Appendix U17

Urban Area Transit Strategy

Appendix U17 Contents

Urban Area Transit Strategy

The attached Urban Area Transit Strategy report, prepared in October 2011, serves as the basis for the transit strategy contained in San Diego Forward: The Regional Plan.

Technical Documentation Report

Urban Area Transit Strategy: A Component of the 2050 Regional Transportation Plan

October 2011

Prepared by:

PARSONS BRINCKERHOFF and SANDAG

1. Introduction and Executive Summary

Over the past several decades, the San Diego region has made considerable investments in its transit system, including the development of its Trolley, COASTER, and SPRINTER rail lines, and the operation of an extensive local bus network. However, given a number of increasingly-important factors, the need to focus additional attention on the region's transit system has increased. These factors include new statewide legislative requirements to reduce greenhouse gas (GHG) emissions contained in Senate Bill (SB) 375, the projected aging of our population, an increasing pattern of infill and redevelopment in the western third of the region, and the growing emphasis on active transportation and public health.

To initiate the transit planning effort for the 2050 Regional Transportation Plan (RTP), SANDAG developed an "Urban Area Transit Strategy" (UATS) focused on the most urbanized areas of the region where investments in transit are generally most efficient and effective. The UATS study boundary is illustrated in Figure TA 7.1. SANDAG and the project team undertook an extensive planning process that involved developing a range of differing transit strategies and approaches to determine the kind of transit future that is desirable for the San Diego region. The project included strategic brainstorming sessions, as well as public workshops, opinion surveys, and input questionnaires. The team reviewed previous market studies and conducted research on transit success stories from other cities to analyze applicability to the San Diego region. The project also included developing performance measures and mode share goals by which to test the strategies.

More specifically, three initial transit strategies for the most urbanized areas of the San Diego region were crafted. The three transit strategies were intentionally designed to vary significantly from one another in order to test how different approaches might function in the long term when compared across the performance measures. For analytical purposes, the highway network and the land use assumptions of each strategy were held constant. The strategies were developed with input from transportation and land use professionals from our own region, from various places across the United States, and from other countries. The public provided input on the strategies; industry experts conducted critical reviews; the projected performance was evaluated against the measures; and many rounds of modifications and refinements occurred, leading to the development of an "unconstrained transit network" for the urban area and the region.

The unconstrained transit network served as the region's wish list for transit investments and pulled in the best elements of the three initial transit strategies. Parallel to the unconstrained transit network was the development of an unconstrained highway network, serving as the region's wish list for highway investments. The unconstrained transit and highway networks were followed by the development of four initial "revenue constrained" transit and highway networks that matched up complimentary combinations of transit and highway investments, with varying levels of emphasis on investment options. The revenue constrained scenarios were developed recognizing the reality that revenues are limited, and that the region cannot afford all of the projects proposed in the unconstrained networks.

After significant discussion and dialogue on the four initial revenue constrained networks, a "preferred revenue constrained" transit network that significantly increases transit service miles and transit mode share in the most urbanized areas of the region was included in the Draft 2050 RTP, along with a preferred revenue constrained highway network. The Draft 2050 RTP was released for public review and comment in April 2011. As a result of public input and SANDAG Board actions on the Draft 2050 RTP, the transit and highway networks were further refined, and ultimately culminated in the "Final 2050 Revenue Constrained Transit Network" and "Final 2050 Revenue Constrained Highway Network" that were included in the Final 2050 RTP, along with the regional bike network, transportation demand management programs, transportation system management programs, incentive programs, a safe routes to transit program, and other complimentary programs.

The Urban Area Transit Strategy served as the foundation for the transit planning process in the 2050 RTP. The transit network development process is illustrated graphically in Figure TA 7.2 within the context of the broader 2050 RTP development process. To assist with this work, SANDAG contracted with the consultant team of Parsons Brinckerhoff (PB). This report documents the Urban Area Transit Strategy planning process, which took place from 2009 to 2011, and provides supporting technical analysis and documentation associated with the process.

2. Transit Vision and Goals for the Urban Area Transit Strategy

The overarching goal of the UATS was to create a world-class transit system for the San Diego region in 2050, with the aim of significantly increasing the attractiveness of transit, walking, and biking in the most urbanized areas of the region.

The vision called for a network of fast, flexible, reliable, safe, and convenient transit services that connect our homes to the region's major employment centers and destinations. Achievement of this vision would make transit a more appealing option for many trips, reducing the impact of vehicular travel on the environment and on public health. Other key goals included:

- Making transit more time-competitive with automobile travel;
- Maximizing the role of transit within the broader transportation system; and
- Reducing vehicle miles traveled and greenhouse gas emissions in the region.

3. Existing Regional Transit Network

SANDAG serves as the regional transportation planning agency and is responsible for long-term transit planning for the San Diego region. This planning function is performed in partnership with the region's two transit operators, the Metropolitan Transit System (MTS) and the North County Transit District (NCTD).

Policies related to service planning and implementation, fare structure and setting, and public involvement have been adopted by SANDAG since consolidation of some transit agency functions in July 2003. These policies promote an integrated regional transit system, including coordinated services and schedules between transit agencies, a system-wide cash and prepaid fare structure, and regional traveler information.

Existing Transit System

The current regional transit system in San Diego County has five primary modes of transit: commuter rail, light rail transit (LRT), Bus Rapid Transit (BRT), Rapid Bus, and local bus services, each with varying geographic service areas, timetables, and frequencies. (Definitions and examples of these and other transit services and facilities used in the UATS planning process are provided in Technical Appendix A.) These transit modes are supported by publicly and privately operated shuttles, buses, and jitneys in communities around the region. San Diego's existing regional transit network is illustrated in Figure TA 7.3.

Transit service in the region is provided by the two transit agencies: MTS and NCTD. These two transit agencies operate the region's fixed-route bus services, COASTER commuter rail, San Diego Trolley light rail, SPRINTER light rail, Sorrento Valley COASTER Connection, and Americans with Disabilities Act (ADA) paratransit services. Connections to adjacent regions further north are provided by Amtrak's "Pacific Surfliner" route, which runs from San Diego to San Luis Obispo through six counties, and the MetroLink commuter rail service from Oceanside to Orange and Los Angeles Counties.

The San Diego Trolley has 51 miles of track over three service lines: the Blue Line, the Orange Line and the Green Line. These three lines serve 53 stations with a fleet of 134 rail cars and an average weekday daily ridership of approximately 99,000. The Blue Line is currently undergoing track and system upgrades, as well as station upgrades to accept new low-floor vehicles. The SPRINTER, in North County, is comprised of 22 miles of track, serving 15 stations with up to 12 vehicles, between Oceanside and Escondido. Weekday ridership on the SPRINTER is approximately 7,800 daily passengers.

Commuter rail service is provided on the COASTER, which travels 41 miles between Oceanside and downtown San Diego on track shared with AMTRAK and freight services. COASTER service is provided by 35 vehicles to eight stations along the route. Ridership on the COASTER averages approximately 5,000 daily passengers.

In addition to the Trolley, SPRINTER, and COASTER, both MTS and NCTD provide bus service in the region. MTS operates approximately 100 bus routes and NCTD operates approximately 35 bus routes in the region. There are currently more than 7,600 bus stops in San Diego County — 5,500 of which are in the MTS service area and over 2,100 in the NCTD service area. The fleet of bus transit vehicles in the San Diego region includes more than 800 buses and approximately 200 minibuses and vans. In addition to the transit agency bus service, a number of publicly- and privately-operated shuttles, buses, and jitneys provide service throughout the region.

The existing transportation system also includes a variety of facilities that support and enhance the operation of transit service within the region. These facilities include exclusive bus lanes, signal prioritization, queue jumpers, freeway Managed Lanes (ML) with direct access ramps/Bus Rapid Transit stations, High Occupancy Vehicle (HOV) lanes, and park-and-ride lots.

4. Regional Growth Projections

Most of the homes and jobs in the San Diego region are located within the western third of the region and this trend is expected to continue into the future. Currently, 3.1 million people live in the San Diego region. The 2050 Regional Growth Forecast projects that another 1.3 million people will live in the region by 2050, for a total of approximately 4.4 million people by 2050. Similar to the rest of the country, San Diego is also projected to experience an aging of the population base in the coming years.

The forecasted growth in housing is projected to increase by approximately 33 percent, or about 388,000 additional units, totaling 1.53 million homes in 2050. Of the 388,000 units, nearly 85 percent are expected to be multi-family homes. Nearly 80 percent of all homes in 2050 are projected to be located within the UATS study boundary (Figure TA 7.4).

The region is also projected to experience an increase of approximately 500,000 jobs over the next 40 years, resulting in a total of nearly two million jobs in 2050. Of the two million total jobs, over 85 percent are projected to be located in the UATS study boundary in 2050 (Figure TA 7.5).

Figure TA 7.1

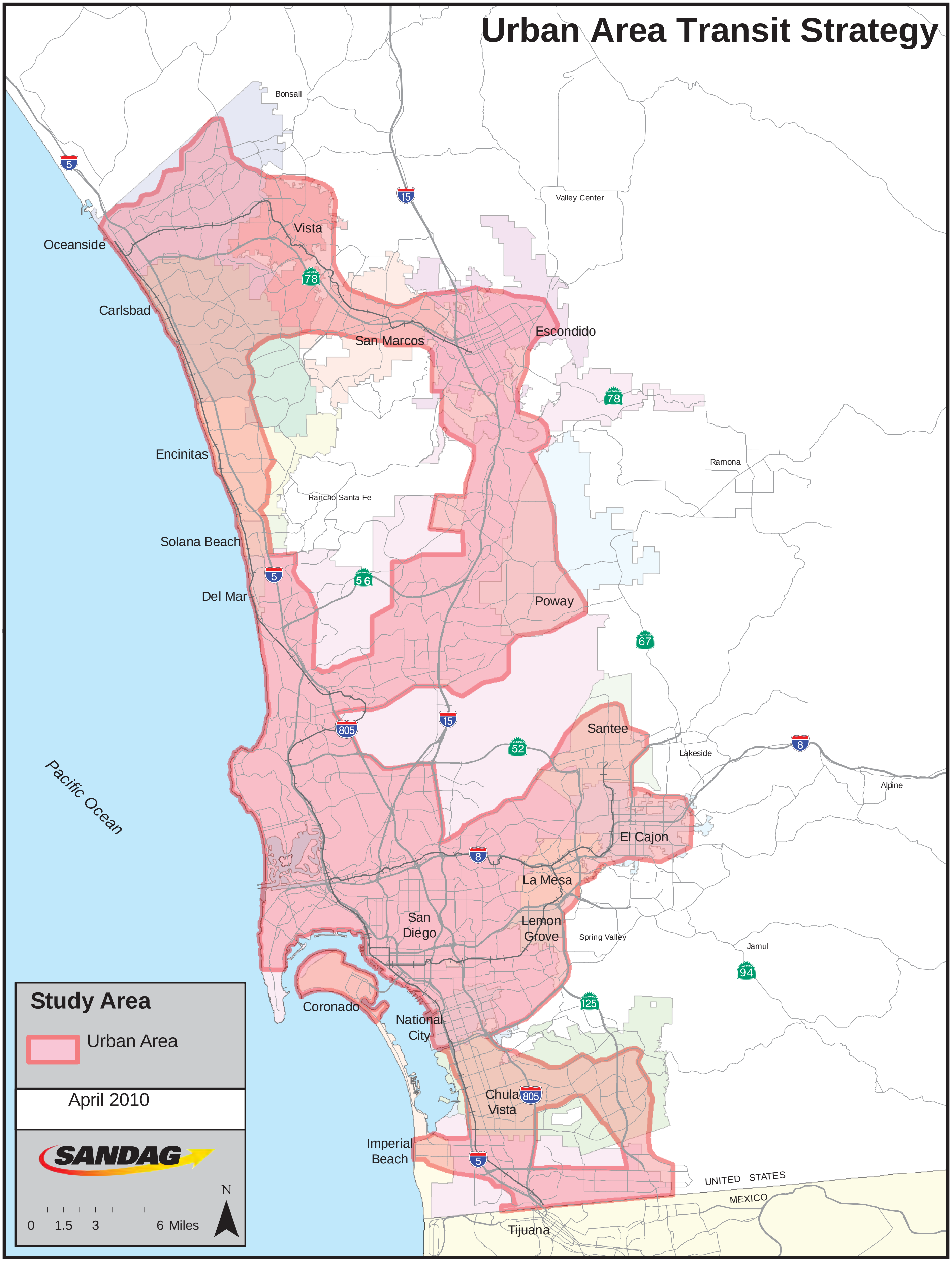

Urban Area Transit Strategy
Bonsall
Valley Center
Oceanside
Vista
Carlsbad
San Marcos
Escondido
Encinitas
Ramona
Rancho Santa Fe
Solana Beach
Del Mar
Poway
Pacific Ocean
Santee
Lakeside
Alpine
El Cajon
La Mesa
San Diego
Lemon Grove
Spring Valley
Jamul
Coronado
National City
Chula Vista
Imperial Beach
UNITED STATES
MEXICO
Tijuana
Study Area
Urban Area
April 2010
SANDAG
N
0 1.5 3 6 Miles

Figure TA 7.2 – Transit Network Development Process in the 2050 Regional Transportation Plan

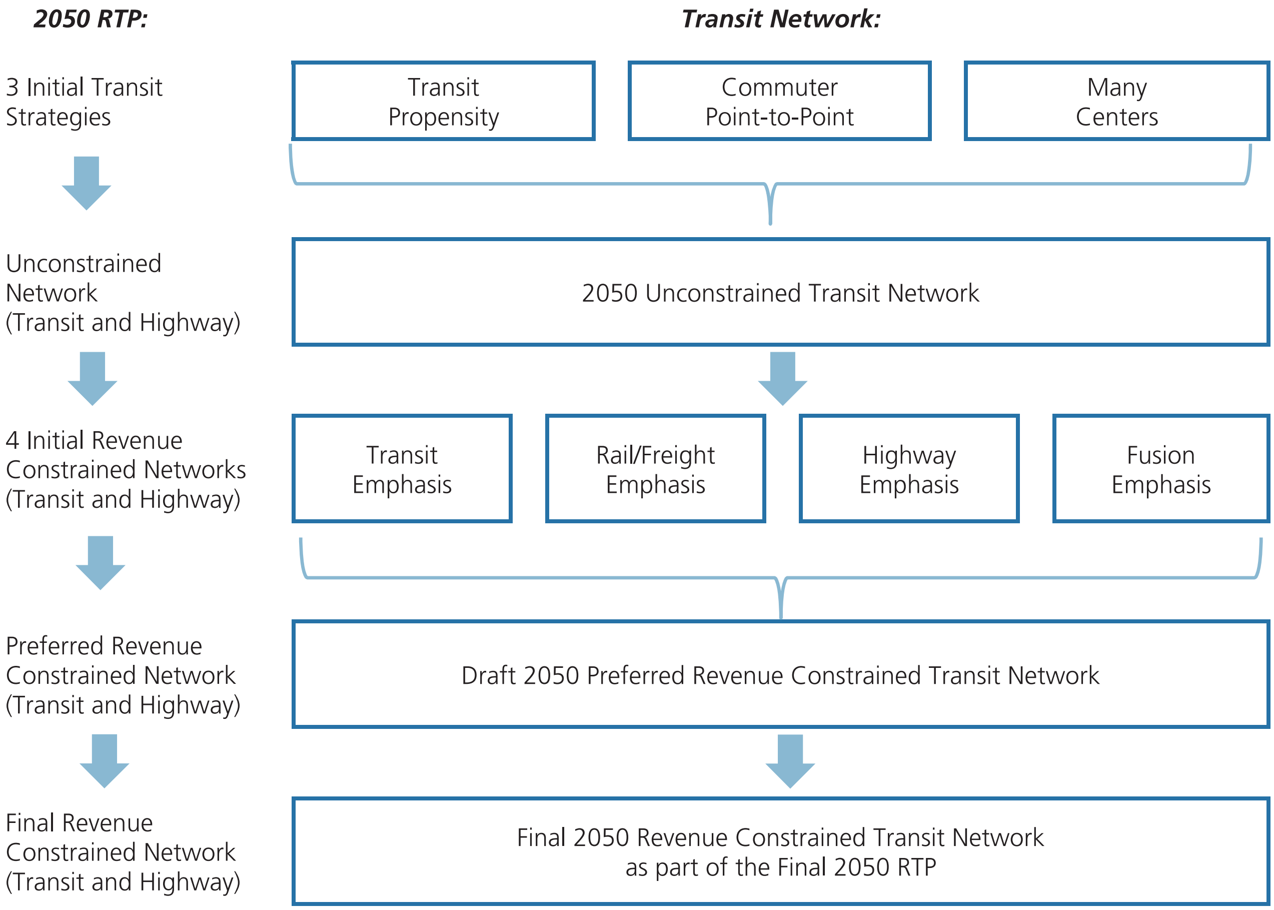


Figure TA 7.3

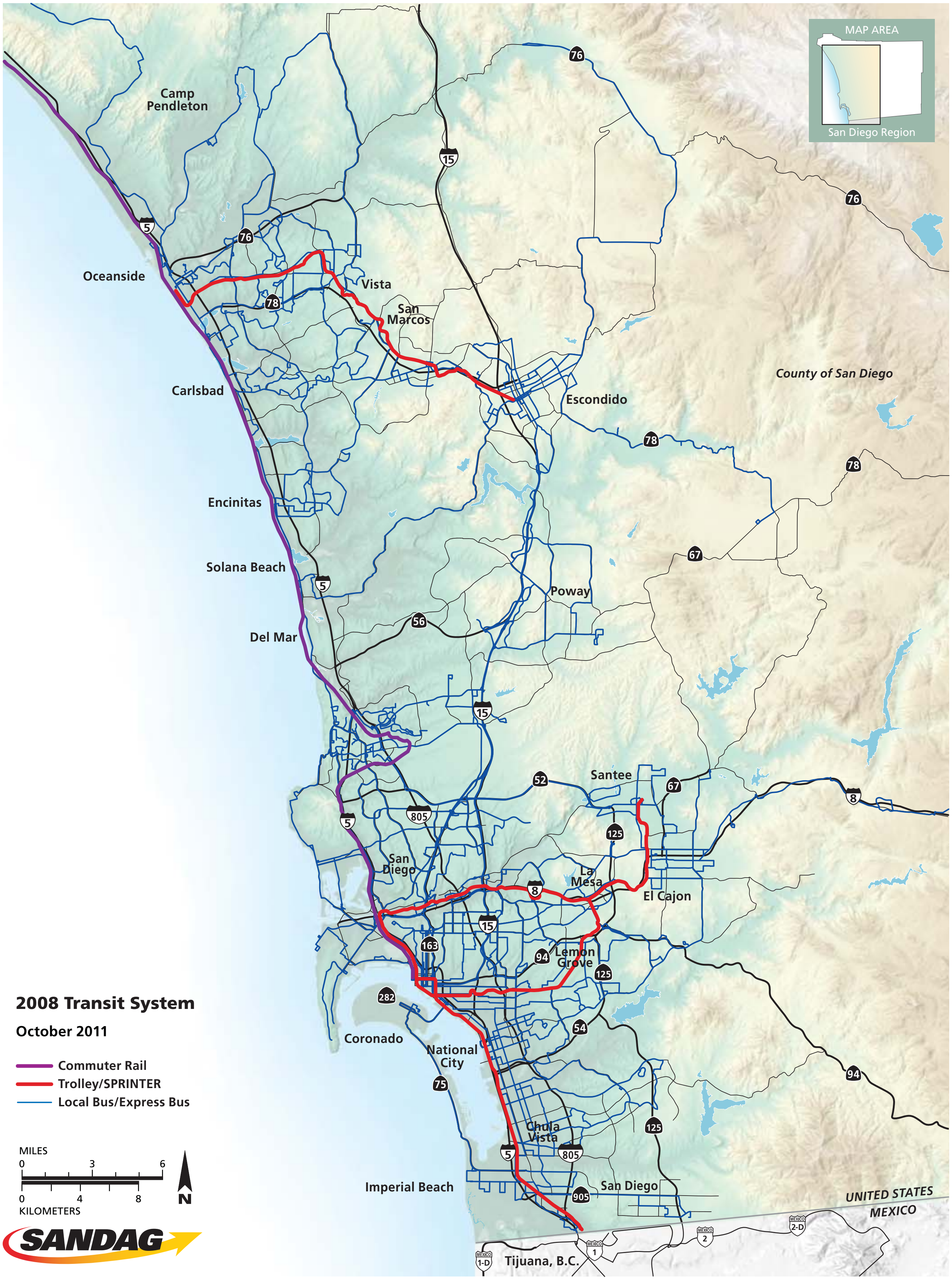

MAP AREA
San Diego Region
Camp Pendleton
Oceanside
Vista
San Marcos
Carlsbad
Escondido
County of San Diego
Encinitas
Solana Beach
Poway
Del Mar
Santee
San Diego
La Mesa
El Cajon
Lemon Grove
Coronado
National City
Chula Vista
Imperial Beach
San Diego
UNITED STATES
MEXICO
Tijuana, B.C.
2008 Transit System
October 2011
Commuter Rail
Trolley/SPRINTER
Local Bus/Express Bus
MILES
0
3
6
0
4
8
KILOMETERS
N
SANDAG

Figure TA 7.4

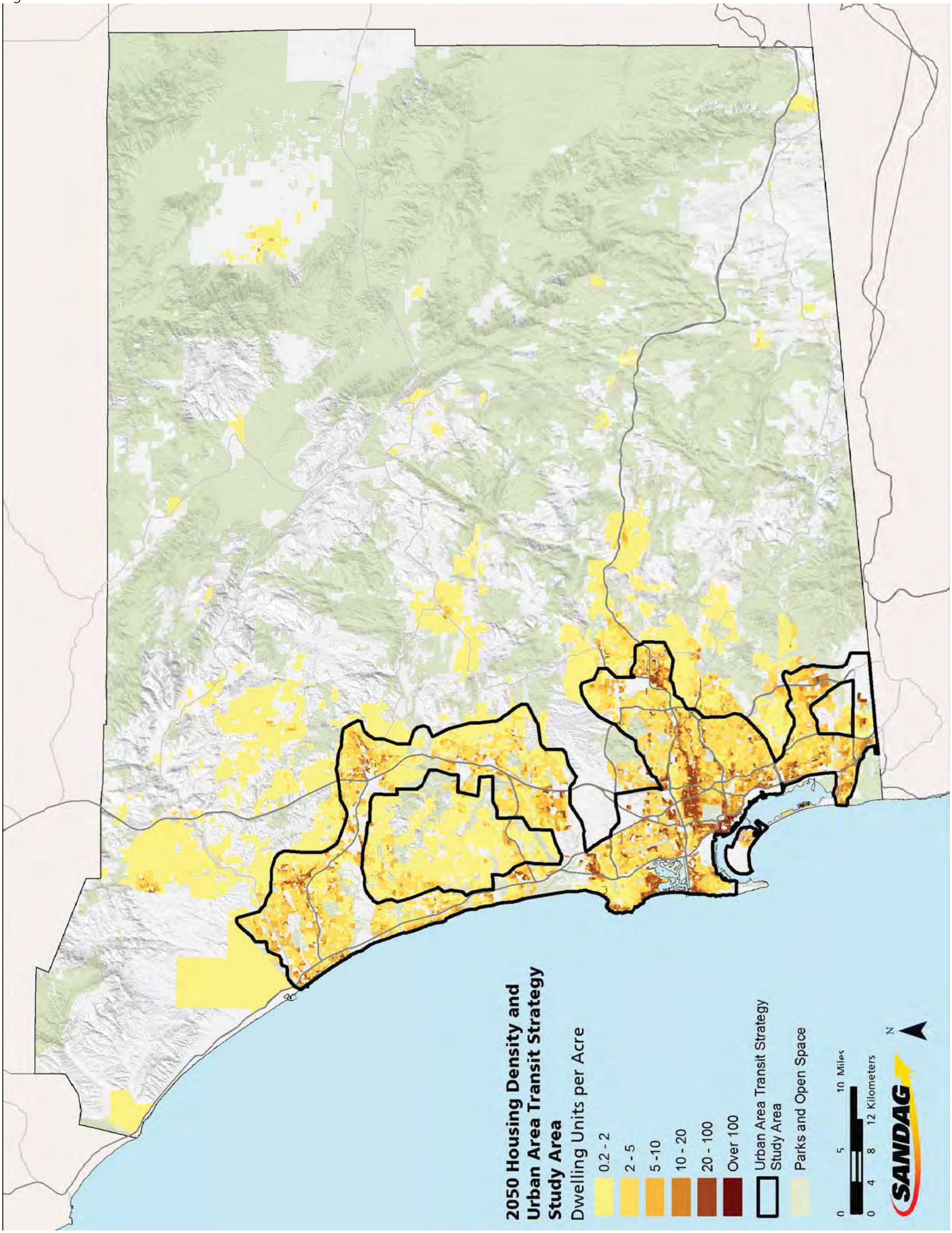
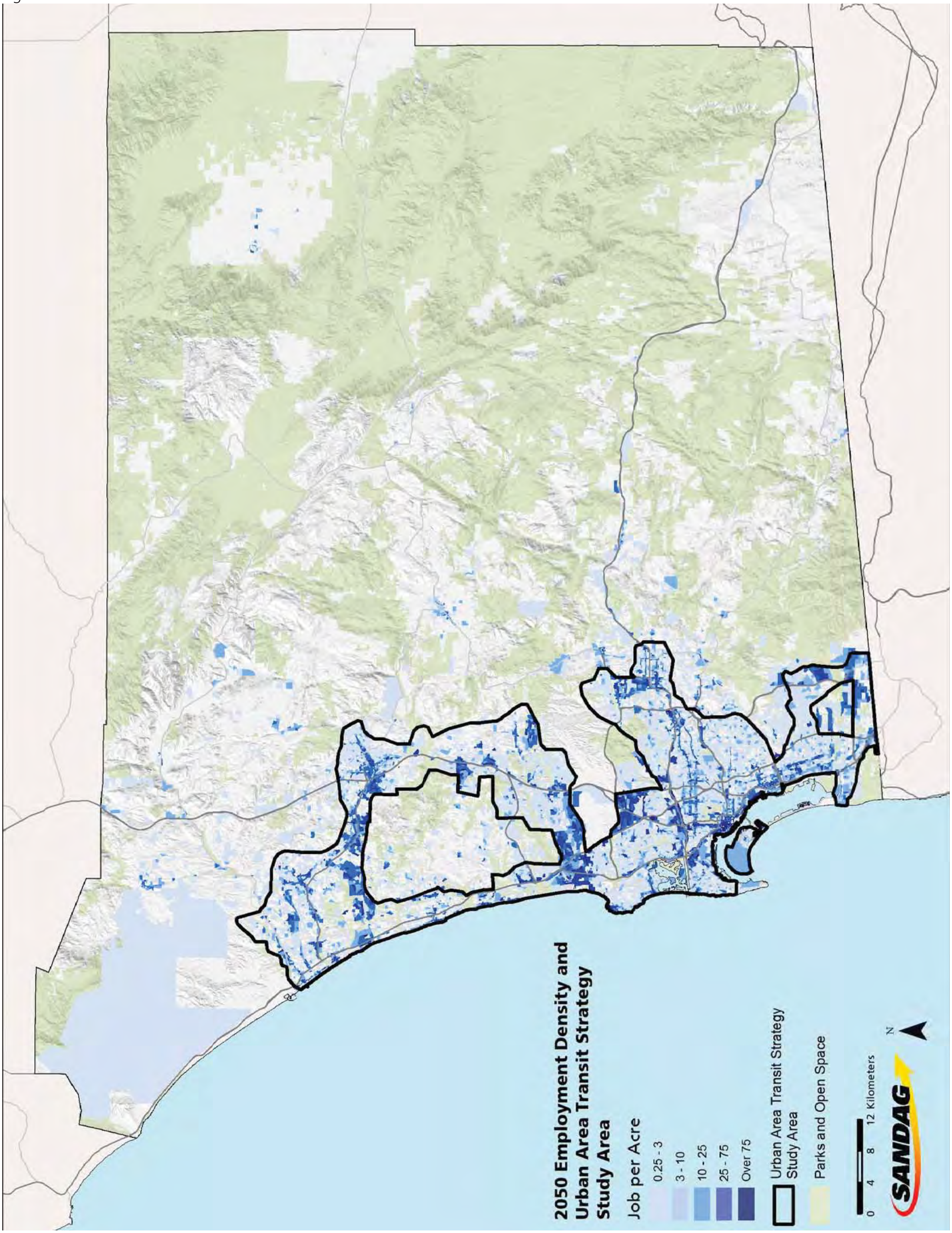

2050 Housing Density and
Urban Area Transit Strategy
Study Area
Dwelling Units per Acre
0.2 - 2
2 - 5
5 - 10
10 - 20
20 - 100
Over 100
Urban Area Transit Strategy
Study Area
Parks and Open Space
0 5 10 Miles
0 4 8 12 Kilometers
N
SANDAG

Figure TA 7.5


2050 Employment Density and Urban Area Transit Strategy Study Area
Job per Acre
0.25 - 3
3 - 10
10 - 25
25 - 75
Over 75
Urban Area Transit Strategy Study Area
Parks and Open Space
0 4 8 12 Kilometers
N

5. Setting the Stage

Brainstorming

To kick off the transit planning process for the Urban Area Transit Strategy and the 2050 RTP, SANDAG conducted brainstorming sessions with local elected officials, stakeholders, member agency staffs, and MTS and NCTD on potential transit concepts that could be considered in the development of the 2050 transit network. Input collected was reported to the SANDAG Transportation and Regional Planning Committees, and the Parsons Brinckerhoff Professional Consulting Team (further discussed in Section 8) in the development of the initial transit strategies. Key points from the brainstorming sessions are summarized in Technical Appendix B. Highlights include:

- Desire for a world-class transit system.
- Focus on maintaining and upgrading the region's existing transit infrastructure and focusing future transit network improvements in urban areas.
- Implement "express" transit services to targeted areas to minimize travel times in key corridors, especially during peak commute times.
- Include shuttles or jitneys to serve as feeder services that improve access to regional transit in residential neighborhood areas.
- Develop long-term, sustainable funding sources for transit.

Lessons Learned

In addition, a review of other regions that have successful transit systems was conducted to help guide the planning process. This review included assessing each area's existing and planned mass transit system, planning process, and any associated policies that support transit use and implementation. These areas offer examples of how transit has been applied successfully, and provide a point of reference or a starting point from which comparisons can be made. The resulting "Lessons Learned from Peer Regions" report (included in Technical Appendix C) offers lessons that can be considered in San Diego.

Three regions that were considered "benchmark" cities for San Diego were researched in some detail. These cities are:

- Portland, Oregon
- Sydney, Australia
- Vancouver BC, Canada

Seven additional "comparison cities" were also studied because they have characteristics similar to San Diego or provide examples of unique transit applications that have helped raise the profile of transit in their regions. These cities are:

- Brisbane, Australia
- Bordeaux, France
- Denver, Colorado
- Los Angeles, California
- Melbourne, Australia

- Minneapolis, Minnesota
- Seattle, Washington

Several overarching themes emerged from the evaluation of the benchmark and comparison cities. Table TA 7.1 summarizes the major themes of the case study and their potential applicability to San Diego.

Table TA 7.1 – Overarching Themes and Considerations for San Diego from Lessons Learned

Overarching Theme	Considerations for San Diego
The success of transit did not happen overnight. Successful transit has been an evolutionary process in case study regions during which certain strategies were used until their usefulness was outlived, and then the strategies were modified or new strategies were implemented.	San Diego embarked on an innovative new transit strategy in the early 1980s with the opening of the region's (and nation's) first urban rail transit line since WWII from downtown San Diego to the International Border. Over the next 25 years, the region expanded the rail network to provide a backbone transit infrastructure and service network, to one that now includes 75 miles of light rail (San Diego Trolley and SPRINTER) and 40 miles of commuter rail (COASTER). Between 1975 and 2005, transit ridership increased 150 percent while regional population increased approximately 75 percent. As the original regional rail program nears completion (the 11-mile Mid-Coast corridor between Old Town and University City is the only remaining rail extension in the 2030 Regional Transportation Plan), the regional transit strategy has shifted to a multimodal, shared right of way approach (transit on managed lanes and arterial streets). Looking to the experiences of the case study regions, San Diego may need to develop a new dramatic strategy for transit for the next 30-40 years, one that combines past, present, and future strategies to recapture the transit momentum experienced in the 1980s. The new strategy will need to include a stronger connection between transit investment and land use policies to achieve SANDAG's vision for a larger transit mode share. in the urban core, and key corridors and communities.
Transit success depends on regional plans and visions that guide the integration of land use and transportation. Many regional plans create a hierarchy of centers focused around transit that provide good design, sufficient density, and a land use mix that supports non-auto access. Success is also dependent on a number of agencies working collaboratively to achieve the regional plans and visions.	SANDAG's Regional Comprehensive Plan and Smart Growth strategy establish a hierarchy of centers designed to be supported by transit, and policies for integrating land use with transportation. Development of a new regional transit strategy should draw heavily on the policies and goals in the Regional Comprehensive Plan for both the region and specific corridors/communities. To achieve success, agencies, transit providers, and stakeholders must work together towards agreed-upon transit and land-use goals.

Table TA 7.1 – Overarching Themes and Considerations for San Diego from Lessons Learned (continued)

Overarching Theme	Considerations for San Diego
Regions use a variety of tools to achieve transit success. Regions use a variety of policy, regulatory, and financial tools that contributed to the success of transit. Tools were modified or new tools added when they were no longer effective for encouraging ridership or investment along transit corridors.	SANDAG and the region already have a variety of policy tools to support transit as defined in the Regional Comprehensive Plan and Smart Growth strategy. Additional policies and tools found in the peer regions/cities that promote and support existing and future transit services for consideration by SANDAG include: improvements to the pedestrian environment, urban growth boundaries, cooperative agreements between public agencies and private developers, tax incentives to foster transit oriented development, parking maximums or limitations, and legislation requiring commute trip reductions by major employers.
Regions experienced a shift in policy and investment toward transit over the past few decades. Regions moved toward transit as a tool to improve mobility and sustainability in response to public pressures related to sprawl, the environment, livable communities, and quality of life issues. These regions also made significant investments in permanent transit infrastructure, which improved transit and also helped generate awareness of the transit system and spur transit-oriented development.	The San Diego region is experiencing similar pressures to contain sprawl, protect the environment, promote livable communities, and maintain and improve the quality of life. Through the Regional Comprehensive Plan, the San Diego region has made the policy connection between investments in transit and achieving these goals. Looking toward the future, new transit policies and strategies designed to increase transit mode share will need to understand the effects of regional highway investments and policies on the potential success of the transit investments and system.
Local bus networks are essential for successful transit systems to provide efficient connections and access to the backbone system. To efficiently support higher frequency transit stations, feeder services are essential and, depending on the local geography, are often structured along grids or hub-and-spoke networks.	San Diego's existing transit network leans toward hub-and-spoke structure with feeder buses connecting to rail based transit centers. However, many trips rely solely on bus transit. A new transit strategy will need to build off the existing rail transit investment, while also considering how best to serve key travel markets (origins/destinations, work trips, etc.) that may not be well served by existing bus/rail connections. The strategy will also need to define the role of local and feeder bus service in relation to the major transit infrastructure investments.
Parking requirements in transit-supportive communities are reduced. Most transit successful regions have coordinated parking policy with land use and transit policy. Parking strategies often differ between central and outlying areas.	Abundant and inexpensive parking have proven to be key deterrents to transit use. A new transit strategy for the San Diego region should evaluate how parking policies (location, availability, and cost), particularly in the city center and urban core, impact transit use.

Table TA 7.1 – Overarching Themes and Considerations for San Diego from Lessons Learned (continued)

Overarching Theme	Considerations for San Diego
Successful transit systems include a variety of transit modes. Cities and regions with successful transit have systems that include combinations of transit modes applied for the particular conditions, objectives and circumstances (i.e., heavy rail, commuter rail, light rail, bus rapid transit, rapid bus, local bus, streetcar, shuttles, and electric bus).	All regions include a combination of transit facility and service applications to create their transit networks and systems.
Unique applications of transit have occurred in the downtowns. While all of the studied regions have a wide range of transit modes that provide area- and location-appropriate transit, these cities have also incorporated special applications of transit infrastructure, services, and policies in their downtowns in ways that raise the profile of transit, promote transit use, and support higher density environments.	Cities with similar transit histories and land use characteristics as San Diego have invested heavily in innovative transit facilities and services in their central cities (transit malls, streetcars, underground bus terminals, fare free zones). These investments have proven highly successful in generating transit ridership, supporting the regional transit network, achieving land use objectives, increasing transit mode share, and contributing to the vitality of their downtown core. Many of these strategies may have applicability to downtown San Diego and other key activity centers.

Public Opinion Survey

To obtain input on priorities from the general public, SANDAG also developed a public opinion telephone survey and a public input questionnaire. Overall, results of the public opinion telephone survey and the public input sample revealed that residents of the San Diego region support significant investments in the future of the region's transit network. Detailed results from the survey and questionnaire, and more information from the broader Public Participation Program, are included in Chapter 9 of the 2050 RTP.

Workshops

SANDAG also held five 2050 RTP public workshops (from April 26 to May 6, 2010) to solicit input on preliminary ideas for the transit planning process. The following is a sampling of the comments received at the workshops. More information on the workshop results is included in Technical Appendix 6 of the 2050 RTP.

- Strong support for more bike projects, more bike racks on buses and trolleys, and related connections to transit stations
- Suggestions on transit line extensions in particular areas (e.g., streetcar from Park Blvd. to I-805 along University Avenue; light rail to North County; streetcar along Monroe Avenue)
- Observation that places with great transit systems (e.g., London, Paris, Sydney, Moscow, San Francisco) have underground stations and lines
- Support for extension of the planned high speed rail system to the international U.S./Mexico border
- Support for building an extensive transit system

- Concern over the lack of funding for transit services and the related suggestion to be less ambitious in the transit planning process
- Need for more real-time information at transit stations
- Encouragement for the use of smaller buses to increase efficiency
- Support for priority measures to bypass areas with traffic congestion and improve travel times
- Concern about future mobility for seniors and the need to plan ahead to meet their needs for "aging in place"
- Encouragement for expanding sidewalks and planting street trees to make walking and biking more pleasant, particularly at transit stations
- Appreciation for the Spanish translation at the workshops

Market Research

In addition, the region's transit planning efforts also build upon private-sector market research[1] conducted in 2000 by the former Metropolitan Transit Development Board (MTDB) and NCTD. This research identified the critical attitudes and preferences that influence San Diegans' daily travel choices. The research identified a number of travel market groups based on a unique set of attributes that they consider when choosing whether to drive or take transit for a given trip. These markets and attributes help identify the kind of customer experience transit will need to offer in order to potentially attract people belonging to a given market segment to transit. The speed of transit and the frequency of service were two of the more obvious attributes identified. But other attributes, embodied in what was termed the "transit customer experience," proved to be equally important in a person's decision on whether to use transit. Paying attention to such things as the design and comfort of vehicles, the design of station shelters and amenities, traveler information, and the ease of paying fares all need to be considered to create a high quality regional transit system that will play an increased role in meeting regional mobility needs.

6. Transit Mode Share Goals

A unique component of the UATS was the development of "transit mode share goals" for the study area. Very few regions have established transit-related goals for areas beyond their downtown centers. However, because of SANDAG's desire to significantly expand transit use in the Urban Area (depicted in Figure TA 7.1), SANDAG set transit mode share goals for 14 major activity and employment areas within the Urban Area, as well as for the Urban Area itself.

Definition of Mode Share

Mode share refers to the proportion of people using a particular form of transportation to get from one place to another. The most common transportation modes include: driving alone, using transit, carpooling, bicycling, and walking. For example, if there is a five percent transit mode share in a particular area, that means that five percent of the trips in that area were made on transit. As a point of reference, in 2008, downtown San Diego's transit mode share was just over 20 percent during peak period commute times, while Sorrento Mesa had a transit mode share of slightly over two percent during that same time period.

The idea behind setting transit mode share goals for specific subareas of the region was to recognize that transit service levels can and should be higher where greater land use concentrations already exist or are anticipated in the

[1] "Market Research Approach for TransitWorks Long Range Strategy," prepared by Cambridge Systematics, Inc. for MTDB, August 15, 2002; and "TransitWorks Strategic Plan Report," MTDB, January 2001.

future, especially during peak period commute times when congestion levels tend to be the highest. The first step to creating mode share goals was to understand current mode shares. This initial understanding established the baseline from which to evaluate planned transit investments and other policies that affect transit ridership relative to future population and employment growth and travel demand. Therefore, setting mode share goals helped guide and define future transit investments by understanding where transit is currently successful and where future investments can be most effective.

Development of Transit Mode Share Goals

To account for the varying ability of transit to efficiently and effectively serve the Urban Area, a number of geographic areas and corridors needed to be defined for use in the development of mode share goals. It was decided that the goals should be based on quantifiable trends and patterns, have the ability to be measured over time, and be ambitious yet achievable.

Two general issues needed to be addressed in identifying the mode share goals: (1) how to determine the most suitable corridors/communities for which to establish goals, and (2) how to set an appropriate mode share goal for the selected areas. As a starting point for identifying where transit mode share goals would be most appropriate, geographic areas and travel corridors were identified based on:

- High volume travel corridors (all motorized trips), both current and future, that factor in trip purpose, trip origins and destinations, and time of day (such as peak period vs. off-peak);
- Major job centers that attract large volumes of peak period trips;
- Locations and communities with transit-supportive land uses, such as mixed-use development;
- Infrastructure that supports access to transit, such as grid street-patterns, sidewalks, bicycle facilities and park-and-ride lots; and
- Existing transit markets that have been identified through the MTS Comprehensive Operational Analysis (COA) and the NCTD Mobility Plan to ensure that RTP transit mode share goals are consistent with current short-range transit plans.

Figure TA 7.6 depicts the major travel corridors and areas used to establish initial geographic districts for mode share analysis. These travel corridors and areas were identified by analyzing peak period and daily travel demand output from SANDAG’s regional travel demand model. Figure TA 7.7 provides a map of the 18 districts that were initially identified, along with the 2008 peak period home-to-work transit mode shares for each district. Based on the existing and projected travel patterns in some of the northern suburban districts and the desire to better define the urbanized central core, these 18 districts were ultimately consolidated into 14 geographic corridors/areas that reflect the region’s major employment areas, high activity areas, and other urbanized areas (shown in Figure TA 7.8).

Initially, preliminary mode share goals for the identified geographic corridors/areas were to be developed using the peak period home-to-work transit mode share projections from two existing model scenarios to understand a range of potential mode share expectations for 2050. The Reasonably Expected Revenue scenario and the Unconstrained Revenue scenario of the adopted 2030 RTP, combined with the 2050 Regional Growth Forecast inputs, were intended to serve as the initial transit mode share goal “low” and “high” indicators. However, upon review of the results, it was found that there was too little variation in the two scenarios to yield meaningful lower and upper-end transit mode share goal ranges.

As a result, a new approach was developed, based on the 1997 South East Queensland Integrated Transport Plan in Brisbane, Australia. The Brisbane approach developed a transit mode share goal which was based on the existing year mode share plus a 50 percent increase in the projected proportion of trips made on public transit between 1997 and 2011, the Plan's horizon year.

Future Baseline Scenario

A similar approach was applied to the UATS planning process. However, instead of using an existing year as the baseline scenario, the project team used a future year as the baseline from which to identify each geographic corridor/area mode share goal, which would result in higher starting point values, and ultimately, higher proposed transit mode share goals. The project team used the 2030 RTP transportation network overlaid onto the projected 2050 land uses to create a future baseline, or starting point, scenario. Once the baseline mode share projections were developed for the 14 transportation corridors and areas for peak period commute trips, a 25 percent increase was applied to the expected "baseline" mode shares to develop the 2050 mode share goals.

To account for the variability in both the current predictive models and other changes that may come about over the course of 40 years, a range was developed for each mode share goal. Development of each area's goal range accounted for the following:

- Proposed goal
- Type of existing transit service and service levels
- Transit supportive infrastructure
- Existing and projected land uses

Transit Mode Share Goals

The transit mode share goals range from a low of 5-10 percent for various ex-urban areas, 10-15 percent for more suburban areas, 15-20 and 20-25 percent in the more urbanized areas of San Diego, to more than 30 percent in downtown San Diego. The resulting transit mode share goal range for the collective Urban Area is 10-15 percent. This represents more than a doubling of the current peak period, home-to-work transit mode share in the Urban Area within the next 40 years.

Figure TA 7.6


Orange County
Riverside County
San Diego County
Camp Pendleton
Oceanside
Vista
San Marcos
Carlsbad
Escondido
Encinitas
Solana Beach
Del Mar
PACIFIC OCEAN
Poway
County of San Diego
Sorrento Valley
University City
San Diego
Santee
Kearny Mesa
El Cajon
La Mesa
Lemon Grove
Downtown
National City
Coronado
Chula Vista
Imperial Beach
San Diego
UNITED STATES
MEXICO
Major Travel Corridors and Areas for Use in Identifying Initial Mode Share Goals
Major Travel Corridor
Major Employment Area
High Activity Area

Figure TA 7.7

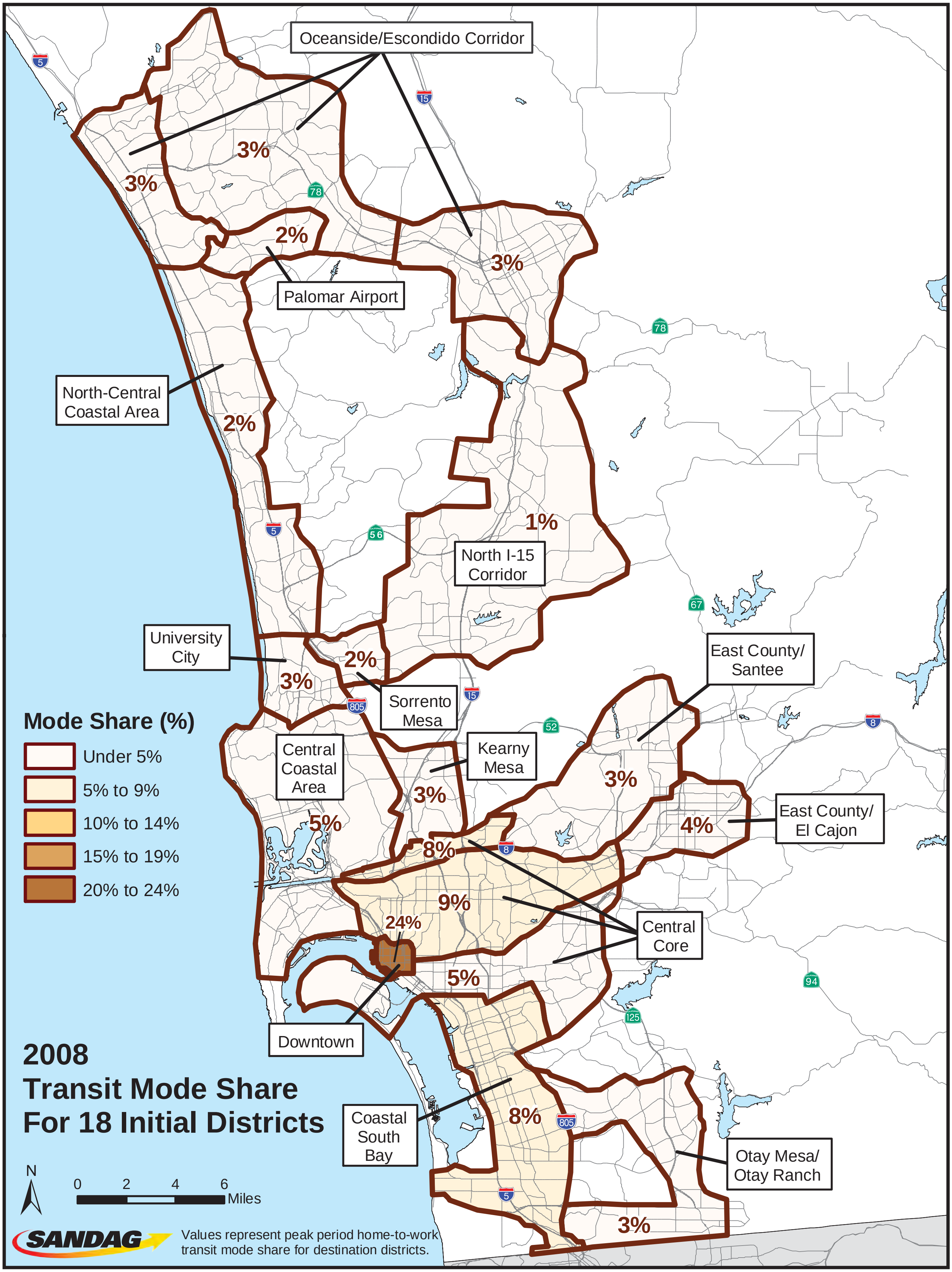

Oceanside/Escondido Corridor
3%
3%
2%
3%
Palomar Airport
North-Central
Coastal Area
2%
1%
North I-15
Corridor
University
City
2%
3%
Sorrento
Mesa
East County/
Santee
Mode Share (%)
Under 5%
5% to 9%
10% to 14%
15% to 19%
20% to 24%
Central
Coastal
Area
Kearny
Mesa
3%
3%
5%
8%
4%
East County/
El Cajon
9%
24%
Central
Core
5%
Downtown
2008
Transit Mode Share
For 18 Initial Districts
Coastal
South
Bay
8%
Otay Mesa/
Otay Ranch
3%
N
0 2 4 6
Miles
SANDAG
Values represent peak period home-to-work
transit mode share for destination districts.

Table TA 7.2 below provides information on existing (2008) transit mode shares, projected "baseline" transit mode shares, the calculated mode share goal applying the 25 percent increase over the baseline, the change over the projected baseline and existing transit mode shares, and finally the proposed 2050 peak period home-to-work transit mode share goal ranges for each identified geographic corridor/area. Figure TA 7.8 illustrates the goals from a geographic perspective.

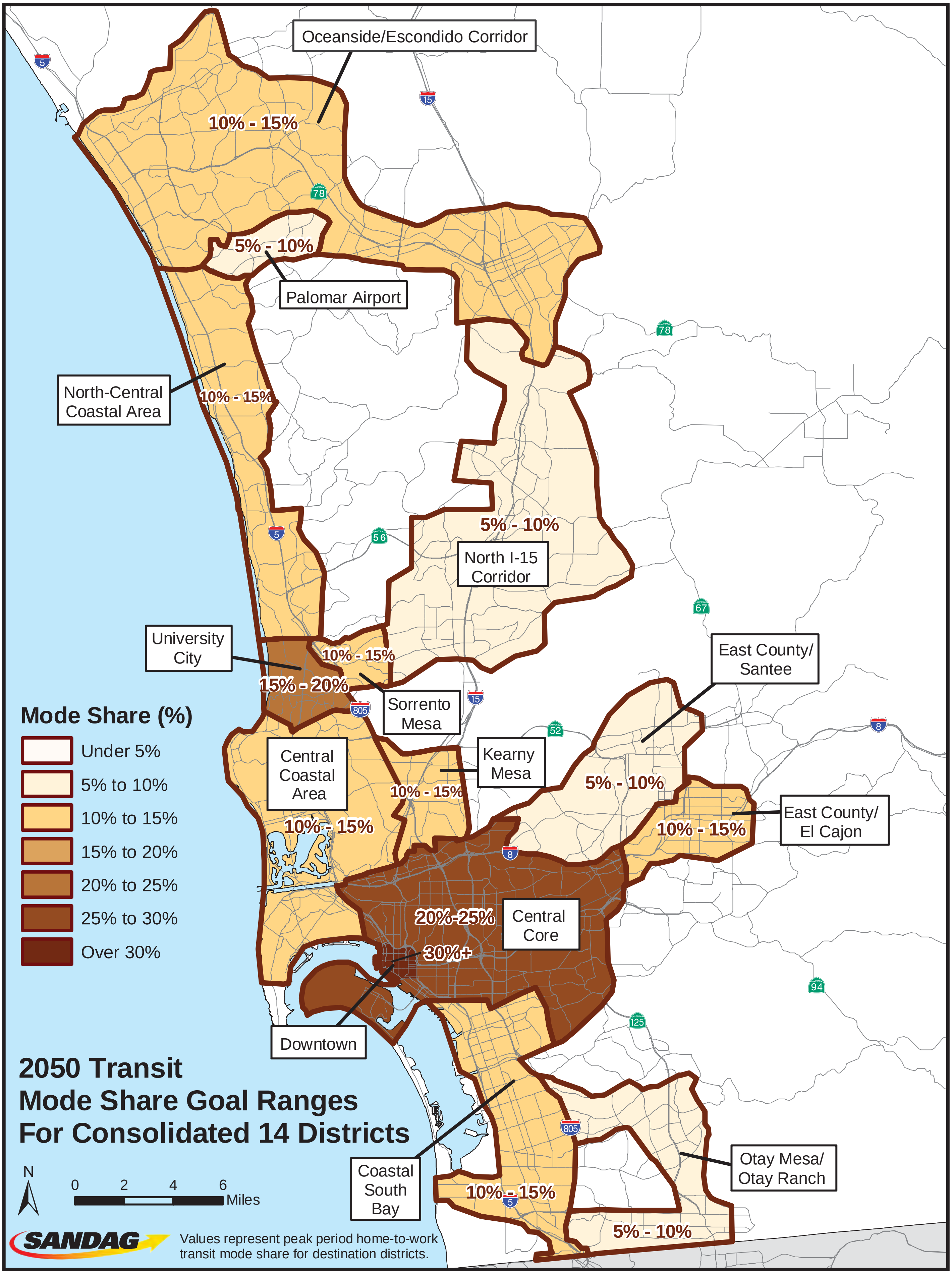
Table TA 7.2 –Peak Period, Home-to-Work Transit Mode Share Goals[1]

	Baseline Data		Supporting Data			Goals
Identified Corridors/Areas	**2008 Existing Transit Mode Share**	**2030 RTP With 2050 Land Uses Mode Share[2]**	**25% Increase Over 2030 RTP (Rounded)**	**Change From 2030 RTP**	**Change From 2008 Existing Transit**	**2050 Peak Period Transit Mode Share Goal Ranges**
Major Employment Areas						
Downtown San Diego	24.00%	25.00%	31%	24%	29%	30% +
University City	3.20%	13.00%	16%	23%	400%	15%-20%
Sorrento Mesa	1.90%	11.00%	14%	27%	637%	10%-15%
Kearny Mesa	2.60%	11.00%	14%	27%	438%	10%-15%
Otay Mesa/ Otay Ranch	2.70%	6.00%	8%	33%	196%	5%-10%
Palomar Airport	1.40%	5.50%	7%	27%	400%	5%-10%
High Activity Areas						
Central Core	11.80%	16.00%	20%	25%	69%	20%-25%
Oceanside/Escondido Corridor	2.90%	7.40%	9%	22%	210%	10%-15%
Other Urbanized Areas						
North I-15 Corridor	0.60%	6.10%	8%	31%	1233%	5%-10%
North Central Coastal Area	1.90%	7.70%	10%	30%	426%	10%-15%
Central Coastal Area	4.70%	10.00%	13%	30%	177%	10%-15%
Coastal South Bay	7.50%	10.70%	13%	21%	73%	10%-15%
East County/El Cajon	4.20%	8.30%	10%	20%	138%	10%-15%
East County/Santee	2.90%	6.30%	8%	27%	176%	5%-10%
UATS Study Area	**5.20%**	**10.10%**	**13%**	**29%**	**150%**	**10%-15%**

[1] Values represent peak period home-to-work trip transit mode share for destination districts.

[2] Values reflect projected mode share of either the currently adopted 2030 Reasonably Expected RTP or the 2030 Unconstrained RTP, whichever is higher, combined with 2050 land uses.

Figure TA 7.8


Oceanside/Escondido Corridor
10% - 15%
5% - 10%
Palomar Airport
North-Central Coastal Area
10% - 15%
5% - 10%
North I-15 Corridor
University City
10% - 15%
15% - 20%
Sorrento Mesa
Mode Share (%)
Under 5%
5% to 10%
10% to 15%
15% to 20%
20% to 25%
25% to 30%
Over 30%
Central Coastal Area
10% - 15%
Kearny Mesa
10% - 15%
East County/ Santee
5% - 10%
East County/ El Cajon
10% - 15%
20%-25%
Central Core
30%+
Downtown
2050 Transit
Mode Share Goal Ranges
For Consolidated 14 Districts
Coastal South Bay
10% - 15%
Otay Mesa/ Otay Ranch
5% - 10%
N
0 2 4 6 Miles
SANDAG
Values represent peak period home-to-work transit mode share for destination districts.

7. UATS Transit Network Evaluation Criteria

A series of performance measures were developed to evaluate each potential transit scenario's ability to make transit more time-competitive, maximize the role of transit within the transportation system, and reduce region-wide vehicle miles traveled and greenhouse gas emissions.

A number of objectives were developed to address the goal and vision for the UATS project. The development of a robust, efficient, and effective transit system requires more than just building and providing additional transit facilities and services. It requires that the proposed transit facilities and services are located where travelers want to go; that transit service is fast, convenient, and easy to use; and that transit can be accessed by a wide variety of users. The objectives developed for the UATS were as follows:

- Increase Peak Period Transit Mode Share
- Maximize Transit Ridership
- Develop a Cost Effective and Implementable Transit System
- Support an Efficient and Effective Transportation System
- Address the Need for Sustainability and Environmental Justice

In order to measure the proposed transit scenarios' ability to achieve the noted objectives, a series of performance measures were developed to allow for either a quantitative or qualitative assessment of each measure and ultimately each transit network's ability to achieve the project goals and objectives. These performance measures were used in conjunction with the transit mode share goals.

The following section outlines the performance measures for each objective noted above.

Increase Peak Period Transit Mode Share

Three performance measures were developed to address each transit network's ability to meet this objective. These are listed below in Table TA 7.3.

Table TA 7.3 – Transit Mode Share Performance Measures

Performance Measure	Definition
Peak period transit mode share as applied to the identified corridors/areas	Peak period transit mode share refers to the percent of total work trips that is projected to occur on transit during the peak travel periods (when the largest concentration of trips occur on the transportation network). The peak periods are associated with the morning and evening commute times, typically occurring between 6 to 9 a.m. for the morning peak and 3 to 6 p.m. for the evening peak. This performance measure provides a projected estimate of the proportion of the regional travel demand that is projected to use transit during the most congested travel times, and applies to home-to-work trips.
All-day transit mode share as applied to the identified corridors/areas	All-day transit mode share refers to the percent of motorized travel that is projected to occur on transit for the entire day. Again, this reflects each potential transit network's ability to address overall travel demand through use of the proposed transit network.
Change in peak period Urban Area transit mode share	This performance indicator measures the change in transit mode share for the entire Urban Area study area. It specifically measures the change in transit mode share from the "baseline" scenario discussed in the previous section.

Maximize Transit Ridership

Four performance measures were developed to evaluate the projected increase in transit ridership for each alternative transit network. All ridership performance measures are regional to assess the changes that each network brings to the overall regional transit network, since all new services build upon the existing regional transit network. The performance measures for this objective are listed in Table TA 7.4.

Table TA 7.4 – Transit Ridership Performance Measures

Performance Measure	Definition
Change in transit person trips	The change in transit person trips reflects the number of individual one-way person trips taken on transit, from origin to destination (considered linked-trips) for all trip purposes. This measures the change in the number of person trips taken by transit for each proposed network as compared to the future baseline scenario. The future baseline scenario, as described in Section 6, consisted of an overlay between the highway and transit networks included in the 2030 RTP and the land use assumptions in the 2050 Regional Growth Forecast. A positive difference between the proposed network and the future baseline scenario reflects a higher use of transit, and thus an improvement.
Change in transit passenger miles	The change in transit passenger miles measures the total number of person-miles traveled on transit, also measured against the future baseline scenario. Like transit person trips, an increase in transit passenger miles generally means that more trips are being taken by transit; however, it could also mean that the available or proposed transit service is focused on serving long-distance trips, which may not be the most efficient or desired provision of transit service.
Change in transit peak period person trips	Changes in peak period transit person trips addresses how the transit network is performing during the morning and evening commute times when the network is most congested. Again, an increase in peak period person transit trips reflects higher transit use and more efficient use of limited roadway capacity.
Change in mode of access to transit (non-motorized, park-and-ride, kiss-and-ride/drop-off)	Measuring the change in how transit riders access transit, be it by walking, bicycling, or by car, helps to assess how efficiently each route, and ultimately the entire network, draws riders within the individual and network catchment areas. What this means is that transit routes and networks that have a higher number of riders walking or biking to the system are convenient and effectively located to enhance and increase transit ridership. This measure also helps assess the value of providing additional park-and-ride facilities and longer-distance bus routes, as compared to providing transit service in areas with infrastructure, and development patterns and land uses that are conducive to transit service and ridership.

Develop a Cost Effective and Implementable Transit System

Four performance measures were developed to evaluate the cost effectiveness and affordability of the proposed alternative transit networks. The performance measures for this objective included the following:

- Cost-effectiveness of network
- Operating subsidy required

- Total transit system capital cost vs. SANDAG revenue-constrained funding scenario
- Ability to phase major system components/elements

Data for these measures was not completed because these measures were found to be more relevant when considered as part of the multimodal RTP network given that some transit infrastructure is required on the Managed Lanes to operate services such as BRT. Comparable data was produced, however, centering on preliminary rough-order-of-magnitude capital cost estimates for each alternative transit network, discussed in Section 10 of this report.

Support an Efficient and Effective Transportation System

Three of the four performance measures developed for this objective focus on the broader transportation system, and only one specifically measures the transit component. These performance measures assess changes across the regional transportation network that are the result of or influenced by each transit network alternative. The performance measures are therefore compared using regional information rather than just the UATS study area. The performance measures, listed in Table TA 7.5, are all measured against the future baseline scenario.

Table TA 7.5 – Efficient Transportation Network Performance Measures

Definition	Mode
Change in passenger miles per transit seat mile	Measuring the change in passenger miles per transit seat mile is an assessment of the efficiency of the transit network, which examines the available transit capacity relative to the transit demand. This performance metric, measures how "full" the transit vehicles are, so positive changes in passenger miles per seat mile against the baseline scenario is an indicator of the effectiveness of the overall transit system.
Change in auto vehicle miles traveled (VMT) per capita	The change in VMT per capita provides a comparison as to the number of miles traveled in a vehicle compared to alternative modes of walking or biking, and to a lesser degree the ability for people to meet their daily needs (work, recreation, shopping) within a smaller area or reasonable distance. Reductions in VMT, as compared to the baseline, are considered a positive indicator of an efficient and effective transportation and transit system.
Change in auto vehicle hours traveled (VHT) per capita	The change in auto VHT per capita provides a relative understanding of how much people are traveling and congestion levels within the overall transportation system. Generally, reductions in this measure are considered positive, as it is a measure of efficiency in the system that could be attributed to the provision of transportation alternatives such as transit, walking, or biking. However, reductions in VHT can also be the result of roadway expansions and the removal of major system bottlenecks that produce congestion on the roadway network.
Change in vehicle trips per capita	Measuring the change in vehicle trips per capita provides an understanding of any changes in how people are traveling within the region. Because this measure includes all motor-driven travel, including buses, it does not measure changes in the number of trips from auto to transit, but rather is a measure of overall trip making, and to a lesser degree an indicator of mode shift to walking and biking.

Address the Need for Sustainability and Environmental Justice

To account for this broad-ranging objective, a number of specific performance measures were developed related to sustainability and environmental justice/social equity, as listed in Tables TA 7.6 and 7.7. The categories developed for this objective are greenhouse gas reduction, non-motorized travel, land-use/transportation connection, and social equity.

Table TA 7.6 – Sustainability Performance Measures

Performance Measure	Definition
Estimated Change in Greenhouse Gas Emissions	The performance metric for this category is a model-derived estimate of the change in regional greenhouse gas emissions as compared to the future baseline scenario. A reduction in greenhouse gas emissions from the future baseline scenario would be a positive indicator.
Non-Motorized Travel: Peak period non-motorized mode share in the UATS study area, and All-day non-motorized mode share in the UATS study area	Measuring the change in both peak period and all-day non-motorized mode share (walking and biking) provides insight into how both the transit network and the regional bike network accommodate travel demand and also change travel behavior. Increases in the mode share for walking and biking as compared to the future baseline scenario are considered a positive measure of overall mobility and accessibility.
Compatibility with Regional Bike Plan	Compatibility with the Regional Bike Plan is measured by calculating the number of miles of regional bicycle facilities that are located within a half-mile of a major transit station. This measure provides a quantitative estimate of the connection between bike and transit facilities and thus an indicator of transit system accessibility to other non-motorized travel modes.
Percent of jobs within a 1/4 mile and 1/2 mile of major transit stations	Measuring the percent of jobs within a 1/4 and 1/2 mile of major transit stations provides an assessment of how well the transit system is providing service to employment areas within the region. The selection of jobs within 1/4 mile from transit stations is significant in that studies have shown that proximity to the employment site is of higher importance for transit riders than proximity to housing locations. Therefore, locating new transit facilities and services to be within 1/4 mile of major employment areas would improve transit's ability to attract new transit riders. However, both distances were ultimately evaluated and reported.
Percent of housing units within a 1/2 mile of major transit stations, with 10- and 15-minute or better service levels	Similar to measuring the percent of jobs, measuring the percent of housing units with access to transit service provides an assessment of regional accessibility to transit and thus overall mobility as well. Generally 1/2 mile is considered a standard threshold for how far people are willing to walk to access transit and was therefore selected as the quantitative measurement for housing units. This measure was also evaluated with additional layers reflecting 10- and 15-minute or better service levels.
Compatibility with regional activity centers (hospitals, universities, colleges, shopping malls, tourist attractions)	This performance measure provides a quantitative estimate of the number of regional activity centers located within 1/2 mile of a major transit station. Again, considering that 1/2 mile is a generally accepted standard, the number of regional activity centers was calculated based on the location of existing and proposed major transit centers as compared to the future baseline scenario. This quantitative measure is used to estimate the relative accessibility and mobility provided by the individual transit network alternatives.

Environmental Justice and Social Equity

The environmental justice and social equity category is focused on the accessibility and mobility provided by the transit network alternatives as they relate to minority, low income, elderly, and households without vehicles. Four performance measures were developed to assess the ability for these specific population segments to access transit facilities and services. The performance measures, listed in Table TA 7.7, are assessed within the broader San Diego region and are also compared against the future baseline scenario.

Table TA 7.7 – Environmental Justice Performance Measures

Performance Measure	Definition
Percent of minority and non-minority populations within 1/2 mile of a major transit station Percent of low-income and non-low-income households within 1/2 mile of a major transit station Percent of aged 75+ population within 1/4 mile of a major transit station and 1/4 mile of all transit stations Percent of zero-car households within 1/2 mile of major transit stations	These performance measures address the accessibility of transit to a population base that may have previously received limited benefits or dis-benefits from other infrastructure projects. These populations include minority or low-income populations or households respectively, or a population that is expected to increase, such as the elderly, or a population that would greatly benefit from increased access to transit, such as households with no available vehicles. These performance measures were assessed based on the 1/2 mile to a major station, except the aged 75+ population category, which used 1/4 mile, as generally this population may find it more difficult to walk longer distances. These performance measures are used to estimate the relative accessibility for the identified populations provided by the alternative transit networks as compared to the future baseline scenario. As such, comparative improvements in the percentage of any of these populations within the designated mileage would be considered a positive change.

All of the above noted measures were used to assess and evaluate the three alternative transit networks developed for the UATS. Technical Appendix D summarizes the initial performance of the transit network alternatives from a comparative standpoint and provides the associated numeric data. The performance of the alternatives is further described in the "Analysis Results" segment of Section 8 of this report.

8. Transit Network Alternatives

A key task in the UATS included assembling an international team of PB professional consultants to help develop concepts and cost estimates for alternative transit networks. The PB Professional Consulting Team convened in San Diego in January 2010 over four days (biographies of the team are included in Technical Appendix E), with their visit culminating in the development of three initial transit concepts. The three concepts were intentionally designed to vary significantly from one another in order to test how transit strategies that are fundamentally different from one another might function in the long term when compared across the identified performance measures.

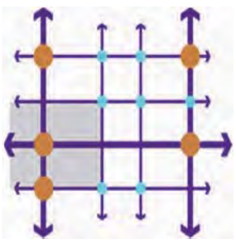
Development of the transit network concepts began with an assessment of the existing transportation system and land use patterns in the San Diego region and an evaluation of projected travel demand based on output and results from the SANDAG regional travel demand model. The project team also reviewed SANDAG's Smart Growth Concept Map, the 2050 Regional Growth Forecast land use inputs, findings from the Lessons Learned from Peer Regions Report, and the results of the brainstorming sessions conducted at the outset of the project.

The project team was tasked with creating three ambitious, visionary, and far reaching transit networks that respond to the region's transit needs by building upon the existing transit network and addressing future travel patterns and demand. The first step in creating the transit networks was the development of key themes or scenarios to guide the process.

The three themes that emerged were: Transit Propensity, Commuter Point-to-Point, and Many Centers. The theme for Transit Propensity was to focus transit investments in the most urbanized areas of San Diego. The theme for Commuter Point-to-Point was to provide high quality, fast transit service to employment centers. And the theme for Many Centers was to connect local smart growth areas and regional activity centers with transit. The graphics below represent the three themes. The graphics were based on initial working maps created by the PB Professional Consulting Team during its stay in San Diego, as shown in Figures TA 7.9, 7.10, and 7.11.

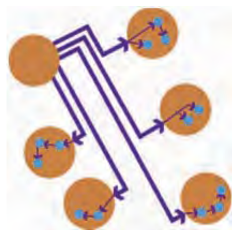
Transit Propensity

Expands Transit in the Most Urbanized Areas



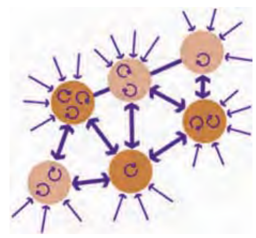
Commuter Point-to-Point

Emphasizes Quick Access to Work



Many Centers

Connects Local Smart Growth Areas and Activity Centers



The project team proposed the following guiding concepts for the development of the transit routes and services that would be coded and modeled for each transit network alternative:

Transit Propensity: Builds on the San Diego region's backbone trolley system – expands transit in the central core and in the region's most urbanized areas, many of which are characterized by pre-World War II street grid patterns. Provides very frequent transit services, alleviating riders from having to consult schedules and facilitating easy transfer connections. Major investments include streetcars, grade separations, priority treatments, transit nodes, expanded light rail, enhanced bike and walk access, and improvements to the public realm.

Commuter Point-to-Point: Transit to work is an easy option – leverages new dedicated transit facilities and flexible use of Managed Lanes to serve work trips. A system of few transfers provides high speed, reliable commute options during peak periods with a variety of "last-mile" treatments. Major investments include Managed Lanes with in-line stations, park and ride lots, new fixed guideways, and some rail expansion.

Many Centers: Supports the San Diego region's local commitments to smart growth – consists of a multi-radial transit system serving many of the region's smart growth areas and major activity centers. Transit services are oriented toward the centers, and supported with frequent connections between the centers. Major investments include a variety of transit priority treatments between centers, expanded light rail, enhanced transit centers, shuttles and streetcars connecting to the transit centers, enhanced bike and walk access, and improvements to the urban realm.

Network Development

The project team next identified new transit routes and services based on the guiding concepts for the alternative networks. The highway network and the land use assumptions of each transit network were held constant. Generally, the alternatives built upon the highway and transit projects included in the 2030 Regional Transportation Plan, and assumed the land use inputs from the 2050 Regional Growth Forecast.

Common Projects

All three alternatives included the following major infrastructure components: High Speed Rail (HSR) to an intermodal transit center at San Diego International Airport, commuter rail overlay utilizing the HSR alignment, double-tracking of the COASTER and SPRINTER rail lines, a Downtown San Diego Trolley Tunnel, and a bus transit "guideway" from downtown San Diego to Mission Valley and Kearny Mesa (referred to as the "Kearny Mesa Guideway" in the UATS process, and defined as a dedicated street/infrastructure network that would facilitate faster and more reliable travel times for existing local buses, new BRT, and Rapid Bus services in the congested corridor that links downtown San Diego with Hillcrest, Mission Valley, and Kearny Mesa and connects a number of key employment areas and residential communities).

The following discussion provides additional detail on the routes and services that were specific to each of the network alternatives.

Transit Propensity Alternative

The Transit Propensity alternative focused on providing new transit services within the downtown and inner-ring suburbs of San Diego where higher intensity, mixed land uses enhance access to transit and support transit use. In addition, the Transit Propensity alternative included localized services for the downtown areas of the larger suburban communities to facilitate first-mile/last-mile connections in these areas. In addition to the common projects listed above, the network included two new trolley lines, nine new streetcar lines, one new BRT route, two new rapid bus routes, and infrastructure connecting the I-15 BRT services to the Green Line at Mission San Diego. The following services are illustrated conceptually in a "subway-style" format in Figure TA 7.12.

New Trolley Lines

- San Diego State University to downtown San Diego via Mid-City communities
- San Diego State University to South Bay/Chula Vista/H Street Station via Mid-City communities, southeastern San Diego communities, and National City.

New Streetcar Lines

- Downtown Escondido – East/West route from Escondido Transit Center to Fig Street
- Downtown Oceanside – Oceanside Transit Center to Coast Highway SPRINTER Station
- Pacific Beach to MidCoast – connecting North Pacific Beach, Pacific Beach and MidCoast Balboa Station
- 30th Avenue – connecting University Heights, North Park, South Park, East Village and downtown San Diego
- Hillcrest to Downtown – connecting Hillcrest and downtown San Diego via 4th and 5th Avenues
- Little Italy to Gaslamp Loop – connecting Little Italy, Smart Corner, East Village, and Gaslamp
- Downtown El Cajon – connecting El Cajon Transit Center to downtown El Cajon
- Downtown Chula Vista – connecting E Street and H Street Stations to downtown Chula Vista
- National City – connecting 8th Street Station to new UTC to South Bay trolley

New Bus Rapid Transit Routes

- Mid-City to University Towne Center

New Rapid Bus Routes

- Euclid Trolley Station to Grantville Trolley Station
- Ocean Beach to Old Town Transit Center

Transit Infrastructure

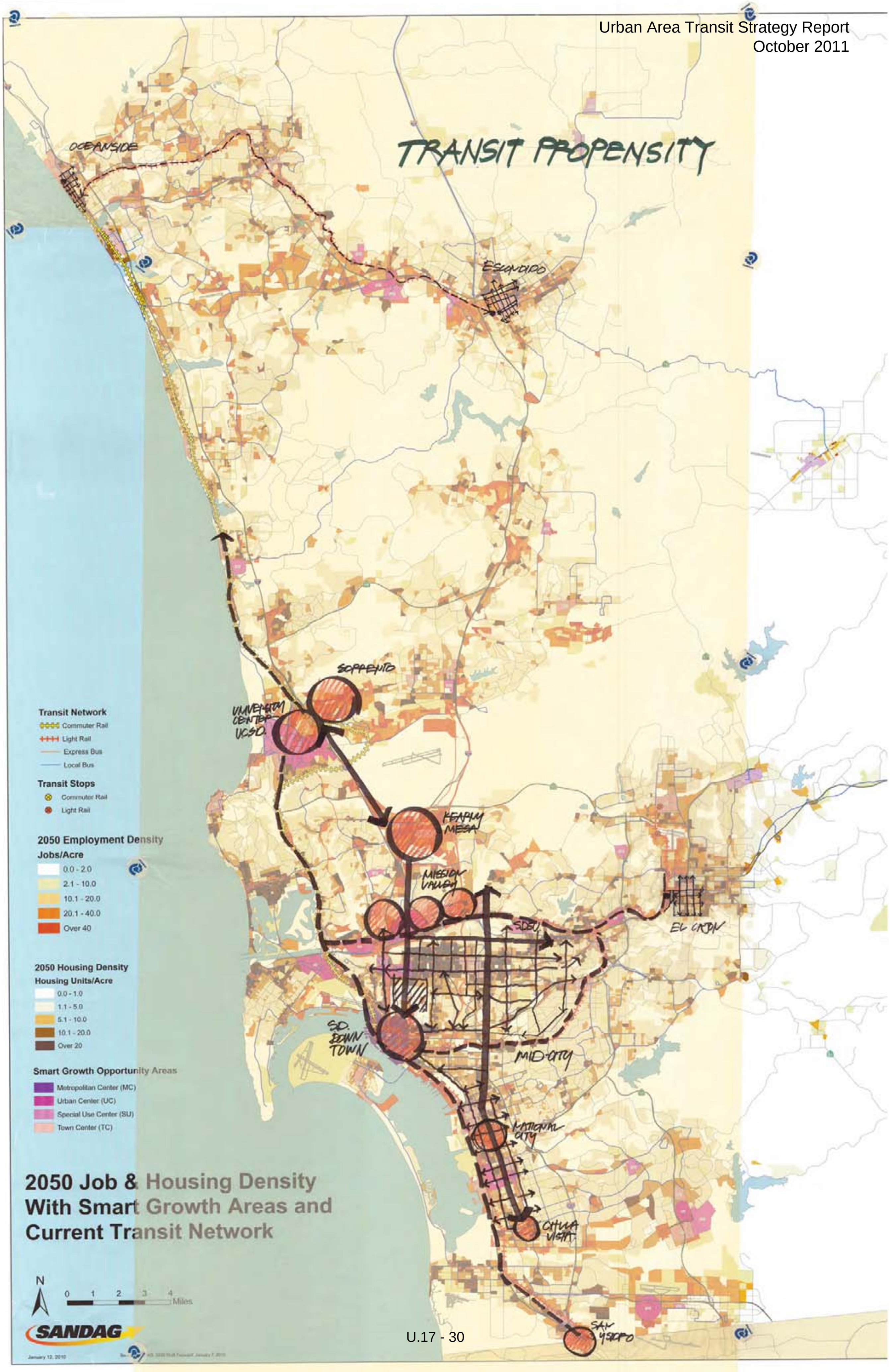
- Infrastructure connecting I-15 managed lanes BRT routes to the Mission San Diego Green Line Trolley Station

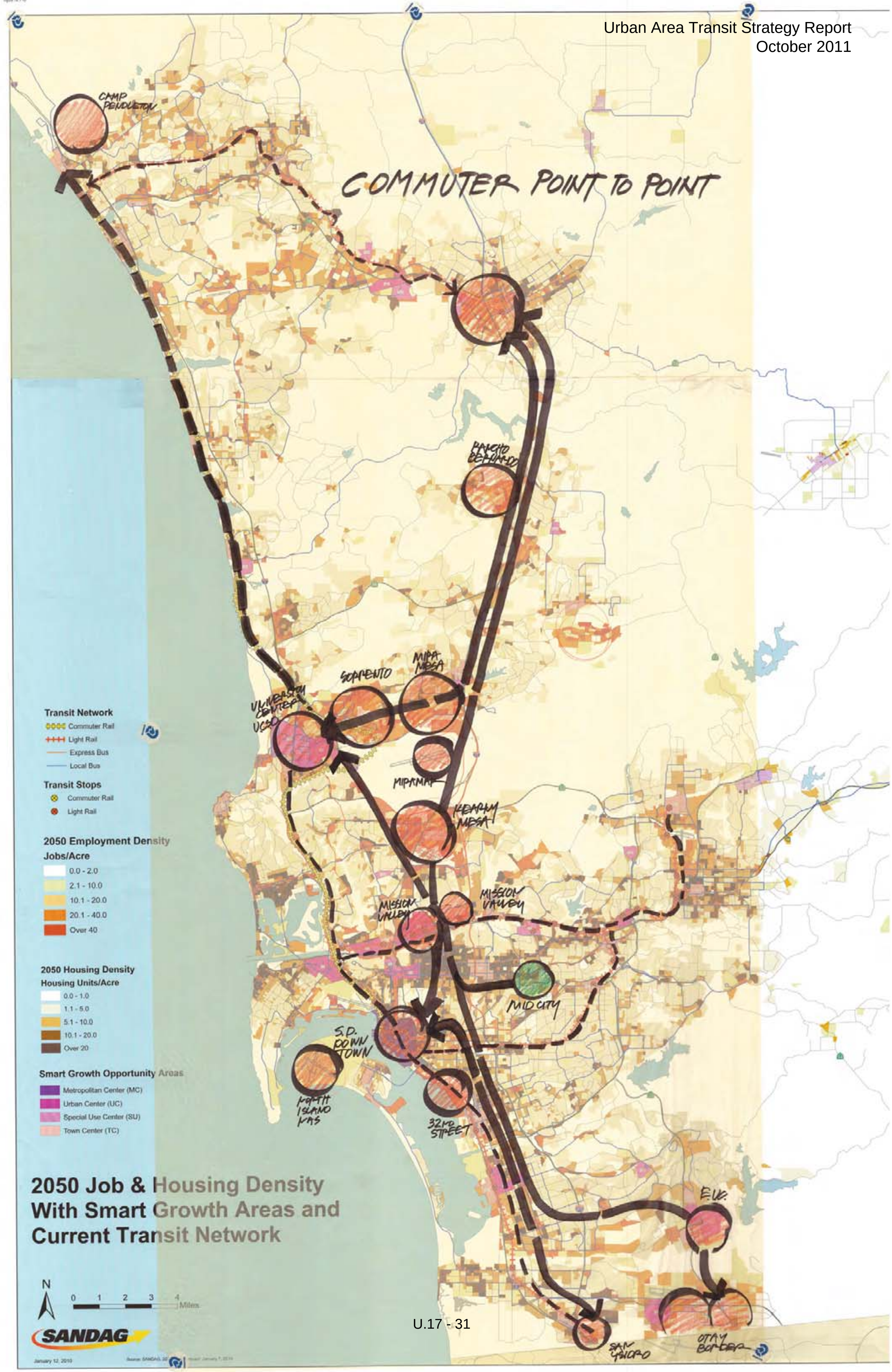
Typical Peak Period Transit Service Standards

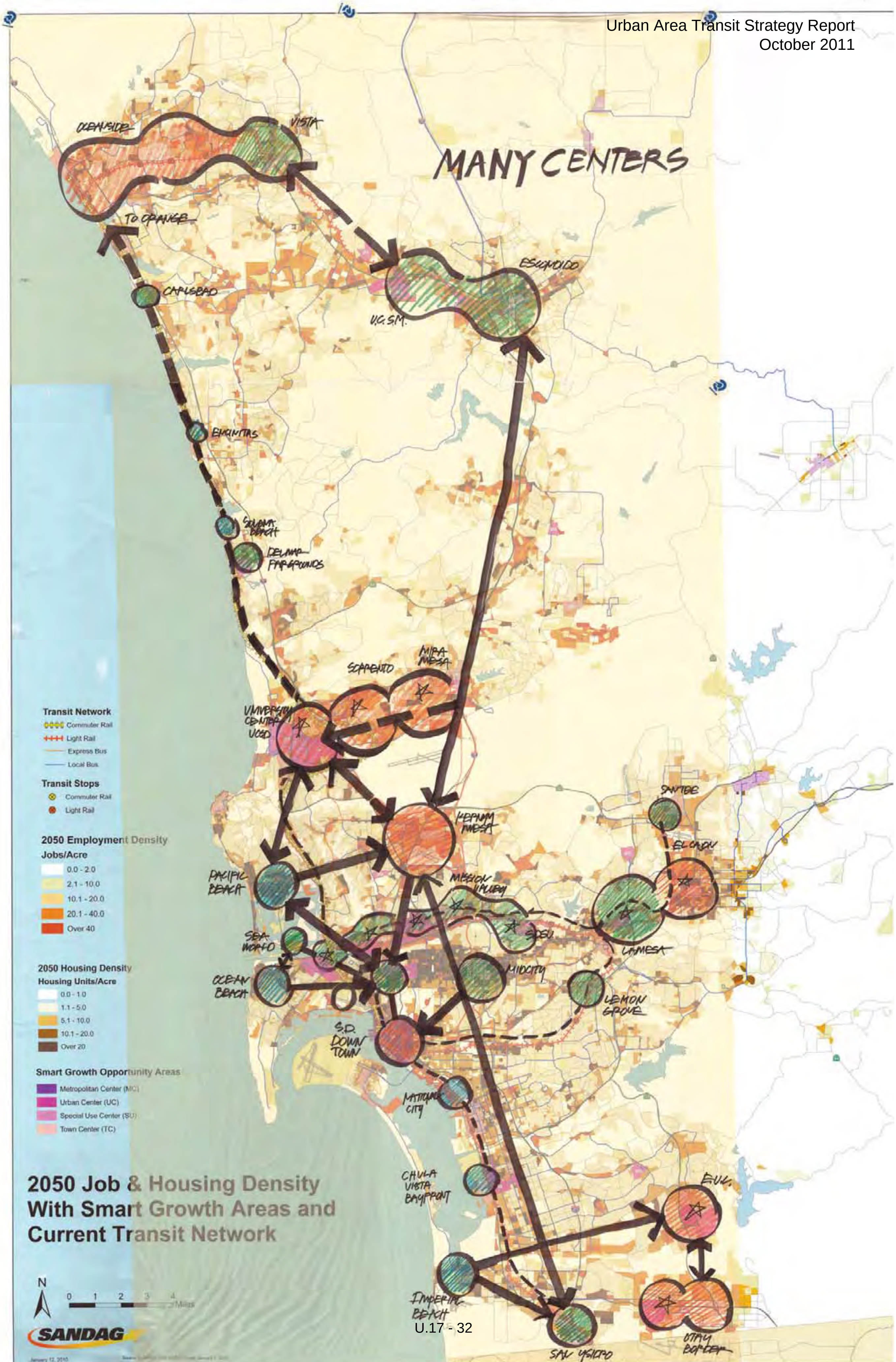
- Trolley – 7.5 minute service
- SPRINTER – 15 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – 10 minute service
- COASTER – 20 minute service
- Commuter Rail on HSR – 15 minute service
- Rapid Bus – 10 minute service
- Local Bus – 10 minute service

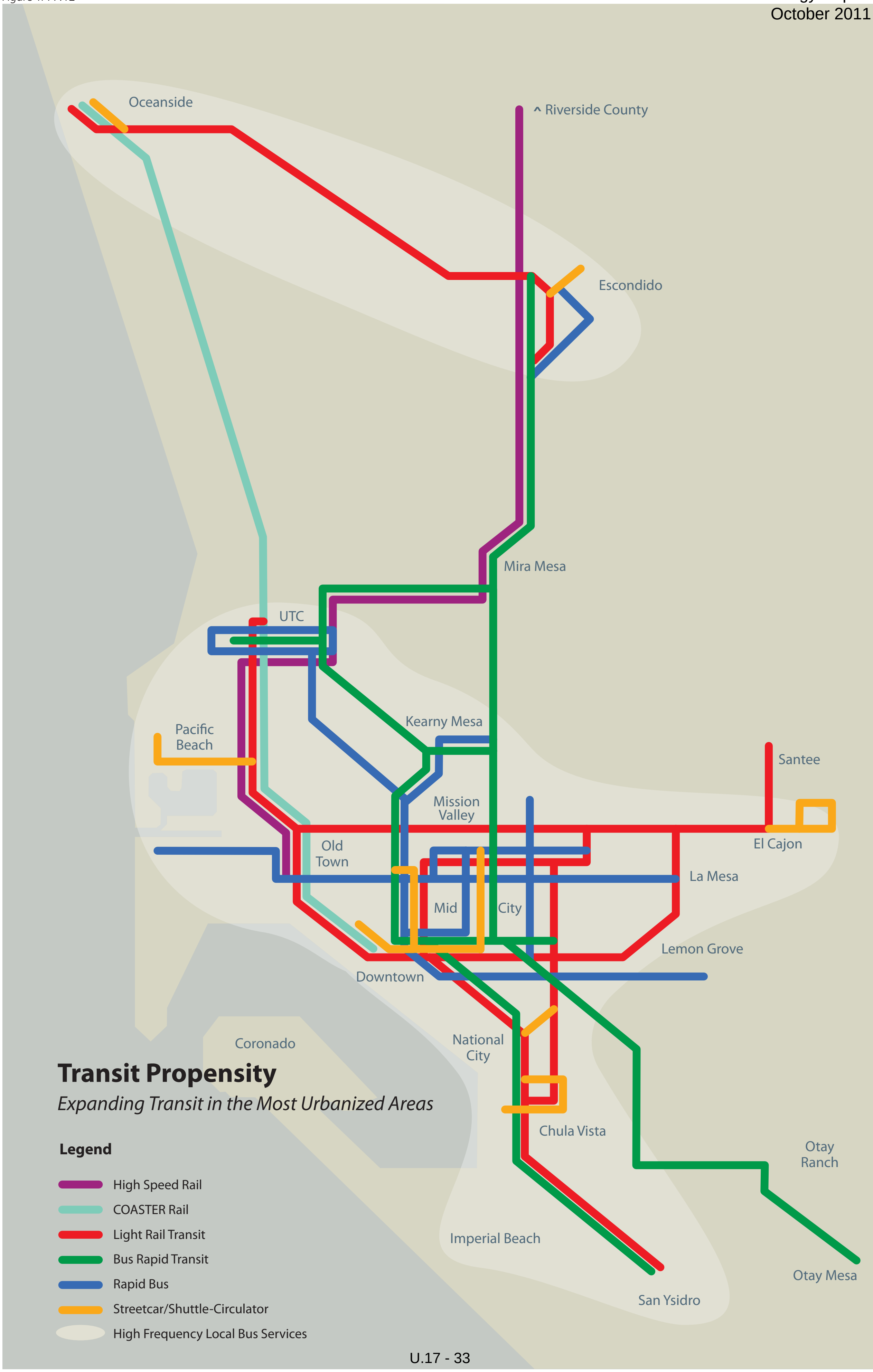
Commuter Point-to-Point Alternative

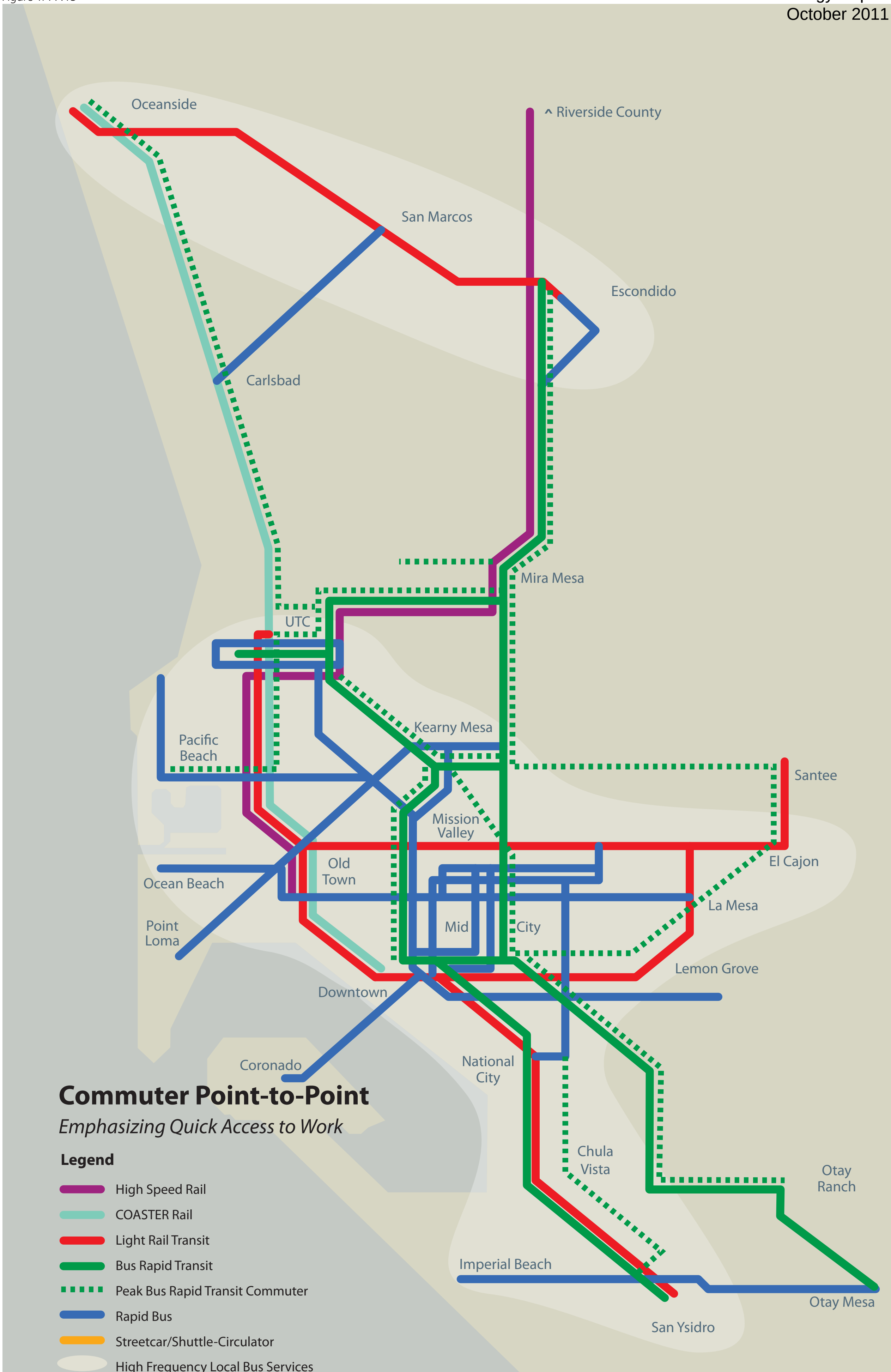
The Commuter Point-to-Point alternative focused on providing new transit services to major employment centers within the region, primarily in peak commute hours, using a variety of bus-based transit services. Because work trips are routine trips, they are generally easier to capture on transit than discretionary trips. In addition to the common projects referenced earlier, the network included 15 new or revised BRT routes, six new rapid bus routes, three shuttles/revised local routes, extension of the COASTER and additional stops, new infrastructure connecting the I-15 BRT services to the Green Line at Mission San Diego, and new park-and-ride facilities. The following services are shown in Figure TA 7.13.


