	57.3%	59.7%
45 minutes – regionwide	Transit – Accessed by Walk and Flexible Fleet – Speed One	67.1%	68.2%	69.6%	68.8%	72.1%	77.5%	79.7%
30 minutes – Mohub	Transit – Accessed by Walk and Flexible Fleet – Speed One	71.0%	72.8%	73.6%	72.0%	74.9%	78.4%	80.0%
45 minutes – Mohub	Transit – Accessed by Walk and Flexible Fleet – Speed One	87.6%	88.3%	88.6%	86.6%	91.5%	93.8%	95.4%
Access to Opportunities via Transit	**All Employment Centers**							
30 minutes – regionwide	Transit – Accessed by Walk and Flexible Fleet – Speed One	80.5%	81.2%	82.4%	82.2%	82.3%	84.7%	85.6%
45 minutes – regionwide	Transit – Accessed by Walk and Flexible Fleet – Speed One	82.0%	82.5%	83.6%	83.4%	83.5%	85.7%	86.7%
30 minutes – Mohub	Transit – Accessed by Walk and Flexible Fleet – Speed One	95.9%	96.3%	96.7%	95.9%	96.6%	98.4%	98.5%

Table T6.1: Primary Measures		2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
45 minutes – Mohub	Transit – Accessed by Walk and Flexible Fleet – Speed One	96.0%	96.3%	96.7%	95.9%	96.6%	98.4%	98.7%
Access to Opportunities via Transit	**Higher Education Access**							
30 minutes – regionwide	Transit – Accessed by Walk and Flexible Fleet – Speed One	43.6%	46.0%	47.4%	47.2%	48.9%	54.1%	55.5%
45 minutes – regionwide	Transit – Accessed by Walk and Flexible Fleet – Speed One	68.3%	69.4%	70.2%	70.1%	73.6%	78.4%	80.4%
30 minutes – Mohub	Transit – Accessed by Walk and Flexible Fleet – Speed One	64.0%	65.6%	66.5%	65.3%	68.0%	72.6%	73.8%
45 minutes – Mohub	Transit – Accessed by Walk and Flexible Fleet – Speed One	88.8%	89.4%	88.9%	87.9%	93.0%	94.5%	96.0%

Table T6.2: Supporting Measures

Table T6.2: Supporting Measures		2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
Mode Share								
Work Trips (peak period)	Bike & walk	3.5%	4.2%	4.6%	4.7%	5.7%	6.7%	8.4%
	Carpool	13.4%	13.1%	12.8%	13.0%	15.9%	15.1%	16.1%
	Drive alone	79.4%	78.6%	78.1%	77.7%	71.9%	66.0%	61.7%
	Other (transportation network company [TNC], micromobility, taxi, school bus)	0.3%	0.3%	0.3%	0.4%	0.5%	0.5%	0.6%
	Transit	3.4%	3.7%	4.2%	4.2%	6.0%	11.6%	13.2%
Work Trips (all day)	Bike & walk	3.7%	4.6%	5.0%	5.0%	6.2%	7.3%	9.0%
	Carpool	13.0%	12.7%	12.3%	12.5%	15.5%	14.7%	15.7%
	Drive alone	79.6%	78.7%	78.3%	77.9%	71.8%	65.8%	61.4%
	Other (TNC, micromobility, taxi, school bus)	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%	0.6%
	Transit	3.4%	3.7%	4.1%	4.2%	6.0%	11.7%	13.2%
All Trips	Bike & walk	7.8%	8.8%	9.9%	10.2%	9.9%	11.9%	13.6%
	Carpool	44.2%	42.2%	39.6%	39.0%	43.5%	40.5%	40.4%
	Drive alone	44.7%	45.5%	46.9%	47.2%	42.1%	40.7%	38.6%
	Other (TNC, micromobility, taxi, school bus)	1.7%	1.7%	1.7%	1.7%	2.1%	2.1%	2.3%
	Transit	1.6%	1.7%	1.9%	1.9%	2.4%	4.7%	5.2%
Number/Percent of People Within 0.5 Miles of a Commuter Rail, Light Rail, or Next Gen *Rapid* (Tier 1/Tier 2/Tier 3) Transit Stop								
Commuter Rail (Tier 1)	Number	15,196	20,720	27,063	28,636	29,448	120,201	262,593
	Percent	0.5%	0.6%	0.8%	0.8%	0.9%	3.4%	7.1%

