Appendix B

Air Quality Planning and Transportation Conformity

Appendix Contents

Background

The federal Clean Air Act (CAA), which was last amended in 1990, requires the U.S. Environmental Protection Agency (EPA) to set national ambient air quality standards (NAAQS) for pollutants considered harmful to public health and the environment. California has adopted state air quality standards that are more stringent than the NAAQS. Areas with levels that exceed the standard for specified pollutants are designated as non-attainment areas.

The U.S. EPA requires that each state containing non-attainment areas develop plans to attain the NAAQS by a specified attainment deadline. These attainment plans are called State Implementation Plans (SIPs). The San Diego County Air Pollution Control District (APCD) prepares the San Diego portion of the California SIP. Once the standards are attained, further plans—called maintenance plans—are required to demonstrate continued maintenance of the NAAQS.

Pursuant to 176(c) of the federal Clean Air Act (42 USC §7506(c)), the San Diego Association of Governments (SANDAG) and the U.S. Department of Transportation (DOT) must make a determination that the Regional Transportation Plan (RTP) and the Regional Transportation Improvement Program (RTIP) conform to the SIP for air quality. Conformity to the SIP means that transportation activities will not create new air quality violations, worsen existing violations, or delay the attainment of the NAAQS.

The San Diego region attained the federal One-Hour Ozone Standard in 2001. The U.S. EPA redesignated the San Diego air basin as attainment/maintenance and approved the One-Hour Ozone Maintenance Plan as a SIP revision, effective on July 28, 2003. On June 15, 2005, the U.S. EPA revoked the federal One-Hour Ozone Standard after the 1997 Eight-Hour Ozone Standard became applicable.

On April 15, 2004, the U.S. EPA designated the San Diego air basin as non-attainment for the 1997 Eight-Hour Ozone Standard. This designation took effect on June 15, 2004.

The air basin initially was classified as a basic non-attainment area under Subpart 1 of the CAA, and the attainment date for the 1997 Eight-Hour Ozone Standard was set as June 15, 2009. However, the U.S. EPA, in response to a court decision, is expected to rule in 2011 that the San Diego basic non-attainment area be reclassified as a Subpart 2 Serious non-attainment area, with a maximum statutory attainment date of June 15, 2013. Final U.S. EPA action on this proposed reclassification has yet to be taken.

Several areas that are tribal lands in eastern San Diego County were excluded from the 1997 Eight-Hour Ozone Standard non-attainment designation. As shown in Figure B.1, the following are attainment areas for the 1997 Eight-Hour Ozone NAAQS: La Posta Areas #1 and #2, Cuyapaipe, Manzanita, and Campo Areas #1 and #2.