TRANSIT PROPENSITY
OCEANSIDE
ESCONDIDO
SORRENTO
UNIVERSITY CENTER UCSD
KEARNY MESA
MISSION VALLEY
SDSU
EL CAJON
SD. DOWNTOWN
MID-CITY
NATIONAL CITY
CHULA VISTA
SAN YSIDRO
Transit Network
Commuter Rail
Light Rail
Express Bus
Local Bus
Transit Stops
Commuter Rail
Light Rail
2050 Employment Density
Jobs/Acre
0.0 - 2.0
2.1 - 10.0
10.1 - 20.0
20.1 - 40.0
Over 40
2050 Housing Density
Housing Units/Acre
0.0 - 1.0
1.1 - 5.0
5.1 - 10.0
10.1 - 20.0
Over 20
Smart Growth Opportunity Areas
Metropolitan Center (MC)
Urban Center (UC)
Special Use Center (SU)
Town Center (TC)
2050 Job & Housing Density
With Smart Growth Areas and
Current Transit Network
N
0 1 2 3 4
Miles
SANDAG


COMMUTER POINT TO POINT
CAMP PENDLETON
RANCHO BERNARDO
SORRENTO
MIRA MESA
UNIVERSITY CENTER
UCSD
MIRAMAR
KEARNY MESA
MISSION VALLEY
MISSION VALLEY
MID CITY
S.D. DOWN TOWN
NORTH ISLAND NAS
32ND STREET
E.U.
SAN YSIDRO
OTAY BORDER
Transit Network
Commuter Rail
Light Rail
Express Bus
Local Bus
Transit Stops
Commuter Rail
Light Rail
2050 Employment Density
Jobs/Acre
0.0 - 2.0
2.1 - 10.0
10.1 - 20.0
20.1 - 40.0
Over 40
2050 Housing Density
Housing Units/Acre
0.0 - 1.0
1.1 - 5.0
5.1 - 10.0
10.1 - 20.0
Over 20
Smart Growth Opportunity Areas
Metropolitan Center (MC)
Urban Center (UC)
Special Use Center (SU)
Town Center (TC)
2050 Job & Housing Density
With Smart Growth Areas and
Current Transit Network
N
0 1 2 3 4
Miles
SANDAG
January 12, 2010


MANY CENTERS
OCEANSIDE
VISTA
TO ORANGE
CARLSBAD
ESCONDIDO
U.C.S.M.
ENCINITAS
SOLANA BEACH
DELMAR FAIRGROUNDS
SORRENTO
MIRA MESA
UNIVERSITY CENTER UCSD
KEARNY MESA
SANTEE
EL CAJON
PACIFIC BEACH
MISSION VALLEY
SEA WORLD
SDSU
LA MESA
OCEAN BEACH
MIDCITY
LEMON GROVE
S.D. DOWNTOWN
NATIONAL CITY
CHULA VISTA BAYFRONT
EUC
IMPERIAL BEACH
SAN YSIDRO
OTAY BORDER
Transit Network
Commuter Rail
Light Rail
Express Bus
Local Bus
Transit Stops
Commuter Rail
Light Rail
2050 Employment Density
Jobs/Acre
0.0 - 2.0
2.1 - 10.0
10.1 - 20.0
20.1 - 40.0
Over 40
2050 Housing Density
Housing Units/Acre
0.0 - 1.0
1.1 - 5.0
5.1 - 10.0
10.1 - 20.0
Over 20
Smart Growth Opportunity Areas
Metropolitan Center (MC)
Urban Center (UC)
Special Use Center (SU)
Town Center (TC)
2050 Job & Housing Density With Smart Growth Areas and Current Transit Network
N
0 1 2 3 4 Miles
SANDAG
January 12, 2010


Oceanside
^ Riverside County
Escondido
Mira Mesa
UTC
Pacific Beach
Kearny Mesa
Santee
Mission Valley
Old Town
El Cajon
La Mesa
Mid
City
Lemon Grove
Downtown
Coronado
National City
Chula Vista
Otay Ranch
Imperial Beach
San Ysidro
Otay Mesa
Transit Propensity
Expanding Transit in the Most Urbanized Areas
Legend
High Speed Rail
COASTER Rail
Light Rail Transit
Bus Rapid Transit
Rapid Bus
Streetcar/Shuttle-Circulator
High Frequency Local Bus Services


Oceanside
^ Riverside County
San Marcos
Escondido
Carlsbad
Mira Mesa
UTC
Kearny Mesa
Pacific
Beach
Santee
Mission
Valley
El Cajon
Old
Town
Ocean Beach
La Mesa
Point
Loma
Mid
City
Lemon Grove
Downtown
Coronado
National
City
Chula
Vista
Otay
Ranch
Imperial Beach
Otay Mesa
San Ysidro
Commuter Point-to-Point
Emphasizing Quick Access to Work
Legend
High Speed Rail
COASTER Rail
Light Rail Transit
Bus Rapid Transit
Peak Bus Rapid Transit Commuter
Rapid Bus
Streetcar/Shuttle-Circulator
High Frequency Local Bus Services

New Trolley Lines

- None

New Streetcar Lines

- None

New Bus Rapid Transit Routes

- Oceanside to Sorrento Mesa
- Escondido to Mira Mesa and Sorrento Mesa – North Route
- Escondido to Mira Mesa and Sorrento Mesa – South Route
- Escondido to UCSD
- Escondido to Kearny Mesa
- Pacific Beach to University Towne Center and Sorrento Mesa
- South Bay (Iris Trolley Station) to Kearny Mesa
- Mid-City to Sorrento Valley
- Mid-City to University Town Center
- El Cajon to Kearny Mesa
- El Cajon to Sorrento Mesa
- El Cajon to University Towne Center
- Chula Vista (Palomar/I-805) to Kearny Mesa
- Chula Vista (Palomar/I-805) to Sorrento Mesa
- Otay Ranch to University Towne Center

New Rapid Bus Routes

- San Marcos to Poinsettia COASTER Station
- La Jolla to Kearny Mesa via Pacific Beach
- Ocean Beach to La Mesa via Old Town Transit Center
- Point Loma to Kearny Mesa
- Downtown San Diego to Coronado/North Island Naval Complex
- Otay Mesa to Imperial Beach

New Shuttle Services/Revised Local Routes

- Poway Business Park Shuttle
- Miramar Shuttle
- Improved Bus Service to COASTER (Route 302 and 309)

COASTER Commuter Rail

- Extend COASTER to Camp Pendleton – station at Vandegrift
- Added stops at Balboa Avenue, UTC, and Lindbergh Field ITC

Transit Infrastructure

- Infrastructure connecting I-15 managed lanes BRT routes to the Mission San Diego Green Line Trolley Station
- Additional park-and-ride facilities

Typical Peak Period Transit Service Standards

- Trolley – 7.5 minute service
- SPRINTER – 15 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – no services
- COASTER – 15 minute service
- Commuter Rail on HSR – 15 minute service
- Rapid Bus – 15 minute service
- Local Bus – 15 minute service

Many Centers Alternative

The Many Centers alternative focused on creating a network of new transit services, linked by regional transit hubs, to connect designated smart growth areas, major activity centers, and major employment and residential areas. In addition to providing new trolley routes, this alternative provides enhanced shuttle and streetcar services to provide quick and convenient access from transit centers to the surrounding area. In addition to the common projects, the network included five new trolley lines, seven new streetcar lines, four new BRT routes, five new rapid bus routes, 16 new shuttle/revised local routes, extension of the HSR line to Otay Mesa, new transit/pedestrian/bicycle infrastructure in Kearny Mesa and new park-and-ride facilities. The following services are shown in Figure TA 7.14.

New Trolley Lines

- La Jolla/University City to Mira Mesa via Sorrento Mesa
- University City to Chula Vista via Kearny Mesa, Mission Valley, Mid-City, southeastern San Diego communities, and National City
- Pacific Beach to El Cajon via Clairemont, Kearny Mesa, Mission Valley, SDSU, and La Mesa
- San Marcos to Carlsbad via the Palomar Airport Road corridor
- Otay Mesa to Chula Vista via Otay Ranch

New Streetcar Lines

- Escondido – North/South route from Escondido Transit Center to Citricado Parkway
- Downtown Oceanside – Neptune Way to Coast Highway SPRINTER Station along Cleveland St
- Hillcrest to Downtown Loop – connecting Hillcrest, Uptown, Balboa Park and downtown San Diego
- Little Italy to Gaslamp Loop – connecting Little Italy, Smart Corner, East Village, and Gaslamp
- Chula Vista – connecting E Street and H Street Stations to downtown Chula Vista
- National City – connecting 8th Street Station to new UTC to South Bay trolley
- Downtown El Cajon – connecting El Cajon Transit Center to downtown El Cajon

New Bus Rapid Transit Routes

- Oceanside to Sorrento Mesa
- El Cajon to University Towne Center
- Mid-City to University Towne Center
- Otay Ranch to University Towne Center

New Rapid Bus Routes

- Old Town Transit Center to University Towne Center
- Ocean Beach to La Mesa via Old Town Transit Center
- Downtown San Diego to Coronado/North Island Naval Complex
- Eastern Urban Center/Otay Ranch to H Street Station
- Otay Mesa to Imperial Beach

New Shuttle Services/Revised Local Routes

- Palomar Hospital to Nordahl Station
- Palomar College to downtown San Marcos
- Buena Station to Palomar Airport Road
- Palomar Airport Business Park Loop
- Solana Beach to Sabre Springs park-and-ride
- Solana Beach to University Towne Center
- Poway Business Park Shuttle
- Northern Sorrento Mesa Shuttle
- Southern Sorrento Mesa Shuttle
- Torrey Pines to University Towne Center
- Campus Point to University Towne Center
- University Towne Center South Shuttle Loop
- Kearny Mesa East Shuttle
- Mesa College Shuttle
- Mission Valley Shuttle System (3 routes)
- Eastern Urban Center Shuttle

High Speed Rail

- Extend HSR from Airport Intermodal Transit Center to Otay Mesa

Transit Infrastructure

- Transit/pedestrian/bicycle infrastructure (new roadway) in Kearny Mesa
- Additional park-and-ride facilities

Typical Peak Period Transit Service Standards

- Trolley – 7.5 minute service

- SPRINTER – 7.5 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – 10 minute service
- COASTER – 15 minute service
- Commuter Rail on HSR – 15 minute service
- Rapid Bus – 10 minute service
- Local Bus – 10 minute service

Analysis Results – Transit Network Alternatives

The performance analysis compares the three transit networks against one another and against the 2050 Baseline scenario. The 2050 Baseline scenario consisted of an overlay of the 2030 RTP transportation network (highway and transit) and the land use assumptions included in the 2050 Regional Growth Forecast. As noted earlier, the highway network was held constant for all of the alternative transit networks as well as the 2050 Baseline scenario, in order to isolate the performance of the alternative transit networks. The performance measure results for the three alternatives are discussed below and are presented comparatively and numerically in Technical Appendix D. In addition, capital and operating cost estimates for each network were prepared. These are described in Section 10 of this report.

Transit Mode Share

When reviewing the peak period home-to-work transit mode share results, the Many Centers alternative had the highest transit mode share by corridor/area of the three alternatives, with ten of the 14 areas projected to achieve the mode share goal. The Many Centers alternative was also projected to have the highest overall Urban Area transit mode share at 11.8 percent compared to 10.6 percent for the Transit Propensity and 10.3 percent for the Commuter Point-to-Point. None of the alternatives was projected to meet or exceed the transit mode share goal of 30 percent or greater for downtown San Diego, although the Transit Propensity and Many Centers alternatives were projected to be close, at 28.3 percent and 28 percent, respectively.

Generally, the Many Centers alternative achieved the highest mode share of the three alternatives with 12 of 14 areas and the overall Urban Area being highest, while the Transit Propensity alternative had the highest mode share for three areas, including downtown San Diego and the Central Core area. The Commuter Point-to-Point network achieved eight transit mode share goals, but did not have the highest transit mode share in any area. The mode share results are summarized below in Table TA 7.8.

Geographic corridors and areas where none of the alternatives were projected to meet the mode share goals included downtown San Diego, Central Core, Oceanside/Escondido Corridor, and the North Central Coastal Area. A possible reason for this non-attainment could be due to the measurement, which only calculated the peak period home-to-work trip for the destination areas. If the measure had included the home-to-work trips that are originating in these areas, it is possible the goals could have been achieved. Another explanation for downtown San Diego and the Central Core could be that these areas are reaching their practical capacity for transit mode share and could only be significantly increased by very dramatic changes in the level of transit, combined with other transit supportive policies related to parking, transit priority measures and/or employment growth (discussed below). With regards to the Oceanside/Escondido Corridor and the North Central Coastal Area, the surrounding land uses and low-density development patterns are challenging to serve efficiently with transit, and it is likely that only very significant transit investments, again combined with other transit supportive policies related to parking, transit priority measures, land use densities and mixes, and/or employment growth, would modify trip making behavior.

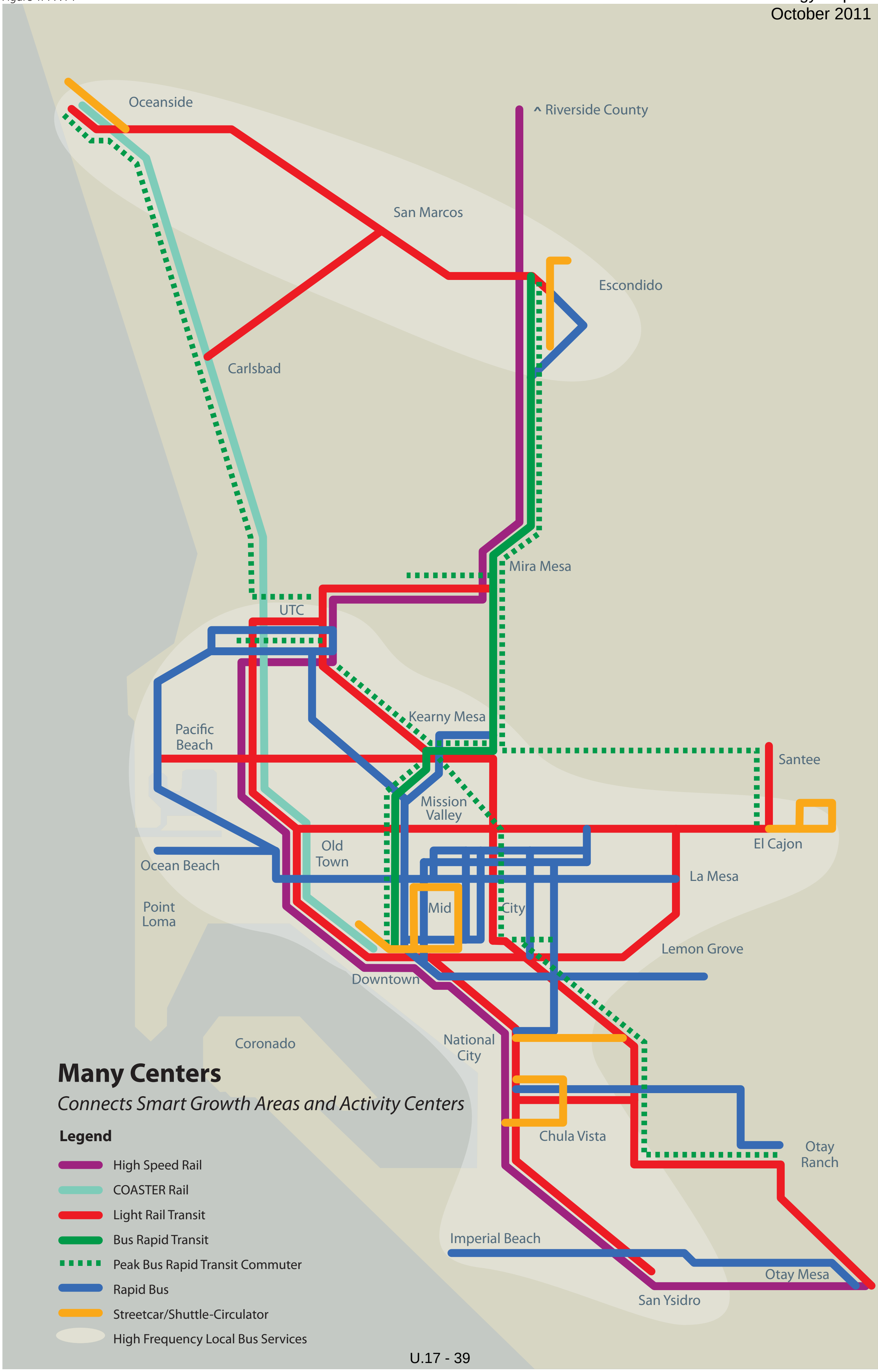

Oceanside
^ Riverside County
San Marcos
Escondido
Carlsbad
Mira Mesa
UTC
Kearny Mesa
Pacific Beach
Santee
Mission Valley
El Cajon
Old Town
Ocean Beach
La Mesa
Point Loma
Mid
City
Lemon Grove
Downtown
Coronado
National City
Chula Vista
Otay Ranch
Imperial Beach
Otay Mesa
San Ysidro
Many Centers
Connects Smart Growth Areas and Activity Centers
Legend
High Speed Rail
COASTER Rail
Light Rail Transit
Bus Rapid Transit
Peak Bus Rapid Transit Commuter
Rapid Bus
Streetcar/Shuttle-Circulator
High Frequency Local Bus Services

Table TA 7.8 – Peak Period Home-to-Work Transit Mode Share Results[1]

Peak Period Home-to-Work Transit Mode Share Results					
Identified Corridors/Areas	**2008 Existing**	**2050 Goal Ranges**	**Transit Propensity**	**Commuter Point-to-Point**	**Many Centers**
Major Employment Areas					
Downtown San Diego	24.0%	30% +	28.3%	26.4%	28.0%
University City	3.2%	15%-20%	14.1%	14.7%	16.5%
Sorrento Mesa	1.9%	10%-15%	9.4%	11.5%	11.8%
Kearny Mesa	2.6%	10%-15%	11.1%	10.9%	14.6%
Otay Mesa/Otay Ranch	2.7%	5%-10%	6.2%	4.1%	7.4%
Palomar Airport	1.4%	5%-10%	4.6%	5.3%	7.4%
High Activity Areas					
Central Core	11.8%	20%-25%	18.1%	16.3%	17.8%
Oceanside/Escondido Corridor	2.9%	10%-15%	7.1%	7.2%	7.5%
Other Urbanized Areas					
North I-15 Corridor	0.6%	5%-10%	4.3%	6.3%	6.7%
North Central Coastal Area	1.9%	10%-15%	9.2%	8.8%	8.5%
Central Coastal Area	4.7%	10%-15%	11.0%	11.0%	12.5%
Coastal South Bay	7.5%	10%-15%	12.6%	10.8%	12.8%
East County/El Cajon	4.2%	10%-15%	9.2%	8.3%	10.4%
East County/Santee	2.9%	5%-10%	6.6%	6.3%	7.5%
Urban Area Transit Strategy Study Area	**5.2%**	**10%-15%**	**10.6%**	**10.3%**	**11.8%**

[1] Values represent peak period home-to-work trip transit mode share for destination districts.

Transit Ridership

As illustrated in Table TA 7.9, the Many Centers alternative was projected to experience the largest differences from the 2050 Baseline scenario, with an overall increase in all transit measures in the 15 percent to 17 percent range – considerably more than either the Transit Propensity or Commuter Point-to-Point alternatives. Interestingly, the Many Centers alternative was projected to experience a less than one percent decrease in persons walking or biking to transit and an approximate five percent increase in auto access to transit. This outcome could be due to the addition of four new trolley lines that would be serving areas that have somewhat lower densities and thus walking distances that are outside of typical walk and bike thresholds.

The Transit Propensity alternative had the next highest changes in transit ridership measures, with improvements in the five to seven percent range. What is perhaps more interesting is the decrease in the percent of riders accessing transit by auto and the moderate increase in riders walking or biking to transit. The Commuter Point-to-Point alternative was projected to experience the smallest change in transit ridership measures, with only a one percent change in transit person trips and a less than five percent change in transit passenger miles and peak period person trips. The Commuter Point-to-Point alternative experienced a nearly eight percent increase in riders accessing transit by auto, which is not unexpected considering that this alternative focused more on transit based on Managed Lanes and park-and-ride access points that extended into suburban areas.

Table TA 7.9 – Transit Ridership Performance Measure Results

Transit Ridership Measures	2050 Baseline	Transit Propensity	Commuter Point-to-Point	Many Centers
Change in Transit Person Trips (Regional)	401,178	7.3%	1.0%	15.3%
Change in Transit Passenger Miles (Regional)	5,196,725	3.9%	4.0%	14.7%
Change in Transit Peak Period Person Trips (Regional)	177,768	7.4%	4.5%	17.5%
Change in Mode of Access to Transit				
Walking/Biking	89.8%	0.7%	-0.9%	-0.5%
Auto (drove and driven)	10.2%	-6.1%	7.9%	4.7%

Transportation Network Efficiency

The transportation network efficiency measures provide the ability to understand how efficiently the transit network and the overall transportation network are functioning for each alternative scenario. Results for those measures are shown in Table TA 7.10. In reviewing the passenger mile per transit seat mile, all of the alternatives perform relatively closely, with the Transit Propensity and Commuter Point-to-Point alternatives performing slightly better than the Many Centers alternative. Interestingly, all alternatives perform slightly less efficiently than the 2050 Baseline alternative. This result is due to the considerable increase in transit service in all of the alternatives as compared to the 2050 Baseline scenario. This result also points to the need for further refinements to the three alternative networks, as particular route segments or service levels could be eliminated or reduced.

When reviewing the overall transportation network performance measures, all three alternatives provide reductions in the per capita vehicle miles traveled. However, the Many Centers alternative is projected to have the largest reduction at -0.4 percent, compared to -0.1 percent for the Transit Propensity and Commuter Point-to-Point, respectively. The same pattern is apparent when assessing the change in per capita vehicle hours and per capita vehicle trips, with projected reductions for the Many Centers alternative higher than the other two alternatives. Again, additional refinements to transit routes and services as well as the base highway assumptions would likely produce additional improvements in these efficiency measures.

Table TA 7.10 – Efficient Transportation Network Performance Measure Results

Efficient Transportation Network Measures	2050 Baseline	Transit Propensity	Commuter Point-to-Point	Many Centers
Passenger Miles per Transit Seat Mile	47%	38%	38%	34%
Change in Auto Vehicle Miles Traveled (VMT) per capita	26.9	-0.1%	-0.1%	-0.4%
Change in Auto Vehicle Hours Traveled (VHT) per capita	0.8	-0.3%	-0.2%	-0.8%
Change in Auto Vehicle Trips per capita	3.5	-0.1%	0.0%	-0.3%

Sustainability

A number of performance measures were identified to assess the sustainability of the transit network alternatives, as well as the underlying transportation network. As noted in Table TA 7.11 below, the greenhouse gas analysis was not completed at the time of screening, but other sustainability performance measures were available for review and assessment. Both the peak period and all-day non-motorized mode share values did not vary by alternative and were not projected to change from the 2050 Baseline scenario projections of 3.3 percent and 3.0 percent, respectively. However, the number of bike facilities within a 1/2 mile of a major transit station projected for all alternatives is projected to be higher than for the 2050 Baseline scenario, at 166 miles, 190 miles, and 192 miles for the Transit Propensity, Commuter Point-to-Point and Many Centers alternatives, respectively.

The 2050 Baseline scenario is projected to provide transit service within a 1/4 mile to approximately 21 percent of the total regional employment. The Commuter Point-to-Point alternative provides transit service to the highest percent of total regional employment, at nearly 31 percent. This result is not surprising, as the alternative was designed to focus on providing transit service to regional employment centers. The Many Centers alternative provides transit service within a 1/4 mile of 28 percent of all regional jobs, with the Transit Propensity alternative projected to cover approximately 25 percent of all regional employment. These numbers increase when the 1/4 mile radius is expanded to 1/2 mile. This is further detailed in Technical Appendix D.

The percentage of housing units projected to be within 1/2 mile of a major transit station with ten minute or better service is nearly 40 percent for the Many Centers alternative, approximately 31 percent for Transit Propensity, and 19 percent for the Commuter Point-to-Point alternative. These values are compared to approximately 23 percent for the 2050 Baseline scenario. The lesser value for the Commuter Point-to-Point is due to the focus on provision of peak period, one-seat ride commute trips, which generally have longer distances and longer headways between scheduled trips. These percentages increase when measuring the proportion of housing units projected to be within 1/2 mile of a major transit station with 15 minutes or better. This is further detailed in Technical Appendix D. When assessing the percent of housing units within 1/2 mile of a major transit station with 15-minute service frequencies, the values for the three alternatives are more similar, at 39 percent, 37 percent, and 40 percent for Many Centers, Transit Propensity and Commuter Point-to-Point, respectively.

Table TA 7.11 – Sustainability Performance Measure Results

Sustainability	2050 Baseline	Transit Propensity	Commuter Point-to-Point	Many Centers
Estimated Change in GHG (tentative)	Not available at time of screening			
Peak Period Non-Motorized Mode Share in Urban Area	3.3%	3.3%	3.3%	3.3%
All-Day Non-Motorized Mode Share in Urban Area	3.0%	3.0%	3.0%	3.0%
Compatibility with Regional Bike Plan (miles of bike facilities within 1/2 mile of major transit station)	146	166	190	192
Percent of Jobs within 1/4 Mile of Major Transit Stations	21.3%	25.5%	30.8%	28.1%
Percent of Housing Units w/in 1/2 Mile of Major Transit Stations with 10 Minute or Better Service	23.4%	31.5%	19.1%	38.8%
Percent of Housing Units within 1/2 mile of Major Transit Stations with 15 Minute or Better Service	31.2%	36.6%	39.8%	39.4%
Compatibility with Regional Activity Centers (Hospitals, Universities/Colleges, Shopping Malls, and Tourist Attractions within 1/2 Mile of Major Transit Stations)	40	45	47	48

Compatibility with regional activity centers is roughly similar for all three alternatives. The 2050 Baseline scenario is projected to provide service to a major transit station within 1/2 mile to 40 regional activity centers. The Transit Propensity alternative is projected to increase the number of activity centers to 45, Commuter Point-to-Point is estimated to be 47, and the Many Centers alternative to 48.

Environmental Justice

As shown in Table TA 7.12, the percent of minority populations projected to be within 1/2 mile of major transit stations is 34 percent for the 2050 Baseline scenario, 40 percent for the Transit Propensity, 43 percent for the Commuter Point-to-Point, and approximately 42 percent for the Many Centers alternative. Results for the percent of low-income households within one-half mile of major transit stations is 50 percent for both the Commuter Point-to-Point and Many Centers alternatives, and 48 percent for the Transit Propensity alternative, compared to approximately 41 percent for the 2050 Baseline scenario. Title VI requires analysis of the burdens of regional transportation system improvements on low-income and minority populations. Measures in this category must evaluate the comparative percent improvement between low-income and non-low-income populations and minority and non-minority populations. The data for these measures indicates no disparate impacts for either of these measures.

The percent of aged 75+ populations is calculated using 1/4 mile distance. As noted earlier, this population group is likely to find it difficult to walk longer distances. All alternatives are expected to provide improved access to transit to the percent of persons aged 75+ than the 2050 Baseline scenario with a projected percentage of approximately 13 percent. The Transit Propensity alternative is projected to reach 15 percent, Commuter Point-to-Point nearly 16 percent, and Many Centers nearly 17 percent. When calculated for all transit stations, not just major transit stations, the percentages increase to approximately 57-58 percent for all scenarios.

The percent of zero-car households within 1/2 mile of major transit stations is 44 percent for the 2050 Baseline scenario, compared to 52 percent, 55 percent, and nearly 55 percent for the Transit Propensity, Commuter Point-to-Point, and Many Centers alternatives, respectively. It should be noted that this performance measure is based on the 2000 census data, as the SANDAG regional model does not calculate future projections for this category.

Table TA 7.12 – Environmental Justice Performance Measure Results

Environmental Justice	2050 Baseline	Transit Propensity	Commuter Point-to-Point	Many Centers
Percent of Minority Populations within 1/2 Mile of Major Transit Stations	34.4%	39.8%	42.7%	42.5%
Percent of Non-Minority Populations within 1/2 Mile of Major Transit Stations	20.2%	23.4%	26.2%	25.6%
Percent of Low-Income Households within 1/2 Mile of Major Transit Stations	41.4%	48.1%	50.5%	50.5%
Percent of Non-Low-Income Households within 1/2 Mile of Major Transit Stations	18.0%	20.8%	23.9%	23.2%
Percent of 75+ Population within 1/4 Mile of Major Transit Stations	12.7%	15.3%	15.6%	16.6%
Percent of 75+ Population within 1/4 Mile of All Transit Stations	58.7%	58.5%	58.3%	57%
Percent Zero-Car Households within 1/2 Mile of Major Transit Stations (2000 census data)	43.9%	52.1%	55.0%	54.6%

Cost Effectiveness

As stated in Section 7, due to a number of factors, data for cost effectiveness measures was not completed. Comparable data that was produced centered on preliminary rough-order-of-magnitude (ROM) capital cost estimates for each alternative transit network, further discussed in Section 10 (Capital Costs and Methodology).

Summary Analysis of Performance Measures Results

The above discussed results show that all three scenarios yielded improvements ranging from modest to significant in most performance measures when compared against the 2050 Baseline scenario, with the exception of transit passenger miles per transit seat mile. The analysis also showed that while none of the scenarios performed the best in all categories, the Many Centers scenario appeared to have the highest overall performance. The Many Centers alternative also comes with the highest capital and operating costs. The analysis also showed that there were effective elements in the Transit Propensity, Commuter Point-to-Point, and Many Centers alternatives that could be refined and developed into a combined strategy.

Peer Review Panel

SANDAG commissioned a Peer Review Panel to take a critical look at the three transit network alternatives. The Peer Review Panel consisted of professionals in land use, economics, transportation, congestion management, transit management, and transit oriented development from the United States and Europe. Peer Review Panel member biographies are included in Technical Appendix F.

Generally, the Peer Review Panel felt that the Transit Propensity and Many Centers transit networks had the most merit and could each result, to varying degrees, in a successful long-term transit network. The Panel predicted that the plan's ultimate success would be through the implementation of near-term demonstration or catalyst projects that showcase elements of the transit vision, particularly the integration of transit into smart growth areas.

More specifically, the Panel made the following observations about the scenarios:

Transit Propensity: The Panel observed that this scenario may have been too focused on some geographically-concentrated areas to the exclusion of other areas (such as major employment areas, University City, and North County) to meet the region's long-term mobility goals.

Commuter Point-to-Point: The Panel felt that this scenario may encourage longer trips by both autos and transit, and that this scenario portrayed a more "business as usual" approach that may not have the ability to influence land use decisions toward more integrated communities and sustainability.

Many Centers: The Panel commented that this scenario provided a solid vision, but needed refinements, including prioritizing transit investments in existing and near-term smart growth areas. The Panel also recommended that SANDAG revisit its Smart Growth Concept Map and consider making changes that might combine smaller smart growth areas into larger ones, thereby creating "smarter" smart growth areas and concepts.

In addition, the Panel provided broader, more global observations on economic competitiveness; technological savvy; world-class region; sustainability and co-benefits; land use development around transit stations; land use, freeways, and parking; project prioritization; leadership; and dedicated funding sources. Technical Appendix G contains the additional detail and information on the Peer Review Panel comments.

9. Unconstrained Transit Network

Based on the comments from the Peer Review Panel, the performance measure results, and input from SANDAG working groups, Policy Committees, the SANDAG Board of Directors, and the public workshops, the project team developed a hybrid transit network that would not be constrained by revenue projections. This new transit network, known as the Unconstrained Transit Network, pulled in the best elements of the three transit network alternatives and incorporated refinements and modifications to some of the proposed routes and transit services. The Unconstrained Transit Network was developed for the RTP's horizon year of 2050 and represented the region's vision for transit improvements and operations to meet travel demand in 2050. As a result, it established the broadest network from which the revenue constrained network scenarios would later be developed.

Like the three initial transit network alternatives, the Unconstrained Transit Network included the following major infrastructure components: High Speed Rail (HSR) to an intermodal transit center at San Diego International Airport, commuter rail overlay using the HSR alignment, double-tracking of the COASTER and SPRINTER rail lines, the Downtown San Diego Trolley Tunnel, and the Kearny Mesa Guideway. Also included in the Unconstrained Network were a downtown bus tunnel and transit hubs to facilitate bus travel through downtown, the extension of the HSR with commuter rail service from the San Diego International Airport to the United States-Mexico international border crossing in Otay Mesa, and the UTC COASTER station and tunnel.

The new transit routes and services contained in the Unconstrained Transit Network included six new trolley lines, ten new streetcar lines, 11 new BRT routes, 21 new Rapid Bus routes, 16 new shuttle/revised local routes, upgrades to Trolley and SPRINTER lines for Express service, an extension of the SPRINTER to the Fig Street in Escondido, and additional park-and-ride facilities. Figure TA 7.15 graphically depicts the services included in the Unconstrained Transit Network.

New Trolley Lines

- San Diego State University to San Ysidro
- San Diego State University to downtown San Diego
- Villa La Jolla to Mira Mesa
- University Towne Center to Chula Vista
- Pacific Beach to Kearny Mesa/SDSU/El Cajon
- Otay Mesa to Chula Vista

New Streetcar Lines

- Escondido – East/West route from Escondido Transit Center to Fig Street
- San Marcos – connecting California State University San Marcos, downtown San Marcos and Palomar College
- Downtown Oceanside – Oceanside Transit Center to Oceanside Boulevard SPRINTER Station
- Mission Bay to La Jolla – connecting Mission Bay, Pacific Beach and La Jolla
- Hillcrest to Downtown Loop – connecting Hillcrest, Uptown, Balboa Park and downtown San Diego
- Little Italy to Gaslamp Loop – connecting Little Italy, Smart Corner, East Village, and Gaslamp
- 30th Avenue – connecting University Heights, North Park, South Park, East Village and downtown San Diego.
- Chula Vista – connecting E Street and H Street Stations to downtown Chula Vista
- National City – connecting 8th Street Station to new UTC to South Bay trolley
- Downtown El Cajon – connecting El Cajon Transit Center to downtown El Cajon

New Bus Rapid Transit Routes

- Rancho Bernardo to downtown San Diego Express
- Escondido to downtown San Diego Express
- Temecula/Escondido to Kearny Mesa/downtown San Diego
- Chula Vista to Palomar Airport/San Marcos
- Downtown San Diego to University Towne Center
- Mid-City to Palomar Airport/San Marcos
- Otay Mesa to El Cajon
- El Cajon to University Towne Center
- El Cajon to Sorrento Mesa/Torrey Pines
- Oceanside to Sorrento Mesa
- Escondido to Oceanside

New Rapid Bus Routes

- 30th Avenue to downtown San Diego
- La Mesa to Ocean Beach
- Spring Valley to downtown San Diego to SDSU
- Point Loma to Kearny Mesa
- Old Town to La Jolla/University Towne Center/Sorrento Mesa
- Old Town/Mission Valley to Clairemont/University Towne Center
- Kearny Mesa to downtown San Diego
- Euclid Trolley Station to Grantville
- Escondido to North County Fair
- Palomar Airport Road/Carlsbad to San Marcos
- Escondido Rapid
- Oceanside to University Towne Center
- Oceanside to Vista
- Camp Pendleton to Carlsbad Village
- Eastlake to Palomar Trolley Station
- SDSU to Spring Valley
- North Park to 32nd Street
- San Ysidro to Otay Mesa
- Iris Trolley Station to North Island Naval Air Station
- Eastern Urban Center to H Street Trolley Station
- Downtown to Coronado/North Island Naval Air Station

New Shuttle Services/Revised Local Routes

- Palomar Hospital to Nordahl Station
- Palomar College to downtown San Marcos
- Buena Station to Palomar Airport Road
- Palomar Airport Business Park Loop
- Solana Beach to Sabre Springs park-and-ride
- Solana Beach to University Towne Center
- Poway Business Park Shuttle
- Northern Sorrento Mesa Shuttle
- Southern Sorrento Mesa Shuttle
- Torrey Pines to University Towne Center
- Campus Point to University Towne Center
- University Towne Center South Shuttle Loop

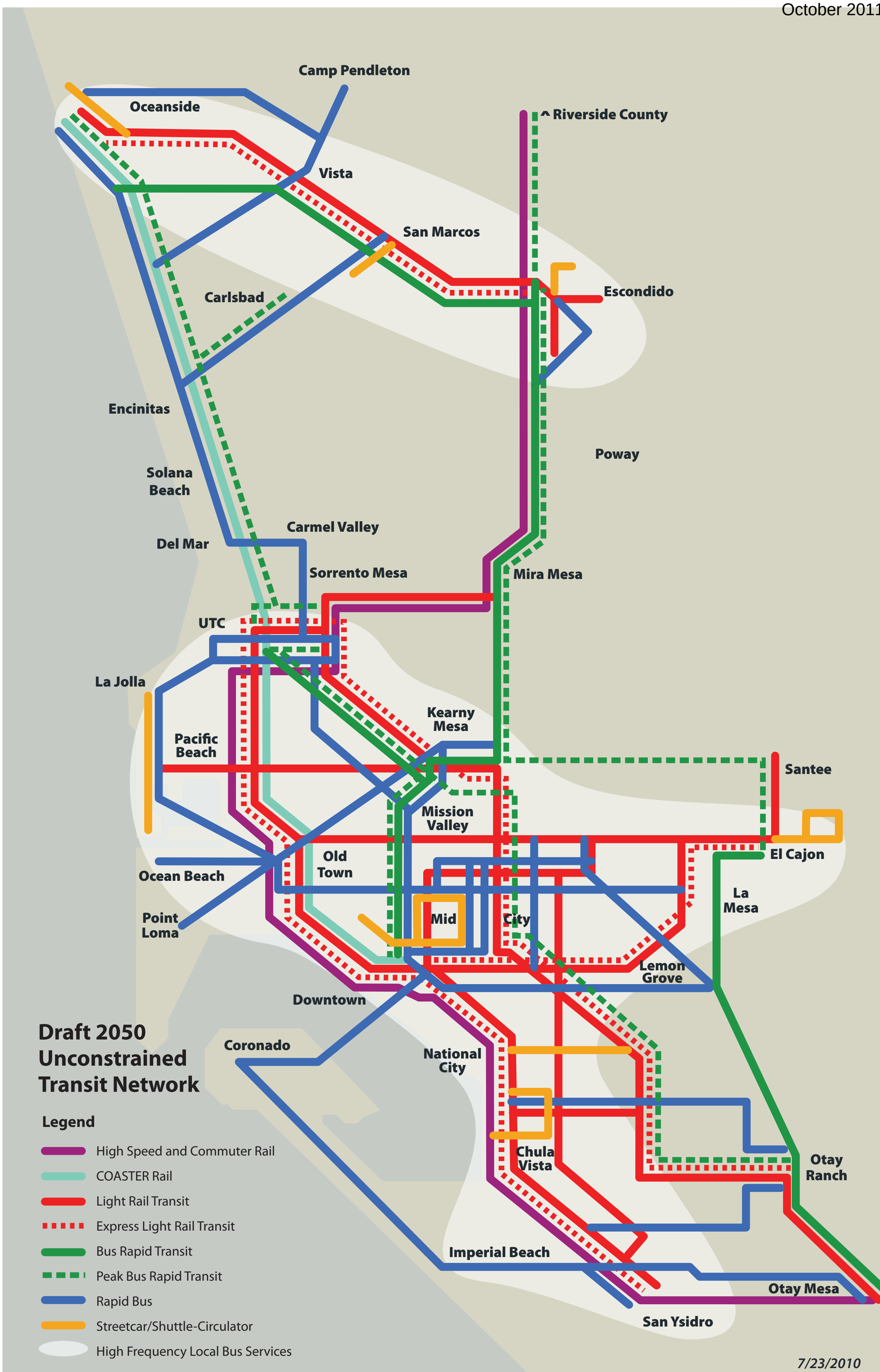
- Kearny Mesa East Shuttle
- Mesa College Shuttle
- Mission Valley Shuttle System (3 routes)
- Eastern Urban Center Shuttle

Transit Infrastructure

- Transit/pedestrian/bicycle infrastructure (new roadway) in Kearny Mesa
- Kearny Mesa Guideway
- Downtown Trolley Tunnel
- Downtown bus tunnel and transit hubs
- UTC COASTER station and tunnel
- Additional park-and-ride facilities

Typical Peak Period Transit Service Standards

- Trolley – 7.5 minute service
- SPRINTER – 7.5 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – 10 minute service
- COASTER – 15 minute service
- Commuter Rail on HSR – 15 minute service
- Rapid Bus – 10 minute service
- Local Bus – 10 minute service


Camp Pendleton
Oceanside
Riverside County
Vista
San Marcos
Escondido
Carlsbad
Encinitas
Poway
Solana Beach
Carmel Valley
Del Mar
Sorrento Mesa
Mira Mesa
UTC
La Jolla
Kearny Mesa
Pacific Beach
Santee
Mission Valley
El Cajon
Old Town
Ocean Beach
La Mesa
Point Loma
Mid
City
Lemon Grove
Downtown
Draft 2050 Unconstrained Transit Network
Coronado
National City
Legend
High Speed and Commuter Rail
COASTER Rail
Light Rail Transit
Express Light Rail Transit
Bus Rapid Transit
Peak Bus Rapid Transit
Rapid Bus
Streetcar/Shuttle-Circulator
High Frequency Local Bus Services
Chula Vista
Otay Ranch
Imperial Beach
Otay Mesa
San Ysidro
7/23/2010

Transit Mode Share

When reviewing the transit mode share results for the Unconstrained Transit Network, the overall patterns were similar to those for the three initial transit alternatives, with ten of the fourteen areas meeting the mode share goals. In general, the Unconstrained Transit Network showed very similar results to the Many Centers alternative. The highest transit mode shares under the Unconstrained Transit Network scenario were in downtown San Diego, University City, the Central Core, and the Central Coastal areas. The overall transit mode share for the UATS study area was projected to be 11.4 percent, as compared to 11.8 percent for Many Centers, 10.6 percent for Transit Propensity and 10.3 percent for Commuter Point-to-Point (Table TA 7.13).

Table TA 7.13 – Peak Period Home to Work Transit Mode Share Results for the Three Initial Transit Network Alternatives and for the Unconstrained Transit Network[1]

Peak Period Home-to-Work Transit Mode Share Results					
Identified Corridors/Areas	**2050 Goal Ranges**	**Transit Propensity**	**Commuter Point-to-Point**	**Many Centers**	**Unconstrained Transit Network**
Major Employment Areas					
Downtown San Diego	30% +	28.3%	26.4%	28.0%	29.4%
University City	15%-20%	14.1%	14.7%	16.5%	17.1%
Sorrento Mesa	10%-15%	9.4%	11.5%	11.8%	10.4%
Kearny Mesa	10%-15%	11.1%	10.9%	14.6%	13.4%
Otay Mesa/Otay Ranch	5%-10%	6.2%	4.1%	7.4%	7.5%
Palomar Airport	5%-10%	4.6%	5.3%	7.4%	5.6%
High Activity Areas					
Central Core	20%-25%	18.1%	16.3%	17.8%	18.3%
Oceanside/Escondido Corridor	10%-15%	7.1%	7.2%	7.5%	7.1%
Other Urbanized Areas					
North I-15 Corridor	5%-10%	4.3%	6.3%	6.7%	5.9%
North Central Coastal Area	10%-15%	9.2%	8.8%	8.5%	8.4%
Central Coastal Area	10%-15%	11.0%	11.0%	12.5%	14.3%
Coastal South Bay	10%-15%	12.6%	10.8%	12.8%	12.7%
East County/El Cajon	10%-15%	9.2%	8.3%	10.4%	10.0%
East County/Santee	5%-10%	6.6%	6.3%	7.5%	7.1%
Urban Area Transit Strategy Study Area	**10%-15%**	**10.6%**	**10.3%**	**11.8%**	**11.4%**

[1] Values represent peak period home-to-work trip transit mode share for destination districts.

10. Capital and Operating Costs and Methodology

Capital Cost Estimates

Methodology

The Parsons Brinckerhoff project team developed Rough-Order-of-Magnitude (ROM) capital cost estimates for the newly identified transit routes and services in each initial transit network alternative (Transit Propensity, Commuter Point-to-Point, and Many Centers) and for the Unconstrained Transit Network for the following transit modes:

- Light Rail Transit (LRT)
- Bus Rapid Transit (BRT)
- Rapid Bus
- Commuter Rail
- Streetcar

These cost estimates were developed using a methodology that is consistent with Federal Transit Administration (FTA) guidelines, the basis of which is the Standard Cost Category (SCC) format. The FTA Standard Cost Categories used to develop the capital cost components were classified into the following cost categories:

10 Guideway and Track Elements

20 Station, Stops, Terminals and Intermodal

30 Support Facilities: yards, shops, and administration buildings (not used)

40 Sitework and Special Conditions

50 Systems

60 Right of Way, Land and Existing Improvements

70 Vehicles (not used)

80 Professional Services

90 Unallocated Contingency (10%)

100 Finance Charges (not used)

Capital cost estimates were developed for every new transit project proposed in each transit network alternative. Individual transit routes and services were estimated based on high-level assumptions and information for at-grade, aerial or tunnel alignments, the number of stations, and the use of existing roadway facilities such as freeway managed lanes, etc. These cost estimates were developed using historical prices for similar types of work. Right of way costs were developed based on historical right of way costs incurred as a percentage of construction cost in San Diego on transit projects. No engineering was performed to verify these costs, and finance charges were not assumed.

Support facilities such as maintenance facilities, yard, administration buildings, etc., and vehicles and vehicle replacement costs were not accounted for in the Parsons Brinckerhoff estimates. The costs of these facilities and vehicles were added later when the overall system needs had been defined.

Contingencies

During the early stages of design, significant uncertainties exist to the extent that the work scope is often limited to a broad description of horizontal and vertical alignments. At this phase of the project development process, inherent uncertainties that could limit capital cost estimates included:

- Standard Design Criteria
- Scope and Quantity Definition
- Commodity Pricing
- Unforeseen Problems

As such, two levels of contingencies were applied at the project level, and a third level of contingency was applied at the network level. At the project level, the first contingency included allocated contingencies by FTA SCC line item (generally in the 10 - 40 percent range) to address lack of scope and/or quantity definition based on the Standard Cost Categories for construction or professional services categories. The second contingency, also at the project level, was the application of an unallocated contingency of ten percent to each individual project to cover unknowns that cannot be anticipated, but are prudent to include for planning purposes. These were calculated as ten percent of the total project cost estimate, including the soft costs, as reflected in Standard Cost Category 90 above. The third contingency was applied at the network level, and consisted of an unallocated contingency of 20 percent to cover additional system-wide unknowns for new projects. This contingency was calculated as 20 percent of the total sum of all new projects contained in each transit network alternative.

Although the actual capital cost of each project may ultimately vary significantly from that developed here, the overall cost of the system improvements is expected to be a reasonable estimate when used for the comparison of system-wide alternatives. Technical Appendix H, Planning Level Capital Cost Estimating Methodology Report (New Projects), provides additional detail and information.

Capital Cost Estimates for the Initial Transit Network Alternatives

The cost estimates represent new transit routes and services developed for the individual transit network alternatives as of June 2010, and do not include the capital costs associated with ongoing transit projects included in the 2030 RTP that carry over into the 2050 RTP. Those costs were updated and refined as part of the 2050 RTP planning process and later incorporated into the overall cost of the Unconstrained Transit Network, the initial Revenue Constrained Transit Networks, the Preferred Revenue Constrained Transit Network, and ultimately, the 2050 Revenue Constrained Transit Network included in the Final 2050 RTP. Examples include double-tracking of the COASTER, the Mid-Coast Trolley extension, the South Bay BRT, and other transit projects.

Table TA 7.14 provides the following information for each transit network alternative: the level of investment for new transit projects by transit mode, the subtotal for new transit projects, the 20 percent network-level unallocated contingency, and the total preliminary capital cost estimates for the new transit projects. All costs are shown in 2009 dollars (totals may differ due to rounding).

There were various similarities among the network alternatives. For example, two major cost components of all three alternatives were the Downtown San Diego Trolley Tunnel, estimated at $2.160 billion, and the Kearny Mesa Guideway at $2.753 billion. These are reflected in the “infrastructure” line item (and described further below), along with other less-costly infrastructure investments. The three alternatives also included a number of shuttle services and changes to local bus services. These transit modes are not reflected in the table, as no capital costs for facilities or infrastructure was assumed since these services would utilize existing roadways and transit facilities, such as existing stops.

Where the alternatives differed was in the provision of service by major transit mode. The Transit Propensity alternative had a large investment in new trolley lines and streetcar lines, again with a focus on providing all-day service to areas of existing density. The Commuter Point-to-Point focus was on the provision of BRT and Rapid Bus service, with some extension and augmentation of COASTER service, focusing on providing commuter-based peak period services. Lastly, the Many Centers alternative was heavily weighted toward the provision of new trolley lines, followed by streetcar service, and to a lesser degree Rapid Bus, focusing on providing service to a larger portion of the UATS study area.

Table TA 7.14 – Preliminary Capital Cost Estimates for the Three Initial Transit Network Alternatives[1] (2009 Dollars)

Transit Mode	Transit Propensity	Commuter Point-to-Point	Many Centers
Light Rail Transit	$2,180.0 M	$0.0 M	$4,310.5 M
Bus Rapid Transit	$9.3 M	$363.4 M	$72.1 M
Streetcar	$986.7 M	$0.0 M	$802.2 M
Rapid Bus	$49.8 M	$361.0 M	$228.8 M
Commuter Rail	$0.0 M	$151.5 M	$0.0 M
Supporting Transit Infrastructure [2]	$5,134.6 M	$5,134.6 M	$5,770.2 M
Subtotal	**$8,360 M**	**$6,102 M**	**$11,184 M**
20% Network Level Unallocated Contingency	$1,672 M	$1,220.4 M	$2,236.8 M
Total	**$10,032 M**	**$7,213 M**	**$13,421 M**

[1] New transit projects only

[2] Includes capital infrastructure that supports more than one transit service (e.g., Downtown Trolley Tunnel and Kearny Mesa Guideway) for all three alternatives, plus bike/pedestrian access to transit improvements in Kearny Mesa and other areas for the Many Centers alternative.

As reflected in Table TA 7.14, the Many Centers alternative had the highest capital cost of the three transit scenarios at approximately $13.4 billion; the Transit Propensity network fell in the middle at approximately $10 billion; and the Commuter Point-to-Point alternative was the least costly at approximately $7.2 billion.

Capital Cost Estimates for Unconstrained Transit Network

The capital cost estimate for the Unconstrained Transit Network contained many of the routes and services included in all three transit networks, refinements and modifications to some of the proposed routes and transit services, and the addition of items that were not originally included in the cost estimates of the three initial alternatives. As such, the cost estimate for the Unconstrained Transit Network was considerably larger than for any of the three alternatives.

As reflected below in Table TA 7.15, the initial Unconstrained Transit Network had a capital cost estimate double that of the most costly Many Centers network alternative. The increase in costs was minimally attributable to route modifications and cost refinements, and mostly attributable to the incorporation of various large-scale infrastructure items that were not originally included in the cost estimates for the three initial alternatives. In particular, the Del Mar and UTC COASTER tunnels were incorporated into the Commuter Rail line item; a bus tunnel and transfer hubs in downtown San Diego were added to the Infrastructure line item; and an update for the cost to double-track the SPRINTER line and modifications to allow Express runs on the Blue, Orange, and Green Trolley lines, and the SPRINTER were reflected in the Light Rail Transit line item. The last column in Table TA 7.15

reflects these changes, and results in an initial approximate capital cost of $27.5 billion for the Unconstrained Transit Network, which was subsequently further refined, as discussed below.

Table TA 7.15 – Preliminary Capital Cost Estimates for the Unconstrained Transit Network (2009 Dollars)

Transit Mode	Transit Propensity	Commuter Point-to-Point	Many Centers	Unconstrained Transit Network
Light Rail Transit	$2,180.0 M	$0.0 M	$4,310.5 M	$8,554.1 M [1]
Bus Rapid Transit	$9.3 M	$363.4 M	$72.1 M	$324.9 M
Streetcar	$986.7 M	$0.0 M	$802.2 M	$1344.6 M
Rapid Bus	$49.8 M	$361.0 M	$228.8 M	$978.1 M
Commuter Rail	$0.0 M	$151.5 M	$0.0 M	$3,477.1 M [2]
Supporting Transit Infrastructure [3]	$5,134.6 M	$5,134.6 M	$5,770.2 M	$8,198.6 M [4]
Subtotal	$8,360 M	$6,102 M	$11,184 M	$22,877 M
20% Network Level Unallocated Contingency	$1,672 M	$1,220.4 M	$2,236.8 M	$4,575.4 M
Total	**$10,032 M**	**$7,213 M**	**$13,421 M**	**$27,452 M** [5]

[1] Includes updated costs to double track SPRINTER and modifications to allow express runs on Blue, Orange, and Green Trolley lines and SPRINTER line

[2] Includes Del Mar and UTC COASTER tunnels

[3] Includes capital infrastructure that supports more than one transit service (e.g. Downtown Trolley Tunnel and Kearny Mesa Guideway) for all three alternatives and the Unconstrained Transit Network; bike/pedestrian access to transit improvements in Kearny Mesa and other areas for the Many Centers alternative and Unconstrained Transit Network

[4] A bus tunnel and transfer hubs in downtown San Diego

[5] Initial total; see additional refinements below

Additional Refinements

These preliminary capital cost estimates for the Unconstrained Transit Network produced by Parsons Brinckerhoff did not include transit maintenance facilities, transit system rehabilitation costs, and vehicle and vehicle replacement costs. These costs were subsequently added, resulting in an estimated capital cost of $33 - $38 billion, and an operating subsidy cost (total operating cost minus fare revenues) of $6 - 8 billion (see methodology below), for a total Unconstrained Transit Network cost of $39 - $46 billion, as of July 2010, in 2009 dollars.

These cost estimates continued to be refined throughout the remainder of the RTP planning process. For example, the capital costs of ongoing transit projects included in the 2030 RTP that would carry over into the 2050 RTP, as well as other refinements, were incorporated into the Revenue Constrained Transit Network Scenarios, the Preferred Revenue Constrained Transit Network, and then subsequently into the 2050 Revenue Constrained Transit Network. Ultimately, the final capital costs were converted to Year-of-Expenditure, as required by federal guidelines that went into effect December 11, 2007, for the preparation of regional transportation plans. The Year-of-Expenditure costs are included in the main body of the RTP while the final costs in constant 2010 dollars[2] are detailed in the 2050 RTP Technical Appendix 5.

[2] The 2009 initial network costs were converted to 2010 dollars for the transportation network in the RTP.

Operating Cost Estimates

Methodology

To calculate the initial operating costs for both existing and new transit services in the Unconstrained Transit Network, the Revenue Constrained Transit Networks, the Preferred Revenue Constrained Transit Network, and the 2050 Revenue Constrained Transit Network, SANDAG used revenue hours from the regional transportation model, and applied hourly operating rates based on 2009 information provided by MTS and NCTD. The hourly operating rates were applied to the following service types:

- Bus (MTS)
- Contract Bus (MTS)
- Contract Bus (NCTD)
- Rapid Bus
- BRT Highway
- Trolley/Streetcar
- COASTER/HSR Commuter Rail Overlay
- SPRINTER
- Additional factor to account for complementary Americans with Disabilities Act (ADA) service cost

An initial farebox recovery rate was assumed for all modes for three-fourths of the life of the plan (30 years) for the Unconstrained Transit Network until phasing could be conducted. Phasing was later conducted as part of the Preferred Revenue Constrained Transportation Network and the 2050 Revenue Constrained Transit Network, which allowed for significant refinements to the initial operating cost and farebox recovery ratio that was reported in July 2010. See the 2050 RTP Technical Appendix 5 for additional information on the final operating costs in constant 2009 dollars.

11. Revenue Constrained Transportation Network Scenarios

Based on revenue projections to 2050, four initial Revenue Constrained Transportation Network Scenarios were developed using the prioritized project ranking list (Technical Appendix I) and other factors. The four revenue constrained scenarios contained both transit and highway networks that matched up complimentary combinations of transit and highway investments, with varying levels of emphasis on investment options. The scenarios are illustrated in a side-by-side format in Technical Appendix J, and summarized as follows:

- **Transit Emphasis Scenario** – Focused on expansion of the regional transit system given flexible funding availability.

- **Rail/Freight Scenario** – Focused on expansion of the regional transit system with an emphasis on rail projects and also highway improvements to support freight given flexible funding availability.

- **Highway Emphasis Scenario** – Focused on expansion of highway system improvements that provide system-wide congestion relief for people and freight given flexible funding availability.

- **Fusion Scenario** – Focused on implementing projects and programs considering the preferred choices identified in the 2050 RTP telephone survey. The choices from the survey included emphasis on new public transit services (rail and bus), highway improvements (bottleneck relief and new lanes), and increased frequencies to existing transit routes.

Transit Projects Common to All Scenarios

Several transit projects were common to all four Scenarios, including a number of "baseline" or ongoing projects (most of them included in the *TransNet* Extension Ordinance) that are in various stages of advanced planning, design, or construction, but were not projected to be completed by the time the 2050 RTP was adopted. It was, therefore, necessary to assume the costs and construction of these projects in the transit networks of all four Scenarios. These baseline projects included:

- Mid-Coast Trolley extension
- Trolley system rehabilitation
- Interstate 15 (I-15) Bus Rapid Transit (BRT) from Escondido to downtown San Diego
- I-15 BRT from Escondido to Sorrento Mesa/University City
- South Bay BRT from Otay Mesa to downtown San Diego
- Mid-City Rapid Bus from San Diego State University to downtown San Diego
- South Bay transit maintenance facilities and downtown BRT stations/layovers

Other projects from the Unconstrained Transportation Network common to all four Scenarios included:

- High-Speed Rail (HSR) from Los Angeles to Lindbergh Field Intermodal Transportation Center (ITC)
- HSR Commuter Rail Overlay from Temecula to Lindbergh Field ITC
- Lindbergh Field Intermodal Transit Center
- COASTER double-tracking (*TransNet*), including several grade separations
- COASTER Del Mar Tunnel
- COASTER positive train control
- SPRINTER double-tracking (*TransNet*)
- Enhanced service frequencies on Blue, Orange, and Green Trolley lines, including several grade separations needed for the increased frequencies (*TransNet*)
- Several Rapid Bus routes in key high demand arterial corridors
- Shuttle/Circulator service in San Marcos (to be locally funded)
- Increased service frequencies on local bus routes within the Urban Area to 10-minute all-day
- Bike and pedestrian network improvements to support access to the regional transit system

Varying Transit Projects/Investments

The four revenue constrained scenarios are discussed further below. During the development of the scenarios, it became helpful to understand that there were several major capital investments that, while included in the Unconstrained Transit Scenario, could not be included equally in all of the Revenue Constrained scenarios due to revenue constraints. These major capital investments included: the Downtown Trolley Tunnel, the Kearny Mesa Guideway, the UTC COASTER Station and Tunnel, and a number of new LRT lines in existing and new corridors, as described below.

- **Downtown Trolley Tunnel:** The Downtown Trolley Tunnel would facilitate higher service frequencies on the existing Blue and Orange LRT lines due to the constraints of downtown San Diego streets, and enable introduction of new Express Trolley services.

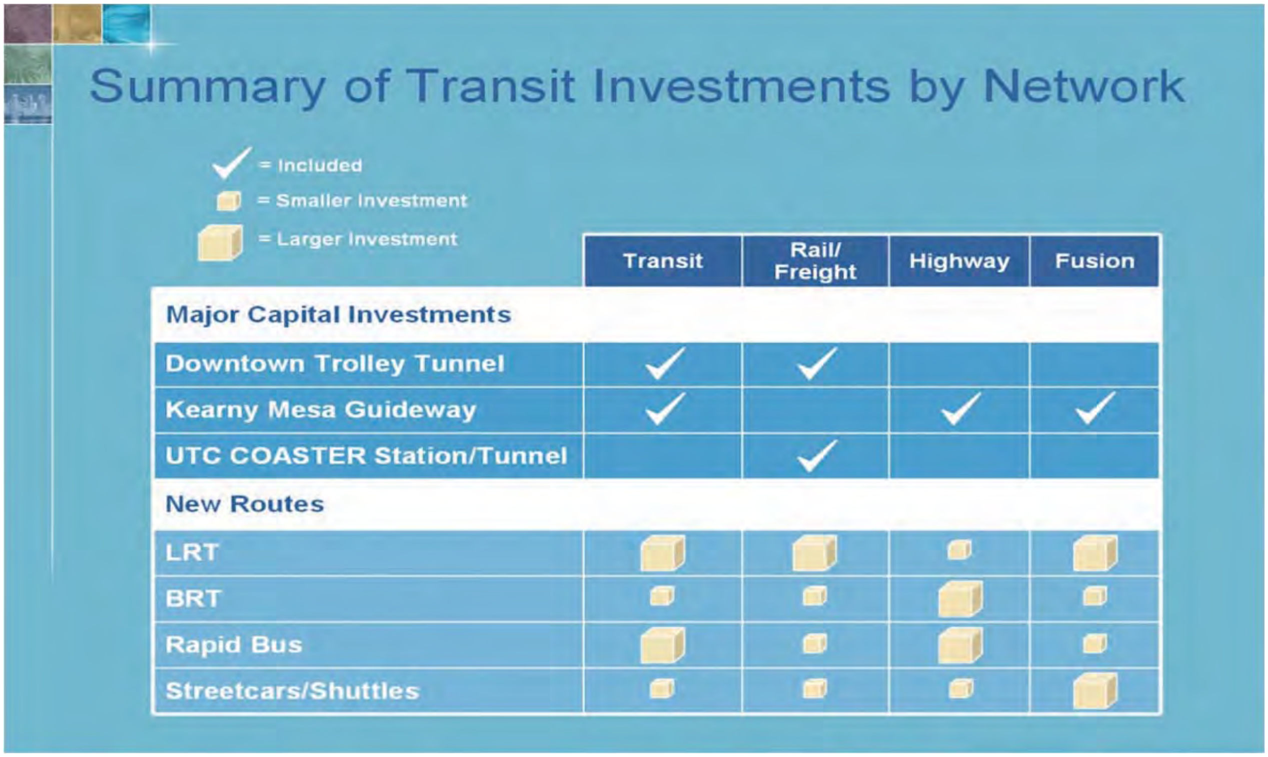
- **Kearny Mesa Guideway:** The Kearny Mesa Guideway would facilitate faster and more reliable travel times for existing local buses and new BRT and Rapid Bus services in the congested corridor that links downtown with Hillcrest, Mission Valley, and Kearny Mesa and connects a number of key employment areas and residential communities. While BRT services in other corridors would use proposed investments in Managed Lanes (ML)/High Occupancy Vehicle (HOV) corridors, a dedicated transit guideway was proposed as an option in this corridor since no ML or HOV facilities were included in the highway networks for the State Route 163 (SR 163) corridor.

- **UTC COASTER Station and Tunnel:** The UTC COASTER Station and Tunnel would provide faster travel times for COASTER and Amtrak services by providing a more direct route and an alternative to the Miramar curve, which requires slower train operations. The UTC COASTER Station and Tunnel also would provide direct station access to the major UTC employment and commercial area.

- **New LRT Lines:** Finally, the various proposed new LRT lines would enhance light rail service along existing trolley corridors through new "Express" services, and expand Trolley service into a number of new residential and employment areas in high-travel corridors.

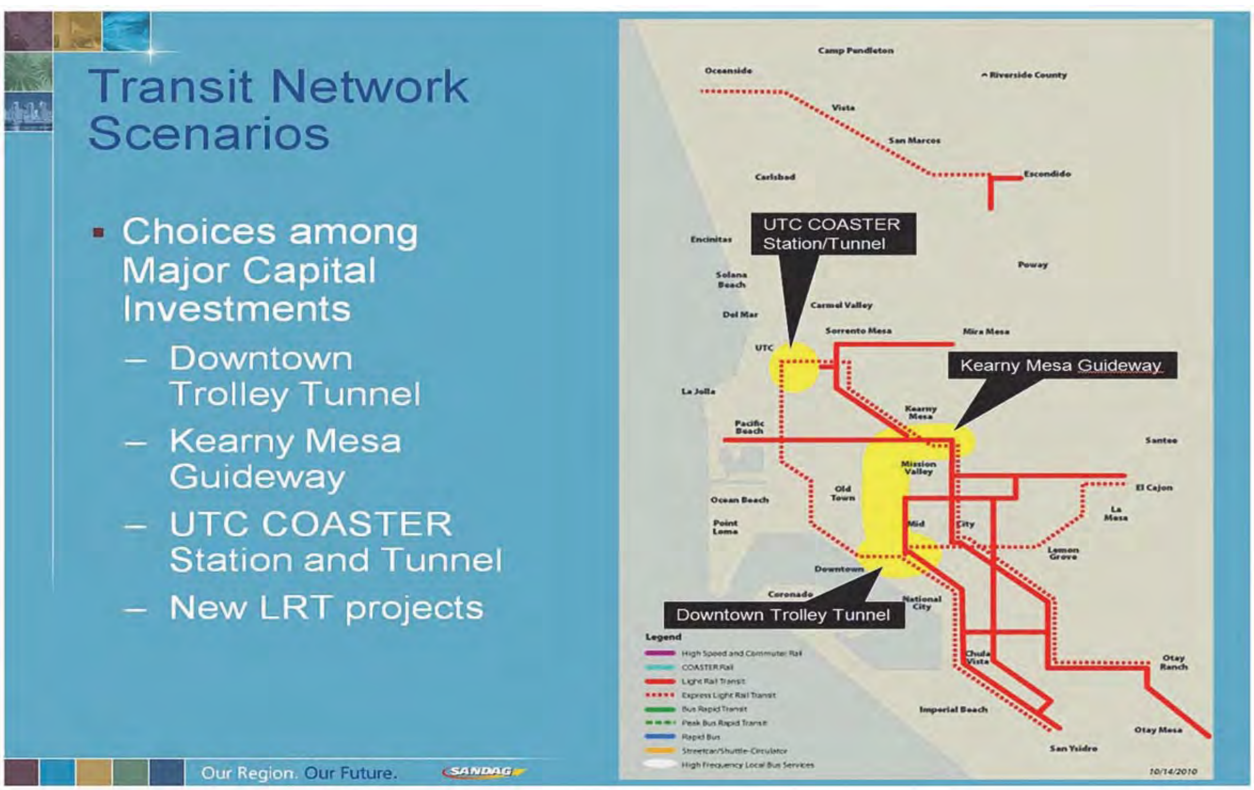
Due to funding limitations, these major capital investments, as proposed, could not all be accommodated within a single Revenue Constrained Transportation Scenario, and were therefore included at varying levels in the four Scenarios, as illustrated in Figures TA 7.16 and TA 7.17.

Figure TA 7.16 – 2050 RTP Revenue Constrained Transportation Network Scenarios: Summary of Transit Investments



	Transit	Rail/ Freight	Highway	Fusion
Major Capital Investments				
Downtown Trolley Tunnel	✓	✓		
Kearny Mesa Guideway	✓		✓	✓
UTC COASTER Station/Tunnel		✓		
New Routes				
LRT	Larger Investment	Larger Investment	Smaller Investment	Larger Investment
BRT	Smaller Investment	Smaller Investment	Larger Investment	Smaller Investment
Rapid Bus	Larger Investment	Smaller Investment	Larger Investment	Smaller Investment
Streetcars/Shuttles	Smaller Investment	Smaller Investment	Smaller Investment	Larger Investment

Figure TA 7.17 – 2050 RTP Revenue Constrained Scenarios: Major Transit Capital Investments



The following discussion provides information on the transit routes and services included in each of the four Revenue Constrained scenarios.

Transit Emphasis Scenario

The transit network in this Scenario was built on the dual philosophy of reinforcing and upgrading existing transit services and maximizing the overall number of transit projects including a variety of rail, BRT, Rapid Bus, and local bus improvements. The transit projects in this Scenario are shown graphically in Figure TA 7.18.

The rail projects in this scenario included the Downtown Trolley Tunnel in downtown San Diego to facilitate frequency enhancements for the Blue and Orange Trolley lines (7.5-minute all-day frequencies). Inclusion of the Downtown Trolley Tunnel also would enable implementation of Express Trolley services on both the Blue and Orange Lines, which introduce "skip-stop" services to facilitate faster travel times for passengers making longer distance trips along these corridors. This Scenario also would convert the Mid-City Rapid Bus service over time to a light rail transit (LRT) service to better serve the strong demand for transit in the Mid-City area. Complementing this LRT route along the east-west corridor between downtown San Diego and San Diego State University (SDSU) would be a north-south LRT service that would connect SDSU and Chula Vista via Mid-City, the southeastern San Diego communities, and National City. For the SPRINTER service, an extension of the line to North County Fair was included. In addition, a commuter rail overlay service along the High Speed Rail corridor was also assumed.

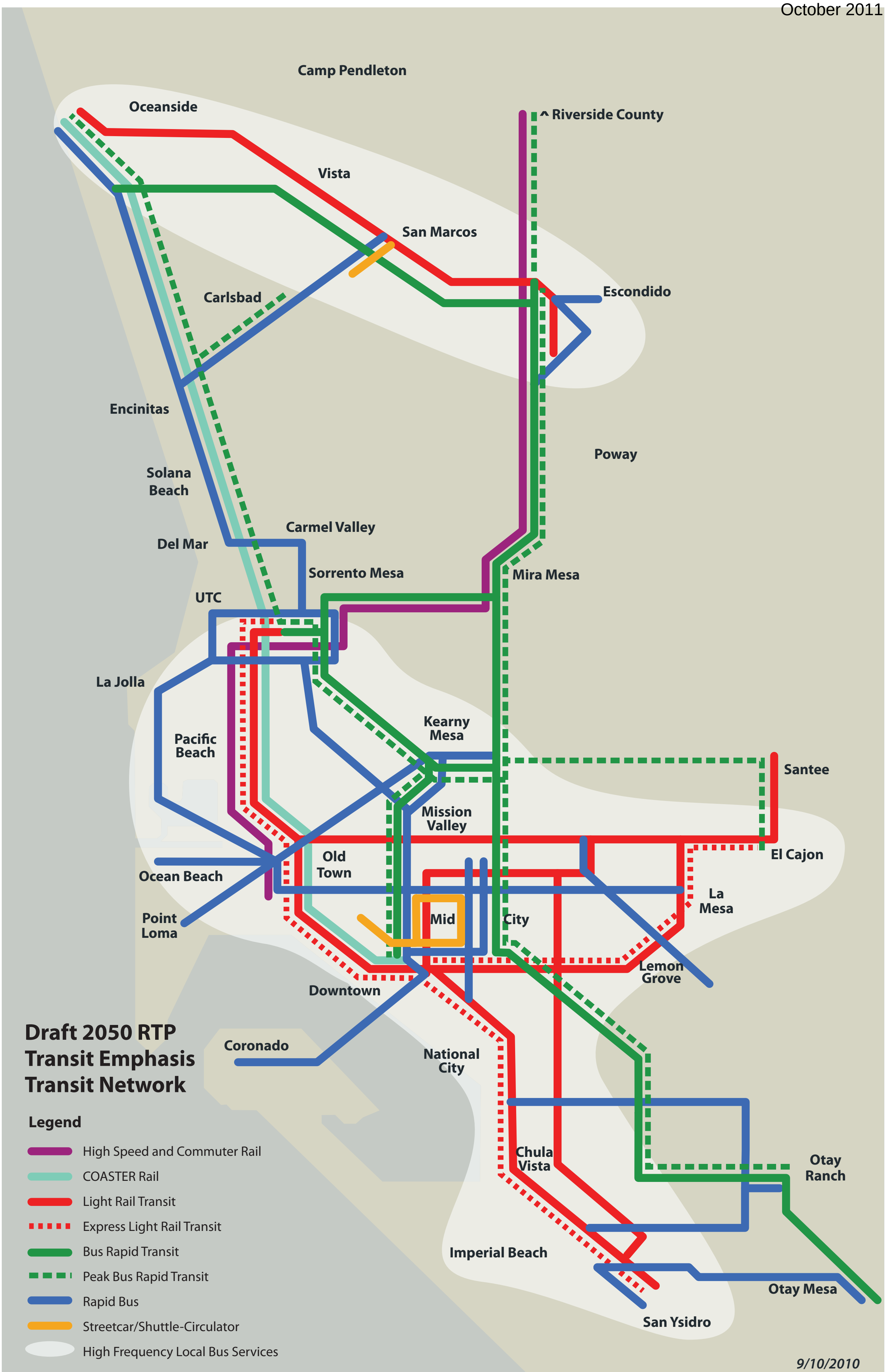
In terms of BRT and Rapid Bus services, a key capital project included in this Scenario was the Kearny Mesa Guideway[3] in the SR 163 travel corridor to facilitate fast and direct access for a number of all-day BRT, peak period BRT, Rapid Bus, and local bus services to improve access to the residential and employment centers in downtown San Diego, Bankers Hill, Hillcrest, Mission Valley, Sharp/Children's Hospital complex, and Kearny Mesa. Several other new BRT services would be implemented in the I-5, I-805, SR 52, and SR 78 freeway corridors and use the Managed Lanes/HOV system investments to facilitate high-speed travel and trip reliability to serve the long-distance trip demand in these areas. Also, 15 new Rapid Bus routes would be implemented along several key arterial corridors throughout the region.

In addition, the Transit Emphasis Scenario included the two highest ranked streetcar projects – downtown San Diego, and Hillcrest/Balboa Park.

The following typical peak period transit service standards were assumed for this scenario:

- Trolley – 7.5 minute service
- SPRINTER – 10 minute service
- Bus Rapid Transit – 10 minute service
- Rapid Bus – 10 minute service
- Streetcar – 10 minute service
- COASTER – 15 minute service
- Commuter Rail Overlay on HSR – 15 minute service

[3] The Kearny Mesa Guideway was defined as a dedicated transitway for BRT, Rapid Bus, and local bus services for a north-south travel corridor between downtown San Diego and Kearny Mesa to improve directness of travel and travel speeds, especially in the Hillcrest and Mission Valley areas.


Camp Pendleton
Oceanside
Vista
San Marcos
Riverside County
Escondido
Carlsbad
Encinitas
Poway
Solana Beach
Del Mar
Carmel Valley
Sorrento Mesa
Mira Mesa
UTC
La Jolla
Pacific Beach
Kearny Mesa
Santee
Mission Valley
El Cajon
Old Town
Ocean Beach
La Mesa
Point Loma
Mid
City
Lemon Grove
Downtown
Coronado
National City
Chula Vista
Otay Ranch
Imperial Beach
Otay Mesa
San Ysidro
Draft 2050 RTP Transit Emphasis Transit Network
Legend
High Speed and Commuter Rail
COASTER Rail
Light Rail Transit
Express Light Rail Transit
Bus Rapid Transit
Peak Bus Rapid Transit
Rapid Bus
Streetcar/Shuttle-Circulator
High Frequency Local Bus Services
9/10/2010

Rail/Freight Emphasis Scenario

The transit network in this Scenario was built on maximizing the number of rail-based transit projects. The specific transit projects included in this scenario are shown graphically in Figure TA 7.19.

In terms of light rail services, the Rail/Freight Emphasis Scenario (like the Transit Emphasis Scenario) included the Downtown Trolley Tunnel to facilitate frequency enhancements for the existing Blue and Orange Trolley services, as well as express Trolley services on both the Blue and Orange lines. In the Central and South County area, two new LRT lines would be implemented: Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, and SDSU; and University Towne Centre (UTC) to Chula Vista via Kearny Mesa, Mission Valley, Mid-City, southeastern San Diego, and National City. In North County, this scenario included an express SPRINTER service between Escondido and Oceanside, and the extension of the SPRINTER line to North County Fair. This was the only Scenario that included the UTC COASTER Station and UTC Tunnel, providing a more direct connection for North County commuters into the University City area. In addition, a commuter rail overlay service along the High Speed Rail corridor was also assumed.

Due to the high capital costs of new rail projects and the UTC COASTER and Tunnel, additional new rail lines outlined in the Unconstrained Transit Network (SDSU to San Ysidro, UTC to Mira Mesa, Otay Mesa to Chula Vista, and the transition of the Mid-City Rapid to LRT) could not be included in the Rail/Freight Scenario.

The emphasis on rail services in this Scenario meant that most BRT and Rapid Bus services in the Unconstrained Transportation Network were not included. The Kearny Mesa Guideway also was not included.

The following typical peak period transit service standards were assumed for this scenario:

- Trolley – 7.5 minute service
- SPRINTER – 10 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – none
- Rapid Bus – 10 minute service
- COASTER – 15 minute service
- Commuter Rail Overlay on HSR – 15 minute service

Highway Emphasis Scenario

The transit network in this Scenario is shown graphically in Figure TA 7.20. It built upon the Managed Lanes and HOV investment in the highway network, and as a result, included all BRT, peak BRT, and Rapid Bus routes proposed in the Unconstrained Transportation Network. This scenario included the Kearny Mesa Guideway to facilitate the BRT and Rapid Bus routes, but it did not include the Downtown Trolley Tunnel, and therefore did not include any of the Trolley Express routes or the SPRINTER Express services.

With the exception of the Kearny Mesa Guideway in the SR 163 travel corridor between downtown San Diego and Kearny Mesa, BRT services are relatively inexpensive to implement since they tend to use already planned Managed Lanes/HOV facilities. There are no Managed Lanes/HOV facilities proposed for the SR 163 corridor, thus resulting in the need for a separate transit guideway. As a result, the capital costs of the BRT routes are limited primarily to station improvements, vehicle acquisition, and associated maintenance facilities. These relatively low capital costs allowed a higher number of transit projects to be included in this Scenario than otherwise might be expected, including all Rapid Bus projects and two light rail projects (SDSU to San Ysidro and UTC to Mira Mesa).

The following typical peak period transit service standards were assumed for this scenario:

- Trolley – 7.5 minute service
- SPRINTER – 10 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – 10 minute service
- Rapid Bus – 10 minute service
- COASTER – 15 minute service
- Commuter Rail Overlay on HSR – 15 minute service

Fusion Scenario

The transit network in this Scenario focused a blend of enhancements to the existing transit system and new transit services that seemed to resonate particularly well with the public based on public outreach and the survey. The Fusion Scenario transit network is shown graphically in Figure TA 7.21.

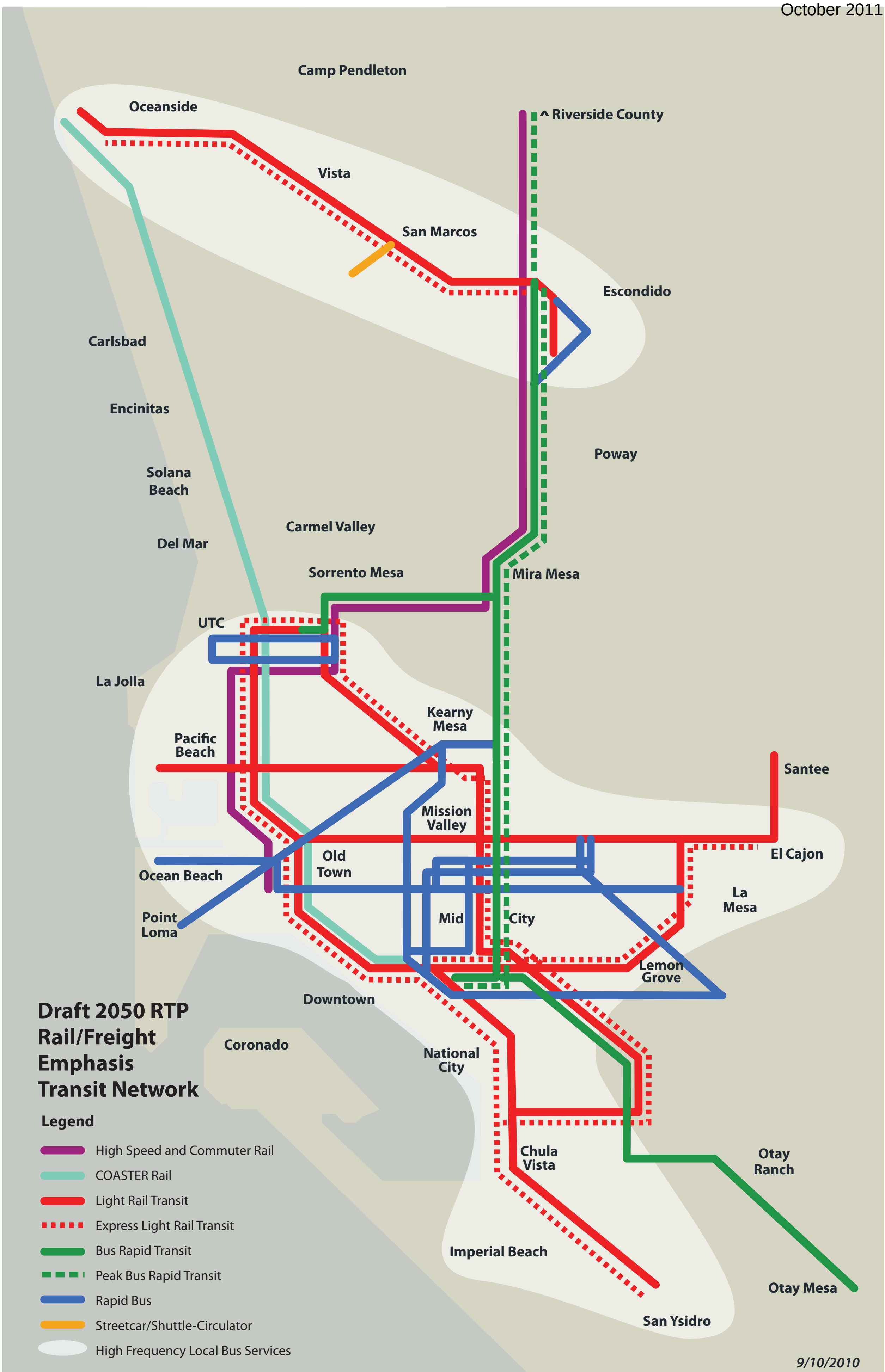
In addition to the baseline projects and the transit projects common to all four Revenue Constrained Transportation Network Scenarios discussed above, the new transit projects proposed in this Scenario included the Kearny Mesa Guideway to facilitate new BRT and Rapid Bus services in the SR 163 travel corridor, and new LRT projects aimed at providing trolley service to a wider geographic service area, including LRT lines in the following corridors: Pacific Beach to El Cajon via Kearny Mesa and Mission Valley; UTC to Mira Mesa via Sorrento Mesa; and UTC to Chula Vista via Kearny Mesa, Mission Valley, Mid-City, southeastern San Diego, and National City; and extension of the SPRINTER line to North County Fair. It also included SPRINTER Express service and a commuter rail overlay service along the High Speed Rail corridor.

This approach differed from the Transit Emphasis Scenario in that it focused more attention on new LRT lines versus improvements to existing LRT lines. As such, it did not include the Downtown Trolley Tunnel that was included in the Transit Emphasis Scenario to enable Express trains on the Blue and Orange Trolley Lines. It also focused less attention on Rapid Bus services (the Fusion Scenario included six Rapid Bus services versus 15 included in the Transit Emphasis Scenario).

Finally, this Scenario included implementation of the highest number of streetcar and/or shuttle/circulator services since this mode resonated highly with many stakeholders that provided input on the Unconstrained Transportation Network.

The following typical peak period transit service standards were assumed for this scenario:

- Trolley – 7.5 minute service
- SPRINTER – 10 minute service
- Streetcar – 10 minute service
- Bus Rapid Transit – 10 minute service
- Rapid Bus – 10 minute service
- COASTER – 15 minute service
- Local Bus – 10 minute service
- Commuter Rail Overlay on HSR – 15 minute service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Kearny Mesa
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Mission Valley
Old Town
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Ocean Beach
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Point Loma
Mid
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Lemon Grove
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Transit Network
Coronado
National City
Legend
High Speed and Commuter Rail
Chula Vista
Otay Ranch
COASTER Rail
Light Rail Transit
Express Light Rail Transit
Bus Rapid Transit
Imperial Beach
Peak Bus Rapid Transit
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Rapid Bus
San Ysidro
Streetcar/Shuttle-Circulator
High Frequency Local Bus Services
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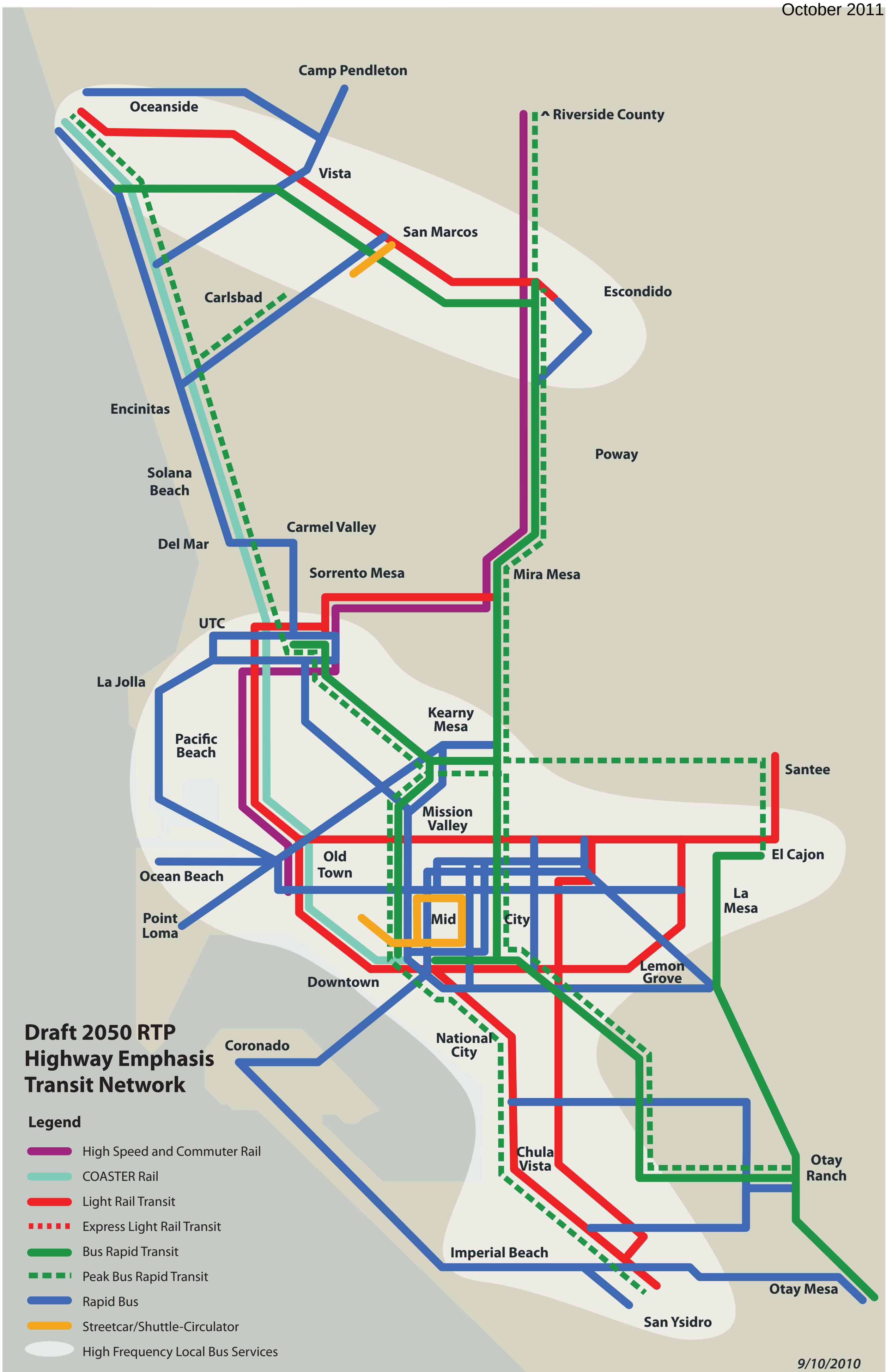
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High Frequency Local Bus Services
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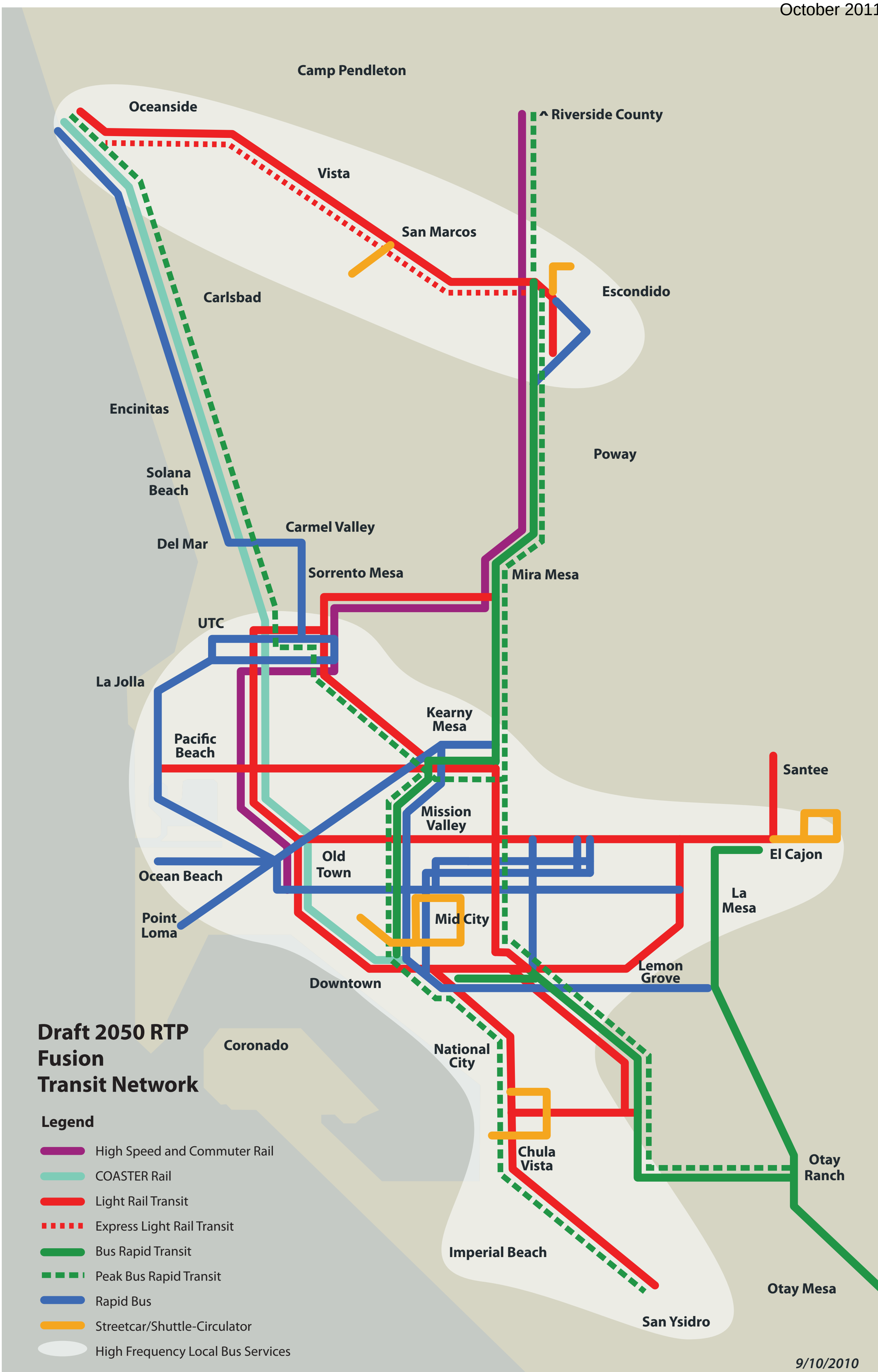
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Bus Rapid Transit
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Peak Bus Rapid Transit
Otay Mesa
Rapid Bus
San Ysidro
Streetcar/Shuttle-Circulator
High Frequency Local Bus Services
9/10/2010

Capital Cost Estimates of the Revenue Constrained Scenarios

Technical Appendices K-1 and K-2 contain a list of all of the transit projects, as well as highway projects, proposed in each Revenue Constrained Transportation Network Scenario as of November 2010. The projects are listed in two categories: constant transit projects among all four scenarios (including *TransNet*-funded projects and other constant projects), and variable transit projects included in one, two, or three of the revenue constrained scenarios. Capital cost estimates and phasing years are listed for each project. Total capital cost estimates for each transportation network alternative in 2010 dollars[4] are listed below.

- Transit Emphasis Network Scenario: $23.085 billion
- Rail/Freight Emphasis Network Scenario: $22.229 billion
- Highway Emphasis Network Scenario: $19.435 billion
- Fusion Network Scenario: $21.587 billion

Operating costs, including vehicle and vehicle replacement costs, were added later based on project phasing, once a Preferred Revenue Constrained Scenario was developed.

Analysis Results of the Four Initial Revenue Constrained Scenarios

The Revenue Constrained Scenarios' performance was evaluated using performance measures developed specifically for the 2050 RTP which are discussed in detail in the 2050 RTP and in 2050 RTP Technical Appendix 3. As such, only the transit mode share results are discussed below.