Table T6.2: Supporting Measures		2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
Light Rail (Tier 2)	Number	141,814	217,514	283,458	296,752	232,174	324,452	462,735
	Percent	4.3%	6.4%	7.9%	8.0%	6.8%	9.1%	12.5%
Next Gen *Rapid* (Tier 3)	Number	187,571	257,959	294,126	329,629	486,892	1,090,842	1,199,007
	Percent	5.7%	7.5%	8.2%	8.9%	14.2%	30.5%	32.4%
Access to Any of the Tiers (1–3)	Number	297,954	408,748	493,973	539,138	603,096	1,175,654	1,293,724
	Percent	9.1%	11.9%	13.8%	14.6%	17.6%	32.9%	35.0%
Number/Percent of Jobs Within 0.5 Miles of a Commuter Rail, Light Rail, or Next Gen *Rapid* (Tier 1/Tier 2/Tier 3) Transit Stop								
Commuter Rail (Tier 1)	Number	33,315	36,922	43,749	46,177	55,669	120,972	220,067
	Percent	2.0%	2.1%	2.3%	2.2%	3.2%	6.3%	10.5%
Light Rail (Tier 2)	Number	193,149	238,120	265,026	287,042	246,246	290,074	374,636
	Percent	11.7%	13.3%	13.7%	13.7%	14.0%	15.1%	18.0%
Next Gen *Rapid* (Tier 3)	Number	211,072	232,996	257,788	275,690	390,385	807,071	915,452
	Percent	12.8%	13.0%	13.3%	13.2%	22.2%	42.0%	43.9%
Access to Any of the Tiers (1–3)	Number	349,992	394,861	430,622	463,425	513,234	876,745	996,408
	Percent	21.3%	22.1%	22.2%	22.1%	29.1%	45.6%	47.8%
Number/Percent of People Within 0.25 Miles of a Bike Facility (Class I and II, Cycletrack, or Bike Boulevard)								
	Number	2,119,378	2,479,613	2,611,993	2,691,117	2,512,080	2,749,408	3,016,029
	Percent	64.9%	72.4%	73.1%	72.7%	73.4%	76.9%	81.5%
Daily Transit Boardings								
Region	Commuter rail (Tier 1)	3,838	4,999	5,443	5,865	9,055	58,540	202,153
	Light rail (Tier 2)	129,852	170,656	200,461	198,906	205,025	349,509	367,714
	Next Gen *Rapid* (Tier 3)	30,378	46,078	51,601	54,155	106,814	392,018	422,243

Table T6.2: Supporting Measures		2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
	Local bus	216,471	217,882	237,176	239,143	293,590	435,703	448,852
	All transit boardings	380,540	439,615	494,681	498,070	614,484	1,235,770	1,440,963
Mohub	Commuter rail (Tier 1)	3,337	4,473	4,931	5,269	7,940	53,806	200,640
	Light rail (Tier 2)	125,924	166,989	196,660	195,087	201,199	342,102	356,802
	Next Gen *Rapid* (Tier 3)	29,029	44,425	49,887	52,365	101,323	340,993	362,013
	Local bus	172,578	174,533	191,693	195,099	233,656	340,206	350,821
	All transit boardings	330,868	390,419	443,171	447,819	544,118	1,077,107	1,270,276
Physical Activity								
Total time engaged in transportation-related physical activity per capita		7.39	8.20	9.01	9.19	9.48	11.81	13.22
Percent of the population engaged in 20 minutes or more of transportation-related physical activity		11.4%	12.6%	13.8%	14.0%	14.6%	18.7%	20.7%
Average Truck/Commercial Vehicle Travel Times to and Around Regional Gateways and Distribution Hubs (Minutes)								
		16.27	16.78	17.23	18.05	16.03	15.97	16.22
Average Particulate Matter (PM2.5)								
Exposure per person		5.12	5.09	5.59	5.85	5.11	5.29	5.44
Truck Travel Time Index								
Highway (SHS)		1.10	1.10	1.13	1.16	1.09	1.14	1.18
Arterial		1.27	1.28	1.29	1.30	1.22	1.20	1.20
Highway (SHS) + Arterial		1.17	1.17	1.18	1.21	1.14	1.16	1.19