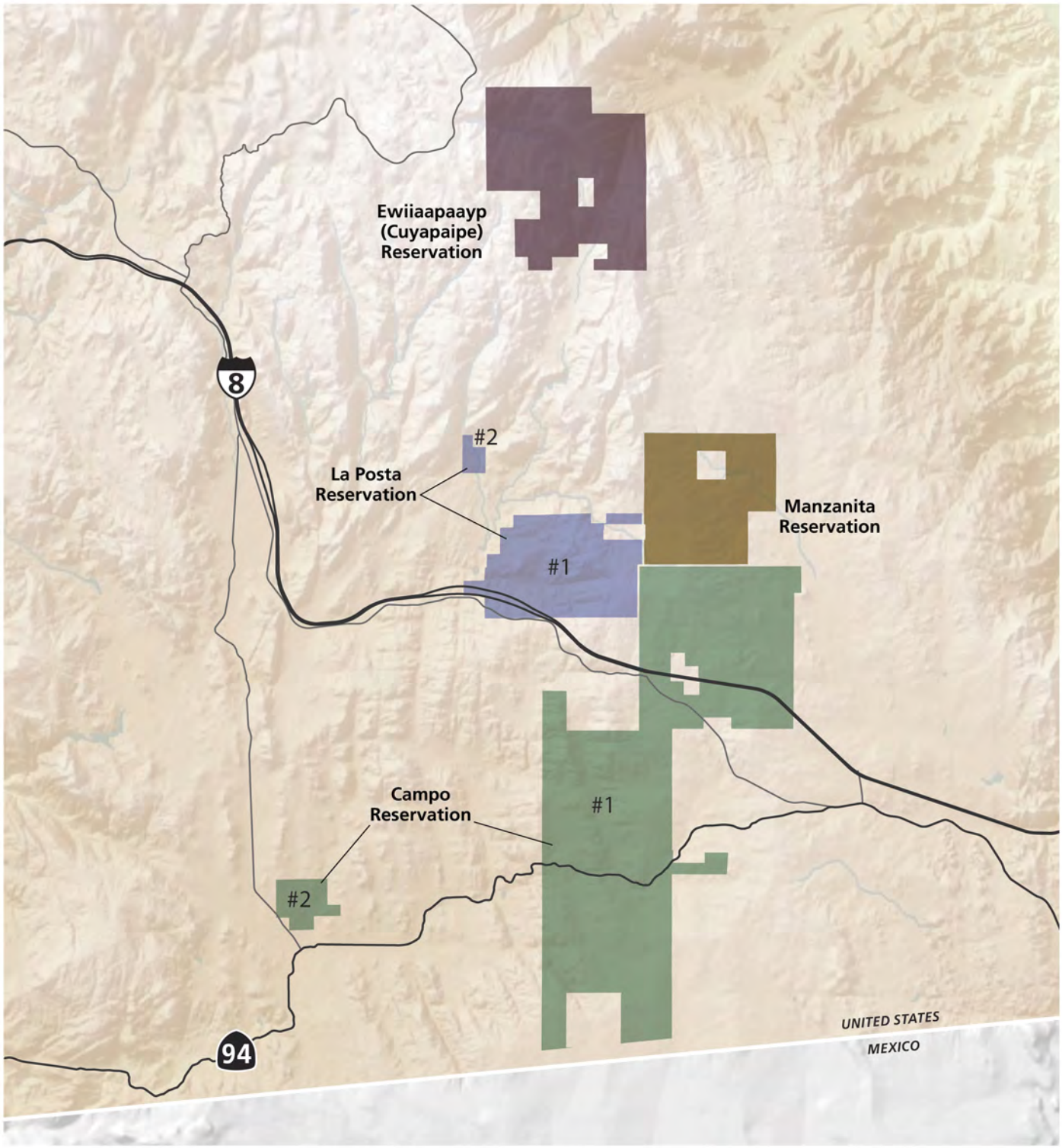

Figure B.1

Eastern San Diego County Attainment Areas for the Eight-Hour Ozone NAAQS

October 2011

Data Source: US EPA, Region 9 GIS Center
1997 Eight-Hour Ozone Standard

MILES
0 1 2 3
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KILOMETERS
N

SANDAG

In cooperation with the San Diego APCD and SANDAG, the California Air Resources Board (CARB) developed an Eight-Hour Ozone Attainment Plan for the 1997 Eight-Hour Ozone Standard, which was submitted to the U.S. EPA on June 15, 2007. The budgets in the Eight-Hour Ozone Attainment Plan for San Diego County were found adequate for transportation conformity purposes by the U.S. EPA, effective June 9, 2008.

The San Diego region also has been designated by the U.S. EPA as a federal maintenance area for the Carbon Monoxide (CO) Standard. On November 8, 2004, CARB submitted the 2004 revision to the California SIP for CO to the U.S. EPA. Effective January 30, 2006, the U.S. EPA has approved this maintenance plan as a SIP revision.

Transportation Conformity: Modeling Procedures

Introduction

SANDAG has developed the Revenue Constrained Scenario of the 2050 San Diego RTP to meet the required air quality conformity analysis. Conformity of the 2010 RTIP Amendment No. 13 has been determined simultaneously for consistency purposes. Tables B.2 and B.4 include the conformity analysis for both the 2050 Revenue Constrained RTP and the 2010 RTIP Amendment No. 13. The 2050 RTP provides information on revenue assumptions and the Revenue Constrained Scenario (Chapter 5). In addition, this conformity determination fulfills the requirements of SB 375, which requires a Sustainable Communities Strategy that allows for compliance with Section 176 of the federal Clean Air Act. (California Government Code, Section 65080(b)(2)(B)(iii)).

2050 RTP Air Quality Conformity Methodology

While the horizon year of this RTP is 2050, the current version of the emissions model approved by the U.S. EPA, EMission FACtors (EMFAC) 2007 only contains emission factors to 2040. Because no other emissions model is approved for use in conformity determinations by metropolitan planning organizations (MPOs) in California, staff explored options under the Transportation Conformity Rule to conduct the air quality conformity determination for the 2050 RTP.

SANDAG staff conducted interagency consultation on the proposed methodology for preparing the 2050 RTP air quality conformity analysis with the San Diego Region Conformity Working Group (CWG) at its August 4 and September 1, 2010, meetings. The CWG is comprised of staff representatives from SANDAG, the San Diego APCD, Caltrans, CARB, the U.S. DOT and U.S. EPA.

The CWG concurred with the proposed methodology. On September 17, 2010, the SANDAG Transportation Committee accepted, for review and distribution, the draft proposed methodology for conducting the air quality conformity determination for the 2050 RTP for a 30-day comment period. A public hearing on shortening the conformity timeline and the proposed methodology for the regional emissions analysis was held at the October 15, 2010, SANDAG Transportation Committee meeting. No comments were received at the hearing or in writing. The SANDAG Board of Directors approved the proposed methodology for conducting the 2050 RTP air quality conformity analysis on November 19, 2010.

In concurrence with the approved methodology, SANDAG staff conducted the Air Quality Conformity Analysis for the 2050 RTP for 2011 through 2040, with the analysis years of 2018, 2020, 2030, and 2040. SANDAG conducted a regional emissions analysis (for information purposes only) for 2050. To perform the informational analysis for 2050, SANDAG used the 2050 travel data from the SANDAG transportation model as input into EMFAC 2007 for the last year of the EMFAC 2007 model (2040).

Growth Forecasts

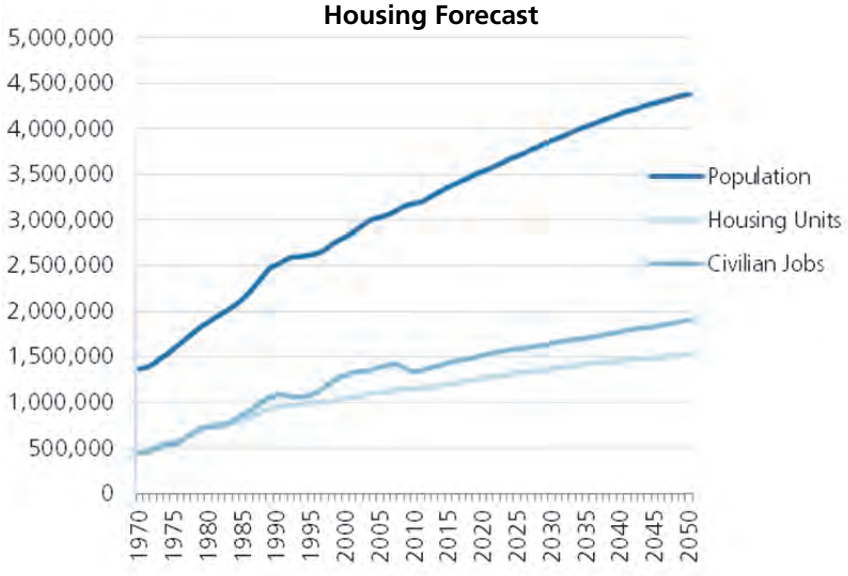
Every three to five years, SANDAG produces a long-range forecast of population, housing, and employment growth for the San Diego region. The most recent is the 2050 Regional Growth Forecast, which the SANDAG Board of Directors accepted on February 26, 2010, for planning purposes.