Transit Mode Share for the Four Initial Revenue Constrained Scenarios

Transit Mode Share results for the four initial revenue constrained transportation scenarios did not vary greatly. They followed the same pattern seen in the three initial transit network alternatives of meeting the goals for most of the areas. The Fusion scenario was projected to meet ten of the 14 corridor/area transit mode share goals, as compared to nine for the Transit Emphasis and eight for both the Rail/Freight and Highway Emphasis scenarios. This is detailed in Table TA 7.16 and illustrated in Figure TA 7.22.

The Fusion scenario was projected to achieve the highest transit mode share for the collective Urban Area Study Area at 11 percent, compared to ten percent for the other three revenue constrained scenarios, while the Transit Emphasis scenario was projected to reach the highest mode share percentage for downtown San Diego at 29 percent. In general, the Fusion scenario was projected to reach the highest transit mode share in five corridors/areas, compared to two for the Transit Emphasis and none for the Rail/Freight and Highway Emphasis scenarios. Again, it should be noted that the transit mode share results did not differ greatly across the scenarios, and many times the difference between the highest and lowest projected mode share was only one or two percentage points.

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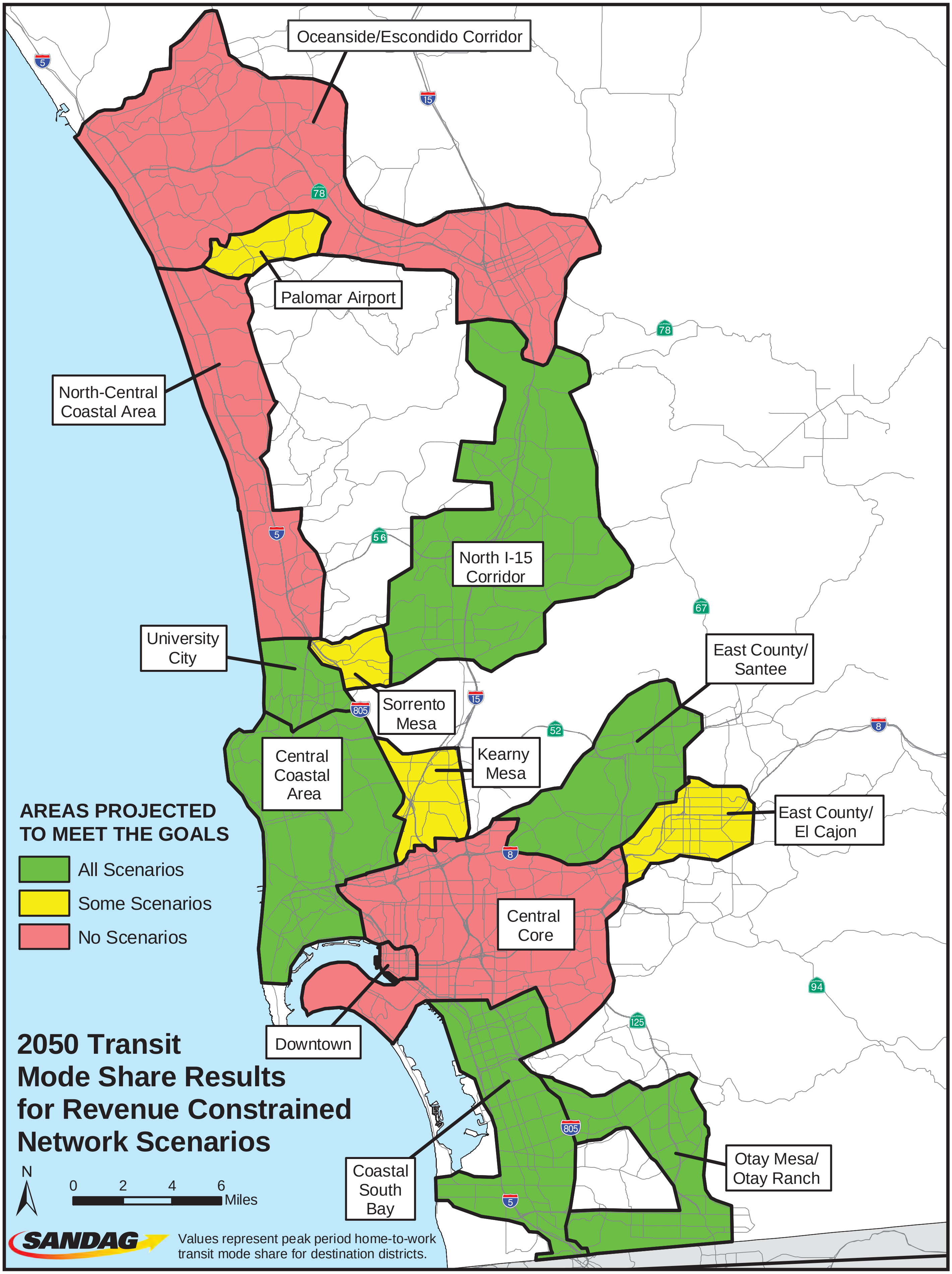
[4] The 2009 initial network capital costs were converted to 2010 dollars for the transportation network in the RTP.

Table TA 7.16 – 2050 Transit Mode Share Results – Revenue Constrained Transportation Scenarios

		Peak Period Transit Mode Share for 2050 RTP Revenue Constrained Transportation Scenarios[1]			
Identified Corridors/Areas	**2050 Peak Period Transit Mode Share Goal Ranges**	**Transit Emphasis**	**Rail & Freight Emphasis**	**Highway Emphasis**	**Fusion**
Major Employment Areas					
Downtown San Diego	30% +	29%	27%	27%	28%
University City	15%-20%	15%	16%	15%	17%
Sorrento Mesa	10%-15%	9%	9%	9%	10%
Kearny Mesa	10%-15%	10%	13%	9%	14%
Otay Mesa/ Otay Ranch	5%-10%	6%	5%	6%	5%
Palomar Airport	5%-10%	5%	4%	5%	4%
High Activity Areas					
Central Core	20%-25%	18%	16%	17%	17%
Oceanside/Escondido Corridor	10%-15%	6%	6%	6%	6%
Other Urbanized Areas					
North I-15 Corridor	5%-10%	5%	5%	6%	6%
North Central Coastal Area	10%-15%	8%	8%	7%	8%
Central Coastal Area	10%-15%	12%	14%	12%	14%
Coastal South Bay	10%-15%	12%	12%	12%	12%
East County/El Cajon	10%-15%	9%	9%	9%	10%
East County/Santee	5%-10%	7%	7%	7%	7%
Urban Area Transit Strategy Study Area	**10%-15%**	**10%**	**10%**	**10%**	**11%**

[1] Values represent peak period home-to-work trip transit mode share for destination districts.

Figure TA 7.22



After the transit mode share and 2050 RTP performance measures were processed and compiled by the project team and SANDAG staff, the results were presented to the SANDAG Transportation Committee and Board of Directors (as well as many other committees and working groups). At the November 2010 meeting of the SANDAG Board of Directors, the performance of the four Revenue Constrained scenarios was discussed and the Board directed SANDAG staff to create a revenue constrained transportation scenario with elements from the Fusion and Highway Emphasis scenarios. The following bullet points summarize the major input received at the Board meeting:

- Importance of the Downtown Trolley Tunnel to the regional transit network
- Importance of providing Express trolley service
- Support for additional funding for regional rail grade separations
- Support for focusing on the existing rail investment in the COASTER and SPRINTER corridors in the North County area and for eliminating redundant transit services
- Continued support for BRT services, particularly in the South County area
- Recognition that the University Towne Center (UTC) COASTER Tunnel and Station are very expensive capital projects, but continued support for providing transit connections in the UTC area
- Support for including higher ranked highway projects in the Hybrid Scenario
- Support for including higher ranked new LRT routes in the Hybrid Scenario

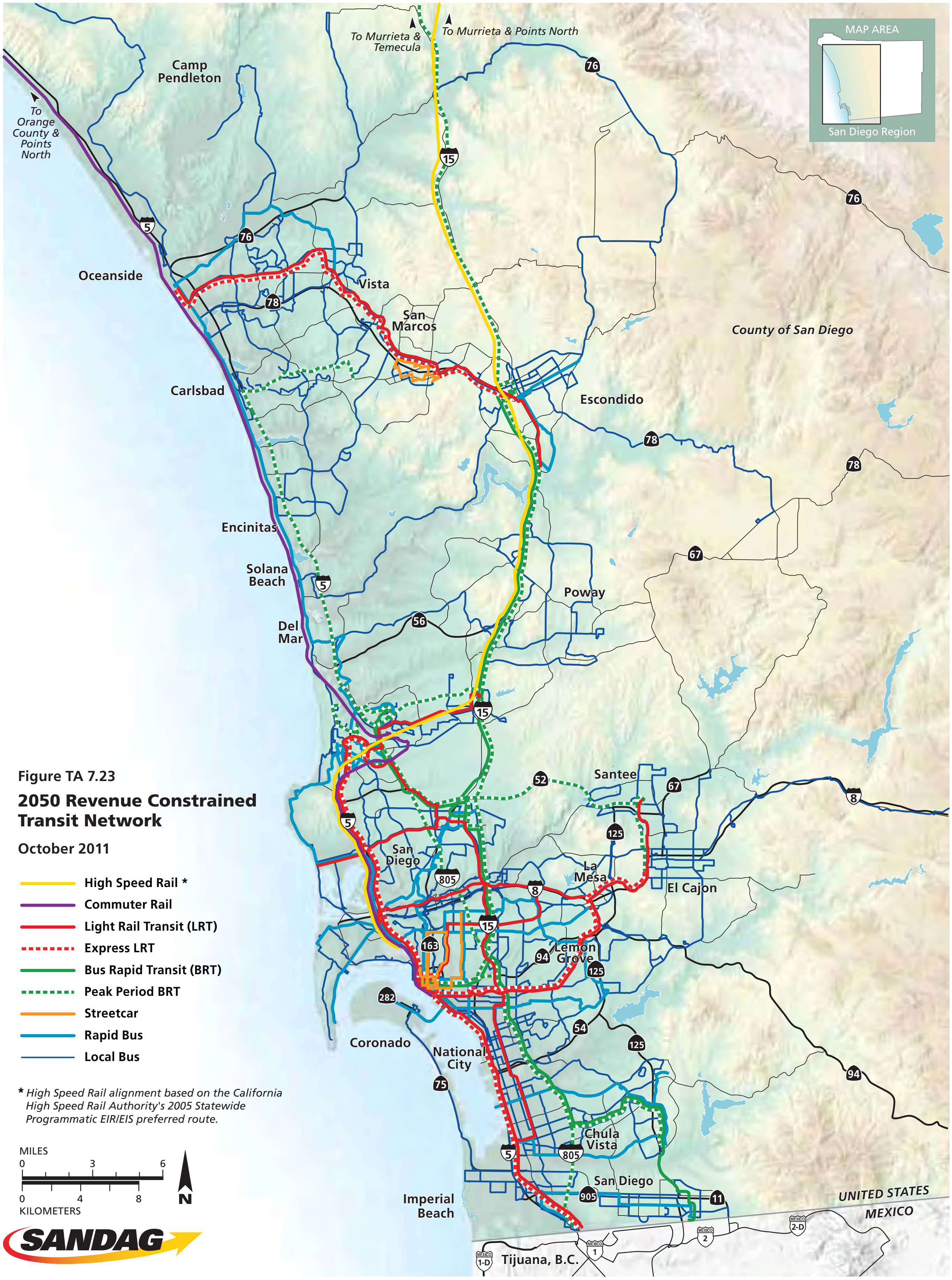
The Board of Directors also directed SANDAG staff to continue to work closely with MTS and NCTD staff to develop the revenue constrained network. The resulting Preferred Revenue Constrained Transit Network is discussed in the following section.

12. Preferred Revenue Constrained Transit Network and Final 2050 RTP Revenue Constrained Transit Network

Based on direction from the SANDAG Board, staff developed a Preferred Revenue Constrained Transit Network, sometimes referred to as the “hybrid” network. The Preferred Revenue Constrained Transit Network contained a variety of multimodal projects from the initial revenue constrained scenarios, particularly from the Fusion and Highway Emphasis scenarios. This network, along with the Preferred Revenue Constrained Highway Network, was a key component of the overall Draft Revenue Constrained Transportation Network included in the Draft 2050 RTP, which was released for public review and comment in April 2011.

During the public review and comment period, SANDAG received more than 4,000 public comments on the Draft 2050 RTP and its SCS, many of them focused on the transit projects contained in the Preferred Revenue Constrained Transit Network. In response to the comments and at the direction of the SANDAG Board, staff produced the 2050 Revenue Constrained Transit Network, which serves as the official transit network of the Final 2050 RTP. This network is shown graphically in Figure TA 7.23. The transit projects that make up the final transit network and their associated phasing are included in Technical Appendix M.

Figure TA 7.23



Transit Mode Share Results of the Final 2050 RTP Revenue Constrained Transit Network

The performance of the Final 2050 Revenue Constrained Transit Network is discussed in detail in the Final 2050 RTP and the 2050 RTP Technical Appendix 3. This section, however, provides detailed information on transit mode share results. Table TA 7.17 and the analysis below compare the 2050 Unconstrained Transportation Network and the Final 2050 RTP Revenue Constrained Transportation Network, which includes the Final 2050 Revenue Constrained Transit Network, against the transit mode share goal ranges in the Urban Area.

Table TA 7.17 – Transit Mode Share Results for Unconstrained Transportation Network and Final 2050 RTP Revenue Constrained Transportation Network[1]

Identified Corridors/Areas	2050 Peak Period Transit Mode Share Goal Ranges	2050 Unconstrained Transportation Network	Final 2050 RTP Revenue Constrained Transportation Network
Major Employment Areas			
Downtown San Diego	30% +	29%	27%
University City	15%-20%	17%	13%
Sorrento Mesa	10%-15%	10%	9%
Kearny Mesa	10%-15%	13%	13%
Otay Mesa/Otay Ranch	5%-10%	8%	7%
Palomar Airport	5%-10%	6%	3%
High Activity Areas			
Central Core	20%-25%	18%	17%
Oceanside/Escondido Corridor	10%-15%	7%	6%
Other Urbanized Areas			
North I-15 Corridor	5%-10%	6%	5%
North Central Coastal Area	10%-15%	8%	7%
Central Coastal Area	10%-15%	14%	12%
Coastal South Bay	10%-15%	13%	12%
East County/El Cajon	10%-15%	10%	9%
East County/Santee	5%-10%	7%	7%
Urban Area Transit Strategy Study Area	10%-15%	11%	10%

[1] Values represent peak period home-to-work trip transit mode share for destination districts.

The Final 2050 RTP Revenue Constrained Transportation Network achieves the mode share goal for the collective Urban Area. It also meets six of the 14 corridor/area goals. And, as shown in Table TA 7.17, of the eight corridors/areas that are not projected to meet the transit mode share goals, seven are projected to come within three percentage points of achieving the goals, reflecting both a positive increase in transit mode share over existing 2008 transit mode shares (see Table TA 7.2) and the challenge presented by establishing high goals.

Although the Final 2050 RTP Revenue Constrained Transportation Network contains a high level of investment in transit in the Central Core area, the transit mode share is projected to fall short of the goal for this area by three percentage points. The ambitious goal for this area reflects the relatively high level of existing transit ridership and mode share (12 percent in 2008), and the existing and planned transit supportive land use patterns and population densities in the area. Other than downtown San Diego, the Central Core area has by far the highest projected transit mode share goal of the 14 corridors/areas. Although projections indicate that it will fall short of meeting the goal, transit mode share is projected to increase by over five percentage points from 2008 levels and the projected 2050 RTP Revenue Constrained transit mode share of 17 percent is well above those of the other corridors/areas (except for downtown San Diego) and is within one percentage point of the Unconstrained Revenue projection for the area.

Most of the other corridor/areas where the transit mode share goals are not projected to be met are along the north I-5 corridor between downtown and Oceanside (University City, Sorrento Mesa, Palomar Airport, Oceanside/Escondido, North Central Coastal) where significant investments in both transit (COASTER and Rapid Bus) and new managed lanes (I-5) are planned. The region’s multimodal investment in the corridor is projected to increase both transit and HOV (carpool/vanpool) use. It is possible that a projected increase in HOV use and mode share has resulted in a corresponding decrease in transit mode share even as transit ridership in the corridor increases in real numbers. The shortfall in meeting the transit mode share goals in the corridor also reflects the challenge in effecting significant mode share shifts in the lower density, suburban areas of the region where land uses, development patterns, and population and employment concentrations generally don’t support transit access and use as well as more densely developed urban areas. Nevertheless, the Final 2050 RTP Revenue Constrained Transportation Network is projected to increase transit mode share over 2008 levels by almost 10 percentage points in University City, over seven percentage points in Sorrento Mesa, and over five percentage points in the North Central Coastal area, significantly positive results for these areas.

In summary, the Final 2050 RTP Revenue Constrained Transportation Network is projected to meet six of the 14 corridor/area transit mode share goals and come within three percentage points of meeting the goals for most of the remaining corridors/areas. In addition, the Final 2050 RTP Revenue Constrained Transportation Network is projected to meet the 10 percent transit mode share goal for the collective Urban Area, doubling the 2008 transit mode share for the Urban Area. The Final 2050 RTP Revenue Constrained Transportation Network provides a solid working base for the San Diego region as SANDAG and its member agencies strive to meet the transit mode share goals.

13. Five and Ten-Year Action Plans

The UATS study and the 2050 RTP identified many new transportation corridors for the development of future transit projects. In addition, assumptions on the transit mode (e.g. light rail, rapid bus, streetcar, etc.) were made to establish mode characteristics (e.g. regional travel vs. local distribution) for modeling, ridership and performance measure projections, and to provide a basis for planning-level cost estimation. However, identification and inclusion in the RTP is just the first step in the development of these potential future transportation projects. While some projects, like local bus service or changes in transit service frequencies generally do not require additional project planning, environmental analysis, and design, major new transit alignments, facilities, and services must undergo further analysis and evaluation. The additional individual project analysis and evaluation is part of the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) process and can include an

Environmental Impact Statement/Environmental Impact Report, an Environmental Assessment/Mitigated Negative Declaration/Negative Declaration, or a Categorical Exclusion/Categorical Exemption.

Transit Project Development Process

The implementation of a major new transit capital investment would first entail a detailed advanced planning process to further outline the proposed project, including an Alternatives Analysis where alternative routes, stations, and transit modes are developed and evaluated that provide detail on capital and operating costs, detailed ridership projections, and potential environmental impacts/benefits. The Alternatives Analysis would result in a preferred alternative or set of alternatives to carry forth into formal environmental studies. Once the environmental studies have been completed and the final project and any mitigation measures are identified, preliminary engineering and final design work would be undertaken leading, ultimately, to project construction.

Preliminary engineering is undertaken to better understand the engineering and construction of the proposed project, and the environmental review and analysis allows for a greater understanding of the impacts and benefits of the project to the natural and built environment (e.g., visual, wetlands, air quality, noise, traffic, etc.), and the mitigation that may need to be incorporated into the project. Ridership, capital costs and operations, and maintenance costs of the proposed project are also further refined during this stage of the project.

After the appropriate environmental review and documentation of the project has been completed and approved, final design, permitting, and construction can take place. Many of the major new transit rail, BRT, and Rapid Bus projects will also go through the Federal Transit Administration's (FTA) project development process to solicit federal capital funding through the New Starts or Small Starts processes. The FTA process is aligned with the NEPA process.

Action Plans

Upon adoption of the Final 2050 RTP, "Five and Ten Year Action Plans" will be developed based on the transit project development process discussed above and final phasing assumptions included in the RTP. The Action Plans will assist SANDAG in better identifying potential federal funding opportunities and potential timing challenges and opportunities surrounding the ultimate implementation of the transit projects included in the Final 2050 RTP.

The Five and Ten Year Action Plans will provide initial project development timeline assumptions, identification of projects for federal funding, and ultimately a framework to guide planning, environmental, design, and construction efforts for the 2050 transit network. The plans will be dynamic and will continue to evolve as implementation of the 2050 RTP proceeds.

14. Policy Options to Support the Transit Network

Developing and funding a robust transit network is essential to achieve SANDAG's multimodal transportation goals. However, a number of other factors also influence the use and success of the regional transit system. Related transportation and land use policies and strategies can directly or indirectly create incentives (or disincentives) to transit use.

As part of the planning process, the project team developed a report entitled, "Menu of Policy Options to Support the Transit Network." This report identified a menu of policies and strategies that can influence transit ridership and mode share. The menu was organized into three categories: parking, land use, and funding. These policies and strategies were culled from technical and academic research, experience in other cities and regions, input from the PB Professional Consulting Transit Team and UATS Peer Review Panel, and suggestions by UATS project stakeholders including the San Diego Council of Design Professionals[5], the SANDAG Regional Planning Stakeholder

[5] At an UATS workshop conducted on April 14, 2010.

Working Group (SWG)[6], and 2050 RTP community workshops[7]. The paper also included information on transit fares, services, and facilities to help maximize the effectiveness of the region's transit network. Technical Appendix N includes additional detail and information.

Input by Working Groups and Local Planning and Design Community

In the fall of 2010, the Regional Planning Technical Working Group (TWG), the Cities/County Transportation Advisory Committee (CTAC), and Regional Planning SWG members, as well as members of the planning and design community, were asked to provide input on the menu of policy options through participation in an interactive activity. The activity consisted of each participant receiving ten dots, which they were then asked to place next to the policy options they most supported. The policy options were listed on large boards throughout the conference room. Flip charts also were available for participants to write down comments. After the activity, the votes were counted for each policy option, and facilitated discussions were held. The interactive activity was intended to provide a starting point for discussion by policymakers for possible consideration in the 2050 RTP and its SCS.

TWG, CTAC, SWG members, and participants from the design community placed similar levels of priority on the policy options. The following policies received the highest levels of support, and are arranged in order of total votes received.[8] Key discussion points are summarized below in Tables TA 7.18, 7.19, and 7.20.

[6] The SWG was formed by SANDAG to provide input into the development of the 2050 Regional Transportation Plan.
[7] Conducted in five communities in April and May 2010.
[8] Working group alternates and members of the public who were present at the meetings were invited to participate in the activity. The results cited in the tables include tallies by working group members only; however, results did not significantly vary when tallies by alternates and members of the public were factored in.

Table TA 7.18 – Parking Policies

Rank	Parking Policy	Total Vote	TWG/ CTAC	SWG	Design Community
1	Create a tool box of localized parking strategies and policies for local jurisdictions that may include: ▪ Parking pricing (on- and off-street) ▪ Zoning to reduce/eliminate parking minimums ▪ Zoning to reduce parking maximums ▪ Shared parking programs and standards ▪ Employer parking cost cash-outs ▪ Unbundling of parking costs from housing costs in targeted areas ▪ Local parking districts ▪ Others as requested by local jurisdictions	48	23	14	11
2	Establish grant programs to fund local parking utilization surveys and provide technical assistance to jurisdictions and transit operators within the SANDAG jurisdiction to promote changes in parking management and zoning requirements related to parking	44	20	11	13
3	Support a remote parking program tied to transit service	40	14	19	7
4	Encourage a regional employer/business assessment on employer-provided parking to be used for transit improvements or transit pass subsidies	30	16	10	4
5	Establish regional policies promoting shared parking, especially at transit stations	22	8	10	4
6	Establish programs to measure and document the amount of parking available in selected areas of the region and use this sample as a baseline to track changes in parking supply over the long-term	17	6	9	2
7	Initiate regional education programs regarding the effects of free parking on congestion and mode choice	16	6	5	5
8 (tied)	Organize the region into subregional areas, and in collaboration with affected jurisdictions, develop guidelines for parking availability and pricing for each subregion	15	11	3	1
8 (tied)	Initiate discussion regarding the establishment of long-term goals for a reduction in parking spaces per capita	15	8	1	6
9	Establish Transportation Management Associations in key employment or urban locations	10	5	4	1

The following points were made during the discussion on parking policies:

- The "tool box" approach likely received the highest ranking because it can provide a range of choices and options to different types of communities across the region (large and small). Grant programs that support the tool box also are very helpful.
- The Seattle example described in the report shows how Seattle transitioned over time toward greater parking restrictions and better transit service and how the results, in the long-term, have been favorable. The region should consider a "parking strategy roadmap" to initiate change as an incremental approach.
- If the region is going to pursue implementation of parking fees at employment sites, the effort should be coordinated at the regional level and tied to transit availability.
- The region should test parking fees for bonding capacity at public institutions first, such as city halls, airports, and universities.

- Data to support the reduction of parking is important.
- Funds generated from parking fees should be used to support fare-free transit zones.
- Funds generated from parking fees should be returned to employees through parking cash-out programs.
- Parking fees in emerging smart growth areas may delay the implementation of smart growth in those areas.
- Remote parking programs have worked well in Portland and other places. This type of approach would provide smaller or more distant communities with greater access to the urbanized areas.
- Pursue technological innovations more aggressively, such as technologies that help people find parking spots more easily and reduce time spent searching for parking spots.
- Consider how the region might re-direct dollars spent on parking structures in urban areas toward other uses, such as investments that support transit, walking, and biking.
- Explore "model parking guidelines" that use street parking as effectively as possible.
- Support first-/last-mile solutions, such as jitneys, shared taxis, and other cost-effective ideas.

Table TA 7.19 – Land Use Policies

Rank	Land Use Policy	Total Votes	TWG/ CTAC	SWG	Design Community
1	Reward the "Smarter Smart Growth" areas with smart growth incentive funding, transit facilities, and transit service investments	59	29	17	13
2	Update the SANDAG Smart Growth "tool box" to include Complete Street concepts as a means to implement Smart Growth policies and facilitate greater access to transit, and encourage jurisdictions to adopt these policies as part of their development codes	56	23	9	24
3	Identify a limited number (three to five) of key employment centers / locations in addition to downtown San Diego (possibly for cluster industry employment) that can accommodate higher employment concentrations sufficient to support transit, and create programs that help concentrate employment in these areas by strategically linking employment center growth and transit investment	50	34	12	4
4	During the next update of the SANDAG Regional Comprehensive Plan and Smart Growth Concept Map, work with local jurisdictions to identify a limited number of "Smarter Smart Growth" areas that would be large geographic areas with the best potential for accommodating regional growth through high-density, mixed-use development	43	23	7	13
5	Review Smart Growth Incentive Program (SGIP) criteria and consider providing higher priority to local jurisdictions that have adopted transit-oriented development, urban design, complete street, and/or form-based codes, policies, and standards for receiving incentive funding and/or regional transit investment priority, or use the adoption of these policies and standards as criteria for transit priority phasing in the next update of the RTP	38	22	6	10
6	Encourage jurisdictions to streamline the development and entitlement process in identified Smart Growth areas to encourage development in these areas	33	11	11	11
7	Update the SANDAG Smart Growth "tool box" to include form-based codes as a means to implement smart growth policies and encourage jurisdictions to adopt these policies as part of their development codes	20	9	5	6

The following points were made during the discussion on land use policies:

- The policies that promote employment areas that can accommodate higher employment concentrations, incentives for Smarter Smart Growth areas, and identification of Smarter Smart Growth areas should be grouped together, as these are all interrelated.
- The approach of rewarding larger-scale "Smarter Smart Growth" areas for transit performance purposes could preclude emerging smaller-scale smart growth areas from competing well for grant funds and making additional progress.
- SANDAG should consider modifying the SGIP program to reward cities that have lower parking minimums.
- It may not be necessary for SANDAG to update the Smart Growth Tool Box with form-based codes since jurisdictions have many different types of tools to implement smart growth policies.
- Consider providing more resources toward Complete Streets Concepts, as this approach helps connect land use with transit, bike facilities, and pedestrian networks, and thereby is one of the most effective ways to significantly enhance the livability of our communities.
- Transform struggling or "dark" retail centers and underutilized parking lots from "dead zones" to vibrant transit-oriented development centers.

Table TA 7.20 – Funding Policies

Rank	Funding Policy	Total Votes	TWG/ CTAC	SWG	Design Community
1	Encourage the creation of Local Improvement Districts and facilities financing mechanisms	48	27	14	7
2	Seek private partners to support promising funding advantages	29	16	6	7
3	Promote bonding against public parking revenues	24	13	3	8

The following points were made during the discussion on funding policies:

- The region should consider increasing the transient occupancy tax to help fund transit improvements.
- Partnerships should be pursued between banks and local jurisdictions whereby banks help fund infrastructure enhancements (particularly improvements to the pedestrian environment) in exchange for increased revenues based on a corresponding rise in property values.
- The formation of local improvement districts in the "Smarter Smart Growth" areas will require resources. Funding for these efforts should be identified.
- Jurisdictions should involve local communities early in the process in developing community financing districts when creating "Smarter Smart Growth" areas.
- Transit agencies should consider issuing weekly or 10-day transit passes in addition to monthly passes to make transit more cost-effective for shorter-term users and generate additional revenues.
- The region should consider implementing a fare free transit zone. The Denver transit mall was cited as a great example.

The Regional Planning and Transportation Committees, and the SANDAG Board of Directors agreed that the policy options should be further considered in a future update of the Regional Comprehensive Plan, rather than as part of the development of the 2050 RTP. Further work on policy options will be considered at that time.

15. Conclusion

Given increasingly important factors, including the region's long-term growth projections, new statewide legislative requirements to reduce GHG emissions contained in SB 375, the projected aging of our population, an increasing pattern of infill and redevelopment in the western third of the region, and the growing emphasis on active transportation and public health, the need to focus the region's attention on transit has increased.

The Urban Area Transit Strategy served as the primary process to facilitate the transit planning effort for the 2050 RTP. The UATS focused on the most urbanized areas of the region where investments in transit are generally most efficient and effective. SANDAG and the project team undertook an extensive planning process that involved developing a range of differing transit strategies and approaches to determine the kind of transit future that is desirable for the San Diego region. The project included strategic brainstorming sessions, as well as public workshops, opinion surveys, and input questionnaires. The team reviewed previous market studies and conducted research on transit success stories from other cities to analyze applicability to the San Diego region. The project also included developing performance measures and mode share goals by which to test the strategies.

The Draft 2050 RTP was released for public review and comment in April 2011. As a result of public input and SANDAG Board actions, the transit and highway networks were refined, and ultimately culminated in the Final 2050 RTP, adopted by the SANDAG Board in October 2011.

Implementation of the transit projects in the Final 2050 RTP will be critical. Five and ten-year action plans will be developed based on the transit project development process and will provide initial project development timeline assumptions, identification of projects for federal funding, and ultimately a framework to guide planning, environmental, design, and construction efforts for the 2050 transit network. Policies from the Final 2050 RTP will be incorporated into the next update of SANDAG's Regional Comprehensive Plan, which will, in turn, further support the performance and use of the transit network.

Appendices:

Technical Appendix A.	Definitions of Transit Services and Facilities for Urban Area Transit Strategy
Technical Appendix B.	Key Points from Brainstorming Sessions on the Urban Area Transit Strategy
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Technical Appendix I.	Draft Transit Evaluation Ranking (Ranked Order)
Technical Appendix J.	Draft 2050 RTP Revenue Constrained Network Scenarios: Transit Network Maps
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Technical Appendix A

Definitions of Transit Services and Facilities For Urban Area Transit Strategy

High-Speed Rail:

France's TGV

Spain's AVE

California High-Speed Rail

Designed for very high-speed long-distance intercity trips with long station spacing and dedicated grade-separated lines. Examples include the Shinkansen in Japan, the TGV in France, and the AVE in Spain. California High-Speed Rail (HSR) currently is being planned from Sacramento to San Diego.

- Vehicles are steel wheel on steel track electrically-powered bidirectional train sets
- Top Speed: 220 miles per hour (mph), but 150 mph maximum expected from San Diego to Escondido and 200 mph maximum from Escondido to Riverside
- Level boarding
- Passenger Capacity: Not yet determined in California. Examples from around the world range from approximately 300 to 1,300 per train but most single level trains have about 400-500
- Operates on dedicated high-speed track with no at-grade crossings
- California HSR system will be over 600 miles

Intercity Rail:

Amtrak Pacific Surfliner

CalTrain

Designed for long distance intercity trips with long station spacing. Typically shares right of way with freight and commuter rail. Examples include the Amtrak Pacific Surfliner, Amtrak Capitol Corridor, and Amtrak Coast Starlight. Intercity rail accommodates leisure and business travelers with upgraded passenger amenities.

- Intercity rail lines typically use diesel locomotives
- Typical speed: 80 mph
- Typically low floor boarding.
- Average station spacing: 10 to 20 miles
- Typical length of line: 100 to 2,000 miles

Commuter Rail:

San Diego COASTER

Southern California MetroLink

Designed for higher-speed, longer-distance regional trips with stations spacing every four to five miles on average. Examples include the San Diego COASTER, Dallas/Fort Worth Trinity Railway Express, and Southern California Metrolink.

Commuter rail lines use diesel or electric locomotives (diesel are more common and are used in Southern California)

- Typical speed: 80 mph
- Typically low floor boarding
- Supported by Park and Ride lots
- Typical passenger capacity: 130 seats per car operating with 3-8 car trains (typically no standees)
- Operates on a dedicated right of way separate from other vehicles
- Typical length of line: 25-100 miles

Light Rail Transit (LRT):

San Diego Trolley

San Diego SPRINTER

Designed for medium-distance trips with station spacing about every mile on average. Examples include the San Diego Trolley, the San Diego SPRINTER, Portland MAX, Minneapolis Hiawatha Line, and Houston MetroRail.

- Electric or diesel-powered rail vehicles
- Typical speed: corridor speed limit, generally not exceeding 55 mph
- Typically low floor boarding
- Designed for high-capacity corridors
- Integrates well with street traffic, signals, and pedestrians
- Operates on a dedicated guideway within a separate right of way or on the street
- Typical passenger capacity: 60-140 seated plus standees (per car), with 1-4 cars
- Typical length of line: 6-25 miles

Streetcar:

Portland Modern Streetcar

San Francisco Historic Streetcar

Designed for short-distance trips with station spacing every few blocks or every quarter-mile on average. Examples include the Portland Modern Streetcar, Seattle Streetcar, and San Francisco Historic Streetcar.

- Electric-powered rail vehicles
- Typical speed: speeds up to the speed limit of the street they operate on, generally averaging 12 mph (with stops)
- Designed for dense urban areas, such as downtown areas
- Integrates well with street traffic, signals, and pedestrians
- Operates either in mixed traffic with automobiles or on a dedicated right of way
- Typical passenger capacity: up to 100 seated and standees per car (vehicles generally provide few seats due to short distance nature of trips). Operate as single vehicles
- Typical length of line: 2-6 miles

Bus Rapid Transit (BRT):

San Diego I-15 BRT

Los Angeles Orange Line

Las Vegas Wright BRT System
(Photo courtesy flipchip/lasvegasvegas.com)

Designed for longer-distance, higher-speed, regional trip-making on a dedicated bus guideway or freeway Managed Lanes/High Occupancy Vehicle (HOV) facilities. All-day, all-stop trunk BRT services can be complemented with peak-period commuter express services designed to provide very limited stop connections to major employment centers. Examples include San Diego Interstate 15 BRT; Los Angeles Orange Line; Eugene, Oregon EmX; and the Brisbane South-East Busway (Australia).

- Diesel or CNG/alternative fuels standard
- Typical speed: corridor speed limit, typically 40-60 mph on average
- Supported by Park and Ride lots
- Designed for high-capacity corridors
- Low floor design
- Operates on dedicated guideway and sometimes in mixed traffic with automobiles
- Typical passenger capacity: 50-60 seated plus standees on arterial routes, 50-80 seated on freeway routes (per bus)
- Typical length of line: 8-15 miles on arterial segments, 10-30 miles on freeway segments
- Typical station spacing: 0.5-1 mile on arterial segments, 4-5 miles on freeway segments

Senior and Persons with Disabilities Services:

MTS Access

- American with Disabilities (ADA) services for those who cannot access regular fixed route services
- Social service agency services, including door-to-door services

Rapid Bus:

Los Angeles Metro Rapid

Future Mid-City Rapid Bus

Provides higher-speed alternatives to local bus services in high-volume arterial corridors and utilizes a range of lower-capital cost signal priority treatments, short segments of transit-only lanes, and limited station stops to achieve faster travel times. Rapid Bus services can be upgraded to BRT over time through the implementation of dedicated transit lanes to bypass congested arterial segments. Examples include Los Angeles Metro Rapid and Boston Washington Street Silver Line.

- Diesel or CNG/alternative fuels standard
- Typical speed: speeds up to the speed limit of the street they operate on, averaging about 25 mph (with stops)
- Low floor design
- Designed for high-capacity corridors
- Integrates well with street traffic, signals, and pedestrians
- Typical passenger capacity: 40 seated plus standees (per bus)
- Typical length of line: 8-15 miles
- Typical station spacing: 0.5-1 mile

High-Frequency Local Bus:

San Diego Metropolitan Transit System (MTS) Bus

San Diego North County Transit District (NCTD) Bus

Facilitates mid- to short-distance trip making within local communities, with closer station spacing. Local bus services serve as the backbone of the transit system and provide the primary access into local communities where fixed-route services are warranted.

- Typically standard and single articulated buses
- Typical speed: speeds up to the speed limit of the street they operate on, averaging 12 mph (with stops)
- Low floor design
- Integrates well with street traffic, signals, and pedestrians
- Operates in mixed traffic with automobiles, but can benefit from transit-signal priority and queue jump lanes
- Typical passenger capacity: 37-57 seated plus standees (per bus)
- Typical length of line: ranges from less than 5 miles to 25 miles
- Typical station spacing: 1-4 blocks

Technical Appendix B

Key Points from Brainstorming Sessions on the Urban Area Transit Strategy (As reported to SANDAG Transportation Committee on March 19, 2010)

In preparation for the development of the Urban Area Transit Strategy, staff facilitated brainstorming sessions on ideas and concepts that could be considered in the alternative transit networks. Brainstorming sessions were held from October to December 2009 with the SANDAG Transportation Committee and Regional Planning Committee; the North County Transit Development (NCTD) Board of Directors; and the SANDAG Regional Planning Stakeholders Working Group (SWG), Regional Planning Technical Working Group (TWG), Cities/County Transportation Advisory Committee (CTAC), and Regional Housing Working Group (RHWG). Comments were solicited from the Metropolitan Transit System (MTS) Board of Directors in February 2010. The following are "key points" from those brainstorming sessions. A more detailed spreadsheet is available upon request.

SANDAG Transportation Committee

- Liked the world-class transit systems of London, Paris, Brisbane, Shanghai, and Portland; also cited lessons that could be learned from transit systems in Phoenix and Pittsburgh.
- Emphasized the importance of keeping the focus on maintaining and upgrading the region's existing transit infrastructure (such as double-tracking of COASTER and SPRINTER lines)
- Encouraged higher frequencies (for example, five-minute frequencies in key corridors)
- Encouraged more directional signage, benches, and shelters at transit stations
- Urged better use of technology (such as cell phone applications) to assist transit customers with real-time transit information
- Advocated for significant improvements between transit networks and bike infrastructure (for example, bike racks at transit stations, bike rental facilities at transit stations, bike racks on trains and buses, similar to European examples)
- Recognized the cleanliness and safety of the existing transit system in San Diego
- Cited Portland as an example of high bike ridership, a free downtown transit ridership zone, and good ties to the airport

SANDAG Regional Planning Committee

- Liked the world-class transit systems of London, Paris, Manila
- Emphasized the need to test the alternative transit networks against the reduction of vehicle miles traveled (VMT) as a key metric
- Suggested the use of smaller vehicles, such as shuttles or jitneys, to increase frequencies and to provide services in residential neighborhood areas
- Advocated building upon the existing transit network, and focusing the future transit network improvements in the urban core areas
- Suggested creating more "express" transit services to targeted areas to minimize travel times in key corridors

- Advocated the incorporation of the Smart Growth Design Guidelines and the Regional Bike Plan into the Urban Core Transit Strategy planning process
- Cited Portland as an example of an area where expenditure decisions have resulted in a tangible benefit to active transportation (high bike mode share)

NCTD Board of Directors

- Emphasized the need to figure out how to make transit work in communities that don't want increased density
- Expressed support for focusing on enhancements to the existing network, not just new ideas, and evaluating last-mile solutions
- Encouraged the evaluation of how high-speed rail fits into the study
- Stated that more service is a great idea, but urged that we consider how we pay for it
- Emphasized that transportation should fit into the land use plans of cities, not the other way around
- Expressed the concept that "transit is what the community wants it to be," and reemphasized that we need better coordination with local plans, especially in the short-term. For example, cities and transit agencies should enter into agreements to better coordinate land use and transportation.

MTS Board of Directors

- Emphasized the need to address long-term, sustainable funding sources for transit
- Encouraged community outreach, particularly to the Mid-City Community
- Recognized that the region has a solid transit network currently in place and that more can be done over time to improve the system

Regional Planning Technical Working Group (TWG) and Cities/County Transportation Advisory Committee (CTAC)

- Liked world-class transit systems of San Francisco, Washington, D.C., Paris, Bogota
- Emphasized building upon our existing transit system backbone and continuing multimodal transit technologies with a variety of options
- Suggested more shared use of parking facilities at transit stations as a way to enhance the quality and activity centers of local places
- Recognized that cul-de-sacs are bad for connectivity
- Urged implementation of bike network improvements, and implementation of more (and better-designed) pedestrian paths
- Suggested making collector streets more pedestrian and bike-friendly (reducing lanes, widening sidewalks, adding landscaping)
- Suggested reintroduction of streetcars in areas where there are space constraints

Regional Planning Stakeholders Working Group (SWG) and Regional Housing Working Group (RHWG)

- Emphasized the desire for more frequent transit, higher-speed transit services, lower fares, and fare free zones in some areas, such as Downtown
- Urged the creation of more well-maintained bike and pedestrian paths that connect to transit stations, with a focus on a multi-modal system with good connections and more bike racks
- Encouraged the availability of transit information and “applications” on cell phones
- Commented on the need for more signage, information, and security at stations
- Commented on the opportunity to increase the broad-base appeal for transit by linking “green issues”
- Voiced the need for more accessibility to transit stations and transit vehicles by the disabled, and the opportunity to link for-profit and nonprofit partners

Technical Appendix C

Urban Area Transit Strategy:

A Component of the 2050 Regional Transportation Plan

Lessons Learned from Peer Regions

December 2009

Prepared by:

PARSONS BRINCKERHOFF

EXECUTIVE SUMMARY

With the preparation of the 2050 Regional Transportation Plan (RTP), the San Diego Association of Governments (SANDAG) is seeking a new and innovative vision for transit that will result in a more significant role for transit in addressing the region's mobility, land use, and sustainability goals. To help guide development of a new transit strategy, a review has been conducted of other regions that have successful transit systems, relatively high levels of transit use, and unique transit services or facilities. These areas offer examples of how transit has been applied successfully, and provide a point of reference or a standard from which comparisons can be made.

Three regions that might be considered "benchmark" cities for San Diego were researched in some detail. These cities are:

- Portland, Oregon
- Sydney, Australia
- Vancouver BC, Canada

Seven additional "comparison cities" are highlighted because they have characteristics similar to San Diego or provide examples of unique transit applications that have helped raise the profile of transit in their regions. These cities are:

- Brisbane, Australia
- Bordeaux, France
- Denver, Colorado
- Los Angeles, California
- Melbourne, Australia
- Minneapolis, Minnesota
- Seattle, Washington

Appendix A contains comparative data for U.S. cities to help provide a point of reference for San Diego.

Overarching Themes and Considerations for San Diego

Several overarching themes emerged from the benchmark and comparison cities evaluation, many of which may be appropriate for consideration as SANDAG develops the 2050 Transit Strategy. The overarching themes found as part of the case study review are presented on the left side of the following table and their potential applicability to San Diego is presented on the right.

Overarching Theme	Considerations for San Diego
The "success" of transit did not happen overnight. Successful transit has been an evolutionary process in case study regions during which certain strategies were used until their usefulness was outlived, and then the strategies were modified or new strategies were implemented.	San Diego embarked on an innovative new transit strategy in the early 1980s with the opening of the region's (and nation's) first urban rail transit line since WWII from downtown San Diego to the International Border. Over the next 25 years, the region expanded the rail network to provide a backbone transit infrastructure and service network, to one that now includes 75 miles of light rail (San Diego Trolley and Sprinter) and 40 miles of commuter rail (Coaster). Between 1975 and 2005, transit ridership increased 150 percent while regional population increased approximately 75 percent. As the original regional rail program nears completion (the 11-mile Mid-Coast corridor between Old Town and University City is the only remaining rail extension in the Regional Transportation Plan), the regional transit strategy has shifted to a multi-modal, shared right-of-way approach (transit on managed lanes and arterial streets). Looking to the experiences of the case study regions, San Diego may need to develop a new "dramatic strategy" for transit for the next 30-40 years – one that combines past, present, and future strategies to recapture the transit momentum experienced in the 1980s. The new strategy will need to include a stronger connection between transit investment and land use policies to achieve SANDAG's vision for a larger transit mode share in the urban core, and key corridors and communities.
Transit success depends on regional plans and visions that guide the integration of land use and transportation. Many regional plans create a hierarchy of centers focused around transit that provide good design, sufficient density, and a land use mix that supports non-auto access to transit. Success is also dependent on a number of agencies working collaboratively to achieve the success of the regional plans and visions.	SANDAG's Regional Comprehensive Plan and Smart Growth strategy have established a hierarchy of centers that are designed to be supported by transit, as well as policies for integrating land use and transportation. Development of a new regional transit strategy should draw heavily on the policies and goals in the Regional Comprehensive Plan for both the region and specific corridors/communities. To achieve success, agencies, transit providers, and stakeholders must work together towards agreed upon transit and land-use goals.

Overarching Theme	Considerations for San Diego
Regions use a variety of tools to achieve transit success. Regions used a variety of policy, regulatory, and financial tools that contributed to the success of transit in these regions. Tools were modified or new tools added when they were no longer effective for encouraging ridership or investment along transit corridors.	SANDAG and the region already have a variety of policy tools to support transit as defined in the Regional Comprehensive Plan and Smart Growth strategy. Additional policies and tools found in the peer regions/cities that promote and support existing and future transit services for consideration by SANDAG include: improvements to the pedestrian environment, urban growth boundaries, cooperative agreements between public agencies and private developers, tax incentives to foster transit oriented development, parking maximums or limitations, and legislation requiring commute trip reductions by major employers.
Regions generally experienced a shift in policy and investment toward transit over the past few decades. Regions moved toward transit as a tool for improving mobility and sustainability in response to public pressures related to sprawl, the environment, livable communities, and quality of life issues. These regions also made significant investments in permanent transit infrastructure, which not only improved transit, but also helped generate awareness and understanding of the transit system and spur transit-oriented development.	The San Diego region is also experiencing similar pressures to contain sprawl, protect the environment, promote livable communities, and maintain and improve the quality of life. Through the Regional Comprehensive Plan, the San Diego region has made the policy connection between investments in transit and achieving these goals. Looking toward the future, new transit policies and strategies designed to increase transit mode share will need to understand the effects of regional highway investments and policies on the potential success of the transit investments and system.
Local bus networks are essential for successful transit systems to provide efficient connections and access to the backbone system. To efficiently support higher frequency transit stations, feeder services are essential components of the transit system and, depending on the local geography, are often structured along grids or hub-and-spoke networks.	San Diego's existing transit network leans toward hub-and-spoke structure with feeder buses connecting to rail based transit centers. However, many trips rely solely on bus transit. A new transit strategy will need to build off the existing rail transit investment, while also considering how best to serve key travel markets (origins/destinations, work trips, etc.) that may not be well served by existing bus/rail connections. The strategy will also need to define the role of local and feeder bus service in relation to the major transit infrastructure investments.

Overarching Theme	Considerations for San Diego
Parking requirements in transit-supportive communities are reduced. Most transit successful regions have coordinated parking policy with land use and transit policy. Parking strategies often differ between central and outlying areas.	Abundant and inexpensive parking have proven to be key deterrents to transit use. A new transit strategy for the San Diego region should evaluate how parking policies (location, availability, and cost), particularly in the city center and urban core, impact transit use.
Successful transit systems include a variety of transit modes. Cities and regions with successful transit have systems that include combinations of transit modes applied for the particular conditions, objectives and circumstances (i.e., heavy rail, commuter rail, light rail, bus rapid transit, rapid bus, local bus, streetcar, shuttles, electric bus, etc.)	All regions include a combination of transit facility and service applications to create their transit networks and systems.
Unique applications of transit have occurred in the central cities. While all of the studied regions have a wide range of transit modes that provide area- and location-appropriate transit, these cities have also incorporated special applications of transit infrastructure, services, and policies in their downtowns in ways that raise the profile of transit, promote transit use, and support higher density environments.	Even cities with similar transit histories and land use characteristics as San Diego have invested heavily in innovative transit facilities and services in their central cities (transit malls, streetcars, underground bus terminals, fare free zones). These investments have proven highly successful in generating transit ridership, supporting the regional transit network, achieving land use objectives, increasing transit mode share, and contributing to the vitality of their downtown core. Many of these strategies may have applicability to downtown San Diego and other key activity centers.

BENCHMARK CITIES

For the benchmark cities, the project team asked a series of questions designed to provide insight into why transit works within the city and what supports the system to make it work.

1) Portland

When did the process begin?

The evolutionary process of becoming a transit city began over 25 years ago when the first light rail line was planned. In Portland, the first light rail line was, in part, an outgrowth of a citizen led freeway revolt that ultimately resulted in the reduction of available land takings for transportation uses. With limited land to work with, TriMet focused on building partnerships and convincing others that transit oriented development (TOD) was an essential tool to address current and future transportation needs. However, transit oriented development was largely an afterthought during development of the first light rail line.

Fifteen years later, the creation of new walkable communities was a primary rationale for building the streetcar line that runs through downtown Portland. Many advocates consider the streetcar to be a housing and redevelopment tool; not just a tool for moving people out of their cars. Since the streetcar opened in 2001, over $3.4 billion in development and 10,212 residential units have been constructed along the route.

What is unique about the system?

The Portland story is about community-building and life-style choice more than a transit or TOD story. The Region 2040 Plan, the regional growth strategy and vision for the Portland Metropolitan region, identifies a series of centers that are focused around transit. As such, TOD is a means or tool to become a sustainable place, not an end in itself.

As each successive light rail line developed, it became clearer that the addition of transit alone was not enough to spur development and increase ridership. A clear strategy and tools were needed to realize the construction of a higher density mix of uses near transit investments. The strategy involves coordination among various agencies, each playing a different role consistent with its overall mission:

- TriMet – seeks to focus growth next to transit because of the evidence supporting the theory that the more people who can walk to transit, means more people who will use transit. TriMet has no special TOD tools or sources of funding, but TriMet does do the following: select rail alignments that support TOD; modify station locations to facilitate supportive development; fund local government planning to encourage implementation of supportive policies; write-down land costs to get better design/density/affordability in TODs; turn park-and-rides into TODs; and invest savings from rail construction to create TODs.

- Metro – oversees the implementation of Region 2040, act as the Metropolitan Planning Organization responsible for identifying existing and future transportation project and program expenditures, sets the regional plan for expanding transit, and manages the Portland metropolitan region's urban growth boundary. In addition to its transportation planning role, Metro has a TOD program that is dedicated to the development of TOD centers and corridors as part of an aggressive strategy to implement Region 2040. The program operates through a series of cooperative agreements between Metro and local jurisdictions and utilizes agreements with private developers (primarily for site acquisition). In the past, the program has focused on projects that might not otherwise be developed on a given site without additional subsidy.
- Portland Development Commission (PDC) – is the urban renewal and economic development arm of the City of Portland. PDC funds projects that are green, support the community and transit, pay prevailing wages, and meet minority and disadvantages business goals. PDC also uses tax abatement and developer agreements to support projects. It has funded several TODs in the City of Portland.

In addition, the private sector is asked to be a partner, as well as be innovative – in return, the public sector seeks to reduce the risk for their private sector partners. For example, when the streetcar was built in the Pearl District, a developer agreement was signed by the developer and the City of Portland (PDC) that addressed housing density, housing affordability, parks, and infrastructure. The developer contributed funding and donated right-of-way for needed infrastructure (streets, streetcar, utilities, and park) within the development and committed to develop at higher housing densities to coincide with certain public improvements to be provided by the City, such as the removal of a structure crossing the abandoned rail yards, construction of the streetcar, and a neighborhood park. The City formed an urban renewal district to allow for tax-increment financing in order to fund its obligations.

Throughout the years, these partnerships have spurred more than $9 billion in development, consistent with transit-friendly land use plans along Portland's 44 miles of light rail and 4 miles of modern streetcar. These partnerships have resulted in residential and employment growth occurring within walking distance of transit. As a result,

- Portland area residents travel about 20 percent fewer miles than residents in other large U.S. metropolitan areas;
- Portland residents are twice as likely to commute to work using transit and seven times more likely to commute by bicycle than the average metropolitan resident in the U.S.;
- Over 8 in 10 of TriMet's riders are choice riders, meaning they have a car available for the trip or choose not to own a car; and
- Portland has the second lowest rate of spending on transportation costs of the 28 largest U.S. metropolitan areas. Residents spend about 4 percentage points less of their total household budgets on transportation than other Americans, about 15.1 percent compared to 19.1 percent nationally.

Have freeway/highway investment strategies changed over time?

Over the years, more federal funds have been sought for transit than previously. The Draft 2035 Regional Transportation Plan identifies approximately 32 percent of the federal priority funds for transit capital and 47 percent for roads and bridges, which includes new street connections to transit or for walking and biking.

What is the share of downtown employment in the region?

Approximately 8 percent of the region’s jobs are in the central business district.

Exhibit 1 Portland MAX Light Rail Network

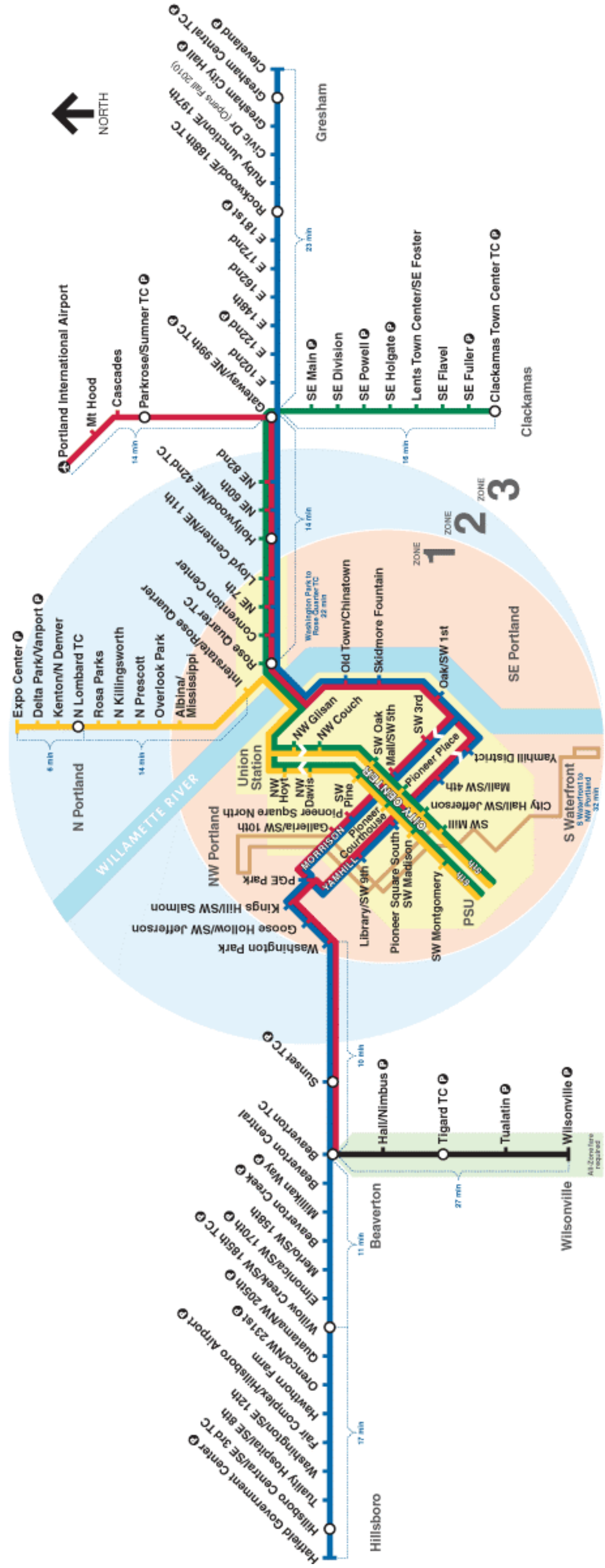
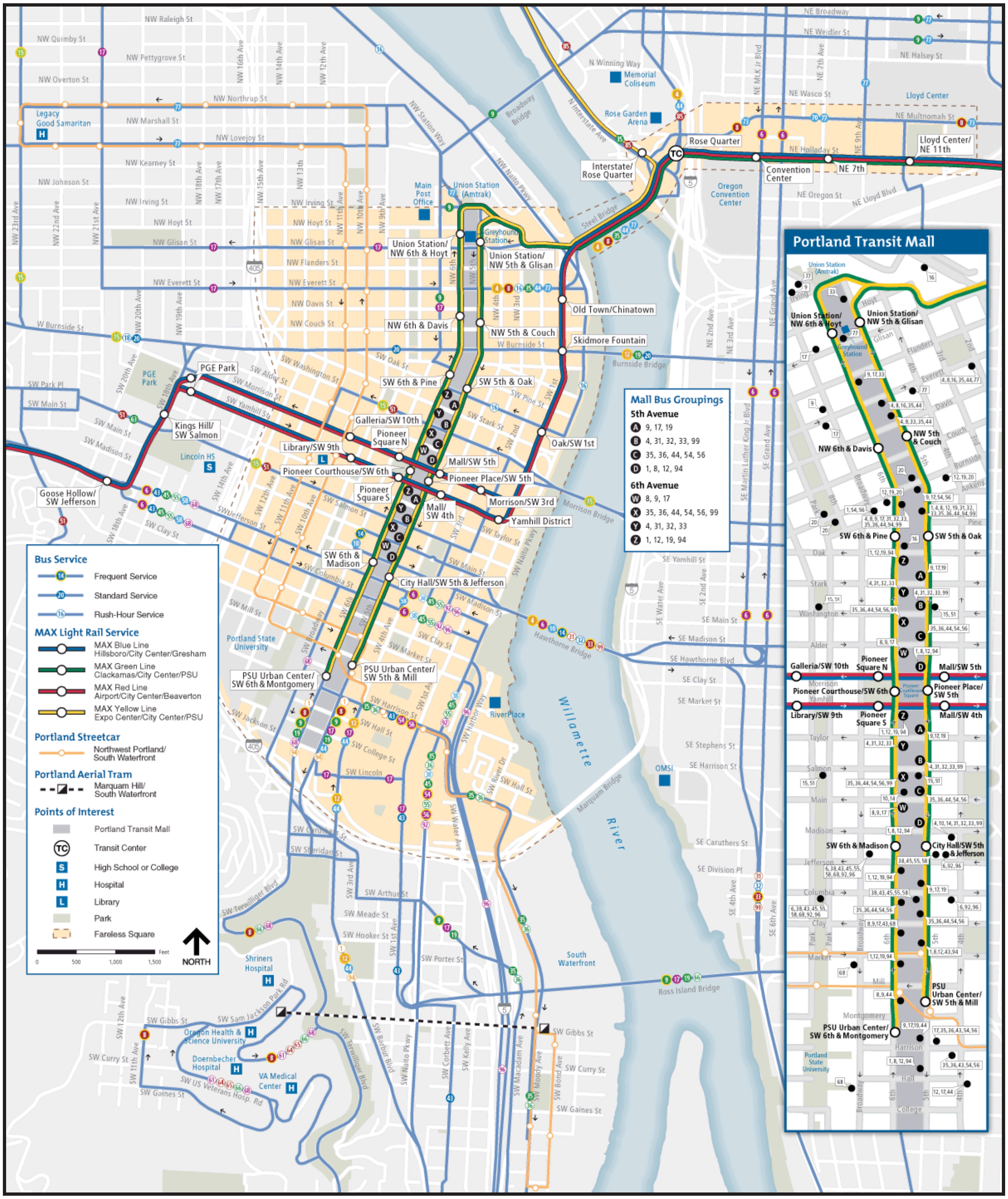


Exhibit 2 Downtown Portland Transit Mall



2. Sydney

When did the process begin?

Over the past three decades metropolitan planning strategies for Sydney have contained policies which sought to promote development and growth in designated centers within the metropolitan area of Sydney, as well as policies that restrict office and retail activities outside of the centers. The 2005 New South Wales Metropolitan Strategy, "City of Cities – A Plan for Sydney's Future," continues the "centers" policy of concentrating activities in a hierarchy of "strategic centers" that includes the city of Sydney, five designated regional cities, areas of high value economic activity designated as specialized centers, and major centers that are areas of civic, shopping and recreational activity. The Strategy explicitly recommends concentrating activities in centers on or near public transport in order to achieve a range of benefits. Improving transport between Sydney's centers and the transportation sustainability of centers are key supporting objectives. While the accompanying transportation strategies included a commitment of resources to rail and other public transport investments and were premised on research that indicates a centers-based urban form requires upgraded public transport links that provide more efficient connections than automobiles, the key elements of the strategies have not always been delivered.

In the 1990's, study began on a network of transitways that would link the region's residential areas to the employment areas in the outer suburban ring around Sydney's central business district.

What is unique about the system?

In 2005, 80 percent of Sydney's population lived within 30 minutes by public transit of Sydney, a designated regional city, or a designated major center. Over 70 percent of employees in the Sydney central business district use public transit to and from work. This is the highest mode share in Australia and is comparable with Manhattan in New York City.

The Liverpool to Parramatta line of the Western Sydney Transitway Network is an example of how people's behavior can change when they are given high quality, frequent transit service. The rapid transit corridor is approximately 19 miles (30 km) long, running from Liverpool to Parramatta on an exclusive busway network. The intent of the line was to improve travel in the outer suburban ring (not into downtown Sydney) and improve access from residential suburbs to suburban employment centers by providing an alternative to the automobile. Originally planned as a fully integrated network, with a mix of dedicated trunk corridor and feeder services, only the trunk corridor services have been developed, which includes 35 stations and approximately five-minute headways during the morning and evening peak. Even without full build-out, the corridor has proven to be successful and has seen a 20 percent annual increase in ridership growth since it opened in 2003. Approximately 20 percent of the transit riders in the corridor previously traveled by automobile.

Have freeway/highway investment strategies changed over time?

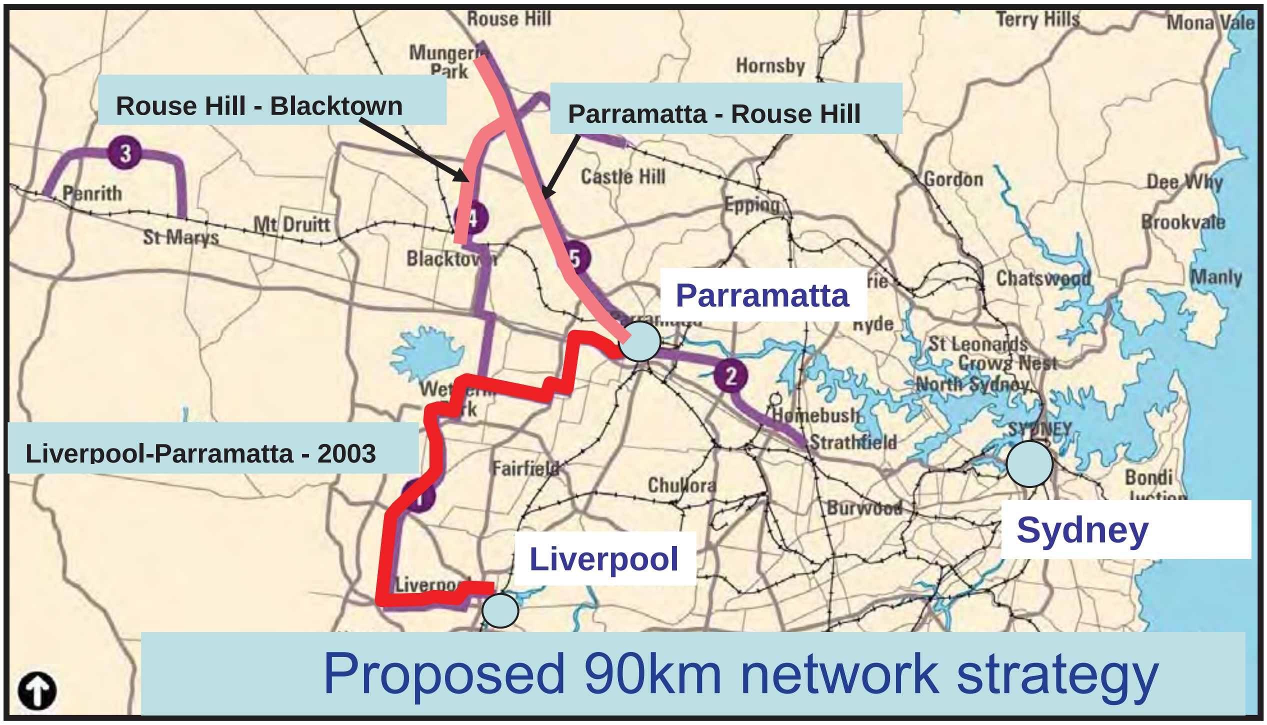
In the last decade, a considerable number of toll-road facilities have been developed and constructed under public-private partnership agreements and have, in part, been to complete the existing road network. In the last five years, there has been a shift away from freeways and toll-roads to transit infrastructure due to a change in policy at the Federal level.

What is the share of downtown employment in the region?

The central business district has approximately 12 percent of the region's employment.

Exhibit 3 Sydney CityRail Network

Exhibit 4 Liverpool to Parramatta Line – Western Sydney Transitway Network



3. Vancouver BC

When did the process begin?

The 1975 Livable Region Plan created a vision of transit-oriented growth. In 1996, the Livable Region Strategic Plan and the Transport 2021 Long-Range Plan were adopted. Both call for more compact development, complete communities, and TOD. The Livable Region Strategic Plan key strategies are:

- Protect the green zone (watersheds, farmlands, conservation areas, parks and other natural assets)
- Build complete communities
- Achieve a compact metropolitan region
- Increase transportation choice.

The Regional Town Centers in the Livable Region Strategic Plan focus employment growth closer to where people live and where transit service is most available. The Vancouver region also encourages infill development and protects their "green zones" through the use of an urban growth boundary.

What is unique about the system?

The urban design and density that supports transit have been part of Vancouver's story for decades due to its topographical and geographic constraints of water and mountains. The density in Vancouver is one of the components that make the transit system work. Social bonus zoning allows extra density in housing developments in exchange for public amenities, such as cultural facilities, parks, schools, and affordable housing, built by the developer. Developers appreciate this approach because they have found that the value of their projects increases with improved public amenities. The social bonus zoning has resulted in greater diversity in housing, both in housing types and demographics, and has also resulted in a vibrant public realm that includes greater walkability and a mix of uses. Public amenities ultimately included in developments are selected and managed by the City of Vancouver through a development agreement.

There are two transportation planning decisions that have greatly influenced how the citizens of Vancouver travel within their city. First, Vancouver is the only major city in North America that does not have a freeway within its boundaries. In the 1970's, as a result of the "Livable Region Plan," a proposed freeway grid system was abandoned in favor of more sustainable transportation systems. Second, the only bridge from downtown across Burrard Inlet is the three-lane Lions Gate Bridge – there are no discussions of replacing or widening the bridge. These two decisions have resulted in an acceptance by residents of alternative transportation options, but the city has also been designed to be walkable, bikeable, and provide a high level of transit service. Within the City of Vancouver, buses generally run on the grid system, but outside the city boundaries, most buses operate on a hub-and-spoke system along feeder routes that connect with SkyTrain, SeaBus, or West Coast Express. There are also express bus routes that travel directly to downtown Vancouver or other regional centers.

Another component of the Livable Region Strategic Plan is the prohibition of surface off-street parking in many of the regional town centers. This limitation has prompted developers to orient projects to transit facilities in order to avoid constructing more expensive structured or underground parking, as part of the proposed development. This limitation in use of available land for parking or auto-based needs can lead to the development of public amenities, such as parks, pedestrian and bike connections, and further development.

Have freeway/highway investment strategies changed over time?

The Livable Region Strategic Plan calls for limiting the amount of new highway infrastructure and increasing the supply of transit services across the region. No expansion of the highway network is proposed into the city of Vancouver and a planned major highway expansion project in BC's Lower Mainland to Highway 1 from Langley to Vancouver is currently experiencing public opposition. Investments by TransLink (the regional transportation authority responsible for regional transit, cycling and commuting options), are required to support the Livable Region Strategic Plan.

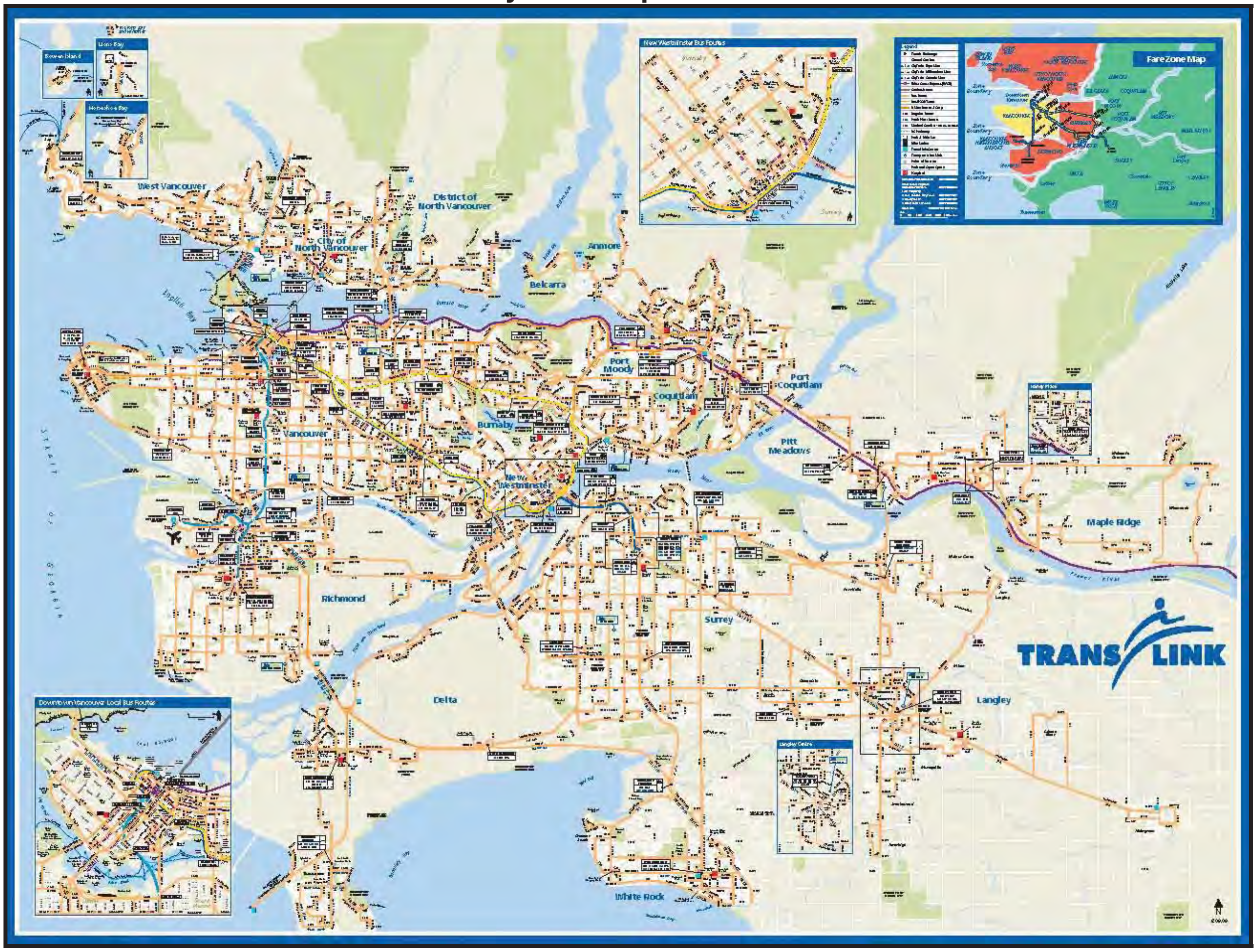
In addition to the Livable Region Strategic Plan, the City of Vancouver adopted a Transportation Plan in 1997 that emphasized limiting overall road capacity to 1997 levels by not expanding the grid system, but instead providing more comfortable walking and biking environments, increasing the use of transit, calming traffic in neighborhoods, and maintaining an efficient network for goods movement. After 10 years, vehicle trips entering Vancouver have decreased 10 percent, bike trips have increased 180 percent, walking trips have increased 44 percent and transit trips have increased by 20 percent.

What is the share of downtown employment in the region?

Approximately 9 percent of the jobs in the Vancouver region are located in the central business district.

Exhibit 5 Vancouver TransLink Map

Exhibit 6 Vancouver TransLink System Map



COMPARISON CITIES

In addition to the three benchmark cities, seven comparison cities that are similar in size and demographic and/or geographic characteristics to San Diego were studied because they have transit components that are worth understanding, particularly in their central areas.

1. Brisbane

Brisbane's transit system is managed by the TransLink Transit Authority and consists of CityTrain, Brisbane's urban rail network of 10 suburban lines and three interurban lines (237 miles), the CityCat ferry system, local bus service, and a busway network. The decision to develop a busway instead of expanding the existing rail system was due to a debate over the expansion of the Pacific Motorway (freeway) from six to eight lanes. The expansion was opposed by a large segment of the community and the Brisbane City Council desired an alternative that focused on people carrying capacity (versus auto carrying capacity). However, the corridor was not included in any future plans for a rail extension and contained relatively low-density development. The busway concept was designed to address the dispersed transit needs of this corridor, fill the gaps between existing rail lines, and further complete the public transportation network. The busway provides a dedicated facility that allows suburban bus routes to access the busway at key locations, providing more point-to-point travel from local bus stops and avoid auto traffic congestion on the motorway. More than half of the bus routes using the busway begin their service in the adjoining suburbs before traveling express to the central business district.

The South East busway was the first section to open and has been operational since 2001. The Inner Northern Busway began service in 2008, creating a core section of the busway system that runs from the Royal Children's Hospital to Queen Street. There are over 19 miles of transit lanes with 17 stations (stations include electronic bus information, security, and bicycle facilities) on dedicated roadways. Both rail and bus systems converge in the Brisbane central business district; the Roma Street station includes platforms for the busway and CityTrain services at the same level. Expansions of the busway are currently being constructed or planned, including the Eastern and Northern Busway.

Exhibit 7 Brisbane Queensland Rail and Busway Network

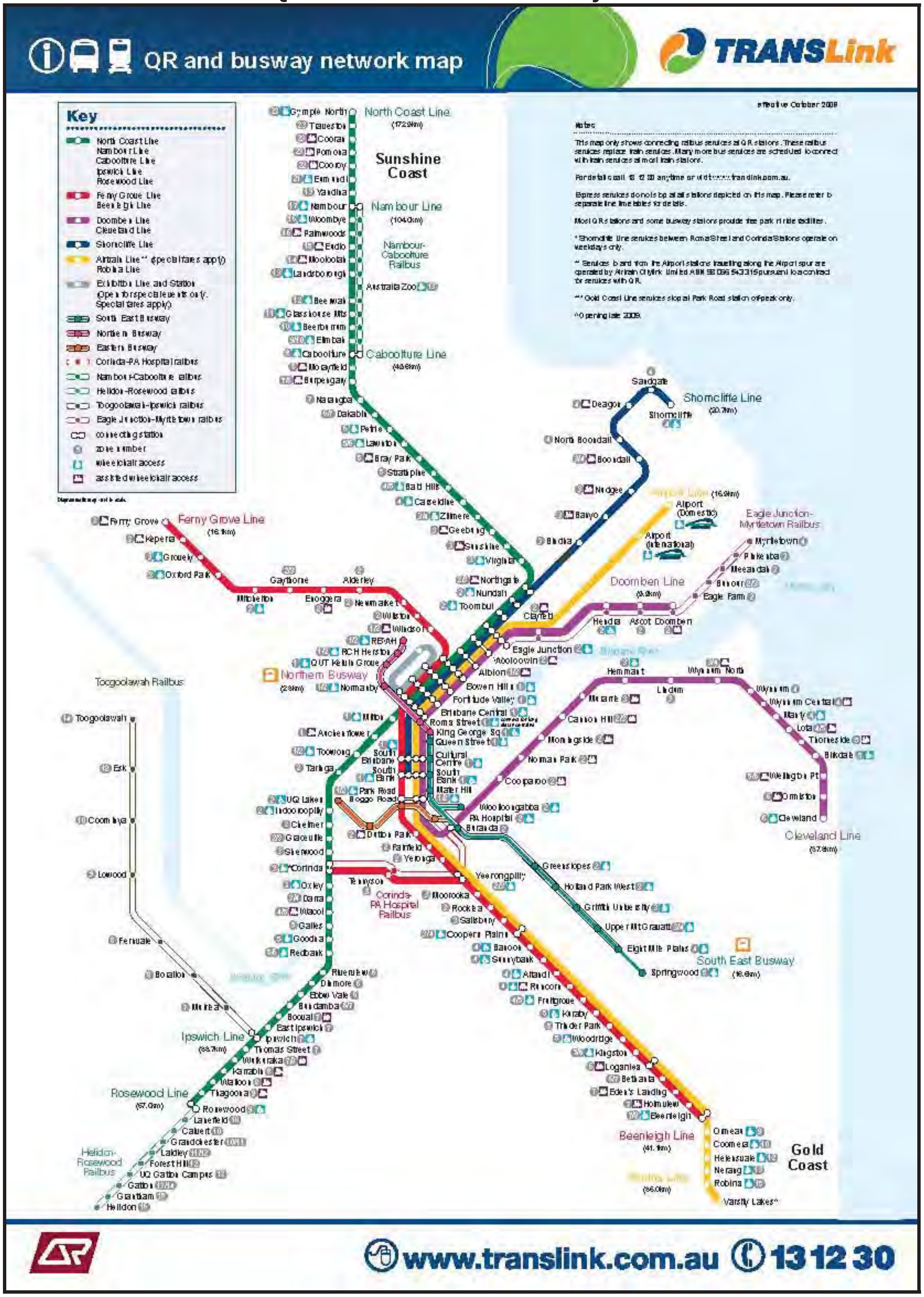


Exhibit 8 Brisbane Translink Busway Network


TransLink busway network
Bracken Ridge
Chermside
Northern Busway
Kedron
RCH Herston
CITY
Northern Busway to Windsor
South Bank
Coorparoo
Eastern Busway (Buranda to Capalaba)
Buranda
Carindale
Greenslopes
Capalaba
Griffith University
South East Busway
Eastern Busway (University of Qld to Buranda)
Springwood
Key
rail network
existing busway network
future busways
proposed busways
Please note: this map is not to scale and indicative only

2. Bordeaux

Bordeaux's public transit system consists of three tram (streetcar) lines, 72 bus routes that all connect to the tramway network and electric bus shuttle in the city center, and a boat shuttle on the Garonne River. The tram network connects Bordeaux with surrounding suburban areas. The first phase of the network consists of a 24.5 km (approximately 15 miles) network and 53 stations. The second phase will extend the three lines a total of 20 km (12.5 miles) and incorporate an additional 28 stations and eight park-and-ride lots.

Many downtown streets and plazas along the tram lines have become pedestrian areas with limited car access – pedestrian mobility is supported by an electric shuttle bus (la navette du centre-ville) in the downtown core that has no set stops. The city of Bordeaux implemented the Urban Project to improve the center city environment for pedestrians and cyclists and established principles of pedestrian-friendly environments in their Street Code document for improved streetscapes and pedestrian connectivity. The city also established car-free zones and pedestrian-only days within the center city. Bordeaux has seen a dramatic increase in the number of cyclists since these measures have been enacted.

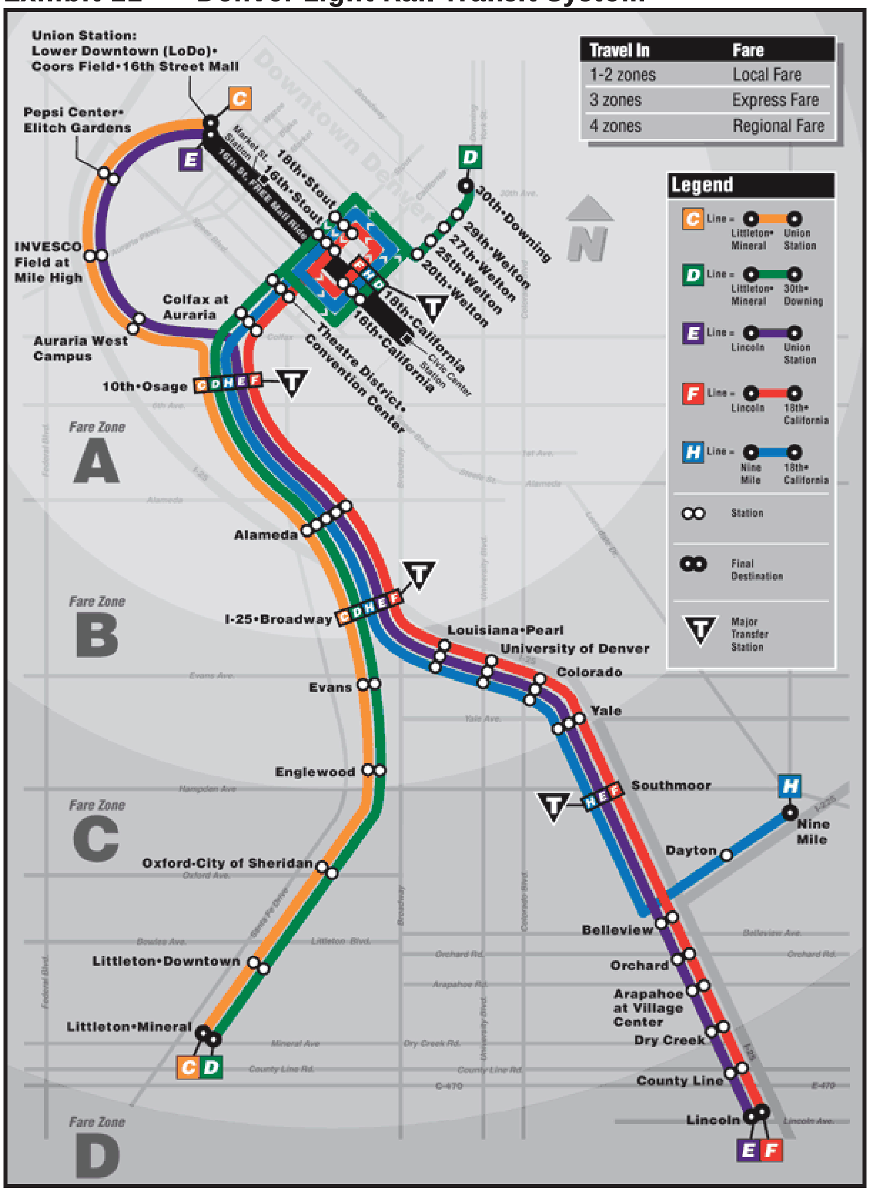
Exhibit 9 Tramway de Bordeaux System Map

Exhibit 10 la navette du centre-ville Route Map (electric shuttle bus)

3. Denver

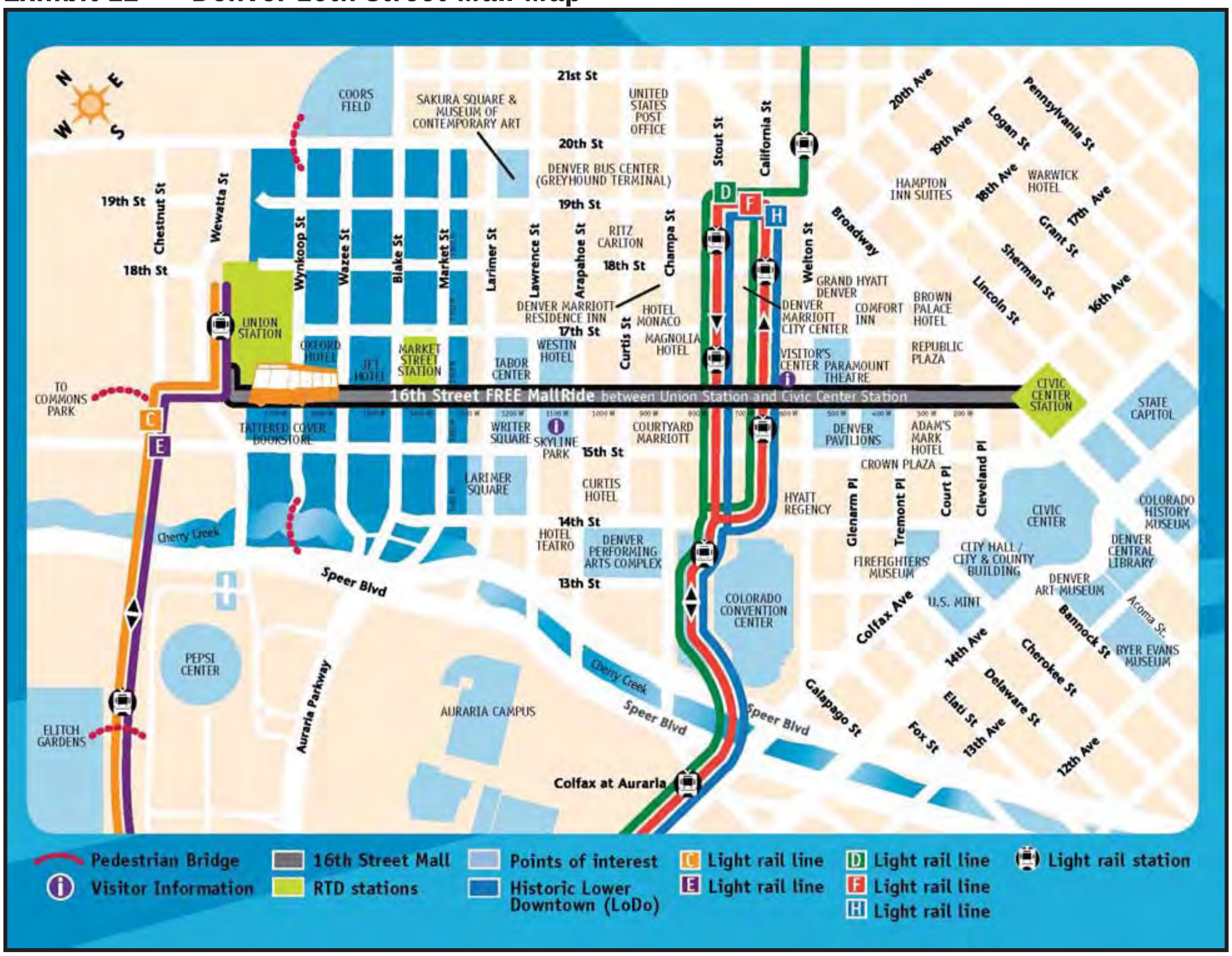
The Regional Transportation District (RTD) manages and coordinates public transportation in the greater Denver area (eight of the twelve counties) and provides service on 140 local, express, and regional bus routes, six light rail lines (totaling 35 miles), and nearly 80 park-and-rides. In 2004, voters approved FasTracks, a light rail, bus, and commuter rail expansion project that will serve neighboring suburbs and communities. It will add 122 miles of new commuter and light rail, 18 miles of bus rapid transit service, 21,000 new parking spaces at rail and bus stations, and enhance bus service within the eight-county district.

Exhibit 11 Denver Light Rail Transit System



Within the central business district, the 16th Street Mall is a pedestrian and transit mall running 1.25 miles from Union Station (Wewatta Street) to Civic Center Station (Broadway). Since its opening in 1982, the Mall has become the city's busiest transit artery and a premier public space. Originally, from Market Street to Broadway, the Mall was extended in 2001 to Wynkoop Street and then to Union Station in 2002 with the completion of the Central Platte Valley (C line) light rail extension. The FREE MallRide, a free high-frequency electric shuttle bus service operated by RTD runs the length of the Mall. The frequency of service is very high, with buses approximately every 1-2 minutes during rush hour. The total travel time from Union Station to Civic Center Station is approximately 11 minutes. Stops are located at every intersection. The FREE MallRide connects to other RTD transit: light rail at Union, 16th/California and 16th/Stout Stations; and bus service at Civic Center and Market Street Stations. The connecting bus services enter below grade bus stations at these locations.

Exhibit 12 Denver 16th Street Mall Map



4. Los Angeles

The Los Angeles County Metropolitan Transportation Authority and several other agencies operate the region's bus, heavy rail, and light rail lines throughout Los Angeles County. Since the 1980s, the region has undergone a fundamental refocusing of its transportation policy from freeways to transit. Los Angeles has invested heavily in transit over the past 20 years, beginning with Proposition A in 1980, which provided a half-cent sales tax specifically for transit, Measure C in 1990, another half-cent sales tax of which at least 40 percent is dedicated to transit (the remaining is for highways and roads), and Measure R in 2008, the most recent half-cent transportation sales tax of which at least 65 percent is dedicated to transit. The combination of the three sales tax measures results in an approximately one-cent sales tax for transit. Transit service in the Los Angeles area includes light rail (Blue, Green, and Gold lines), heavy rail subway (Red and Purple Lines), BRT guideway (the Orange Line, El Monte Busway, and Harbor Transitway), and 20 Rapid Bus projects, tying rail and bus together into a backbone system in a relatively short time. In addition, MetroLink provides commuter rail service within and between Los Angeles, surrounding counties and many suburban areas, and an extensive local bus network supports the backbone system.

Downtown Los Angeles is the hub of the city's rail transit system and on the northeastern edge of downtown, the Los Angeles Union Station (known as the "Last of the Great Railway Stations") serves as the region's main transportation hub. However, the region includes a number of non-downtown serving rail and bus facilities, particularly the Metro Rapid bus services, which now operate on a 450 mile network, complementing light and heavy rail transit throughout Los Angeles County.

Exhibit 13 System Map of Los Angeles Metro (LRT), MetroLink (Commuter Rail), and Orange Line (BRT Guideway)

Exhibit 14 Los Angeles Metro Rapid (Arterial Bus) and Rail System Map

5. Melbourne

Public transportation in Melbourne includes train, tram (streetcar), and bus networks. MetTrain, the rail network, consists of 16 suburban lines that feed into City Loop, a partially underground one-way loop that is serviced by five stations. Melbourne's tram network has 29 routes and 250 km (155 miles) of double track, approximately 80 percent of which shares surface roads with other vehicles and users. In addition, Melbourne has a bus network of approximately 300 routes that are provided by about 50 privately-owned bus companies under a franchise system. Melbourne also has a fare free transit service (CityCircle) within the downtown area.

Unlike other cities post World War II, Melbourne did not abandon its tram system. Because of the long history of trams in the central area, Melbourne has retained a strong focus on compact development in the central business district. Also contributing to the high central business district densities is the City's reluctance to connect the core and lower density suburban areas with high capacity freeway links. When the 1969 Metropolitan Transportation Plan proposed that a 500-kilometer freeway network would be needed within 15 years to avoid citywide gridlock, the Committee for Urban Action did not want a freeway to take over the city and mobilized against the proposal in order to preserve the unique design of the inner city from "imposing freeway structures."

In the mid-1980's, an effort was made to strengthen the region's core through the adoption of the "Central City Plan" that focused on infill development in the established areas and creating "green wedges" between the urban and rural areas. This plan transformed Melbourne's central city through urban design and planning, including the implementation of height limits, design standards and public amenities, private investment, and new land uses in the central city. The addition of a designated urban growth boundary within its Melbourne 2030 Plan also strives to focus growth within the central city.