Table T6.2: Supporting Measures		2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
Heavy Duty Truck Delay by Facility Type (Average Daily)								
All day – Heavy Heavy Duty (HHD)	Highway (SHS)	1,584	1,942	2,928	4,279	1,731	3,047	4,663
	Arterial	5,910	6,706	7,774	8,571	5,168	5,500	5,843
A.m. and p.m. peak – HHD	Highway (SHS)	1,234	1,487	2,150	3,064	1,318	1,914	2,813
	Arterial	2,697	3,044	3,503	3,916	2,350	2,439	2,575
All day – Medium Heavy Duty (MHD)	Highway (SHS)	638	740	1,068	1,512	659	1,137	1,674
	Arterial	3,407	3,720	4,189	4,511	2,865	2,936	3,122
A.m. and p.m. peak – MHD	Highway (SHS)	475	541	751	1,034	480	668	949
	Arterial	1,398	1,513	1,706	1,847	1,171	1,171	1,217
All day – Light Heavy Duty (LHD)	Highway (SHS)	1,466	1,704	2,431	3,420	1,510	2,612	3,737
	Arterial	8,433	9,289	10,532	11,449	7,172	7,417	7,903
A.m. and p.m. peak – LHD	Highway (SHS)	1,055	1,199	1,640	2,247	1,060	1,447	2,012
	Arterial	3,266	3,557	4,022	4,396	2,764	2,782	2,902
All day – All Heavy Duty (HHD + MHD + LHD)	Highway (SHS)	3,688	4,385	6,427	9,212	3,900	6,796	10,074
	Arterial	17,750	19,715	22,495	24,531	15,205	15,853	16,868
A.m. and p.m. peak – All Heavy Duty (HHD + MHD + LHD)	Highway (SHS)	2,765	3,227	4,542	6,346	2,859	4,030	5,774
	Arterial	7,362	8,114	9,231	10,159	6,285	6,392	6,694
Transportation System Use Costs								
Percent of income consumed by out-of-pocket transportation costs		7.6%	8.2%	7.5%	7.2%	10.0%	10.0%	10.4%
Change in percent of income consumed by out-of-pocket transportation costs		n/a	0.6%	-0.1%	-0.5%	2.4%	2.4%	2.8%

Table T6.3: Corridor Travel Times

Table T6.3: Corridor Travel Times	2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
Oceanside – Downtown San Diego (AM)							
By Transit	63	63	63	63	63	39	36
By Auto	60	58	60	63	59	57	63
By Carpool	59	55	58	62	47	51	50
Escondido – Downtown San Diego (AM)							
By Transit	46	45	46	49	42	47	48
By Auto	51	51	52	55	51	48	50
By Carpool	42	42	43	46	39	41	42
El Cajon – Kearny Mesa (AM)							
By Transit	95	90	91	92	84	56	26
By Auto	29	29	29	31	25	25	25
By Carpool	29	29	29	31	25	23	23
Mid City – UTC							
By Transit	67	56	57	58	54	14	14
By Auto	27	29	30	32	26	27	26

Table T6.3: Corridor Travel Times	2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
By Carpool	27	29	30	32	26	20	20
Western Chula Vista – Mission Valley							
By Transit	62	62	62	63	62	35	14
By Auto	28	29	30	31	26	27	27
By Carpool	28	29	30	31	26	25	25
Carlsbad – Sorrento Mesa (AM)							
By Transit	42	42	42	42	41	30	18
By Auto	50	47	48	50	47	44	49
By Carpool	46	42	44	47	32	39	38
Escondido – Oceanside (AM)							
By Transit	53	53	53	53	53	53	53
By Auto	33	33	35	36	31	33	34
By Carpool	33	33	35	36	31	29	29
San Ysidro – Downtown San Diego							
By Transit	48	48	48	48	48	19	19
By Auto	31	31	33	34	29	29	29

Table T6.3: Corridor Travel Times	2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Build	2035 Build	2050 Build
By Carpool	31	31	33	34	29	24	25
Otay Ranch – UTC							
By Transit	119	93	93	94	78	59	52
By Auto	57	56	57	57	51	52	47
By Carpool	56	52	53	56	47	40	36
Pala/Pauma – Oceanside Transit Center							
By Transit	105	143	143	144	140	133	133
By Auto	52	51	52	54	47	47	48
By Carpool	52	51	52	54	47	47	48
SR 67 (Ramona) – Downtown San Diego							
By Transit	132	130	133	134	112	112	108
By Auto	78	77	78	80	74	72	73
By Carpool	72	71	72	74	68	67	69