The forecast process relies on three integrated forecasting models. The first one, the Demographic and Economic Forecasting Model (DEFM), provides a detailed econometric and demographic forecast for the entire region. The second one, the Interregional Commuting Model, provides a forecast of commuting between the San Diego region, Orange County, southwest Riverside County, Imperial County, and Tijuana/Northern Baja California. The third one, the Urban Development Model, allocates the results of the first two models to subregional areas based upon the current plans and policies of the jurisdictions.

In April 2010, SANDAG consulted with the San Diego Region CWG on the use of the 2050 Regional Growth Forecast for the air quality conformity analysis for the 2050 RTP conformity determination and the CWG concurred. Previously, both the U.S. DOT and the U.S. EPA concurred that approved plans should be used as input in the air quality conformity process. Figure B.2 and Table B.1 show the regional population, jobs, and housing growth forecast for the San Diego region through 2050.

The 2050 Regional Growth Forecast is based largely on the adopted general plans and community plans and policies of the 18 cities, and in some cases, includes draft plans that are nearing completion. Because many of the local general plans have horizon years of 2030 – 20 years before the 2050 Growth Forecast horizon year – the later part of the forecast was developed in collaboration with each of the local jurisdictions through an iterative process that allowed each city to provide its projections for land uses in those later years. For unincorporated areas, the forecast is based on the County's referral alternative draft of the General Plan update, with additional constraints included for sensitive habitat areas.

Figure B.2 – San Diego Regional Population, Jobs, and Housing Forecast



Source: 2050 Regional Growth Forecast, SANDAG, February 2010

Table B.1 – San Diego Regional Population and Employment Forecast

2050 Regional Growth Forecast		
Year	**Population**	**Civilian Employment**
2008	3,131,552	1,411,811
2020	3,535,000	1,515,346
2030	3,870,000	1,648,361
2040	4,163,688	1,773,399
2050	4,384,867	1,898,769

Source: 2050 Regional Growth Forecast, SANDAG, February 2010

Transportation Modeling

SANDAG follows a widely used, four-step transportation modeling process of trip generation, trip distribution, mode choice, and assignment to forecast travel activity in the San Diego region. After a first pass through the four steps, a feedback process is used to pass congested travel conditions back into trip distribution and through to assignment. After several feedback iterations, a final pass is made through the mode choice and assignment steps to reflect congested travel conditions in mode decision-making. Travel model results are then combined with additional post-process input and output functions to form the complete modeling chain. For the first time, a truck model is run parallel to the four-step model. Truck origin-destination trip tables are merged with vehicle trip tables for highway assignment and air quality procedures.

The estimates of regional transportation-related emissions analyses meet the requirements established in the Transportation Conformity Rule, 40 CFR Sections 93.122(b) and 93.122(c). These requirements relate to the procedures to determine regional transportation-related emissions, including the use of network-based travel models, methods to estimate traffic speeds and delays, and the estimation of vehicle miles of travel. TransCAD 5.0 is the transportation planning computer package used by SANDAG to provide a framework for performing much of the computer processing involved with modeling, and it is used for the trip distribution and assignment steps. Another software package used extensively in the modeling process is ArcInfo. This Geographic Information System (GIS) maintains, manipulates, and displays transportation, land use, and demographic data. SANDAG has written numerous programs that provide a linkage between TransCAD and ArcInfo. Other custom programs perform some modeling functions, such as trip generation and mode choice. A number of data files and surveys are used to calibrate the transportation models. These include:

- 1995 San Diego Region Travel Behavior Study
- 2006 San Diego Household Travel Study
- 2001 Caltrans Statewide Travel Survey
- 2001-2003 San Diego Regional Transit Survey
- External Trip Surveys (2006 Interregional Travel Behavior Study)
- Traffic Generation Studies

- 1991 San Diego Visitor Survey
- 2000 Census Transportation Planning Package
- 2010 Freight Gateway Study
- 2002 Freight Analysis Framework

In addition to model parameters derived from these surveys and studies, there are three major inputs to the transportation models:

- Growth forecast inputs used to describe existing and planned land use patterns and demographic characteristics
- Highway networks used to describe existing roadway facilities and planned improvements to the roadway system
- Transit networks used to describe existing and planned public transit service

Highway Networks

The regional highway networks in the 2050 RTP include all roads classified by local jurisdictions in their general plan circulation elements. These roads include freeways, expressways, and the Regional Arterial System (RAS). The RAS consists of all conventional state highways, prime arterials, and selected major streets. In addition, some local streets are included in the networks for connectivity between zones.

The route improvements and additions in the 2050 RTP are developed to provide adequate travel service that is compatible with adopted regional policies for land use and population growth. All regionally significant projects are included in the quantitative emissions analysis. These include all state highways, all proposed national highway system routes, all regionally significant arterials, and all "other principal arterials" functionally classified by the Federal Highway Administration.