Exhibit 15 Melbourne Train Network

Exhibit 16 Melbourne Tram (Streetcar) Network

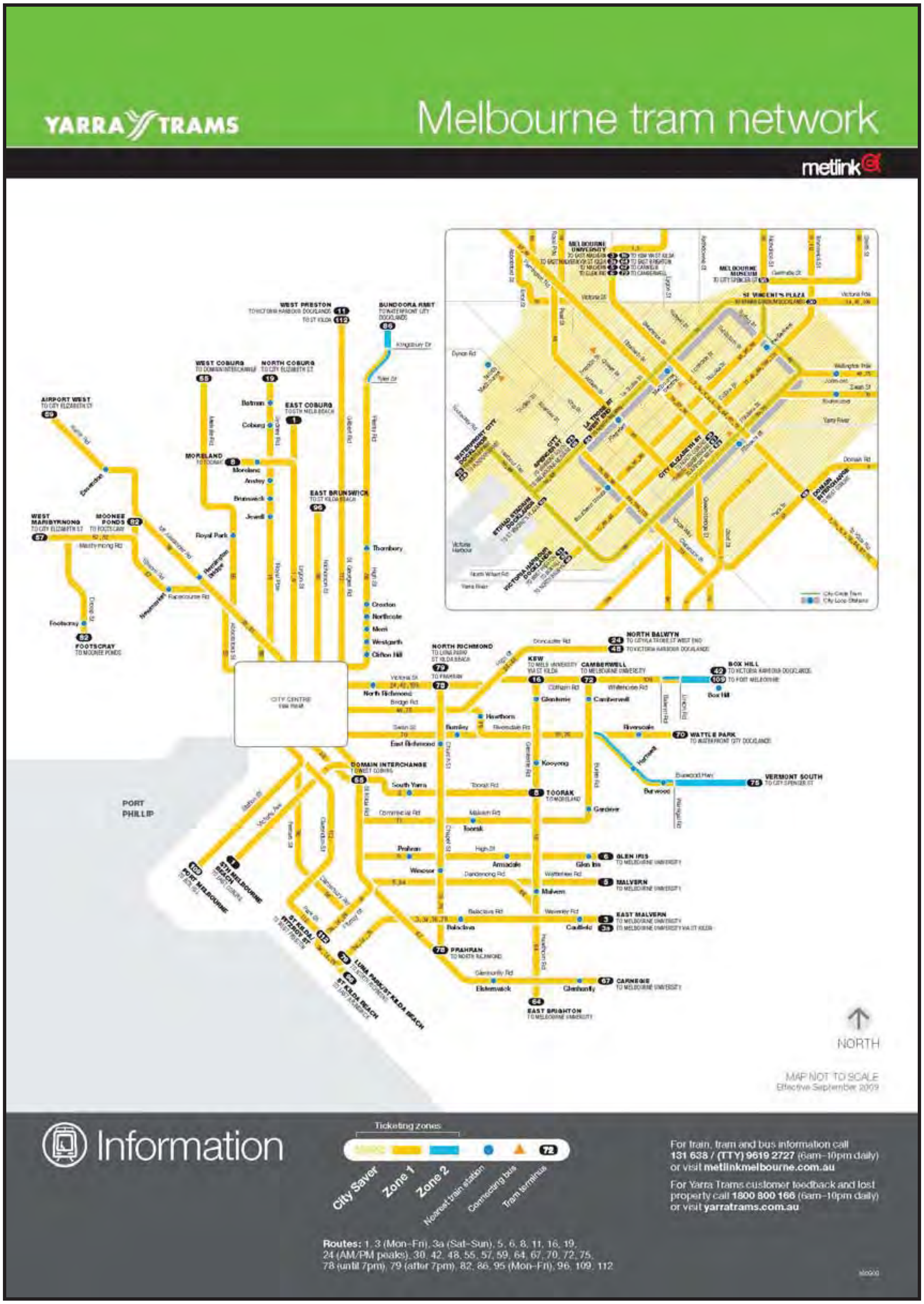
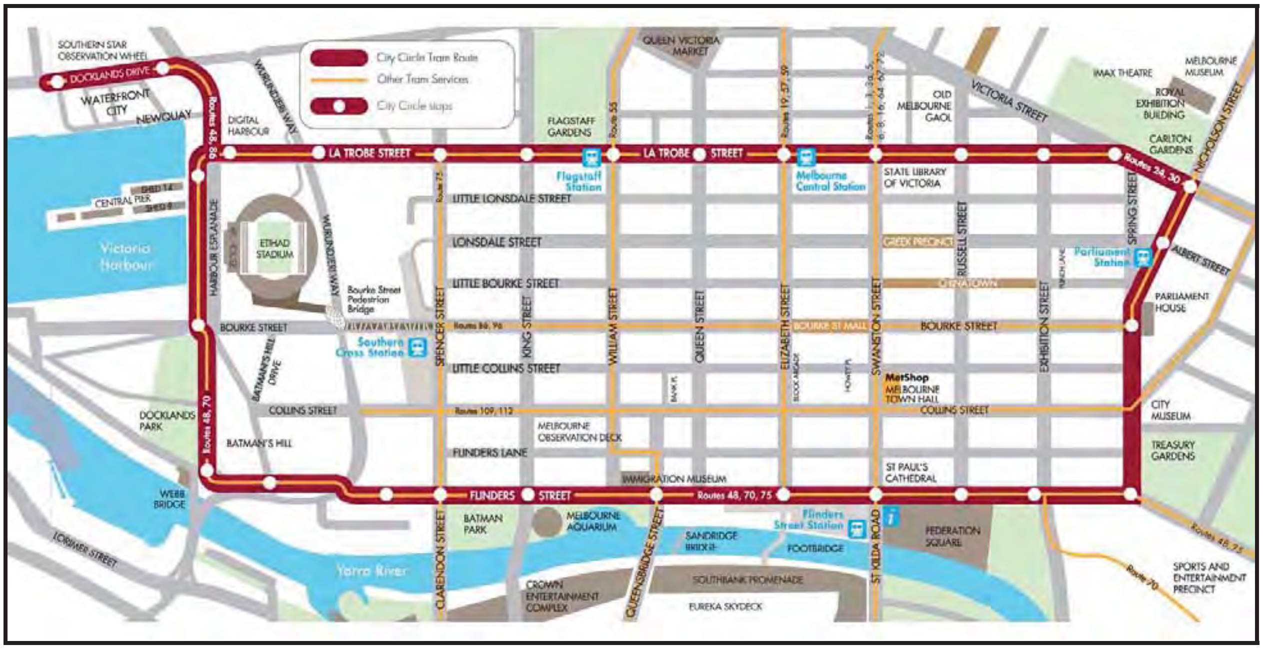


Exhibit 17 Melbourne Free City Circle Service


City Circle Tram Route
Other Tram Services
City Circle stops
SOUTHERN STAR OBSERVATION WHEEL
DOCKLANDS DRIVE
WATERFRONT CITY
NEWQUAY
DIGITAL HARBOUR
Routes 48, 86
WURUNDJERI WAY
LA TROBE STREET
FLAGSTAFF GARDENS
Route 55
Flagstaff Station
QUEEN VICTORIA MARKET
Routes 19, 57, 59
Melbourne Central Station
OLD MELBOURNE GAOL
VICTORIA STREET
IMAX THEATRE
MELBOURNE MUSEUM
ROYAL EXHIBITION BUILDING
CARLTON GARDENS
NICHOLSON STREET
Routes 24, 30
STATE LIBRARY OF VICTORIA
CENTRAL PIER
SHED 14
SHED 9
Victoria Harbour
HARBOUR ESPLANADE
ETIHAD STADIUM
Route 75
LITTLE LONSDALE STREET
LONSDALE STREET
LITTLE BOURKE STREET
GREEK PRECINCT
CHINATOWN
RUSSELL STREET
SPRING STREET
Parliament Station
ALBERT STREET
PARLIAMENT HOUSE
Bourke Street Pedestrian Bridge
BOURKE STREET
Routes 86, 96
Southern Cross Station
SPENCER STREET
KING STREET
WILLIAM STREET
QUEEN STREET
ELIZABETH STREET
BOURKE ST MALL
SWANSTON STREET
EXHIBITION STREET
BATMAN'S HILL DRIVE
LITTLE COLLINS STREET
MetShop
MELBOURNE TOWN HALL
DOCKLANDS PARK
Routes 48, 70
COLLINS STREET
Routes 109, 112
CITY MUSEUM
BATMAN'S HILL
MELBOURNE OBSERVATION DECK
FLINDERS LANE
TREASURY GARDENS
IMMIGRATION MUSEUM
ST PAUL'S CATHEDRAL
FLINDERS STREET
Routes 48, 70, 75
WEBB BRIDGE
BATMAN PARK
MELBOURNE AQUARIUM
Flinders Street Station
FEDERATION SQUARE
LORIMER STREET
Yarra River
CLARENDON STREET
QUEENSBRIDGE STREET
SANDRIDGE BRIDGE
FOOTBRIDGE
ST KILDA ROAD
Routes 48, 75
CROWN ENTERTAINMENT COMPLEX
SOUTHBANK PROMENADE
EUREKA SKYDECK
Route 70
SPORTS AND ENTERTAINMENT PRECINCT

6. Minneapolis

Metro Transit is the transit service provider in the seven-county region surrounding Minneapolis and St. Paul, providing service on approximately 130 routes, the Hiawatha Line light rail, and the Northstar commuter rail line. In addition to these more traditional transit services, Minneapolis has over 250 miles of bus-only shoulders in the metro area. The bus-only shoulder concept provides more reliable service and faster transit travel times in congested corridors, which is designed to promote and increase transit ridership. The Metropolitan Council is currently undertaking a project that is assessing opportunities to 'right size' their highway system by analyzing future infrastructure scenarios that range from traditional highway expansion infrastructure investments to various scenarios utilizing lower-cost/high-benefit projects that could include investment in managed lane facilities, pricing strategies, and other operational strategies. In addition, Minneapolis has an urban service area boundary, which is not a strict growth boundary, but a framework to direct development to areas with existing roads and sewers to efficiently use existing infrastructure.

Running through downtown Minneapolis is the Nicollet Mall – a pedestrian and bus transit mall that, in addition to Hennepin Avenue, is considered the cultural and commercial heart of the city. In addition to serving many Metro Transit bus routes, Nicollet Mall also connects to the current and future light rail system. The Hiawatha light rail line connects downtown Minneapolis to the airport and the Mall of Americas, crosses the Nicollet Mall at one end, and the planned Central Corridor line to downtown St. Paul will also include a stop on Nicollet Mall.

Exhibit 18 Minneapolis Transit System

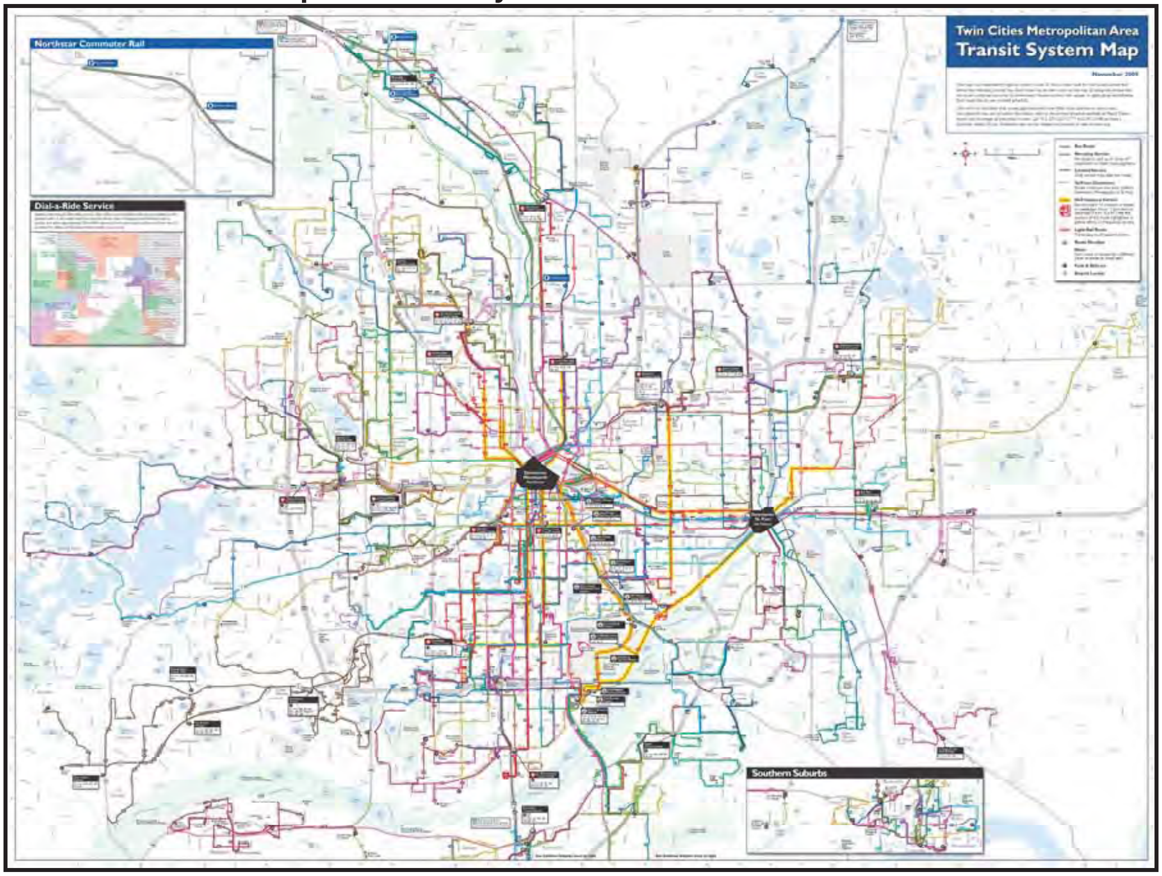
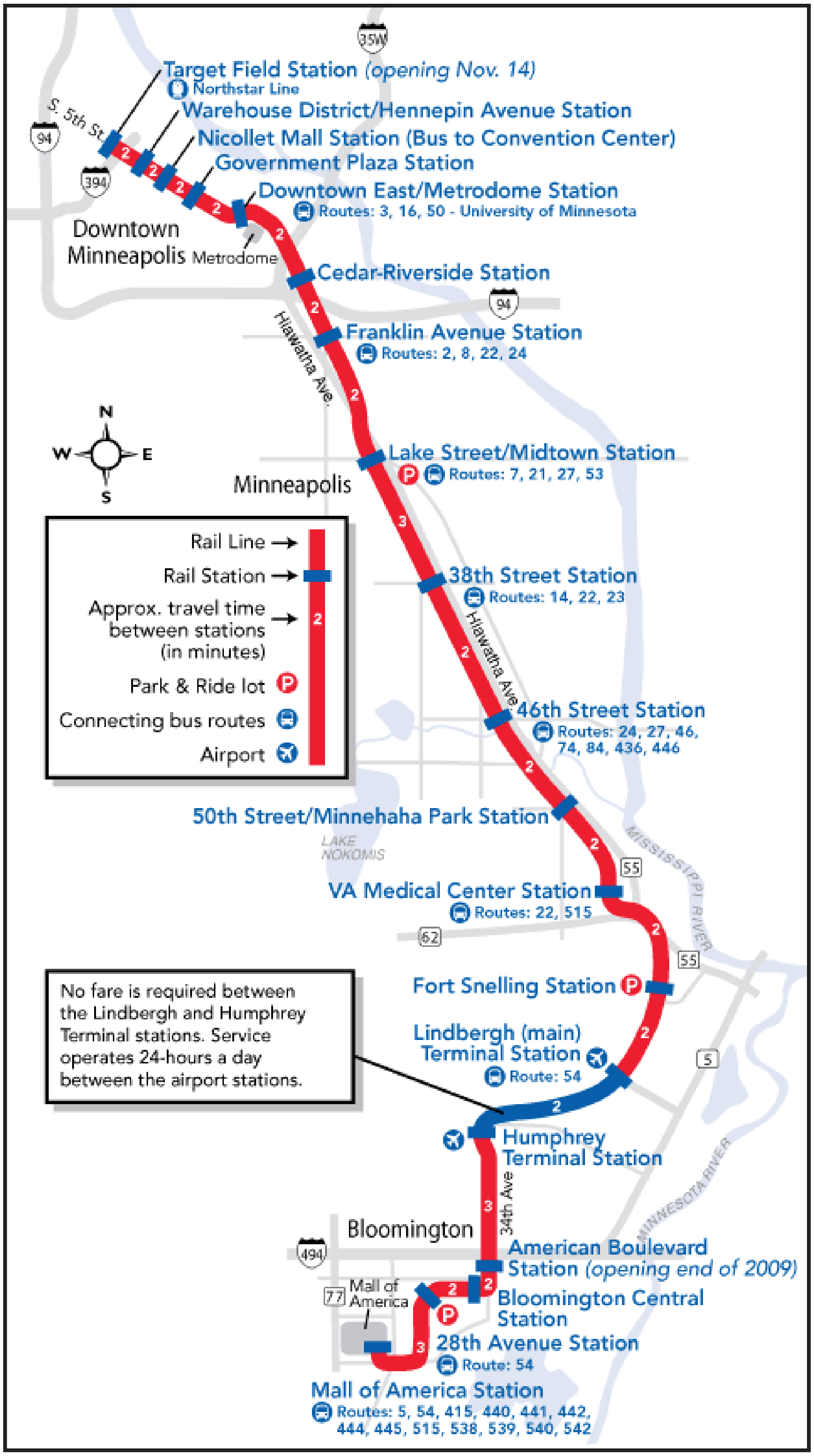


Exhibit 19 Minneapolis Hiawatha Light Rail Line



7. Seattle

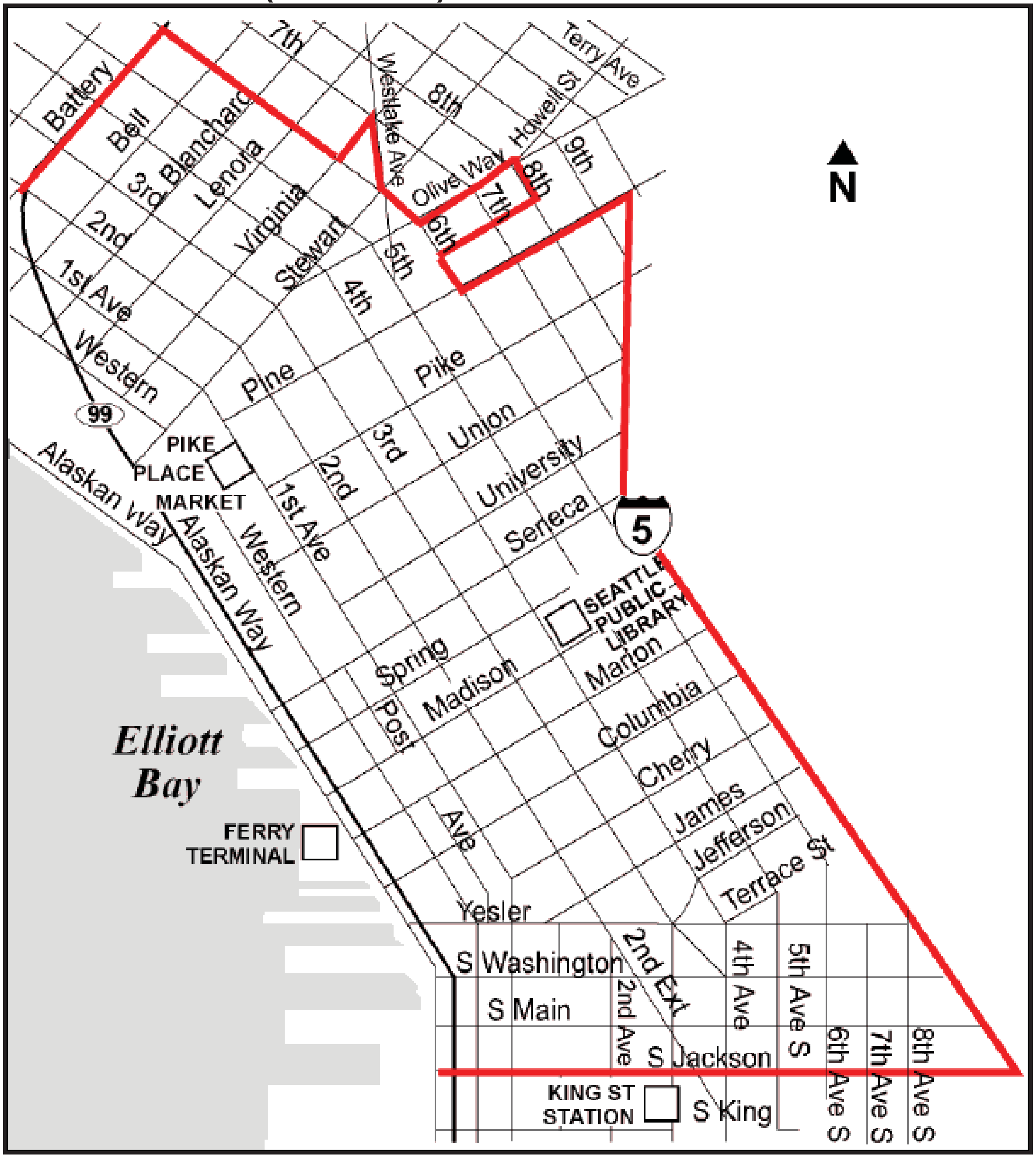
Sound Transit is the provider of regional express bus, commuter rail, and light rail service in the greater Seattle and Puget Sound region. The City of Seattle is the primary focus of transit service in the region and accommodates multiple modes of transit through the use of a transit tunnel and dedicated street right-of-way through the downtown. The Downtown Seattle Transit Tunnel (DSTT) runs underground, the length of downtown Seattle, approximately 2.1 miles from Ninth Avenue and Pike Street to Fifth Avenue South and South Jackson Street. The tunnel opened for service in 1990 and has recently been retrofitted to accommodate Sound Transit's new light rail service, which commenced operation in 2009. Seventeen bus routes and the light rail line operate in the tunnel and serve a total of five tunnel stations.

During reconstruction of the DSTT for light rail use, Third Avenue through downtown was designated as a transit only street during the morning and evening peak hours. These operational designations are currently being maintained even though reconstruction of the tunnel is complete, providing transit priority and facilitating transit travel through downtown. In addition to Third Avenue, both Second and Fourth Avenues include dedicated transit lanes from approximately Stewart Street to Washington Street on Second Avenue and from Yesler Way to Pike Street on Fourth Avenue (about 12 city blocks in length). Downtown Seattle also has a Ride Free Zone, where fares are not required for anyone traveling with the designated downtown travel zone.

In 2007, the City of Seattle opened service on the South Lake Union Streetcar, which runs from Westlake Center in downtown to and through the newly redeveloping neighborhood of South Lake Union immediately north of the downtown area. Infill development is encouraged in Seattle and the surrounding region through the use of an urban growth boundary.

Exhibit 20   Sound Transit Regional Transit System

Exhibit 21 Seattle (Metro Transit) Ride Free Area



Appendix A – Comparative Demographic Data

Urban Core Transit Strategy
US Comparison Cities: Transit and Demographic Information

		San Diego	Denver	Los Angeles	Minneapolis	Portland	Seattle
Rail	Heavy Rail						
	Commuter Rail						
	Light Rail						
BRT	Guideway						
	HOV/Express						
	Rapid Bus						
Bus	Local Bus						
Other			Electric Shuttle		Bus on Freeway Shoulder	Streetcar & aerial tram	Streetcar
Urbanized Area Population (1)		2.7m	2.3m	11.4m	2.4m	1.6m	2.7m
Unlinked Annual Transit Trips (2)		99.4m	94.2m	717.4m (7)	88.9m	106.7m	181.9m (9)
Passenger Miles (2)		591.0m	538.0m	3220.2m (7)	444.6m	448.8m	1183.6m (9)
Urbanized Area Population/Square Mile (density) (1)		3419	3979	7068	2671	3340	2844
Service Area (square miles) (1)		782	499	1500	894	474	954
Service Area Population (3)		2.2m	2.0m	8.6m	2.4m	1.5m	2.7m
Metropolitan Area Employment		1.4m (6)	1.3m (10)	4.4m (10)	1.7m (10)	1.0m (10)	1.4m (10)
Downtown Employment /Regional Employment		5.6%	8% (11)		8.5% (12)	8.0%	8.1% (13)
Auto Ownership Estimates (4)		90%	86%	84%	80%	86%	84%
Vehicles per Household (14)		1.85	1.80	1.79	1.80	1.80	1.83
Transit Annual Operating Budget 2008 (5)		$271.7m	$374.8m	$1352.8m	$315.7m	$338.0m (8)	$657.4m

(1) 2008 National Transit Database Appendix D: 2000 US Urbanized Areas
(2) APTA Fact Book, Appendix B, Transit Agency and Urbanized Area Operating Statistics, Table 9
(3) 2008 National Transit Database
(4) Carfree Census Data Estimates
(5) 2008 National Transit Database, Table 12 (regional or major transit providers)
(6) SANDAG Regional Employment Data Year 2000
(7) Includes Los Angeles/Orange UZA and Metrolink
(8) Does not include Portland Streetcar, Inc.
(9) Includes WA State Ferries and Monorail
(10) Bureau of Labor Statistics 2009
(11) Denver Region Council of Governments
(12) Metropolitan Council data request (Minneapolis 2008)
(13) Puget Sound Trends, Puget Sound Regional Council, October 2009
(14) Demographia, MSA Vehicles per Household, 2008

Appendix B – References and Resources

- Arrington, GB. "Portland's TOD Evolution: From Planning to Lifestyle," *Transit Oriented Development, Making it Happen*, Ashgate Press, 2009
- Boddy, Trevor, "Vancouverism vs. Lower Manhattanism: Shaping the High Density City," *The Vancouver Sun*, September 20, 2005
- Bowers, Lew, The Pearl District: From Brownfield to Goldmine, powerpoint, October 2009.
- Carinci, Justin, "A tale of two cities' crossings: different takes on congestion," *Daily Journal of Commerce*, November 17, 2009
- Centre City Development Corporation, Downtown San Diego Complete Community/Mobility, September, 2008
- Cervero, Robert. "The Transit Metropolis: A Global Inquiry," Island Press, 1998
- City of Vancouver Transportation Plan Update, October 2007
- City of Vancouver Information Sheet 2005
- Dick Fleming interview and powerpoint, November 2009
- Fleming, Dick, John Stott and Don Bletchly, "The Effectiveness of Bus Rapid Transit in Low Density Cities – A Review of Australian Experience"
- Gordon Price interview and powerpoint, November 2009
- Melbourne 2030 – Planning for Sustainable Growth
- Metro.kingcounty.gov
- Metro, Draft 2035 Regional Transportation Plan (Portland)
- Urban Transport Fact Book, October 2003
- www.bordeaux.fr (translated)
- www.dse.vic.gov.au
- www.infotbc.com (translated)
- www.metlinkmelbourne.com.au
- www.metro.net
- www.metrocouncil.org
- www.metrostrategy.nsw.gov.au
- www.metrovancouver.org
- www.rtd-denver.com
- www.rtd-fastracts.com
- www.soundtransit.org
- www.translink.com.au
- www.vancouver.ca

Technical Appendix D

Urban Area Transit Strategy - Initial Performance of Transit Network Alternatives (Relative Values)

Key: ● Most Effective ◉ Middle ○ Least Effective □ No Significant Change

A. Mode Share

Mode Share Measures	2008 Existing	Baseline[1]	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
A1. Peak-Period Transit Mode Share as Applied to the Identified Corridors/Areas		Not yet available.			
A2. All-Day Transit Mode Share as Applied to the Identified Corridors/Areas					
A3. Change in Peak Period Urban Area Transit Mode Share					

B. Transit Ridership

Ridership Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
B1. Change in Transit Person Trips (Regional)	202,000	401,000	◉	○	●
B2. Change in Transit Passenger Miles (Regional)	1,593,000	5,197,000	◉	◉	●
B3. Change in Transit Peak-Period Person Trips (Regional)	79,000	178,000	◉	○	●
B4. Change in Mode of Access to Transit (Non-Motorized and Auto)					
Walking/Biking	85.4%	89.8%	□	□	□
Auto (drove and driven)	14.6%	10.2%	●	○	◉

C. Cost-Effectiveness

Cost-Effectiveness Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
C1. Rough Order of Magnitude (ROM) Capital Cost Estimate			Middle	Lowest	Highest
C2. Cost-Effectiveness of Network (Region)			Not yet available.		
C3. Operating Subsidy Required (Region)					
C4. Total Transit System Capital Cost vs. SANDAG Revenue-Constrained Funding Scenario					
C5. Ability to Phase Major System Components/Elements					

D. Efficient Transportation Network

Efficiency Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
Transit System Performance					
D1. Passenger Miles to Transit Seat Mile Ratio	36%	47%	◉	◉	○
Regional Transportation System Performance					
D2. Change in Auto Vehicle Miles Traveled (VMT) per capita	26.9	26.9	□	□	□
D3. Change in Auto Vehicle Hours Traveled (VHT) per capita	0.7	0.8	□	□	□
D4. Change in Auto Vehicle Trips per capita	3.6	3.5	□	□	□

[1] Baseline scenario consists of an overlay between the highway and transit networks included in the 2030 RTP and the land use assumptions included in the 2050 Regional Growth Forecast.

Urban Area Transit Strategy - Initial Performance of Transit Network Alternatives (Relative Values)

E. Sustainability

Sustainability Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline		
			Transit Propensity	Commuter Point-to-Point	Many Centers
Greenhouse Gas Reduction					
E1. Estimated Change in GHG (tentative)		Not yet available.			
Non-Motorized Travel					
E2. Peak-Period Non-Motorized Mode Share in Urban Area	3.7%	3.3%	□	□	□
E3. All-Day Non-Motorized Mode Share in Urban Area	3.4%	3.0%	□	□	□
E4. Compatibility with Regional Bike Plan (mi. of bike fac. within 1/2 mile of major station)	73	146	◉	●	●
Land-Use/Transportation Connection					
E5a. % of Jobs within 1/2 Mile of Major Transit Stations	21.1%	38.9%	◉	●	●
E5b. % of Jobs within 1/4 Mile of Major Transit Stations	10.7%	21.3%	◉	●	●
E6a. % of Housing Units within 1/2 Mile of Major Transit Stations	9.4%	31.2%	◉	●	●
E6b. % of Housing Units w/in 1/2 Mile of Major Transit Stations with 10 Minute or Better Service	0.0%	23.4%	◉	○	●
E6c. % of Housing Units w/in 1/2 Mile of Major Transit Stations with 15 Minute or Better Service	7.3%	30.6%	●	◉	●
E7. Compatibility with current Regional Activity Centers (Hospitals, Universities/Colleges, Shopping Malls, and Tourist Attractions within 1/2 Mile of Major Transit Stations)	17	40	⊙	●	●

F. Social Equity/Environmental Justice

Social Equity/Environmental Justice Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline		
			Transit Propensity	Commuter Point-to-Point	Many Centers
Title VI Requirements[2]					
F1a. % of Minority Populations within 1/2 Mile of Major Transit Stations (% Improvement)	11.2%	34.4%	2	2	2
F1b. % of Non-Minority Populations within 1/2 Mile of Major Transit Stations (% Improvement)	7.0%	20.2%	2	2	2
F1c. % of Low-Income Households within 1/2 Mile of Major Transit Stations (% Improvement)	13.2%	41.4%	2	2	2
F1d. % of Non-Low-Income Households within 1/2 Mile of Major Transit Stations (% Improvement)	9.2%	18.0%	2	2	2
Other Meaningful Social Equity/Environmental Justice Measures					
F2a. % of 75+ Population within 1/4 Mile of Major Transit Stations	3.0%	12.7%	□	□	□
F2b. % of 75+ Population within 1/4 Mile of All Stations	54.8%	58.7%	●	●	●
F3. % Zero-Car Households within 1/2 Mile of Major Transit Stations (2000 census data)	16.7%	43.9%	◉	●	●

[2] Title VI requires analysis of the burdens of regional transportation system investments on low-income and minority populations. Measures in this category evaluate the comparative percent improvement between low-income and non-low-income populations and minority and non-minority populations.

Key: A "1" indicates disparate impact and a "2" indicates no disparate impact.

Urban Area Transit Strategy - Initial Performance of Transit Network Alternatives (Relative Values)

G. Time-Competitiveness

	Time Competiveness Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
G1.	Oceanside - Downtown San Diego Travel Times (in Minutes)					
	SOV	55	81	☐	☐	☐
	Carpool	53	52	☐	☐	☐
	Transit - Walk Access	104	85	☐	☐	●
	Transit - Drive Access	93	77	☐	☐	●
G2.	Escondido - Downtown San Diego Travel Times (in Minutes)					
	SOV	48	75	☐	☐	☐
	Carpool	45	49	☐	☐	☐
	Transit - Walk Access	78	70	●	◉	●
	Transit - Drive Access	78	66	●	●	●
G3.	El Cajon - Downtown San Diego Travel Times (in Minutes)					
	SOV	32	46	☐	☐	☐
	Carpool	32	34	☐	☐	☐
	Transit - Walk Access	76	72	●	◉	●
	Transit - Drive Access	62	58	◉	◉	◉
G4.	Mid City San Diego - Sorrento Valley Travel Times (in Minutes)					
	SOV	31	49	☐	☐	☐
	Carpool	30	27	☐	☐	☐
	Transit - Walk Access	89	41	☐	●	○
	Transit - Drive Access	82	42	☐	●	○
G5.	Chula Vista - Sorrento Valley Travel Times (in Minutes)					
	SOV	41	69	☐	☐	☐
	Carpool	41	31	☐	☐	☐
	Transit - Walk Access	136	68	☐	●	◉
	Transit - Drive Access	120	54	○	●	◉
G6.	San Ysidro - Downtown San Diego Travel Times (in Minutes)					
	SOV	28	33	☐	☐	☐
	Carpool	28	29	☐	☐	☐
	Transit - Walk Access	44	44	●	●	●
	Transit - Drive Access	46	42	☐	☐	◉
G7.	El Cajon - Sorrento Valley Travel Times (in Minutes)					
	SOV	44	58	☐	☐	☐
	Carpool	44	33	☐	☐	☐
	Transit - Walk Access	130	79	◉	●	◉
	Transit - Drive Access	111	64	☐	●	☐

Urban Area Transit Strategy - Initial Performance of Transit Network Alternatives (Numeric Values)

A. Mode Share

Mode Share Measures	2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
A1. Peak-Period Transit Mode Share as Applied to the Identified Corridors/Areas		Not yet available.			
A2. All-Day Transit Mode Share as Applied to the Identified Corridors/Areas					
A3. Change in Peak Period Urban Area Transit Mode Share					

B. Transit Ridership

Ridership Measures	2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
B1. Change in Transit Person Trips (Regional)	202,000	401,000	7.3%	1.0%	15.3%
B2. Change in Transit Passenger Miles (Regional)	1,593,000	5,197,000	3.9%	4.0%	14.7%
B3. Change in Transit Peak-Period Person Trips (Regional)	79,000	178,000	7.4%	4.5%	17.5%
B4. Change in Mode of Access to Transit (Non-Motorized and Auto)					
Walking/Biking	85.4%	89.8%	0.7%	-0.9%	-0.5%
Auto (drove and driven)	14.6%	10.2%	-6.1%	7.9%	4.7%

C. Cost-Effectiveness

Cost-Effectiveness Measures	2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
C1. Rough Order of Magnitude (ROM) Capital Cost Estimate		Not yet available.			
C2. Cost-Effectiveness of Network (Region)					
C3. Operating Subsidy Required (Region)					
C4. Total Transit System Capital Cost vs. SANDAG Revenue-Constrained Funding Scenario					
C5. Ability to Phase Major System Components/Elements					

D. Efficient Transportation Network

Efficiency Measures	2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
Transit System Performance					
D1. Passenger Miles to Transit Seat Mile Ratio	36%	47%	38%	38%	34%
Regional Transportation System Performance					
D2. Change in Auto Vehicle Miles Traveled (VMT) per capita	26.9	26.9	-0.1%	-0.1%	-0.4%
D3. Change in Auto Vehicle Hours Traveled (VHT) per capita	0.7	0.8	-0.3%	-0.2%	-0.8%
D4. Change in Auto Vehicle Trips per capita	3.6	3.5	-0.1%	0.0%	-0.3%

E. Sustainability and Environmental Justice

Sustainability Measures	2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
Greenhouse Gas Reduction					
E1. Estimated Change in GHG (tentative)		Not yet available.			
Non-Motorized Travel					
E2. Peak-Period Non-Motorized Mode Share in Urban Area	3.7%	3.3%	3.3%	3.3%	3.3%
E3. All-Day Non-Motorized Mode Share in Urban Area	3.4%	3.0%	3.0%	3.0%	3.0%
E4. Compatibility with Regional Bike Plan (mi. of bike fac. within 1/2 mile of major station)	73	146	166	190	192
Land-Use/Transportation Connection					
E5a. % of Jobs within 1/2 Mile of Major Transit Stations	21.1%	38.9%	44.2%	52.9%	50.0%
E5b. % of Jobs within 1/4 Mile of Major Transit Stations	10.7%	21.3%	25.5%	30.8%	28.1%
E6a. % of Housing Units within 1/2 Mile of Major Transit Stations	9.4%	31.2%	36.6%	39.8%	39.4%
E6b. % of Housing Units w/in 1/2 Mile of Major Transit Stations with 10 Minute or Better Service	0.0%	23.4%	31.5%	19.1%	38.8%
E6c. % of Housing Units w/in 1/2 Mile of Major Transit Stations with 15 Minute or Better Service	7.3%	30.6%	36.0%	32.8%	38.8%
E7. Compatibility with current Regional Activity Centers (Hospitals, Universities/Colleges, Shopping Malls, and Tourist Attractions within 1/2 Mile of Major Transit Stations)	17	40	45	47	48

F. Social Equity and Environmental Justice

Social Equity and Environmental Justice Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
Title VI Requirements*					
F1a. % of Minority Populations within 1/2 Mile of Major Transit Stations	11.2%	34.4%	5.4%	8.3%	8.1%
F1b. % of Non-Minority Populations within 1/2 Mile of Major Transit Stations	7.0%	20.2%	3.2%	6.0%	5.4%
F1c. % of Low Income Households within 1/2 Mile of Major Transit Stations	13.2%	41.4%	6.7%	9.0%	9.1%
F1d. % of Non-Low Income Households within 1/2 Mile of Major Transit Stations	9.2%	18.0%	2.8%	5.9%	5.2%
Other Meaningful Social Equity/Environmental Justice Measures					
F2a. % of 75+ Population within 1/4 Mile of Major Transit Stations	3.0%	12.7%	15.3%	15.6%	16.6%
F2b. % of 75+ Population within 1/4 Mile of All Stations	54.8%	58.7%	58.5%	58.3%	57.0%
F3. % Zero-Car Households within 1/2 Mile of Major Transit Stations (2000 census data)	16.7%	43.9%	52.1%	55.0%	54.6%

Urban Area Transit Strategy - Initial Performance of Transit Network Alternatives (Numeric Values)

G. Time-Competitiveness

Time Competiveness Measures		2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline		
				Transit Propensity	Commuter Point-to-Point	Many Centers
G1.	Oceanside - Downtown San Diego Travel Times (in Minutes)					
	SOV	55	81	0	0	0
	Carpool	53	52	0	0	0
	Transit - Walk Access	104	85	0	+1	-2
	Transit - Drive Access	93	77	0	+1	-3
G2.	Escondido - Downtown San Diego Travel Times (in Minutes)					
	SOV	48	75	0	0	0
	Carpool	45	49	0	0	0
	Transit - Walk Access	78	70	-9	-6	-9
	Transit - Drive Access	78	66	-21	-21	-21
G3.	El Cajon - Downtown San Diego Travel Times (in Minutes)					
	SOV	32	46	0	0	0
	Carpool	32	34	0	0	0
	Transit - Walk Access	76	72	-7	-4	-7
	Transit - Drive Access	62	58	-4	-4	-4
G4.	Mid City San Diego - Sorrento Valley Travel Times (in Minutes)					
	SOV	31	49	0	0	0
	Carpool	30	27	0	0	0
	Transit - Walk Access	89	41	0	-6	+5
	Transit - Drive Access	82	42	0	-6	+5
G5.	Chula Vista - Sorrento Valley Travel Times (in Minutes)					
	SOV	41	69	0	0	0
	Carpool	41	31	0	0	0
	Transit - Walk Access	136	68	+1	-8	-4
	Transit - Drive Access	120	54	+2	-12	-8
G6.	San Ysidro - Downtown San Diego Travel Times (in Minutes)					
	SOV	28	33	0	0	0
	Carpool	28	29	0	0	0
	Transit - Walk Access	44	44	-4	-4	-4
	Transit - Drive Access	46	42	0	0	-2
G7.	El Cajon - Sorrento Valley Travel Times (in Minutes)					
	SOV	44	58	0	0	0
	Carpool	44	33	0	0	0
	Transit - Walk Access	130	79	-3	-15	-8
	Transit - Drive Access	111	64	0	-16	+1

Technical Appendix E

PARSONS BRINKERHOFF (PB) PROFESSIONAL CONSULTING TEAM BIOGRAPHIES

CATHY J. STROMBOM, AICP

Vice President
Senior Planning Manager
Principal Professional Associate
Certified Principal Project Manager

Key Qualifications

Cathy Strombom has 35-plus years experience as a transportation planner and senior project manager on a wide range of projects in the Puget Sound region, as well as on projects in Oregon, Hawaii, and internationally. Projects have included multimodal transportation/environmental impact studies, traffic impact assessments, bus and rail feasibility studies, marine transportation planning, central business district circulation analyses, and TOD projects.

Most recently, Ms. Strombom managed a $12 million study to update Sound Transit's long-range regional transit system plan that includes light rail, commuter rail, regional express bus, as well as transit center projects, park-and-rides, and HOV direct access ramps. She also led the development of the implementation plan that included evaluation of alternative packages of capital and service improvements with respect to costs and benefits, potential environmental impacts, compatibility with existing projects, as well as consistency with the long-range Vision. The implementation plan was presented to and approved by the voters in 2008 and is now being implemented. Ms. Strombom managed an intermediate-capacity transit study for the City of Seattle that analyzed alternative modes (streetcar, light rail, and elevated guideway) in seven major corridors. She was the project manager for a legislative study under the auspices of the Washington State Rail Development Commission that created the Regional Transit Authority to implement high-capacity transit in the Puget Sound region—now known as Sound Transit, this study evaluated a wide range of alternative institutional arrangements and funding mechanisms.

Ms. Strombom was co-leader for a team of Turkish planners in modeling travel demand for seven transportation alternatives, including a metro system, light rail transit, commuter railroad improvements, express and local bus service improvements, passenger and auto ferry service improvements, and a railroad tunnel beneath the Bosphorus Strait connecting the European and Asian sides of Istanbul. Ms. Strombom has promoted sustainability on projects through the development of user-friendly, menu-driven Transit and Highway Sustainability Checklists, as well as a project management module on how sustainability can be incorporated into transportation projects.

GERALD B. (G.B.) ARRINGTON

Vice President, Senior Planning Manager
Principal Practice Leader, PlaceMaking
Senior Professional Associate

Key Qualifications

G.B. Arrington provides strategic direction and leads PB's global transit-oriented development (TOD) practice. He is internationally recognized as a leader in TOD and for his skills in linking transit and land use to create livable communities of lasting value. Mr. Arrington served on PB's global sustainability task force and helped shape PB's commitment and involvement in sustainable practices.

Mr. Arrington specializes in policy, research, planning, and design services that assist public and private sector clients in solving politically and technically complex land use and transportation challenges. His work has taken him across the United States, to China, Australia, New Zealand, Dubai, and the Caribbean. Mr. Arrington has directed the preparation of over 125 TOD plans.

His career has been defined by a commitment to continuous innovation to reinvent how cities grow while enhancing their quality of life. Before joining PB, he charted a new, award-winning direction for Portland, Oregon's transit agency. His innovative planning and community involvement strategies changed the face of transit and land use in the region and received awards from the White House and the Federal Transit Administration (FTA). Mr. Arrington is one of the founders of the Rail~Volution conference and is an active New Urbanist.

BILL A. DAVIDSON

Senior Vice President, PB Americas, Inc.
Principal Professional Associate
Senior Technical Manager

Key Qualifications

Bill Davidson is a nationally recognized leader in the field of travel demand model development and forecasting. Using original travel survey data, he has estimated and developed complete travel forecasting model sets and advanced-practice, tour-based models in some of this country's largest regions. He is particularly well known for his work in mode choice model development and is one of a small number who pioneered the development and application of fully nested logit models. This includes recent work in the area of nested logit mode choice modeling for Los Angeles, San Francisco, Miami, Raleigh-Durham, Salt Lake City, Atlanta, Baltimore, Washington, D.C., San Diego, San Juan, Houston, Chicago, Kansas City, Phoenix, Las Vegas, and Reno. Mr. Davidson has also developed station choice models for the METRA Commuter Rail system in Chicago and the Metrolink system in Los Angeles. Also, he is a leader in the development of travel models for specialized trip purposes, most notably, visitor travel models.

Mr. Davidson is nationally recognized for his extensive work for the FTA New Starts projects. In addition to project-related efforts, he has worked closely with the FTA to develop travel forecasting-related guidelines and best practice procedures. Mr. Davidson has directed the travel forecasting component of at least 30 major investment studies and 18 alternatives analysis studies ranging from system planning to preliminary engineering and final design.

Mr. Davidson has extensive experience in toll road and value/congestion pricing studies. This experience includes the ongoing San Francisco Congestion Pricing Study, Montreal Traffic and Revenue Study, the Orange County Transportation Authority Toll Road Forecasting Study, the Interstate 680 Value Pricing Study, the Sonoma 101 Highway High Occupancy Toll (HOT) Lane Study, and the Colorado Department of Transportation HOT Lane Study. Within the context of regional nested logit mode choice models, Mr. Davidson has developed lower-level nesting structures that address the toll/non-toll choice. He is also the principal-in-charge for the NCHRP 8-57 and SHRP 2 C04 projects, which will develop an improved framework and tools for highway pricing decisions.

DICK FLEMING

National Technical Executive – Transit Planning
Principal Professional Associate

Key Qualifications

Dick Fleming is the national technical executive of transit planning for PB Australia. He has been engaged as a specialist in planning for urban transit systems, multimodal interchange planning and design, road-based priority systems, and integrated land use/transport planning for nearly 30 years. Mr. Fleming is an internationally recognized expert in BRT systems and has worked throughout Australia, New Zealand, the United Kingdom, China, the Philippines, and Pakistan.

Mr. Fleming advised the City of Beijing on the development of its BRT strategy and has acted as technical advisor for the Cambridgeshire Guided Busway and the East London Transit Project in the United Kingdom. He was deeply involved in surface transportation planning for the highly successful Sydney 2000 Olympics, developed the transportation master plan for Beijing's Olympic Green, and has since advised London's 2012 and Tokyo's 2016 bid for the Olympics. Mr. Fleming is a vice chair of the board of the International Association of Public Transport (Australia/New Zealand) and a past national president of the Australian Institute of Traffic Planning and Management.

DAVID B. MCBRAYER, AICP, PTP

Senior Engineering Manager
Principal Professional Associate, Transportation Planning
Certified Project Manager

Key Qualifications

David McBrayer is an expert in urban transportation improvement planning, including alternatives formulation and analysis, transit operations planning, transportation economic evaluation, and financial analysis. He has served in project management and key technical roles for numerous projects in the United States, England, Africa, the Middle East, the Far East, Australia, and South America.

Mr. McBrayer was recently the quality control manager for the Gwinnett County Transportation Plan in Georgia; the project or task manager for transit studies in Los Angeles, the U.S. Territory of Guam, Phoenix, and Laredo, Texas; planning advisor for a proposed Fredericksburg Corridor BRT project in San Antonio, Texas; operations planner for a BRT/HOV project in Atlanta, Georgia; and manager of transit planning services for a Great Street project in Uptown Houston, Texas. These and other transit planning studies in the United States follow a variety of road and transit projects in Asia and South America, as well as earlier experience in numerous transit and transportation improvement studies in the United States and elsewhere.

PAUL B. ARNOLD

Senior Planning Manager
Professional Associate
Certified Senior Project Manager

Key Qualifications

Paul Arnold is a senior planning manager at PB and a recognized technical leader in the area of transportation planning. Over his 20-year career, Mr. Arnold has focused on intermodal operations, particularly in the areas of transit operations serving as technical lead or project manager for transit system planning projects, park-and-ride lot demand estimation and siting, transit routing, bus and high occupancy vehicle (HOV) system planning and evaluation, and nonmotorized planning and operational analysis of interfaces between modes.

Mr. Arnold has a degree in economics (an MBA), leads our Virtual Design and Construction community of practice, and serves on the corporate Geospatial community of practice. Mr. Arnold is quantitatively focused and understands market influences, especially their impact on transit demand. Also, he has a background in travel demand forecasting and traffic operations analysis, which allows him to understand the strengths and weaknesses of macro and micro travel demand and simulations models and apply them appropriately in a variety of project environments.
One recent example of Mr. Arnold's unique approach to transit system planning and program development was the use of interactive work sessions with the planning and financial modeling staff of Sound Transit. Sound Transit identified over 100 potential projects for inclusion in their ST2

program. Through a series of interactive sessions with a comprehensive financial model, Mr. Arnold was able to collaboratively lead Sound Transit staff through the decision process to select the projects to be included in the plan, identify the optimal timing for implementation, and select the tax rate required to adequately fund the plan. Through the development of a better user interface on the financial model and the facilitation of interdisciplinary work sessions, Mr. Arnold was able to reduce dramatically the cycle time on the evaluation of plan options. The end result was a plan that was broadly accepted by all levels of staff, the Sound Transit board, and ultimately, the public, which passed the 0.5 percent tax increase in the November 2008 ballot.

TONI BATES

Senior Planning Manager
Senior Professional Associate
Certified Project Manager

Key Qualifications

Toni Bates is a senior planning manager with 28 years experience in transportation planning and programming, bus and rail facilities development, short- and long-range transit service planning, transportation/land use coordination, environmental analysis and documentation, public involvement programs, and interagency coordination. Her experience includes policy and strategic planning for regional transit systems, short- and long-range transit system planning, managing small and large transit development projects, leading the analysis and concept planning for transit and land use integration, analyzing complex technical and stakeholder situations, and developing recommendations and solutions.

Ms. Bates joined PB after 20 years as director of planning and development and project manager for the San Diego Metropolitan Transit Development Board and three years as director of transit planning for the San Diego Association of Governments. She has managed the planning, preliminary engineering, and environmental document preparation for rail extension projects; has led planning and concept development of a modern streetcar project; and has overseen planning and design of bus rapid transit (BRT) and intermodal transportation center projects, including the incorporation of community-sensitive design features and public art. Ms. Bates has also designed and implemented local and regional bus service plans and developed strategic long-range transit plans.

ELIZABETH (LIZ) G. YOUNG, AICP

Senior Supervising Transportation Planner
Certified Project Manager

Key Qualifications

Liz Young brings nearly 15 years of experience as a transportation planner on both transit and highway projects in the greater Seattle area, various projects across the United States, and she lived and worked in Brisbane, Australia, for nine months. While in Seattle, Ms. Young led the East King County Subarea High-Capacity Transit (HCT) analysis work for Sound Transit's Phase 2 planning effort, which included development, screening, conceptual design, and cost elements for three HCT corridors between Seattle and major destinations east of Lake Washington. The project also incorporated development of planning-level HOV project elements and cost estimates for highway-related improvements such as direct access facilities, park-and-ride lots, in-line transit stations, and arterial HOV lanes. Ms. Young also had a key lead role in the Seattle Mercer Corridor/South Lake Union Transportation Study that defined and evaluated a range of multimodal improvements to South Lake Union neighborhood to support the city's goal of creating an urban village in this neighborhood adjacent to downtown. The study recommended a set of roadway, transit, bicycle, and pedestrian improvements as part of a multimodal transportation plan.

Ms. Young is currently working with the Metropolitan Council and Minnesota Department of Transportation to assess opportunities to 'right size' their highway system using flexible design and operational and management strategies. This effort includes analyzing future infrastructure scenarios that range from traditional highway expansion investments to various scenarios utilizing lower-cost/high-benefit operational improvements that could include investment in managed lane facilities, pricing strategies, intelligent transportation systems, and European Active Traffic Management strategies.

Technical Appendix F

Peer Review Panel Member Biographies
Urban Area Transit Strategy

John M. Inglish – General Manager/CEO, Utah Transit Authority (UTA)

John Inglish has worked in the transportation industry for more than 35 years. With an engineering background, Mr. Inglish began his career in 1970 as a systems planning engineer for the Utah State Highway Department. In the early 1970s he began working for the Wasatch Front Regional council on the early initiatives that formed today's UTA. In 1977, he became the director of Transit Development for UTA, and in August 1997, the UTA Board of Trustees appointed Mr. Inglish as the general manager for the Authority. Under his leadership, UTA has garnered national and worldwide recognition for its transportation systems. He oversaw funding and construction of the $312.5 million Sandy to Salt Lake TRAX light rail line, completing the 15-mile TRAX line one year ahead of schedule and under budget, as well as the $118.5 million University TRAX light rail line connecting downtown Salt Lake City and the University of Utah in time for the 2002 Winter Olympics.

Martin Tuttle – Deputy Director, Planning and Modal Programs for the California Department of Transportation

Martin Tuttle has more than 25 years of top transportation and innovative land use planning management experience at the local, regional and state levels of government. As Deputy Director of Planning and Modal Programs at Caltrans, Mr. Tuttle is responsible for the Caltrans Divisions of Local Assistance, Mass Transportation, Planning, Rail, Aeronautics and Transportation System Information. As the executive director of the Sacramento Area Council of Governments (SACOG), he launched its nationally-recognized "Blueprint" transportation and land use growth plan. Mr. Tuttle also has served as the executive director of the Solano Transportation Authority (STA). As a top staff member to Assembly Majority Leader Tom Hannigan in the California State Legislature for 13 years, Mr. Tuttle managed innovative land-use and transportation reform legislation, including the bill establishing the successful Capitol Corridor intercity rail service between Sacramento and San Jose. Prior to joining Caltrans, he oversaw transit oriented development and urban infill housing projects for URS Corporation and New Faze Development.

George Hazel – Chairman, MRC McLean Hazel Ltd

George Hazel has extensive experience in all aspects of transport and communications, both urban and rural. He has specific expertise in strategic planning and policy development, the integration of transportation with other related areas, the prioritization of projects with respect to economic, environmental, and social objectives, and innovative funding of transportation infrastructure around the world. He has studied all forms of transportation policy around the world, including congestion charging and demand management, mode shift, goods movement, and growth management. Mr. Hazel has worked in the public, private, and academic sectors at a senior level and has acted as advisor to the Academy of Sustainable Communities, the Commission for Integrated Transport, Transport for London, the Queensland State Government, the Greater Toronto and Hamilton Region, the City of San Diego and many government agencies around the United Kingdom. Currently an honorary professor at the Robert Gordon University and adjunct professor at the Queensland University of Technology, Mr. Hazel has published a book on Making Cities Work and presents at conferences around the world.

Aidan Hughes – Principal, Arup

Aidan Hughes is the leader of Arup's planning practice in the US, which focuses on integrated urbanism and sustainable planning and design. Mr. Hughes brings over 20 years experience and a proven track record in the management of complex multi-disciplinary projects. He consults to municipal governments, transportation agencies, and developers, and is currently leading the sustainable redevelopment of the Concord Naval Weapons Station in Concord, CA. A major part of the redevelopment program is compliance with California AB 32 (global warming act) and evaluating and mitigating carbon emissions from transportation, energy, and other sources for each redevelopment alternative. He also is involved in the Treasure Island Sustainability Planning project in San Francisco. Mr. Hughes is a USGBC LEED Accredited Professional, has worked in Europe, Asia and the United States, and has a broad understanding of the global approaches to delivering successful planning and infrastructure projects.

Technical Appendix G

Peer Review Panel Comments
(As reported to the Joint Meeting of the Transportation and Regional Planning Committees on June 4, 2010)

Peer Review Panel's Global Observations

The Peer Review Panel convened in San Diego from April 19 – 21, 2010, to review and assess the work completed on the Urban Area Transit Strategy in relation to the preparation of the broader 2050 Regional Transportation Plan (RTP). In addition to the Panel's comments on the three alternative transit networks outlined in the Technical Documentation report, the Panel also made a number of global observations, as follows.

- **Economic Competitiveness**: Transportation is seen as the major driver of regions' economic competitiveness, and an increased focus on developing public transit systems is seen as a key factor in cities around the world for meeting mobility needs that ensure long-term economic sustainability.

- **Technological Savviness**: All over the world, technology is increasingly being used to market transportation options and other services to individuals based on user-preferences. Integrated electronic cards, such as the Octopus Card in Hong Kong and the Oyster Card in England, are providing tremendous potential to the private sector for marketing goods and services to end users; to the public sector for tailoring, directing, and providing incentives for transit/transportation services to end users; and for users who receive incentives and discounts for many kinds of products and services based on established purchasing choices. Global technology firms are actively seeking opportunities to develop markets. The Compass Card in the San Diego region is a solid start, and the region should proactively work to expand the Compass Card services beyond transportation to provide users with more convenience and incentives, and to maximize the region's ability to direct future transportation marketing decisions.

- **World Class Region**: The San Diego region has true potential of becoming a world class region. The focus of the Urban Area Transit Strategy should shift from developing a "world class transit system" to developing a "transportation system that supports a world class region and its local communities."

- **Sustainability and Co-Benefits**: In addition to pursuing transit as a means to help meet the Senate Bill 375 (SB 375) (Steinberg, 2008) regulatory mandates to reduce greenhouse gas emissions, transit also can help provide alternative transportation options, reduce foreign energy dependency, improve air quality, and reduce the proportion of American budgets spent on transportation. In addition, any co-benefits from smart growth development patterns and integrated transit systems should be highlighted and promoted, including internal trip capture, increased walking and biking, and carbon reductions in energy, waste, and water resulting from green building programs.

- **Land Use Development around Transit Stations**: Land use developers around the world recognize the economic potential for redevelopment around transit stations. Increasingly, the public sector is participating more directly with the private sector in the planning, design, and implementation of these types of redevelopment projects that result in more transit-oriented uses and direct economic benefits to the public sector that can then be invested back into transit infrastructure development. The Panel cited the proposed Tecolote Road, Clairemont Drive, and Balboa Avenue station sites along the Mid-Coast light-rail transit alignment as prime examples where such public/private partnerships could be forged. Additionally, the Panel expressed concern over the proposed Genesee Avenue alignment in the University City area, where an elevated trackway and station are currently proposed in order to minimize impacts on auto traffic. The Panel felt that the added costs of grade-separation versus an at-grade alignment may not be justified given the benefit that would accrue to the overall transportation system with the addition of the Mid-Coast project. They emphasized the importance of having transit facilities at the ground level as a means to better integrate into the surrounding community rather than forcing a separation from vehicle traffic as a traditional method of addressing congestion.

- **Land Use, Freeways, and Parking**: Land use density, design, and mix are essential components of a successful urban fabric and transit system. Locations that have limited parking and freeway expansions, and have simultaneously added an array transit services, have increased the overall performance of their transit systems and have increased transit mode share. The Panel felt that SANDAG should more directly reward communities that currently have high land use densities near transit stations, and should more directly influence land development in areas that currently have regional transit services. In addition, the Panel encouraged SANDAG to work more directly with the development community to build higher-density projects at stations, and to evaluate the allocation of affordable housing through the Regional Housing Needs Assessment process. In addition, the Panel expressed concerns that the region's Managed Lanes could be counterproductive toward transit if not properly implemented and operated, and suggested that SANDAG should monitor transit productivity as the Managed Lanes and Bus Rapid Transit (BRT) systems are implemented.

- **Project Prioritization**: The process to prioritize the funding of transportation projects needs to be easily understood by policymakers and the public, and needs to be conducted through a transparent process. A "policy audit table" example was provided. The audit helps to bridge the gap between the goals and objectives included in policy documents and the proposed transportation projects to help identify which transportation projects align with which policies, and alternatively which policies may not be addressed by any transportation projects.

- **Leadership and Champions**: Places that have successful transit systems have had strong leaders and champions to promote transit. Increasingly, bicycle and pedestrian advocates are supporting transit when they see opportunities for enhancements between the various modes. All successful transit systems need proactive and well-informed champions.

- **Dedicated Funding Sources**: Obtaining dedicated funding sources for transit is critical. In some cases, placing initiatives on the ballot solely for transit (versus for additional transportation modes and/or for other services) has culminated in success. (Within this context, the Panel recognized the difficulty of reaching California's two-thirds voter approval threshold for new special taxes.) The Panel also noted the potential of exploring a subregional funding approach in San Diego as an innovative concept that should be pursued.

Peer Review Panel Individual Observations

Peer review panelists were also invited to submit individual observations, if desired. The following comments were submitted by the noted panelists.

AIDAN HUGHES – PRINCIPAL, ARUP

Strengths

1. SANDAG has a strong relationship with the two transit operators and has good relationships with the Cities. This allows you to establish bold visions and work together to deliver on the vision. A more fractured relationship can get mired in delay and compromise.
2. SANDAG and the two operators have a very capable and experienced staff complemented with strong and committed leadership at the political and executive level. This translates into an ambition for leadership – learning from global best practice and seeking innovation in delivery and operation.
3. The existing system is operating successfully with strong farebox recovery and good coverage in the core areas. Much of the backbone system is in place through the LRT, Coaster and Sprinter systems linked into regional and international transport networks. While from the "inside" there is a recognition of some of the operational difficulties (for example, operating the trolley in the downtown), the public perception appears to be very positive. This establishes a strong platform for getting acceptance of system expansion and support for raising new capital. This also brings a responsibility to continue to deliver high quality service with clear benefits for riders as new projects are delivered.

Weaknesses

1. The Smart Growth plan is valuable as a comprehensive tool and it is being used appropriately as the basis for the transit networks. However, it is a bottom-up plan (the best the Cities are prepared to do right now) and it is not directly related to the availability of transit. There is an opportunity for SANDAG to take a lead in punching up the Smart Growth plan by using the carrot of transit investment to encourage Smart(er) Growth. Where there are proposed transit investments, they should be directly linked to some "threshold" metrics for smart growth.
2. The discussion we had around elevated light rail was interesting. It points to a fundamental issue that will face all projects, namely whether a case can (or should) be made to give transit priority in terms of road space at the expense of the auto. A greater

commitment should be made to support trade-offs in favor of transit – case studies around the nation and world have demonstrated that this can be achieved with little downside. The upside is an ability to increase ridership, demonstrate the benefits of transit and make more complete communities with transit at its core. In many ways, this philosophical change in emphasis will be the platform for the world class community vision.

3. As we noted “parking is a big issue” and it is interesting that you have experience of the negative consequences in relation to parking for the downtown ballpark. We didn’t have time to address parking in all its complexities as part of the peer review, but parking policies should be dealt with as essential complementary measures to support successful transit.

GEORGE HAZEL – CHAIRMAN, MRC MCLEAN HAZEL LTD

Strengths

1. Enthusiasm, understanding, and competence of the team.
2. History of what you’ve done to date to build on.
3. In general, an exciting plan to deliver in a potentially world class city – you’re not there yet!

Weaknesses

1. Attitudes to not inconveniencing cars - unless you sort this out and the leadership backs and understands that it is the city’s and the car drivers’ best interests to have a world class transit system and give it top priority and road space, then you will find it very difficult. Discussion on elevated section of Mid-Coast is a key example.
2. Governance needs to be sorted - too many agencies saying different things and doing different things.
3. I worry about managed lanes as a transit policy, specifically that they could be counterproductive toward the performance of transit. I would suggest experimenting with peak time express transit service or local off-peak service and monitor the results.

In addition you should really look at the potential of Intelligent Commuting Technology (ICT) and the Transport Retail Model, building on the Compass Card you have, and also the potential regarding capturing increased land value to fund transit.

Technical Appendix H

URBAN AREA TRANSIT STRATEGY:

A COMPONENT OF THE 2050 REGIONAL TRANSPORTATION PLAN

PLANNING LEVEL CAPITAL COST ESTIMATING METHODOLOGY REPORT

(NEW PROJECTS)

NOVEMBER 2010

Prepared by:

PARSONS BRINCKERHOFF

1.0 INTRODUCTION

System planning level capital cost estimates were developed for several transit modes being considered as part of the Urban Area Transit Strategy Project. These modes include:

- Light Rail Transit (LRT)
- Bus Rapid Transit (BRT)
- Rapid Bus
- Commuter Rail
- Streetcar

These system planning level capital costs were developed using a methodology that is consistent with Federal Transit Administration (FTA) guidelines, the basis of which is the Standard Cost Category (SCC) format. The SCC cost structure is described below.

2.0 FTA STANDARD COST CATEGORIES

In accordance with the latest FTA SCCs, the capital cost components were classified into the following cost categories:

10 Guideway and Track Elements
20 Station, Stops, Terminals, and Intermodal
30 Support Facilities: Yards, Shops, and Administration Buildings (Not Used)
40 Sitework and Special Conditions
50 Systems
60 Right-of-Way, Land, and Existing Improvements
70 Vehicles (Not Used)
80 Professional Services
90 Unallocated Contingency (10%)
100 Finance Charges (Not Used)

2.1 SCC 10 – Guideway and Track Elements

The guideway and track elements are portions of the transit system that can be assigned costs at a fairly aggregate level, with an acceptable level of accuracy. Most commonly, these elements are linear and can be represented by typical cross sections.

The guideway costs are divided into the following sub categories:

10.01 Guideway: At-grade exclusive right-of-way
10.02 Guideway: At-grade semi-exclusive right-of-way (allows cross-traffic)
10.03 Guideway: At-grade right-of-way (in mixed traffic)

- 10.04 Guideway: Aerial structure
- 10.05 Guideway: Built-up fill
- 10.06 Guideway: Underground cut and cover
- 10.07 Guideway: Underground tunnel
- 10.08 Guideway: Retained cut or fill

These costs include all foundational construction elements up to the point where track construction typically begins (at the top of sub ballast). The guideway cost estimates are based on parametric unit cost information specifically developed for each construction type.

2.2 SCC 20 – Stations, Stops, Terminals, and Intermodal

Station costs represent the fixed facilities and amenities for transit stations. The passenger station cost estimates are based on historical costs of similar stations. The station cost category is made up of a number of sub categories. The following is a list of these sub categories:

- 20.01 At-grade station, stop, shelter, mall, terminal, and platform
- 20.02 Aerial station, stop, shelter, mall, terminal, and platform
- 20.03 Underground station, stop, shelter, mall, terminal, and platform
- 20.04 Other stations, landings, and terminals: intermodal, ferry, trolley, etc.
- 20.05 Joint development
- 20.06 Automobile parking multi-story structure
- 20.07 Elevators and escalators

2.3 SCC 30 – Support Facilities: Yards, Shops, and Administration Buildings

This cost category includes vehicle storage and maintenance buildings, trackwork for the storage of rail vehicles, vehicle cleaning and painting facilities, office support areas, maintenance-of-way facilities, and general and major shop equipment. At this time, the extent of support facilities have not been identified and the capital costs developed to date do not include the cost of such facilities. Once these features have been identified, their costs will be distributed to each of the transit project in that alternative.

2.4 SCC 40 – Sitework and Special Conditions

The development of a functional transit system often requires that a number of ancillary mitigation requirements, which may or may not be directly related to the transit system service, be addressed. Sitework and special conditions costs often include items that cannot be adequately represented by a typical cross-section because of complexities, uncertain alignments, special site conditions, or other unique circumstances. The sitework and special conditions cost category is sub divided into the following:

- 40.01 Demolition, clearing, and fine grading
- 40.02 Site utilities and utility relocation
- 40.03 Hazardous materials, contaminated soil removal/mitigation and ground water treatments

40.04 Environmental mitigation, e.g. wetlands, historic/archaeological, and parks
40.05 Site structures, including retaining walls and sound walls
40.06 Pedestrian/bike access and accommodation, including landscaping
40.07 Automobile, bus, and van accessways, including roads and parking lots
40.08 Temporary facilities and other indirect costs during construction including mobilization

2.5 SCC 50 – Systems

This cost category includes the following cost elements:

50.01 Train control and signals
50.02 Traffic signals and crossing protection
50.03 Traction power supply substations
50.04 Traction power distribution catenary
50.05 Communications
50.06 Fare collection system and equipment
50.07 Central control

2.6 SCC 60 – Right-of-Way, Land, and Existing Improvements

This cost category covers all land acquisition and acquisition-related costs required to obtain various real property needed for the construction, operation, and maintenance of the proposed alignments. Costs include the fee acquisition of permanent takes and temporary easements, relocation costs, business damages, and other miscellaneous costs. This cost was developed based on historical cost real estate per transit project, as a percentage of the construction cost. Both purchase and relocation costs were included in a single line item.

60.01 Purchase or lease of real estate

2.7 SCC 70 – Vehicles

This cost category is generally subdivided into revenue (identified by transit mode) and non-revenue vehicles (where non-revenue vehicles include maintenance-of-way vehicles and agency trucks and automobiles). During this phase of the project development process, the unit costs for vehicles typically include costs for engineering, procurement, and spare parts, and are based on current quotes received by MTS or other transit authorities with similar vehicles.

An estimate for vehicles has not been developed. Once the overall system needs are determined, the total number of transit vehicles will be identified and included in the overall system cost.

2.8 SCC 80 – Professional Services

This cost category includes allowances for preliminary engineering, final design, project and construction management, agency program management, project insurance, surveys and testing, and start-up costs. These allowances are computed by applying a percentage to the total construction costs estimated for each cost category (excluding right-of-way and vehicle costs). Right-of-way and vehicle costs are typically calculated to include the management and administration costs associated with these activities and are therefore excluded from the calculation of professional services. The following is a list of the percentage multipliers being applied to the total construction costs to cover these items:

80.01	Preliminary Engineering	5.0%
80.02	Final Design	10.0%
80.03	Project Management for Design and Construction	7.0%
80.04	Construction Administration and Management	10.0%
80.05	Insurance	2.5%
80.06	Legal: Permits, Review Fees, Etc.	1.0%
80.07	Surveys, Testing, Investigation, and Inspection	2.0%
80.10	Start Up	1.5%
	Total Professional Services Costs	**39.0%**

2.9 SCC 90 – Unallocated Contingency

An unallocated contingency is intended to cover bid risks and construction risks that cannot reasonably be allocated to specific SCCs, such as change orders during construction (allocated contingencies are included in each of the construction subcategories). This cost category is intended to cover unknowns that cannot be anticipated, but nonetheless are prudent to include for planning purposes. The unallocated contingency is calculated as 10 percent of the total capital cost estimate.

2.10 SCC 100 – Finance Charges

Finance charges are not included in the scope of the initial project cost estimate.

3.0 ESTIMATING METHODOLOGY

Cost estimates were developed for each mode and for most of the FTA's Standard Cost Categories (SCC). These cost estimates were developed using historical prices for similar types of work. Right-of-way costs were developed based on historical right-of-way costs incurred as a percentage of construction cost in San Diego on Transit projects.

At this time, support facilities such maintenance facilities, yard, administration buildings, etc, have not been accounted for. The cost of these facilities would be determined when the overall system needs have been defined. When the needs of the overall system have been identified, those costs can be distributed to individual routes based on a reasonable distribution of such costs.

In order to arrive at the capital cost in a reasonable timeframe, a significant number of simplifying assumptions were made. It is noted that these costs are "high-level" costs used for system planning and no engineering was performed to verify these costs. Although the actual cost of each project may vary significantly from that developed here, the overall cost of the system improvements is expected to be a reasonable estimate when used for comparison of system wide alternatives.

3.1 Allocated Contingency

An allocated contingency is typically included in a cost estimate to address the lack of scope and/or quantity definition during the in-progress design stages. Using the SCC format, this is now a required step in the preparation of cost estimates. In the early stages, an allocated contingency may represent a significant portion of the cost estimate for any particular SCC. As the design progresses and more detailed quantity take-offs are developed, the allowance will be reduced. At 100 percent design completion, the allocated contingency, by definition, will be zero.

For the current project development phase, an allocated contingency will be applied to address the lack of scope definition and the inability to measure exact quantities. The amount of the allocated contingency will depend upon the complexity of the particular SCC, as well as the stage of engineering completion, but will typically be in the 10 to 30 percent range. The percentages shown in Table 3-1 are typical allocated contingency values; however, slightly higher or lower values may be used if warranted by a project-specific element.

Table 3-1. Allocated Contingency Percentages for Planning Estimates

FTA SCC	Description	Allocated Contingency Percentage
10	Guideway and Track Elements	
	Guideway Elements (Except Underground)	25
	Guideway Elements (Underground)	35
	Track Elements	15
20	Stations, Stops, Terminals, and Intermodals	
	At-grade or Aerial	25
	Below Grade	40
30	Support Facilities: Yards, Shops, and Administration Buildings	25
40	Sitework and Special Conditions	
	Demolition, Clearing, and Earthwork	25
	Site Utilities and Utility Relocation	50
	Hazardous Materials, Contaminated Soil Removal/Mitigation, and Groundwater Treatments	25
	Environmental Mitigation, e.g., Wetlands, Historic/Archaeological, and Parks	25
	Site Structures, including Retaining Walls and Sound Walls	25
	Pedestrian/Bike Access and Accommodation, including Landscaping	25
	Automobile, Bus, and Van Access, including Roads and Parking Lots	25
50	Systems	25
60	Right-of-Way, Land, and Existing Improvements	25 (unless otherwise noted)
70	Vehicles	5

3.2 Unit Pricing

Detailed quantity take-offs are generally not performed during the initial system planning stages of project development. Hence, rough order of magnitude (ROM) costs were used. Tables 3-2 through 3-6 show the ROM costs for the various transit modes being studied. All historical ROM costs are based on 2009 dollars.

Cost Categories 60 through 100 are the same for all transit modes. These costs are shown on Table 3-2 (LRT mode). They have not been repeated for the other modes.

Table 3-2: Light Rail Transit

		Units	Base Year (2009) Unit Price (X000)
10 GUIDEWAY & TRACK ELEMENTS			
10.01	Guideway: At-grade exclusive right-of-way	Route Mile	3,800
10.02	Guideway: At-grade semi-exclusive (allows cross-traffic)	Route Mile	5,900
10.04	Guideway: Aerial structure	Route Mile	47,000
10.06	Guideway: Underground cut & cover	Route Mile	140,000
10.07	Guideway: Underground tunnel	Route Mile	160,000
10.08	Guideway: Retained cut or fill	Route Mile	21,500
10.09	Track: Direct fixation	Route Mile	4,800
10.11	Track: Ballasted	Route Mile	2,700
10.12	Track: Special (switches, turnouts)	Route Mile	600
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)			
20.01	At-grade station, stop, shelter, mall, terminal, platform	Each	5,000
20.02	Aerial station, stop, shelter, mall, terminal, platform	Each	12,000
20.03	Underground station, stop, shelter, mall, terminal, platform	Each	90,000
	Transit Center and Parking Facility, small	Each	5,000
	Transit Center and Parking Facility, medium	Each	10,000
20.06	Automobile parking multi-story structure	Per Space	20
20.07	Elevators, escalators	Each	500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			**NA**
40 SITEWORK & SPECIAL CONDITIONS			
40.01	Demolition, Clearing, Earthwork	Route Mile	100
40.02	Site Utilities, Utility Relocation	Route Mile	500
40.03	Haz. mat'l, contam'd soil removal/mitigation, ground water treatments	Route Mile	100
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	Route Mile	300

Table 3-2: Light Rail Transit (Cont.)

40.05	Site structures including retaining walls, sound walls	Route Mile	1000
40.06	Pedestrian / bike access and accommodation, landscaping	Route Mile	300
40.08	Temporary Facilities and other indirect costs during construction	Lump Sum	12% of other Construction Cost
50 SYSTEMS			
50.01	Train control and signals	Route Mile	1500
50.02	Traffic signals and crossing protection	Route Mile	500
50.03	Traction power supply: substations	Route Mile	800
50.04	Traction power distribution: catenary and third rail	Route Mile	1000
50.05	Communications	Route Mile	400
50.06	Fare collection system and equipment	Route Mile	400
50.07	Central Control	Route Mile	100
60 ROW, LAND, EXISTING IMPROVEMENTS			
60.01	Purchase or lease of real estate	Lump Sum	20% of Construction Cost
70 VEHICLES (number)			**NA**
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)			
80.01	Preliminary Engineering	Lump Sum	5% of Construction Cost
80.02	Final Design	Lump Sum	10% of Construction Cost
80.03	Project Management for Design and Construction	Lump Sum	7% of Construction Cost
80.04	Construction Administration & Management	Lump Sum	10% of Construction Cost
80.05	Professional Liability and other Non-Construction Insurance	Lump Sum	2.5% of Construction Cost
80.06	Legal; Permits; Review Fees by other agencies, cities, etc.	Lump Sum	1% of Construction Cost
80.07	Surveys, Testing, Investigation, Inspection	Lump Sum	2% of Construction Cost
80.08	Start up	Lump Sum	1.5% of Construction Cost
90 UNALLOCATED CONTINGENCY			10% of all Cost
100 FINANCE CHARGES			**NA**

Table 3-3: Bus Rapid Transit			
		Units	Base Year (2009) Unit Price (X000)
10 GUIDEWAY & TRACK ELEMENTS			
10.01	Guideway: At-grade exclusive right-of-way	Route Mile	5,500
10.02	Guideway: At-grade semi-exclusive (allows cross-traffic)	Route Mile	850
10.03	Guideway: At-grade in mixed traffic	Route Mile	500
10.04	Guideway: Aerial structure	Route Mile	70,000
10.06	Guideway: Underground cut & cover	Route Mile	160,000
10.07	Guideway: Underground tunnel	Route Mile	180,000
10.08	Guideway: Retained cut or fill	Route Mile	10,000
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)			
20.01	At-grade station, stop, shelter, mall, terminal, platform	Each	5,000
20.02	Aerial station, stop, shelter, mall, terminal, platform	Each	15,000
20.03	Underground station, stop, shelter, mall, terminal, platform	Each	90,000
	Transit Center and Parking Facility, small	Each	5,000
	Transit Center and Parking Facility, medium	Each	10,000
20.06	Automobile parking multi-story structure	Per Space	20
20.07	Elevators, escalators	Each	500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			**NA**
40 SITEWORK & SPECIAL CONDITIONS			
40.01	Demolition, Clearing, Earthwork	Route Mile	100
40.02	Site Utilities, Utility Relocation	Route Mile	500
40.03	Haz. mat'l, contam'd soil removal/mitigation, ground water treatments	Route Mile	100
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	Route Mile	300
40.05	Site structures including retaining walls, sound walls	Route Mile	1000
40.06	Pedestrian / bike access and accommodation, landscaping	Route Mile	300
40.08	Temporary Facilities and other indirect costs during construction	Lump Sum	12% of other Construction Cost
50 SYSTEMS			
50.02	Traffic signals and crossing protection	Route Mile	100
50.05	Communications	Route Mile	200
50.06	Fare collection system and equipment	Route Mile	200

Table 3-4: Rapid Bus			
		Units	Base Year (2009) Unit Price (X000)
10 GUIDEWAY & TRACK ELEMENTS			
10.03	Guideway: At-grade in mixed traffic	Route Mile	200
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)			
20.01	At-grade station, stop, shelter, mall, terminal, platform	Each	500
	Transit Center and Parking Facility, small	Each	5,000
	Transit Center and Parking Facility, medium	Each	10,000
20.06	Automobile parking multi-story structure	Per Space	20
20.07	Elevators, escalators	Each	500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			**NA**
40 SITEWORK & SPECIAL CONDITIONS			
40.01	Demolition, Clearing, Earthwork	Route Mile	50
40.02	Site Utilities, Utility Relocation	Route Mile	50
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	Route Mile	20
40.05	Site structures including retaining walls, sound walls	Route Mile	20
40.06	Pedestrian / bike access and accommodation, landscaping	Route Mile	100
40.07	Automobile, bus, van accessways including roads, parking lots	Route Mile	100
40.08	Temporary Facilities and other indirect costs during construction	Lump Sum	12% of other Construction Cost
50 SYSTEMS			
50.02	Traffic signals and crossing protection	Route Mile	200
50.05	Communications	Route Mile	200
50.06	Fare collection system and equipment	Route Mile	100

Table 3-5: Commuter Rail			
		Units	Base Year (2009) Unit Price (X000)
10 GUIDEWAY & TRACK ELEMENTS			
10.01	Guideway: At-grade exclusive right-of-way	Route Mile	3,800
10.04	Guideway: Aerial structure	Route Mile	53,000
10.06	Guideway: Underground cut & cover	Route Mile	160,000
10.07	Guideway: Underground tunnel	Route Mile	180,000
10.08	Guideway: Retained cut or fill	Route Mile	21,500
10.09	Track: Direct Fixation	Route Mile	4,800
10.11	Track: Ballasted	Route Mile	2,700
10.12	Track: Special (switches, turnouts)	Route Mile	600
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)			
20.01	At-grade station, stop, shelter, mall, terminal, platform	Each	15,000
20.03	Underground station, stop, shelter, mall, terminal, platform	Each	200,000
	Transit Center and Parking Facility, small	Each	5,000
	Transit Center and Parking Facility, medium	Each	10,000
20.06	Automobile parking multi-story structure	Per Space	20
20.07	Elevators, escalators	Each	500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			**NA**
40 SITEWORK & SPECIAL CONDITIONS			
40.01	Demolition, Clearing, Earthwork	Route Mile	100
40.02	Site Utilities, Utility Relocation	Route Mile	500
40.03	Haz. mat'l, contam'd soil removal/mitigation, ground water treatments	Route Mile	100
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	Route Mile	300
40.05	Site structures including retaining walls, sound walls	Route Mile	1000
40.06	Pedestrian / bike access and accommodation, landscaping	Route Mile	300
40.08	Temporary Facilities and other indirect costs during construction	Lump Sum	12% of other Construction Cost
50 SYSTEMS			
50.01	Train control and signals	Route Mile	1500
50.02	Traffic signals and crossing protection	Route Mile	500
50.05	Communications	Route Mile	400
50.06	Fare collection system and equipment	Route Mile	400
50.07	Central Control	Route Mile	100

Table 3-6: Streetcar			
		Units	Base Year (2009) Unit Price (X000)
10 GUIDEWAY & TRACK ELEMENTS			
10.01	Guideway: At-grade exclusive right-of-way	Route Mile	3,800
10.02	Guideway: At-grade semi-exclusive (allows cross-traffic)	Route Mile	5,900
10.03	Guideway: At-grade in mixed traffic	Route Mile	2,500
10.04	Guideway: Aerial structure	Route Mile	47,000
10.06	Guideway: Underground cut & cover	Route Mile	140,000
10.07	Guideway: Underground tunnel	Route Mile	160,000
10.08	Guideway: Retained cut or fill	Route Mile	21,500
10.09	Track: Direct fixation	Route Mile	4,800
10.11	Track: Ballasted	Route Mile	2,700
10.12	Track: Special (switches, turnouts)	Route Mile	600
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)			
20.01	At-grade station, stop, shelter, mall, terminal, platform	Each	500
20.02	Aerial station, stop, shelter, mall, terminal, platform	Each	12,000
20.03	Underground station, stop, shelter, mall, terminal, platform	Each	90,000
	Transit Center and Parking Facility, small	Each	5,000
	Transit Center and Parking Facility, medium	Each	10,000
20.06	Automobile parking multi-story structure	Per Space	20
20.07	Elevators, escalators	Each	500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			**NA**
40 SITEWORK & SPECIAL CONDITIONS			
40.01	Demolition, Clearing, Earthwork	Route Mile	200
40.02	Site Utilities, Utility Relocation	Route Mile	500
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	Route Mile	20
40.05	Site structures including retaining walls, sound walls	Route Mile	50
40.06	Pedestrian / bike access and accommodation, landscaping	Route Mile	100
40.07	Automobile, bus, van accessways including roads, parking lots	Route Mile	100
40.08	Temporary Facilities and other indirect costs during construction	Lump Sum	12% of other Construction Cost
50 SYSTEMS			
50.01	Train control and signals	Route Mile	1500
50.02	Traffic signals and crossing protection	Route Mile	200
50.03	Traction power supply: substations	Route Mile	800
50.04	Traction power distribution: catenary	Route Mile	2,000
50.05	Communications	Route Mile	400
50.06	Fare collection system and equipment	Route Mile	400
50.07	Central Control	Route Mile	100

4.0 ESTIMATE LIMITATIONS

During the early stages of design, significant uncertainties exist to the extent that the work scope is often limited to a broad description of horizontal and vertical alignments. At this phase of the project development process, inherent uncertainties that could limit capital cost estimates include:

- Standard Design Criteria
- Scope and Quantity Definition
- Commodity Pricing
- Unforeseen Problems

Technical Appendix I

Draft Transit Evaluation Ranking (Ranked Order)

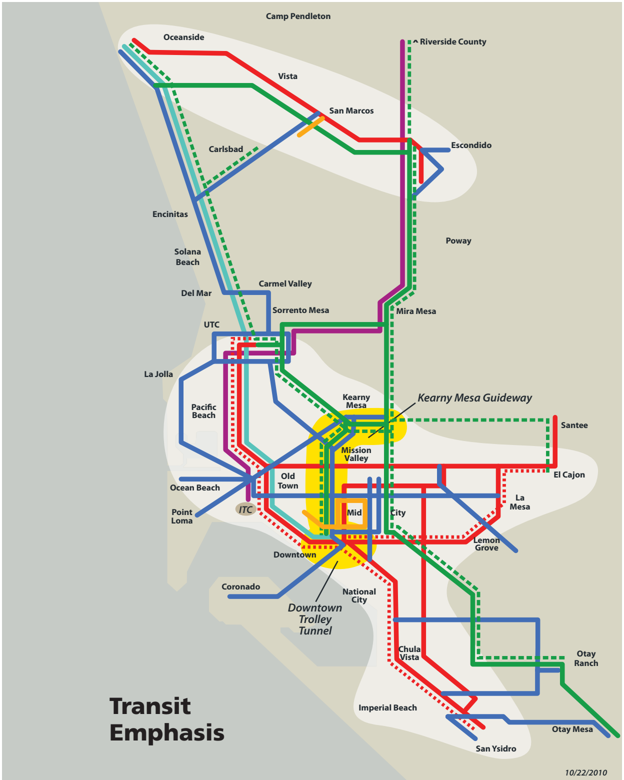
Project ID	*TransNet*	Route	Mode	Description	Capital Cost Est. (mil)	Operating Subsidy Est. (mil)	Total Cost Est. (mil)	Total Score	2050 RTP Project Rank
4		510	LRT	Blue Line UTC to San Ysidro via Downtown San Diego	$540	$424	$964	72.37	1
6		530	LRT	Green Line Santee to 12th/Imperial	$0	$367	$367	70.39	2
17		610	Peak BRT	Temecula/Escondido to Downtown via I-15, Kearny Mesa Guideway	$920	$310	$1,230	68.64	3
14		540	Express LRT	Blue Line UTC to San Ysidro via Downtown San Diego	$316	$229	$546	61.90	4
15		566	Express LRT	Otay (EUC) to UTC via Mid-City, Kearny Mesa	$227	$219	$446	56.40	5
13		522	Express LRT	Orange Line El Cajon to Downtown San Diego via Euclid	$160	$145	$305	52.45	6
22		870	Peak BRT	El Cajon to UTC via Santee, SR 52, Kearny Mesa	$7	$17	$24	52.36	7
1		598	CR	High Speed Rail - Commuter Rail Service from Riverside to Int'l Border	$3,753	$912	$4,665	52.22	8
11		563	LRT	Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, SDSU	$1,051	$272	$1,323	51.09	9
2	*TransNet*	398	CR	COASTER with Del Mar and University Town Center (UTC) Tunnels, Permanent Station at Del Mar Fairgrounds, and New Station at Convention Center in Downtown San Diego	$4,630	$825	$5,455	50.02	10
5		520	LRT	Orange Line with Extension to Airport and Downtown Tunnel	$540	$330	$869	49.02	11
32		120	Rapid	Kearny Mesa to Downtown via Sharp Hospital, Mission Valley, Hillcrest	$917	$57	$974	47.64	12
8		560	LRT	SDSU to Downtown via El Cajon Blvd/Mid-City	$1,025	$171	$1,196	47.42	13
10		562	LRT	UTC to Chula Vista via Kearny Mesa, Mission Valley, Mid-City, National City	$1,612	$269	$1,881	45.92	14
27		10	Rapid	La Mesa to Ocean Beach via Mid-City, Hillcrest, Old Town	$71	$124	$196	45.29	15
20		652	BRT	Downtown to UTC via Hillcrest, Mission Valley, via Kearny Mesa Guideway	$950	$74	$1,024	44.56	16
25		430	BRT	Oceanside to Escondido via SR 78 HOV Lanes	$196	$57	$252	43.40	17
44		910	Rapid	Coronado to Downtown via Coronado Bridge	$21	$55	$76	43.28	18
35		473	Rapid	Oceanside to UTC via Hwy 101 Coastal Communities, Carmel Valley	$106	$165	$270	41.85	19
7		550	LRT	SDSU to San Ysidro via East San Diego, SE San Diego, National City	$1,388	$286	$1,674	40.19	20
3	Partial *TransNet*	399	LRT	SPRINTER Oceanside to Escondido (with Branch Extensions to North County Fair and East Escondido)	$609	$341	$950	39.82	21
21		692	BRT	El Cajon to Otay Mesa via Spring Valley, SR 125, Millenia	$6	$82	$88	36.07	22
16		588	Express LRT	SPRINTER - Stops at Oceanside, Vista, Escondido Transit Centers	$197	$118	$315	35.08	23
30		30	Rapid	Old Town to Sorrento Mesa via Pacific Beach, La Jolla, UTC	$81	$161	$242	34.88	24
18		650	Peak BRT	Otay Ranch/Chula Vista to Palomar Airport Road Business Park via I-805/I-5	$67	$28	$96	34.68	25
28		11	Rapid	Spring Valley to SDSU via SE San Diego, Downtown, Hillcrest, Mid-City	$92	$150	$242	34.56	26

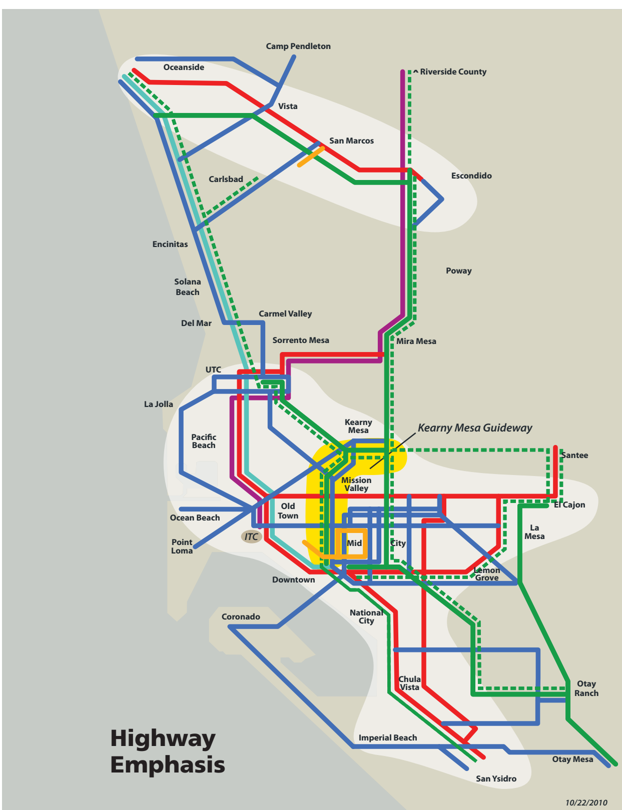
Draft Transit Evaluation Ranking (Ranked Order)

Project ID	*TransNet*	Route	Mode	Description	Capital Cost Est. (mil)	Operating Subsidy Est. (mil)	Total Cost Est. (mil)	Total Score	2050 RTP Project Rank
29		28	Rapid	Point Loma to Kearny Mesa via Old Town, Linda Vista	$40	$76	$117	33.89	27
9		561	LRT	UTC to Mira Mesa via Sorrento Mesa	$1,173	$131	$1,304	33.17	28
49		555	Streetcar	30th St. to downtown San Diego via North Park/Golden Hill	$207	$164	$371	32.61	29
47		553	Streetcar	San Diego Downtown - Little Italy to East Village	$113	$81	$194	31.37	30
48		554	Streetcar	Hillcrest/Balboa Park/Downtown San Diego Loop	$231	$160	$391	30.74	31
12		564	LRT	Otay Mesa to Chula Vista via Otay Ranch/Millenia	$668	$186	$854	29.73	32
19		653	Peak BRT	SE San Diego/Mid-City to Palomar Airport Road Business Park via I-	$10	$30	$40	29.63	33
31		41	Rapid	Old Town to UTC via Linda Vista, Clairemont	$45	$64	$109	27.71	34
26		2	Rapid	30th Ave to Downtown San Diego via North Park	$32	$68	$100	27.33	35
24		940	Peak BRT	Oceanside to Sorrento Mesa via I-5, Carlsbad, Encinitas	$36	$14	$50	26.94	36
43		709	Rapid	H St Trolley to Millenia via H St Corridor, Southwestern College	$30	$55	$85	26.07	37
39		636	Rapid	SDSU to Spring Valley via East San Diego, Lemon Grove, Skyline	$32	$55	$87	25.60	38
23		890	Peak BRT	El Cajon to Sorrento Mesa via Santee, SR 52	$10	$23	$33	25.16	39
33		440	Rapid	Carlsbad to San Marcos via Palomar Airport Road Corridor	$42	$57	$98	23.38	40
38		635	Rapid	Millenia to Palomar Trolley via Main St Corridor	$45	$70	$115	22.29	41
45		551	Streetcar	Chula Vista Downtown	$112	$89	$201	22.15	42
40		637	Rapid	North Park to 32nd St Trolley via Golden Hill, SE San Diego	$26	$46	$72	21.95	43
50		557	Streetcar	El Cajon Downtown	$133	$98	$231	21.86	44
51		558	Streetcar	Escondido Downtown	$42	$33	$74	19.91	45
36		474	Rapid	Oceanside to Vista via Mission Ave/Santa Fe Road Corridor	$41	$76	$117	19.64	46
34		471	Rapid	Downtown Escondido to East Escondido	$26	$32	$58	19.14	47
41		638	Rapid	San Ysidro to Otay Mesa via Otay, SR 905 Corridor	$44	$67	$111	19.10	48
46		552	Streetcar	National City Downtown	$33	$48	$81	18.69	49
53		565	Streetcar	Mission Beach to La Jolla via Pacific Beach	$199	$154	$354	17.55	50
42		639	Rapid	Otay to North Island via Imperial Beach, Silver Strand, Coronado	$44	$65	$109	17.18	51
52		559	Streetcar	Oceanside Downtown	$37	$25	$62	16.48	52
37		477	Rapid	Camp Pendleton to Carlsbad Village via College Blvd, Plaza Camino Real	$65	$92	$156	15.62	53
54		567*	Streetcar	San Marcos Downtown to Palomar College to CSUSM	$60	$179	$239	12.26	54

* This project was ranked as a streetcar. The City of San Marcos has proposed to fund this service (capital and operations) as a shuttle/circulator.