The networks also account for programs intended to improve the operation of the highway system, including High Occupancy Vehicle (HOV) lanes, Managed Lanes, and ramp metering. Existing and proposed toll facilities also are modeled to reflect time, cost, and capacity effects of these facilities. State Route 125 (SR 125) South, SR 11, SR 241, and additional lanes on Interstate 15 (I-15) north of SR 78 as well as additional lanes on I-5 north of Vandegrift Boulevard are modeled toll facilities included in the Revenue Constrained Plan for the San Diego region.

In addition, several managed/HOV lanes are included in the Revenue Constrained Plan. Facilities with proposed Managed Lanes include I-5, I-15, and I-805; and SR 52, SR 54, SR 78, SR 94, and SR 125. Managed Lanes are defined as reversible HOV routes or HOV routes with two or more lanes in the peak direction. Additionally, one-lane HOV facilities that operate as two-person carpool lanes in the earlier years of the plan transition to Managed Lanes by 2035. It is assumed that the excess capacity not used by carpools and transit on these facilities would be managed, so that single occupant vehicles could use these lanes under a pricing mechanism. Traffic flows would be managed so that the facility would operate at level of service D or better.

Based on the networks and programs described above, the transportation forecasts of the 2050 RTP differentiate among eight highway modes:

- Drive alone non-toll
- Drive alone toll
- Shared-ride non HOV/non-toll
- Shared-ride HOV/non-toll
- Shared-ride HOV/toll
- Light – heavy-duty
- Medium – heavy-duty
- Heavy – heavy-duty

SANDAG maintains a master highway network from which a specific-year network between the years 2008 (the 2050 Regional Growth Forecast base year) and 2050 can be built. Four networks were built and verified (2018, 2020, 2030, and 2040) for air quality conformity analyses of the 2050 RTP. A network also was built and verified for the year 2050 for an air quality analysis for informational purposes.

A list of the major highway and near-term regional arterial projects included in the conformity analysis, along with information on phasing for their implementation, is included in Tables A.4 and A.8, located in Appendix A. Locally funded, regionally significant projects also have been included in the air quality conformity analysis. These projects are funded with *TransNet* funds, a 20-year, half-cent local sales tax for transportation that expired in 2008; *TransNet* Extension funds, a 40-year, half-cent local sales tax extension approved by voters in 2004 that expires in 2048; and other local revenue sources.

Transit Networks

SANDAG also maintains transit network datasets for existing and proposed transit systems. Most transit routes run over the same streets, freeways, HOV lanes, and ramps used in the highway networks. As a result, the only additional facilities that are added to the transportation coverage for transit modeling purposes are:

- Trolley and commuter rail lines
- Streets used by buses that are not part of local general plan circulation elements

Seven transit modes group routes with similar operating characteristics. They are:

- Commuter Rail
- Trolley/Light Rail
- Bus Rapid Transit (BRT)
- Rapid Bus
- Limited-Express Bus
- Express Bus
- Local Bus

BRT service would have stations similar to commuter rail and light rail, and operating characteristics midway between rail and bus service. BRT service would be provided by advanced design buses operating on HOV lanes or Managed Lanes, some grade-separated transit ways, and surface streets with priority transit systems. Once TransCAD transit networks have been built, TransCAD finds minimum time paths between transit access points (TAPs). TAPs are selected transit stops that are used to represent walk and auto access to the transit system.

The following four sets of paths are created for modes:

- A.M. Peak-period local bus
- A.M. Peak-period premium service
- Midday local bus
- Midday premium service

Bus speeds assumed in the transit networks are derived from modeled highway speeds and reflect the effects of congestion. Regional and express transit routes on surface streets are assumed to operate out of congestion due to priority transit treatments. Higher bus speeds may result for transit vehicles operating on highways with HOV lanes and HOV bypass lanes at ramp meters, compared with those routes that operate on highways where these facilities do not exist.

In addition to transit travel times, transit fares are required as input to the mode choice model. TransCAD procedures replicate the San Diego region's complex fare policies which differ among:

- Buses, which collect a flat fare of between $1 and $4, depending on the type of service
- Trolleys, which charge $2.50 for all trips
- SPRINTER, which charges $2
- Commuter rail (COASTER), which has a zone-based fare of between $5 and $6.50
- Proposed regional BRT routes, which are assumed to charge $4
- Proposed Rapid Bus routes, which are assumed to charge $2.50

Fares are expressed in 1999 dollars (consistent with household incomes from the 2050 Regional Growth Forecast) and are assumed to remain constant in inflation-adjusted dollars over the forecast period.

Near-term transit route changes are drawn from the Coordinated Plan, which was produced in cooperation with the region's transit agencies. Longer-range improvements are proposed as a part of the RTP development and other transit corridor studies. In addition to federal and state funded projects, locally funded transit projects that are regionally significant have been included in the air quality conformity analysis of the 2050 RTP. These transit projects also are funded with *TransNet* funds or other local revenue sources. Once network coding is completed, the transportation models are run for the applicable scenarios (2018, 2020, 2030, 2040, and 2050 (for informational purposes)). A list of major regional transit projects included in the draft air quality conformity analysis, as well as information on phasing their implementation, is included in Table A.5, located in Appendix A.

Trip Generation

A trip generation analysis is the first step in the transportation modeling process. Average weekday trip ends, by all forms of transportation and starting and ending in each zone, are estimated for ten trip types:

- Home-to-work
- Home-to-college
- Home-to-school
- Home-to-shop
- Home-to-other

- Work-to-other
- Other-other
- Serve passenger
- Visitor
- Airport

The model computes person trips, which account for all forms of transportation – including automobiles, trucks, taxicabs, motorcycles, public transit, bicycling, and walking.

The trip-generation model works by applying trip rates to zone-level growth forecasts. The model calculates each of the trip ends separately as trip productions and attractions. Trip production rates are expressed as trips per household, while trip production rates vary by trip type and structure type. Trip attractions are expressed as trips per acre of nonresidential land use or trips per household. Trip attraction rates vary by trip type and land use category. The 2050 Regional Growth Forecast was used to produce trip-generation forecasts for the years 2018, 2020, 2030, 2040, and 2050. Trip generation rates were established by utilizing data from traffic generator studies, as well as expanding rates from the 1995 San Diego Region Travel Behavior Study, the 2006 San Diego Household Travel Study, and the 2001 Caltrans Statewide Travel Survey.

The model reduces future year person-trips by a small amount to reflect the increased use of teleworking and e-commerce. Reduction factors of 1, 3, or 5 percent were applied to selected trip purposes and land uses. Telework reduction factors depend on the likelihood that the land use type would have employee categories that could feasibly telecommute. Reduction factors start in the year 2020.

The truck model follows a process similar to the one followed by the person model. The model computes truck vehicle trips for heavy-duty trucks, including light heavy-duty, medium heavy-duty, and heavy heavy-duty trucks. The truck classifications correspond to the CARB truck classifications used in the air quality model EMFAC. Trip production and attraction rates are expressed as trips per employee, and the rates vary by employee industry category.

Trip Distribution

After the trip generation analysis is completed, trip movements between zones are determined using a form of the trip distribution model known as the doubly-constrained, gamma-function gravity model. Inputs to the trip distribution model include zone-level trip generation forecasts by trip type, zone-to-zone impedances, and gamma function parameters by trip type and 4D category. 4D index categories attempt to define locations by their density, diversity, distance, and urban design characteristics. A high 4D index value represents areas that would be considered smart growth and would result in shortened trip lengths. In this way, the model is designed to reflect changing trip patterns in response to the types of new development in land use scenarios. The model also modifies trip patterns as new roadways are added.

A truck trip distribution analysis is performed in a similar manner, but it is used to distribute vehicle trips rather than person-trips by purpose, as in the person model. The truck model also uses different distribution parameters by vehicle type, which are not segmented by 4D category.

The model is calibrated to match observed trip length frequencies from the 2006 Household Travel Study and the 2001 Caltrans Statewide Travel Survey. Zone-to-zone impedances are a composite measure of peak and off-peak travel times and costs by highway, transit, and non-motorized modes.

Mode Choice

At this point in the modeling process, total person-trip movements between zones are split into different forms of transportation by highway, transit, and non-motorized modes (bicycling and walking). Highway modes include drive-alone non-toll, drive-alone toll, shared-ride non HOV/non-toll, shared-ride HOV/non-toll, and shared-ride HOV/toll. Nine transit modes differentiate transit trips by three ride modes (rail, BRT, and bus) and three access modes (walk, drive, and drop-off). The mode choice model is designed to link mode use to demographic assumptions, highway network conditions, transit system configuration, land use alternatives, parking costs, transit fares, and auto operating costs. Trips between zone pairs are allocated to modes based on the cost and time of traveling by a particular mode, compared with the cost and time of traveling by other modes. For example, vehicle trips on a congested route would be more likely to be diverted to light rail than vehicle trips on an uncongested freeway.

Income level also is considered, because lower-income households tend to own fewer automobiles and therefore make more trips by transit and carpooling. People in higher income households tend to choose modes based on time and convenience rather than cost. The mode choice model is calibrated using the 1995 San Diego Travel Behavior Study and the 2006 Household Travel Study trip tables by mode and income, as well as 2001-2003 Regional Transit Survey transit trip characteristics. Regional-level Census 2000 work-trip mode shares also were used to fine tune mode-share estimates.

Highway and transit travel times reflect highway congestion effects from the final iteration of the feedback loop. The model produces a.m. peak, p.m. peak, and off-peak period trip tables for vehicles and transit riders. The a.m. peak period is from 6 to 9 a.m. and the p.m. peak period is from 3 to 6 p.m. The off-peak period covers the remaining 18 hours of the day.

Highway and Transit Assignment

Highway assignment produces traffic-volume estimates for all roadway segments in the system. These traffic volumes are an important input to emissions modeling. Similarly, transit trips are assigned to transit routes and segments.

Highway

SANDAG loads traffic using the TransCAD Multimodal Multiclass Assignment function. Before loading the traffic onto the network, the three truck modes are combined with the five passenger vehicle modes. Multi-class assignment allows SANDAG to assign the eight vehicle modes (as defined in the highway network section) in one combined procedure.

The highway assignment model works by finding roads that provide the shortest travel impedance between each zone pair. Trips between zone pairs are then accumulated on road segments making up minimum paths. Highway impedances consider posted speed limits, signal delays, congestion delays, and costs. The model computes congestion delays for each segment based on the ratio of the traffic volume to roadway capacity. Motorists may

choose different paths during peak hours, when congestion can be heavy and during off-peak hours, when roadways are typically free flowing. For this reason, traffic is assigned separately for a.m. peak, p.m. peak, and off-peak periods. Vehicle trip tables for each scenario reflect increased trip-making due to population growth and variations in travel patterns due to the alternative transportation facilities/ networks proposed.

Model accuracy is assessed by comparing model estimated traffic volumes with actual traffic counts obtained through the SANDAG traffic monitoring program and the Highway Performance Monitoring System estimates of Vehicle Miles of Travel (VMT).

After completing the highway assignments, additional processing is needed. Adjustments are made for calibration error volume, HOV/managed lane volume, bus volumes, hourly distribution factors, Level of Service, and travel time.