Technical Appendix J





Draft 2050 Revenue Constrained Network Scenarios

Transit Network Maps

November 12, 2010

Legend

- High Speed and Commuter Rail
- COASTER Rail
- Light Rail Transit
- Express Light Rail Transit
- Bus Rapid Transit
- Peak Bus Rapid Transit
- Rapid Bus
- Streetcar/Shuttle-Circulator
- High Frequency Local Bus Services
- Major Capital Investments Projects

✓ = Included
= Smaller Investment
= Larger Investment

Major Capital Investments	Transit	Rail/Freight	Highway	Fusion
Downtown Trolley Tunnel	✓	✓		
Kearny Mesa Guideway	✓		✓	✓
UTC COASTER Station/Tunnel		✓		
New Routes				
LRT	Larger Investment	Larger Investment	Smaller Investment	Larger Investment
BRT	Smaller Investment	Smaller Investment	Larger Investment	Smaller Investment
Rapid Bus	Larger Investment	Smaller Investment	Larger Investment	Smaller Investment
Streetcars/Shuttles	Smaller Investment	Smaller Investment	Smaller Investment	Larger Investment

Technical Appendix K-1

Attachment 6

Draft 2050 RTP Revenue Constrained Network Scenarios
Constant Projects List
December 17, 2010

	***TransNet* Projects**					**Estimated UNC Cost* ($2010)**	**Project Ranking**	**Scenario #1** Transit Emphasis	**Scenario #2** Rail/Freight Emphasis	**Scenario #3** Highway Emphasis	**Scenario #4** Fusion	**Scenario #5** Hybrid
	FREEWAY/HIGHWAY IMPROVEMENT PROJECTS											
	Route	**From**	**To**	**Existing**	**Improvement**							
1	I-5	SR 905	SR 54	8F	8F+2ML	$220	15	✓	✓	✓	✓	✓
2	I-5	SR 54	I-15	8F	8F+2ML	$100	14	✓	✓	✓	✓	✓
3	I-5	I-15	I-8	8F	8F+Operational	$1,130	17	✓	✓	✓	✓	✓
4	I-5	I-8	La Jolla Village Dr	8F/10F	8F/10F+2ML	$530	6	✓	✓	✓	✓	✓
5	I-5	La Jolla Village Dr	I-5/I-805 Merge	8F/14F	8F/14F+2ML	$303	28	✓	✓	✓	✓	✓
6	I-5	I-5/I-805 Merge	Manchester Ave	8F/14F+ 2HOV	8F/14F+4ML	$427	32	✓	✓	✓	✓	✓
7	I-5	Manchester Ave	Palomar Airport Rd	8F	8F+4ML	$2,059	4	✓	✓	✓	✓	✓
8	I-5	Palomar Airport Rd	Vandegrift Boulevard	8F	8F+4ML	$1,311	25	✓	✓	✓	✓	✓
9	I-8	2nd Street	Los Coches	4F/6F	6F	$54	41	✓	✓	✓	✓	✓
10	SR 15	SR 94	I-8	8F	8F+2ML	$120	19	✓	✓	✓	✓	✓
11	I-15	Viaduct		8F	8F+2ML	$720	42	✓	✓	✓	✓	✓
12	I-15	I-8	SR 163	8F	8F+2ML	$130	3	✓	✓	✓	✓	✓
13	I-15	SR 163	SR 56	8F+2ML(R)	10F+4ML/MB	$419	N/A	✓	✓	✓	✓	✓
14	I-15	Centre City Pkwy	SR 78	8F	8F+4ML	$210	N/A	✓	✓	✓	✓	✓
15	SR 52	I-15	SR 125	4F	6F+2ML(R)	$325	11	✓	✓	✓	✓	✓
16	SR 54	I-5	SR 125	6F	6F+2ML	$100	37	✓	✓	✓	✓	✓
17	SR 56	I-5	I-15	4F	6F	$221	46	✓	✓	✓	✓	✓
18	SR 67	Mapleview St	Dye Rd	2C/4C	4C	$570	8	✓	✓	✓	✓	✓
19	SR 76	Melrose Drive	I-15	2C	4C	$404	N/A	✓	✓	✓	✓	✓
20	SR 78	I-5	I-15	6F	6F+2ML/Ops	$570	5	✓	✓	✓	✓	✓
21	SR 94	I-5	I-805	8F	8F+2ML	$480	22	✓	✓	✓	✓	✓
22	SR 94	I-805	College Ave	8F	8F+2ML	$220	27	✓	✓	✓	✓	✓
23	SR 94	College Ave	SR 125	8F	8F+2ML	$230	44	✓	✓	✓	✓	✓
24	SR 94	SR 125	Avocado Blvd	4F	6F	$90	34	✓	✓	✓	✓	✓
25	SR 94	Avocado Blvd	Steele Canyon Rd	2C/4C	4C	$50	45, 24	✓	✓	✓	✓	✓
26	SR 125	SR 54	SR 94	6F	6F+2ML	$100	16	✓	✓	✓	✓	✓
27	SR 125	SR 94	I-8	8F	8F+2ML	$70	2	✓	✓	✓	✓	✓
28	I-805	Palomar St	Carroll Canyon Rd	8F/10F	8F+2ML	$2,003	18, 9, 10, 1	✓	✓	✓	✓	✓
29	I-805	Mission Valley Viaduct		8F	8F+2ML	$401	10	✓	✓	✓	✓	✓
30	I-805	Carroll Canyon Rd	I-5 (north)	8F/10F	8F+2ML	$86	7	✓	✓	✓	✓	✓

	TransNet Projects			Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #4 Hybrid
	FREEWAY CONNECTORS									
	Fwy	**Intersecting Freeway**	**Movement**							
31	I-5	SR 56	West to North	$33	9	✓	✓	✓	✓	✓
32	I-5	SR 56	South to East	$98	10	✓	✓	✓	✓	✓
33	I-5	SR 78	South to East	$60	2	✓	✓	✓	✓	✓
34	I-5	SR 78	West to South	$46	4	✓	✓	✓	✓	✓
35	SR 94	SR 125	West to North	$180	1	✓	✓	✓	✓	✓
36	SR 94	SR 125	South to East	$139	5	✓	✓	✓	✓	✓
	HOV CONNECTORS									
	Route	**Intersecting Freeway**	**Movement**							
37	I-5	I-805	North to North and South to South	$170	3	✓	✓	✓	✓	✓
38	I-15	SR 78	East to South and North to West	$105	1	✓	✓	✓	✓	✓
39	I-15	SR 94	East to North and South to West	$80	19	✓	✓	✓	✓	✓
	TRANSIT PROJECTS									
40	COASTER - Double Tracking (including Fairgrounds and Convention Center Stations, and grade separation at Leucadia) + two additional grade separations + quiet zone improvements (Rte 398)			$1,996	10	✓	✓	✓	✓	✓
41	Trolley - Mid-Coast LRT Extension (Rte 510)			$1,350	N/A	✓	✓	✓	✓	✓
42	Trolley - Trolley System Rehabilitation			$510	N/A	✓	✓	✓	✓	✓
43	SPRINTER - Double Tracking (Oceanside-Escondido); (including rail grade separations assumed at El Camino Real, Vista Village, Melrose, and Mission/San Marcos Stations) + 2 additional rail grade separations (Rte 399)			$798	21	✓	✓	✓	✓	✓
44	BRT - North I-15 (Sabre Springs/Mira Mesa PNRs, Mid-City Stations) (Rte 610)			$103	3	✓	✓	✓	✓	✓
45	BRT - Escondido-UTC via Mira Mesa Blvd (Rt 470 Project) (Peak only)			$20	N/A	✓	✓	✓	✓	✓
46	BRT - South Bay BRT (Otay Mesa-Downtown) (Rte 628)			$200	N/A	✓	✓	✓	✓	✓
47	BRT - South Bay Maintenance Facility			$51	N/A	✓	✓	✓	✓	✓
48	BRT - Downtown BRT stations/layovers			$110	N/A	✓	✓	✓	✓	✓
49	BRT - Otay Mesa to Sorrento Mesa via I-805, Kearny Mesa (Rt 680)			$200	N/A	✓	✓	✓	✓	✓
50	Rapid - Mid-City Rapid - Phase 1			$44	N/A	✓	✓	✓	✓	✓
51	Rapid - Mid-City Rapid – Phase 2 Balboa Park (Rte 15)			$24	N/A	✓	✓	✓	✓	✓
52	Rapid - UTC Area Super Loop (Rte 180)			$0	N/A	✓	✓	✓	✓	✓
			Total			**$19,970**	**$19,970**	**$19,970**	**$19,970**	**$19,970**

	OTHER CONSTANT PROJECTS					Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #4 Hybrid
	FREEWAY/HIGHWAY IMPROVEMENT PROJECTS											
	Route	**From**	**To**	**Existing**	**Improvement**							
53	I-5	Vandegrift Boulevard	Orange County	8F	8F+4T	$754	N/A	✓	✓	✓	✓	✓
54	I-8	SR 125	2nd Street	6F/8F	6F/8F+Operational	$125	13	✓	✓	✓	✓	✓
55	SR 11	SR 905	Mexico	--	4T	$356	N/A	✓	✓	✓	✓	✓
56	SR 15	I-5	SR 94	6F	8F+2ML	$90	23	✓	✓	✓	✓	✓
57	I-15	SR 78	Riverside County	8F	8F+4T	$1,005	N/A	✓	✓	✓	✓	✓
58	SR 52	I-5	I-805	4F	6F	$110	31	✓	✓	✓	✓	✓

	OTHER CONSTANT PROJECTS					Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #4 Hybrid
59	SR 52	I-805	I-15	6F	6F+2ML	$190	30	✓	✓	✓	✓	✓
60	SR 125	SR 905	San Miguel Rd	4T	8F	$110	N/A	✓	✓	✓	✓	✓
61	SR 125	San Miguel Rd	SR 54	4F	8F	$60	N/A	✓	✓	✓	✓	✓
62	SR 241	Orange County	I-5	--	4T/6T	$443	N/A	✓	✓	✓	✓	✓
63	SR 905	I-805	Mexico	--	6F	$595	N/A	✓	✓	✓	✓	✓
	FREEWAY CONNECTORS											
	Fwy	**Intersecting Freeway**	**Movement**									
64	I-15	SR 56	North to West			$100	7	✓	✓	✓	✓	✓
	HOV CONNECTORS											
	Route	**Intersecting Freeway**	**Movement**									
65	I-15	I-805	North to North and South to South			$90	4	✓	✓	✓	✓	✓
66	I-805	SR 52	West to North and South to East			$90	2	✓	✓	✓	✓	✓
67	I-805	SR 94	East to South and North to West			$160	6	✓	✓	✓	✓	✓
	TRANSIT PROJECTS											
68	High Speed Rail (HSR) Intercity - Temecula to Lindbergh Field ITC					$0	N/A	✓	✓	✓	✓	✓
69	COASTER - Tunnel (Del Mar) (Rte 398)					$1,184	N/A	✓	✓	✓	✓	✓
70	COASTER - Positive Train Control					$108	N/A	✓	✓	✓	✓	✓
71	Trolley - Blue Line Frequency Enhancements (rail grade seps at: Taylor, Palomar St, H St, E St, 32nd St, 28th St, Washington St/Sassafras St + Blue/Orange Track Connection at 12th/Imperial) (Rte 510)					$572	1	✓	✓	✓	✓	✓
72	Trolley - Orange Line Frequency Enhancements (rail grade seps at: Allison/University, Severin Dr, Broadway/Lemon Grove Ave, Euclid Ave) (Rte 520)					$312	11	✓	✓	✓	✓	✓
73	Trolley - Green Line Frequency Enhancements (Rte 530)					$0	2	✓	✓	✓	✓	✓
74	Rapid - La Mesa to Ocean Beach via Mid-City, Hillcrest, Old Town (Rte 10)					$85	15	✓	✓	✓	✓	✓
75	Rapid - Point Loma to Kearny Mesa via Old Town, Linda Vista (Rte 28)					$48	27	✓	✓	✓	✓	✓
76	Rapid - Kearny Mesa to Downtown via KM Guideway (Rte 120)					$0	12	✓	✓	✓	✓	✓
77	Rapid - Escondido to Del Lago via Escondido Blvd & Bear Valley (Rte 350)					$0	N/A	✓	✓	✓	✓	✓
78	Shuttles - San Marcos					$0	N/A	✓	✓	✓	✓	✓
79	Local Bus Routes - 10 min in key corridors					$0	N/A	✓	✓	✓	✓	✓
80	Feeder Bus System					$0	N/A	✓	✓	✓	✓	✓
81	Lindbergh Intermodal Transit Center (ITC)					$215	N/A	✓	✓	✓	✓	✓
82	Bike/Pedestrian Access Improvements					$500	N/A	✓	✓	✓	✓	✓
83	Other (Maintenance facilities, transit system rehab, park and ride, ITS)					$3,020	N/A	✓	✓	✓	✓	✓
	ADDITIONAL GOODS MOVEMENT PROJECTS											
84	Vesta Street Bridge - Mobility connector over Harbor Drvie at Naval Base San Diego					$60	1	✓	✓	✓	✓	✓
85	32nd Street - Freeway Access Enhancement					$119	3	✓	✓	✓	✓	✓
86	10th Ave Marine Terminal Entrance - Rail Line Grade Separation/Barrio Logan Enhancement					$67	3	✓	✓	✓	✓	✓
87	National City Marine Terminal - Bay Marina Drive, Civic Center Freeway Access Improvements					$7	6	✓	✓	✓	✓	✓
88	National City Rail Yard					$7	1	✓	✓	✓	✓	✓
					Total			**$10,582**	**$10,582**	**$10,582**	**$10,582**	**$10,582**

Note: All Managed Lane facilities will have a HOV-3+ occupancy requirement after 2020. HOV-2 and SOVs will be required to pay a fee to use these facilities.

TransNet projects are included in all scenarios with the exception of the I-805 corridor where different improvements are being tested in some scenarios.

N/A - Projects were not ranked using Board-approved project evaluation criteria.

* Capital costs only. Operating costs, which include vehicle and vehicle replacement costs, will be based on phasing.

** Project Rankings was from Temecula to International Border.

Technical Appendix K-2

Draft 2050 RTP Revenue Constrained Network Scenarios
Variable Projects List
December 17, 2010

	VARIABLE PROJECTS					Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #5 Hybrid
	FREEWAY/HIGHWAY IMPROVEMENT PROJECTS											
	Route	**From**	**To**	**Constant**	**Add'l Improvement**							
89	I-5	SR 54	I-15	8F+2ML	10F+2ML	$100	14	-	-	✓	✓	✓
90	I-5	SR 56	Palomar Airport Rd	8F+4ML	10F+4ML	$136	4	-	-	✓	-	✓
91	I-5	Palomar Airport Rd	Vandegrift	8F+4ML	10F+4ML	$87	25	-	-	✓	-	-
92	I-8	I-5	I-15	8F	8F+Operational	$440	33	✓	-	✓	✓	✓
93	I-8	I-15	SR 125	8F/10F	8F/10F+Operational	$125	40	✓	-	✓	✓	✓
94	I-8	Los Coches	Dunbar Rd	4F/6F	6F	$335	41	-	-	✓	-	-
95	SR 52	I-15	SR 125	6F+2ML(R)	6F+3ML/MB	$115	11	-	-	✓	-	-
96	SR 52	SR 125	SR 67	4F	6F	$120	36	-	-	✓	-	-
97	SR 54	I-5	SR 125	6F+2ML	6F/8F+2ML	$40	37	-	-	✓	-	-
98	SR 56	I-5	I-15	6F	6F+2ML	$69	46	-	-	✓	-	-
99	SR 67	I-8	Mapleview St	4F/6F	6F/8F	$180	29	-	✓	✓	-	-
100	SR 76	I-5	Melrose Drive	4E	6E	$225	39	-	-	✓	-	-
101	SR 76	Melrose Drive	Mission Rd	4C	6C	$190	20	-	-	✓	-	-
102	SR 76	I-15	Couser Canyon	2C	4C/6C + Ops	$130	26	-	-	✓	✓	✓
103	SR 94	I-805	College Ave	8F+2ML	10F+2ML	$70	27	-	-	✓	✓	-
104	SR 94	Steele Canyon Rd	Melody Rd	2C	4C	$90	45, 24	-	✓	✓	-	-
105	SR 125	SR 54	SR 94	6F+2ML	8F+2ML	$40	16	-	-	✓	-	-
106	SR 125	SR 94	I-8	8F+2ML	10F+2ML	$215	2	-	-	✓	✓	✓
107	SR 125	I-8	SR 52	6F	6F+2ML	$440	38	-	✓	✓	-	-
108	SR 163	I-805	I-15	8F	8F+2ML	$320	35	-	-	✓	-	-
109	I-805	SR 905	Telegraph Canyon Rd.	8F	8F+4ML	$140	12	-	-	✓	-	✓
110	I-805	Telegraph Canyon Rd.	SR 54	8F+2ML	8F+4ML	$100	18	-	-	✓	-	✓
111	I-805	SR 54	I-8	8F+2ML	8F+4ML	$160	9	-	-	✓	-	✓
112	I-805	Mission Valley Viaduct		8F+2ML	8F+4ML	$160	10	-	-	✓	-	✓
113	I-805	I-8	La Jolla Village Dr	8F/10F+2ML	8F/10F+4ML	$100	1	-	-	✓	-	✓
114	I-805	Palomar St	SR 94	8F+2ML	8F+4ML	$516	18	✓	-	-	-	-
115	I-805	SR 52	Carroll Canyon Rd	8F/10F+2ML	8F/10F+4ML	$180	1	✓	-	-	-	-
116	I-805	SR 905	Palomar St	8F	8F+2ML	$200	12	-	✓	-	-	-
117	SR 905	I-5	I-805	4F	8F	$150	43	-	✓	✓	-	-
118	SR 905	I-805	Mexico	6F	8F	$426	21	-	✓	✓	-	-
	FREEWAY CONNECTORS											
	Fwy	**Intersecting Freeway**	**Movement**									
119	I-5	I-8	East to North			$220	6	-	-	✓	-	-
120	I-5	I-8	South to West			$100	3	-	-	✓	-	-
121	I-5	SR 94	North to East			$120	8	-	✓	-	-	-
	HOV CONNECTORS											
	Route	**Intersecting Freeway**	**Movement**									
122	I-5	SR 56	North to East and West to South			$80	5	-	-	✓	-	-
123	I-5	SR 78	South to East and West to North			$120	8	✓	-	✓	-	✓
124	I-5	SR 78	North to East and West to South			$120	7	✓	-	✓	-	✓
125	I-15	SR 52	West to North and South to East			$140	10	✓	-	-	✓	✓

	VARIABLE PROJECTS	Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #5 Hybrid
	TRANSIT PROJECTS							
126	High Speed Rail (HSR) Commuter Rail Overlay - Temecula to Lindbergh ITC (Rte 598)	$330	8**	✓	✓	✓	✓	-
127	COASTER - UTC Tunnel and UTC COASTER Station (Rte 398)	$2,989	See Note A	-	✓	-	-	-
128	SPRINTER - Branch Extensions to North County Fair (Rte 399)	$172	See Note B	✓	✓	-	✓	✓
129	SPRINTER Express (Rte 588)	$207	23	-	✓	-	✓	✓
130	Trolley - Downtown Trolley Tunnel betw. Park/Island and Ash St (facilitates frequency enhancements for Blue/Orange Lines and Blue/Orange Express) (Rtes 510 & 520)	$2,592	See Note C	✓	✓	-	-	✓
131	Trolley Express - Blue Line Express - UTC to San Ysidro via Downtown (Rte 540)	$455	4	✓	✓	-	-	✓
132	Trolley Express - Orange Line Express - El Cajon to Downtown San Diego via Euclid (Rte 522)	$230	6	✓	✓	-	-	✓
133	Trolley Express - H St Trolley Station (formerly EUC) to UTC via Mid-City, Kearny Mesa (Rte 566)	$327	5	-	✓	-	-	-
134	Trolley - SDSU to Downtown via El Cajon Blvd/Mid-City (transition of Mid-City Rapid to LRT) (Rte 560)	$1,921	13	✓	-	-	-	✓
135	Trolley - Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, SDSU (Rte 563)	$1,262	9	-	✓	-	✓	✓
136	Trolley - SDSU to San Ysidro via East San Diego, SE San Diego, National City (Rte 550)	$1,665	20	✓	-	✓	-	-
137	Trolley - UTC to H St Trolley Station via Kearny Mesa, Mission Valley, Mid-City, National City (Rte 562)	$1,935	14	-	✓	-	✓	-
138	Trolley - UTC to Palomar Trolley Station via Kearny Mesa, Mission Valley, Mid-City, National City/Chula Vista via Highland Ave/4th Ave (Modified Rte 562)	$2,548	N/A	-	-	-	-	✓
139	Trolley - UTC to Mira Mesa via Sorrento Mesa (Rte 561)	$1,408	28	-	-	✓	✓	-
140	Trolley - UTC to Mira Mesa via Sorrento Mesa/Carroll Cyn (Modified Rte 561)	$1,140	N/A	-	-	-	-	✓
141	Guideway - Downtown to Kearny Mesa Guideway (facilitates direct access for BRT, Rapid Bus, and local bus - Rtes 120, 610, 640, 652)	$3,302	See Note D	✓	-	✓	✓	-
142	Modified Guideway - Hillcrest to Mission Valley Transit Priority Measures (facilitates direct access for BRT, Rapid Bus, and local bus - Rtes 120, 610, and 640)	$500	See Note E	-	-	-	-	✓
143	BRT - I-5 - San Ysidro to Kearny Mesa via I-5 shoulder lanes/HOV lanes, Downtown, Kearny Mesa Guideway (Rte 640) (eventually replaced by Blue Line Express Route 540)	$90	N/A	-	-	✓	✓	✓
144	BRT - Downtown to UTC via Kearny Mesa Guideway/I-805 (Rte 652)	$2	16	✓	-	✓	✓	-
145	BRT - El Cajon to UTC/Campus Pt via Santee, SR 52, I-805 (Rte 870) (Peak Only)	$7	7	✓	-	✓	-	✓
146	BRT - Oceanside to Escondido via SR 78 HOV Lanes (Rte 430)	$234	17	✓	-	✓	-	-
147	BRT - Chula Vista to Palomar Airport Road Bus. Park via I-805/5 (Rte 650) (Peak Only)	$80	25	-	-	✓	-	-
148	BRT - El Cajon to Sorrento Mesa via SR 52, Kearny Mesa (Rte 890) (Peak Only)	$12	39	✓	-	✓	-	✓
149	BRT - El Cajon to Otay Mesa via Spring Valley, SR 125, Millenia (Rte 692)	$6	22	-	-	✓	✓	-
150	BRT - Mid City to Palomar Airport Road via Kearny Mesa/I-805/I-5 (Rte 653) (Peak Only)	$10	33	✓	-	✓	-	✓
151	BRT - Oceanside to UTC via I-5, Carlsbad, Encinitas (Rte 940) (Peak Only)	$38	N/A	✓	-	✓	✓	-
152	BRT - Santee/El Cajon Transit Centers to Downtown via SR 94 (Rte 90) (Peak Only) (eventually replaced by Orange Line Express Route 522)	$0	N/A	-	-	✓	✓	✓
153	BRT - Millenia/Otay Ranch to Sorrento Mesa Express (Rte 688) (Peak Only)	$0	N/A	✓	-	✓	✓	✓
154	BRT - Millenia/Otay Ranch to UTC/Torrey Pines Express (Rte 689) (Peak Only)	$0	N/A	✓	-	✓	✓	✓

	VARIABLE PROJECTS	Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #5 Hybrid
155	Rapid - Oceanside to UTC via Hwy 101 Coastal Communities, Carmel Valley (Rte 473)	$127	19	✓	-	✓	✓	✓
156	Rapid - Old Town to Sorrento Mesa via Pacific Beach, La Jolla, UTC (Rte 30)	$102	24	✓	-	✓	✓	✓
157	Rapid - Carlsbad to San Marcos via Palomar Airport Road Corridor (Rte 440)	$50	40	✓	-	✓	-	-
158	Rapid - Coronado to Downtown via Coronado Bridge (Rte 910)	$25	18	✓	-	✓	-	✓
159	Rapid - Spring Valley to SDSU via SE San Diego, Downtown, Hillcrest, Mid-City (Rte 11)	$110	26	-	✓	✓	✓	✓
160	Rapid - Fashion Valley to UTC/UCSD via Linda Vista and Clairemont (Rte 41)	$54	34	✓	-	✓	-	-
161	Rapid - SDSU to Spring Valley via East San Diego, Lemon Grove, Skyline (Rte 636)	$39	38	✓	✓	✓	-	✓
162	Rapid - North Park to 32nd Street Trolley via Golden Hill (Rte 637)	$32	43	✓	-	✓	-	✓
163	Rapid - Downtown Escondido to East Escondido (Rte 471)	$31	47	✓	-	✓	-	✓
164	Rapid - Eastlake/EUC to Palomar Trolley via Main Street Corridor (Rte 635)	$54	41	✓	-	✓	-	✓
165	Rapid - San Ysidro to Otay Mesa via Otay, SR 905 Corridor (Rte 638)	$53	48	✓	-	✓	-	✓
166	Rapid - Otay to North Island via Imperial Beach and Silver Strand, Coronado (Rte 639)	$53	51	-	-	✓	-	-
167	Rapid - H Street Trolley to Millenia via H Street Corridor, Southwestern College (Rte 709)	$36	37	✓	-	✓	-	✓
168	Rapid - North Park to Downtown San Diego via 30th St (Rte 2)	$38	35	✓	-	✓	-	✓
169	Rapid - Oceanside to Vista via Mission Ave/Santa Fe Road Corridor (Rte 474)	$49	46	-	-	✓	-	✓
170	Rapid - Camp Pendleton to Carlsbad Village via College Blvd, Plaza Camino Real (Rte 477)	$78	53	-	-	✓	-	-
171	Streetcar - Hillcrest/Balboa Park/Downtown San Diego Loop (Rte 554)***	$277	31	✓	-	✓	✓	✓
172	Streetcar - 30th St to Downtown San Diego via North Park/Golden Hill (Rte 555)***	$249	29	✓	-	-	✓	✓
173	Streetcar - Downtown San Diego: Little Italy to East Village (Rte 553)***	$135	30	✓	-	✓	✓	✓
174	Streetcar - El Cajon Downtown (Rte 557)***	$160	44	-	-	-	✓	-
175	Streetcar - Chula Vista Downtown (Rte 551)***	$134	42	-	-	-	✓	-
176	Streetcar - Escondido Downtown (Rte 558)***	$50	47	-	-	-	✓	-
177	San Ysidro Intermodal Center	$50	N/A	-	-	-	-	✓
	Total			$13,317	$12,254	$13,749	$10,412	$14,144
	UNCONSTRAINED PROJECTS ONLY	**Estimated UNC Cost* ($2010)**	**Project Ranking**	**Scenario #1** Transit Emphasis	**Scenario #2** Rail/Freight Emphasis	**Scenario #3** Highway Emphasis	**Scenario #4** Fusion	**Scenario #5** Hybrid
	FREEWAY/HIGHWAY IMPROVEMENT PROJECTS							
	Route / From / To / Constant / Add'l Improvement							
178	I-15 / Centre City Pkwy / SR 78 / 8F+4ML / 10F+4ML	TBD	N/A****	-	-	-	-	-
	HOV CONNECTORS							
	Route / Intersecting Freeway / Movement							
179	I-5 / SR 15 / North to North and South to South	$183	11	-	-	-	-	-
180	I-5 / SR 54 / West to South and North to East	$120	21	-	-	-	-	-
181	I-5 / SR 54 / South to East and West to North	$120	22	-	-	-	-	-
182	I-5 / SR 56 / South to East and West to North	$170	13	-	-	-	-	-
183	I-15 / SR 52 / West to South and North to East	$140	23	-	-	-	-	-
184	I-15 / SR 56 / East to North and South to West	$180	13	-	-	-	-	-

UNCONSTRAINED PROJECTS ONLY					Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #5 Hybrid
185	I-15	SR 163	North to North and South to South		$160	9	-	-	-	-	-
186	SR 52	SR 125	North to West and East to South		$100	16	-	-	-	-	-
187	SR 94	SR 125	East to North and South to West		$140	12	-	-	-	-	-
188	I-805	SR 54	South to East and West to North		$140	15	-	-	-	-	-
189	I-805	SR 94	West to South and North to East		$160	20	-	-	-	-	-
190	I-805	SR 94	East to North and South to East		$160	14	-	-	-	-	-
191	I-805	SR 163	North to North and South to South		$150	17	-	-	-	-	-
	TRANSIT PROJECTS										
192	High Speed Rail (HSR) Extension from Lindbergh Field ITC to International Border				$3,557	N/A	-	-	-	-	-
193	SPRINTER - Branch Extensions to East Escondido (Rte 399)				$59	N/A	-	-	-	-	-
194	Trolley - Otay Mesa East Border Crossing to western Chula Vista via Otay Ranch/Millenia (Rte 564)				$854	32	-	-	-	-	-
195	Trolley - Downtown Bus Tunnel and Hubs				$2,917	N/A	-	-	-	-	-
196	Streetcar - National City Downtown (Rte 552)				$40	49	-	-	-	-	-
197	Streetcar - Oceanside Downtown (Rte 559)				$45	52	-	-	-	-	-
198	Streetcar - Mission Beach to La Jolla via Pacific Beach (Rte 565)				$239	50	-	-	-	-	-
199	Otay Mesa East Intermodal Transit Center				-	N/A	-	-	-	-	-
				Total			$9,634	$9,634	$9,634	$9,634	$9,634

Note: All Managed Lane facilities will have a HOV-3+ occupancy requirement after 2020. HOV-2 and SOVs will be required to pay a fee to use these facilities.

TransNet projects are included in all scenarios with the exception of the I-805 corridor where different improvements are being tested in some scenarios.

N/A - Projects were not ranked using Board-approved project evaluation criteria.

* Capital costs only. Operating costs, which include vehicle and vehicle replacement costs, will be based on phasing.

** Project Ranking was from Temecula to International Border

*** Only 10% of the project cost is assumed for regional funding.

**** This project was recommended to be added to the Unconstrained Network by the Transportation Committee at its December 10, 2010 meeting.

Note A: Included in COASTER double-tracking ranking

Note B: Included in SPRINTER double-tracking ranking

Note C: Included in several LRT project rankings

Note D: Included in several BRT project rankings; cost and length of guideway modified for Hybrid Scenario

Note E: Guideway and/or transit priority measures designed to improve transit speeds in Hillcrest and Mission Valley.

Technical Appendix L

Draft 2050 RTP Revenue Constrained Transportation Scenario
Transit Phasing
January 28, 2011

	TRANSIT PROJECTS	Estimated Capital Cost	Phasing Year	Project Ranking
	ONGOING TRANSIT PROJECTS			
	2010-2020			
34	Rapid - UTC Area Super Loop (Rte 180)	$0	✓	N/A
38	Rapid - Escondido to Del Lago via Escondido Blvd & Bear Valley (Rte 350)	$0	✓	N/A
6	Trolley - Mid-Coast LRT Extension (Rte 510)	$1,200	✓	N/A
7	Trolley - Trolley System Rehabilitation (Blue and Orange Lines)	$510	✓	N/A
20	BRT - Escondido-UTC via Mira Mesa Blvd (Rte 470 Project)	$20	✓	N/A
21	BRT - South Bay BRT (Otay Mesa-Downtown) (Rte 628)	$200	✓	N/A
22	BRT - South Bay Maintenance Facility	$51	✓	N/A
23	BRT - Downtown BRT stations/layovers	$110	✓	N/A
24	BRT - Otay Mesa to Sorrento Mesa via I-805, Kearny Mesa (Rte 680 and Peak Rtes 688/689) (includes I-15/Green Line transfer station (facilitates Green Line, and BRT Rtes 610, 680)	$300	✓	N/A
32	Rapid - Mid-City Rapid - Phase 1 (Rte 15)	$44	✓	N/A
33	Rapid - Mid-City Rapid – Phase 2 Balboa Park (Rte 15)	$24	✓	N/A
	TRANSIT PROJECTS			
	2010-2020			
19	BRT - North I-15 (Sabre Springs/Mira Mesa PNRs, Mid-City Stations) (Rte 610)	$103	✓	3
26	BRT - El Cajon to UTC/Campus Pt via Santee, SR 52, I-805 (Rte 870) (Peak Only)	$7	✓	7
2a	COASTER - Positive Train Control	$88	✓	10
2b	COASTER - Convention Ctr Station	$20	✓	10
2c	COASTER - Double Tracking (Rte 398) (includes near term improvements from LOSSAN Project Prioritization Analysis	$465	✓	10
2d	COASTER - Quiet Zone Improvements (1)	$6	✓	10
35	Rapid - La Mesa to Ocean Beach via Mid-City, Hillcrest, Old Town (Rte 10)	$85	✓	15
3a	SPRINTER Double Tracking (Oceanside-Escondido) short term improvements	$100	✓	21
51	Streetcar - Hillcrest/Balboa Park/Downtown San Diego Loop (Rte 554) (2)	$28	✓	31
25	BRT - I-5 - San Ysidro to Kearny Mesa via I-5 shoulder lanes/HOV lanes, Downtown, Hillcrest/Mission Valley Guideway (Rte 640) (eventually replaced by Blue Line Express Route 540)	$90	✓	N/A - Rte 540 ranked 4
29	BRT - Santee/El Cajon Transit Centers to Downtown via SR 94 (Rte 90) (Peak Only) (eventually replaced by Orange Line Express Route 522)	$0	✓	N/A - Rte 522 ranked 6
54	Shuttles - San Marcos	$0	✓	N/A - locally funded
55	Local Bus Routes - 15 min in key corridors	$0	✓	N/A (3)
58	Lindbergh Intermodal Transit Center (ITC)	$215	✓	N/A (4)
63a	Other (Vehicles/vehicle replacement, maintenance facilities, transit system rehab, regulatory compliance, park and ride, ITS)	$1,368	✓	N/A (5)
	2021-2030			
8a	Trolley - Blue Line Frequency Enhancements, incl.rail grade seps at: Palomar St, H St, E St, 32nd St, 28th St, Blue/Orange Track Connection at 12th/Imperial (Rte 510)	$260	✓	1
2e	COASTER - Double Tracking (Rte 398) (includes mid term improvements from LOSSAN Project Prioritization Analysis + Fairgrounds Station + Station Parking Improvements)	$424	✓	10
37	Rapid - Kearny Mesa to Downtown (Rte 120)	$0	✓	12
41	Rapid - Coronado to Downtown via Coronado Bridge (Rte 910)	$25	✓	18
39	Rapid - Oceanside to UTC via Hwy 101 Coastal Communities, Carmel Valley (Rte 473)	$127	✓	19
3b	SPRINTER - Double Tracking (Oceanside-Escondido) completion of doubletracking (including rail grade separations assumed at El Camino Real, Vista Village, Melrose, and Mission/San Marcos Stations) + 2 additional rail grade separations (Rte 399)	$698	✓	21
4	SPRINTER - Branch Extension to South Escondido (Rte 399)	$172	✓	21
5	SPRINTER Express (Rte 588)	$284	✓	23
40	Rapid - Old Town to Sorrento Mesa via Pacific Beach, La Jolla, UTC (Rte 30)	$102	✓	24
36	Rapid - Point Loma to Kearny Mesa via Old Town, Linda Vista (Rte 28)	$48	✓	27
17	Trolley - UTC to Mira Mesa via Sorrento Mesa/Carroll Cyn (Rte 561)	$1,140	✓	28
53	Streetcar - Downtown San Diego: Little Italy to East Village (Rte 553) (2)	$14	✓	30
49	Rapid - North Park to Downtown San Diego via 30th St (Rte 2)	$38	✓	35

	TRANSIT PROJECTS	Estimated Capital Cost	Phasing Year	Project Ranking
	TRANSIT PROJECTS (Continued)			
	2021-2030 (Continued)			
48	Rapid - H Street Trolley to Millenia via H Street Corridor, Southwestern College (Rte 709)	$36	✓	37
27	BRT - El Cajon to Sorrento Mesa via SR 52, Kearny Mesa (Rte 890) (Peak Only)	$12	✓	39
18	Hillcrest to Mission Valley Transit Priority Measures and I-15 Green Line transfer station (facilitates direct access for BRT, Rapid Bus, and local bus - Rtes 120, 610, 640)	$500	✓	12, 3
62a	Bike/Pedestrian Access Improvements for Transit Facilities	$100	✓	N/A (6)
63b	Other (Vehicles/vehicle replacement, maintenance facilities, transit system rehab, regulatory compliance, park and ride, ITS)	$1,807	✓	N/A (5)
	2031-2035			
1	High Speed Rail (HSR) Intercity - Temecula to Lindbergh Field ITC	$0	✓	N/A
15	Trolley - Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, SDSU (Rte 563)	$1,262	✓	9
9	Trolley - Orange Line Enhancements (rail grade seps at: Allison/University, Severin Dr, Broadway/Lemon Grove Ave, Euclid Ave) (Rte 520)	$312	✓	11
42	Rapid - Spring Valley to SDSU via SE San Diego, Downtown, Hillcrest, Mid-City (Rte 11)	$110	✓	26
52	Streetcar - 30th St to Downtown San Diego via North Park/Golden Hill (Rte 555) (2)	$25	✓	29
28	BRT - Mid City to Palomar Airport Road via Kearny Mesa/I-805/I-5 (Rte 653) (Peak Only)	$10	✓	33
46	Rapid - Eastlake/EUC to Palomar Trolley via Main Street Corridor (Rte 635)	$54	✓	41
44	Rapid - North Park to 32nd Street Trolley via Golden Hill (Rte 637)	$32	✓	43
50	Rapid - Oceanside to Vista via Mission Ave/Santa Fe Road Corridor (Rte 474)	$49	✓	46
45	Rapid - Downtown Escondido to East Escondido (Rte 471)	$31	✓	47
47	Rapid - San Ysidro to Otay Mesa via Otay, SR 905 Corridor (Rte 638)	$53	✓	48
43	Rapid - SDSU to Spring Valley via East San Diego, Lemon Grove, Skyline (Rte 636)	$39	✓	38
56	Local Bus Routes - 10 min in key corridors	$0	✓	N/A (3)
62b	Bike/Pedestrian Access Improvements for Transit Facilities	$50	✓	N/A (6)
63c	Other (Vehicles/vehicle replacement, maintenance facilities, transit system rehab, regulatory compliance, park and ride, ITS)	$1,142	✓	N/A (5)
	2036-2040			
8b	Trolley - Blue Line Enhancements (rail grade seps at Taylor St, Washington St/Sassafras St) (Rte 510)	$290	✓	1
10	Trolley - Green Line Frequency Enhancements (Rte 530)	$0	✓	2
9	Trolley Orange Line Frequency Enhancements (Rt 520)	$0	✓	11
12	Trolley Express - Blue Line Express - UTC to San Ysidro via Downtown (Rte 540)	$455	✓	4
13	Trolley Express - Orange Line Express - El Cajon to Downtown San Diego (Rte 522)	$230	✓	6
11	Trolley - Downtown Trolley Tunnel btwn Park/Island and Ash St -- Phase 1 (facilitates frequency enhancements for Blue/Orange Lines and implementation of Blue/Orange Express & Mid-City LRT) (Rtes	$2,592	✓	1, 11, 4, 6, 13
63d	Other (Vehicles/vehicle replacement, maintenance facilities, transit system rehab, regulatory compliance, park and ride, ITS)	$0	✓	N/A (5)
	2041-2050			
2f	COASTER - (Rt 398) (including long term improvements from LOSSAN Project Prioritization Analysis + Del Mar tunnel + two additional grade separations)	$1,614	✓	10
14	Trolley - SDSU to Downtown via El Cajon Blvd/Mid-City (transition of Mid-City Rapid to LRT) (Rte 560)	$1,921	✓	13
16	Trolley - UTC to Palomar Trolley Station via Kearny Mesa, Mission Valley, Mid-City, National City/Chula Vista via Highland Ave/4th Ave (Modified Rte 562)	$2,548	✓	14
59	San Ysidro Intermodal Center	$50	✓	N/A
62c	Bike/Pedestrian Access Improvements for Transit Facilities	$350	✓	N/A (6)
63e	Other (Vehicles/vehicle replacement, maintenance facilities, transit system rehab, regulatory compliance, park and ride, ITS)	$1,267	✓	N/A (5)
57	Feeder Bus System	$0	✓	N/A (3)

2010-2020 Phasing
2021-2030 Phasing
2031-2035 Phasing
2036-2040 Phasing
2041-2050 Phasing
Included in all phases

Bold project numbers are *TransNet* projects
N/A - projects not ranked
(1) - Quiet zone improvements represent 10% of total project costs; other 90% assumed to come from non-transit sources
(2) - Streetcar capital costs represent 10% of total project costs; other 90% assumed to come from non-transit sources
(3) - Local bus are service frequency improvements only (no capital); feeder bus system are service improvements to local bus system to support new rail and BRT services.
(4) - Lindbergh and San Ysidro Intermodal Centers not ranked since they are facility/station improvements supporting other rail/BRT capital projects
(5) - Support facilities for existing transit infrastructure and new rail/bus capital projects
(6) - Infrastructure improvements at existing and new rail/bus stations/transit centers to improve pedestrian access

Technical Appendix M

Final 2050 RTP Revenue Constrained Network Transit Projects and Phasing

Decade	Service	Route	Description	Peak Headway (Minutes)	Off-Peak Headway (Minutes)
2018	COASTER	398	Double tracking/Increased Frequency between Oceanside and downtown San Diego with extension to Convention Center/Petco Park	20	Current
2018	Trolley	510	Mid-Coast LRT Extension (peak frequencies 7.5 to downtown/15 to UTC)	7.5/15	15
2018	Trolley	530	Green Line Extend to downtown – Bayside	15	15
2018	BRT	470	Escondido – UTC/UCSD via Mira Mesa Blvd	10	-
2018	BRT	607	Rancho Bernardo – downtown Express	10	-
2018	BRT	608	Escondido – downtown Express	10	-
2018	BRT	610	Temecula (Peak Only)/Escondido – downtown	10	10
2018	BRT	628	South Bay BRT (Otay Mesa – downtown) via Otay Ranch/Millenia	15	-
2018	BRT	680	Otay Mesa to Sorrento Mesa via I-805 Corridor, Otay Ranch/Millenia, National City, Southeastern San Diego, Kearny Mesa	15	15
2018	BRT	688	San Ysidro to Sorrento Mesa Express	15	-
2018	BRT	689	Millenia/Otay Ranch to UTC/Torrey Pines Express	15	-
2018	Rapid	15	Mid-City Rapid (SDSU – downtown) via Mid-City, El Cajon and Park Blvds	10	10
2018	Rapid	201/202	UTC Area Super Loop	10	15
2018	Rapid	350	Escondido to Del Lago via Escondido Blvd & Bear Valley	10	10
2020	Streetcar	554	Hillcrest/Balboa Park/downtown San Diego Loop	10	10
2020	BRT	90	Santee/El Cajon Transit Centers to downtown via SR 94	15	-
2020	BRT	640	I-5 – San Ysidro to downtown & Kearny Mesa via I-5 shoulder lanes/HOV lanes, downtown, Hillcrest, Mission Valley	15	15
2020	BRT	870	El Cajon to UTC via Santee, SR 52, I-805 (Peak only)	10	-
2020	Rapid	10	La Mesa to Ocean Beach via Mid-City, Hillcrest, Old Town	10	10
2020	Shuttle	448/449	San Marcos Shuttle	15	15
2020	Airport Express		I-5 from McClellan-Palomar Airport to San Diego International Airport	30	30
2020	Airport Express		I-15 from Escondido Transit Center to San Diego International Airport	30	30
2020	Airport Express		I-15 from Escondido Transit Center to Cross Border Facility	30	30
2020			Local Bus Routes - 15 minutes in key corridors	15	15

Final 2050 RTP Revenue Constrained Network Transit Projects and Phasing (Continued)

Decade	Service	Route	Description	Peak Headway (Minutes)	Off-Peak Headway (Minutes)
2030	COASTER	398	Additional Double tracking/Increased Frequency	20	60
2030	SPRINTER	399	Double tracking (Oceanside-Escondido) Increased Frequencies	10	10
2030	Trolley	561	UTC to Mira Mesa via Sorrento Mesa/Carroll Canyon (extension of route 510)	7.5	7.5
2030	Trolley	520	Orange Line - Increased Frequency (existing 15/15)	7.5	15
2030	Streetcar	553	Downtown San Diego: Little Italy to East Village	10	10
2030	SPRINTER	588	SPRINTER Express	10	15
2030	BRT	890	El Cajon to Sorrento Mesa via SR 52, Kearny Mesa	10	-
2030	Rapid	2	North Park to downtown San Diego via North Park, Golden Hill	10	10
2030	Rapid	28	Point Loma to Kearny Mesa via Old Town, Linda Vista	10	10
2030	Rapid	30	Old Town to Sorrento Mesa via Pacific Beach, La Jolla, UTC	10	10
2030	Rapid	120	Kearny Mesa to downtown via Mission Valley	10	10
2030	Rapid	473	Oceanside to UTC via Hwy 101 Coastal Communities, Carmel Valley	10	10
2030	Rapid	709	H Street Trolley to Otay Ranch/Millenia via H Street Corridor, Southwestern College	10	10
2030	Rapid	910	Coronado to downtown via Coronado Bridge	10	10
2035	Trolley	520	Orange Line - Extend to Airport Intermodal Transit Center	7.5	15
2035	Streetcar	555	30th St to downtown San Diego via North Park/Golden Hill	10	10
2035	Trolley	560	Mid-City to downtown (Phase 1) via El Cajon and Park Blvds	7.5	7.5
2035	Trolley	563	Pacific Beach to El Cajon via Clairemont, Kearny Mesa, Mission Valley, SDSU	7.5	10
2035	BRT	653	Mid-City to Palomar Airport Road via Kearny Mesa/I-805/I-5	15	-
2035	Rapid	11	Spring Valley to SDSU via Southeastern San Diego, Downtown, Hillcrest, Mid-City	10	10
2035	Rapid	201/202	UTC Area Super Loop - Increase Frequencies	10	10
2035	Rapid	471	Downtown Escondido to East Escondido	10	10
2035	Rapid	474	Oceanside to Vista via Mission Ave/Santa Fe Road Corridor	10	10
2035	Rapid	635	Eastlake/EUC to Palomar Trolley via Main Street Corridor	10	10
2035	Rapid	636	SDSU to Spring Valley via East San Diego, Lemon Grove, Skyline	10	10
2035	Rapid	637	North Park to 32nd Street Trolley via Golden Hill	10	10

Final 2050 RTP Revenue Constrained Network Transit Projects and Phasing (Continued)

Decade	Service	Route	Description	Peak Headway (Minutes)	Off-Peak Headway (Minutes)
2035	Rapid	638	San Ysidro to Otay Mesa via Otay, SR 905 Corridor	10	10
2035	Shuttle	448/449	San Marcos - Increase Frequencies	10	10
2035			Local Bus Routes - 10 minutes in key corridors	10	10
2040	Trolley	520	Orange Line - Increased Frequencies	7.5	7.5
2040	Trolley	522	Orange Line Express - El Cajon to downtown San Diego	10	10
2040	Trolley	530	Green Line Extend to downtown - Bayside	7.5	7.5
2040	Trolley	540	Blue Line Express - UTC to San Ysidro via downtown	10	10
2050	Trolley	560	SDSU to downtown (Phase 2) via Mid-City, El Cajon and Park Blvds	7.5	7.5
2050	Trolley	562	UTC to San Ysidro via Kearny Mesa, Mission Valley, Mid-City, Southeastern San Diego, National City/Chula Vista via Highland Ave/4th Ave	7.5	10

Technical Appendix N

Urban Area Transit Strategy:

A Component of the

2050 Regional Transportation Plan

Menu of Policy Options to Support the Transit Network

November 19, 2010

Prepared by:

PARSONS BRINCKERHOFF

Introduction

As part of the development of the 2050 Regional Transportation Plan (RTP), the San Diego Association of Governments (SANDAG) has been preparing a visionary Urban Area Transit Strategy (UATS) for the San Diego region to significantly increase the use of transit, walking, and biking in the urbanized areas of the region. The strategy focuses on maximizing the use of transit during the peak periods, reducing greenhouse gas (GHG) emissions and vehicle miles traveled, and increasing the share of regional trips made on transit (the transit mode share). The transit network resulting from the UATS will be incorporated into the 2050 RTP and Sustainable Communities Strategy (SCS).

Developing and funding a robust transit network is essential to achieve SANDAG's goals. However, a number of other factors also influence the use and success of the regional transit system. Related transportation and land use policies and strategies can directly or indirectly create incentives (or disincentives) to transit use. By incorporating supporting policies and strategies into the RTP, SANDAG can enhance the ability of the future transit network to increase transit use and transit mode share, and help achieve regional, state, and federal goals and legislative requirements related to Smart Growth, GHG emissions, and sustainability.

This report identifies a "menu" of policies and strategies that influence transit ridership and mode share. The menu is organized into three categories: parking, land use, and funding. These policies and strategies were culled from technical and academic research, experience in other cities and regions, input from the UATS Strategic Transit Team and Peer Review Panel, and suggestions by UATS project stakeholders including the San Diego Council of Design Professionals[1], SANDAG's Stakeholder Working Group[2], and RTP community workshops[3]. The paper also includes information on transit fares, services, and facilities to help maximize the effectiveness of the region's transit network. This additional information is included in the latter half of the paper.

Menu of Policies and Strategies

A. Parking

Parking policy and its relationship to travel behavior is a complex topic[4], especially because drivers do not directly pay the true cost of providing parking. Parking policy generally falls into two interrelated categories; parking supply and parking cost. A third component, parking management, relates to both supply and cost.

Results from international studies provide interesting data confirming the overall importance of parking policies as a management tool, and although many of the more stringent parking (and smart growth) policies implemented in other countries would find limited acceptance in the United States, both international and domestic research strongly points to the importance of parking availability and price on travel behavior. ***The research also shows that transit usage is more sensitive to parking cost than to transit service levels or fare prices, and that the combination of increased transit service and increased parking prices are more effective than either of the two strategies separately.*** There are other effective and feasible parking management strategies, such as changes to parking minimums or

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[1] At an UATS workshop conducted on April 14, 2010.

[2] The SWG was formed by SANDAG to provide input into the development of the 2050 RTP.

[3] Conducted in five communities in April and May 2010.

[4] When examining the details of parking supply and its impact on travel behavior and urban form, the results of analyses can be somewhat ambiguous due to dependency on indirect and long-term strategies. Although the vast majority of studies show an inverse relationship between parking costs, vehicle trips, and transit ridership, the magnitude of this relationship varies depending on the study location, the geographic scope of the research (i.e., whether investigators were looking at individual work places or regional data), and the type of parking management technique (supply constraint, taxation, time of day pricing, parking cash-out, etc.).

maximums in zoning codes, although some of these may take decades to show results. Parking cost can offer more immediate gains in transit ridership and transit mode share.

One of the key first policy steps for SANDAG is to address whether or not parking is a high priority topic to be considered at the regional level. Is there a willingness to address parking as an important part of the tool box for managing urban form and transportation issues? Are there broad policy statements that can be included in the RTP that can lay the groundwork for future inclusion of more detailed discussions regarding the implementation of specific parking policies? If parking supply, pricing, and management strategies are considered an important tool, then a future possible step would be to determine SANDAG's role in supporting cities who must ultimately implement the strategies at a local level.

Assuming parking strategies are on the menu of policies under consideration to increase transit ridership and mode share, and support the SCS, SANDAG will need to wade through the varying opinions and research related to how parking should be provided and at what price to meet overall regional goals. Although the implications of large supplies of free parking have been discussed more frequently in the planning community over the past decade, given the current embedded zoning policies and existing land use characteristics in much of the United States and in the San Diego region, it is still important to review a few key facts regarding parking to put the issue into context. The following information was presented in numerous studies on parking performed over the past several decades:

- 99 percent of all automobile trips end in free parking. *(1990 Nationwide Personal Transportation Survey (NPTS)).* In the San Diego Region, 88 percent of solo driver work trips have free parking at the place of employment.[5]
- The number of parking spaces per car (excluding home) has been estimated to range from 2 to 4 spaces per registered vehicle. (Davis, 2009)
- Employer paid parking increases the propensity for workers to travel alone in single-occupant vehicles (SOV) to work. (Vaca, Kuzmyak, 2005)
- In general, individuals are more responsive to increases in marginal changes in parking costs than to other vehicle operating costs. (Bianco, 1998)
- Mode choice is sensitive to parking cost. (Vaca, Kuzmyak, 2005)
- The impact of parking costs on mode shift to transit is location-sensitive. Parking charges have different impacts on commuter mode choice, depending on residential location choices and access to transit. (Dueker, Stratham, Bianco, 1998)
- Increasing parking costs while simultaneously increasing transit service has more impact than increasing transit service alone. (Bianco, 1998)

To summarize, the United States in general, as well as the greater San Diego region, have an ample supply of parking and the vast majority of it is not priced. As a result, the end user of the good (the driver) does not pay directly for parking, rather the cost of parking is embedded in the costs of residential, retail, and employment activity in the region. Parking costs help shift the true cost of parking to the user and both parking supply and cost have been shown to directly impact vehicle miles traveled (VMT) and transit mode share. When implemented properly, especially when coordinated with the provision of other transportation choices, parking policies and management strategies that shift the true cost of parking to the end user can be valuable tools for supporting regional goals regarding Smart Growth, VMT reduction, and increasing transit mode share. In fact, SANDAG's 2010 *Parking Strategies for Smart Growth* study notes that less available parking leads to higher parking costs and can reinforce lower vehicle trip generation rates as drivers re-evaluate their mode choice and some change

[5] 2050 RTP, Public Opinion Survey Report, prepared for SANDAG, True North Research, June 23, 2010.

their travel behavior.[6] In SANDAG's recent 2050 RTP Public Opinion Survey, nearly half (47%) of the respondents who currently drive alone to work and have free parking (88 percent of all work trip commuters) indicated that a $10 a day charge for parking would get them to change their travel behavior to an alternative mode.[7]

However, implementation and technical issues can complicate regional parking policy decisions. Projecting the impact of various parking strategies and policies on a regional level is challenging because they are primarily implemented under location specific conditions. Beyond that, modeling specific strategies at the regional scale is difficult when using a traditional transportation modeling platform. Usually proxies must be used in the travel demand model and typically they only apply to downtown regions where parking is coded into the more detailed zonal network – other strategies, such as parking cash-out, zoning changes, or shared parking are difficult to incorporate. As a result, there is a wealth of data regarding case studies, strategies, and guidebooks about the impact of parking strategies, but only a few studies that could be applied at the regional level to predict likely impact on region-wide transportation measures, such as VMT and transit use. Even studies regarding the elasticity of vehicle trips to parking costs have failed to reach a standard consensus on equations that can be successfully applied at the regional level.

Parking management also can be a highly debated topic and is often considered at a subregional level. One example of this would be the Comprehensive Parking Plan for Downtown San Diego prepared for the City Centre Development Corporation in March 2009. This study looked at parking supply and demand in the downtown San Diego area and recommended a number of parking management strategies for the near-, medium-, and long-term. The Plan mentioned the potential for reduced parking demand in the long-term resulting from projected increases in transit ridership, but it does not directly address whether parking supply should be adjusted to incentivize transit ridership to downtown and support regional transit mode share and GHG reduction goals.

Parking Strategies

There are a variety of parking strategies that could be incorporated into policies and implemented at the local or regional levels. SANDAG as the regional planning and transportation funding agency, and local jurisdictions as the local land use, planning, zoning, and regulatory agencies, have different roles in promoting, implementing, and enforcing the various strategies and policies. SANDAG could establish parking policies at the regional level to influence, but not mandate, implementation by local jurisdictions. To influence parking policy, SANDAG could identify parking policies and strategies that would support regional land use and transportation goals, spearhead a regional approach or consensus on specific policy issues, develop regional parking policy guidelines, identify implementation tools, provide staff and technical resources to local jurisdictions, and support local implementation of specific strategies. SANDAG also could choose to use local parking policy as a criterion for awarding transportation and/or smart growth incentive funding (similar to the way in which the Federal Transit Administration uses regional and local land use policies as criteria for awarding federal New Starts transit funding). At the local level, cities could both establish and implement specific parking policies for their jurisdictions. Local jurisdiction implementation of parking policies generally occurs through zoning codes which, over the long-term, results in changes in private parking supply and cost.

Table 1 identifies a number of parking strategies that SANDAG could address regionally and jurisdictions could implement locally to influence a shift in transit use. These policies are discussed in detail in documents referenced in Appendix A. In particular, the U.S. Environmental Protection Agency (EPA) document "Parking Spaces/Community Places", the Metropolitan Transportation Commission's

[6] SANDAG, Trip Generation for Smart Growth, June 2010, page 1.
[7] 2050 RTP, Public Opinion Survey Report, prepared for SANDAG, True North Research, June 23, 2010, page 12.

"Tool Box/Handbook: Parking Best Practices & Strategies for Supporting Transit Oriented Development In the San Francisco Bay Area" and the parking management section of the Victoria Policy Institute's Online Transportation Demand Management (TDM) encyclopedia provide excellent case studies of each type of implementation. Several local jurisdictions have already moved to implement versions of some of the identified strategies, as identified in SANDAG's *Parking Strategies for Smart* Growth study. The strategies identified in Table 1 fall into four general policy categories: (1) Availability Standards Policies, (2) Location Specific Policies, (3) Pricing Policies, and (4) Management Policies.

Table 1: Examples of Parking Strategies

Strategy	Strategy Category	Strategy Description
Shared Parking	1, 2	Parking spaces serve multiple users and destinations typically taking advantage of different time of day peaking characteristics.
Parking Regulations	1, 4	Regulations favor short-term uses, such as service vehicles, deliveries, customers, quick errands, and people with special needs and are generally applied to on-street parking.
More Accurate and Flexible Standards	1, 2	Adjust parking standards to more accurately reflect demand in a particular situation.
Parking Maximums	1, 2	Establish maximum parking standards in zoning codes.
Parking Minimums	1, 2	Reduce/delete minimum parking requirements in zoning codes.
Remote Parking	2, 4	Provide off-site or urban fringe parking facilities with transit connections to reduce long SOV trips into urban areas and reduce parking in urban areas.
Smart Growth	1, 2	Encourage more compact, mixed, multimodal development to allow more parking sharing and use of alternative modes.
Parking Pricing	3, 4	Charge motorists directly and efficiently for using parking facilities.
Improve Pricing Implementation	4	Use better charging techniques and equipment to make pricing more convenient and cost effective. (e.g., smart parking meters)
Financial Incentives	3	Provide financial incentives to shift mode, such as parking cash-out.
Unbundle Parking	2, 3	Rent or sell parking facilities separately from building space.
Improve User Information & Marketing	4	Provide convenient and accurate information on parking availability and price, using maps, signs, brochures, and electronic communication.
Improve Enforcement	4	Ensure that parking regulation enforcement is efficient, considerate, and fair.
Transportation Management Associations	2, 4	Establish member-controlled organizations that provide transport and parking management services in a particular area.
Overflow Parking Plans and Management	2, 3, 4	Establish plans to manage occasional peak parking demands. Use management, enforcement, and pricing to address spillover problems.

1 = Availability Standards Policies
2 = Location Specific Policies
3 = Pricing Policies
4 = Management Policies

The effectiveness of the various parking strategies is dependent on many factors. One of the best pieces of research regarding the overall sensitivity of transit ridership to different parking strategies is Transit Research Cooperative Report 40 "Strategies to Attract Auto Users to Public Transport" (1998). This document addressed the following questions:

- How does parking price and transit service affect transit use in United States cities?
- How does parking price and transit service affect transit use for downtown-destined work trips?
- How does increasing parking price compare with other strategies in reducing work trip SOV travel?

- How do different parking strategies compare with one another in reducing SOV work trips?

The study's main conclusions were:

- In general, higher transit ridership levels exist in cities with higher parking prices and more restrictive parking programs, but because of the wide variation among cities and their circumstances, no specific formula was developed for determining which levels of parking price and transit service would result in certain transit mode shares.
- In general, parking pricing policies have the greatest effect on travel behavior for residents of urban core, inner ring, or suburbs of large cities.
- The impact of parking pricing is highest when transit service levels also are high.

The Transit Research Cooperative study also presented the relative effectiveness of several parking strategies on transit usage as summarized in Table 2.

Table 2: Relative Effectiveness of Parking Strategies on Transit Usage

Strategy	Definition	Effectiveness	Scope
Parking Tax on Revenue	Tax applied to commercial off-street parking on gross or net revenue.	Moderate	Narrow spatial scope as it would apply only to areas that are already priced
Parking Tax on Spaces	Taxation is applied on a per space basis. Can be applied to suburban employers.	High in areas with good transit	Broad spatial scope
Parking Cash-out	Parking cash-out allows employees to opt out of having a parking space and instead receive compensation. The employer who leases (or owns) a space pays the employee not to park.	Moderate	Narrow spatial scope
Expand the use of meters and residential permit programs	Implement parking meters in combination with residential permit programs to manage parking and reduce spillover.	Low to Moderate	Narrow spatial scope
Zoning Changes • Decreased Minimums • Establish/Reduce Parking Maximums • Conditional Use Permits	Reduce the growth of future parking spaces through modifications to parking related zoning requirements.	Low short-term/ Moderate Long-term	Broad spatial scope depending on implementation
Shared Parking	Increase the efficiency of parking spaces through shared use based on the typical use patterns for multiple user types (e.g., employer parking and movie theater parking).	Low	Narrow spatial scope

Source: Transit Research Cooperative Report 40 "Strategies to Attract Auto Users to Public Transport"

Because parking policy and strategy implementation is such a complex issue, implementing incremental steps in a longer term parking strategy roadmap can initiate change and point the way to effective long-term policy. The Seattle, Washington experience, outlined in Table 3, provides a 30-year case study on initial steps and incremental implementation of effective parking policy and strategies.

Table 3: Seattle, Washington Parking Strategy Implementation Timeline

Year	Strategy	Source
1974	Commuter Pool Program begins to encourage carpools with a matching service, marketing, and discounted parking.	Seattle Office of Policy Planning, 1979
1976	Comprehensive Downtown Parking Policy adopted. The Policy made the following changes: • Some maximum limitations were placed on parking spaces for new developments and rehabilitated buildings, depending on type of land use. • Principal use parking (not accessory to some other use) was prohibited within part of downtown. • New open parking lots prohibited in part of downtown, only permitted if accessory to rehabilitated buildings.	Seattle Office of Policy Planning, 1979
1976-1978	Metro Transit increased service to downtown Seattle during rush hour by 25 percent to meet the demand created by shortage of parking.	Seattle Office of Policy Planning, 1979
1985 - 1990	John Doan, of the City of Seattle's Department of Construction and Land Use, puts it succinctly: 'There's an intent, policywise, to make them (parking places) dry up. We look for mechanisms to accomplish it.' "In the past five years, the requirement has been pegged at .75 to 1.0 parking spaces per 1,000 square feet of new office space in the downtown core."	Seattle Times, 3/16/90
2005	Seattle eliminates commercial parking requirements downtown.	Seattle, 12/12/06
2006	Seattle City Council votes to eliminate parking minimums for businesses and developers in Capitol Hill, First Hill, Lower Queen Anne, the University District, Northgate, and South Lake Union.	Seattle Times, 12/12/06
2010	Current Seattle codes have minimums for some areas/uses, as well as some maximums (1.0 spaces per 1,000 square feet of office space downtown).	Code is available at: http://clerk.ci.seattle.wa.us/~scripts/nph-brs.exe?s1=&s2=&S3=Title+23&Sect4=AND&l=20&Sect1=IMAGE&Sect3=PLURON&Sect5=CODE1&d=CODE&p=22&u=%2F%7Epublic%2Fcode1.htm&r=422&Sect6=HITOFF&f=G

Seattle's move toward transit supportive parking policies, as shown in Figures 1 and 2, has resulted in a 15-year stabilization of parking supply (and supply reduction in recent years), increases in parking costs, and growth in transit mode share into downtown Seattle to a 40 percent peak period transit mode share in 2007.

Figure 1: Downtown Seattle Parking Spaces and Daily Cost 1980-2007

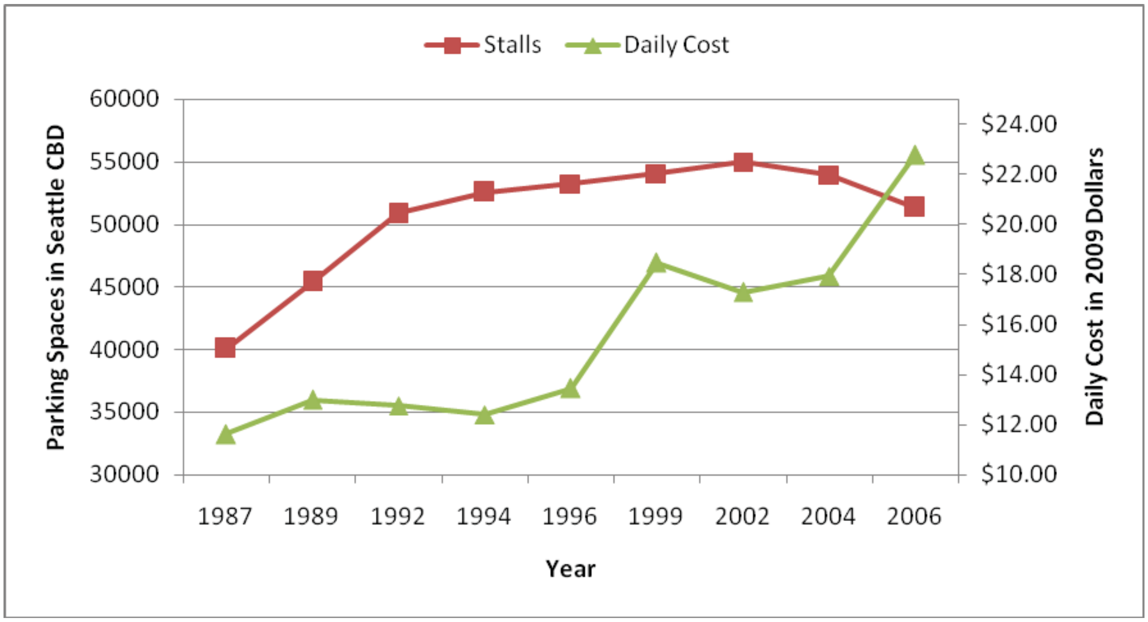
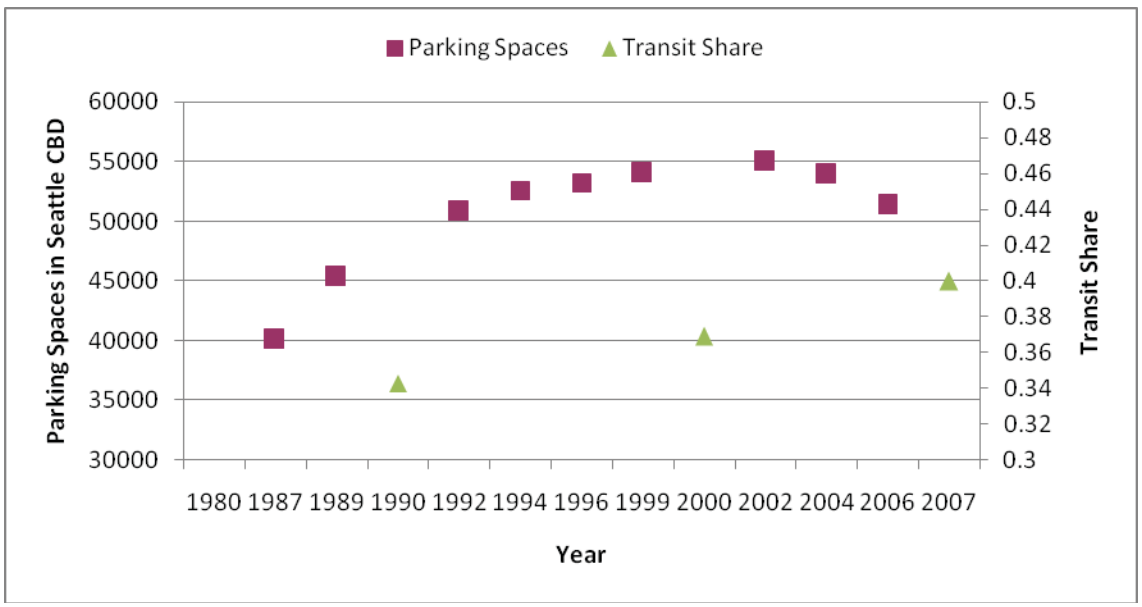


Figure 2: Downtown Seattle Parking Spaces and Peak Period Transit Mode Share 1980-2007



Observations/Policy Options Related to Parking:

Parking policies can play a significant role in increasing transit use and transit mode share. However, establishing and implementing parking policies and strategies is complex because they are generally applied and enforced at the local level, but have significant consequences for regional travel behavior. At the regional level, SANDAG could guide and influence local parking policy to support regional transit and sustainability goals, both in the short- and long-term. A menu of parking policies and strategies that could be considered on a regional and/or local basis includes the following, several of which are identified in SANDAG's 2010 *Parking Policies for Smart Growth* study report (as designated with an asterisk below):

1. Organize the region into subregional areas, and in collaboration with affected jurisdictions, develop guidelines for parking availability and pricing for each subregion
2. Encourage a regional employer/business assessment on employer-provided parking to be used for transit improvements or transit pass subsidies
3. Support a remote parking program tied to transit service
4. Establish regional policies promoting shared parking, particularly at transit stations*
5. Establish Transportation Management Associations in key employment or urban locations*
6. Create a tool box of localized parking strategies and policies for local jurisdictions that may include:
   - Parking pricing (on- and off-street)*
   - Zoning to reduce/eliminate parking minimums*
   - Zoning to reduce parking maximums*
   - Shared parking programs and standards*
   - Employer parking cost cash-outs*
   - Unbundling of parking costs from housing costs in targeted areas
   - Local parking districts
   - Others as requested by local jurisdictions
7. Initiate regional education programs regarding the effects of free parking on congestion and mode choice
8. Initiate discussion regarding the establishment of long-term goals for a reduction in parking spaces per capita
9. Establish grant programs to fund local parking utilization surveys and provide technical assistance to jurisdictions and transit operators within the SANDAG jurisdiction to promote changes in parking management and zoning requirements related to parking
10. Establish programs to measure and document the amount of parking available in selected areas of the region and use this sample as a baseline to track changes in parking supply over the long-term

B. Land Use

Land use patterns and characteristics play a significant role in influencing how people choose to travel. Low density, use-separated housing, retail and employment areas with circuitous and disconnected streets, and limited pedestrian paths are difficult to serve with transit and encourage auto use. More intense mixed use communities with interconnecting street and pedestrian networks (typically a grid street system) are more transit-supportive because they provide active streets and a mixture of housing and employment with convenient access to transit service. Regional, local, and station area land use policies that guide smart growth (including transit oriented development and urban design), and employment and housing concentrations and locations, can lead to development patterns and communities that promote transit use and reduce auto use, resulting in increased transit (and walk/bike) mode share.

Smart Growth and Urban Form

Smart growth policies have been adopted in urban areas throughout the country to discourage urban sprawl, preserve environmental amenities, and encourage more town-centered, transit, and pedestrian-oriented mixed-use communities. Studies and experience across the country, including SANDAG's own June 2010 *Trip Generation for Smart Growth* study, have concluded that smart growth development leads to a reduction in vehicle trip generation and a higher transit, pedestrian, and bicycle mode share. SANDAG has been a leader in establishing regional smart growth policies and programs and using these to help guide transit and other public investments. The 2004 SANDAG Regional Comprehensive Plan (RCP) and subsequent Smart Growth Concept Map define a hierarchy and locations for almost 200 existing, planned, and potential smart growth areas throughout the region. SANDAG's Transportation Project Evaluation Criteria give these smart growth areas higher priority for regional transportation improvement funding, and SANDAG annually provides approximately $5 million to $6 million in smart growth incentive funding to local jurisdictions for infrastructure and/or planning that supports smart growth areas.

Other regions across the country have implemented similar financial incentives to encourage smart growth. The Maryland Department of Transportation (MDOT) established priority funding for very focused smart growth areas as a centerpiece of statewide smart growth legislation. For example, in Harford County, northeast of Baltimore, the priority funding area encompasses only 20 percent of the county.[8] The Urban Area Transit Strategy Peer Review Panel that convened in April 2010 noted that SANDAG's Smart Growth Concept Map identifies a large number of smart growth areas, many of which are relatively small in area and limited in defined intensity, and cautioned against diluting the region's Smart Growth impact and funding with too many identified Smart Growth areas. Although SANDAG's hierarchy of Smart Growth place-types is intended to encourage better land use throughout the region, and its Smart Growth Incentive Program funding has primarily been awarded to the larger, more intense smart growth areas, the Peer Review Panel felt that SANDAG's Smart Growth map and policies should emphasize, "smarter Smart Growth" by focusing on fewer priority Smart Growth areas that have the greatest potential for high land use intensities and concentrated infrastructure investment, and can effectively support enough transit service to increase transit mode share.

There are a number of regional and local tools that are already embraced by SANDAG that support implementation of smart growth policies and objectives:

- Transit Oriented Development
- Pedestrian and Bicycle Friendly Urban Design
- Complete Streets and Context Sensitive Solutions (CSS)

An additional tool is form-based building codes. Form-based codes differ from conventional zoning codes, which tend to focus on the distinction or separation of the land use types rather than creating a community vision or establishing a sense of place. As an alternative to conventional zoning policies, form-based codes are typically used to cultivate predictable physical results that establish a higher quality urban form. This is accomplished by focusing on the overall built environment rather than the separation of land uses. Form-based codes address the relationship between building facades and the public realm, the form and massing of buildings in relation to one another, and the scale of streets and blocks to establish the character of future development. Form-based codes can be used as tools to achieve a vision and are widely held as an effective methodology for implementing Smart Growth objectives through private development. SANDAG has already established a regional policy basis for adoption of local form-based codes through its Smart Growth Design Guidelines. This policy document provides broad principles for infill development, including guidelines for:

[8] *Smart Transportation in* Maryland, Neil Pedersen, Maryland State Highway Administration, pages 93-94, Transportation Research Board, Conference Proceedings 32 September 8-10, 2002.

- Site Design – related to where buildings are located on a site, how they fit with their surroundings, and how landscaping can be integrated with the site
- Building Design – to explain how new buildings can be designed to enhance community character and reflect their local context
- Multimodal Streets – describing how to create streets that balance the needs of all modes of transportation, including pedestrians, bicyclists, vehicles, and transit[9]

Form-based building codes could be created as a regulatory process implemented through county or city law and should not be confused as design guidelines or advisory policies. Form-based codes can be used as a tool to create pedestrian and transit-friendly environments (in which walk access to transit is comfortable, pleasant, and convenient), which in turn help increase transit ridership and transit mode share. Table 4 identifies some specific form-based code tools.

Table 4: Form-Based Code Tools

Form-Based Code Tool	Description	Prevalence of Use
Regulating Plan	A map of the regulated area designating the locations where different building form standards apply, based on clear community intentions regarding the physical character of the area being coded.	Common
Public Space Standards	Specifications for the elements within the public realm (e.g., sidewalks, travel lanes, on-street parking, street trees, street furniture, etc.).	Common
Building Form Standards	Regulations controlling the configuration, features, and functions of buildings that define and shape the public realm.	Common
Architectural Standards	Regulations controlling external architectural materials and quality.	Sometimes
Landscaping Standards	Regulations controlling landscape design and plant materials on private property as they impact public spaces (e.g., regulations about parking lot screening and shading, maintaining sight lines, insuring unobstructed pedestrian movements, etc.).	Sometimes
Signage Standards	Regulations controlling allowable signage sizes, materials, illumination, and placement.	Sometimes
Environmental Resource Standards	Regulations controlling issues such as storm water drainage and infiltration, development on slopes, tree protection, solar access.	Sometimes

Source: FBIC (Form-Based Codes Institute) Definition of Form-Based Code (draft 2.17.09)

<u>Regional Employment Centers</u>

Local jurisdictions within the region compete against one another to attract major employers and create employment nodes to reap the tax and investment benefits. This practice results in dispersed employment and relatively small employment centers throughout the region that are difficult to serve by transit due to the lack of employment concentration and employee volumes. Few single employment centers in the San Diego region are large enough or concentrated enough to generate the ridership levels necessary to support significant transit investments, and without adequate transit services and facilities, would-be transit users are discouraged by the lack of viable alternatives and continue to use personal vehicles.

In the San Diego region, the trend toward dispersed employment is projected to continue through 2050 and is exacerbated by the following:

[9] Designing for Smart Growth: Creating Great Places in the San Diego Region, SANDAG, June 2009.

- Downtown San Diego is not the largest employment center in the region
- Downtown San Diego contains a smaller percent of regional employment than the downtowns of comparable cities (see Table 5)
- There is a lack of a single dominant employment center in the region
- No employment center in the region will increase its regional employment share by more than two percent between 2008 and 2050
- The four largest employment centers in the region (University City, Kearny Mesa, downtown San Diego, and Sorrento Mesa/Mira Mesa) are all projected to lose regional employment share through 2050

Table 5: Downtown Employment as a Percent of Regional Employment

City	Downtown Employment
San Diego	5.2%
Denver	8.0%
Minneapolis	8.5%
Portland	8.0%
Seattle	8.1%
Sydney, Australia	12.0%
Vancouver, BC	9.0%

Source: SANDAG Urban Area Transit Strategy, *Lessons Learned from Peer Regions*, December 9, 2009

Table 6 identifies the four largest employment centers in the region. Although all four are projected to grow in absolute numbers of employees between 2008 and 2050, none will experience employment growth close to the 33.4 percent growth projected for the region by 2050. As a result, all will lose regional employment share.

Table 6: Trends for the Largest Employment Centers in the San Diego Region

Employment Area	2008		2030		2050		Percent Change 2008 - 2050
	#	%	#	%	#	%	
Downtown San Diego	78,600	5.2	86,300	4.9	95,800	4.8	21.8
University City	90,300	6.0	97,300	5.6	108,500	5.4	20.2
Kearny Mesa	87,300	5.8	92,700	5.2	104,300	5.2	19.4
Sorrento Mesa/ Mira Mesa	76,200	5.1	82,500	4.7	91,900	4.5	19.6
Region	1,501,100		1,752,600		2,003,000		33.4

Source: SANDAG Series 12 Regional Growth Forecast, City of San Diego Planning Areas

Table 7 further reveals the degree of regional dispersal of employment projected through 2050. Communities with at least one percent of regional employment in 2008 and/or 2050 are included in the table. All other communities not listed have less than one percent of regional employment in 2008 and/or 2050. Of the communities with at least one percent share of regional employment in 2008, Otay Mesa is projected to have the largest increase in regional employment share by 2050, but will only increase it share 1.56 percent to a total of 2.6 percent of regional employment. Most other communities will lose employment share by 2050. And the land use patterns in the vast majority of these employment communities are characterized by low density and/or business park development with large amounts of free parking and limited pedestrian environments. The absence of large, concentrated, and growing employment centers, and the ongoing trend of employment dispersal highlight the challenges of providing efficient transit service for commute trips in the region.

Table 7: San Diego Region Employment Share by Community and City – 2008 and 2050

	Number of Jobs 2008	Number of Jobs 2050	Change	Percent of Regional Share 2008	Percent of Regional Share 2050	Increase in Regional Share
Communities*						
Otay Mesa	14,360	51,110	36,750	1.0%	2.6%	1.59
Otay	2,828	15,385	12,557	0.2%	0.8%	0.58
Navajo	21,190	29,402	8,212	1.4%	1.5%	0.10
Lakeside	14,205	19,204	4,999	0.9%	1.0%	0.01
Rancho Bernardo	20,786	26,532	5,746	1.4%	1.3%	-0.06
Peninsula	15,126	18,589	3,463	1.0%	0.9%	-0.10
College Area	15,184	17,785	2,601	1.0%	0.9%	-0.10
Torrey Pines	15,801	17,791	1,990	1.1%	0.9%	-0.20
Linda Vista	16,672	18,379	1,707	1.1%	0.9%	-0.20
Midway/Pacific Hwy Corridor	21,416	24,070	2,654	1.4%	1.2%	-0.23
La Jolla	21,196	23,271	2,075	1.4%	1.2%	-0.25
Clairemont Mesa	22,447	24,891	2,444	1.5%	1.2%	-0.25
Uptown	29,361	34,046	4,685	2.0%	1.7%	-0.26
Mission Valley	52,551	64,920	12,369	3.5%	3.2%	-0.26
Pendleton-De Luz	30,959	35,459	4,500	2.1%	1.8%	-0.29
Palomar Airport Road	13,052	19,020	5,968	1.3%	0.9%	-0.32
Downtown San Diego	78,614	95,780	17,166	5.2%	4.8%	-0.46
Mira Mesa	76,172	91,111	14,939	5.1%	4.5%	-0.53
University	90,300	108,547	18,247	6.0%	5.4%	-0.60
Kearny Mesa	87,331	104,303	16,972	5.8%	5.2%	-0.61
Cities**						
Carlsbad	61,999	87,100	25,101	4.1%	4.3%	0.22
Chula Vista	70,230	121,555	51,325	4.7%	6.1%	1.39
Coronado	27,994	33,251	5,257	1.9%	1.7%	-0.20
El Cajon	41,686	58,630	16,944	2.8%	2.9%	0.15
Encinitas	26,985	31,481	4,496	1.8%	1.6%	-0.23
Escondido	61,143	75,004	13,861	4.1%	3.7%	-0.33
La Mesa	27,579	32,018	4,439	1.8%	1.6%	-0.24
National City	28,743	37,668	8,925	1.9%	1.9%	-0.03
Oceanside	43,977	67,410	23,433	2.9%	3.4%	0.44
Poway	31,176	41,005	9,829	2.1%	2.0%	-0.03
San Marcos	37,383	61,585	24,202	2.5%	3.1%	0.58
Santee	15,304	26,554	11,250	1.0%	1.3%	0.31
Vista	41,315	61,293	19,978	2.8%	3.1%	0.31
Subtotal	1,175,065	1,574,149	399,084			
Remainder of Region	326,015	428,889	102,874			
Region TOTAL	**1,501,080**	**2,003,038**	**501,958**			

*City of San Diego and County of San Diego communities with 1.0 percent or more of regional job share in 2008 and/or 2050.

**Cities with 1.0 percent of more of regional job share in 2008 and/or 2050. Some cities include community data.

Source: SANDAG, Series 12 Regional Growth Forecast

Policies that reverse projected declines in regional employment share in the largest employment centers and promote a greater share of employment growth in downtown San Diego and a limited number of employment areas (for example, the largest three to five employment centers outside of downtown) would support efficient provision of transit and increase transit ridership and mode share to these centers. This is particularly true for downtown San Diego where land use patterns and limited free parking create the environment that supports transit investments. Other regions across the country have recognized the regional economic and mobility value of ensuring that the central business district or primary employment center is dynamic, accessible, and well connected to the rest of the region by transit.

For example, in the late 1990s, the Chicago Department of Transportation (CDOT) found that 73 percent of downtown businesses indicated that the availability of transit was the strongest factor in locating downtown. As a result, the CDOT established a program to further enhance transit services to achieve a 70 percent transit mode share into downtown Chicago. The Chicago Central Area Plan "is based on a core belief that directing growth to the historic center of the region will eliminate sprawl [and] enable the greatest number of people to commute on transit…"[10] Downtown San Diego is the region's cultural, entertainment, and recognized central core characterized by high density land uses, an urban-grid street system and a large employment base that support transit use. The region has made large investments in transit infrastructure and service to and within downtown, which is reflected in the 24 percent existing peak period work trip transit mode share in downtown in 2008, by far the largest transit mode share in the region. Policies that strengthen the region's urban core by supporting higher concentrations of employment and housing will lead to further increases in transit use and mode share and support the extensive existing and planned transit infrastructure and service investment to and within downtown.

In addition, SANDAG's RCP addresses regional employment growth and location policy in two primary ways:

- The *Economic Prosperity* analysis states that the region and jurisdictions should focus on creating employment clusters for key industries – concentrations of like industries in one location
- The *Smart Growth* policy promotes job growth in higher density, mixed use areas to create a jobs and housing balance

Both of these job location policies can be served by and support transit investments and ridership if implemented in high enough densities with large volumes of employees. SANDAG's RCP states that an inventory of employment land conducted by the San Diego Regional Economic Development Corporation and SANDAG found that there is sufficient employment land in the region, but most of it is not generally located near housing, freeways, or transit, and much of what is will require redevelopment to accommodate employment growth. Therefore, in parallel to strengthening employment in downtown, and as stated in the RCP, "the region also should consider more efficient and compact use of existing and planned employment lands, possibly through redevelopment and other mechanisms."[11]

Observations/Policy Options Related to Land Use:

The crux of the strategies to increase transit use and mode share focuses on making transit investments where transit can be most efficient and effective. Research and experience across the country and world demonstrate that integrating transit with transit-supportive land uses is the key to increasing transit use and transit mode share. SANDAG could consider a variety of land use and integrated transit/land use policies to help achieve higher transit mode share in the region, including the following:

1. During the next update of the SANDAG RTP and Smart Growth Concept Map, work with local jurisdictions to identify a limited number of "Smarter Smart Growth" areas which would be large geographic areas with the best potential for accommodating regional growth through high density, mixed use development

[10] *Smart Transportation in Chicago*, Luann Hamilton, Chicago Department of Transportation, "Smart Growth and Transportation, Issues and Lessons Learned", pages 73-74, Transportation Research Board, Conference Proceedings 32 September 8-10, 2002.

[11] SANDAG 2004 RCP, pages 199-200.

2. Reward the “Smarter Smart Growth” areas with smart growth incentive funding, transit facilities, and transit service investments

3. Encourage jurisdictions to streamline the development and entitlement process in identified Smart Growth areas to encourage development in these designated areas

4. Update the SANDAG Smart Growth “tool box” to include form-based codes as a means to implement Smart Growth polices and encourage jurisdictional agencies to adopt these policies as part of their development codes

5. Update the SANDAG Smart Growth “tool box” to include Complete Street concepts as a means to implement Smart Growth policies and facilitate greater access to transit, and encourage jurisdictions to adopt these policies as part of their development codes

6. Review Smart Growth Incentive Program criteria and consider providing higher priority to local jurisdictions that have adopted TOD, urban design, complete street and/or form-based codes, policies, and standards for receiving incentive funding and/or regional transit investment priority, or use the adoption of these policies and standards as criteria for transit project priority phasing in the next update of the RTP

7. Identify a limited number (three to five) key strategic employment centers/locations in addition to downtown San Diego (possibly for cluster industry employment) that can accommodate higher employment concentrations sufficient to support transit, and create programs that help concentrate employment in these areas by strategically linking employment center growth and transit investment

C. Funding

Adequate levels of transportation funding are essential to meet expected future transportation needs, transit mode share goals, and GHG reduction requirements. Currently, transportation expenditures are funded by a broad range of sources at multiple levels of government. Successful implementation of an expanded transit network will require consistent and stable revenue, as well as an expansion of revenues and revenue sources. Potential local and regional funding sources that may support the transit system include facilities assessments, taxes and fees, and others. New development typically contributes to the road network by building parts of that network directly, providing parking, and paying assessments that contribute to the costs of building, operating, and maintaining roads and similar approaches could be considered for transit.

Other funding approaches also have been used to garner support for regional transit infrastructure and service investments. Some of these focus on specific projects or subregions, providing targeted localized support that directly links funding to specific infrastructure or services. The *TransNet* sales tax, while collected countywide, specifies funding for specific projects and services. Future similar measures could more directly link revenue collected with transit improvements on a subregional basis, providing opportunities for areas with high transit ridership and mode share propensity to generate higher levels of funding for transit to realize that potential. This approach provides a means to invest in appropriate modal and service levels based on the specific needs of each area or subregion.

Partnering with private entities may have a growing role in transit system funding. To the extent that the use of privately-contributed funds for transit produces measurable financial benefit to the private side of this equation, transit improvement projects may be self-financing. Or, the private investor may become a source of up-front financing subject to future repayment from other sources available to the public agency. However, SANDAG’s experience has been that the public sector generally is required to provide subsidies for projects entered into with the private sector, and most of these projects are for joint development at stations rather than for the transit infrastructure itself. Other less direct methods for garnering private sector funding for transit could include creation of Local Improvement Districts (LIDs), including transit in local jurisdiction development facilities financing mechanisms, and/or bonding against public parking revenues. In Portland, Oregon, the Portland Streetcar funding package included $14.6 million in property owner contributions through a LID on non-owner occupied residences and $28.6 million in bonds backed by revenues from a $0.20 per hour short-term parking rate increase in city-owned parking garages. The Seattle South Lake Union Streetcar funding package included $25.7 million in LID funds, and an assessment district in Tampa provided funds for the TECO Line streetcar.[12]

Observations/Policy Options Related to Funding:

Funding policies can be challenging to change or implement on a regional basis because many of them are established by state and federal legislation. However, SANDAG could take a leadership role in initiating discussions that would establish funding policy and strategies beneficial to and/or specifically focused on transit. Some options for discussion include:

1. Encourage the creation of LIDs and facilities financing mechanisms
2. Promote bonding against public parking revenues
3. Seek private partners in cases of promising funding advantages

Additional Supporting Information

As stated in the introduction, this paper also includes a discussion on how strategies related to transit fares, services, and facilities can enhance the effectiveness of the region's future transit network. The region is currently making progress in many of these areas, and SANDAG and the transit operators should continue to work to make additional refinements over the long-term that would support the performance of the overall system.

A. Transit Fares

Transit fares generate revenue that supports the provision of transit service. The price of a transit trip can be an incentive or disincentive to transit use that affects the willingness of potential riders to choose transit over other modes, as well as their frequency of transit travel. Consequently, establishing fare policy and fare levels can be a balancing act for transit agencies and regions between two competing objectives:

- Generating passenger payment for transit service to cover a portion of the operating costs; and
- Achieving desired levels of transit use and transit mode share.

<u>Paying for Transit Service</u>

Fare revenue provides just one source of funding for transit operations and often covers less than half of a transit system's operating and maintenance cost. Farebox recovery ratio (or farebox ratio) is defined as the proportion of total transit operating and maintenance cost covered by fare revenue. For transit systems in the United States, the farebox ratio is typically between 25 percent and 35 percent, with the remaining costs generally covered by local, state, and/or federal subsidies. For the San Diego region, the fiscal year 2009 farebox ratio for fixed-route services (bus and rail) was almost 40 percent. This relatively

[12] Santa Ana & Garden Grove Transit Vision and Go Local Project Concept Study, May 2008, Parsons Brinckerhoff, Table 4C.

high farebox ratio denotes the importance of fare revenue in supporting transit service and operations in the region. FY 2009 farebox ratio broken down by mode and operator is provided in Table 8:

Table 8: San Diego Region FY 2009 Fixed Route Farebox Ratio

Operator/Service	Farebox Ratio
MTS	
Fixed Route Bus	39.52%
Rail (San Diego Trolley)	57.20%
Total Fixed Route Bus and Rail	44.85%
NCTD	
Fixed Route Bus	20.66%
Rail (Coaster and Sprinter)	29.34%
Total Fixed Route Bus and Rail	24.42%
Region Total Fixed Route Bus and Rail	**39.28%**

Source: SANDAG: MTS and NCTD TDA Quarterly Report Statistics.

Generally, increases in transit fares lead to decreases in transit ridership, while decreases in fares lead to increases in ridership. However, fare changes are never implemented in a vacuum and changing external factors, such as the economy, gas prices, changes in the regional transportation system (i.e., opening of a new rail line), and military deployments, influence the response of ridership to fare changes.

Without a fare change, increases in ridership that can be accommodated within the existing level of service can increase farebox recovery by generating more fare revenue to cover the established operating and maintenance cost. However, there is a capacity and network threshold at which increased ridership requires increased expenditures for service, facilities, and capital equipment to accommodate new transit demand. In this case, while transit mode share may increase with higher ridership, farebox ratio does not necessarily improve. In addition, depending on the fare structure and pricing, increases in transit ridership resulting from decreases in fares may not necessarily offset the revenue lost through the fare reduction. As a result, regions and transit agencies are constantly seeking to balance fare policy and farebox ratio needs with ridership and mode share goals.

<u>Sensitivity of Transit Ridership to Transit Fares</u>

Transit fare sensitivity can generally be measured using elasticities, which is defined as the percent change in ridership resulting from a one percent change in fares, if all other factors are held constant. Research conducted by Todd Litman of the Victoria Transport Policy Institute indicates that transit ridership elasticity to fare changes ranges from -0.2 to -0.5 in the first year after a fare change. This means that in the first year, a ten percent increase in fares should produce a two to five percent decrease in ridership.[13] While elasticities can be applied to both fare increases and decreases, Litman found evidence that fare reductions are much less elastic than fare increases (i.e., fare reductions do not result in ridership increases to the same extent that fare increases result in ridership declines).[14]

However, the sensitivity of transit ridership to fare levels and changes is dependent on a variety of factors, including the characteristics of the transit service (trip type, trip purpose, time of day, mode), the demographics of riders (income, age, gender), and the external factors noted above (i.e., economy, gas prices, parking prices, etc.). In the San Diego region, recent fare changes have generally been implemented with services changes and in the context of fluctuating gas prices and military deployments, making it difficult to isolate the relationship of fares to ridership. Regardless, it appears that both revenue and ridership have increased despite recent changes in fare structure, and increases in some fare types. These regional results are encouraging and suggest that targeted fare policy,

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[13] Litman, Todd, *Transit Price Elasticities and Cross-Elasticities*, August 17, 2007, page 14, Victoria Transport Policy Institute.
[14] Litman, Todd, *Transit Price Elasticities and Cross-Elasticities*, August 17, 2007, page 5, Victoria Transport Policy Institute.

structure and pricing changes (versus direct fare reductions) can have a significant effect on attaining transit ridership and mode share goals in specific markets. Still, most fare structure and level changes are implemented to increase fare revenue (vs. increase ridership) since nonfare operating funding for transit is limited. Any consideration of fare reductions to increase transit ridership also would need to consider complementary policies and programs that increase nonfare transit revenues to ensure sustainable attainment of transit ridership and mode share goals, as discussed below.

Perception of the Cost of Transit

Most transit systems need to generate fare revenue as a source of transit operating funding and therefore, must balance the financial issues associated with fare reductions with the desire to attract more riders with lower fares. As a result, there may be a need for policies that reach beyond fares. An important aspect of fare policies and programs relates to how users perceive fares.