Transit

For transit assignment, TransCAD software assigns TAP-to-TAP transit trips to the network. Eight separate transit assignments are produced for peak and off-peak periods, walk and auto access, and local bus and premium service. These individual assignments are summed to obtain total transit ridership forecasts.

Before assigning transit trips, external transit trips coming into San Diego from outside the region need to be added to the internal transit trips estimated by the mode choice model. Currently, few transit trips enter from the north or east. However, more than 20,000 transit trips cross the Mexican border each day. To account for these trips, an external transit trip table for the base year is developed from on-board transit ridership surveys and factored to future years based on border crossing trends.

For accuracy, transit ridership forecasts from the transit assignment model are compared with transit counts from the SANDAG transit passenger counting program to determine whether transit modeling parameters need to be adjusted.

Some of these comparisons of model-estimated boardings with actual boardings include:

- System-level boardings, which may reveal transfer rate problems and lead to changes to the transfer wait time factor in the mode choice model
- Boardings by mode, which may reveal modal biases and lead to changes in mode choice modal constants
- Boardings by frequency of service, which may show biases that lead to changes in the first wait factor in the mode choice model
- A Centre City screenline crossing, which may lead to changes in parking costs and boardings by stop location, which may indicate problems with specific generators, such as a university

Post-TransCAD Processing

Standard TransCAD output needs to be reformatted and adjusted to be useful for emissions modeling. Several routines and computer programs have been written to accomplish the following major functions:

- Correcting link-specific traffic volume forecasts for calibration errors
- Adding in estimated travel on roads not in the transportation modeling process

- Computing link speeds based on corrected link volumes, highway capacity manual relationships between congestion and speed (or signal delay)
- Splitting link volumes into heavy-duty truck and other traffic to obtain speed distributions by vehicle class
- Preparing a data set that contains total VMT, number of trip starts, and VMT by speed category by time of day for each vehicle class

The travel demand modeling procedures used for the 2050 RTP differ from previous modeling procedures in three key ways, as described in the previous sections. To summarize, first a truck model is run parallel to the four-step model. Truck origin-destination trip tables are merged with vehicle trip tables for highway assignment and air quality procedures. Second, new inputs are used, including the recently completed 2010 Freight Gateway Study (a forecast of freight traffic in the region), 2002 Freight Analysis Framework data, and the 2050 Regional Growth Forecast projections. Third, a 4D (density, diversity, distance, and urban design characteristics) category is used as an input into the trip distribution model. These new inputs and procedures have contributed to changes in output for emissions modeling.

Motor Vehicle Emissions Modeling

Emissions Model

In November 2006, CARB released EMFAC 2007, an emissions inventory model that calculates emissions for motor vehicles operating in California. It is an integrated model that combines emission rate data with vehicle activity to calculate regional emissions. The U.S. EPA approved EMFAC 2007 for use in conformity determinations on January 18, 2008. The EMFAC 2007 model supports the calculation of emissions for the Burden mode. The Burden mode is used for calculating regional emission inventories. In this mode, the model reports total emissions as tons per day for each pollutant, by vehicle class, and the total vehicle fleet. The Burden mode uses emission factors that have been corrected for ambient conditions and speeds combined with vehicle activity to calculate emissions in tons per day. Vehicle activity includes the number of vehicles, daily VMT, and the number of daily trips.

The air quality analysis of the 2050 RTP was conducted using the EMFAC 2007 Burden mode. Projections of daily regional emissions were prepared for reactive organic gases (ROG), nitrogen oxides (NOx), and CO.

On-road motor vehicle emissions are attributed to several different processes:

- Starting exhaust
- Running exhaust
- Idle exhaust (calculated for heavy-duty trucks only)
- Resting and diurnal evaporation
- Running losses
- Hot soak evaporation

Emission factors vary by vehicle class, fuel usage, and technology. The fuels modeled are gasoline, diesel, and electricity-powered vehicles. Technology categories can be grouped into catalyst, non-catalyst, and diesel. Thirteen vehicle classes are modeled:

- Passenger car
- Two types of light-duty trucks

- Medium-duty truck
- Two types of light heavy-duty trucks
- Medium heavy-duty truck
- Heavy heavy-duty truck
- Line-haul vehicle
- Urban bus
- School bus
- Motorcycle
- Motor home

Emission factors for processes that vary by temperature (i.e., starting exhaust, hot soak, and running exhaust) are broken down further by specified temperature ranges. Exhaust emission factors also are broken down by speed range.

Regional Emissions Forecasts

Regional transportation forecasts were initiated in December 2010. Output from the TransCAD model was then reformatted and adjusted to be useful for emissions modeling.

Eight-Hour Ozone Standard

Effective June 9, 2008, the U.S. EPA found the eight-hour ozone budgets included in the Eight-Hour Ozone Attainment Plan for San Diego County adequate for transportation conformity purposes. Beginning in December 2010, SANDAG prepared countywide forecasts of average weekday ROG and NOx emissions for 2018, 2020, 2030, 2040, and 2050 (for informational purposes) using the EMFAC 2007 model. ROG and NOx emissions are based on the summer season.

The analysis years were selected to comply with 40 CFR Sections 93.106(a)(1) and 93.118(a) of the Transportation Conformity Rule and the approved methodology for conducting the 2050 RTP Air Quality Conformity Analysis, which shortened the conformity horizon to 2040 and requires an informational analysis of the plan horizon year (2050). According to these sections of the Conformity Rule, the first horizon year (2018) must be within ten years from the base year used to validate the regional transportation model (2008), the last horizon year must be the last year of the transportation plan's forecast period, or in the case of the 2050 RTP, the last year of the conformity determination (2040), and the horizon years may be no more than ten years apart (2020 and 2030).

CO Standard

CO regional emissions were projected for 2018, 2020, 2030, 2040, and 2050 (for informational purposes) for the conformity determination of the 2050 RTP. CO emissions are based on the winter season.

Emissions Modeling Results

An emissions budget is the part of the SIP that identifies emissions levels necessary for meeting emissions reduction milestones, attainment, or maintenance demonstrations.

To determine conformity of the 2050 RTP, the plan must comply with the emissions analysis described in the Regional Emissions Forecast section. Table B.2 shows that projected ROG and NOx emissions from the 2050 RTP are below the ROG and Nox budgets.

Adjustment factors for ROG and NOx were provided by CARB to account for recently-adopted emission control programs not reflected in EMFAC 2007 and other corrections. Table B.3 includes the adjustment factors by analysis year.

Table B.2 – 2050 Revenue Constrained RTP – Air Quality Conformity Analysis for Eight-Hour Ozone (EMFAC 2007)

			ROG		NOx	
Year	Average Weekday Vehicle Starts (1,000s)	Average Weekday Vehicle Miles (1,000s)	SIP Emissions Budget Tons/Day	ROG Emissions Tons/Day	SIP Emissions Budget Tons/Day	NOx Emissions Tons/Day
2018	14,760	85,073	53	26	98	42
2020	14,979	86,155	53	24	98	38
2030	16,396	98,912	53	19	98	28
2040	17,676	107,715	53	18	98	28
2050[1]	18,942	117,825	53	19	98	31

[1] The emission data for 2050 was prepared using 2040 emission factors, as emission factors for 2050 are not available. The 2050 RTP air quality conformity analysis was conducted for the years 2011 – 2040. Emissions data for 2050 is included for informational purposes only.

Note: Emissions budgets are from the Eight-Hour Ozone Attainment Plan for San Diego County, which were found adequate for transportation conformity purposes by the U.S. EPA, effective June 9, 2008.

Table B.3 – EMFAC 2007 Adjustment Factors

Year	ROG Adjustment Factor (Tons/Day)	NOx Adjustment Factor (Tons/Day)
2018	0.25	2.48
2020	0.33	2.40
2030	0.71	2.80

Note: Adjustment factors were provided by CARB. The tons listed are subtracted from the EMFAC 2007 output of tons per day for ROG and NOx.

Table B.4 shows that projected CO emissions from the 2050 RTP are below the 2003 CO budget of 730 tons per day.

Exempt Projects

Section 93.126 of the Transportation Conformity Rule exempts certain highway and transit projects from the requirement to determine conformity. The categories of exempt projects include safety, mass transit, air quality (ridesharing and bicycle and pedestrian facilities), and other (such as planning studies).

Table B.5 illustrates the exempt projects considered in the 2050 Revenue Constrained RTP. This table shows short-term exempt projects. Additional unidentified projects could be funded with revenues expected to be available from the continuation of existing state and federal programs.

Table B.4 – 2050 Revenue Constrained RTP Air Quality Conformity Analysis for Carbon Monoxide (EMFAC 2007)

			CO	
Year	Average Weekday Vehicle Starts (1,000s)	Average Weekday Vehicle Miles (1,000s)	SIP Emissions Budget Tons/Day	CO Emissions Tons/Day
2018	14,760	85,073	730	231
2020	14,979	86,115	730	207
2030	16,396	98,912	730	158
2040	17,676	107,715	730	144
2050[(2)]	18,942	117,825	730	157

[(2)] The emission data for 2050 was prepared using 2040 emission factors, as emission factors for 2050 are not available. The 2050 RTP air quality conformity analysis was conducted for the years 2011 – 2040. Emissions data for 2050 is included for informational purposes only.

Note: Emissions budgets for the San Diego region are from 2004 Revision to California State Implementation Plan for Carbon Monoxide, Updated Maintenance Plan for Ten Federal Planning Areas (Approved as a SIP revision in January 2006).

Implementation of Transportation Control Measures

There are four federally-approved Transportation Control Measures (TCMs) that must be implemented in San Diego, which the SIP refers to as transportation tactics. They include ridesharing, transit service improvements, traffic-flow improvements, and bicycle facilities and programs.

These TCMs were established in the 1982 SIP, which identified general objectives and implementing actions for each tactic. The TCMs have been fully implemented. Ridesharing, transit, bicycling, and traffic-flow improvements continue to be funded, although the level of implementation established in the SIP has been surpassed.