People who travel are likely to think of the *per trip* cost of transit as being higher than the *per trip* cost of using a car, despite the fact that the actual total cost of transit that an individual traveler pays is generally less than the true cost of travel by car. Table 9 displays the personal commute costs for comparable drive alone and transit trips for the San Diego region using SANDAG's Commute Cost Calculator. In general, the true cost of driving is more than transit for all but the shortest trips, and driving costs are even higher when parking fees are part of the driving trip. Note that SANDAG's drive alone calculation does not include full-coverage insurance, license, registration, taxes, depreciation (15,000 miles annually), vehicle loan payments, or finance charges, which are some of the key hidden costs of driving and which would make the cost of driving shown in Table 9 even higher.

Table 9: San Diego Region Commute Trip Cost Comparison – Drive Alone and Transit

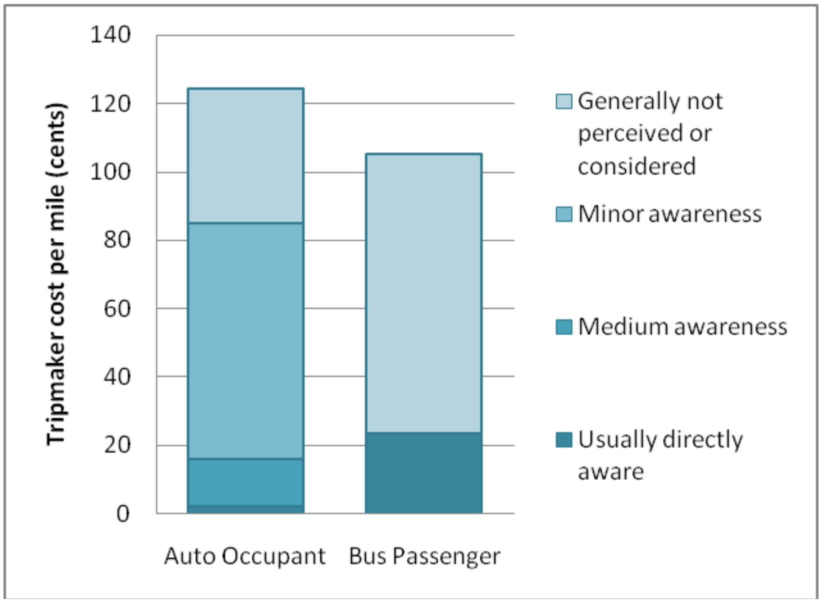
Trip	Daily	Monthly	Yearly
Drive Alone - 10 Mile Round Trip			
Free Parking	$2.13	$46.86	$562.32
$100/Month Parking	$5.68	$146.86	$1,762.32
Drive Alone - 20 Mile Round Trip			
Free Parking	$4.26	$93.72	$1,124.64
$100/Month Parking	$8.81	$193.72	$2,324.64
Drive Alone - 40 Mile Round Trip			
Drive Alone – Free Parking	$8.52	$187.44	$2,249.28
Drive Alone - $100/Month Parking	$13.07	$287.44	$3,449.28
Transit			
MTS Local/Express Bus	$5.00	$72.00	$816.00
MTS Premium Bus	$14.00	$100.00	$1,080.00
Trolley	$5.00	$72.00	$816.00
NCTD BREEZE Bus	$5.00	$59.00	$708.00
SPRINTER	$5.00	$59.00	$708.00
COASTER	$14.00	$144.00 - $182.00	$1,728.00 - $2,184.00

Source: www.sandag.org, iCommute Commute Cost Calculator

- Based on 22 commute days/month, 20 miles/gallon (auto trips), and $3.20 gallon gasoline.
- Drive alone cost estimates include an average 5 cents/mile maintenance and tire cost based on AAA "Your Driving Costs 2008" brochure. Cost estimates do not include full-coverage insurance, license, registration, taxes, depreciation (15,000 miles annually), vehicle loan payments, or finance charges.
- Transit prices are based on purchase of full fare adult Day or Monthly Pass. COASTER daily ticket prices reflect round trip purchase. Yearly transit costs equal Monthly Pass price x 12.

User perception of travel cost also is strongly influenced by the way in which one pays the cost, and who pays the cost – the user or others. Increasingly removing the user from direct, per-trip payment decreases their overall perception of per-trip costs. Figure 3 illustrates this situation.

Figure 3: Total and Perceived Costs of Travel by Car and Transit



Sources: www.commutesolutions.org; National Transit Database; PB analysis

In the case of transit fares, fare instruments such as multiple-trip passes tend to reduce user perception of per-trip cost and thereby tend to be less of a disincentive to transit use. Fare media that are automatically replenished are less likely to have a disincentive effect than media requiring a conscious periodic transaction. Fares paid for or subsidized by employers or others remove the individual from fare payment entirely and thus remove the fare disincentive from a potential transit user's travel mode choice.

From these observations one can see that the choice of fare media, and the presence or absence of fare programs that enlist employers or others in helping to pay transit fares, can materially affect potential transit users' perception of transit travel costs, and consequently their willingness to use transit. In a recent survey of San Diego residents, half of all respondents indicated that having a transit pass paid for by their employer (or school) would increase their use of transit.[15] As significant, however, is the application of technology to fare payment as a way to create incentives for use transit. Technology is increasingly being used around the world to market transportation options and other services based on user-preferences. SANDAG's Urban Area Transit Strategy Peer Review Panel noted that integrated electronic cards, such as the Octopus Card in Hong Kong and the Oyster Card in England, are providing tremendous potential to the private sector for marketing goods and services to end users, to the public sector for tailoring, directing, and providing incentives for transit and transportation services to end users, and for the users themselves who receive incentives and discounts for many kinds of products and services based on established purchasing choices. To take advantage of these technological applications, the region could proactively work to expand the Compass Card services beyond transportation to provide users with more convenience and incentives, and to maximize the region's ability to direct future transportation marketing decisions.[16]

[15] 2050 RTP, Public Opinion Survey Report, prepared for SANDAG, True North Research, June 23, 2010.

[16] SANDAG Peer Review Panel, Week of April 19, 2010 and SANDAG Board of Directors Agenda Item No. 10-05-5, May 14, 2010, pages 4-5.

Some options for obtaining nonrider partners in transit fare payment include:

- Expanding employer pass subsidy programs;
- Unbundling parking from housing or office costs and providing an option for housing developers and residential and commercial landlords to include a transit pass in the cost of housing or office space in lieu of a parking space;
- Expanding partnerships with colleges and universities to include transit costs in student fees to include all campuses; and
- Establishing partnerships with businesses to:
  - Integrate transit fare payment with retail debit cards
  - Provide retail discounts to transit riders through debit cards or the Compass Card

At the same time, the region also might consider ways to continue to increase the awareness of the cost associated with travel by car. Such actions could encourage the use of transit, a lower-cost alternative, without also reducing transit cost recovery. There also is the potential to have a larger effect on transit use than can be achieved by means of policies and programs aimed at transit fares and fare payment. For example, most trips are made by car rather than transit – therefore, influencing a small percentage of drivers to change modes based on a better understanding of the full cost of vehicle ownership per trip may be easier than influencing mode change by lowering per trip transit costs.

B. Transit Service and Facilities

Transit services and facilities can have an impact on transit ridership and mode share. Discussion related to transit <u>service</u> generally relates to the quantity of transit service, including geographic coverage, system linkages, frequency, and span of service. Discussion related to transit <u>facilities</u> generally relates to the quality of transit service and falls into two categories:

- Strategies that enhance passenger service (including travel time); and
- Strategies that address provision of passenger amenities

The two areas that can be most directly measured for impact on ridership are service frequency (headway) and speed (in-vehicle travel time).

However, their cost implications are quite different. Increasing the frequency of service can be costly; every added trip requires added operator and vehicle hours. Reducing headways (improving frequency), unless accomplished by means of extensive route re-design, would increase operating and maintenance cost, and could require capital expenditures to increase the transit vehicle fleet and provide maintenance and storage facilities for added vehicles. Reducing in-vehicle travel time (increasing speed) would decrease transit operating and maintenance cost, and while it can sometimes be achieved through operating modifications, such as limited-stop or express service, it most often requires some level of capital investment in the form of dedicated transit lanes, traffic signal priority, and/or off-board fare payment to achieve higher average operating speeds.

<u>Service Frequency (Headway)</u>

Frequency improvements can be gained in two ways. If headways are regular, halving the headway requires twice as many transit vehicle trips. If headways are irregular, either by design or by unpredictable delays, achieving uniform headways can effectively reduce the average headway. For example, if a transit corridor with one or more bus routes has 12 buses per hour, but they arrive at the same time, the effective average headway is ten minutes, rather than five minutes if they are evenly spaced.

Also, the effect of headway improvement on a particular route is a function of the current headway; improvements to vehicle headways that are already closely spaced will have relatively little effect on ridership, while improvements to widely-spaced headways can have a dramatic effect.

The financial impact of service improvements in many cases may be more severe than the financial impact of fare reductions. This is because lost fare revenues resulting from a fare reduction are partly offset by the gain in transit riders, while ridership increases resulting from service increases do not generally offset the increase in required operating subsidy. For example, increased ridership resulting from frequency reductions will most often require increased service, which increases operating and maintenance cost and often increases capital costs for fleet expansion and vehicle maintenance and storage facilities.

<u>Speed (In-Vehicle Travel Time)</u>

Transit's in-vehicle travel time is the combined total of trip length (running time), delay caused by traffic and traffic signals, and dwell time at transit stops or stations. Buses in urban corridors sometimes have as much as half their in-vehicle travel time expended in the form of traffic signal delay and transit stops. Traffic signal delay can be reduced significantly by measures such as transit signal priority and queue jumps. Transit stop delay time can be reduced by using off-vehicle fare collection and multi-door boarding and alighting. Traffic signal delays and reductions in time spent at passenger stops have yielded bus running time reductions of more than 20 percent in some cases. For example, the initial demonstration implementation of the Los Angeles Metro Rapid service, which employs transit signal priority and other operating enhancements, reduced transit travel time on the Wilshire corridor by 29 percent and on the Ventura corridor by 23 percent.[17]

Forms of transit priority treatment include:

- *Dedicated Transit Lanes:* Where transit service is frequent and road space permits, especially on congested streets, transit travel time (and reliability) will benefit from the establishment of reserved lanes. The best reserved-lane situation is one that does not require buses to change lanes. On arterial and local streets and roads, transit lanes can take many forms. They can be designed and built into new streets and roads. Or, they can be retrofitted into existing roadways in a variety of configurations:

    - Converted auto lanes – these are regular travel lanes selectively converted to transit only use. Transit only use can be continuous for the length of the street or discontinuous and applied only in specific areas. It also can designed for transit only use by time of day (i.e., peak period only or all day).
    - Converted parking lanes - parking lanes adjacent to curbs can be converted to transit only lanes. As with converted auto lanes, these can be continuous or discontinuous and designated for transit use by time of day.
    - Shared transit lanes – these lanes give priority to transit, but allow shared auto use for right turns, driveway access, and even continuous auto travel. In the latter case, autos may be delayed in shared transit lanes by buses stopping in the lane at transit stops.
    - Converted roadway shoulders – on regional roadways and highways, shoulders can be converted to transit only lanes with specific operational procedures and appropriate signage.

- *Transit Streets/Busways/Rail Corridors/Grade-Separated Transit:* Ambitious expansion of transit will lead to the need for even greater transit priority, and for projects to fill in "missing links" for more direct connectivity serving major passenger flows. Dedicated transitways for bus or rail provide competitive advantages in favor of transit.

[17] LAMTA, Metro Rapid Planning and Programming Committee Presentation, March 1999.

- *Managed Lanes/Direct Access Ramps:* The San Diego region has an extensive program to establish a managed lanes system on regional freeways that provide congestion-free travel for carpools, vanpools, bus transit, and toll-paying single-occupant autos. The managed lanes and direct access ramps provide free-flow priority for regional transit.

- *Traffic Signal Priority:* Traffic signal priority for transit can take on two forms – signal preemption and signal priority. Signal preemption gives transit vehicles the privilege of changing a traffic signal to allow passage without delay. This technique tends to disrupt general traffic flow, including preventing signal-to-signal progression and its use is generally limited for this reason. Traffic signal priority allows transit vehicles to obtain, within certain set limits, an extension of a green light or advancement of green light, thereby reducing delay caused by signals. Signal priority is valuable where signal-caused delay is significant and there is a dominant transit flow. If transit volumes on cross streets are similar there may be no advantage to implementing signal priority.

- *Queue Jumps:* Queue jumps provide short transit lanes at signalized intersections, allowing transit buses to move to the beginning of the queue of vehicles waiting at a red light and transit signal priority, which provides a bus-only green light that precedes that for general purpose traffic, allowing the buses to cross into the intersection and proceed ahead of the auto traffic.

The purpose of transit priority treatments is to make transit travel time competitive with auto travel times by offsetting or overcoming the time impacts of accessing and waiting for transit, multiple stops, transfers, and indirect routings for particular trips. Improving transit's level of service will help make transit a more viable travel option.

Other Service and Facility Measures

It is well established that the introduction of measures improving the comfort, convenience, attractiveness, and permanence of transit can lead to higher ridership and transit mode share. Less well established is how to predict the magnitude of these ridership increases. However, there is a growing body of knowledge drawn from experience with various transit modes (vehicle and system technologies), such as Bus Rapid Transit (BRT), Light Rail (LRT), and express buses, and with the use of passenger information systems, service branding, and other transit attribute modifications that link these service and facility measures to ridership improvements.

Service and facility strategies can have a positive effect on ridership by refining and augmenting the transit system. Many of these strategies are being incorporated into the Urban Area Transit Strategy network planning and include:

- *Direct Routing:* Increased use of direct routes, which includes limited-stop or express service if warranted, to minimize the need for passenger transfers and minimize in-vehicle travel times. Priority for establishing direct route services should be given to origin-destination pairs with sufficient passenger volumes to support reasonable service frequency.

- *Span of Service:* Increasing the span of service; some travel cannot be made by transit because it must or may take place during hours when service is not provided. This includes off-peak trips in areas having only peak period service, or late night trips when almost all transit service is absent. Periodic review of span-of-service criteria is needed to maximize hours of operation where there is sufficient need.

- *Transit Centers*: Establishing transit centers, especially in conjunction with Smart Growth areas, increases regional accessibility via transit by providing timed-transfer route meeting points for trips that do not support direct route service. By facilitating multiple origin-destination trip patterns with a minimal number of routes, service frequency can be optimized.

- *Access to Transit:* Often the biggest impediment to transit use is getting to and from the transit stop or station. Land use patterns, street networks, topography, and distances between trip origins and transit stations ("first-mile") or transit stations and trip destinations ("last-mile") create barriers that are difficult for transit vehicles to negotiate and are difficult or impractical for those wishing to access transit to overcome. Strategies and programs that promote first-mile/last-mile solution can help encourage transit use and increase transit mode share, especially in suburban and low density employment areas where walking to transit is impractical. Potential solutions to address first-mile/last-mile access include:

    - Pedestrian access improvements
    - Bicycle policies and programs that include the expansion of bicycle lanes and paths to transit stations and the inclusion of bike space on roadways, incorporation of secure bicycle storage facilities at stations, establishment of policies and designated facilities/space that allow for bicycles on board transit vehicles (including distribution of folding bikes to riders), and bike rental/sharing programs that allow transit riders to "borrow" bikes to complete their trips
    - Ample park/ride and kiss/ride facilities at stations
    - Feeder-distributor bus and shuttle routes which are generally provided by the transit operator from major transit centers and stations
    - Employer shuttles provided from transit to major employment centers by a large employer or a group of employers
    - Privately operated jitney or taxi services that provide for shared rides and integrated fares
    - Car sharing and station car programs and services that provide on-demand access to shared vehicles for short trips to and from the transit station
    - Casual carpooling (also known as "slugging") that establishes a recognized market and method for informal "on-the-spot" rides to and from transit stations
    - Rideshare match programs

- *Unique Downtown Transit Applications:* The December 2009 "Lessons Learned from Peer Regions" case study report conducted for the Urban Area Transit Strategy project revealed that most cities with successful, high profile transit systems had unique services and facilities for transit in their downtowns. These services and facilities demonstrate a commitment to transit in the region and increase the awareness, improve the image, and enhance the convenience of transit for travelers and trips extending well beyond the downtown. Some applications also can be applied in secondary downtowns in the region. Examples of unique transit applications include:

    - Dedicated transit streets or malls (Denver, Portland, Minneapolis)
    - Downtown edge transit hubs connected by very high-frequency shuttles (Denver)
    - Network of high-frequency circulator shuttle routes (Los Angeles DASH)
    - Streetcars (Seattle, Portland, San Francisco)
    - Downtown rail and bus transit tunnel (Seattle)
    - Dedicated bus lanes (Seattle, Los Angeles)
    - Fare free zones (Seattle)

- *Design Quality and Passenger Amenities:* Transit systems should ensure that capital facilities are well designed, constructed, and maintained and provide a level of comfort, convenience, and safety that will help attract and retain riders. Well designed and constructed stops, stations, transit centers, transit vehicles, and travel-ways provide passengers with a comfortable environment and smooth ride. Shelters, lighting, passenger information, fare vending, convenience retail, low-floor vehicles, and security cameras and personnel at stations all serve to make transit easier and more comfortable to use.

- *Community Integration:* Transit systems that provide the most access and convenience are those that physically and intrinsically weave transit into communities and neighborhoods. While different areas require different transit applications, regional land use and transportation strategies should strive to balance freeway-based transit investments (i.e., transit stations at managed lane direct access ramps) with community based investments in which transit penetrates and directly serves neighborhoods (and is accessible by foot or bike).

Summary: Menu of Policy Options

Table 10 below provides a summary of the menu of policy options discussed in this paper for consideration in the RTP development process. *(Please note: The policy options have been listed in order of priority based on an interactive exercise conducted on September 21, 2010, with SANDAG's Regional Planning Technical Working Group, Cities/County Transportation Advisory Committee, and Regional Planning Stakeholders Working Group, and on October 20, 2010, with local members of the design and planning community.)*

Table 10: Menu of Policy Options

Policy Area	Policy Options
A. Parking	1. Create a tool box of localized parking strategies and policies for local jurisdictions that may include: o Parking pricing (on- and off-street) o Zoning to reduce/eliminate parking minimums o Zoning to reduce parking maximums o Shared parking programs and standards o Employer parking cost cash-outs o Unbundling of parking costs from housing costs in targeted areas o Local parking districts o Others as requested by local jurisdictions 2. Establish grant programs to fund local parking utilization surveys and provide technical assistance to jurisdictions and transit operators within the SANDAG jurisdiction to promote changes in parking management and zoning requirements related to parking 3. Support a remote parking program tied to transit service 4. Encourage a regional employer/business assessment on employer-provided parking to be used for transit improvements or transit pass subsidies 5. Establish regional policies promoting shared parking, particularly at transit stations 6. Establish programs to measure and document the amount of parking available in selected areas of the region and use this sample as a baseline to track changes in parking supply over the long-term 7. Initiate regional education programs regarding the effects of free parking on congestion and mode choice 8. Organize the region into subregional areas, and in collaboration with affected jurisdictions, develop guidelines for parking availability and pricing for each subregion 9. Initiate discussion regarding the establishment of long-term goals for a reduction in parking spaces per capita 10. Establish Transportation Management Associations in key employment or urban locations

Policy Area	Policy Options
B. Land Use	1. Reward the “Smarter Smart Growth” areas with smart growth incentive funding, transit facilities, and transit service investments *(Note: Tied with #1 in interactive exercise)* 2. Update the SANDAG Smart Growth “tool box” to include Complete Street concepts as a means to implement Smart Growth policies and facilitate greater access to transit, and encourage jurisdictions to adopt these policies as part of their development codes 3. Identify a limited number (three to five) key strategic employment centers/locations in addition to downtown San Diego (possibly for cluster industry employment) that can accommodate higher employment concentrations sufficient to support transit, and create programs that help concentrate employment in these areas by strategically linking employment center growth and transit investment *(Note: Tied with #2 in interactive exercise)* 4. During the next update of the SANDAG RCP and Smart Growth Concept Map, work with local jurisdictions to identify a limited number of “Smarter Smart Growth” areas which would be large geographic areas with the best potential for accommodating regional growth through high density, mixed use development 5. Review Smart Growth Incentive Program criteria and consider providing higher priority to local jurisdictions that have adopted TOD, urban design, complete street, and/or form-based codes, policies, and standards for receiving incentive funding and/or regional transit investment priority, or use the adoption of these policies and standards as criteria for transit project priority phasing in the next update of the RTP 6. Encourage jurisdictions to streamline the development and entitlement process in identified Smart Growth areas to encourage development in these designated areas 7. Update the SANDAG Smart Growth “tool box” to include form-based codes as a means to implement Smart Growth policies and encourage jurisdictions to adopt these policies as part of their development codes
C. Funding	1. Encourage the creation of LIDs and facilities financing mechanisms 2. Seek private partners in cases of promising funding advantages 3. Promote bonding against public parking revenues

Appendix A

Parking Policy and Strategy Resources/References

Deakin, E., Harvey, G., Pozdena, R., and Yarema, G., Transportation Pricing Strategies for California: An Assessment of Congestion, Emissions, Energy and Equity Impacts. Final Report. Prepared for California Air Resources Board, Sacramento, CA (1996).

Dowling, R., Feltham, D., and Wycko, W., "Factors Affecting Transportation Demand Management Program Effectiveness at Six San Francisco Medical Institutions." Transportation Research Record 1321 (1991).

Dueker, K. J., Strathman, J. G., and Bianco, M. J., "Strategies to Attract Auto Users to Public Transportation." TCRP Report 40, Transportation Research Board, Washington, DC (1998).

Feeney, B. P., "A Review of the Impact of Parking Policy Measures on Travel Demand." Transportation Planning and Technology, Vol. 13 (1989).

Kolozsvari, D., and Shoup, D., "Turning Small Change into Big Changes." Access, No. 23 (Fall, 2003)
K.T. Analytics, Inc., "Parking Cash-Out." TDM Status Report, Federal Transit Administration, Washington, DC (February, 1994).

Kuppam, A., Pendyala, R., and Gollakoti, M., Analysis of the Potential Effectiveness of Parking Pricing Based Transportation Control Measures Using Stated Response Data. University of South Florida, Department of Civil and Environmental Engineering, Tampa, FL (1997).

Metropolitan Transportation Commission, "Developing Parking Policies to Support Smart Growth in Local Jurisdictions: Best Practices," 2007.

Portland State University, "Policy Options to Attract Auto Users to Public Transportation." Volume II: Technical Report (Preliminary Draft Final Report), prepared for the Transit Cooperative Research Program. Portland, OR (December, 1995).

Shoup, D., Evaluating the Effects of Parking Cash-Out: Eight Case Studies. Final Report. Prepared for California Air Resources Board Research Division, Sacramento, CA (1997).

Taylor, B., Fink, C.; The Factors Influencing Transit Ridership: A review and Analysis of the Ridership Literature, UCLA Department of Urban Planning Working Paper.

Vaca, E., Kuzmyak, R., "Traveler Response to Transportation System Changes Chapter 13—Parking Pricing and Fees;" TCRP Report 95, Transportation Research Board, Washington, DC (2005).

Victoria Transport Policy Institute, "Online TDM Encyclopedia." http://www.vtpi.org/tdm/ (Web site updated December 17, 2003).

Weinberger, Kaehny, Refu; U.S. Parking Policies: An Overview of Management Strategies; Institute for Transportation and Development Policy.

http://www.smgov.net/Departments/OSE/Categories/Sustainability/Sustainable_City_Progress_Report/Transportation/Average_Vehicle_Ridership.aspx.

Technical Appendix 7

Urban Area Transit Strategy

Appendix Contents

2050 Regional Transportation Plan

Urban Area Transit Strategy

To initiate the transit planning effort for the 2050 Regional Transportation Plan (RTP), SANDAG developed an Urban Area Transit Strategy that focused on the most urbanized areas of the region. This technical appendix includes the technical documentation report for the Urban Area Transit Strategy.

Technical Documentation Report

Urban Area Transit Strategy: A Component of the 2050 Regional Transportation Plan

October 2011

Prepared by:

PARSONS BRINCKERHOFF and SANDAG

1. Introduction and Executive Summary

Over the past several decades, the San Diego region has made considerable investments in its transit system, including the development of its Trolley, COASTER, and SPRINTER rail lines, and the operation of an extensive local bus network. However, given a number of increasingly-important factors, the need to focus additional attention on the region's transit system has increased. These factors include new statewide legislative requirements to reduce greenhouse gas (GHG) emissions contained in Senate Bill (SB) 375, the projected aging of our population, an increasing pattern of infill and redevelopment in the western third of the region, and the growing emphasis on active transportation and public health.

To initiate the transit planning effort for the 2050 Regional Transportation Plan (RTP), SANDAG developed an "Urban Area Transit Strategy" (UATS) focused on the most urbanized areas of the region where investments in transit are generally most efficient and effective. The UATS study boundary is illustrated in Figure TA 7.1. SANDAG and the project team undertook an extensive planning process that involved developing a range of differing transit strategies and approaches to determine the kind of transit future that is desirable for the San Diego region. The project included strategic brainstorming sessions, as well as public workshops, opinion surveys, and input questionnaires. The team reviewed previous market studies and conducted research on transit success stories from other cities to analyze applicability to the San Diego region. The project also included developing performance measures and mode share goals by which to test the strategies.

More specifically, three initial transit strategies for the most urbanized areas of the San Diego region were crafted. The three transit strategies were intentionally designed to vary significantly from one another in order to test how different approaches might function in the long term when compared across the performance measures. For analytical purposes, the highway network and the land use assumptions of each strategy were held constant. The strategies were developed with input from transportation and land use professionals from our own region, from various places across the United States, and from other countries. The public provided input on the strategies; industry experts conducted critical reviews; the projected performance was evaluated against the measures; and many rounds of modifications and refinements occurred, leading to the development of an "unconstrained transit network" for the urban area and the region.

The unconstrained transit network served as the region's wish list for transit investments and pulled in the best elements of the three initial transit strategies. Parallel to the unconstrained transit network was the development of an unconstrained highway network, serving as the region's wish list for highway investments. The unconstrained transit and highway networks were followed by the development of four initial "revenue constrained" transit and highway networks that matched up complimentary combinations of transit and highway investments, with varying levels of emphasis on investment options. The revenue constrained scenarios were developed recognizing the reality that revenues are limited, and that the region cannot afford all of the projects proposed in the unconstrained networks.

After significant discussion and dialogue on the four initial revenue constrained networks, a "preferred revenue constrained" transit network that significantly increases transit service miles and transit mode share in the most urbanized areas of the region was included in the Draft 2050 RTP, along with a preferred revenue constrained highway network. The Draft 2050 RTP was released for public review and comment in April 2011. As a result of public input and SANDAG Board actions on the Draft 2050 RTP, the transit and highway networks were further refined, and ultimately culminated in the "Final 2050 Revenue Constrained Transit Network" and "Final 2050 Revenue Constrained Highway Network" that were included in the Final 2050 RTP, along with the regional bike network, transportation demand management programs, transportation system management programs, incentive programs, a safe routes to transit program, and other complimentary programs.

The Urban Area Transit Strategy served as the foundation for the transit planning process in the 2050 RTP. The transit network development process is illustrated graphically in Figure TA 7.2 within the context of the broader 2050 RTP development process. To assist with this work, SANDAG contracted with the consultant team of Parsons Brinckerhoff (PB). This report documents the Urban Area Transit Strategy planning process, which took place from 2009 to 2011, and provides supporting technical analysis and documentation associated with the process.

2. Transit Vision and Goals for the Urban Area Transit Strategy

The overarching goal of the UATS was to create a world-class transit system for the San Diego region in 2050, with the aim of significantly increasing the attractiveness of transit, walking, and biking in the most urbanized areas of the region.

The vision called for a network of fast, flexible, reliable, safe, and convenient transit services that connect our homes to the region's major employment centers and destinations. Achievement of this vision would make transit a more appealing option for many trips, reducing the impact of vehicular travel on the environment and on public health. Other key goals included:

- Making transit more time-competitive with automobile travel;
- Maximizing the role of transit within the broader transportation system; and
- Reducing vehicle miles traveled and greenhouse gas emissions in the region.

3. Existing Regional Transit Network

SANDAG serves as the regional transportation planning agency and is responsible for long-term transit planning for the San Diego region. This planning function is performed in partnership with the region's two transit operators, the Metropolitan Transit System (MTS) and the North County Transit District (NCTD).

Policies related to service planning and implementation, fare structure and setting, and public involvement have been adopted by SANDAG since consolidation of some transit agency functions in July 2003. These policies promote an integrated regional transit system, including coordinated services and schedules between transit agencies, a system-wide cash and prepaid fare structure, and regional traveler information.

Existing Transit System

The current regional transit system in San Diego County has five primary modes of transit: commuter rail, light rail transit (LRT), Bus Rapid Transit (BRT), Rapid Bus, and local bus services, each with varying geographic service areas, timetables, and frequencies. (Definitions and examples of these and other transit services and facilities used in the UATS planning process are provided in Technical Appendix A.) These transit modes are supported by publicly and privately operated shuttles, buses, and jitneys in communities around the region. San Diego's existing regional transit network is illustrated in Figure TA 7.3.

Transit service in the region is provided by the two transit agencies: MTS and NCTD. These two transit agencies operate the region's fixed-route bus services, COASTER commuter rail, San Diego Trolley light rail, SPRINTER light rail, Sorrento Valley COASTER Connection, and Americans with Disabilities Act (ADA) paratransit services. Connections to adjacent regions further north are provided by Amtrak's "Pacific Surfliner" route, which runs from San Diego to San Luis Obispo through six counties, and the MetroLink commuter rail service from Oceanside to Orange and Los Angeles Counties.

The San Diego Trolley has 51 miles of track over three service lines: the Blue Line, the Orange Line and the Green Line. These three lines serve 53 stations with a fleet of 134 rail cars and an average weekday daily ridership of approximately 99,000. The Blue Line is currently undergoing track and system upgrades, as well as station upgrades to accept new low-floor vehicles. The SPRINTER, in North County, is comprised of 22 miles of track, serving 15 stations with up to 12 vehicles, between Oceanside and Escondido. Weekday ridership on the SPRINTER is approximately 7,800 daily passengers.

Commuter rail service is provided on the COASTER, which travels 41 miles between Oceanside and downtown San Diego on track shared with AMTRAK and freight services. COASTER service is provided by 35 vehicles to eight stations along the route. Ridership on the COASTER averages approximately 5,000 daily passengers.

In addition to the Trolley, SPRINTER, and COASTER, both MTS and NCTD provide bus service in the region. MTS operates approximately 100 bus routes and NCTD operates approximately 35 bus routes in the region. There are currently more than 7,600 bus stops in San Diego County — 5,500 of which are in the MTS service area and over 2,100 in the NCTD service area. The fleet of bus transit vehicles in the San Diego region includes more than 800 buses and approximately 200 minibuses and vans. In addition to the transit agency bus service, a number of publicly- and privately-operated shuttles, buses, and jitneys provide service throughout the region.

The existing transportation system also includes a variety of facilities that support and enhance the operation of transit service within the region. These facilities include exclusive bus lanes, signal prioritization, queue jumpers, freeway Managed Lanes (ML) with direct access ramps/Bus Rapid Transit stations, High Occupancy Vehicle (HOV) lanes, and park-and-ride lots.

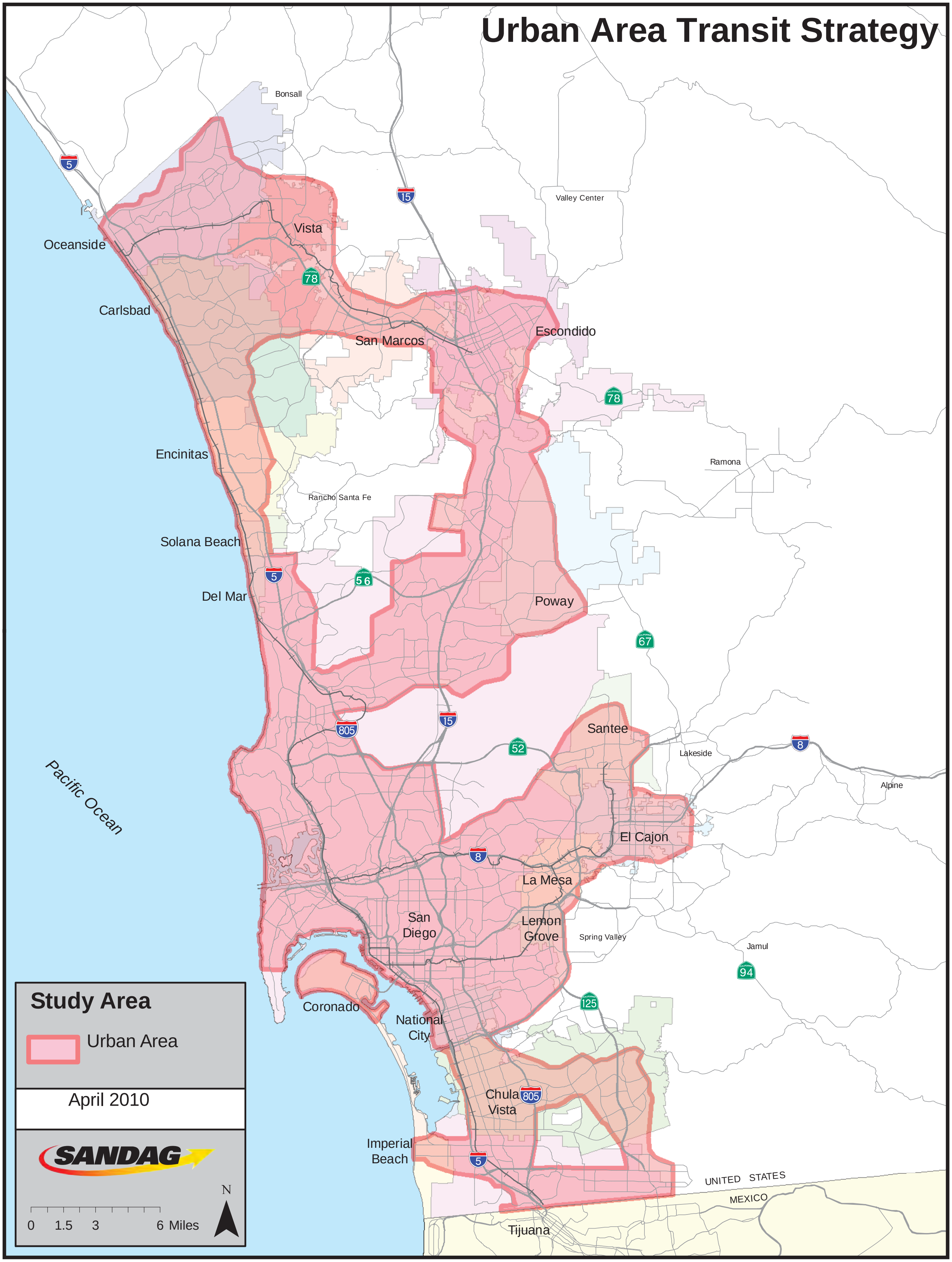
4. Regional Growth Projections

Most of the homes and jobs in the San Diego region are located within the western third of the region and this trend is expected to continue into the future. Currently, 3.1 million people live in the San Diego region. The 2050 Regional Growth Forecast projects that another 1.3 million people will live in the region by 2050, for a total of approximately 4.4 million people by 2050. Similar to the rest of the country, San Diego is also projected to experience an aging of the population base in the coming years.

The forecasted growth in housing is projected to increase by approximately 33 percent, or about 388,000 additional units, totaling 1.53 million homes in 2050. Of the 388,000 units, nearly 85 percent are expected to be multi-family homes. Nearly 80 percent of all homes in 2050 are projected to be located within the UATS study boundary (Figure TA 7.4).

The region is also projected to experience an increase of approximately 500,000 jobs over the next 40 years, resulting in a total of nearly two million jobs in 2050. Of the two million total jobs, over 85 percent are projected to be located in the UATS study boundary in 2050 (Figure TA 7.5).

Figure TA 7.1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Valley Center
Vista
Oceanside
Carlsbad
San Marcos
Escondido
Encinitas
Ramona
Rancho Santa Fe
Solana Beach
Del Mar
Poway
Pacific Ocean
Santee
Lakeside
Alpine
El Cajon
La Mesa
San Diego
Lemon Grove
Spring Valley
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National City
Chula Vista
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Figure TA 7.2 – Transit Network Development Process in the 2050 Regional Transportation Plan

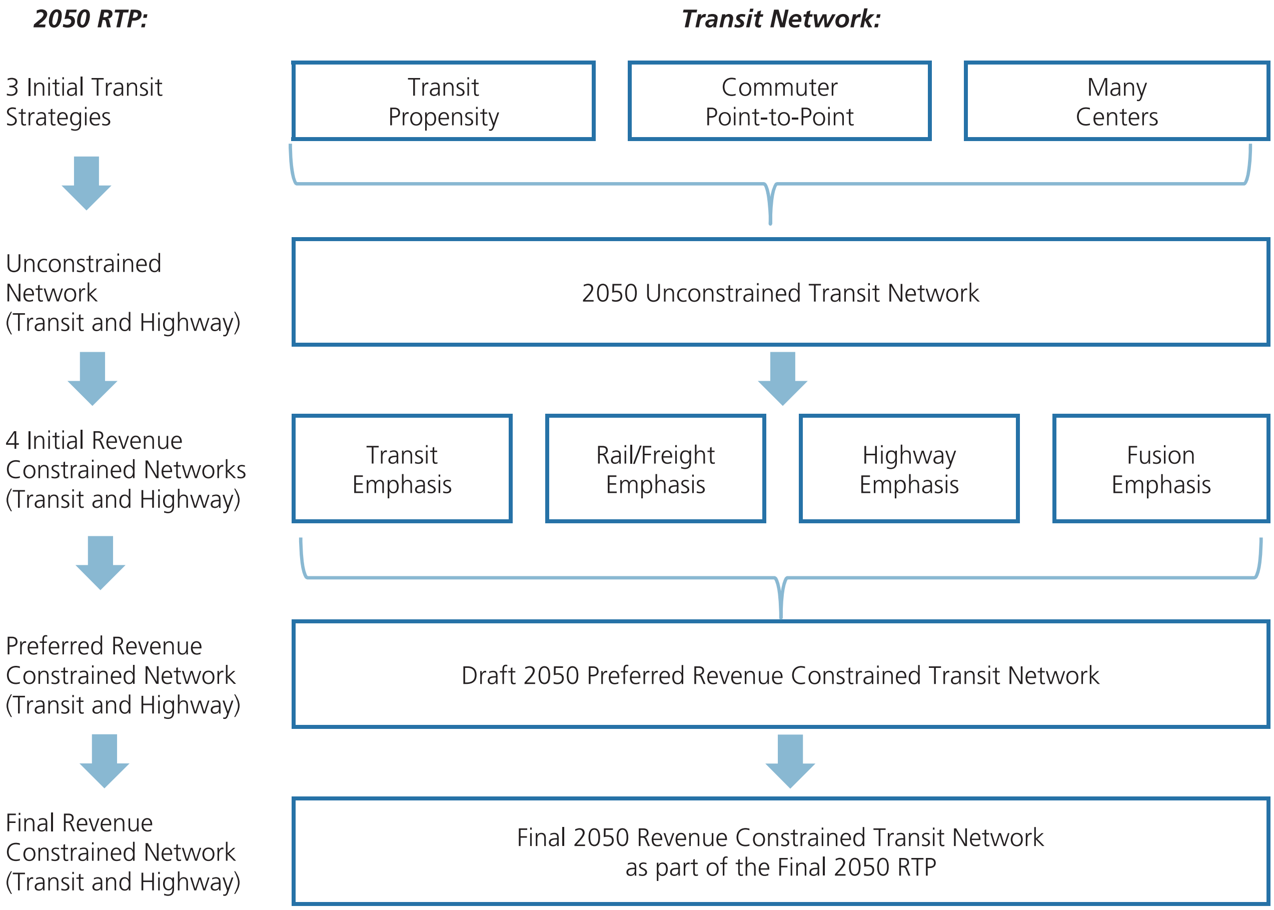
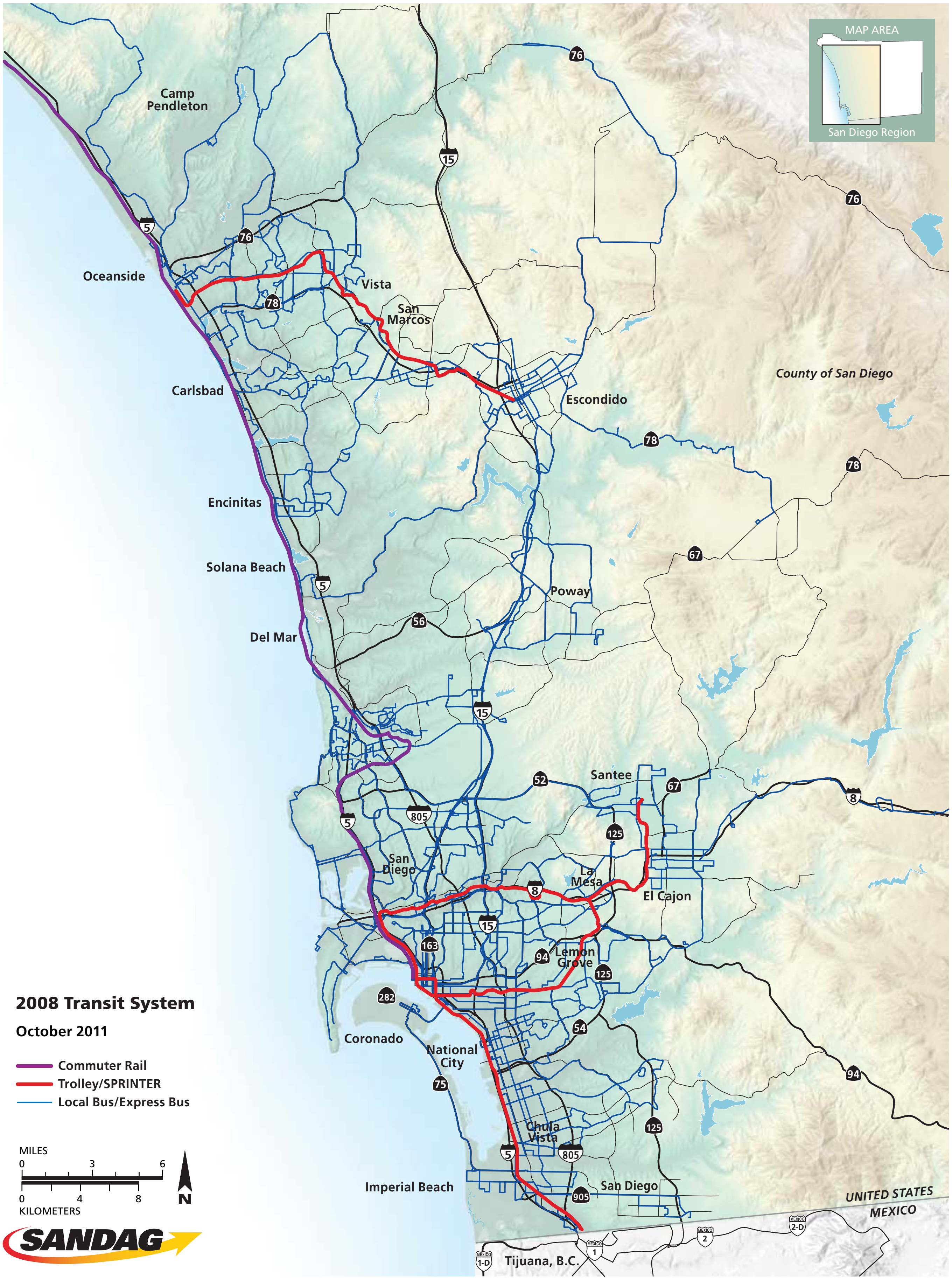


Figure TA 7.3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San Diego Region
Camp Pendleton
Oceanside
Vista
San Marcos
Carlsbad
Escondido
County of San Diego
Encinitas
Solana Beach
Poway
Del Mar
Santee
San Diego
La Mesa
El Cajon
Lemon Grove
Coronado
National City
Chula Vista
Imperial Beach
San Diego
UNITED STATES
MEXICO
Tijuana, B.C.
2008 Transit System
October 2011
Commuter Rail
Trolley/SPRINTER
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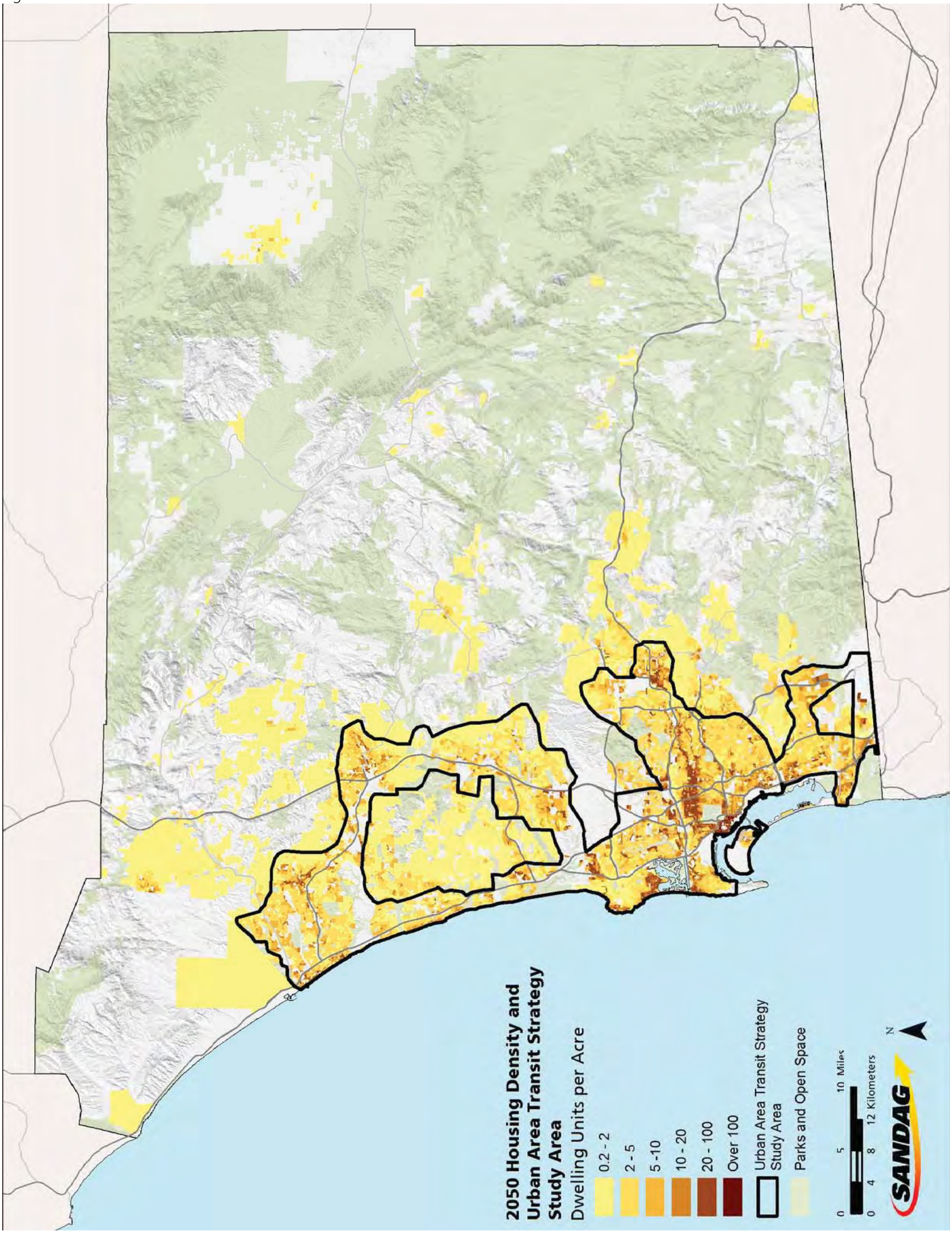
Figure TA 7.4


2050 Housing Density and
Urban Area Transit Strategy
Study Area
Dwelling Units per Acre
0.2 - 2
2 - 5
5 - 10
10 - 20
20 - 100
Over 100
Urban Area Transit Strategy
Study Area
Parks and Open Space
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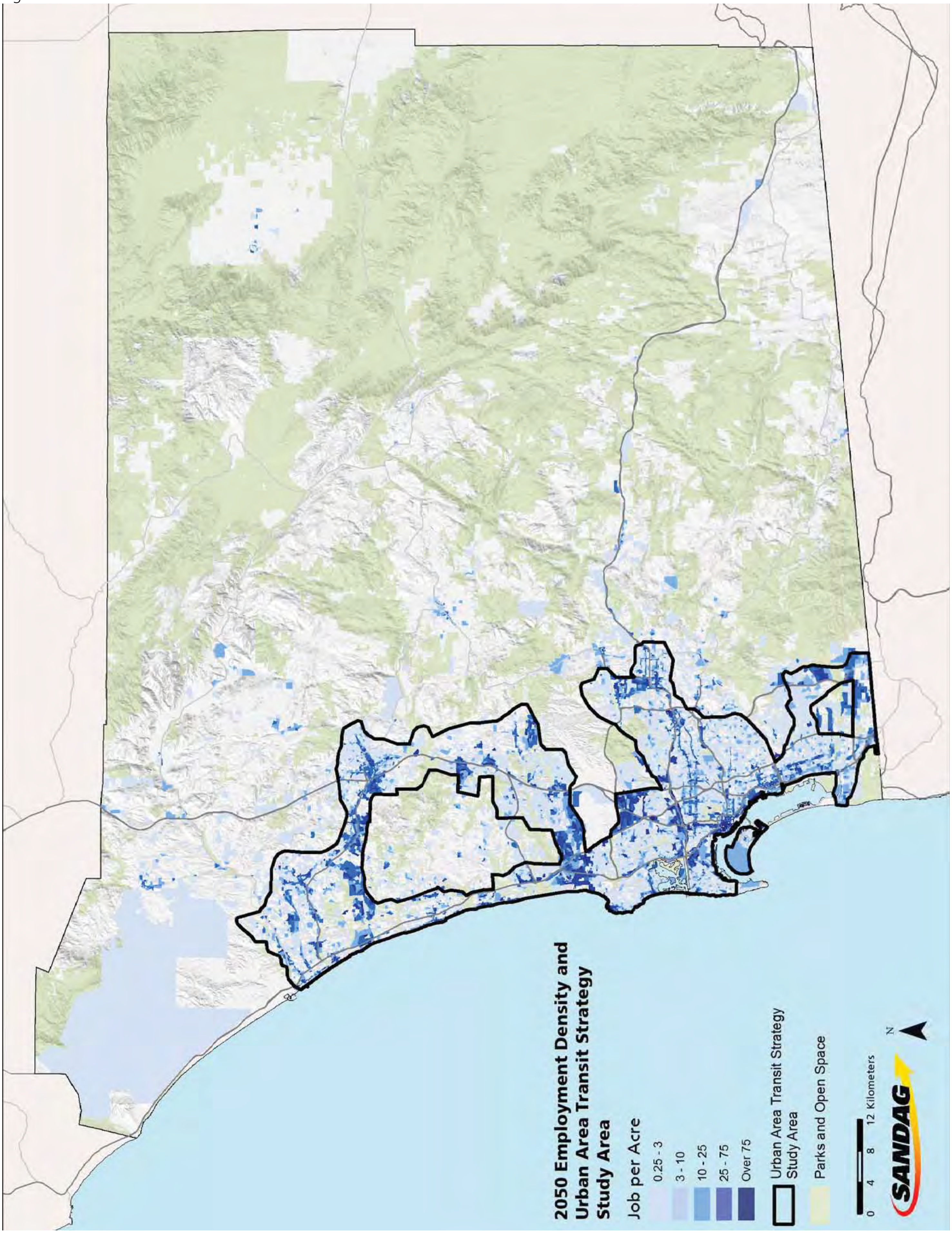
0 4 8 12 Kilometers
N

Figure TA 7.5


2050 Employment Density and
Urban Area Transit Strategy
Study Area
Job per Acre
0.25 - 3
3 - 10
10 - 25
25 - 75
Over 75
Urban Area Transit Strategy
Study Area
Parks and Open Space
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5. Setting the Stage

Brainstorming

To kick off the transit planning process for the Urban Area Transit Strategy and the 2050 RTP, SANDAG conducted brainstorming sessions with local elected officials, stakeholders, member agency staffs, and MTS and NCTD on potential transit concepts that could be considered in the development of the 2050 transit network. Input collected was reported to the SANDAG Transportation and Regional Planning Committees, and the Parsons Brinckerhoff Professional Consulting Team (further discussed in Section 8) in the development of the initial transit strategies. Key points from the brainstorming sessions are summarized in Technical Appendix B. Highlights include:

- Desire for a world-class transit system.
- Focus on maintaining and upgrading the region's existing transit infrastructure and focusing future transit network improvements in urban areas.
- Implement "express" transit services to targeted areas to minimize travel times in key corridors, especially during peak commute times.
- Include shuttles or jitneys to serve as feeder services that improve access to regional transit in residential neighborhood areas.
- Develop long-term, sustainable funding sources for transit.

Lessons Learned

In addition, a review of other regions that have successful transit systems was conducted to help guide the planning process. This review included assessing each area's existing and planned mass transit system, planning process, and any associated policies that support transit use and implementation. These areas offer examples of how transit has been applied successfully, and provide a point of reference or a starting point from which comparisons can be made. The resulting "Lessons Learned from Peer Regions" report (included in Technical Appendix C) offers lessons that can be considered in San Diego.

Three regions that were considered "benchmark" cities for San Diego were researched in some detail. These cities are:

- Portland, Oregon
- Sydney, Australia
- Vancouver BC, Canada

Seven additional "comparison cities" were also studied because they have characteristics similar to San Diego or provide examples of unique transit applications that have helped raise the profile of transit in their regions. These cities are:

- Brisbane, Australia
- Bordeaux, France
- Denver, Colorado
- Los Angeles, California
- Melbourne, Australia

- Minneapolis, Minnesota
- Seattle, Washington

Several overarching themes emerged from the evaluation of the benchmark and comparison cities. Table TA 7.1 summarizes the major themes of the case study and their potential applicability to San Diego.

Table TA 7.1 – Overarching Themes and Considerations for San Diego from Lessons Learned

Overarching Theme	Considerations for San Diego
The success of transit did not happen overnight. Successful transit has been an evolutionary process in case study regions during which certain strategies were used until their usefulness was outlived, and then the strategies were modified or new strategies were implemented.	San Diego embarked on an innovative new transit strategy in the early 1980s with the opening of the region's (and nation's) first urban rail transit line since WWII from downtown San Diego to the International Border. Over the next 25 years, the region expanded the rail network to provide a backbone transit infrastructure and service network, to one that now includes 75 miles of light rail (San Diego Trolley and SPRINTER) and 40 miles of commuter rail (COASTER). Between 1975 and 2005, transit ridership increased 150 percent while regional population increased approximately 75 percent. As the original regional rail program nears completion (the 11-mile Mid-Coast corridor between Old Town and University City is the only remaining rail extension in the 2030 Regional Transportation Plan), the regional transit strategy has shifted to a multimodal, shared right of way approach (transit on managed lanes and arterial streets). Looking to the experiences of the case study regions, San Diego may need to develop a new dramatic strategy for transit for the next 30-40 years, one that combines past, present, and future strategies to recapture the transit momentum experienced in the 1980s. The new strategy will need to include a stronger connection between transit investment and land use policies to achieve SANDAG's vision for a larger transit mode share. in the urban core, and key corridors and communities.
Transit success depends on regional plans and visions that guide the integration of land use and transportation. Many regional plans create a hierarchy of centers focused around transit that provide good design, sufficient density, and a land use mix that supports non-auto access. Success is also dependent on a number of agencies working collaboratively to achieve the regional plans and visions.	SANDAG's Regional Comprehensive Plan and Smart Growth strategy establish a hierarchy of centers designed to be supported by transit, and policies for integrating land use with transportation. Development of a new regional transit strategy should draw heavily on the policies and goals in the Regional Comprehensive Plan for both the region and specific corridors/communities. To achieve success, agencies, transit providers, and stakeholders must work together towards agreed-upon transit and land-use goals.

Table TA 7.1 – Overarching Themes and Considerations for San Diego from Lessons Learned (continued)

Overarching Theme	Considerations for San Diego
Regions use a variety of tools to achieve transit success. Regions use a variety of policy, regulatory, and financial tools that contributed to the success of transit. Tools were modified or new tools added when they were no longer effective for encouraging ridership or investment along transit corridors.	SANDAG and the region already have a variety of policy tools to support transit as defined in the Regional Comprehensive Plan and Smart Growth strategy. Additional policies and tools found in the peer regions/cities that promote and support existing and future transit services for consideration by SANDAG include: improvements to the pedestrian environment, urban growth boundaries, cooperative agreements between public agencies and private developers, tax incentives to foster transit oriented development, parking maximums or limitations, and legislation requiring commute trip reductions by major employers.
Regions experienced a shift in policy and investment toward transit over the past few decades. Regions moved toward transit as a tool to improve mobility and sustainability in response to public pressures related to sprawl, the environment, livable communities, and quality of life issues. These regions also made significant investments in permanent transit infrastructure, which improved transit and also helped generate awareness of the transit system and spur transit-oriented development.	The San Diego region is experiencing similar pressures to contain sprawl, protect the environment, promote livable communities, and maintain and improve the quality of life. Through the Regional Comprehensive Plan, the San Diego region has made the policy connection between investments in transit and achieving these goals. Looking toward the future, new transit policies and strategies designed to increase transit mode share will need to understand the effects of regional highway investments and policies on the potential success of the transit investments and system.
Local bus networks are essential for successful transit systems to provide efficient connections and access to the backbone system. To efficiently support higher frequency transit stations, feeder services are essential and, depending on the local geography, are often structured along grids or hub-and-spoke networks.	San Diego's existing transit network leans toward hub-and-spoke structure with feeder buses connecting to rail based transit centers. However, many trips rely solely on bus transit. A new transit strategy will need to build off the existing rail transit investment, while also considering how best to serve key travel markets (origins/destinations, work trips, etc.) that may not be well served by existing bus/rail connections. The strategy will also need to define the role of local and feeder bus service in relation to the major transit infrastructure investments.
Parking requirements in transit-supportive communities are reduced. Most transit successful regions have coordinated parking policy with land use and transit policy. Parking strategies often differ between central and outlying areas.	Abundant and inexpensive parking have proven to be key deterrents to transit use. A new transit strategy for the San Diego region should evaluate how parking policies (location, availability, and cost), particularly in the city center and urban core, impact transit use.

Table TA 7.1 – Overarching Themes and Considerations for San Diego from Lessons Learned (continued)

Overarching Theme	Considerations for San Diego
Successful transit systems include a variety of transit modes. Cities and regions with successful transit have systems that include combinations of transit modes applied for the particular conditions, objectives and circumstances (i.e., heavy rail, commuter rail, light rail, bus rapid transit, rapid bus, local bus, streetcar, shuttles, and electric bus).	All regions include a combination of transit facility and service applications to create their transit networks and systems.
Unique applications of transit have occurred in the downtowns. While all of the studied regions have a wide range of transit modes that provide area- and location-appropriate transit, these cities have also incorporated special applications of transit infrastructure, services, and policies in their downtowns in ways that raise the profile of transit, promote transit use, and support higher density environments.	Cities with similar transit histories and land use characteristics as San Diego have invested heavily in innovative transit facilities and services in their central cities (transit malls, streetcars, underground bus terminals, fare free zones). These investments have proven highly successful in generating transit ridership, supporting the regional transit network, achieving land use objectives, increasing transit mode share, and contributing to the vitality of their downtown core. Many of these strategies may have applicability to downtown San Diego and other key activity centers.

Public Opinion Survey

To obtain input on priorities from the general public, SANDAG also developed a public opinion telephone survey and a public input questionnaire. Overall, results of the public opinion telephone survey and the public input sample revealed that residents of the San Diego region support significant investments in the future of the region's transit network. Detailed results from the survey and questionnaire, and more information from the broader Public Participation Program, are included in Chapter 9 of the 2050 RTP.

Workshops

SANDAG also held five 2050 RTP public workshops (from April 26 to May 6, 2010) to solicit input on preliminary ideas for the transit planning process. The following is a sampling of the comments received at the workshops. More information on the workshop results is included in Technical Appendix 6 of the 2050 RTP.

- Strong support for more bike projects, more bike racks on buses and trolleys, and related connections to transit stations
- Suggestions on transit line extensions in particular areas (e.g., streetcar from Park Blvd. to I-805 along University Avenue; light rail to North County; streetcar along Monroe Avenue)
- Observation that places with great transit systems (e.g., London, Paris, Sydney, Moscow, San Francisco) have underground stations and lines
- Support for extension of the planned high speed rail system to the international U.S./Mexico border
- Support for building an extensive transit system

- Concern over the lack of funding for transit services and the related suggestion to be less ambitious in the transit planning process
- Need for more real-time information at transit stations
- Encouragement for the use of smaller buses to increase efficiency
- Support for priority measures to bypass areas with traffic congestion and improve travel times
- Concern about future mobility for seniors and the need to plan ahead to meet their needs for "aging in place"
- Encouragement for expanding sidewalks and planting street trees to make walking and biking more pleasant, particularly at transit stations
- Appreciation for the Spanish translation at the workshops

Market Research

In addition, the region's transit planning efforts also build upon private-sector market research[1] conducted in 2000 by the former Metropolitan Transit Development Board (MTDB) and NCTD. This research identified the critical attitudes and preferences that influence San Diegans' daily travel choices. The research identified a number of travel market groups based on a unique set of attributes that they consider when choosing whether to drive or take transit for a given trip. These markets and attributes help identify the kind of customer experience transit will need to offer in order to potentially attract people belonging to a given market segment to transit. The speed of transit and the frequency of service were two of the more obvious attributes identified. But other attributes, embodied in what was termed the "transit customer experience," proved to be equally important in a person's decision on whether to use transit. Paying attention to such things as the design and comfort of vehicles, the design of station shelters and amenities, traveler information, and the ease of paying fares all need to be considered to create a high quality regional transit system that will play an increased role in meeting regional mobility needs.

6. Transit Mode Share Goals

A unique component of the UATS was the development of "transit mode share goals" for the study area. Very few regions have established transit-related goals for areas beyond their downtown centers. However, because of SANDAG's desire to significantly expand transit use in the Urban Area (depicted in Figure TA 7.1), SANDAG set transit mode share goals for 14 major activity and employment areas within the Urban Area, as well as for the Urban Area itself.

Definition of Mode Share

Mode share refers to the proportion of people using a particular form of transportation to get from one place to another. The most common transportation modes include: driving alone, using transit, carpooling, bicycling, and walking. For example, if there is a five percent transit mode share in a particular area, that means that five percent of the trips in that area were made on transit. As a point of reference, in 2008, downtown San Diego's transit mode share was just over 20 percent during peak period commute times, while Sorrento Mesa had a transit mode share of slightly over two percent during that same time period.

The idea behind setting transit mode share goals for specific subareas of the region was to recognize that transit service levels can and should be higher where greater land use concentrations already exist or are anticipated in the

[1] "Market Research Approach for TransitWorks Long Range Strategy," prepared by Cambridge Systematics, Inc. for MTDB, August 15, 2002; and "TransitWorks Strategic Plan Report," MTDB, January 2001.

future, especially during peak period commute times when congestion levels tend to be the highest. The first step to creating mode share goals was to understand current mode shares. This initial understanding established the baseline from which to evaluate planned transit investments and other policies that affect transit ridership relative to future population and employment growth and travel demand. Therefore, setting mode share goals helped guide and define future transit investments by understanding where transit is currently successful and where future investments can be most effective.

Development of Transit Mode Share Goals

To account for the varying ability of transit to efficiently and effectively serve the Urban Area, a number of geographic areas and corridors needed to be defined for use in the development of mode share goals. It was decided that the goals should be based on quantifiable trends and patterns, have the ability to be measured over time, and be ambitious yet achievable.

Two general issues needed to be addressed in identifying the mode share goals: (1) how to determine the most suitable corridors/communities for which to establish goals, and (2) how to set an appropriate mode share goal for the selected areas. As a starting point for identifying where transit mode share goals would be most appropriate, geographic areas and travel corridors were identified based on:

- High volume travel corridors (all motorized trips), both current and future, that factor in trip purpose, trip origins and destinations, and time of day (such as peak period vs. off-peak);
- Major job centers that attract large volumes of peak period trips;
- Locations and communities with transit-supportive land uses, such as mixed-use development;
- Infrastructure that supports access to transit, such as grid street-patterns, sidewalks, bicycle facilities and park-and-ride lots; and
- Existing transit markets that have been identified through the MTS Comprehensive Operational Analysis (COA) and the NCTD Mobility Plan to ensure that RTP transit mode share goals are consistent with current short-range transit plans.

Figure TA 7.6 depicts the major travel corridors and areas used to establish initial geographic districts for mode share analysis. These travel corridors and areas were identified by analyzing peak period and daily travel demand output from SANDAG's regional travel demand model. Figure TA 7.7 provides a map of the 18 districts that were initially identified, along with the 2008 peak period home-to-work transit mode shares for each district. Based on the existing and projected travel patterns in some of the northern suburban districts and the desire to better define the urbanized central core, these 18 districts were ultimately consolidated into 14 geographic corridors/areas that reflect the region's major employment areas, high activity areas, and other urbanized areas (shown in Figure TA 7.8).

Initially, preliminary mode share goals for the identified geographic corridors/areas were to be developed using the peak period home-to-work transit mode share projections from two existing model scenarios to understand a range of potential mode share expectations for 2050. The Reasonably Expected Revenue scenario and the Unconstrained Revenue scenario of the adopted 2030 RTP, combined with the 2050 Regional Growth Forecast inputs, were intended to serve as the initial transit mode share goal "low" and "high" indicators. However, upon review of the results, it was found that there was too little variation in the two scenarios to yield meaningful lower and upper-end transit mode share goal ranges.

As a result, a new approach was developed, based on the 1997 South East Queensland Integrated Transport Plan in Brisbane, Australia. The Brisbane approach developed a transit mode share goal which was based on the existing year mode share plus a 50 percent increase in the projected proportion of trips made on public transit between 1997 and 2011, the Plan's horizon year.

Future Baseline Scenario

A similar approach was applied to the UATS planning process. However, instead of using an existing year as the baseline scenario, the project team used a future year as the baseline from which to identify each geographic corridor/area mode share goal, which would result in higher starting point values, and ultimately, higher proposed transit mode share goals. The project team used the 2030 RTP transportation network overlaid onto the projected 2050 land uses to create a future baseline, or starting point, scenario. Once the baseline mode share projections were developed for the 14 transportation corridors and areas for peak period commute trips, a 25 percent increase was applied to the expected "baseline" mode shares to develop the 2050 mode share goals.

To account for the variability in both the current predictive models and other changes that may come about over the course of 40 years, a range was developed for each mode share goal. Development of each area's goal range accounted for the following:

- Proposed goal
- Type of existing transit service and service levels
- Transit supportive infrastructure
- Existing and projected land uses

Transit Mode Share Goals

The transit mode share goals range from a low of 5-10 percent for various ex-urban areas, 10-15 percent for more suburban areas, 15-20 and 20-25 percent in the more urbanized areas of San Diego, to more than 30 percent in downtown San Diego. The resulting transit mode share goal range for the collective Urban Area is 10-15 percent. This represents more than a doubling of the current peak period, home-to-work transit mode share in the Urban Area within the next 40 years.

Figure TA 7.6


Orange County
Riverside County
San Diego County
Camp Pendleton
Oceanside
Vista
San Marcos
Carlsbad
Escondido
Encinitas
Solana Beach
Del Mar
Poway
PACIFIC OCEAN
County of San Diego
Sorrento Valley
University City
San Diego
Santee
Kearny Mesa
El Cajon
La Mesa
Lemon Grove
National City
Downtown
Coronado
Chula Vista
Imperial Beach
San Diego
UNITED STATES
MEXICO
Major Travel Corridors and Areas for Use in Identifying Initial Mode Share Goals
Major Travel Corridor
Major Employment Area
High Activity Area

Figure TA 7.7

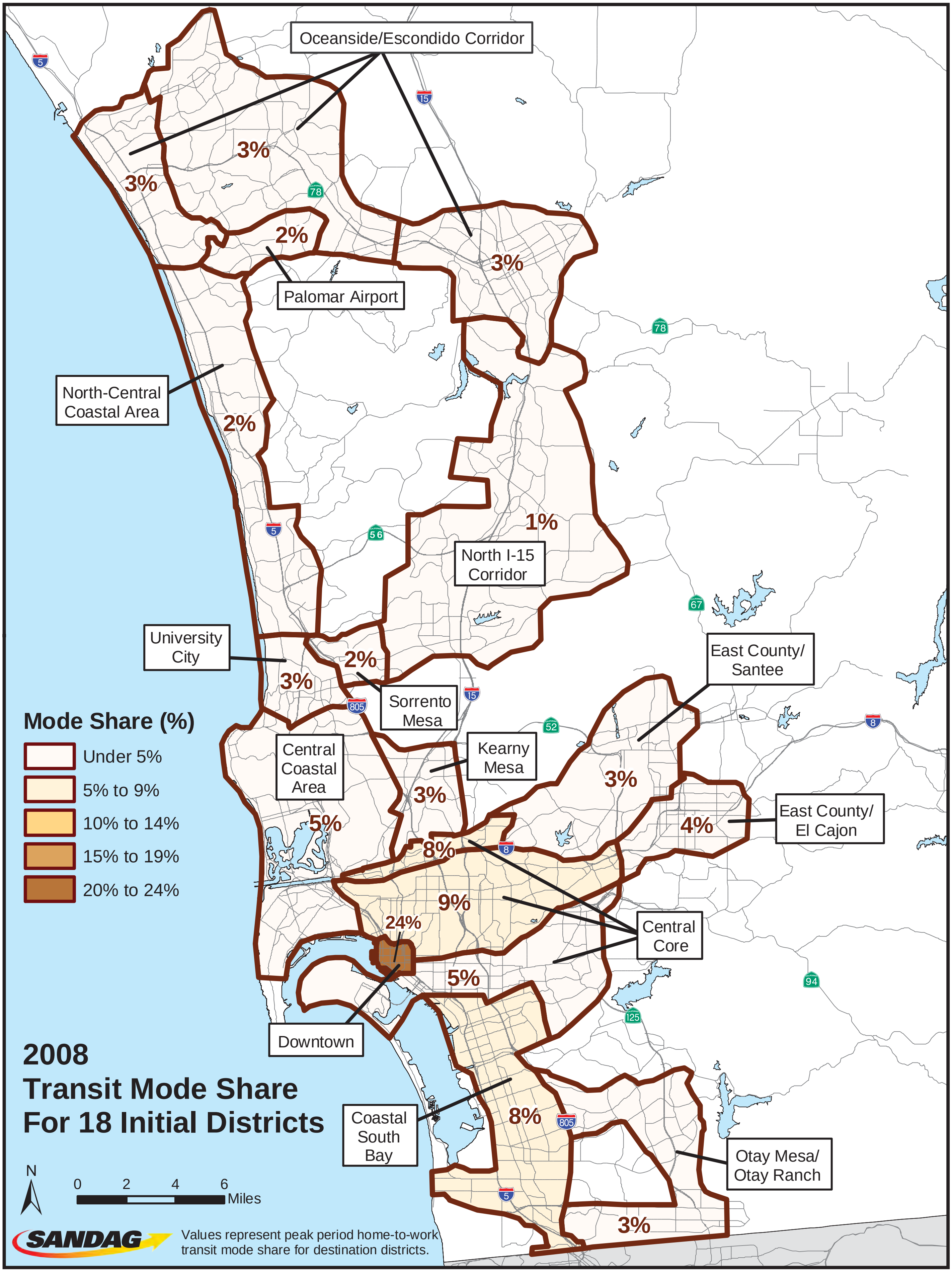

Oceanside/Escondido Corridor
3%
3%
2%
3%
Palomar Airport
North-Central
Coastal Area
2%
1%
North I-15
Corridor
University
City
3%
2%
Sorrento
Mesa
East County/
Santee
Mode Share (%)
Under 5%
5% to 9%
10% to 14%
15% to 19%
20% to 24%
Central
Coastal
Area
5%
Kearny
Mesa
3%
3%
4%
East County/
El Cajon
8%
9%
24%
Central
Core
5%
Downtown
2008
Transit Mode Share
For 18 Initial Districts
Coastal
South
Bay
8%
Otay Mesa/
Otay Ranch
3%
N
0 2 4 6
Miles
SANDAG
Values represent peak period home-to-work
transit mode share for destination districts.

Table TA 7.2 below provides information on existing (2008) transit mode shares, projected "baseline" transit mode shares, the calculated mode share goal applying the 25 percent increase over the baseline, the change over the projected baseline and existing transit mode shares, and finally the proposed 2050 peak period home-to-work transit mode share goal ranges for each identified geographic corridor/area. Figure TA 7.8 illustrates the goals from a geographic perspective.

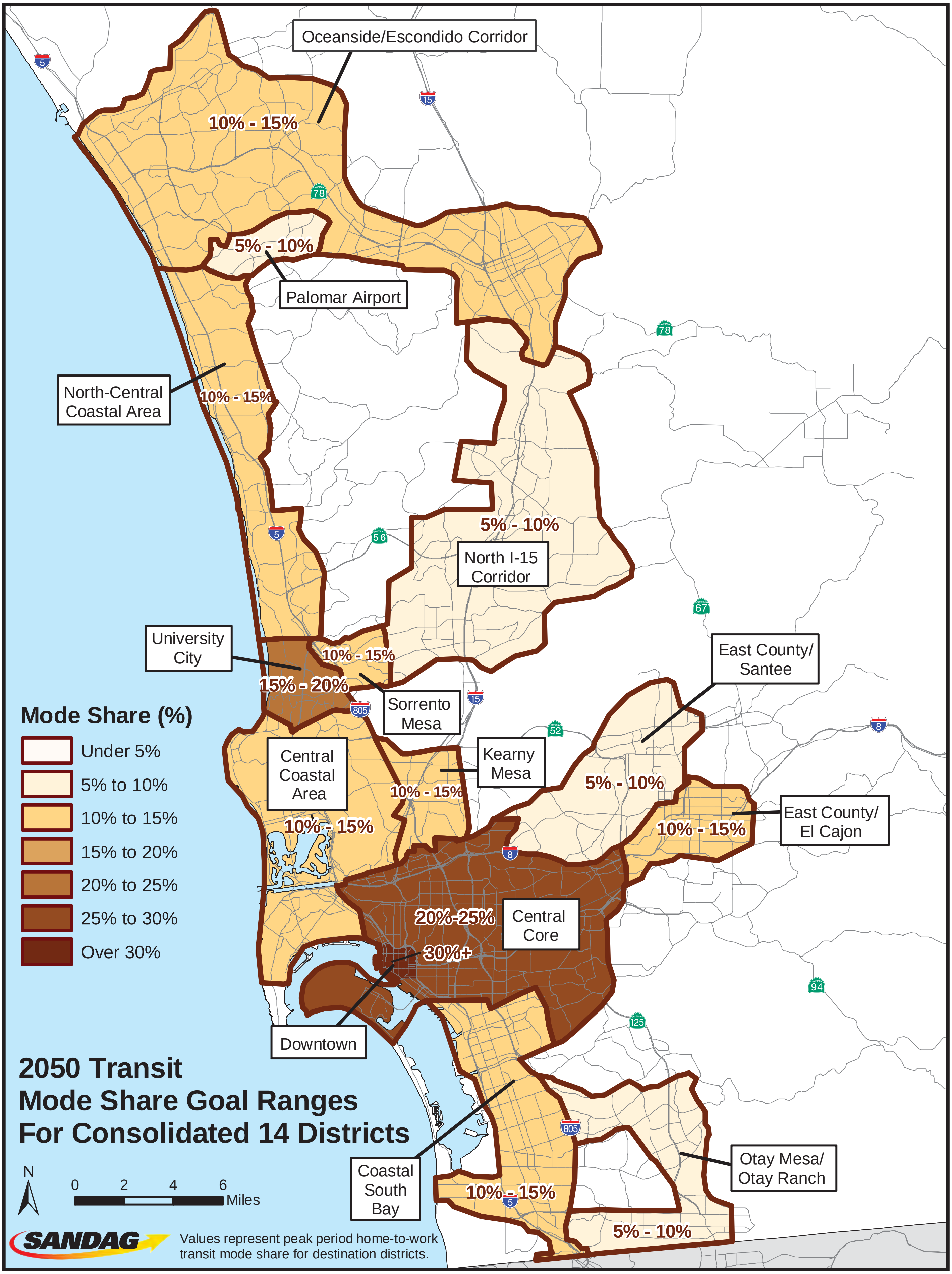
Table TA 7.2 –Peak Period, Home-to-Work Transit Mode Share Goals[1]

	Baseline Data		Supporting Data			Goals
Identified Corridors/Areas	**2008 Existing Transit Mode Share**	**2030 RTP With 2050 Land Uses Mode Share[2]**	**25% Increase Over 2030 RTP (Rounded)**	**Change From 2030 RTP**	**Change From 2008 Existing Transit**	**2050 Peak Period Transit Mode Share Goal Ranges**
Major Employment Areas						
Downtown San Diego	24.00%	25.00%	31%	24%	29%	30% +
University City	3.20%	13.00%	16%	23%	400%	15%-20%
Sorrento Mesa	1.90%	11.00%	14%	27%	637%	10%-15%
Kearny Mesa	2.60%	11.00%	14%	27%	438%	10%-15%
Otay Mesa/ Otay Ranch	2.70%	6.00%	8%	33%	196%	5%-10%
Palomar Airport	1.40%	5.50%	7%	27%	400%	5%-10%
High Activity Areas						
Central Core	11.80%	16.00%	20%	25%	69%	20%-25%
Oceanside/Escondido Corridor	2.90%	7.40%	9%	22%	210%	10%-15%
Other Urbanized Areas						
North I-15 Corridor	0.60%	6.10%	8%	31%	1233%	5%-10%
North Central Coastal Area	1.90%	7.70%	10%	30%	426%	10%-15%
Central Coastal Area	4.70%	10.00%	13%	30%	177%	10%-15%
Coastal South Bay	7.50%	10.70%	13%	21%	73%	10%-15%
East County/El Cajon	4.20%	8.30%	10%	20%	138%	10%-15%
East County/Santee	2.90%	6.30%	8%	27%	176%	5%-10%
UATS Study Area	**5.20%**	**10.10%**	**13%**	**29%**	**150%**	**10%-15%**

[1] Values represent peak period home-to-work trip transit mode share for destination districts.

[2] Values reflect projected mode share of either the currently adopted 2030 Reasonably Expected RTP or the 2030 Unconstrained RTP, whichever is higher, combined with 2050 land uses.

Figure TA 7.8


Oceanside/Escondido Corridor
10% - 15%
5% - 10%
Palomar Airport
North-Central Coastal Area
10% - 15%
5% - 10%
North I-15 Corridor
University City
10% - 15%
15% - 20%
Sorrento Mesa
East County/ Santee
Mode Share (%)
Under 5%
5% to 10%
10% to 15%
15% to 20%
20% to 25%
25% to 30%
Over 30%
Central Coastal Area
Kearny Mesa
10% - 15%
5% - 10%
10% - 15%
East County/ El Cajon
10% - 15%
20%-25%
Central Core
30%+
Downtown
2050 Transit
Mode Share Goal Ranges
For Consolidated 14 Districts
Coastal South Bay
Otay Mesa/ Otay Ranch
10% - 15%
5% - 10%
N
0 2 4 6
Miles
SANDAG
Values represent peak period home-to-work transit mode share for destination districts.

7. UATS Transit Network Evaluation Criteria

A series of performance measures were developed to evaluate each potential transit scenario's ability to make transit more time-competitive, maximize the role of transit within the transportation system, and reduce region-wide vehicle miles traveled and greenhouse gas emissions.

A number of objectives were developed to address the goal and vision for the UATS project. The development of a robust, efficient, and effective transit system requires more than just building and providing additional transit facilities and services. It requires that the proposed transit facilities and services are located where travelers want to go; that transit service is fast, convenient, and easy to use; and that transit can be accessed by a wide variety of users. The objectives developed for the UATS were as follows:

- Increase Peak Period Transit Mode Share
- Maximize Transit Ridership
- Develop a Cost Effective and Implementable Transit System
- Support an Efficient and Effective Transportation System
- Address the Need for Sustainability and Environmental Justice

In order to measure the proposed transit scenarios' ability to achieve the noted objectives, a series of performance measures were developed to allow for either a quantitative or qualitative assessment of each measure and ultimately each transit network's ability to achieve the project goals and objectives. These performance measures were used in conjunction with the transit mode share goals.

The following section outlines the performance measures for each objective noted above.

Increase Peak Period Transit Mode Share

Three performance measures were developed to address each transit network's ability to meet this objective. These are listed below in Table TA 7.3.

Table TA 7.3 – Transit Mode Share Performance Measures

Performance Measure	Definition
Peak period transit mode share as applied to the identified corridors/areas	Peak period transit mode share refers to the percent of total work trips that is projected to occur on transit during the peak travel periods (when the largest concentration of trips occur on the transportation network). The peak periods are associated with the morning and evening commute times, typically occurring between 6 to 9 a.m. for the morning peak and 3 to 6 p.m. for the evening peak. This performance measure provides a projected estimate of the proportion of the regional travel demand that is projected to use transit during the most congested travel times, and applies to home-to-work trips.
All-day transit mode share as applied to the identified corridors/areas	All-day transit mode share refers to the percent of motorized travel that is projected to occur on transit for the entire day. Again, this reflects each potential transit network's ability to address overall travel demand through use of the proposed transit network.
Change in peak period Urban Area transit mode share	This performance indicator measures the change in transit mode share for the entire Urban Area study area. It specifically measures the change in transit mode share from the "baseline" scenario discussed in the previous section.

Maximize Transit Ridership

Four performance measures were developed to evaluate the projected increase in transit ridership for each alternative transit network. All ridership performance measures are regional to assess the changes that each network brings to the overall regional transit network, since all new services build upon the existing regional transit network. The performance measures for this objective are listed in Table TA 7.4.

Table TA 7.4 – Transit Ridership Performance Measures

Performance Measure	Definition
Change in transit person trips	The change in transit person trips reflects the number of individual one-way person trips taken on transit, from origin to destination (considered linked-trips) for all trip purposes. This measures the change in the number of person trips taken by transit for each proposed network as compared to the future baseline scenario. The future baseline scenario, as described in Section 6, consisted of an overlay between the highway and transit networks included in the 2030 RTP and the land use assumptions in the 2050 Regional Growth Forecast. A positive difference between the proposed network and the future baseline scenario reflects a higher use of transit, and thus an improvement.
Change in transit passenger miles	The change in transit passenger miles measures the total number of person-miles traveled on transit, also measured against the future baseline scenario. Like transit person trips, an increase in transit passenger miles generally means that more trips are being taken by transit; however, it could also mean that the available or proposed transit service is focused on serving long-distance trips, which may not be the most efficient or desired provision of transit service.
Change in transit peak period person trips	Changes in peak period transit person trips addresses how the transit network is performing during the morning and evening commute times when the network is most congested. Again, an increase in peak period person transit trips reflects higher transit use and more efficient use of limited roadway capacity.
Change in mode of access to transit (non-motorized, park-and-ride, kiss-and-ride/drop-off)	Measuring the change in how transit riders access transit, be it by walking, bicycling, or by car, helps to assess how efficiently each route, and ultimately the entire network, draws riders within the individual and network catchment areas. What this means is that transit routes and networks that have a higher number of riders walking or biking to the system are convenient and effectively located to enhance and increase transit ridership. This measure also helps assess the value of providing additional park-and-ride facilities and longer-distance bus routes, as compared to providing transit service in areas with infrastructure, and development patterns and land uses that are conducive to transit service and ridership.

Develop a Cost Effective and Implementable Transit System

Four performance measures were developed to evaluate the cost effectiveness and affordability of the proposed alternative transit networks. The performance measures for this objective included the following:

- Cost-effectiveness of network
- Operating subsidy required

- Total transit system capital cost vs. SANDAG revenue-constrained funding scenario
- Ability to phase major system components/elements

Data for these measures was not completed because these measures were found to be more relevant when considered as part of the multimodal RTP network given that some transit infrastructure is required on the Managed Lanes to operate services such as BRT. Comparable data was produced, however, centering on preliminary rough-order-of-magnitude capital cost estimates for each alternative transit network, discussed in Section 10 of this report.

Support an Efficient and Effective Transportation System

Three of the four performance measures developed for this objective focus on the broader transportation system, and only one specifically measures the transit component. These performance measures assess changes across the regional transportation network that are the result of or influenced by each transit network alternative. The performance measures are therefore compared using regional information rather than just the UATS study area. The performance measures, listed in Table TA 7.5, are all measured against the future baseline scenario.

Table TA 7.5 – Efficient Transportation Network Performance Measures

Definition	Mode
Change in passenger miles per transit seat mile	Measuring the change in passenger miles per transit seat mile is an assessment of the efficiency of the transit network, which examines the available transit capacity relative to the transit demand. This performance metric, measures how "full" the transit vehicles are, so positive changes in passenger miles per seat mile against the baseline scenario is an indicator of the effectiveness of the overall transit system.
Change in auto vehicle miles traveled (VMT) per capita	The change in VMT per capita provides a comparison as to the number of miles traveled in a vehicle compared to alternative modes of walking or biking, and to a lesser degree the ability for people to meet their daily needs (work, recreation, shopping) within a smaller area or reasonable distance. Reductions in VMT, as compared to the baseline, are considered a positive indicator of an efficient and effective transportation and transit system.
Change in auto vehicle hours traveled (VHT) per capita	The change in auto VHT per capita provides a relative understanding of how much people are traveling and congestion levels within the overall transportation system. Generally, reductions in this measure are considered positive, as it is a measure of efficiency in the system that could be attributed to the provision of transportation alternatives such as transit, walking, or biking. However, reductions in VHT can also be the result of roadway expansions and the removal of major system bottlenecks that produce congestion on the roadway network.
Change in vehicle trips per capita	Measuring the change in vehicle trips per capita provides an understanding of any changes in how people are traveling within the region. Because this measure includes all motor-driven travel, including buses, it does not measure changes in the number of trips from auto to transit, but rather is a measure of overall trip making, and to a lesser degree an indicator of mode shift to walking and biking.

Address the Need for Sustainability and Environmental Justice

To account for this broad-ranging objective, a number of specific performance measures were developed related to sustainability and environmental justice/social equity, as listed in Tables TA 7.6 and 7.7. The categories developed for this objective are greenhouse gas reduction, non-motorized travel, land-use/transportation connection, and social equity.

Table TA 7.6 – Sustainability Performance Measures

Performance Measure	Definition
Estimated Change in Greenhouse Gas Emissions	The performance metric for this category is a model-derived estimate of the change in regional greenhouse gas emissions as compared to the future baseline scenario. A reduction in greenhouse gas emissions from the future baseline scenario would be a positive indicator.
Non-Motorized Travel: Peak period non-motorized mode share in the UATS study area, and All-day non-motorized mode share in the UATS study area	Measuring the change in both peak period and all-day non-motorized mode share (walking and biking) provides insight into how both the transit network and the regional bike network accommodate travel demand and also change travel behavior. Increases in the mode share for walking and biking as compared to the future baseline scenario are considered a positive measure of overall mobility and accessibility.
Compatibility with Regional Bike Plan	Compatibility with the Regional Bike Plan is measured by calculating the number of miles of regional bicycle facilities that are located within a half-mile of a major transit station. This measure provides a quantitative estimate of the connection between bike and transit facilities and thus an indicator of transit system accessibility to other non-motorized travel modes.
Percent of jobs within a 1/4 mile and 1/2 mile of major transit stations	Measuring the percent of jobs within a 1/4 and 1/2 mile of major transit stations provides an assessment of how well the transit system is providing service to employment areas within the region. The selection of jobs within 1/4 mile from transit stations is significant in that studies have shown that proximity to the employment site is of higher importance for transit riders than proximity to housing locations. Therefore, locating new transit facilities and services to be within 1/4 mile of major employment areas would improve transit's ability to attract new transit riders. However, both distances were ultimately evaluated and reported.
Percent of housing units within a 1/2 mile of major transit stations, with 10- and 15-minute or better service levels	Similar to measuring the percent of jobs, measuring the percent of housing units with access to transit service provides an assessment of regional accessibility to transit and thus overall mobility as well. Generally 1/2 mile is considered a standard threshold for how far people are willing to walk to access transit and was therefore selected as the quantitative measurement for housing units. This measure was also evaluated with additional layers reflecting 10- and 15-minute or better service levels.
Compatibility with regional activity centers (hospitals, universities, colleges, shopping malls, tourist attractions)	This performance measure provides a quantitative estimate of the number of regional activity centers located within 1/2 mile of a major transit station. Again, considering that 1/2 mile is a generally accepted standard, the number of regional activity centers was calculated based on the location of existing and proposed major transit centers as compared to the future baseline scenario. This quantitative measure is used to estimate the relative accessibility and mobility provided by the individual transit network alternatives.

Environmental Justice and Social Equity

The environmental justice and social equity category is focused on the accessibility and mobility provided by the transit network alternatives as they relate to minority, low income, elderly, and households without vehicles. Four performance measures were developed to assess the ability for these specific population segments to access transit facilities and services. The performance measures, listed in Table TA 7.7, are assessed within the broader San Diego region and are also compared against the future baseline scenario.

Table TA 7.7 – Environmental Justice Performance Measures

Performance Measure	Definition
Percent of minority and non-minority populations within 1/2 mile of a major transit station Percent of low-income and non-low-income households within 1/2 mile of a major transit station Percent of aged 75+ population within 1/4 mile of a major transit station and 1/4 mile of all transit stations Percent of zero-car households within 1/2 mile of major transit stations	These performance measures address the accessibility of transit to a population base that may have previously received limited benefits or dis-benefits from other infrastructure projects. These populations include minority or low-income populations or households respectively, or a population that is expected to increase, such as the elderly, or a population that would greatly benefit from increased access to transit, such as households with no available vehicles. These performance measures were assessed based on the 1/2 mile to a major station, except the aged 75+ population category, which used 1/4 mile, as generally this population may find it more difficult to walk longer distances. These performance measures are used to estimate the relative accessibility for the identified populations provided by the alternative transit networks as compared to the future baseline scenario. As such, comparative improvements in the percentage of any of these populations within the designated mileage would be considered a positive change.

All of the above noted measures were used to assess and evaluate the three alternative transit networks developed for the UATS. Technical Appendix D summarizes the initial performance of the transit network alternatives from a comparative standpoint and provides the associated numeric data. The performance of the alternatives is further described in the "Analysis Results" segment of Section 8 of this report.

8. Transit Network Alternatives

A key task in the UATS included assembling an international team of PB professional consultants to help develop concepts and cost estimates for alternative transit networks. The PB Professional Consulting Team convened in San Diego in January 2010 over four days (biographies of the team are included in Technical Appendix E), with their visit culminating in the development of three initial transit concepts. The three concepts were intentionally designed to vary significantly from one another in order to test how transit strategies that are fundamentally different from one another might function in the long term when compared across the identified performance measures.

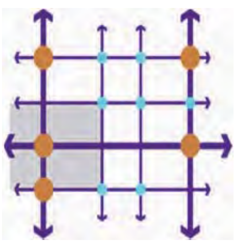
Development of the transit network concepts began with an assessment of the existing transportation system and land use patterns in the San Diego region and an evaluation of projected travel demand based on output and results from the SANDAG regional travel demand model. The project team also reviewed SANDAG's Smart Growth Concept Map, the 2050 Regional Growth Forecast land use inputs, findings from the Lessons Learned from Peer Regions Report, and the results of the brainstorming sessions conducted at the outset of the project.

The project team was tasked with creating three ambitious, visionary, and far reaching transit networks that respond to the region's transit needs by building upon the existing transit network and addressing future travel patterns and demand. The first step in creating the transit networks was the development of key themes or scenarios to guide the process.

The three themes that emerged were: Transit Propensity, Commuter Point-to-Point, and Many Centers. The theme for Transit Propensity was to focus transit investments in the most urbanized areas of San Diego. The theme for Commuter Point-to-Point was to provide high quality, fast transit service to employment centers. And the theme for Many Centers was to connect local smart growth areas and regional activity centers with transit. The graphics below represent the three themes. The graphics were based on initial working maps created by the PB Professional Consulting Team during its stay in San Diego, as shown in Figures TA 7.9, 7.10, and 7.11.

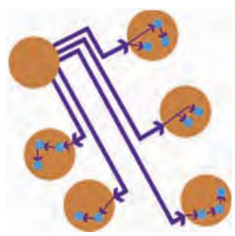
Transit Propensity

Expands Transit in the Most Urbanized Areas



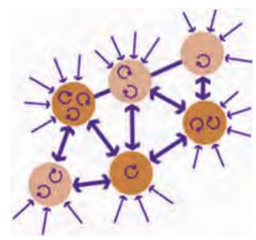
Commuter Point-to-Point

Emphasizes Quick Access to Work



Many Centers

Connects Local Smart Growth Areas and Activity Centers



The project team proposed the following guiding concepts for the development of the transit routes and services that would be coded and modeled for each transit network alternative:

Transit Propensity: Builds on the San Diego region's backbone trolley system – expands transit in the central core and in the region's most urbanized areas, many of which are characterized by pre-World War II street grid patterns. Provides very frequent transit services, alleviating riders from having to consult schedules and facilitating easy transfer connections. Major investments include streetcars, grade separations, priority treatments, transit nodes, expanded light rail, enhanced bike and walk access, and improvements to the public realm.