Table B.5 – Exempt Projects

Project/Program Description	Project/Program Description
Bikeway, Rail Trail, and Pedestrian Projects	
Bayshore Bikeway	Maple Street Pedestrian Plaza
Bay-to-Ranch Bikeway	Mid-County Bikeway
Border Access Bicycle Corridor	Mira Mesa Bicycle Corridor
Camp Pendleton Trail	Mission Valley – Chula Vista Bicycle Corridor
Carlsbad – San Marcos Bicycle Corridor	North Park – Centre City Bicycle Corridor
Central Coast Bicycle Corridor	Otay Mesa Port of Entry Pedestrian/Bicycle Facilities
Chula Vista Greenbelt	Park Boulevard Bicycle Connector
City Heights – Old Town Bicycle Corridor	Poway Bicycle Loop
Clairemont – Centre City Bicycle Corridor	San Diego Regional Bicycle Plan
Coastal Rail Trail	San Diego River Multi-Use Bicycle and Pedestrian Path
East County Northern Bicycle Loop	San Luis Rey River Trail
East County Southern Bicycle Loop	Santee – El Cajon Bicycle Corridor
El Camino Real Bicycle Corridor	SR 52 Bikeway
Encinitas – San Marcos Bicycle Corridor	SR 56 Bikeway
Escondido Creek Bike Path Bridge and Bikeway	SR 56/Black Mountain Road Bikeway Interchange
Gilman Bicycle Connector	SR 125 Bicycle Corridor
Hillcrest – El Cajon Bicycle Corridor	SR 905 Bicycle Corridor
Imperial Beach Bicycle Connector	Sweetwater River Bikeway
Inland Rail Trail	Tecate International Border Crossing Pedestrian Facilities
Interstate 8 Bicycle Corridor	Ted Williams Parkway Pedestrian Bridge at Shoal Creek
Interstate 15 Bikeway	Third Avenue Bicycle and Pedestrian Access
Interstate 805 Bicycle Corridor	Vista Way Bicycle Connector
Kearny Mesa – Beaches Bicycle Corridor	West Bernardo Bike Path
Kensington – Balboa Park Bicycle Corridor	

Table B.5 – Exempt Projects (Continued)

Project/Program Description	Project/Program Description
Safety Improvement Program	**Transportation Systems Management**
Bridge Rehabilitation/Preservation/Retrofit	Automated Traveler Information System (ATIS)
Collision Reduction	Bus on Shoulder Service
Emergency Response	Compass Card
Hazard Elimination/Safe Routes to School	FasTrak®
Highway Maintenance	Freeway Service Patrol
Safety Improvement Program	Connected Vehicle Roadside Devices
Roadway/Roadside Preservation	Intermodal Transportation Management System (IMTMS)
Smart Growth Incentive Program	ITS Operations
Transit Terminals	Joint Transportation Operations Center (JTOC)
Airport Intermodal Transit Center/Terminal	Trolley Fiber Communication Network
San Ysidro Intermodal Transit Center/Terminal	Universal Transportation Account
	Various Traffic Signal/Prioritization

Interagency Consultation Process and Public Input

The consultation process followed to prepare the Air Quality Conformity Analysis for the 2050 RTP complies with the San Diego Transportation Conformity Procedures adopted in July 1998. In turn, these procedures comply with federal requirements under 40 CFR 93. Interagency consultation involves SANDAG (as the MPO for San Diego County), APCD, Caltrans, CARB, U.S. DOT, and U.S. EPA. In addition, pursuant to Government Code Section 14522.2, the methodology and key assumptions of travel demand models are provided in Technical Appendix 15.

Consultation is a three-tier process that:

- Formulates and review drafts through a conformity working group
- Provides local agencies and the public with opportunities for input through existing regional advisory committees and workshops
- Seeks comments from affected federal and state agencies through participation in the development of draft documents and the circulation of supporting materials prior to formal adoption

SANDAG consulted on the development of the Air Quality Conformity Analysis of the 2050 RTP at meetings of the San Diego Region CWG, as follows:

- On August 4, 2010, SANDAG staff presented the RTP process and timeline, schedule for the 2050 RTP development, and information on some of the RTP conformity procedures, including the Public Involvement Plan, pollutant budgets and Transportation Control Measures. Additionally, staff presented the 2050 RTP Draft Proposed Conformity Analysis Methodology for review and comment by the CWG and requested any comments in writing by August 20, 2010.

- On September 1, 2010, SANDAG presented information on the 2050 Growth Forecast and the 2050 RTP Travel Demand Model. Staff also presented once more the 2050 RTP Draft Proposed Conformity Analysis Methodology, to provide the group with another opportunity to review the information and provide any comments. No comments were received.
- On September 17, 2010, the SANDAG Transportation Committee accepted for review and distribution the draft proposed methodology for conducting the air quality conformity determination for the 2050 RTP for a 30-day comment period.
- On October 6, 2010, SANDAG staff presented information on several conformity criteria and procedures for the development of the 2050 RTP, including 2050 RTP public outreach, latest emissions model, and draft revenue constrained financial assumptions.
- On October 15, 2010, the SANDAG Transportation Committee held a public hearing to solicit public comments on shortening the conformity timeline and on the proposed methodology for the regional emissions analysis. No comments were received at the hearing or in writing.
- On November 19, 2010, the SANDAG Board of Directors approved the 2050 RTP Conformity Analysis Methodology for use in the Draft 2050 RTP and its air quality conformity determination.
- On December 17, 2010, the SANDAG Board of Directors selected the Revenue Constrained Transportation Network to be included in the Draft 2050 RTP and its Air Quality Conformity Analysis.
- SANDAG staff initiated the air quality conformity modeling for the Draft 2050 RTP on December 17, 2010.
- At the January 5, 2011, CWG meeting, SANDAG staff presented the 2050 RTP revenue constrained and exempt project lists.
- On February 25, 2011, the Draft 2050 RTP Air Quality Conformity Analysis was released to the CWG for a 30-day review period.
- At the March 2, 2011, CWG meeting, the Draft 2050 RTP Air Quality Conformity Analysis was discussed.
- On April 22, 2011, the SANDAG Board of Directors released the Draft 2050 RTP, including its air quality conformity analysis, for a public review period that closed on July 8, 2011.
- On July 26, 2011, the revised air quality conformity analysis document was released to the CWG for a 30-day review period that closed on August 26, 2011.
- On August 1, 2011, the revised air quality conformity analysis document was released to the public for a 30-day review period that ended on August 31, 2011. No comments were received.

Members of the public have been welcomed to provide comments at meetings of the San Diego Region CWG, the Transportation Committee, and the SANDAG Board of Directors.