Commuter Point-to-Point: Transit to work is an easy option – leverages new dedicated transit facilities and flexible use of Managed Lanes to serve work trips. A system of few transfers provides high speed, reliable commute options during peak periods with a variety of "last-mile" treatments. Major investments include Managed Lanes with in-line stations, park and ride lots, new fixed guideways, and some rail expansion.

Many Centers: Supports the San Diego region's local commitments to smart growth – consists of a multi-radial transit system serving many of the region's smart growth areas and major activity centers. Transit services are oriented toward the centers, and supported with frequent connections between the centers. Major investments include a variety of transit priority treatments between centers, expanded light rail, enhanced transit centers, shuttles and streetcars connecting to the transit centers, enhanced bike and walk access, and improvements to the urban realm.

Network Development

The project team next identified new transit routes and services based on the guiding concepts for the alternative networks. The highway network and the land use assumptions of each transit network were held constant. Generally, the alternatives built upon the highway and transit projects included in the 2030 Regional Transportation Plan, and assumed the land use inputs from the 2050 Regional Growth Forecast.

Common Projects

All three alternatives included the following major infrastructure components: High Speed Rail (HSR) to an intermodal transit center at San Diego International Airport, commuter rail overlay utilizing the HSR alignment, double-tracking of the COASTER and SPRINTER rail lines, a Downtown San Diego Trolley Tunnel, and a bus transit "guideway" from downtown San Diego to Mission Valley and Kearny Mesa (referred to as the "Kearny Mesa Guideway" in the UATS process, and defined as a dedicated street/infrastructure network that would facilitate faster and more reliable travel times for existing local buses, new BRT, and Rapid Bus services in the congested corridor that links downtown San Diego with Hillcrest, Mission Valley, and Kearny Mesa and connects a number of key employment areas and residential communities).

The following discussion provides additional detail on the routes and services that were specific to each of the network alternatives.

Transit Propensity Alternative

The Transit Propensity alternative focused on providing new transit services within the downtown and inner-ring suburbs of San Diego where higher intensity, mixed land uses enhance access to transit and support transit use. In addition, the Transit Propensity alternative included localized services for the downtown areas of the larger suburban communities to facilitate first-mile/last-mile connections in these areas. In addition to the common projects listed above, the network included two new trolley lines, nine new streetcar lines, one new BRT route, two new rapid bus routes, and infrastructure connecting the I-15 BRT services to the Green Line at Mission San Diego. The following services are illustrated conceptually in a "subway-style" format in Figure TA 7.12.

New Trolley Lines

- San Diego State University to downtown San Diego via Mid-City communities
- San Diego State University to South Bay/Chula Vista/H Street Station via Mid-City communities, southeastern San Diego communities, and National City.

New Streetcar Lines

- Downtown Escondido – East/West route from Escondido Transit Center to Fig Street
- Downtown Oceanside – Oceanside Transit Center to Coast Highway SPRINTER Station
- Pacific Beach to MidCoast – connecting North Pacific Beach, Pacific Beach and MidCoast Balboa Station
- 30th Avenue – connecting University Heights, North Park, South Park, East Village and downtown San Diego
- Hillcrest to Downtown – connecting Hillcrest and downtown San Diego via 4th and 5th Avenues
- Little Italy to Gaslamp Loop – connecting Little Italy, Smart Corner, East Village, and Gaslamp
- Downtown El Cajon – connecting El Cajon Transit Center to downtown El Cajon
- Downtown Chula Vista – connecting E Street and H Street Stations to downtown Chula Vista
- National City – connecting 8th Street Station to new UTC to South Bay trolley

New Bus Rapid Transit Routes

- Mid-City to University Towne Center

New Rapid Bus Routes

- Euclid Trolley Station to Grantville Trolley Station
- Ocean Beach to Old Town Transit Center

Transit Infrastructure

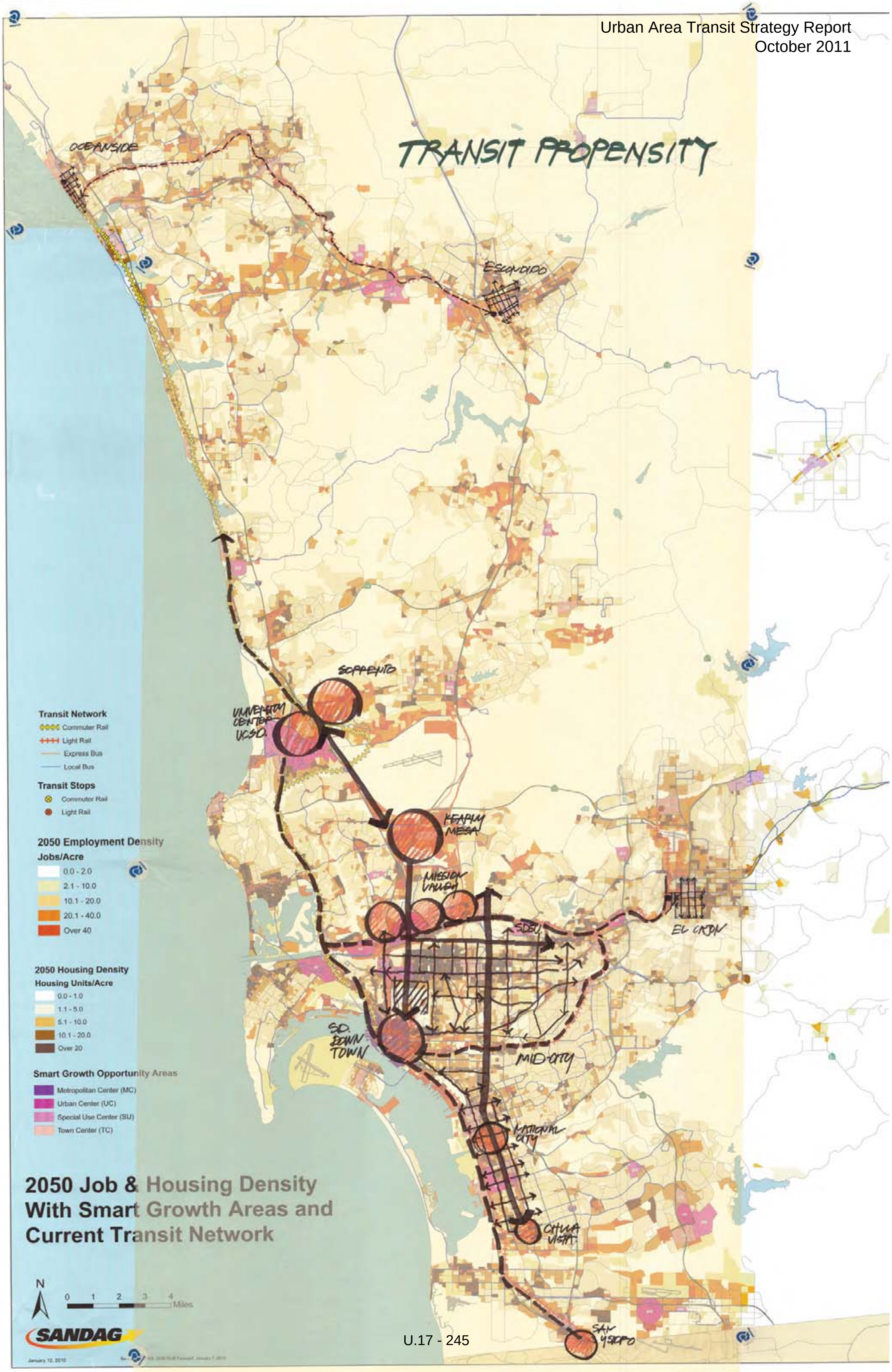
- Infrastructure connecting I-15 managed lanes BRT routes to the Mission San Diego Green Line Trolley Station

Typical Peak Period Transit Service Standards

- Trolley – 7.5 minute service
- SPRINTER – 15 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – 10 minute service
- COASTER – 20 minute service
- Commuter Rail on HSR – 15 minute service
- Rapid Bus – 10 minute service
- Local Bus – 10 minute service

Commuter Point-to-Point Alternative

The Commuter Point-to-Point alternative focused on providing new transit services to major employment centers within the region, primarily in peak commute hours, using a variety of bus-based transit services. Because work trips are routine trips, they are generally easier to capture on transit than discretionary trips. In addition to the common projects referenced earlier, the network included 15 new or revised BRT routes, six new rapid bus routes, three shuttles/revised local routes, extension of the COASTER and additional stops, new infrastructure connecting the I-15 BRT services to the Green Line at Mission San Diego, and new park-and-ride facilities. The following services are shown in Figure TA 7.13.


TRANSIT PROPENSITY
OCEANSIDE
ESCONDIDO
SORRENTO
UNIVERSITY CENTER UCSD
KEARNY MESA
MISSION VALLEY
SDSU
EL CAJON
SD. DOWNTOWN
MID-CITY
NATIONAL CITY
CHULA VISTA
SAN YSIDRO
Transit Network
Commuter Rail
Light Rail
Express Bus
Local Bus
Transit Stops
Commuter Rail
Light Rail
2050 Employment Density
Jobs/Acre
0.0 - 2.0
2.1 - 10.0
10.1 - 20.0
20.1 - 40.0
Over 40
2050 Housing Density
Housing Units/Acre
0.0 - 1.0
1.1 - 5.0
5.1 - 10.0
10.1 - 20.0
Over 20
Smart Growth Opportunity Areas
Metropolitan Center (MC)
Urban Center (UC)
Special Use Center (SU)
Town Center (TC)
2050 Job & Housing Density
With Smart Growth Areas and
Current Transit Network
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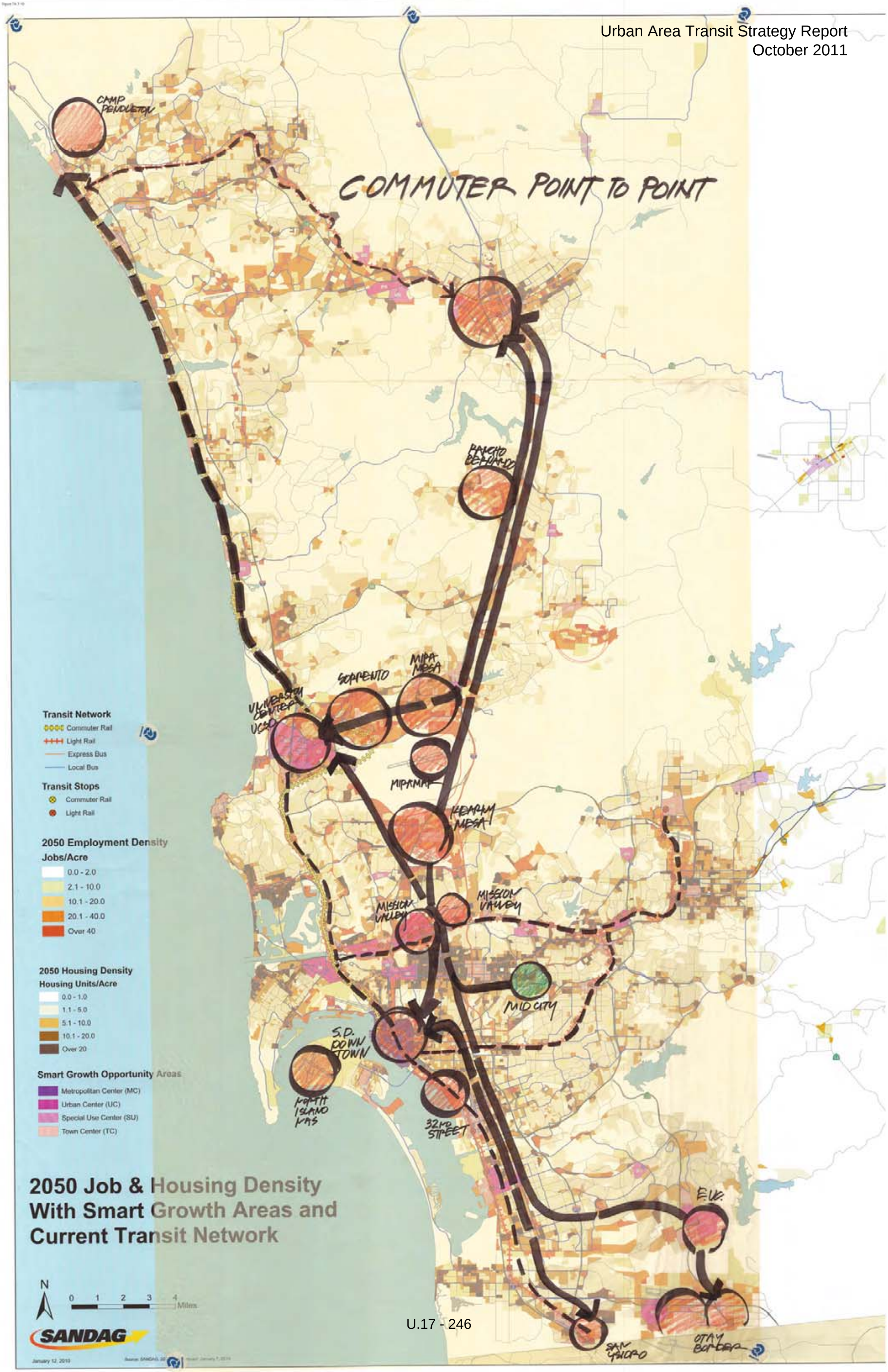
CAMP PENDLETON
COMMUTER POINT TO POINT
RANCHO BERNARDO
SORRENTO
MIRA MESA
UNIVERSITY CENTER UCSD
MIRAMAR
KEARNY MESA
MISSION VALLEY
MISSION VALLEY
MID CITY
S.D. DOWN TOWN
NORTH ISLAND NAS
32ND STREET
E.V.
SAN YSIDRO
OTAY BORDER
Transit Network
Commuter Rail
Light Rail
Express Bus
Local Bus
Transit Stops
Commuter Rail
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2050 Employment Density
Jobs/Acre
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2.1 - 10.0
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20.1 - 40.0
Over 40
2050 Housing Density
Housing Units/Acre
0.0 - 1.0
1.1 - 5.0
5.1 - 10.0
10.1 - 20.0
Over 20
Smart Growth Opportunity Areas
Metropolitan Center (MC)
Urban Center (UC)
Special Use Center (SU)
Town Center (TC)
2050 Job & Housing Density
With Smart Growth Areas and
Current Transit Network
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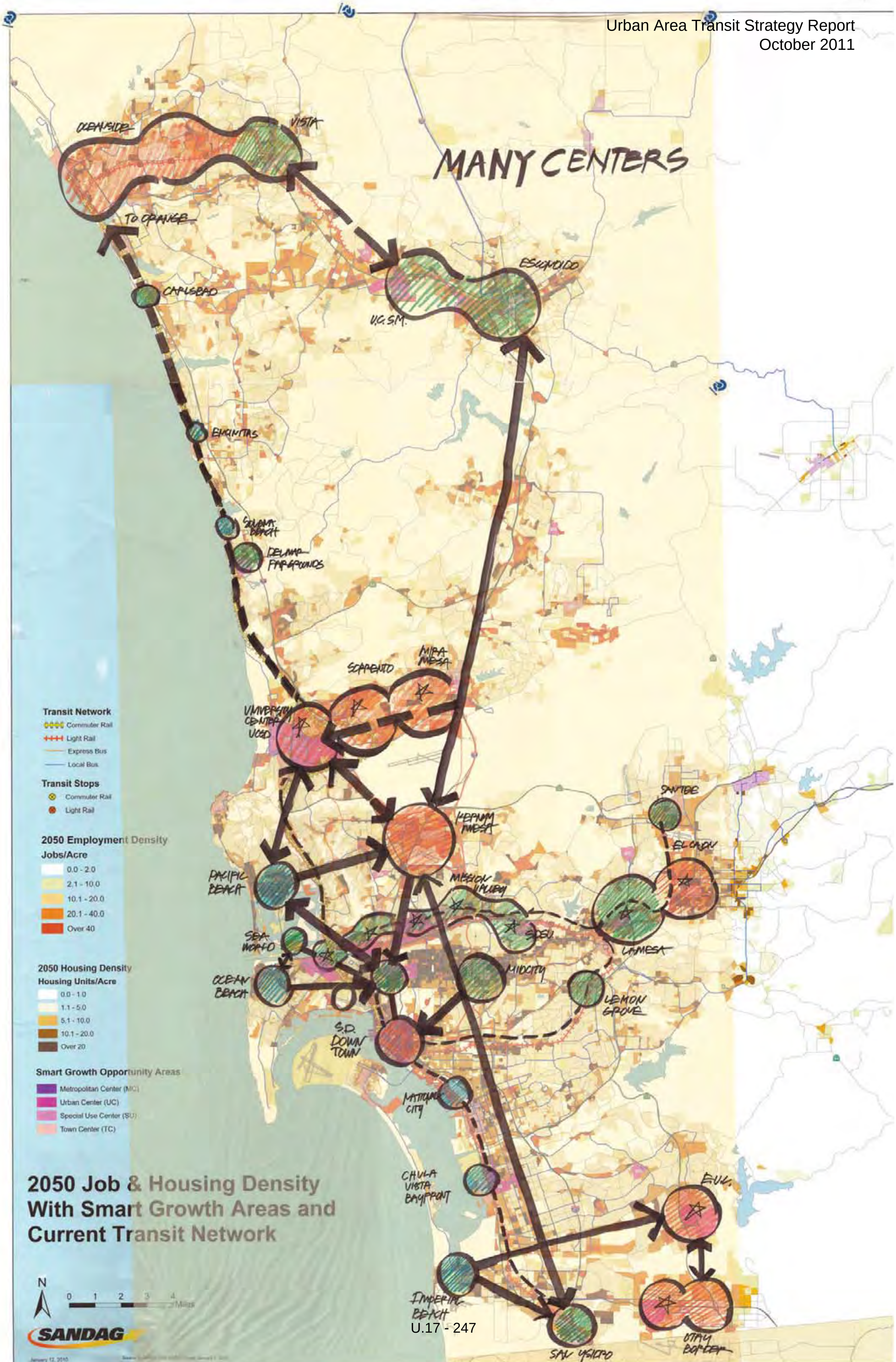
SANDAG
January 12, 2010


MANY CENTERS
OCEANSIDE
VISTA
TO ORANGE
CARLSBAD
U.C.S.M.
ENCINITAS
SOLANA BEACH
DELMAR FAIRGROUNDS
SORRENTO
MIRA MESA
UNIVERSITY CENTER UCSD
KEARNY MESA
PACIFIC BEACH
MISSION VALLEY
SEA WORLD
OCEAN BEACH
MIDCITY
SDSU
LA MESA
LEMON GROVE
SANTEE
EL CAJON
S.D. DOWNTOWN
NATIONAL CITY
CHULA VISTA BAYFRONT
E.U.C.
IMPERIAL BEACH
SAN YSIDRO
OTAY BORDER
Transit Network
Commuter Rail
Light Rail
Express Bus
Local Bus
Transit Stops
Commuter Rail
Light Rail
2050 Employment Density
Jobs/Acre
0.0 - 2.0
2.1 - 10.0
10.1 - 20.0
20.1 - 40.0
Over 40
2050 Housing Density
Housing Units/Acre
0.0 - 1.0
1.1 - 5.0
5.1 - 10.0
10.1 - 20.0
Over 20
Smart Growth Opportunity Areas
Metropolitan Center (MC)
Urban Center (UC)
Special Use Center (SU)
Town Center (TC)
2050 Job & Housing Density With Smart Growth Areas and Current Transit Network
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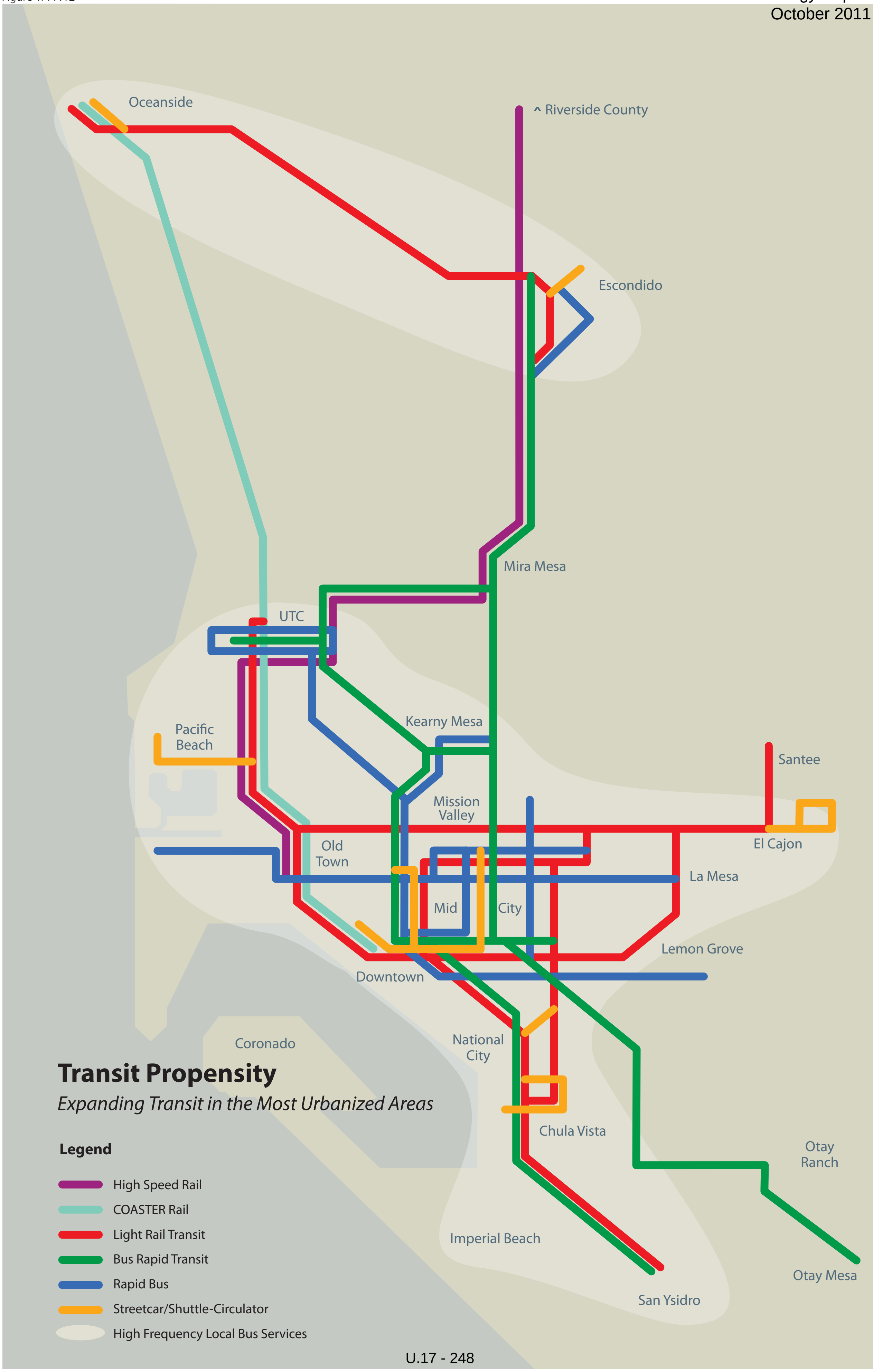
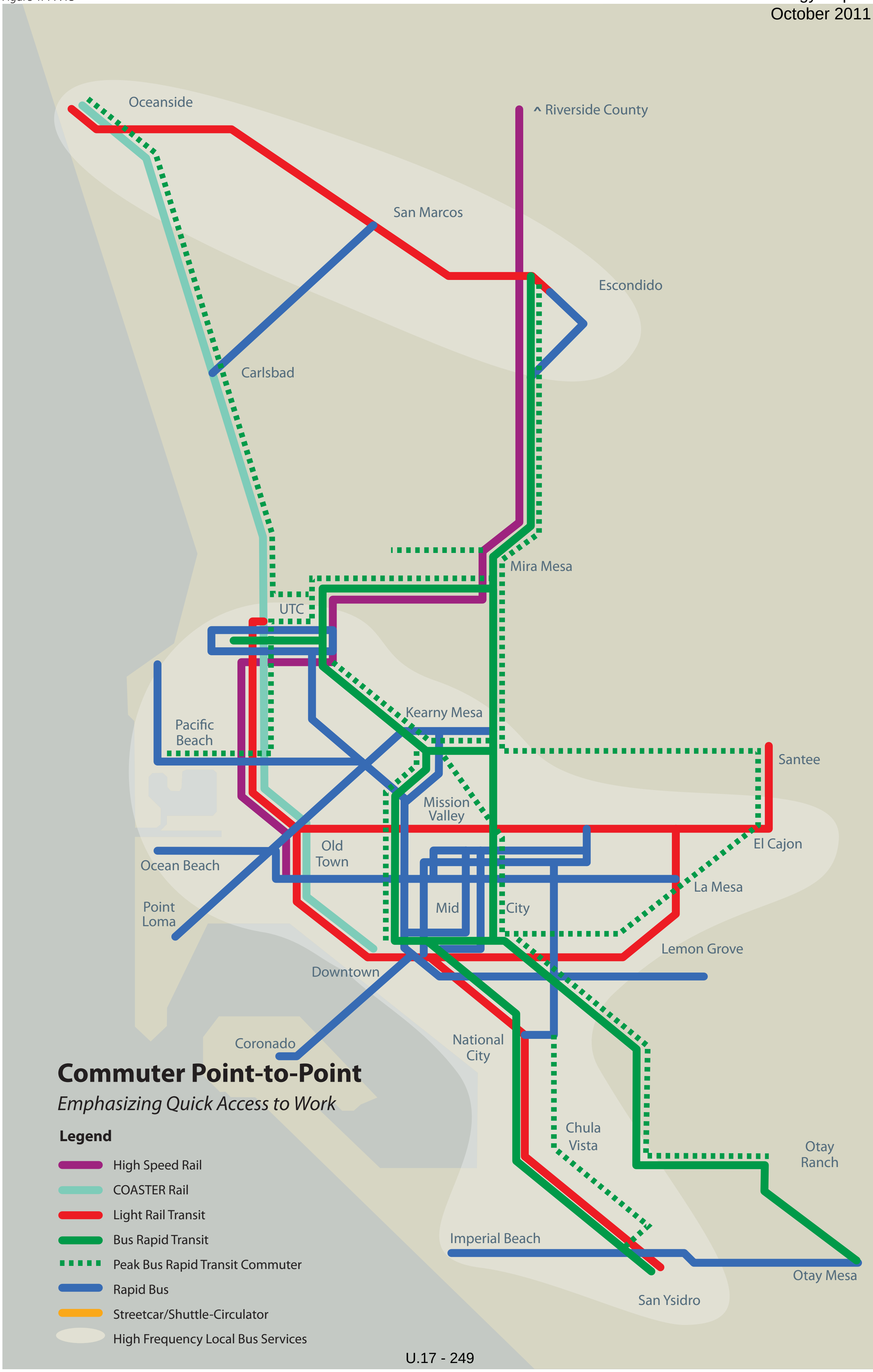
0 1 2 3 4 Miles
SANDAG


Oceanside
Riverside County
Escondido
Mira Mesa
UTC
Kearny Mesa
Pacific
Beach
Santee
Mission
Valley
El Cajon
Old
Town
La Mesa
Mid
City
Lemon Grove
Downtown
Coronado
National
City
Transit Propensity
Expanding Transit in the Most Urbanized Areas
Chula Vista
Legend
Otay
Ranch
High Speed Rail
COASTER Rail
Light Rail Transit
Bus Rapid Transit
Rapid Bus
Imperial Beach
Streetcar/Shuttle-Circulator
Otay Mesa
San Ysidro
High Frequency Local Bus Services


Oceanside
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Mira Mesa
UTC
Kearny Mesa
Pacific Beach
Santee
Mission Valley
El Cajon
Old Town
Ocean Beach
La Mesa
Point Loma
Mid
City
Lemon Grove
Downtown
Coronado
National City
Chula Vista
Otay Ranch
Imperial Beach
Otay Mesa
San Ysidro
Commuter Point-to-Point
Emphasizing Quick Access to Work
Legend
High Speed Rail
COASTER Rail
Light Rail Transit
Bus Rapid Transit
Peak Bus Rapid Transit Commuter
Rapid Bus
Streetcar/Shuttle-Circulator
High Frequency Local Bus Services

New Trolley Lines

- None

New Streetcar Lines

- None

New Bus Rapid Transit Routes

- Oceanside to Sorrento Mesa
- Escondido to Mira Mesa and Sorrento Mesa – North Route
- Escondido to Mira Mesa and Sorrento Mesa – South Route
- Escondido to UCSD
- Escondido to Kearny Mesa
- Pacific Beach to University Towne Center and Sorrento Mesa
- South Bay (Iris Trolley Station) to Kearny Mesa
- Mid-City to Sorrento Valley
- Mid-City to University Town Center
- El Cajon to Kearny Mesa
- El Cajon to Sorrento Mesa
- El Cajon to University Towne Center
- Chula Vista (Palomar/I-805) to Kearny Mesa
- Chula Vista (Palomar/I-805) to Sorrento Mesa
- Otay Ranch to University Towne Center

New Rapid Bus Routes

- San Marcos to Poinsettia COASTER Station
- La Jolla to Kearny Mesa via Pacific Beach
- Ocean Beach to La Mesa via Old Town Transit Center
- Point Loma to Kearny Mesa
- Downtown San Diego to Coronado/North Island Naval Complex
- Otay Mesa to Imperial Beach

New Shuttle Services/Revised Local Routes

- Poway Business Park Shuttle
- Miramar Shuttle
- Improved Bus Service to COASTER (Route 302 and 309)

COASTER Commuter Rail

- Extend COASTER to Camp Pendleton – station at Vandegrift
- Added stops at Balboa Avenue, UTC, and Lindbergh Field ITC

Transit Infrastructure

- Infrastructure connecting I-15 managed lanes BRT routes to the Mission San Diego Green Line Trolley Station
- Additional park-and-ride facilities

Typical Peak Period Transit Service Standards

- Trolley – 7.5 minute service
- SPRINTER – 15 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – no services
- COASTER – 15 minute service
- Commuter Rail on HSR – 15 minute service
- Rapid Bus – 15 minute service
- Local Bus – 15 minute service

Many Centers Alternative

The Many Centers alternative focused on creating a network of new transit services, linked by regional transit hubs, to connect designated smart growth areas, major activity centers, and major employment and residential areas. In addition to providing new trolley routes, this alternative provides enhanced shuttle and streetcar services to provide quick and convenient access from transit centers to the surrounding area. In addition to the common projects, the network included five new trolley lines, seven new streetcar lines, four new BRT routes, five new rapid bus routes, 16 new shuttle/revised local routes, extension of the HSR line to Otay Mesa, new transit/pedestrian/bicycle infrastructure in Kearny Mesa and new park-and-ride facilities. The following services are shown in Figure TA 7.14.

New Trolley Lines

- La Jolla/University City to Mira Mesa via Sorrento Mesa
- University City to Chula Vista via Kearny Mesa, Mission Valley, Mid-City, southeastern San Diego communities, and National City
- Pacific Beach to El Cajon via Clairemont, Kearny Mesa, Mission Valley, SDSU, and La Mesa
- San Marcos to Carlsbad via the Palomar Airport Road corridor
- Otay Mesa to Chula Vista via Otay Ranch

New Streetcar Lines

- Escondido – North/South route from Escondido Transit Center to Citricado Parkway
- Downtown Oceanside – Neptune Way to Coast Highway SPRINTER Station along Cleveland St
- Hillcrest to Downtown Loop – connecting Hillcrest, Uptown, Balboa Park and downtown San Diego
- Little Italy to Gaslamp Loop – connecting Little Italy, Smart Corner, East Village, and Gaslamp
- Chula Vista – connecting E Street and H Street Stations to downtown Chula Vista
- National City – connecting 8th Street Station to new UTC to South Bay trolley
- Downtown El Cajon – connecting El Cajon Transit Center to downtown El Cajon

New Bus Rapid Transit Routes

- Oceanside to Sorrento Mesa
- El Cajon to University Towne Center
- Mid-City to University Towne Center
- Otay Ranch to University Towne Center

New Rapid Bus Routes

- Old Town Transit Center to University Towne Center
- Ocean Beach to La Mesa via Old Town Transit Center
- Downtown San Diego to Coronado/North Island Naval Complex
- Eastern Urban Center/Otay Ranch to H Street Station
- Otay Mesa to Imperial Beach

New Shuttle Services/Revised Local Routes

- Palomar Hospital to Nordahl Station
- Palomar College to downtown San Marcos
- Buena Station to Palomar Airport Road
- Palomar Airport Business Park Loop
- Solana Beach to Sabre Springs park-and-ride
- Solana Beach to University Towne Center
- Poway Business Park Shuttle
- Northern Sorrento Mesa Shuttle
- Southern Sorrento Mesa Shuttle
- Torrey Pines to University Towne Center
- Campus Point to University Towne Center
- University Towne Center South Shuttle Loop
- Kearny Mesa East Shuttle
- Mesa College Shuttle
- Mission Valley Shuttle System (3 routes)
- Eastern Urban Center Shuttle

High Speed Rail

- Extend HSR from Airport Intermodal Transit Center to Otay Mesa

Transit Infrastructure

- Transit/pedestrian/bicycle infrastructure (new roadway) in Kearny Mesa
- Additional park-and-ride facilities

Typical Peak Period Transit Service Standards

- Trolley – 7.5 minute service

- SPRINTER – 7.5 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – 10 minute service
- COASTER – 15 minute service
- Commuter Rail on HSR – 15 minute service
- Rapid Bus – 10 minute service
- Local Bus – 10 minute service

Analysis Results – Transit Network Alternatives

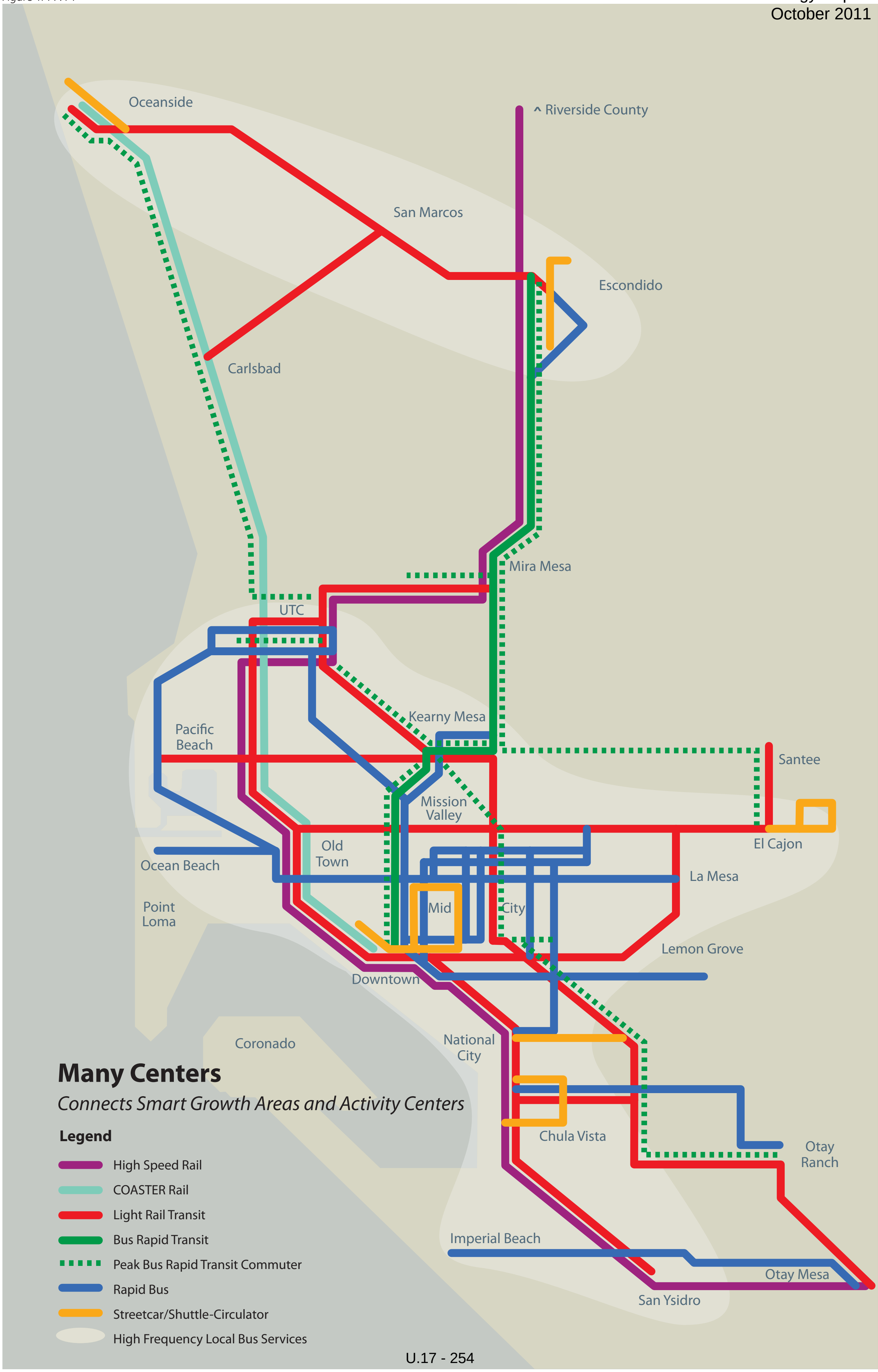
The performance analysis compares the three transit networks against one another and against the 2050 Baseline scenario. The 2050 Baseline scenario consisted of an overlay of the 2030 RTP transportation network (highway and transit) and the land use assumptions included in the 2050 Regional Growth Forecast. As noted earlier, the highway network was held constant for all of the alternative transit networks as well as the 2050 Baseline scenario, in order to isolate the performance of the alternative transit networks. The performance measure results for the three alternatives are discussed below and are presented comparatively and numerically in Technical Appendix D. In addition, capital and operating cost estimates for each network were prepared. These are described in Section 10 of this report.

Transit Mode Share

When reviewing the peak period home-to-work transit mode share results, the Many Centers alternative had the highest transit mode share by corridor/area of the three alternatives, with ten of the 14 areas projected to achieve the mode share goal. The Many Centers alternative was also projected to have the highest overall Urban Area transit mode share at 11.8 percent compared to 10.6 percent for the Transit Propensity and 10.3 percent for the Commuter Point-to-Point. None of the alternatives was projected to meet or exceed the transit mode share goal of 30 percent or greater for downtown San Diego, although the Transit Propensity and Many Centers alternatives were projected to be close, at 28.3 percent and 28 percent, respectively.

Generally, the Many Centers alternative achieved the highest mode share of the three alternatives with 12 of 14 areas and the overall Urban Area being highest, while the Transit Propensity alternative had the highest mode share for three areas, including downtown San Diego and the Central Core area. The Commuter Point-to-Point network achieved eight transit mode share goals, but did not have the highest transit mode share in any area. The mode share results are summarized below in Table TA 7.8.

Geographic corridors and areas where none of the alternatives were projected to meet the mode share goals included downtown San Diego, Central Core, Oceanside/Escondido Corridor, and the North Central Coastal Area. A possible reason for this non-attainment could be due to the measurement, which only calculated the peak period home-to-work trip for the destination areas. If the measure had included the home-to-work trips that are originating in these areas, it is possible the goals could have been achieved. Another explanation for downtown San Diego and the Central Core could be that these areas are reaching their practical capacity for transit mode share and could only be significantly increased by very dramatic changes in the level of transit, combined with other transit supportive policies related to parking, transit priority measures and/or employment growth (discussed below). With regards to the Oceanside/Escondido Corridor and the North Central Coastal Area, the surrounding land uses and low-density development patterns are challenging to serve efficiently with transit, and it is likely that only very significant transit investments, again combined with other transit supportive policies related to parking, transit priority measures, land use densities and mixes, and/or employment growth, would modify trip making behavior.



Many Centers

Connects Smart Growth Areas and Activity Centers

Legend

- High Speed Rail
- COASTER Rail
- Light Rail Transit
- Bus Rapid Transit
- Peak Bus Rapid Transit Commuter
- Rapid Bus
- Streetcar/Shuttle-Circulator
- High Frequency Local Bus Services

Table TA 7.8 – Peak Period Home-to-Work Transit Mode Share Results[1]

Identified Corridors/Areas	2008 Existing	2050 Goal Ranges	Transit Propensity	Commuter Point-to-Point	Many Centers
Peak Period Home-to-Work Transit Mode Share Results					
Major Employment Areas					
Downtown San Diego	24.0%	30% +	28.3%	26.4%	28.0%
University City	3.2%	15%-20%	14.1%	14.7%	16.5%
Sorrento Mesa	1.9%	10%-15%	9.4%	11.5%	11.8%
Kearny Mesa	2.6%	10%-15%	11.1%	10.9%	14.6%
Otay Mesa/Otay Ranch	2.7%	5%-10%	6.2%	4.1%	7.4%
Palomar Airport	1.4%	5%-10%	4.6%	5.3%	7.4%
High Activity Areas					
Central Core	11.8%	20%-25%	18.1%	16.3%	17.8%
Oceanside/Escondido Corridor	2.9%	10%-15%	7.1%	7.2%	7.5%
Other Urbanized Areas					
North I-15 Corridor	0.6%	5%-10%	4.3%	6.3%	6.7%
North Central Coastal Area	1.9%	10%-15%	9.2%	8.8%	8.5%
Central Coastal Area	4.7%	10%-15%	11.0%	11.0%	12.5%
Coastal South Bay	7.5%	10%-15%	12.6%	10.8%	12.8%
East County/El Cajon	4.2%	10%-15%	9.2%	8.3%	10.4%
East County/Santee	2.9%	5%-10%	6.6%	6.3%	7.5%
Urban Area Transit Strategy Study Area	**5.2%**	**10%-15%**	**10.6%**	**10.3%**	**11.8%**

[1] Values represent peak period home-to-work trip transit mode share for destination districts.

Transit Ridership

As illustrated in Table TA 7.9, the Many Centers alternative was projected to experience the largest differences from the 2050 Baseline scenario, with an overall increase in all transit measures in the 15 percent to 17 percent range – considerably more than either the Transit Propensity or Commuter Point-to-Point alternatives. Interestingly, the Many Centers alternative was projected to experience a less than one percent decrease in persons walking or biking to transit and an approximate five percent increase in auto access to transit. This outcome could be due to the addition of four new trolley lines that would be serving areas that have somewhat lower densities and thus walking distances that are outside of typical walk and bike thresholds.

The Transit Propensity alternative had the next highest changes in transit ridership measures, with improvements in the five to seven percent range. What is perhaps more interesting is the decrease in the percent of riders accessing transit by auto and the moderate increase in riders walking or biking to transit. The Commuter Point-to-Point alternative was projected to experience the smallest change in transit ridership measures, with only a one percent change in transit person trips and a less than five percent change in transit passenger miles and peak period person trips. The Commuter Point-to-Point alternative experienced a nearly eight percent increase in riders accessing transit by auto, which is not unexpected considering that this alternative focused more on transit based on Managed Lanes and park-and-ride access points that extended into suburban areas.

Table TA 7.9 – Transit Ridership Performance Measure Results

Transit Ridership Measures	2050 Baseline	Transit Propensity	Commuter Point-to-Point	Many Centers
Change in Transit Person Trips (Regional)	401,178	7.3%	1.0%	15.3%
Change in Transit Passenger Miles (Regional)	5,196,725	3.9%	4.0%	14.7%
Change in Transit Peak Period Person Trips (Regional)	177,768	7.4%	4.5%	17.5%
Change in Mode of Access to Transit				
Walking/Biking	89.8%	0.7%	-0.9%	-0.5%
Auto (drove and driven)	10.2%	-6.1%	7.9%	4.7%

Transportation Network Efficiency

The transportation network efficiency measures provide the ability to understand how efficiently the transit network and the overall transportation network are functioning for each alternative scenario. Results for those measures are shown in Table TA 7.10. In reviewing the passenger mile per transit seat mile, all of the alternatives perform relatively closely, with the Transit Propensity and Commuter Point-to-Point alternatives performing slightly better than the Many Centers alternative. Interestingly, all alternatives perform slightly less efficiently than the 2050 Baseline alternative. This result is due to the considerable increase in transit service in all of the alternatives as compared to the 2050 Baseline scenario. This result also points to the need for further refinements to the three alternative networks, as particular route segments or service levels could be eliminated or reduced.

When reviewing the overall transportation network performance measures, all three alternatives provide reductions in the per capita vehicle miles traveled. However, the Many Centers alternative is projected to have the largest reduction at -0.4 percent, compared to -0.1 percent for the Transit Propensity and Commuter Point-to-Point, respectively. The same pattern is apparent when assessing the change in per capita vehicle hours and per capita vehicle trips, with projected reductions for the Many Centers alternative higher than the other two alternatives. Again, additional refinements to transit routes and services as well as the base highway assumptions would likely produce additional improvements in these efficiency measures.

Table TA 7.10 – Efficient Transportation Network Performance Measure Results

Efficient Transportation Network Measures	2050 Baseline	Transit Propensity	Commuter Point-to-Point	Many Centers
Passenger Miles per Transit Seat Mile	47%	38%	38%	34%
Change in Auto Vehicle Miles Traveled (VMT) per capita	26.9	-0.1%	-0.1%	-0.4%
Change in Auto Vehicle Hours Traveled (VHT) per capita	0.8	-0.3%	-0.2%	-0.8%
Change in Auto Vehicle Trips per capita	3.5	-0.1%	0.0%	-0.3%

Sustainability

A number of performance measures were identified to assess the sustainability of the transit network alternatives, as well as the underlying transportation network. As noted in Table TA 7.11 below, the greenhouse gas analysis was not completed at the time of screening, but other sustainability performance measures were available for review and assessment. Both the peak period and all-day non-motorized mode share values did not vary by alternative and were not projected to change from the 2050 Baseline scenario projections of 3.3 percent and 3.0 percent, respectively. However, the number of bike facilities within a 1/2 mile of a major transit station projected for all alternatives is projected to be higher than for the 2050 Baseline scenario, at 166 miles, 190 miles, and 192 miles for the Transit Propensity, Commuter Point-to-Point and Many Centers alternatives, respectively.

The 2050 Baseline scenario is projected to provide transit service within a 1/4 mile to approximately 21 percent of the total regional employment. The Commuter Point-to-Point alternative provides transit service to the highest percent of total regional employment, at nearly 31 percent. This result is not surprising, as the alternative was designed to focus on providing transit service to regional employment centers. The Many Centers alternative provides transit service within a 1/4 mile of 28 percent of all regional jobs, with the Transit Propensity alternative projected to cover approximately 25 percent of all regional employment. These numbers increase when the 1/4 mile radius is expanded to 1/2 mile. This is further detailed in Technical Appendix D.

The percentage of housing units projected to be within 1/2 mile of a major transit station with ten minute or better service is nearly 40 percent for the Many Centers alternative, approximately 31 percent for Transit Propensity, and 19 percent for the Commuter Point-to-Point alternative. These values are compared to approximately 23 percent for the 2050 Baseline scenario. The lesser value for the Commuter Point-to-Point is due to the focus on provision of peak period, one-seat ride commute trips, which generally have longer distances and longer headways between scheduled trips. These percentages increase when measuring the proportion of housing units projected to be within 1/2 mile of a major transit station with 15 minutes or better. This is further detailed in Technical Appendix D. When assessing the percent of housing units within 1/2 mile of a major transit station with 15-minute service frequencies, the values for the three alternatives are more similar, at 39 percent, 37 percent, and 40 percent for Many Centers, Transit Propensity and Commuter Point-to-Point, respectively.

Table TA 7.11 – Sustainability Performance Measure Results

Sustainability	2050 Baseline	Transit Propensity	Commuter Point-to-Point	Many Centers
Estimated Change in GHG (tentative)	Not available at time of screening			
Peak Period Non-Motorized Mode Share in Urban Area	3.3%	3.3%	3.3%	3.3%
All-Day Non-Motorized Mode Share in Urban Area	3.0%	3.0%	3.0%	3.0%
Compatibility with Regional Bike Plan (miles of bike facilities within 1/2 mile of major transit station)	146	166	190	192
Percent of Jobs within 1/4 Mile of Major Transit Stations	21.3%	25.5%	30.8%	28.1%
Percent of Housing Units w/in 1/2 Mile of Major Transit Stations with 10 Minute or Better Service	23.4%	31.5%	19.1%	38.8%
Percent of Housing Units within 1/2 mile of Major Transit Stations with 15 Minute or Better Service	31.2%	36.6%	39.8%	39.4%
Compatibility with Regional Activity Centers (Hospitals, Universities/Colleges, Shopping Malls, and Tourist Attractions within 1/2 Mile of Major Transit Stations)	40	45	47	48

Compatibility with regional activity centers is roughly similar for all three alternatives. The 2050 Baseline scenario is projected to provide service to a major transit station within 1/2 mile to 40 regional activity centers. The Transit Propensity alternative is projected to increase the number of activity centers to 45, Commuter Point-to-Point is estimated to be 47, and the Many Centers alternative to 48.

Environmental Justice

As shown in Table TA 7.12, the percent of minority populations projected to be within 1/2 mile of major transit stations is 34 percent for the 2050 Baseline scenario, 40 percent for the Transit Propensity, 43 percent for the Commuter Point-to-Point, and approximately 42 percent for the Many Centers alternative. Results for the percent of low-income households within one-half mile of major transit stations is 50 percent for both the Commuter Point-to-Point and Many Centers alternatives, and 48 percent for the Transit Propensity alternative, compared to approximately 41 percent for the 2050 Baseline scenario. Title VI requires analysis of the burdens of regional transportation system improvements on low-income and minority populations. Measures in this category must evaluate the comparative percent improvement between low-income and non-low-income populations and minority and non-minority populations. The data for these measures indicates no disparate impacts for either of these measures.

The percent of aged 75+ populations is calculated using 1/4 mile distance. As noted earlier, this population group is likely to find it difficult to walk longer distances. All alternatives are expected to provide improved access to transit to the percent of persons aged 75+ than the 2050 Baseline scenario with a projected percentage of approximately 13 percent. The Transit Propensity alternative is projected to reach 15 percent, Commuter Point-to-Point nearly 16 percent, and Many Centers nearly 17 percent. When calculated for all transit stations, not just major transit stations, the percentages increase to approximately 57-58 percent for all scenarios.

The percent of zero-car households within 1/2 mile of major transit stations is 44 percent for the 2050 Baseline scenario, compared to 52 percent, 55 percent, and nearly 55 percent for the Transit Propensity, Commuter Point-to-Point, and Many Centers alternatives, respectively. It should be noted that this performance measure is based on the 2000 census data, as the SANDAG regional model does not calculate future projections for this category.

Table TA 7.12 – Environmental Justice Performance Measure Results

Environmental Justice	2050 Baseline	Transit Propensity	Commuter Point-to-Point	Many Centers
Percent of Minority Populations within 1/2 Mile of Major Transit Stations	34.4%	39.8%	42.7%	42.5%
Percent of Non-Minority Populations within 1/2 Mile of Major Transit Stations	20.2%	23.4%	26.2%	25.6%
Percent of Low-Income Households within 1/2 Mile of Major Transit Stations	41.4%	48.1%	50.5%	50.5%
Percent of Non-Low-Income Households within 1/2 Mile of Major Transit Stations	18.0%	20.8%	23.9%	23.2%
Percent of 75+ Population within 1/4 Mile of Major Transit Stations	12.7%	15.3%	15.6%	16.6%
Percent of 75+ Population within 1/4 Mile of All Transit Stations	58.7%	58.5%	58.3%	57%
Percent Zero-Car Households within 1/2 Mile of Major Transit Stations (2000 census data)	43.9%	52.1%	55.0%	54.6%

Cost Effectiveness

As stated in Section 7, due to a number of factors, data for cost effectiveness measures was not completed. Comparable data that was produced centered on preliminary rough-order-of-magnitude (ROM) capital cost estimates for each alternative transit network, further discussed in Section 10 (Capital Costs and Methodology).

Summary Analysis of Performance Measures Results

The above discussed results show that all three scenarios yielded improvements ranging from modest to significant in most performance measures when compared against the 2050 Baseline scenario, with the exception of transit passenger miles per transit seat mile. The analysis also showed that while none of the scenarios performed the best in all categories, the Many Centers scenario appeared to have the highest overall performance. The Many Centers alternative also comes with the highest capital and operating costs. The analysis also showed that there were effective elements in the Transit Propensity, Commuter Point-to-Point, and Many Centers alternatives that could be refined and developed into a combined strategy.

Peer Review Panel

SANDAG commissioned a Peer Review Panel to take a critical look at the three transit network alternatives. The Peer Review Panel consisted of professionals in land use, economics, transportation, congestion management, transit management, and transit oriented development from the United States and Europe. Peer Review Panel member biographies are included in Technical Appendix F.

Generally, the Peer Review Panel felt that the Transit Propensity and Many Centers transit networks had the most merit and could each result, to varying degrees, in a successful long-term transit network. The Panel predicted that the plan's ultimate success would be through the implementation of near-term demonstration or catalyst projects that showcase elements of the transit vision, particularly the integration of transit into smart growth areas.

More specifically, the Panel made the following observations about the scenarios:

Transit Propensity: The Panel observed that this scenario may have been too focused on some geographically-concentrated areas to the exclusion of other areas (such as major employment areas, University City, and North County) to meet the region's long-term mobility goals.

Commuter Point-to-Point: The Panel felt that this scenario may encourage longer trips by both autos and transit, and that this scenario portrayed a more "business as usual" approach that may not have the ability to influence land use decisions toward more integrated communities and sustainability.

Many Centers: The Panel commented that this scenario provided a solid vision, but needed refinements, including prioritizing transit investments in existing and near-term smart growth areas. The Panel also recommended that SANDAG revisit its Smart Growth Concept Map and consider making changes that might combine smaller smart growth areas into larger ones, thereby creating "smarter" smart growth areas and concepts.

In addition, the Panel provided broader, more global observations on economic competitiveness; technological savvy; world-class region; sustainability and co-benefits; land use development around transit stations; land use, freeways, and parking; project prioritization; leadership; and dedicated funding sources. Technical Appendix G contains the additional detail and information on the Peer Review Panel comments.

9. Unconstrained Transit Network

Based on the comments from the Peer Review Panel, the performance measure results, and input from SANDAG working groups, Policy Committees, the SANDAG Board of Directors, and the public workshops, the project team developed a hybrid transit network that would not be constrained by revenue projections. This new transit network, known as the Unconstrained Transit Network, pulled in the best elements of the three transit network alternatives and incorporated refinements and modifications to some of the proposed routes and transit services. The Unconstrained Transit Network was developed for the RTP's horizon year of 2050 and represented the region's vision for transit improvements and operations to meet travel demand in 2050. As a result, it established the broadest network from which the revenue constrained network scenarios would later be developed.

Like the three initial transit network alternatives, the Unconstrained Transit Network included the following major infrastructure components: High Speed Rail (HSR) to an intermodal transit center at San Diego International Airport, commuter rail overlay using the HSR alignment, double-tracking of the COASTER and SPRINTER rail lines, the Downtown San Diego Trolley Tunnel, and the Kearny Mesa Guideway. Also included in the Unconstrained Network were a downtown bus tunnel and transit hubs to facilitate bus travel through downtown, the extension of the HSR with commuter rail service from the San Diego International Airport to the United States-Mexico international border crossing in Otay Mesa, and the UTC COASTER station and tunnel.

The new transit routes and services contained in the Unconstrained Transit Network included six new trolley lines, ten new streetcar lines, 11 new BRT routes, 21 new Rapid Bus routes, 16 new shuttle/revised local routes, upgrades to Trolley and SPRINTER lines for Express service, an extension of the SPRINTER to the Fig Street in Escondido, and additional park-and-ride facilities. Figure TA 7.15 graphically depicts the services included in the Unconstrained Transit Network.

New Trolley Lines

- San Diego State University to San Ysidro
- San Diego State University to downtown San Diego
- Villa La Jolla to Mira Mesa
- University Towne Center to Chula Vista
- Pacific Beach to Kearny Mesa/SDSU/El Cajon
- Otay Mesa to Chula Vista

New Streetcar Lines

- Escondido – East/West route from Escondido Transit Center to Fig Street
- San Marcos – connecting California State University San Marcos, downtown San Marcos and Palomar College
- Downtown Oceanside – Oceanside Transit Center to Oceanside Boulevard SPRINTER Station
- Mission Bay to La Jolla – connecting Mission Bay, Pacific Beach and La Jolla
- Hillcrest to Downtown Loop – connecting Hillcrest, Uptown, Balboa Park and downtown San Diego
- Little Italy to Gaslamp Loop – connecting Little Italy, Smart Corner, East Village, and Gaslamp
- 30th Avenue – connecting University Heights, North Park, South Park, East Village and downtown San Diego.
- Chula Vista – connecting E Street and H Street Stations to downtown Chula Vista
- National City – connecting 8th Street Station to new UTC to South Bay trolley
- Downtown El Cajon – connecting El Cajon Transit Center to downtown El Cajon

New Bus Rapid Transit Routes

- Rancho Bernardo to downtown San Diego Express
- Escondido to downtown San Diego Express
- Temecula/Escondido to Kearny Mesa/downtown San Diego
- Chula Vista to Palomar Airport/San Marcos
- Downtown San Diego to University Towne Center
- Mid-City to Palomar Airport/San Marcos
- Otay Mesa to El Cajon
- El Cajon to University Towne Center
- El Cajon to Sorrento Mesa/Torrey Pines
- Oceanside to Sorrento Mesa
- Escondido to Oceanside

New Rapid Bus Routes

- 30th Avenue to downtown San Diego
- La Mesa to Ocean Beach
- Spring Valley to downtown San Diego to SDSU
- Point Loma to Kearny Mesa
- Old Town to La Jolla/University Towne Center/Sorrento Mesa
- Old Town/Mission Valley to Clairemont/University Towne Center
- Kearny Mesa to downtown San Diego
- Euclid Trolley Station to Grantville
- Escondido to North County Fair
- Palomar Airport Road/Carlsbad to San Marcos
- Escondido Rapid
- Oceanside to University Towne Center
- Oceanside to Vista
- Camp Pendleton to Carlsbad Village
- Eastlake to Palomar Trolley Station
- SDSU to Spring Valley
- North Park to 32nd Street
- San Ysidro to Otay Mesa
- Iris Trolley Station to North Island Naval Air Station
- Eastern Urban Center to H Street Trolley Station
- Downtown to Coronado/North Island Naval Air Station

New Shuttle Services/Revised Local Routes

- Palomar Hospital to Nordahl Station
- Palomar College to downtown San Marcos
- Buena Station to Palomar Airport Road
- Palomar Airport Business Park Loop
- Solana Beach to Sabre Springs park-and-ride
- Solana Beach to University Towne Center
- Poway Business Park Shuttle
- Northern Sorrento Mesa Shuttle
- Southern Sorrento Mesa Shuttle
- Torrey Pines to University Towne Center
- Campus Point to University Towne Center
- University Towne Center South Shuttle Loop

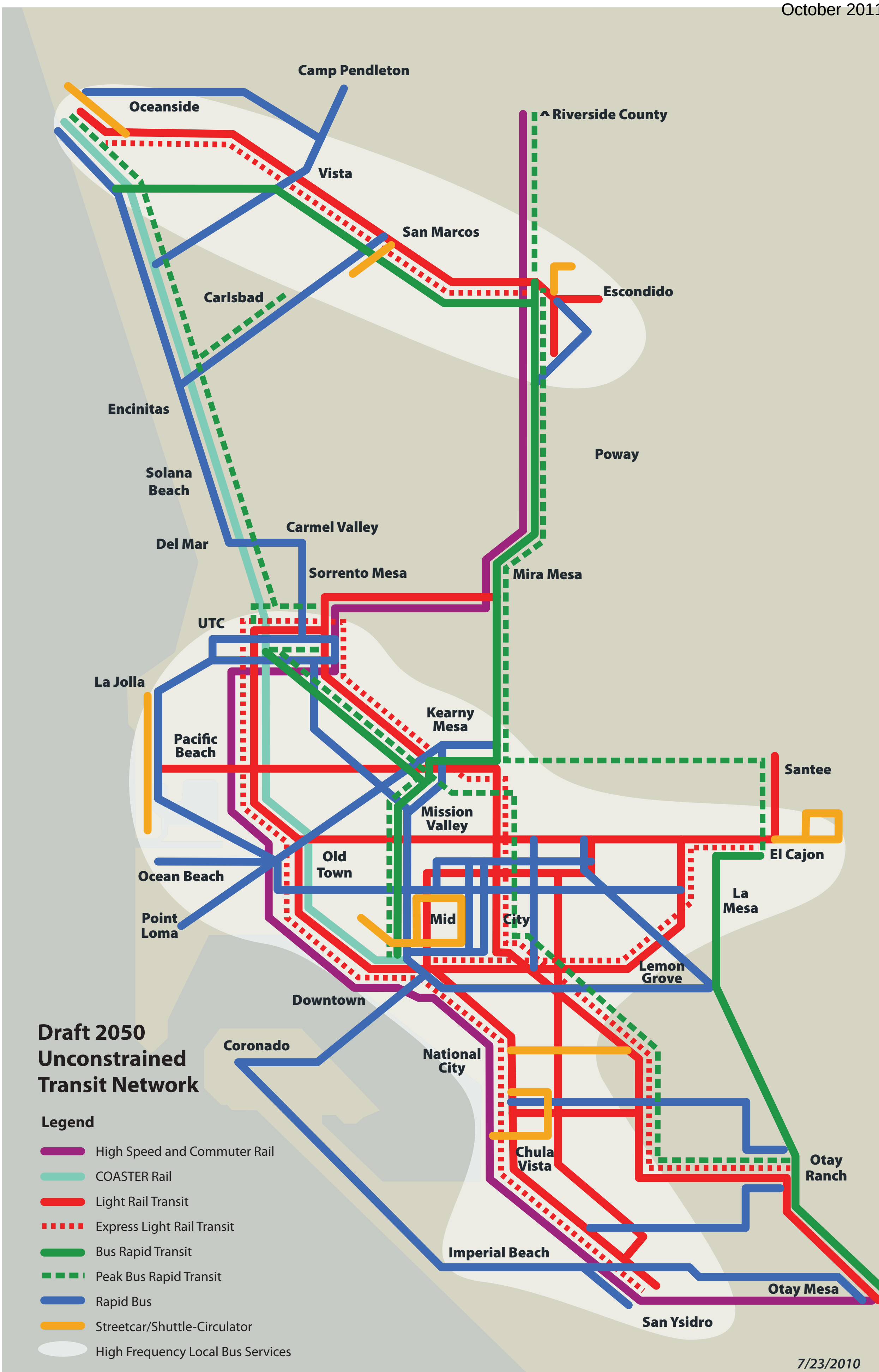
- Kearny Mesa East Shuttle
- Mesa College Shuttle
- Mission Valley Shuttle System (3 routes)
- Eastern Urban Center Shuttle

Transit Infrastructure

- Transit/pedestrian/bicycle infrastructure (new roadway) in Kearny Mesa
- Kearny Mesa Guideway
- Downtown Trolley Tunnel
- Downtown bus tunnel and transit hubs
- UTC COASTER station and tunnel
- Additional park-and-ride facilities

Typical Peak Period Transit Service Standards

- Trolley – 7.5 minute service
- SPRINTER – 7.5 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – 10 minute service
- COASTER – 15 minute service
- Commuter Rail on HSR – 15 minute service
- Rapid Bus – 10 minute service
- Local Bus – 10 minute service


Camp Pendleton
Oceanside
Riverside County
Vista
San Marcos
Escondido
Carlsbad
Encinitas
Poway
Solana Beach
Carmel Valley
Del Mar
Sorrento Mesa
Mira Mesa
UTC
La Jolla
Kearny Mesa
Pacific Beach
Santee
Mission Valley
El Cajon
Old Town
Ocean Beach
La Mesa
Point Loma
Mid
City
Lemon Grove
Downtown
Draft 2050 Unconstrained Transit Network
Coronado
National City
Legend
High Speed and Commuter Rail
COASTER Rail
Light Rail Transit
Express Light Rail Transit
Bus Rapid Transit
Peak Bus Rapid Transit
Rapid Bus
Streetcar/Shuttle-Circulator
High Frequency Local Bus Services
Chula Vista
Otay Ranch
Imperial Beach
Otay Mesa
San Ysidro
7/23/2010

Transit Mode Share

When reviewing the transit mode share results for the Unconstrained Transit Network, the overall patterns were similar to those for the three initial transit alternatives, with ten of the fourteen areas meeting the mode share goals. In general, the Unconstrained Transit Network showed very similar results to the Many Centers alternative. The highest transit mode shares under the Unconstrained Transit Network scenario were in downtown San Diego, University City, the Central Core, and the Central Coastal areas. The overall transit mode share for the UATS study area was projected to be 11.4 percent, as compared to 11.8 percent for Many Centers, 10.6 percent for Transit Propensity and 10.3 percent for Commuter Point-to-Point (Table TA 7.13).

Table TA 7.13 – Peak Period Home to Work Transit Mode Share Results for the Three Initial Transit Network Alternatives and for the Unconstrained Transit Network[1]

Peak Period Home-to-Work Transit Mode Share Results					
Identified Corridors/Areas	**2050 Goal Ranges**	**Transit Propensity**	**Commuter Point-to-Point**	**Many Centers**	**Unconstrained Transit Network**
Major Employment Areas					
Downtown San Diego	30% +	28.3%	26.4%	28.0%	29.4%
University City	15%-20%	14.1%	14.7%	16.5%	17.1%
Sorrento Mesa	10%-15%	9.4%	11.5%	11.8%	10.4%
Kearny Mesa	10%-15%	11.1%	10.9%	14.6%	13.4%
Otay Mesa/Otay Ranch	5%-10%	6.2%	4.1%	7.4%	7.5%
Palomar Airport	5%-10%	4.6%	5.3%	7.4%	5.6%
High Activity Areas					
Central Core	20%-25%	18.1%	16.3%	17.8%	18.3%
Oceanside/Escondido Corridor	10%-15%	7.1%	7.2%	7.5%	7.1%
Other Urbanized Areas					
North I-15 Corridor	5%-10%	4.3%	6.3%	6.7%	5.9%
North Central Coastal Area	10%-15%	9.2%	8.8%	8.5%	8.4%
Central Coastal Area	10%-15%	11.0%	11.0%	12.5%	14.3%
Coastal South Bay	10%-15%	12.6%	10.8%	12.8%	12.7%
East County/El Cajon	10%-15%	9.2%	8.3%	10.4%	10.0%
East County/Santee	5%-10%	6.6%	6.3%	7.5%	7.1%
Urban Area Transit Strategy Study Area	**10%-15%**	**10.6%**	**10.3%**	**11.8%**	**11.4%**

[1] Values represent peak period home-to-work trip transit mode share for destination districts.

10. Capital and Operating Costs and Methodology

Capital Cost Estimates

Methodology

The Parsons Brinckerhoff project team developed Rough-Order-of-Magnitude (ROM) capital cost estimates for the newly identified transit routes and services in each initial transit network alternative (Transit Propensity, Commuter Point-to-Point, and Many Centers) and for the Unconstrained Transit Network for the following transit modes:

- Light Rail Transit (LRT)
- Bus Rapid Transit (BRT)
- Rapid Bus
- Commuter Rail
- Streetcar

These cost estimates were developed using a methodology that is consistent with Federal Transit Administration (FTA) guidelines, the basis of which is the Standard Cost Category (SCC) format. The FTA Standard Cost Categories used to develop the capital cost components were classified into the following cost categories:

10 Guideway and Track Elements

20 Station, Stops, Terminals and Intermodal

30 Support Facilities: yards, shops, and administration buildings (not used)

40 Sitework and Special Conditions

50 Systems

60 Right of Way, Land and Existing Improvements

70 Vehicles (not used)

80 Professional Services

90 Unallocated Contingency (10%)

100 Finance Charges (not used)

Capital cost estimates were developed for every new transit project proposed in each transit network alternative. Individual transit routes and services were estimated based on high-level assumptions and information for at-grade, aerial or tunnel alignments, the number of stations, and the use of existing roadway facilities such as freeway managed lanes, etc. These cost estimates were developed using historical prices for similar types of work. Right of way costs were developed based on historical right of way costs incurred as a percentage of construction cost in San Diego on transit projects. No engineering was performed to verify these costs, and finance charges were not assumed.

Support facilities such as maintenance facilities, yard, administration buildings, etc., and vehicles and vehicle replacement costs were not accounted for in the Parsons Brinckerhoff estimates. The costs of these facilities and vehicles were added later when the overall system needs had been defined.

Contingencies

During the early stages of design, significant uncertainties exist to the extent that the work scope is often limited to a broad description of horizontal and vertical alignments. At this phase of the project development process, inherent uncertainties that could limit capital cost estimates included:

- Standard Design Criteria
- Scope and Quantity Definition
- Commodity Pricing
- Unforeseen Problems

As such, two levels of contingencies were applied at the project level, and a third level of contingency was applied at the network level. At the project level, the first contingency included allocated contingencies by FTA SCC line item (generally in the 10 - 40 percent range) to address lack of scope and/or quantity definition based on the Standard Cost Categories for construction or professional services categories. The second contingency, also at the project level, was the application of an unallocated contingency of ten percent to each individual project to cover unknowns that cannot be anticipated, but are prudent to include for planning purposes. These were calculated as ten percent of the total project cost estimate, including the soft costs, as reflected in Standard Cost Category 90 above. The third contingency was applied at the network level, and consisted of an unallocated contingency of 20 percent to cover additional system-wide unknowns for new projects. This contingency was calculated as 20 percent of the total sum of all new projects contained in each transit network alternative.

Although the actual capital cost of each project may ultimately vary significantly from that developed here, the overall cost of the system improvements is expected to be a reasonable estimate when used for the comparison of system-wide alternatives. Technical Appendix H, Planning Level Capital Cost Estimating Methodology Report (New Projects), provides additional detail and information.

Capital Cost Estimates for the Initial Transit Network Alternatives

The cost estimates represent new transit routes and services developed for the individual transit network alternatives as of June 2010, and do not include the capital costs associated with ongoing transit projects included in the 2030 RTP that carry over into the 2050 RTP. Those costs were updated and refined as part of the 2050 RTP planning process and later incorporated into the overall cost of the Unconstrained Transit Network, the initial Revenue Constrained Transit Networks, the Preferred Revenue Constrained Transit Network, and ultimately, the 2050 Revenue Constrained Transit Network included in the Final 2050 RTP. Examples include double-tracking of the COASTER, the Mid-Coast Trolley extension, the South Bay BRT, and other transit projects.

Table TA 7.14 provides the following information for each transit network alternative: the level of investment for new transit projects by transit mode, the subtotal for new transit projects, the 20 percent network-level unallocated contingency, and the total preliminary capital cost estimates for the new transit projects. All costs are shown in 2009 dollars (totals may differ due to rounding).

There were various similarities among the network alternatives. For example, two major cost components of all three alternatives were the Downtown San Diego Trolley Tunnel, estimated at $2.160 billion, and the Kearny Mesa Guideway at $2.753 billion. These are reflected in the “infrastructure” line item (and described further below), along with other less-costly infrastructure investments. The three alternatives also included a number of shuttle services and changes to local bus services. These transit modes are not reflected in the table, as no capital costs for facilities or infrastructure was assumed since these services would utilize existing roadways and transit facilities, such as existing stops.

Where the alternatives differed was in the provision of service by major transit mode. The Transit Propensity alternative had a large investment in new trolley lines and streetcar lines, again with a focus on providing all-day service to areas of existing density. The Commuter Point-to-Point focus was on the provision of BRT and Rapid Bus service, with some extension and augmentation of COASTER service, focusing on providing commuter-based peak period services. Lastly, the Many Centers alternative was heavily weighted toward the provision of new trolley lines, followed by streetcar service, and to a lesser degree Rapid Bus, focusing on providing service to a larger portion of the UATS study area.

Table TA 7.14 – Preliminary Capital Cost Estimates for the Three Initial Transit Network Alternatives[1] (2009 Dollars)

Transit Mode	Transit Propensity	Commuter Point-to-Point	Many Centers
Light Rail Transit	$2,180.0 M	$0.0 M	$4,310.5 M
Bus Rapid Transit	$9.3 M	$363.4 M	$72.1 M
Streetcar	$986.7 M	$0.0 M	$802.2 M
Rapid Bus	$49.8 M	$361.0 M	$228.8 M
Commuter Rail	$0.0 M	$151.5 M	$0.0 M
Supporting Transit Infrastructure [2]	$5,134.6 M	$5,134.6 M	$5,770.2 M
Subtotal	**$8,360 M**	**$6,102 M**	**$11,184 M**
20% Network Level Unallocated Contingency	$1,672 M	$1,220.4 M	$2,236.8 M
Total	**$10,032 M**	**$7,213 M**	**$13,421 M**

[1] New transit projects only

[2] Includes capital infrastructure that supports more than one transit service (e.g., Downtown Trolley Tunnel and Kearny Mesa Guideway) for all three alternatives, plus bike/pedestrian access to transit improvements in Kearny Mesa and other areas for the Many Centers alternative.

As reflected in Table TA 7.14, the Many Centers alternative had the highest capital cost of the three transit scenarios at approximately $13.4 billion; the Transit Propensity network fell in the middle at approximately $10 billion; and the Commuter Point-to-Point alternative was the least costly at approximately $7.2 billion.

Capital Cost Estimates for Unconstrained Transit Network

The capital cost estimate for the Unconstrained Transit Network contained many of the routes and services included in all three transit networks, refinements and modifications to some of the proposed routes and transit services, and the addition of items that were not originally included in the cost estimates of the three initial alternatives. As such, the cost estimate for the Unconstrained Transit Network was considerably larger than for any of the three alternatives.

As reflected below in Table TA 7.15, the initial Unconstrained Transit Network had a capital cost estimate double that of the most costly Many Centers network alternative. The increase in costs was minimally attributable to route modifications and cost refinements, and mostly attributable to the incorporation of various large-scale infrastructure items that were not originally included in the cost estimates for the three initial alternatives. In particular, the Del Mar and UTC COASTER tunnels were incorporated into the Commuter Rail line item; a bus tunnel and transfer hubs in downtown San Diego were added to the Infrastructure line item; and an update for the cost to double-track the SPRINTER line and modifications to allow Express runs on the Blue, Orange, and Green Trolley lines, and the SPRINTER were reflected in the Light Rail Transit line item. The last column in Table TA 7.15

reflects these changes, and results in an initial approximate capital cost of $27.5 billion for the Unconstrained Transit Network, which was subsequently further refined, as discussed below.

Table TA 7.15 – Preliminary Capital Cost Estimates for the Unconstrained Transit Network (2009 Dollars)

Transit Mode	Transit Propensity	Commuter Point-to-Point	Many Centers	Unconstrained Transit Network
Light Rail Transit	$2,180.0 M	$0.0 M	$4,310.5 M	$8,554.1 M [1]
Bus Rapid Transit	$9.3 M	$363.4 M	$72.1 M	$324.9 M
Streetcar	$986.7 M	$0.0 M	$802.2 M	$1344.6 M
Rapid Bus	$49.8 M	$361.0 M	$228.8 M	$978.1 M
Commuter Rail	$0.0 M	$151.5 M	$0.0 M	$3,477.1 M [2]
Supporting Transit Infrastructure [3]	$5,134.6 M	$5,134.6 M	$5,770.2 M	$8,198.6 M [4]
Subtotal	$8,360 M	$6,102 M	$11,184 M	$22,877 M
20% Network Level Unallocated Contingency	$1,672 M	$1,220.4 M	$2,236.8 M	$4,575.4 M
Total	**$10,032 M**	**$7,213 M**	**$13,421 M**	**$27,452 M** [5]

[1] Includes updated costs to double track SPRINTER and modifications to allow express runs on Blue, Orange, and Green Trolley lines and SPRINTER line

[2] Includes Del Mar and UTC COASTER tunnels

[3] Includes capital infrastructure that supports more than one transit service (e.g. Downtown Trolley Tunnel and Kearny Mesa Guideway) for all three alternatives and the Unconstrained Transit Network; bike/pedestrian access to transit improvements in Kearny Mesa and other areas for the Many Centers alternative and Unconstrained Transit Network

[4] A bus tunnel and transfer hubs in downtown San Diego

[5] Initial total; see additional refinements below

Additional Refinements

These preliminary capital cost estimates for the Unconstrained Transit Network produced by Parsons Brinckerhoff did not include transit maintenance facilities, transit system rehabilitation costs, and vehicle and vehicle replacement costs. These costs were subsequently added, resulting in an estimated capital cost of $33 - $38 billion, and an operating subsidy cost (total operating cost minus fare revenues) of $6 - 8 billion (see methodology below), for a total Unconstrained Transit Network cost of $39 - $46 billion, as of July 2010, in 2009 dollars.

These cost estimates continued to be refined throughout the remainder of the RTP planning process. For example, the capital costs of ongoing transit projects included in the 2030 RTP that would carry over into the 2050 RTP, as well as other refinements, were incorporated into the Revenue Constrained Transit Network Scenarios, the Preferred Revenue Constrained Transit Network, and then subsequently into the 2050 Revenue Constrained Transit Network. Ultimately, the final capital costs were converted to Year-of-Expenditure, as required by federal guidelines that went into effect December 11, 2007, for the preparation of regional transportation plans. The Year-of-Expenditure costs are included in the main body of the RTP while the final costs in constant 2010 dollars[2] are detailed in the 2050 RTP Technical Appendix 5.

[2] The 2009 initial network costs were converted to 2010 dollars for the transportation network in the RTP.

Operating Cost Estimates

Methodology

To calculate the initial operating costs for both existing and new transit services in the Unconstrained Transit Network, the Revenue Constrained Transit Networks, the Preferred Revenue Constrained Transit Network, and the 2050 Revenue Constrained Transit Network, SANDAG used revenue hours from the regional transportation model, and applied hourly operating rates based on 2009 information provided by MTS and NCTD. The hourly operating rates were applied to the following service types:

- Bus (MTS)
- Contract Bus (MTS)
- Contract Bus (NCTD)
- Rapid Bus
- BRT Highway
- Trolley/Streetcar
- COASTER/HSR Commuter Rail Overlay
- SPRINTER
- Additional factor to account for complementary Americans with Disabilities Act (ADA) service cost

An initial farebox recovery rate was assumed for all modes for three-fourths of the life of the plan (30 years) for the Unconstrained Transit Network until phasing could be conducted. Phasing was later conducted as part of the Preferred Revenue Constrained Transportation Network and the 2050 Revenue Constrained Transit Network, which allowed for significant refinements to the initial operating cost and farebox recovery ratio that was reported in July 2010. See the 2050 RTP Technical Appendix 5 for additional information on the final operating costs in constant 2009 dollars.

11. Revenue Constrained Transportation Network Scenarios

Based on revenue projections to 2050, four initial Revenue Constrained Transportation Network Scenarios were developed using the prioritized project ranking list (Technical Appendix I) and other factors. The four revenue constrained scenarios contained both transit and highway networks that matched up complimentary combinations of transit and highway investments, with varying levels of emphasis on investment options. The scenarios are illustrated in a side-by-side format in Technical Appendix J, and summarized as follows:

- **Transit Emphasis Scenario** – Focused on expansion of the regional transit system given flexible funding availability.
- **Rail/Freight Scenario** – Focused on expansion of the regional transit system with an emphasis on rail projects and also highway improvements to support freight given flexible funding availability.
- **Highway Emphasis Scenario** – Focused on expansion of highway system improvements that provide system-wide congestion relief for people and freight given flexible funding availability.
- **Fusion Scenario** – Focused on implementing projects and programs considering the preferred choices identified in the 2050 RTP telephone survey. The choices from the survey included emphasis on new public transit services (rail and bus), highway improvements (bottleneck relief and new lanes), and increased frequencies to existing transit routes.

Transit Projects Common to All Scenarios

Several transit projects were common to all four Scenarios, including a number of "baseline" or ongoing projects (most of them included in the *TransNet* Extension Ordinance) that are in various stages of advanced planning, design, or construction, but were not projected to be completed by the time the 2050 RTP was adopted. It was, therefore, necessary to assume the costs and construction of these projects in the transit networks of all four Scenarios. These baseline projects included:

- Mid-Coast Trolley extension
- Trolley system rehabilitation
- Interstate 15 (I-15) Bus Rapid Transit (BRT) from Escondido to downtown San Diego
- I-15 BRT from Escondido to Sorrento Mesa/University City
- South Bay BRT from Otay Mesa to downtown San Diego
- Mid-City Rapid Bus from San Diego State University to downtown San Diego
- South Bay transit maintenance facilities and downtown BRT stations/layovers

Other projects from the Unconstrained Transportation Network common to all four Scenarios included:

- High-Speed Rail (HSR) from Los Angeles to Lindbergh Field Intermodal Transportation Center (ITC)
- HSR Commuter Rail Overlay from Temecula to Lindbergh Field ITC
- Lindbergh Field Intermodal Transit Center
- COASTER double-tracking (*TransNet*), including several grade separations
- COASTER Del Mar Tunnel
- COASTER positive train control
- SPRINTER double-tracking (*TransNet*)
- Enhanced service frequencies on Blue, Orange, and Green Trolley lines, including several grade separations needed for the increased frequencies (*TransNet*)
- Several Rapid Bus routes in key high demand arterial corridors
- Shuttle/Circulator service in San Marcos (to be locally funded)
- Increased service frequencies on local bus routes within the Urban Area to 10-minute all-day
- Bike and pedestrian network improvements to support access to the regional transit system

Varying Transit Projects/Investments

The four revenue constrained scenarios are discussed further below. During the development of the scenarios, it became helpful to understand that there were several major capital investments that, while included in the Unconstrained Transit Scenario, could not be included equally in all of the Revenue Constrained scenarios due to revenue constraints. These major capital investments included: the Downtown Trolley Tunnel, the Kearny Mesa Guideway, the UTC COASTER Station and Tunnel, and a number of new LRT lines in existing and new corridors, as described below.

- **Downtown Trolley Tunnel:** The Downtown Trolley Tunnel would facilitate higher service frequencies on the existing Blue and Orange LRT lines due to the constraints of downtown San Diego streets, and enable introduction of new Express Trolley services.

- **Kearny Mesa Guideway:** The Kearny Mesa Guideway would facilitate faster and more reliable travel times for existing local buses and new BRT and Rapid Bus services in the congested corridor that links downtown with Hillcrest, Mission Valley, and Kearny Mesa and connects a number of key employment areas and residential communities. While BRT services in other corridors would use proposed investments in Managed Lanes (ML)/High Occupancy Vehicle (HOV) corridors, a dedicated transit guideway was proposed as an option in this corridor since no ML or HOV facilities were included in the highway networks for the State Route 163 (SR 163) corridor.

- **UTC COASTER Station and Tunnel:** The UTC COASTER Station and Tunnel would provide faster travel times for COASTER and Amtrak services by providing a more direct route and an alternative to the Miramar curve, which requires slower train operations. The UTC COASTER Station and Tunnel also would provide direct station access to the major UTC employment and commercial area.

- **New LRT Lines:** Finally, the various proposed new LRT lines would enhance light rail service along existing trolley corridors through new "Express" services, and expand Trolley service into a number of new residential and employment areas in high-travel corridors.

Due to funding limitations, these major capital investments, as proposed, could not all be accommodated within a single Revenue Constrained Transportation Scenario, and were therefore included at varying levels in the four Scenarios, as illustrated in Figures TA 7.16 and TA 7.17.

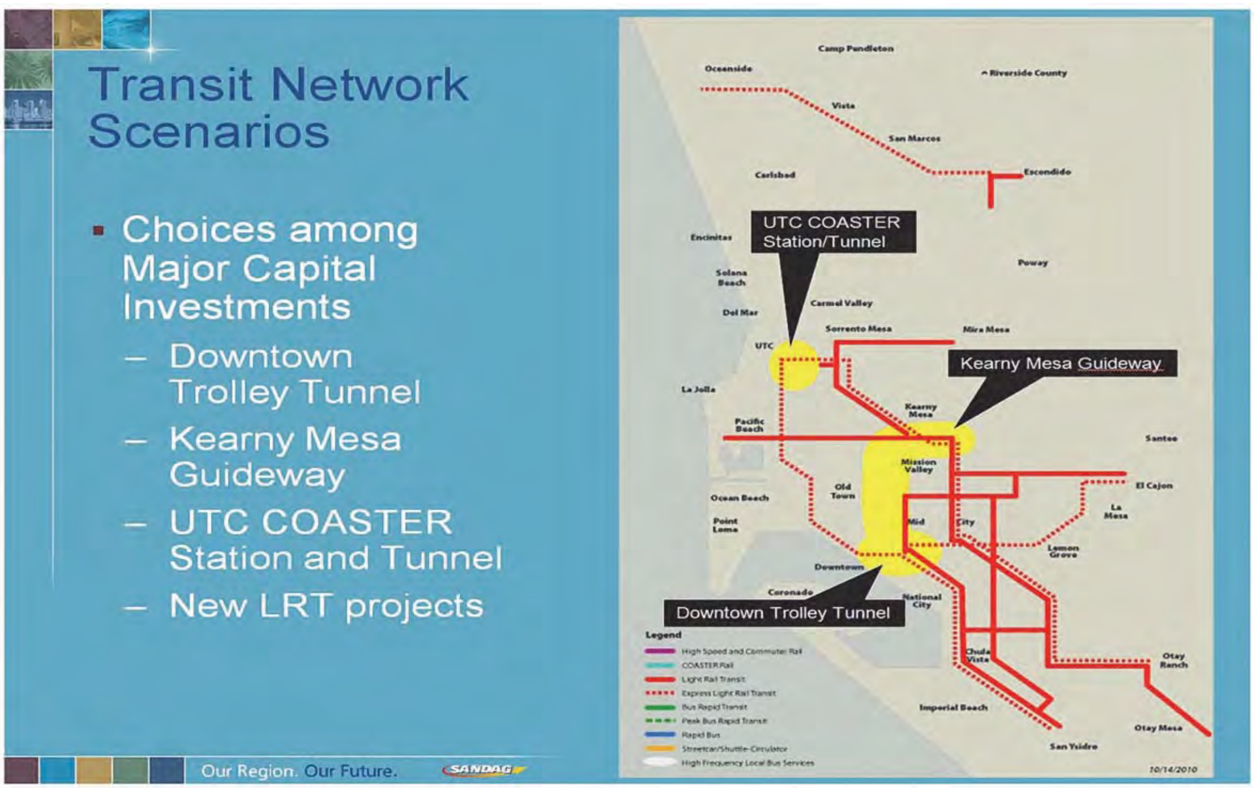
Figure TA 7.16 – 2050 RTP Revenue Constrained Transportation Network Scenarios: Summary of Transit Investments

Summary of Transit Investments by Network

✓ = Included
= Smaller Investment
= Larger Investment

	Transit	Rail/ Freight	Highway	Fusion
Major Capital Investments				
Downtown Trolley Tunnel	✓	✓		
Kearny Mesa Guideway	✓		✓	✓
UTC COASTER Station/Tunnel		✓		
New Routes				
LRT	Larger Investment	Larger Investment	Smaller Investment	Larger Investment
BRT	Smaller Investment	Smaller Investment	Larger Investment	Smaller Investment
Rapid Bus	Larger Investment	Smaller Investment	Larger Investment	Smaller Investment
Streetcars/Shuttles	Smaller Investment	Smaller Investment	Smaller Investment	Larger Investment

Figure TA 7.17 – 2050 RTP Revenue Constrained Scenarios: Major Transit Capital Investments



The following discussion provides information on the transit routes and services included in each of the four Revenue Constrained scenarios.

Transit Emphasis Scenario

The transit network in this Scenario was built on the dual philosophy of reinforcing and upgrading existing transit services and maximizing the overall number of transit projects including a variety of rail, BRT, Rapid Bus, and local bus improvements. The transit projects in this Scenario are shown graphically in Figure TA 7.18.

The rail projects in this scenario included the Downtown Trolley Tunnel in downtown San Diego to facilitate frequency enhancements for the Blue and Orange Trolley lines (7.5-minute all-day frequencies). Inclusion of the Downtown Trolley Tunnel also would enable implementation of Express Trolley services on both the Blue and Orange Lines, which introduce "skip-stop" services to facilitate faster travel times for passengers making longer distance trips along these corridors. This Scenario also would convert the Mid-City Rapid Bus service over time to a light rail transit (LRT) service to better serve the strong demand for transit in the Mid-City area. Complementing this LRT route along the east-west corridor between downtown San Diego and San Diego State University (SDSU) would be a north-south LRT service that would connect SDSU and Chula Vista via Mid-City, the southeastern San Diego communities, and National City. For the SPRINTER service, an extension of the line to North County Fair was included. In addition, a commuter rail overlay service along the High Speed Rail corridor was also assumed.

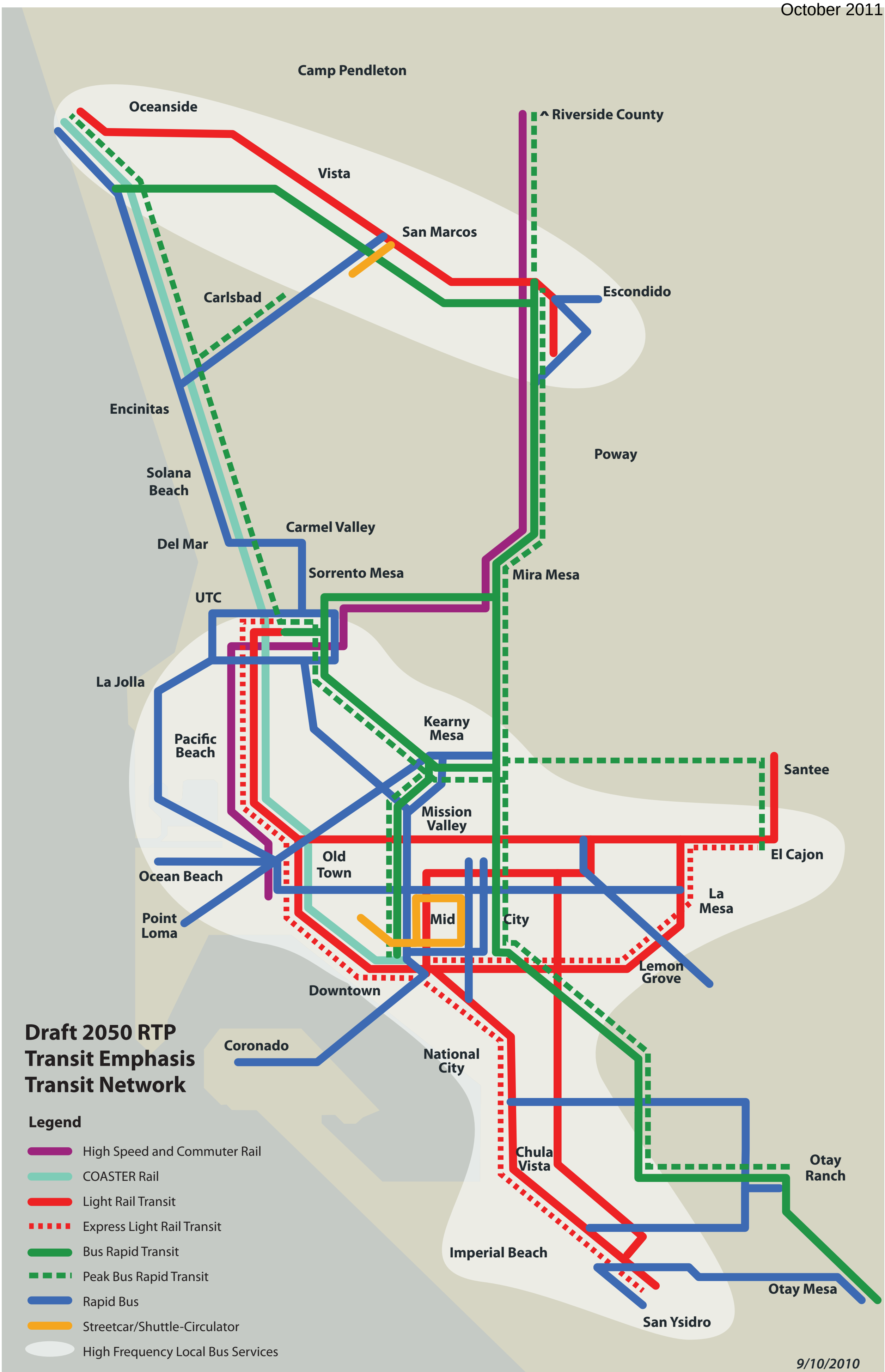
In terms of BRT and Rapid Bus services, a key capital project included in this Scenario was the Kearny Mesa Guideway[3] in the SR 163 travel corridor to facilitate fast and direct access for a number of all-day BRT, peak period BRT, Rapid Bus, and local bus services to improve access to the residential and employment centers in downtown San Diego, Bankers Hill, Hillcrest, Mission Valley, Sharp/Children's Hospital complex, and Kearny Mesa. Several other new BRT services would be implemented in the I-5, I-805, SR 52, and SR 78 freeway corridors and use the Managed Lanes/HOV system investments to facilitate high-speed travel and trip reliability to serve the long-distance trip demand in these areas. Also, 15 new Rapid Bus routes would be implemented along several key arterial corridors throughout the region.

In addition, the Transit Emphasis Scenario included the two highest ranked streetcar projects – downtown San Diego, and Hillcrest/Balboa Park.

The following typical peak period transit service standards were assumed for this scenario:

- Trolley – 7.5 minute service
- SPRINTER – 10 minute service
- Bus Rapid Transit – 10 minute service
- Rapid Bus – 10 minute service
- Streetcar – 10 minute service
- COASTER – 15 minute service
- Commuter Rail Overlay on HSR – 15 minute service

[3] The Kearny Mesa Guideway was defined as a dedicated transitway for BRT, Rapid Bus, and local bus services for a north-south travel corridor between downtown San Diego and Kearny Mesa to improve directness of travel and travel speeds, especially in the Hillcrest and Mission Valley areas.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Mira Mesa
UTC
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La Mesa
Point Loma
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Lemon Grove
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Transit Network
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National City
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Peak Bus Rapid Transit
Rapid Bus
Streetcar/Shuttle-Circulator
High Frequency Local Bus Services
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Otay Ranch
Imperial Beach
Otay Mesa
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Rail/Freight Emphasis Scenario

The transit network in this Scenario was built on maximizing the number of rail-based transit projects. The specific transit projects included in this scenario are shown graphically in Figure TA 7.19.

In terms of light rail services, the Rail/Freight Emphasis Scenario (like the Transit Emphasis Scenario) included the Downtown Trolley Tunnel to facilitate frequency enhancements for the existing Blue and Orange Trolley services, as well as express Trolley services on both the Blue and Orange lines. In the Central and South County area, two new LRT lines would be implemented: Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, and SDSU; and University Towne Centre (UTC) to Chula Vista via Kearny Mesa, Mission Valley, Mid-City, southeastern San Diego, and National City. In North County, this scenario included an express SPRINTER service between Escondido and Oceanside, and the extension of the SPRINTER line to North County Fair. This was the only Scenario that included the UTC COASTER Station and UTC Tunnel, providing a more direct connection for North County commuters into the University City area. In addition, a commuter rail overlay service along the High Speed Rail corridor was also assumed.

Due to the high capital costs of new rail projects and the UTC COASTER and Tunnel, additional new rail lines outlined in the Unconstrained Transit Network (SDSU to San Ysidro, UTC to Mira Mesa, Otay Mesa to Chula Vista, and the transition of the Mid-City Rapid to LRT) could not be included in the Rail/Freight Scenario.

The emphasis on rail services in this Scenario meant that most BRT and Rapid Bus services in the Unconstrained Transportation Network were not included. The Kearny Mesa Guideway also was not included.

The following typical peak period transit service standards were assumed for this scenario:

- Trolley – 7.5 minute service
- SPRINTER – 10 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – none
- Rapid Bus – 10 minute service
- COASTER – 15 minute service
- Commuter Rail Overlay on HSR – 15 minute service

Highway Emphasis Scenario

The transit network in this Scenario is shown graphically in Figure TA 7.20. It built upon the Managed Lanes and HOV investment in the highway network, and as a result, included all BRT, peak BRT, and Rapid Bus routes proposed in the Unconstrained Transportation Network. This scenario included the Kearny Mesa Guideway to facilitate the BRT and Rapid Bus routes, but it did not include the Downtown Trolley Tunnel, and therefore did not include any of the Trolley Express routes or the SPRINTER Express services.

With the exception of the Kearny Mesa Guideway in the SR 163 travel corridor between downtown San Diego and Kearny Mesa, BRT services are relatively inexpensive to implement since they tend to use already planned Managed Lanes/HOV facilities. There are no Managed Lanes/HOV facilities proposed for the SR 163 corridor, thus resulting in the need for a separate transit guideway. As a result, the capital costs of the BRT routes are limited primarily to station improvements, vehicle acquisition, and associated maintenance facilities. These relatively low capital costs allowed a higher number of transit projects to be included in this Scenario than otherwise might be expected, including all Rapid Bus projects and two light rail projects (SDSU to San Ysidro and UTC to Mira Mesa).

The following typical peak period transit service standards were assumed for this scenario:

- Trolley – 7.5 minute service
- SPRINTER – 10 minute service
- Bus Rapid Transit – 10 minute service
- Streetcar – 10 minute service
- Rapid Bus – 10 minute service
- COASTER – 15 minute service
- Commuter Rail Overlay on HSR – 15 minute service

Fusion Scenario

The transit network in this Scenario focused a blend of enhancements to the existing transit system and new transit services that seemed to resonate particularly well with the public based on public outreach and the survey. The Fusion Scenario transit network is shown graphically in Figure TA 7.21.

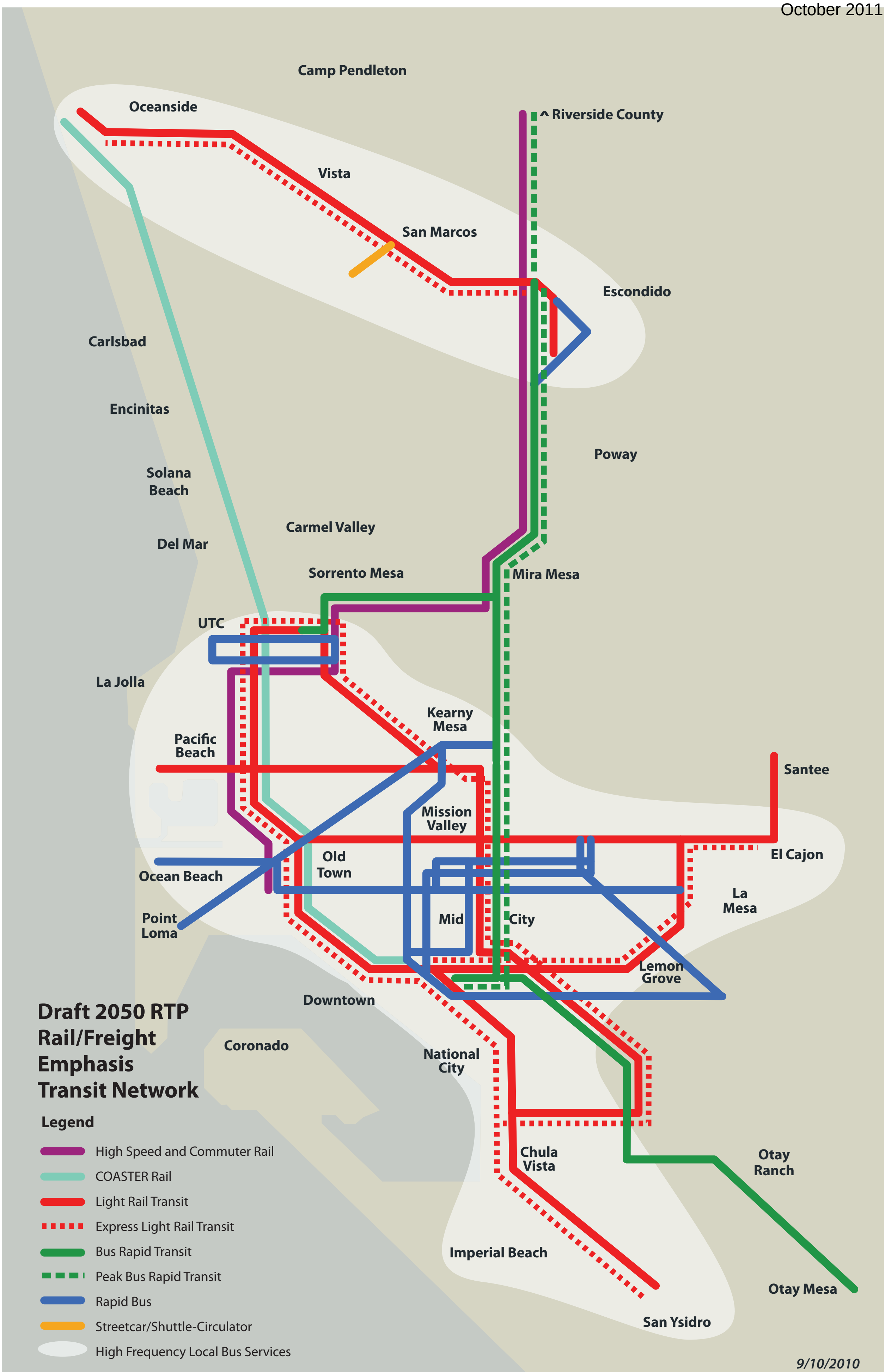
In addition to the baseline projects and the transit projects common to all four Revenue Constrained Transportation Network Scenarios discussed above, the new transit projects proposed in this Scenario included the Kearny Mesa Guideway to facilitate new BRT and Rapid Bus services in the SR 163 travel corridor, and new LRT projects aimed at providing trolley service to a wider geographic service area, including LRT lines in the following corridors: Pacific Beach to El Cajon via Kearny Mesa and Mission Valley; UTC to Mira Mesa via Sorrento Mesa; and UTC to Chula Vista via Kearny Mesa, Mission Valley, Mid-City, southeastern San Diego, and National City; and extension of the SPRINTER line to North County Fair. It also included SPRINTER Express service and a commuter rail overlay service along the High Speed Rail corridor.

This approach differed from the Transit Emphasis Scenario in that it focused more attention on new LRT lines versus improvements to existing LRT lines. As such, it did not include the Downtown Trolley Tunnel that was included in the Transit Emphasis Scenario to enable Express trains on the Blue and Orange Trolley Lines. It also focused less attention on Rapid Bus services (the Fusion Scenario included six Rapid Bus services versus 15 included in the Transit Emphasis Scenario).

Finally, this Scenario included implementation of the highest number of streetcar and/or shuttle/circulator services since this mode resonated highly with many stakeholders that provided input on the Unconstrained Transportation Network.

The following typical peak period transit service standards were assumed for this scenario:

- Trolley – 7.5 minute service
- SPRINTER – 10 minute service
- Streetcar – 10 minute service
- Bus Rapid Transit – 10 minute service
- Rapid Bus – 10 minute service
- COASTER – 15 minute service
- Local Bus – 10 minute service
- Commuter Rail Overlay on HSR – 15 minute service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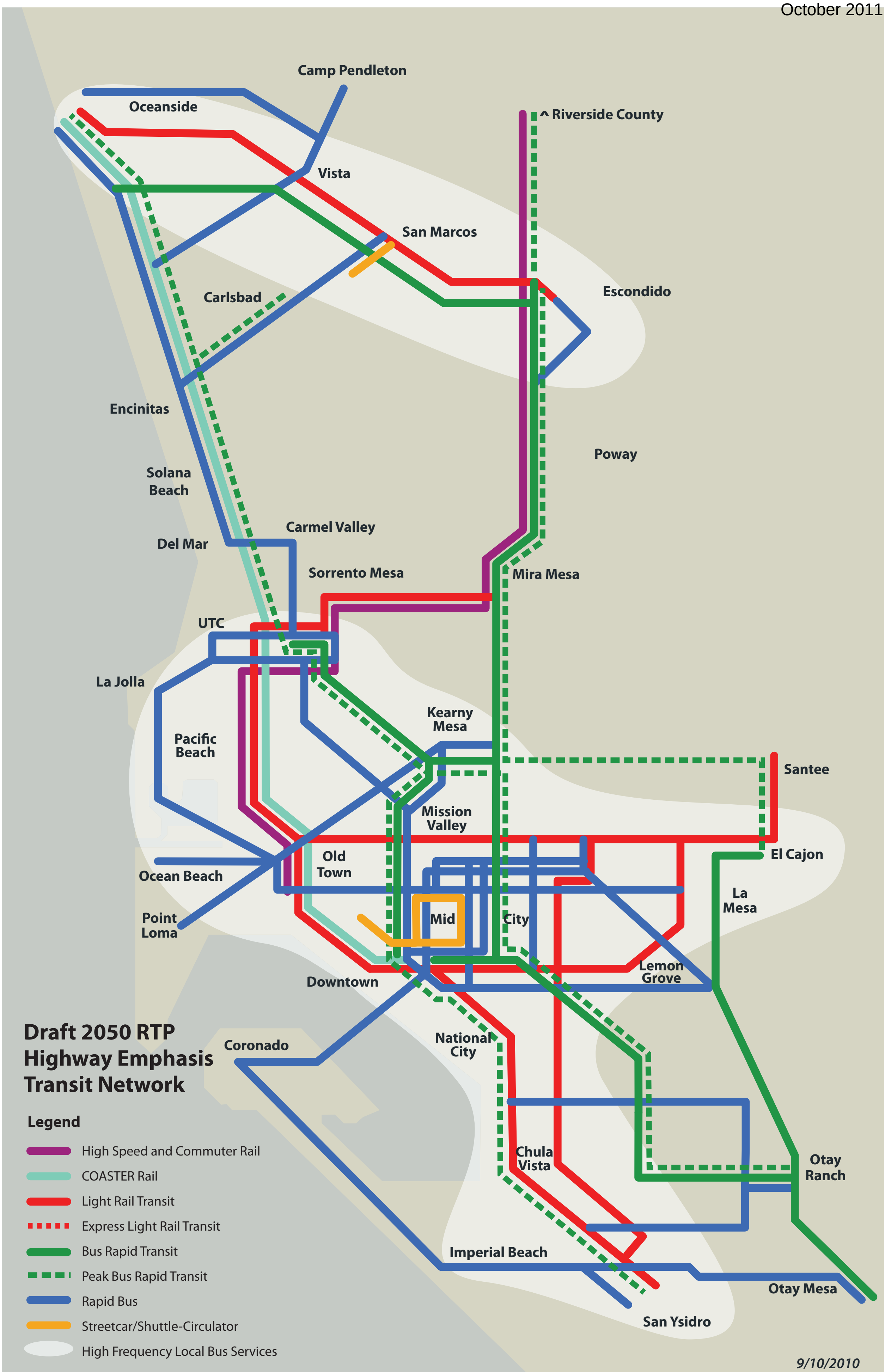
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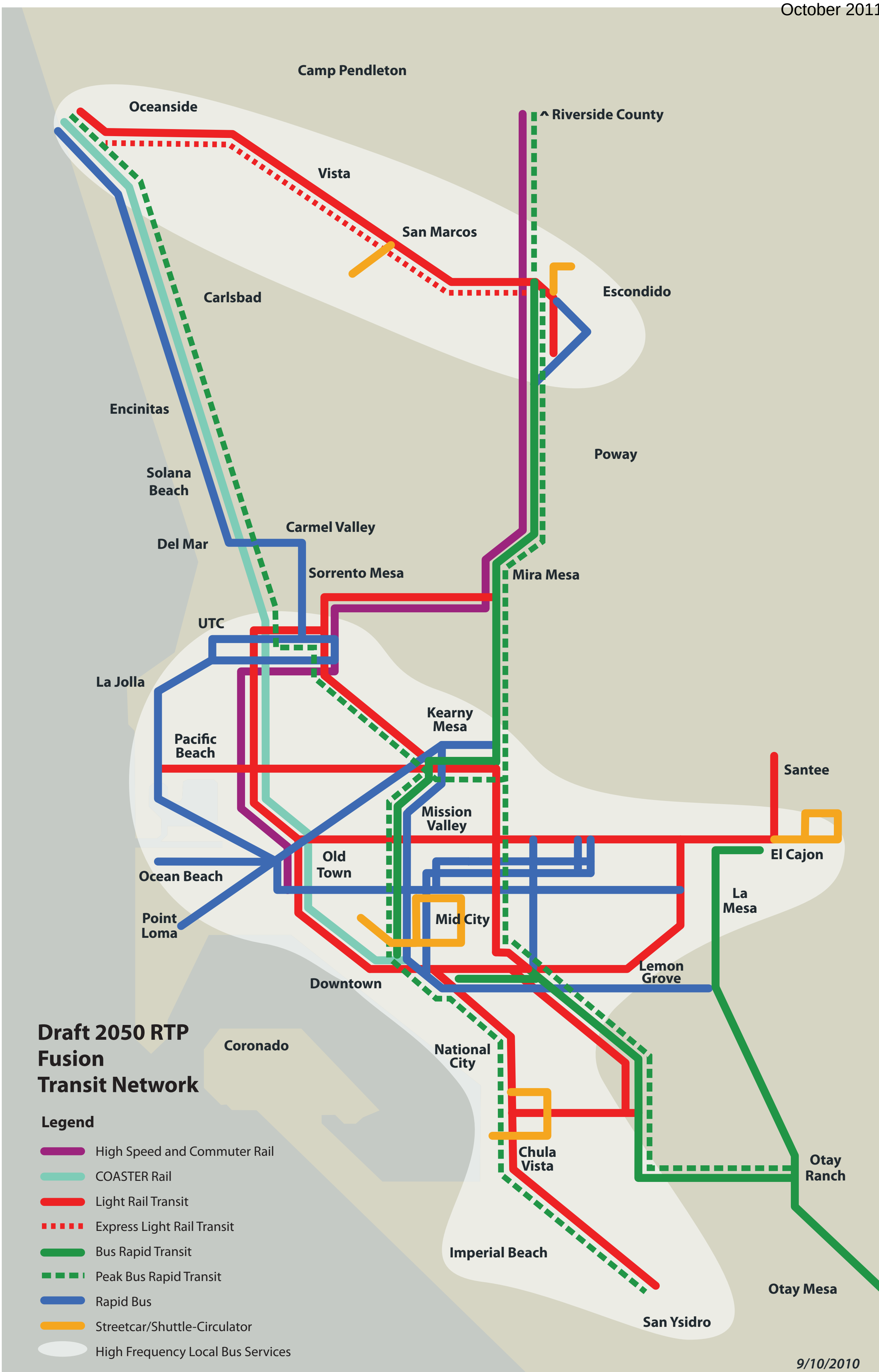
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Capital Cost Estimates of the Revenue Constrained Scenarios

Technical Appendices K-1 and K-2 contain a list of all of the transit projects, as well as highway projects, proposed in each Revenue Constrained Transportation Network Scenario as of November 2010. The projects are listed in two categories: constant transit projects among all four scenarios (including *TransNet*-funded projects and other constant projects), and variable transit projects included in one, two, or three of the revenue constrained scenarios. Capital cost estimates and phasing years are listed for each project. Total capital cost estimates for each transportation network alternative in 2010 dollars[4] are listed below.

- Transit Emphasis Network Scenario: $23.085 billion
- Rail/Freight Emphasis Network Scenario: $22.229 billion
- Highway Emphasis Network Scenario: $19.435 billion
- Fusion Network Scenario: $21.587 billion

Operating costs, including vehicle and vehicle replacement costs, were added later based on project phasing, once a Preferred Revenue Constrained Scenario was developed.

Analysis Results of the Four Initial Revenue Constrained Scenarios

The Revenue Constrained Scenarios' performance was evaluated using performance measures developed specifically for the 2050 RTP which are discussed in detail in the 2050 RTP and in 2050 RTP Technical Appendix 3. As such, only the transit mode share results are discussed below.

Transit Mode Share for the Four Initial Revenue Constrained Scenarios

Transit Mode Share results for the four initial revenue constrained transportation scenarios did not vary greatly. They followed the same pattern seen in the three initial transit network alternatives of meeting the goals for most of the areas. The Fusion scenario was projected to meet ten of the 14 corridor/area transit mode share goals, as compared to nine for the Transit Emphasis and eight for both the Rail/Freight and Highway Emphasis scenarios. This is detailed in Table TA 7.16 and illustrated in Figure TA 7.22.

The Fusion scenario was projected to achieve the highest transit mode share for the collective Urban Area Study Area at 11 percent, compared to ten percent for the other three revenue constrained scenarios, while the Transit Emphasis scenario was projected to reach the highest mode share percentage for downtown San Diego at 29 percent. In general, the Fusion scenario was projected to reach the highest transit mode share in five corridors/areas, compared to two for the Transit Emphasis and none for the Rail/Freight and Highway Emphasis scenarios. Again, it should be noted that the transit mode share results did not differ greatly across the scenarios, and many times the difference between the highest and lowest projected mode share was only one or two percentage points.

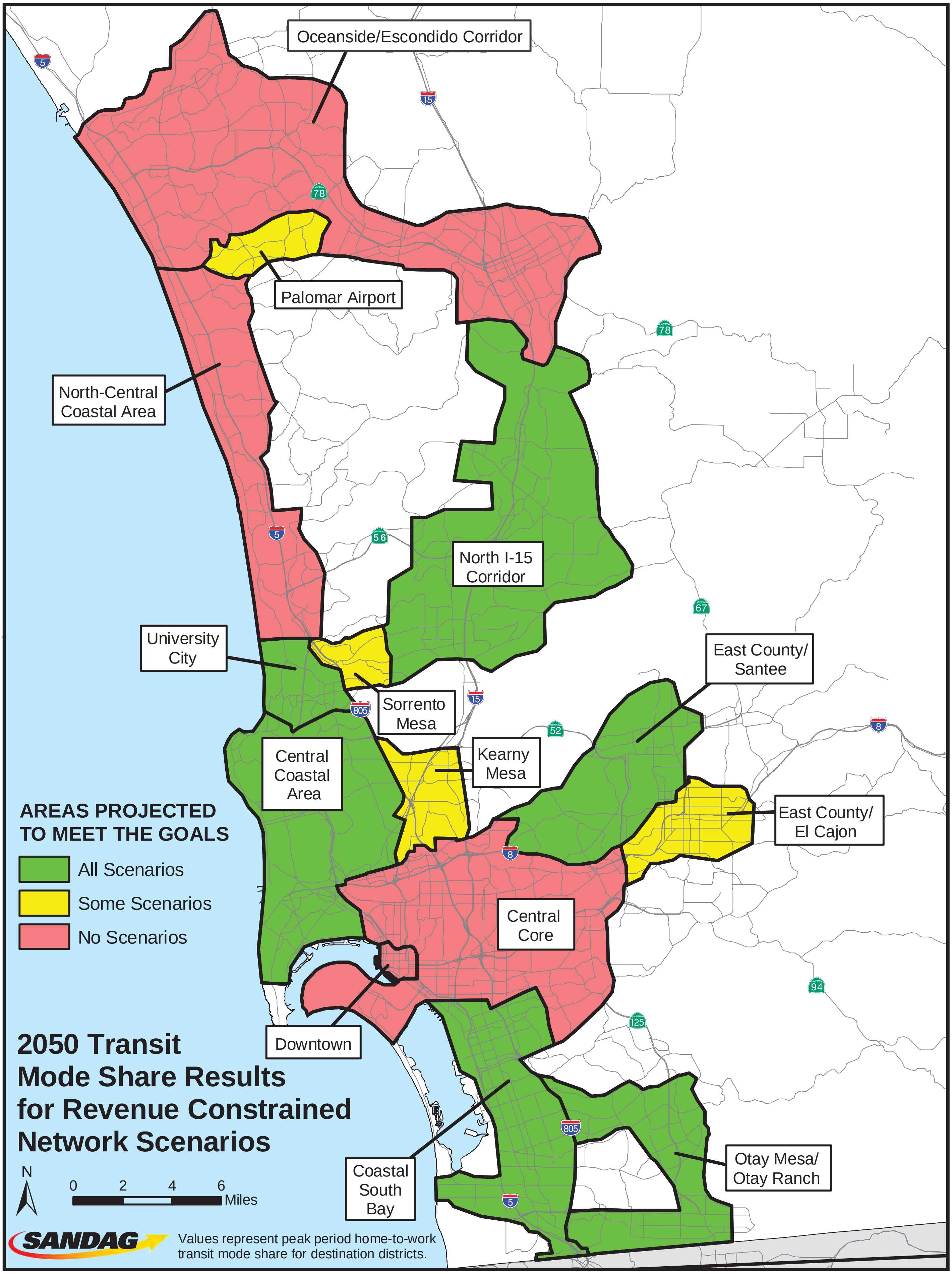
[4] The 2009 initial network capital costs were converted to 2010 dollars for the transportation network in the RTP.

Table TA 7.16 – 2050 Transit Mode Share Results – Revenue Constrained Transportation Scenarios

Identified Corridors/Areas	2050 Peak Period Transit Mode Share Goal Ranges	Peak Period Transit Mode Share for 2050 RTP Revenue Constrained Transportation Scenarios[1]			
		Transit Emphasis	Rail & Freight Emphasis	Highway Emphasis	Fusion
Major Employment Areas					
Downtown San Diego	30% +	29%	27%	27%	28%
University City	15%-20%	15%	16%	15%	17%
Sorrento Mesa	10%-15%	9%	9%	9%	10%
Kearny Mesa	10%-15%	10%	13%	9%	14%
Otay Mesa/ Otay Ranch	5%-10%	6%	5%	6%	5%
Palomar Airport	5%-10%	5%	4%	5%	4%
High Activity Areas					
Central Core	20%-25%	18%	16%	17%	17%
Oceanside/Escondido Corridor	10%-15%	6%	6%	6%	6%
Other Urbanized Areas					
North I-15 Corridor	5%-10%	5%	5%	6%	6%
North Central Coastal Area	10%-15%	8%	8%	7%	8%
Central Coastal Area	10%-15%	12%	14%	12%	14%
Coastal South Bay	10%-15%	12%	12%	12%	12%
East County/El Cajon	10%-15%	9%	9%	9%	10%
East County/Santee	5%-10%	7%	7%	7%	7%
Urban Area Transit Strategy Study Area	**10%-15%**	**10%**	**10%**	**10%**	**11%**

[1] Values represent peak period home-to-work trip transit mode share for destination districts.

Figure TA 7.22



After the transit mode share and 2050 RTP performance measures were processed and compiled by the project team and SANDAG staff, the results were presented to the SANDAG Transportation Committee and Board of Directors (as well as many other committees and working groups). At the November 2010 meeting of the SANDAG Board of Directors, the performance of the four Revenue Constrained scenarios was discussed and the Board directed SANDAG staff to create a revenue constrained transportation scenario with elements from the Fusion and Highway Emphasis scenarios. The following bullet points summarize the major input received at the Board meeting:

- Importance of the Downtown Trolley Tunnel to the regional transit network
- Importance of providing Express trolley service
- Support for additional funding for regional rail grade separations
- Support for focusing on the existing rail investment in the COASTER and SPRINTER corridors in the North County area and for eliminating redundant transit services
- Continued support for BRT services, particularly in the South County area
- Recognition that the University Towne Center (UTC) COASTER Tunnel and Station are very expensive capital projects, but continued support for providing transit connections in the UTC area
- Support for including higher ranked highway projects in the Hybrid Scenario
- Support for including higher ranked new LRT routes in the Hybrid Scenario

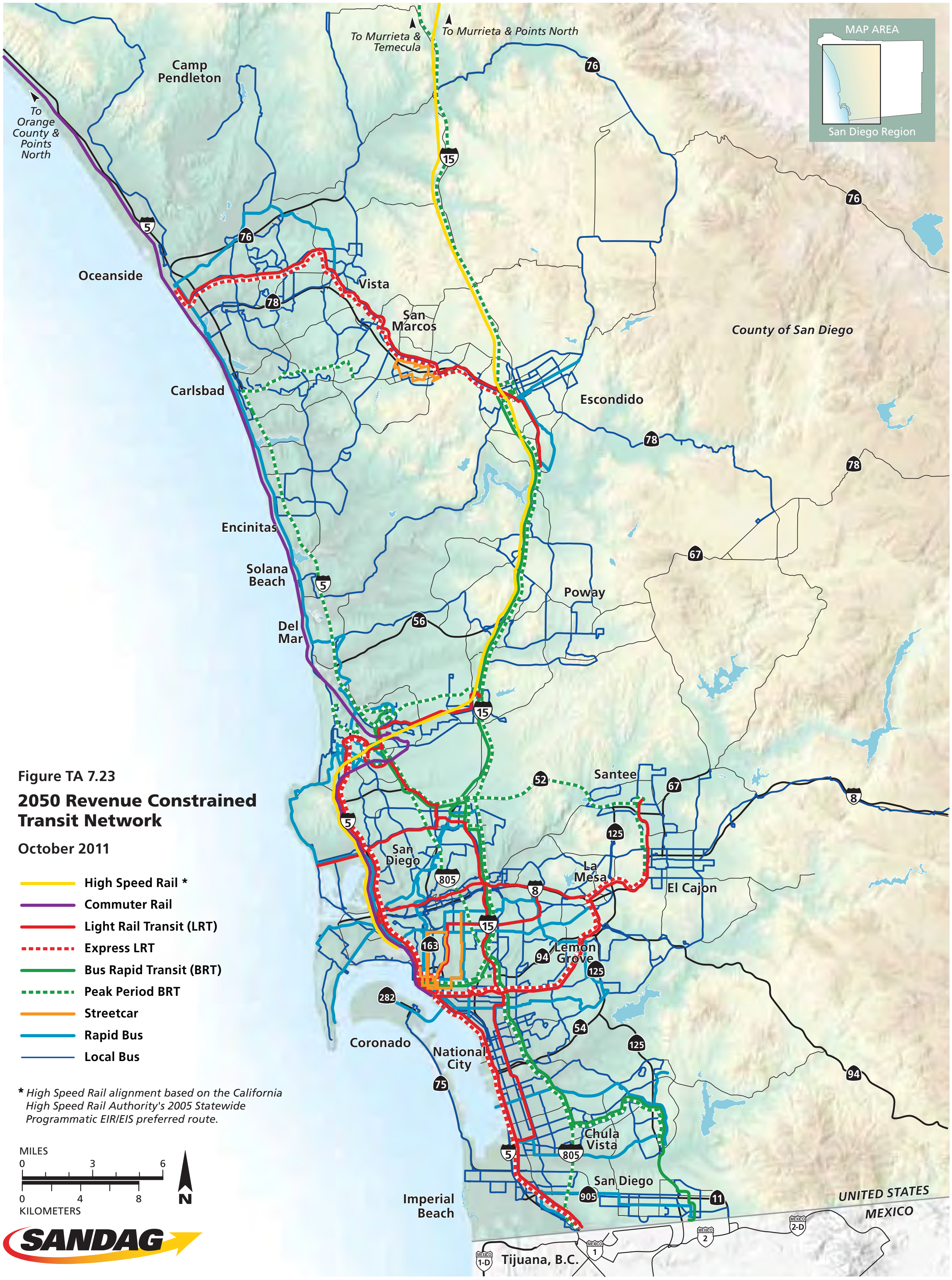
The Board of Directors also directed SANDAG staff to continue to work closely with MTS and NCTD staff to develop the revenue constrained network. The resulting Preferred Revenue Constrained Transit Network is discussed in the following section.

12. Preferred Revenue Constrained Transit Network and Final 2050 RTP Revenue Constrained Transit Network

Based on direction from the SANDAG Board, staff developed a Preferred Revenue Constrained Transit Network, sometimes referred to as the “hybrid” network. The Preferred Revenue Constrained Transit Network contained a variety of multimodal projects from the initial revenue constrained scenarios, particularly from the Fusion and Highway Emphasis scenarios. This network, along with the Preferred Revenue Constrained Highway Network, was a key component of the overall Draft Revenue Constrained Transportation Network included in the Draft 2050 RTP, which was released for public review and comment in April 2011.

During the public review and comment period, SANDAG received more than 4,000 public comments on the Draft 2050 RTP and its SCS, many of them focused on the transit projects contained in the Preferred Revenue Constrained Transit Network. In response to the comments and at the direction of the SANDAG Board, staff produced the 2050 Revenue Constrained Transit Network, which serves as the official transit network of the Final 2050 RTP. This network is shown graphically in Figure TA 7.23. The transit projects that make up the final transit network and their associated phasing are included in Technical Appendix M.

Figure TA 7.23



Transit Mode Share Results of the Final 2050 RTP Revenue Constrained Transit Network

The performance of the Final 2050 Revenue Constrained Transit Network is discussed in detail in the Final 2050 RTP and the 2050 RTP Technical Appendix 3. This section, however, provides detailed information on transit mode share results. Table TA 7.17 and the analysis below compare the 2050 Unconstrained Transportation Network and the Final 2050 RTP Revenue Constrained Transportation Network, which includes the Final 2050 Revenue Constrained Transit Network, against the transit mode share goal ranges in the Urban Area.

Table TA 7.17 – Transit Mode Share Results for Unconstrained Transportation Network and Final 2050 RTP Revenue Constrained Transportation Network[1]

Identified Corridors/Areas	2050 Peak Period Transit Mode Share Goal Ranges	2050 Unconstrained Transportation Network	Final 2050 RTP Revenue Constrained Transportation Network
Major Employment Areas			
Downtown San Diego	30% +	29%	27%
University City	15%-20%	17%	13%
Sorrento Mesa	10%-15%	10%	9%
Kearny Mesa	10%-15%	13%	13%
Otay Mesa/Otay Ranch	5%-10%	8%	7%
Palomar Airport	5%-10%	6%	3%
High Activity Areas			
Central Core	20%-25%	18%	17%
Oceanside/Escondido Corridor	10%-15%	7%	6%
Other Urbanized Areas			
North I-15 Corridor	5%-10%	6%	5%
North Central Coastal Area	10%-15%	8%	7%
Central Coastal Area	10%-15%	14%	12%
Coastal South Bay	10%-15%	13%	12%
East County/El Cajon	10%-15%	10%	9%
East County/Santee	5%-10%	7%	7%
Urban Area Transit Strategy Study Area	10%-15%	11%	10%

[1] Values represent peak period home-to-work trip transit mode share for destination districts.

The Final 2050 RTP Revenue Constrained Transportation Network achieves the mode share goal for the collective Urban Area. It also meets six of the 14 corridor/area goals. And, as shown in Table TA 7.17, of the eight corridors/areas that are not projected to meet the transit mode share goals, seven are projected to come within three percentage points of achieving the goals, reflecting both a positive increase in transit mode share over existing 2008 transit mode shares (see Table TA 7.2) and the challenge presented by establishing high goals.

Although the Final 2050 RTP Revenue Constrained Transportation Network contains a high level of investment in transit in the Central Core area, the transit mode share is projected to fall short of the goal for this area by three percentage points. The ambitious goal for this area reflects the relatively high level of existing transit ridership and mode share (12 percent in 2008), and the existing and planned transit supportive land use patterns and population densities in the area. Other than downtown San Diego, the Central Core area has by far the highest projected transit mode share goal of the 14 corridors/areas. Although projections indicate that it will fall short of meeting the goal, transit mode share is projected to increase by over five percentage points from 2008 levels and the projected 2050 RTP Revenue Constrained transit mode share of 17 percent is well above those of the other corridors/areas (except for downtown San Diego) and is within one percentage point of the Unconstrained Revenue projection for the area.

Most of the other corridor/areas where the transit mode share goals are not projected to be met are along the north I-5 corridor between downtown and Oceanside (University City, Sorrento Mesa, Palomar Airport, Oceanside/Escondido, North Central Coastal) where significant investments in both transit (COASTER and Rapid Bus) and new managed lanes (I-5) are planned. The region's multimodal investment in the corridor is projected to increase both transit and HOV (carpool/vanpool) use. It is possible that a projected increase in HOV use and mode share has resulted in a corresponding decrease in transit mode share even as transit ridership in the corridor increases in real numbers. The shortfall in meeting the transit mode share goals in the corridor also reflects the challenge in effecting significant mode share shifts in the lower density, suburban areas of the region where land uses, development patterns, and population and employment concentrations generally don't support transit access and use as well as more densely developed urban areas. Nevertheless, the Final 2050 RTP Revenue Constrained Transportation Network is projected to increase transit mode share over 2008 levels by almost 10 percentage points in University City, over seven percentage points in Sorrento Mesa, and over five percentage points in the North Central Coastal area, significantly positive results for these areas.

In summary, the Final 2050 RTP Revenue Constrained Transportation Network is projected to meet six of the 14 corridor/area transit mode share goals and come within three percentage points of meeting the goals for most of the remaining corridors/areas. In addition, the Final 2050 RTP Revenue Constrained Transportation Network is projected to meet the 10 percent transit mode share goal for the collective Urban Area, doubling the 2008 transit mode share for the Urban Area. The Final 2050 RTP Revenue Constrained Transportation Network provides a solid working base for the San Diego region as SANDAG and its member agencies strive to meet the transit mode share goals.

13. Five and Ten-Year Action Plans

The UATS study and the 2050 RTP identified many new transportation corridors for the development of future transit projects. In addition, assumptions on the transit mode (e.g. light rail, rapid bus, streetcar, etc.) were made to establish mode characteristics (e.g. regional travel vs. local distribution) for modeling, ridership and performance measure projections, and to provide a basis for planning-level cost estimation. However, identification and inclusion in the RTP is just the first step in the development of these potential future transportation projects. While some projects, like local bus service or changes in transit service frequencies generally do not require additional project planning, environmental analysis, and design, major new transit alignments, facilities, and services must undergo further analysis and evaluation. The additional individual project analysis and evaluation is part of the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) process and can include an

Environmental Impact Statement/Environmental Impact Report, an Environmental Assessment/Mitigated Negative Declaration/Negative Declaration, or a Categorical Exclusion/Categorical Exemption.

Transit Project Development Process

The implementation of a major new transit capital investment would first entail a detailed advanced planning process to further outline the proposed project, including an Alternatives Analysis where alternative routes, stations, and transit modes are developed and evaluated that provide detail on capital and operating costs, detailed ridership projections, and potential environmental impacts/benefits. The Alternatives Analysis would result in a preferred alternative or set of alternatives to carry forth into formal environmental studies. Once the environmental studies have been completed and the final project and any mitigation measures are identified, preliminary engineering and final design work would be undertaken leading, ultimately, to project construction.

Preliminary engineering is undertaken to better understand the engineering and construction of the proposed project, and the environmental review and analysis allows for a greater understanding of the impacts and benefits of the project to the natural and built environment (e.g., visual, wetlands, air quality, noise, traffic, etc.), and the mitigation that may need to be incorporated into the project. Ridership, capital costs and operations, and maintenance costs of the proposed project are also further refined during this stage of the project.

After the appropriate environmental review and documentation of the project has been completed and approved, final design, permitting, and construction can take place. Many of the major new transit rail, BRT, and Rapid Bus projects will also go through the Federal Transit Administration's (FTA) project development process to solicit federal capital funding through the New Starts or Small Starts processes. The FTA process is aligned with the NEPA process.

Action Plans

Upon adoption of the Final 2050 RTP, "Five and Ten Year Action Plans" will be developed based on the transit project development process discussed above and final phasing assumptions included in the RTP. The Action Plans will assist SANDAG in better identifying potential federal funding opportunities and potential timing challenges and opportunities surrounding the ultimate implementation of the transit projects included in the Final 2050 RTP.

The Five and Ten Year Action Plans will provide initial project development timeline assumptions, identification of projects for federal funding, and ultimately a framework to guide planning, environmental, design, and construction efforts for the 2050 transit network. The plans will be dynamic and will continue to evolve as implementation of the 2050 RTP proceeds.

14. Policy Options to Support the Transit Network

Developing and funding a robust transit network is essential to achieve SANDAG's multimodal transportation goals. However, a number of other factors also influence the use and success of the regional transit system. Related transportation and land use policies and strategies can directly or indirectly create incentives (or disincentives) to transit use.

As part of the planning process, the project team developed a report entitled, "Menu of Policy Options to Support the Transit Network." This report identified a menu of policies and strategies that can influence transit ridership and mode share. The menu was organized into three categories: parking, land use, and funding. These policies and strategies were culled from technical and academic research, experience in other cities and regions, input from the PB Professional Consulting Transit Team and UATS Peer Review Panel, and suggestions by UATS project stakeholders including the San Diego Council of Design Professionals[5], the SANDAG Regional Planning Stakeholder

[5] At an UATS workshop conducted on April 14, 2010.

Working Group (SWG)[6], and 2050 RTP community workshops[7]. The paper also included information on transit fares, services, and facilities to help maximize the effectiveness of the region's transit network. Technical Appendix N includes additional detail and information.

Input by Working Groups and Local Planning and Design Community

In the fall of 2010, the Regional Planning Technical Working Group (TWG), the Cities/County Transportation Advisory Committee (CTAC), and Regional Planning SWG members, as well as members of the planning and design community, were asked to provide input on the menu of policy options through participation in an interactive activity. The activity consisted of each participant receiving ten dots, which they were then asked to place next to the policy options they most supported. The policy options were listed on large boards throughout the conference room. Flip charts also were available for participants to write down comments. After the activity, the votes were counted for each policy option, and facilitated discussions were held. The interactive activity was intended to provide a starting point for discussion by policymakers for possible consideration in the 2050 RTP and its SCS.

TWG, CTAC, SWG members, and participants from the design community placed similar levels of priority on the policy options. The following policies received the highest levels of support, and are arranged in order of total votes received.[8] Key discussion points are summarized below in Tables TA 7.18, 7.19, and 7.20.

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[6] The SWG was formed by SANDAG to provide input into the development of the 2050 Regional Transportation Plan.
[7] Conducted in five communities in April and May 2010.
[8] Working group alternates and members of the public who were present at the meetings were invited to participate in the activity. The results cited in the tables include tallies by working group members only; however, results did not significantly vary when tallies by alternates and members of the public were factored in.

Table TA 7.18 – Parking Policies

Rank	Parking Policy	Total Vote	TWG/ CTAC	SWG	Design Community
1	Create a tool box of localized parking strategies and policies for local jurisdictions that may include: ▪ Parking pricing (on- and off-street) ▪ Zoning to reduce/eliminate parking minimums ▪ Zoning to reduce parking maximums ▪ Shared parking programs and standards ▪ Employer parking cost cash-outs ▪ Unbundling of parking costs from housing costs in targeted areas ▪ Local parking districts ▪ Others as requested by local jurisdictions	48	23	14	11
2	Establish grant programs to fund local parking utilization surveys and provide technical assistance to jurisdictions and transit operators within the SANDAG jurisdiction to promote changes in parking management and zoning requirements related to parking	44	20	11	13
3	Support a remote parking program tied to transit service	40	14	19	7
4	Encourage a regional employer/business assessment on employer-provided parking to be used for transit improvements or transit pass subsidies	30	16	10	4
5	Establish regional policies promoting shared parking, especially at transit stations	22	8	10	4
6	Establish programs to measure and document the amount of parking available in selected areas of the region and use this sample as a baseline to track changes in parking supply over the long-term	17	6	9	2
7	Initiate regional education programs regarding the effects of free parking on congestion and mode choice	16	6	5	5
8 (tied)	Organize the region into subregional areas, and in collaboration with affected jurisdictions, develop guidelines for parking availability and pricing for each subregion	15	11	3	1
8 (tied)	Initiate discussion regarding the establishment of long-term goals for a reduction in parking spaces per capita	15	8	1	6
9	Establish Transportation Management Associations in key employment or urban locations	10	5	4	1

The following points were made during the discussion on parking policies:

- The "tool box" approach likely received the highest ranking because it can provide a range of choices and options to different types of communities across the region (large and small). Grant programs that support the tool box also are very helpful.
- The Seattle example described in the report shows how Seattle transitioned over time toward greater parking restrictions and better transit service and how the results, in the long-term, have been favorable. The region should consider a "parking strategy roadmap" to initiate change as an incremental approach.
- If the region is going to pursue implementation of parking fees at employment sites, the effort should be coordinated at the regional level and tied to transit availability.
- The region should test parking fees for bonding capacity at public institutions first, such as city halls, airports, and universities.

- Data to support the reduction of parking is important.
- Funds generated from parking fees should be used to support fare-free transit zones.
- Funds generated from parking fees should be returned to employees through parking cash-out programs.
- Parking fees in emerging smart growth areas may delay the implementation of smart growth in those areas.
- Remote parking programs have worked well in Portland and other places. This type of approach would provide smaller or more distant communities with greater access to the urbanized areas.
- Pursue technological innovations more aggressively, such as technologies that help people find parking spots more easily and reduce time spent searching for parking spots.
- Consider how the region might re-direct dollars spent on parking structures in urban areas toward other uses, such as investments that support transit, walking, and biking.
- Explore "model parking guidelines" that use street parking as effectively as possible.
- Support first-/last-mile solutions, such as jitneys, shared taxis, and other cost-effective ideas.

Table TA 7.19 – Land Use Policies

Rank	Land Use Policy	Total Votes	TWG/ CTAC	SWG	Design Community
1	Reward the "Smarter Smart Growth" areas with smart growth incentive funding, transit facilities, and transit service investments	59	29	17	13
2	Update the SANDAG Smart Growth "tool box" to include Complete Street concepts as a means to implement Smart Growth policies and facilitate greater access to transit, and encourage jurisdictions to adopt these policies as part of their development codes	56	23	9	24
3	Identify a limited number (three to five) of key employment centers / locations in addition to downtown San Diego (possibly for cluster industry employment) that can accommodate higher employment concentrations sufficient to support transit, and create programs that help concentrate employment in these areas by strategically linking employment center growth and transit investment	50	34	12	4
4	During the next update of the SANDAG Regional Comprehensive Plan and Smart Growth Concept Map, work with local jurisdictions to identify a limited number of "Smarter Smart Growth" areas that would be large geographic areas with the best potential for accommodating regional growth through high-density, mixed-use development	43	23	7	13
5	Review Smart Growth Incentive Program (SGIP) criteria and consider providing higher priority to local jurisdictions that have adopted transit-oriented development, urban design, complete street, and/or form-based codes, policies, and standards for receiving incentive funding and/or regional transit investment priority, or use the adoption of these policies and standards as criteria for transit priority phasing in the next update of the RTP	38	22	6	10
6	Encourage jurisdictions to streamline the development and entitlement process in identified Smart Growth areas to encourage development in these areas	33	11	11	11
7	Update the SANDAG Smart Growth "tool box" to include form-based codes as a means to implement smart growth policies and encourage jurisdictions to adopt these policies as part of their development codes	20	9	5	6

The following points were made during the discussion on land use policies:

- The policies that promote employment areas that can accommodate higher employment concentrations, incentives for Smarter Smart Growth areas, and identification of Smarter Smart Growth areas should be grouped together, as these are all interrelated.
- The approach of rewarding larger-scale "Smarter Smart Growth" areas for transit performance purposes could preclude emerging smaller-scale smart growth areas from competing well for grant funds and making additional progress.
- SANDAG should consider modifying the SGIP program to reward cities that have lower parking minimums.
- It may not be necessary for SANDAG to update the Smart Growth Tool Box with form-based codes since jurisdictions have many different types of tools to implement smart growth policies.
- Consider providing more resources toward Complete Streets Concepts, as this approach helps connect land use with transit, bike facilities, and pedestrian networks, and thereby is one of the most effective ways to significantly enhance the livability of our communities.
- Transform struggling or "dark" retail centers and underutilized parking lots from "dead zones" to vibrant transit-oriented development centers.

Table TA 7.20 – Funding Policies

Rank	Funding Policy	Total Votes	TWG/ CTAC	SWG	Design Community
1	Encourage the creation of Local Improvement Districts and facilities financing mechanisms	48	27	14	7
2	Seek private partners to support promising funding advantages	29	16	6	7
3	Promote bonding against public parking revenues	24	13	3	8

The following points were made during the discussion on funding policies:

- The region should consider increasing the transient occupancy tax to help fund transit improvements.
- Partnerships should be pursued between banks and local jurisdictions whereby banks help fund infrastructure enhancements (particularly improvements to the pedestrian environment) in exchange for increased revenues based on a corresponding rise in property values.
- The formation of local improvement districts in the "Smarter Smart Growth" areas will require resources. Funding for these efforts should be identified.
- Jurisdictions should involve local communities early in the process in developing community financing districts when creating "Smarter Smart Growth" areas.
- Transit agencies should consider issuing weekly or 10-day transit passes in addition to monthly passes to make transit more cost-effective for shorter-term users and generate additional revenues.
- The region should consider implementing a fare free transit zone. The Denver transit mall was cited as a great example.

The Regional Planning and Transportation Committees, and the SANDAG Board of Directors agreed that the policy options should be further considered in a future update of the Regional Comprehensive Plan, rather than as part of the development of the 2050 RTP. Further work on policy options will be considered at that time.

15. Conclusion

Given increasingly important factors, including the region's long-term growth projections, new statewide legislative requirements to reduce GHG emissions contained in SB 375, the projected aging of our population, an increasing pattern of infill and redevelopment in the western third of the region, and the growing emphasis on active transportation and public health, the need to focus the region's attention on transit has increased.

The Urban Area Transit Strategy served as the primary process to facilitate the transit planning effort for the 2050 RTP. The UATS focused on the most urbanized areas of the region where investments in transit are generally most efficient and effective. SANDAG and the project team undertook an extensive planning process that involved developing a range of differing transit strategies and approaches to determine the kind of transit future that is desirable for the San Diego region. The project included strategic brainstorming sessions, as well as public workshops, opinion surveys, and input questionnaires. The team reviewed previous market studies and conducted research on transit success stories from other cities to analyze applicability to the San Diego region. The project also included developing performance measures and mode share goals by which to test the strategies.

The Draft 2050 RTP was released for public review and comment in April 2011. As a result of public input and SANDAG Board actions, the transit and highway networks were refined, and ultimately culminated in the Final 2050 RTP, adopted by the SANDAG Board in October 2011.

Implementation of the transit projects in the Final 2050 RTP will be critical. Five and ten-year action plans will be developed based on the transit project development process and will provide initial project development timeline assumptions, identification of projects for federal funding, and ultimately a framework to guide planning, environmental, design, and construction efforts for the 2050 transit network. Policies from the Final 2050 RTP will be incorporated into the next update of SANDAG's Regional Comprehensive Plan, which will, in turn, further support the performance and use of the transit network.

Appendices:

Technical Appendix A.	Definitions of Transit Services and Facilities for Urban Area Transit Strategy
Technical Appendix B.	Key Points from Brainstorming Sessions on the Urban Area Transit Strategy
Technical Appendix C.	Lessons Learned from Peer Regions
Technical Appendix D.	Initial Performance of Transit Network Alternatives – Relative and Numeric Values
Technical Appendix E.	Parsons Brinckerhoff (PB) Professional Consulting Team Biographies
Technical Appendix F.	Peer Review Panel Member Biographies
Technical Appendix G.	Peer Review Panel Comments
Technical Appendix H.	Planning Level Capital Cost Estimating Methodology Report (New Projects)
Technical Appendix I.	Draft Transit Evaluation Ranking (Ranked Order)
Technical Appendix J.	Draft 2050 RTP Revenue Constrained Network Scenarios: Transit Network Maps
Technical Appendix K-1.	Draft 2050 RTP Revenue Constrained Network Scenarios Constant Projects List
Technical Appendix K-2.	Draft 2050 RTP Revenue Constrained Network Scenarios Variable Projects List
Technical Appendix L.	Draft 2050 RTP Revenue Constrained Transportation Scenario Transit Phasing
Technical Appendix M.	Final 2050 RTP Revenue Constrained Network Transit Projects and Phasing
Technical Appendix N.	Menu of Policy Options to Support the Transit Network Report

Technical Appendix A

Definitions of Transit Services and Facilities
For Urban Area Transit Strategy

High-Speed Rail:

France's TGV

Spain's AVE

California High-Speed Rail

Designed for very high-speed long-distance intercity trips with long station spacing and dedicated grade-separated lines. Examples include the Shinkansen in Japan, the TGV in France, and the AVE in Spain. California High-Speed Rail (HSR) currently is being planned from Sacramento to San Diego.

- Vehicles are steel wheel on steel track electrically-powered bidirectional train sets
- Top Speed: 220 miles per hour (mph), but 150 mph maximum expected from San Diego to Escondido and 200 mph maximum from Escondido to Riverside
- Level boarding
- Passenger Capacity: Not yet determined in California. Examples from around the world range from approximately 300 to 1,300 per train but most single level trains have about 400-500
- Operates on dedicated high-speed track with no at-grade crossings
- California HSR system will be over 600 miles

Intercity Rail:

Amtrak Pacific Surfliner

CalTrain

Designed for long distance intercity trips with long station spacing. Typically shares right of way with freight and commuter rail. Examples include the Amtrak Pacific Surfliner, Amtrak Capitol Corridor, and Amtrak Coast Starlight. Intercity rail accommodates leisure and business travelers with upgraded passenger amenities.

- Intercity rail lines typically use diesel locomotives
- Typical speed: 80 mph
- Typically low floor boarding.
- Average station spacing: 10 to 20 miles
- Typical length of line: 100 to 2,000 miles

Commuter Rail:

San Diego COASTER

Southern California MetroLink

Designed for higher-speed, longer-distance regional trips with stations spacing every four to five miles on average. Examples include the San Diego COASTER, Dallas/Fort Worth Trinity Railway Express, and Southern California Metrolink.

Commuter rail lines use diesel or electric locomotives (diesel are more common and are used in Southern California)

- Typical speed: 80 mph
- Typically low floor boarding
- Supported by Park and Ride lots
- Typical passenger capacity: 130 seats per car operating with 3-8 car trains (typically no standees)
- Operates on a dedicated right of way separate from other vehicles
- Typical length of line: 25-100 miles

Light Rail Transit (LRT):

San Diego Trolley

San Diego SPRINTER

Designed for medium-distance trips with station spacing about every mile on average. Examples include the San Diego Trolley, the San Diego SPRINTER, Portland MAX, Minneapolis Hiawatha Line, and Houston MetroRail.

- Electric or diesel-powered rail vehicles
- Typical speed: corridor speed limit, generally not exceeding 55 mph
- Typically low floor boarding
- Designed for high-capacity corridors
- Integrates well with street traffic, signals, and pedestrians
- Operates on a dedicated guideway within a separate right of way or on the street
- Typical passenger capacity: 60-140 seated plus standees (per car), with 1-4 cars
- Typical length of line: 6-25 miles

Streetcar:

Portland Modern Streetcar

San Francisco Historic Streetcar

Designed for short-distance trips with station spacing every few blocks or every quarter-mile on average. Examples include the Portland Modern Streetcar, Seattle Streetcar, and San Francisco Historic Streetcar.

- Electric-powered rail vehicles
- Typical speed: speeds up to the speed limit of the street they operate on, generally averaging 12 mph (with stops)
- Designed for dense urban areas, such as downtown areas
- Integrates well with street traffic, signals, and pedestrians
- Operates either in mixed traffic with automobiles or on a dedicated right of way
- Typical passenger capacity: up to 100 seated and standees per car (vehicles generally provide few seats due to short distance nature of trips). Operate as single vehicles
- Typical length of line: 2-6 miles

Bus Rapid Transit (BRT):

San Diego I-15 BRT

Los Angeles Orange Line

Las Vegas Wright BRT System
(Photo courtesy flipchip/lasvegasvegas.com)

Designed for longer-distance, higher-speed, regional trip-making on a dedicated bus guideway or freeway Managed Lanes/High Occupancy Vehicle (HOV) facilities. All-day, all-stop trunk BRT services can be complemented with peak-period commuter express services designed to provide very limited stop connections to major employment centers. Examples include San Diego Interstate 15 BRT; Los Angeles Orange Line; Eugene, Oregon EmX; and the Brisbane South-East Busway (Australia).

- Diesel or CNG/alternative fuels standard
- Typical speed: corridor speed limit, typically 40-60 mph on average
- Supported by Park and Ride lots
- Designed for high-capacity corridors
- Low floor design
- Operates on dedicated guideway and sometimes in mixed traffic with automobiles
- Typical passenger capacity: 50-60 seated plus standees on arterial routes, 50-80 seated on freeway routes (per bus)
- Typical length of line: 8-15 miles on arterial segments, 10-30 miles on freeway segments
- Typical station spacing: 0.5-1 mile on arterial segments, 4-5 miles on freeway segments

Senior and Persons with Disabilities Services:

MTS Access

- American with Disabilities (ADA) services for those who cannot access regular fixed route services
- Social service agency services, including door-to-door services

Rapid Bus:

Los Angeles Metro Rapid

Future Mid-City Rapid Bus

Provides higher-speed alternatives to local bus services in high-volume arterial corridors and utilizes a range of lower-capital cost signal priority treatments, short segments of transit-only lanes, and limited station stops to achieve faster travel times. Rapid Bus services can be upgraded to BRT over time through the implementation of dedicated transit lanes to bypass congested arterial segments. Examples include Los Angeles Metro Rapid and Boston Washington Street Silver Line.

- Diesel or CNG/alternative fuels standard
- Typical speed: speeds up to the speed limit of the street they operate on, averaging about 25 mph (with stops)
- Low floor design
- Designed for high-capacity corridors
- Integrates well with street traffic, signals, and pedestrians
- Typical passenger capacity: 40 seated plus standees (per bus)
- Typical length of line: 8-15 miles
- Typical station spacing: 0.5-1 mile

High-Frequency Local Bus:

San Diego Metropolitan Transit System (MTS) Bus

San Diego North County Transit District (NCTD) Bus

Facilitates mid- to short-distance trip making within local communities, with closer station spacing. Local bus services serve as the backbone of the transit system and provide the primary access into local communities where fixed-route services are warranted.

- Typically standard and single articulated buses
- Typical speed: speeds up to the speed limit of the street they operate on, averaging 12 mph (with stops)
- Low floor design
- Integrates well with street traffic, signals, and pedestrians
- Operates in mixed traffic with automobiles, but can benefit from transit-signal priority and queue jump lanes
- Typical passenger capacity: 37-57 seated plus standees (per bus)
- Typical length of line: ranges from less than 5 miles to 25 miles
- Typical station spacing: 1-4 blocks

Technical Appendix B

Key Points from Brainstorming Sessions on the Urban Area Transit Strategy (As reported to SANDAG Transportation Committee on March 19, 2010)

In preparation for the development of the Urban Area Transit Strategy, staff facilitated brainstorming sessions on ideas and concepts that could be considered in the alternative transit networks. Brainstorming sessions were held from October to December 2009 with the SANDAG Transportation Committee and Regional Planning Committee; the North County Transit Development (NCTD) Board of Directors; and the SANDAG Regional Planning Stakeholders Working Group (SWG), Regional Planning Technical Working Group (TWG), Cities/County Transportation Advisory Committee (CTAC), and Regional Housing Working Group (RHWG). Comments were solicited from the Metropolitan Transit System (MTS) Board of Directors in February 2010. The following are "key points" from those brainstorming sessions. A more detailed spreadsheet is available upon request.

SANDAG Transportation Committee

- Liked the world-class transit systems of London, Paris, Brisbane, Shanghai, and Portland; also cited lessons that could be learned from transit systems in Phoenix and Pittsburgh.
- Emphasized the importance of keeping the focus on maintaining and upgrading the region's existing transit infrastructure (such as double-tracking of COASTER and SPRINTER lines)
- Encouraged higher frequencies (for example, five-minute frequencies in key corridors)
- Encouraged more directional signage, benches, and shelters at transit stations
- Urged better use of technology (such as cell phone applications) to assist transit customers with real-time transit information
- Advocated for significant improvements between transit networks and bike infrastructure (for example, bike racks at transit stations, bike rental facilities at transit stations, bike racks on trains and buses, similar to European examples)
- Recognized the cleanliness and safety of the existing transit system in San Diego
- Cited Portland as an example of high bike ridership, a free downtown transit ridership zone, and good ties to the airport

SANDAG Regional Planning Committee

- Liked the world-class transit systems of London, Paris, Manila
- Emphasized the need to test the alternative transit networks against the reduction of vehicle miles traveled (VMT) as a key metric
- Suggested the use of smaller vehicles, such as shuttles or jitneys, to increase frequencies and to provide services in residential neighborhood areas
- Advocated building upon the existing transit network, and focusing the future transit network improvements in the urban core areas
- Suggested creating more "express" transit services to targeted areas to minimize travel times in key corridors

- Advocated the incorporation of the Smart Growth Design Guidelines and the Regional Bike Plan into the Urban Core Transit Strategy planning process
- Cited Portland as an example of an area where expenditure decisions have resulted in a tangible benefit to active transportation (high bike mode share)

NCTD Board of Directors

- Emphasized the need to figure out how to make transit work in communities that don't want increased density
- Expressed support for focusing on enhancements to the existing network, not just new ideas, and evaluating last-mile solutions
- Encouraged the evaluation of how high-speed rail fits into the study
- Stated that more service is a great idea, but urged that we consider how we pay for it
- Emphasized that transportation should fit into the land use plans of cities, not the other way around
- Expressed the concept that "transit is what the community wants it to be," and reemphasized that we need better coordination with local plans, especially in the short-term. For example, cities and transit agencies should enter into agreements to better coordinate land use and transportation.

MTS Board of Directors

- Emphasized the need to address long-term, sustainable funding sources for transit
- Encouraged community outreach, particularly to the Mid-City Community
- Recognized that the region has a solid transit network currently in place and that more can be done over time to improve the system

Regional Planning Technical Working Group (TWG) and Cities/County Transportation Advisory Committee (CTAC)

- Liked world-class transit systems of San Francisco, Washington, D.C., Paris, Bogota
- Emphasized building upon our existing transit system backbone and continuing multimodal transit technologies with a variety of options
- Suggested more shared use of parking facilities at transit stations as a way to enhance the quality and activity centers of local places
- Recognized that cul-de-sacs are bad for connectivity
- Urged implementation of bike network improvements, and implementation of more (and better-designed) pedestrian paths
- Suggested making collector streets more pedestrian and bike-friendly (reducing lanes, widening sidewalks, adding landscaping)
- Suggested reintroduction of streetcars in areas where there are space constraints

Regional Planning Stakeholders Working Group (SWG) and Regional Housing Working Group (RHWG)

- Emphasized the desire for more frequent transit, higher-speed transit services, lower fares, and fare free zones in some areas, such as Downtown
- Urged the creation of more well-maintained bike and pedestrian paths that connect to transit stations, with a focus on a multi-modal system with good connections and more bike racks
- Encouraged the availability of transit information and “applications” on cell phones
- Commented on the need for more signage, information, and security at stations
- Commented on the opportunity to increase the broad-base appeal for transit by linking “green issues”
- Voiced the need for more accessibility to transit stations and transit vehicles by the disabled, and the opportunity to link for-profit and nonprofit partners

Technical Appendix C

Urban Area Transit Strategy:

A Component of the 2050 Regional Transportation Plan

Lessons Learned from Peer Regions

December 2009

Prepared by:

PARSONS BRINCKERHOFF

EXECUTIVE SUMMARY

With the preparation of the 2050 Regional Transportation Plan (RTP), the San Diego Association of Governments (SANDAG) is seeking a new and innovative vision for transit that will result in a more significant role for transit in addressing the region's mobility, land use, and sustainability goals. To help guide development of a new transit strategy, a review has been conducted of other regions that have successful transit systems, relatively high levels of transit use, and unique transit services or facilities. These areas offer examples of how transit has been applied successfully, and provide a point of reference or a standard from which comparisons can be made.

Three regions that might be considered "benchmark" cities for San Diego were researched in some detail. These cities are:

- Portland, Oregon
- Sydney, Australia
- Vancouver BC, Canada

Seven additional "comparison cities" are highlighted because they have characteristics similar to San Diego or provide examples of unique transit applications that have helped raise the profile of transit in their regions. These cities are:

- Brisbane, Australia
- Bordeaux, France
- Denver, Colorado
- Los Angeles, California
- Melbourne, Australia
- Minneapolis, Minnesota
- Seattle, Washington

Appendix A contains comparative data for U.S. cities to help provide a point of reference for San Diego.

Overarching Themes and Considerations for San Diego

Several overarching themes emerged from the benchmark and comparison cities evaluation, many of which may be appropriate for consideration as SANDAG develops the 2050 Transit Strategy. The overarching themes found as part of the case study review are presented on the left side of the following table and their potential applicability to San Diego is presented on the right.

Overarching Theme	Considerations for San Diego
The "success" of transit did not happen overnight. Successful transit has been an evolutionary process in case study regions during which certain strategies were used until their usefulness was outlived, and then the strategies were modified or new strategies were implemented.	San Diego embarked on an innovative new transit strategy in the early 1980s with the opening of the region's (and nation's) first urban rail transit line since WWII from downtown San Diego to the International Border. Over the next 25 years, the region expanded the rail network to provide a backbone transit infrastructure and service network, to one that now includes 75 miles of light rail (San Diego Trolley and Sprinter) and 40 miles of commuter rail (Coaster). Between 1975 and 2005, transit ridership increased 150 percent while regional population increased approximately 75 percent. As the original regional rail program nears completion (the 11-mile Mid-Coast corridor between Old Town and University City is the only remaining rail extension in the Regional Transportation Plan), the regional transit strategy has shifted to a multi-modal, shared right-of-way approach (transit on managed lanes and arterial streets). Looking to the experiences of the case study regions, San Diego may need to develop a new "dramatic strategy" for transit for the next 30-40 years – one that combines past, present, and future strategies to recapture the transit momentum experienced in the 1980s. The new strategy will need to include a stronger connection between transit investment and land use policies to achieve SANDAG's vision for a larger transit mode share in the urban core, and key corridors and communities.
Transit success depends on regional plans and visions that guide the integration of land use and transportation. Many regional plans create a hierarchy of centers focused around transit that provide good design, sufficient density, and a land use mix that supports non-auto access to transit. Success is also dependent on a number of agencies working collaboratively to achieve the success of the regional plans and visions.	SANDAG's Regional Comprehensive Plan and Smart Growth strategy have established a hierarchy of centers that are designed to be supported by transit, as well as policies for integrating land use and transportation. Development of a new regional transit strategy should draw heavily on the policies and goals in the Regional Comprehensive Plan for both the region and specific corridors/communities. To achieve success, agencies, transit providers, and stakeholders must work together towards agreed upon transit and land-use goals.

Overarching Theme	Considerations for San Diego
Regions use a variety of tools to achieve transit success. Regions used a variety of policy, regulatory, and financial tools that contributed to the success of transit in these regions. Tools were modified or new tools added when they were no longer effective for encouraging ridership or investment along transit corridors.	SANDAG and the region already have a variety of policy tools to support transit as defined in the Regional Comprehensive Plan and Smart Growth strategy. Additional policies and tools found in the peer regions/cities that promote and support existing and future transit services for consideration by SANDAG include: improvements to the pedestrian environment, urban growth boundaries, cooperative agreements between public agencies and private developers, tax incentives to foster transit oriented development, parking maximums or limitations, and legislation requiring commute trip reductions by major employers.
Regions generally experienced a shift in policy and investment toward transit over the past few decades. Regions moved toward transit as a tool for improving mobility and sustainability in response to public pressures related to sprawl, the environment, livable communities, and quality of life issues. These regions also made significant investments in permanent transit infrastructure, which not only improved transit, but also helped generate awareness and understanding of the transit system and spur transit-oriented development.	The San Diego region is also experiencing similar pressures to contain sprawl, protect the environment, promote livable communities, and maintain and improve the quality of life. Through the Regional Comprehensive Plan, the San Diego region has made the policy connection between investments in transit and achieving these goals. Looking toward the future, new transit policies and strategies designed to increase transit mode share will need to understand the effects of regional highway investments and policies on the potential success of the transit investments and system.
Local bus networks are essential for successful transit systems to provide efficient connections and access to the backbone system. To efficiently support higher frequency transit stations, feeder services are essential components of the transit system and, depending on the local geography, are often structured along grids or hub-and-spoke networks.	San Diego's existing transit network leans toward hub-and-spoke structure with feeder buses connecting to rail based transit centers. However, many trips rely solely on bus transit. A new transit strategy will need to build off the existing rail transit investment, while also considering how best to serve key travel markets (origins/destinations, work trips, etc.) that may not be well served by existing bus/rail connections. The strategy will also need to define the role of local and feeder bus service in relation to the major transit infrastructure investments.

Overarching Theme	Considerations for San Diego
Parking requirements in transit-supportive communities are reduced. Most transit successful regions have coordinated parking policy with land use and transit policy. Parking strategies often differ between central and outlying areas.	Abundant and inexpensive parking have proven to be key deterrents to transit use. A new transit strategy for the San Diego region should evaluate how parking policies (location, availability, and cost), particularly in the city center and urban core, impact transit use.
Successful transit systems include a variety of transit modes. Cities and regions with successful transit have systems that include combinations of transit modes applied for the particular conditions, objectives and circumstances (i.e., heavy rail, commuter rail, light rail, bus rapid transit, rapid bus, local bus, streetcar, shuttles, electric bus, etc.)	All regions include a combination of transit facility and service applications to create their transit networks and systems.
Unique applications of transit have occurred in the central cities. While all of the studied regions have a wide range of transit modes that provide area- and location-appropriate transit, these cities have also incorporated special applications of transit infrastructure, services, and policies in their downtowns in ways that raise the profile of transit, promote transit use, and support higher density environments.	Even cities with similar transit histories and land use characteristics as San Diego have invested heavily in innovative transit facilities and services in their central cities (transit malls, streetcars, underground bus terminals, fare free zones). These investments have proven highly successful in generating transit ridership, supporting the regional transit network, achieving land use objectives, increasing transit mode share, and contributing to the vitality of their downtown core. Many of these strategies may have applicability to downtown San Diego and other key activity centers.

BENCHMARK CITIES

For the benchmark cities, the project team asked a series of questions designed to provide insight into why transit works within the city and what supports the system to make it work.

1) Portland

When did the process begin?

The evolutionary process of becoming a transit city began over 25 years ago when the first light rail line was planned. In Portland, the first light rail line was, in part, an outgrowth of a citizen led freeway revolt that ultimately resulted in the reduction of available land takings for transportation uses. With limited land to work with, TriMet focused on building partnerships and convincing others that transit oriented development (TOD) was an essential tool to address current and future transportation needs. However, transit oriented development was largely an afterthought during development of the first light rail line.

Fifteen years later, the creation of new walkable communities was a primary rationale for building the streetcar line that runs through downtown Portland. Many advocates consider the streetcar to be a housing and redevelopment tool; not just a tool for moving people out of their cars. Since the streetcar opened in 2001, over $3.4 billion in development and 10,212 residential units have been constructed along the route.

What is unique about the system?

The Portland story is about community-building and life-style choice more than a transit or TOD story. The Region 2040 Plan, the regional growth strategy and vision for the Portland Metropolitan region, identifies a series of centers that are focused around transit. As such, TOD is a means or tool to become a sustainable place, not an end in itself.

As each successive light rail line developed, it became clearer that the addition of transit alone was not enough to spur development and increase ridership. A clear strategy and tools were needed to realize the construction of a higher density mix of uses near transit investments. The strategy involves coordination among various agencies, each playing a different role consistent with its overall mission:

- TriMet – seeks to focus growth next to transit because of the evidence supporting the theory that the more people who can walk to transit, means more people who will use transit. TriMet has no special TOD tools or sources of funding, but TriMet does do the following: select rail alignments that support TOD; modify station locations to facilitate supportive development; fund local government planning to encourage implementation of supportive policies; write-down land costs to get better design/density/affordability in TODs; turn park-and-rides into TODs; and invest savings from rail construction to create TODs.

- Metro – oversees the implementation of Region 2040, act as the Metropolitan Planning Organization responsible for identifying existing and future transportation project and program expenditures, sets the regional plan for expanding transit, and manages the Portland metropolitan region's urban growth boundary. In addition to its transportation planning role, Metro has a TOD program that is dedicated to the development of TOD centers and corridors as part of an aggressive strategy to implement Region 2040. The program operates through a series of cooperative agreements between Metro and local jurisdictions and utilizes agreements with private developers (primarily for site acquisition). In the past, the program has focused on projects that might not otherwise be developed on a given site without additional subsidy.
- Portland Development Commission (PDC) – is the urban renewal and economic development arm of the City of Portland. PDC funds projects that are green, support the community and transit, pay prevailing wages, and meet minority and disadvantages business goals. PDC also uses tax abatement and developer agreements to support projects. It has funded several TODs in the City of Portland.

In addition, the private sector is asked to be a partner, as well as be innovative – in return, the public sector seeks to reduce the risk for their private sector partners. For example, when the streetcar was built in the Pearl District, a developer agreement was signed by the developer and the City of Portland (PDC) that addressed housing density, housing affordability, parks, and infrastructure. The developer contributed funding and donated right-of-way for needed infrastructure (streets, streetcar, utilities, and park) within the development and committed to develop at higher housing densities to coincide with certain public improvements to be provided by the City, such as the removal of a structure crossing the abandoned rail yards, construction of the streetcar, and a neighborhood park. The City formed an urban renewal district to allow for tax-increment financing in order to fund its obligations.

Throughout the years, these partnerships have spurred more than $9 billion in development, consistent with transit-friendly land use plans along Portland's 44 miles of light rail and 4 miles of modern streetcar. These partnerships have resulted in residential and employment growth occurring within walking distance of transit. As a result,

- Portland area residents travel about 20 percent fewer miles than residents in other large U.S. metropolitan areas;
- Portland residents are twice as likely to commute to work using transit and seven times more likely to commute by bicycle than the average metropolitan resident in the U.S.;
- Over 8 in 10 of TriMet's riders are choice riders, meaning they have a car available for the trip or choose not to own a car; and
- Portland has the second lowest rate of spending on transportation costs of the 28 largest U.S. metropolitan areas. Residents spend about 4 percentage points less of their total household budgets on transportation than other Americans, about 15.1 percent compared to 19.1 percent nationally.

Have freeway/highway investment strategies changed over time?

Over the years, more federal funds have been sought for transit than previously. The Draft 2035 Regional Transportation Plan identifies approximately 32 percent of the federal priority funds for transit capital and 47 percent for roads and bridges, which includes new street connections to transit or for walking and biking.

What is the share of downtown employment in the region?

Approximately 8 percent of the region's jobs are in the central business district.

Exhibit 1 Portland MAX Light Rail Network

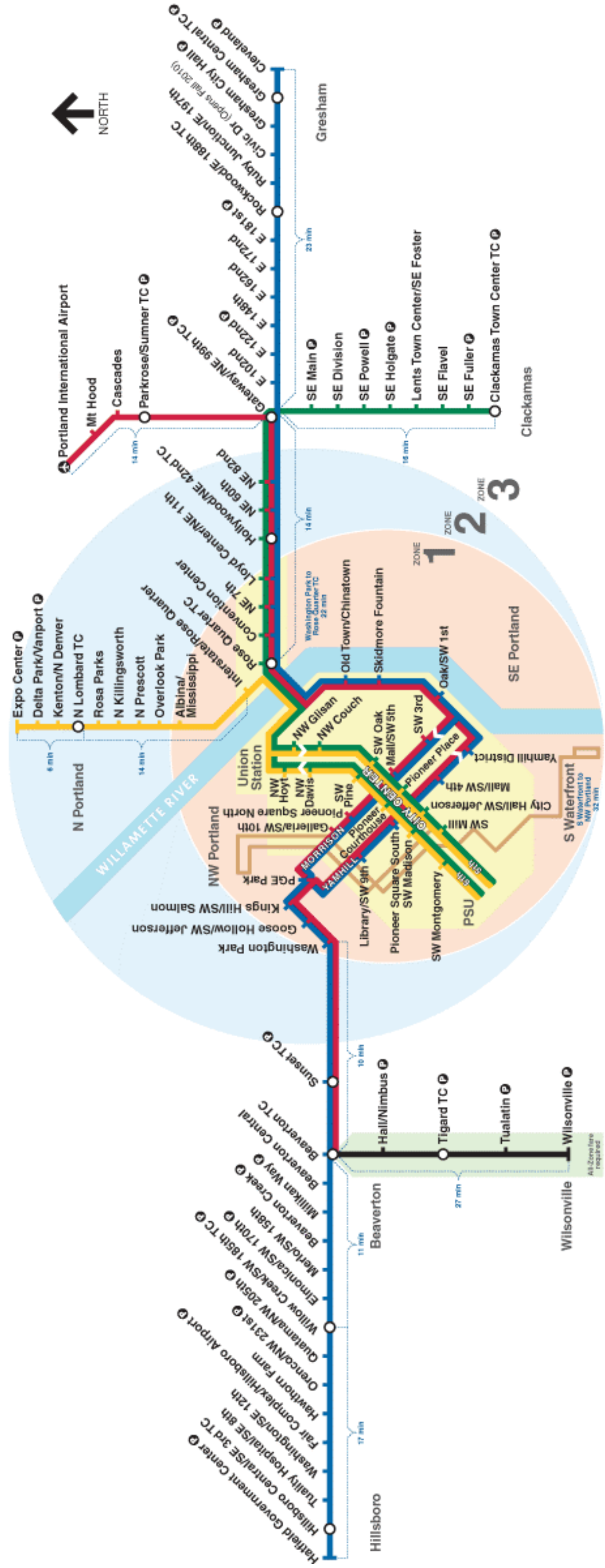
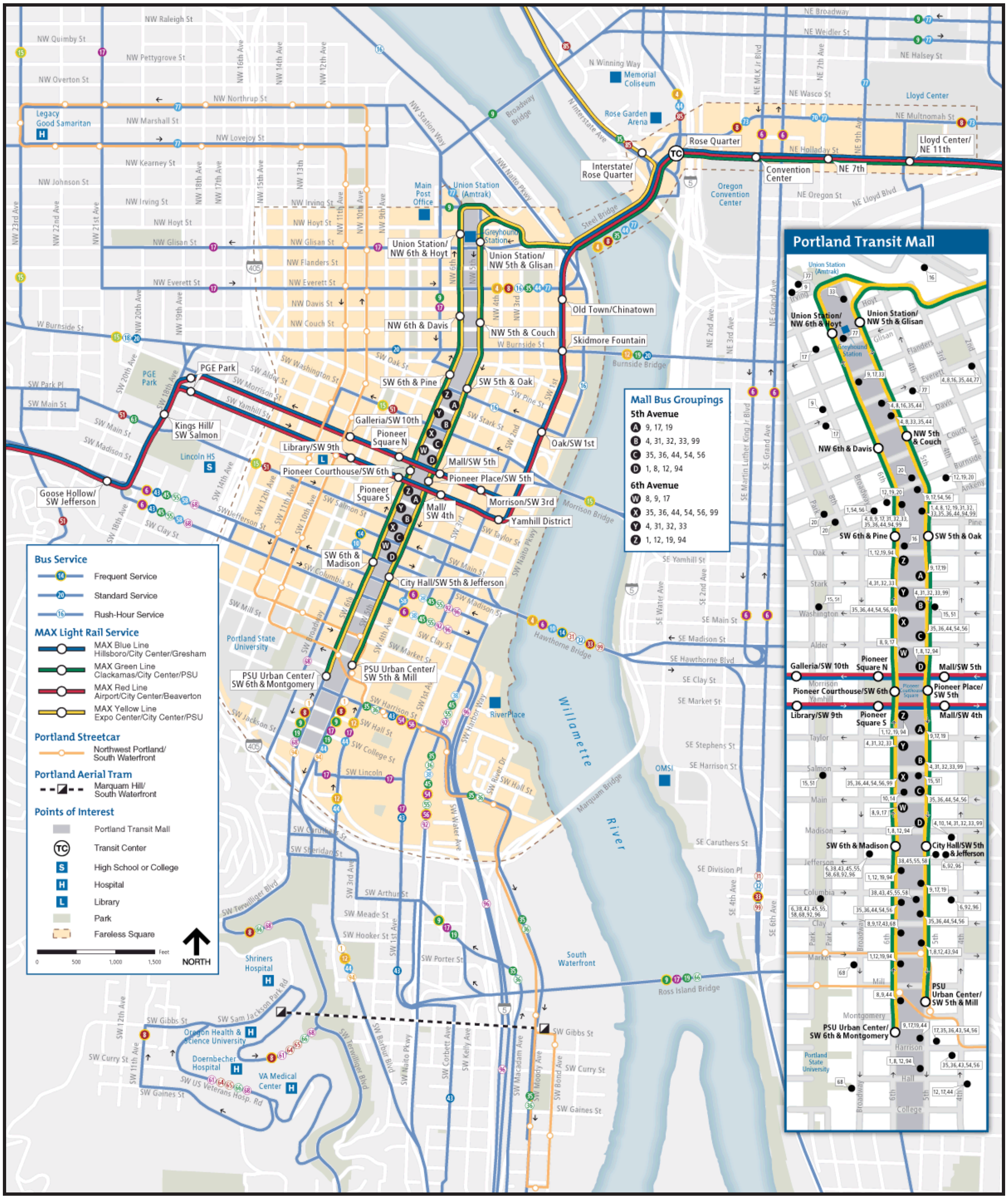


Exhibit 2 Downtown Portland Transit Mall



2. Sydney

When did the process begin?

Over the past three decades metropolitan planning strategies for Sydney have contained policies which sought to promote development and growth in designated centers within the metropolitan area of Sydney, as well as policies that restrict office and retail activities outside of the centers. The 2005 New South Wales Metropolitan Strategy, "City of Cities – A Plan for Sydney's Future," continues the "centers" policy of concentrating activities in a hierarchy of "strategic centers" that includes the city of Sydney, five designated regional cities, areas of high value economic activity designated as specialized centers, and major centers that are areas of civic, shopping and recreational activity. The Strategy explicitly recommends concentrating activities in centers on or near public transport in order to achieve a range of benefits. Improving transport between Sydney's centers and the transportation sustainability of centers are key supporting objectives. While the accompanying transportation strategies included a commitment of resources to rail and other public transport investments and were premised on research that indicates a centers-based urban form requires upgraded public transport links that provide more efficient connections than automobiles, the key elements of the strategies have not always been delivered.

In the 1990's, study began on a network of transitways that would link the region's residential areas to the employment areas in the outer suburban ring around Sydney's central business district.

What is unique about the system?

In 2005, 80 percent of Sydney's population lived within 30 minutes by public transit of Sydney, a designated regional city, or a designated major center. Over 70 percent of employees in the Sydney central business district use public transit to and from work. This is the highest mode share in Australia and is comparable with Manhattan in New York City.

The Liverpool to Parramatta line of the Western Sydney Transitway Network is an example of how people's behavior can change when they are given high quality, frequent transit service. The rapid transit corridor is approximately 19 miles (30 km) long, running from Liverpool to Parramatta on an exclusive busway network. The intent of the line was to improve travel in the outer suburban ring (not into downtown Sydney) and improve access from residential suburbs to suburban employment centers by providing an alternative to the automobile. Originally planned as a fully integrated network, with a mix of dedicated trunk corridor and feeder services, only the trunk corridor services have been developed, which includes 35 stations and approximately five-minute headways during the morning and evening peak. Even without full build-out, the corridor has proven to be successful and has seen a 20 percent annual increase in ridership growth since it opened in 2003. Approximately 20 percent of the transit riders in the corridor previously traveled by automobile.

Have freeway/highway investment strategies changed over time?

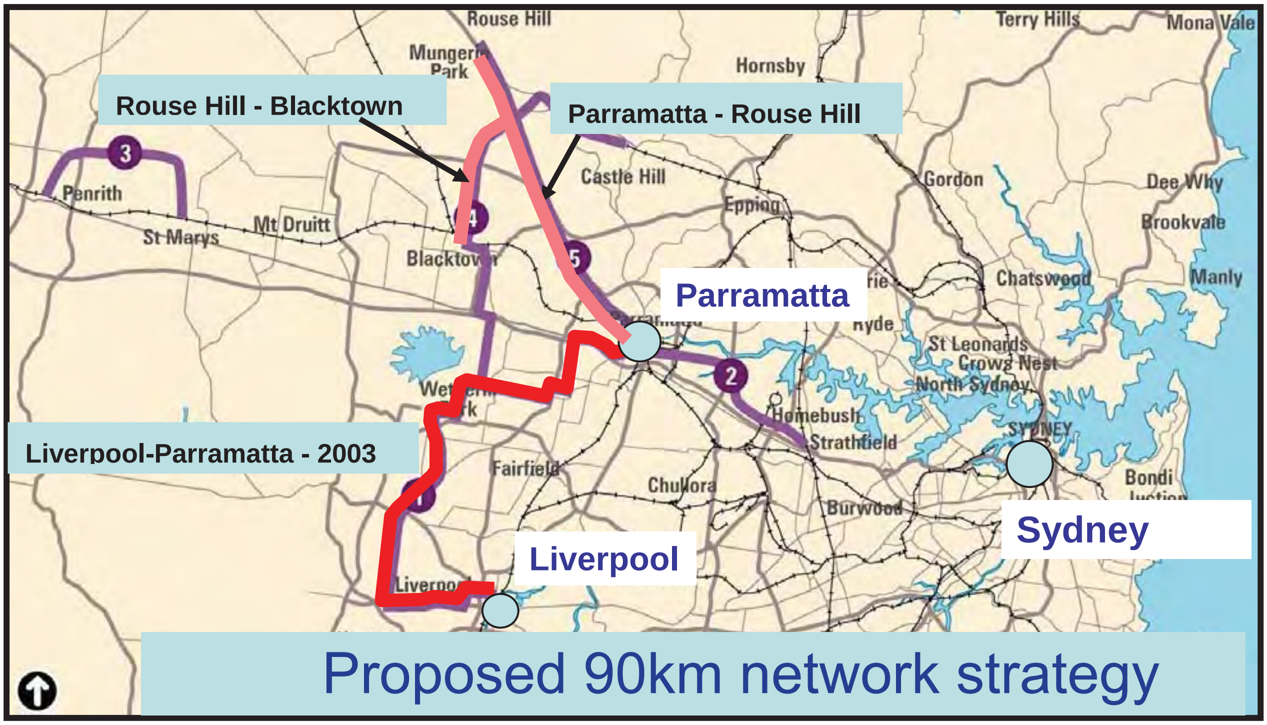
In the last decade, a considerable number of toll-road facilities have been developed and constructed under public-private partnership agreements and have, in part, been to complete the existing road network. In the last five years, there has been a shift away from freeways and toll-roads to transit infrastructure due to a change in policy at the Federal level.

What is the share of downtown employment in the region?

The central business district has approximately 12 percent of the region's employment.

Exhibit 3 Sydney CityRail Network

Exhibit 4 Liverpool to Parramatta Line – Western Sydney Transitway Network



3. Vancouver BC

When did the process begin?

The 1975 Livable Region Plan created a vision of transit-oriented growth. In 1996, the Livable Region Strategic Plan and the Transport 2021 Long-Range Plan were adopted. Both call for more compact development, complete communities, and TOD. The Livable Region Strategic Plan key strategies are:

- Protect the green zone (watersheds, farmlands, conservation areas, parks and other natural assets)
- Build complete communities
- Achieve a compact metropolitan region
- Increase transportation choice.

The Regional Town Centers in the Livable Region Strategic Plan focus employment growth closer to where people live and where transit service is most available. The Vancouver region also encourages infill development and protects their "green zones" through the use of an urban growth boundary.

What is unique about the system?

The urban design and density that supports transit have been part of Vancouver's story for decades due to its topographical and geographic constraints of water and mountains. The density in Vancouver is one of the components that make the transit system work. Social bonus zoning allows extra density in housing developments in exchange for public amenities, such as cultural facilities, parks, schools, and affordable housing, built by the developer. Developers appreciate this approach because they have found that the value of their projects increases with improved public amenities. The social bonus zoning has resulted in greater diversity in housing, both in housing types and demographics, and has also resulted in a vibrant public realm that includes greater walkability and a mix of uses. Public amenities ultimately included in developments are selected and managed by the City of Vancouver through a development agreement.

There are two transportation planning decisions that have greatly influenced how the citizens of Vancouver travel within their city. First, Vancouver is the only major city in North America that does not have a freeway within its boundaries. In the 1970's, as a result of the "Livable Region Plan," a proposed freeway grid system was abandoned in favor of more sustainable transportation systems. Second, the only bridge from downtown across Burrard Inlet is the three-lane Lions Gate Bridge – there are no discussions of replacing or widening the bridge. These two decisions have resulted in an acceptance by residents of alternative transportation options, but the city has also been designed to be walkable, bikeable, and provide a high level of transit service. Within the City of Vancouver, buses generally run on the grid system, but outside the city boundaries, most buses operate on a hub-and-spoke system along feeder routes that connect with SkyTrain, SeaBus, or West Coast Express. There are also express bus routes that travel directly to downtown Vancouver or other regional centers.

Another component of the Livable Region Strategic Plan is the prohibition of surface off-street parking in many of the regional town centers. This limitation has prompted developers to orient projects to transit facilities in order to avoid constructing more expensive structured or underground parking, as part of the proposed development. This limitation in use of available land for parking or auto-based needs can lead to the development of public amenities, such as parks, pedestrian and bike connections, and further development.

Have freeway/highway investment strategies changed over time?

The Livable Region Strategic Plan calls for limiting the amount of new highway infrastructure and increasing the supply of transit services across the region. No expansion of the highway network is proposed into the city of Vancouver and a planned major highway expansion project in BC's Lower Mainland to Highway 1 from Langley to Vancouver is currently experiencing public opposition. Investments by TransLink (the regional transportation authority responsible for regional transit, cycling and commuting options), are required to support the Livable Region Strategic Plan.

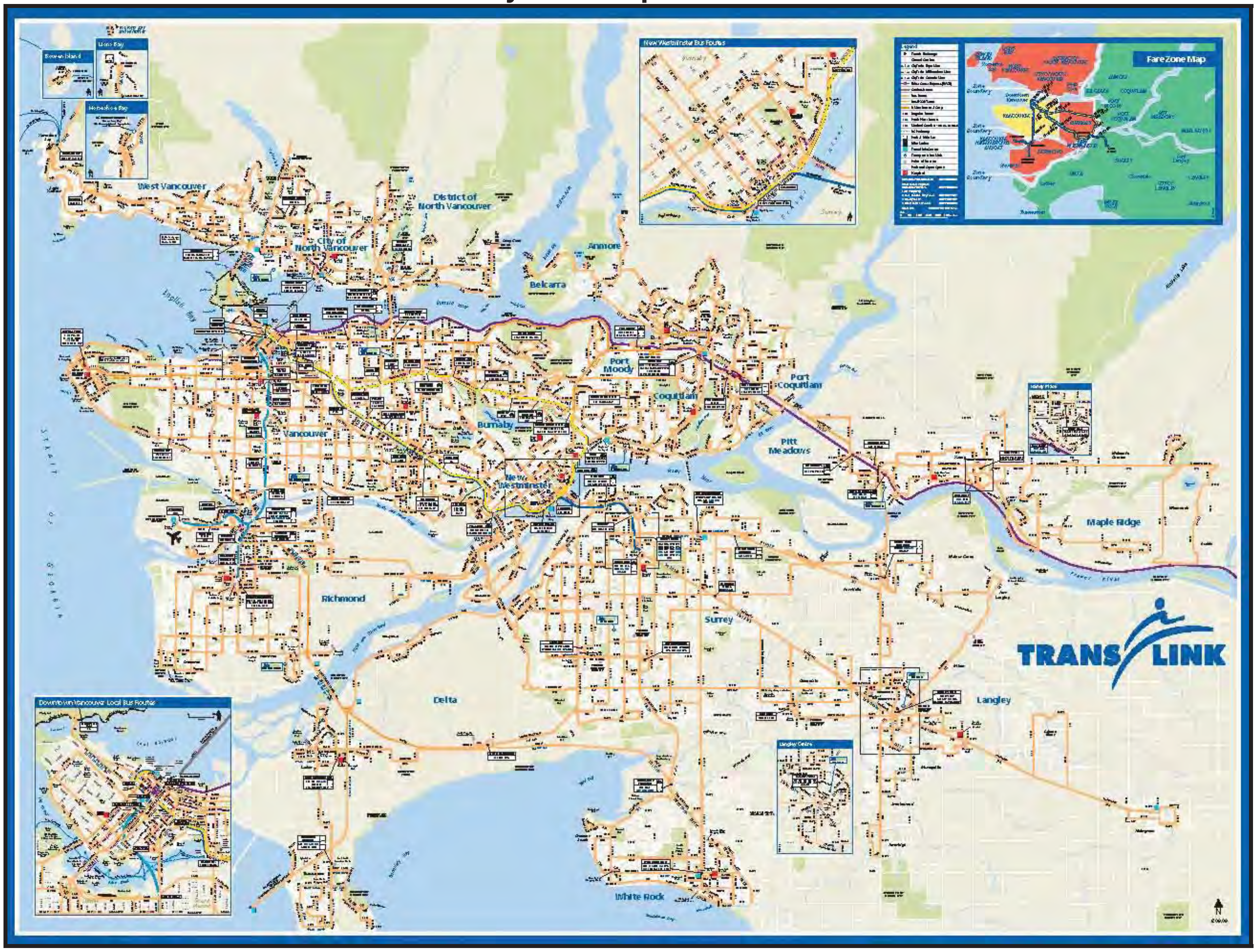
In addition to the Livable Region Strategic Plan, the City of Vancouver adopted a Transportation Plan in 1997 that emphasized limiting overall road capacity to 1997 levels by not expanding the grid system, but instead providing more comfortable walking and biking environments, increasing the use of transit, calming traffic in neighborhoods, and maintaining an efficient network for goods movement. After 10 years, vehicle trips entering Vancouver have decreased 10 percent, bike trips have increased 180 percent, walking trips have increased 44 percent and transit trips have increased by 20 percent.

What is the share of downtown employment in the region?

Approximately 9 percent of the jobs in the Vancouver region are located in the central business district.

Exhibit 5 Vancouver TransLink Map

Exhibit 6 Vancouver TransLink System Map



COMPARISON CITIES

In addition to the three benchmark cities, seven comparison cities that are similar in size and demographic and/or geographic characteristics to San Diego were studied because they have transit components that are worth understanding, particularly in their central areas.

1. Brisbane

Brisbane's transit system is managed by the TransLink Transit Authority and consists of CityTrain, Brisbane's urban rail network of 10 suburban lines and three interurban lines (237 miles), the CityCat ferry system, local bus service, and a busway network. The decision to develop a busway instead of expanding the existing rail system was due to a debate over the expansion of the Pacific Motorway (freeway) from six to eight lanes. The expansion was opposed by a large segment of the community and the Brisbane City Council desired an alternative that focused on people carrying capacity (versus auto carrying capacity). However, the corridor was not included in any future plans for a rail extension and contained relatively low-density development. The busway concept was designed to address the dispersed transit needs of this corridor, fill the gaps between existing rail lines, and further complete the public transportation network. The busway provides a dedicated facility that allows suburban bus routes to access the busway at key locations, providing more point-to-point travel from local bus stops and avoid auto traffic congestion on the motorway. More than half of the bus routes using the busway begin their service in the adjoining suburbs before traveling express to the central business district.

The South East busway was the first section to open and has been operational since 2001. The Inner Northern Busway began service in 2008, creating a core section of the busway system that runs from the Royal Children's Hospital to Queen Street. There are over 19 miles of transit lanes with 17 stations (stations include electronic bus information, security, and bicycle facilities) on dedicated roadways. Both rail and bus systems converge in the Brisbane central business district; the Roma Street station includes platforms for the busway and CityTrain services at the same level. Expansions of the busway are currently being constructed or planned, including the Eastern and Northern Busway.

Exhibit 7 Brisbane Queensland Rail and Busway Network

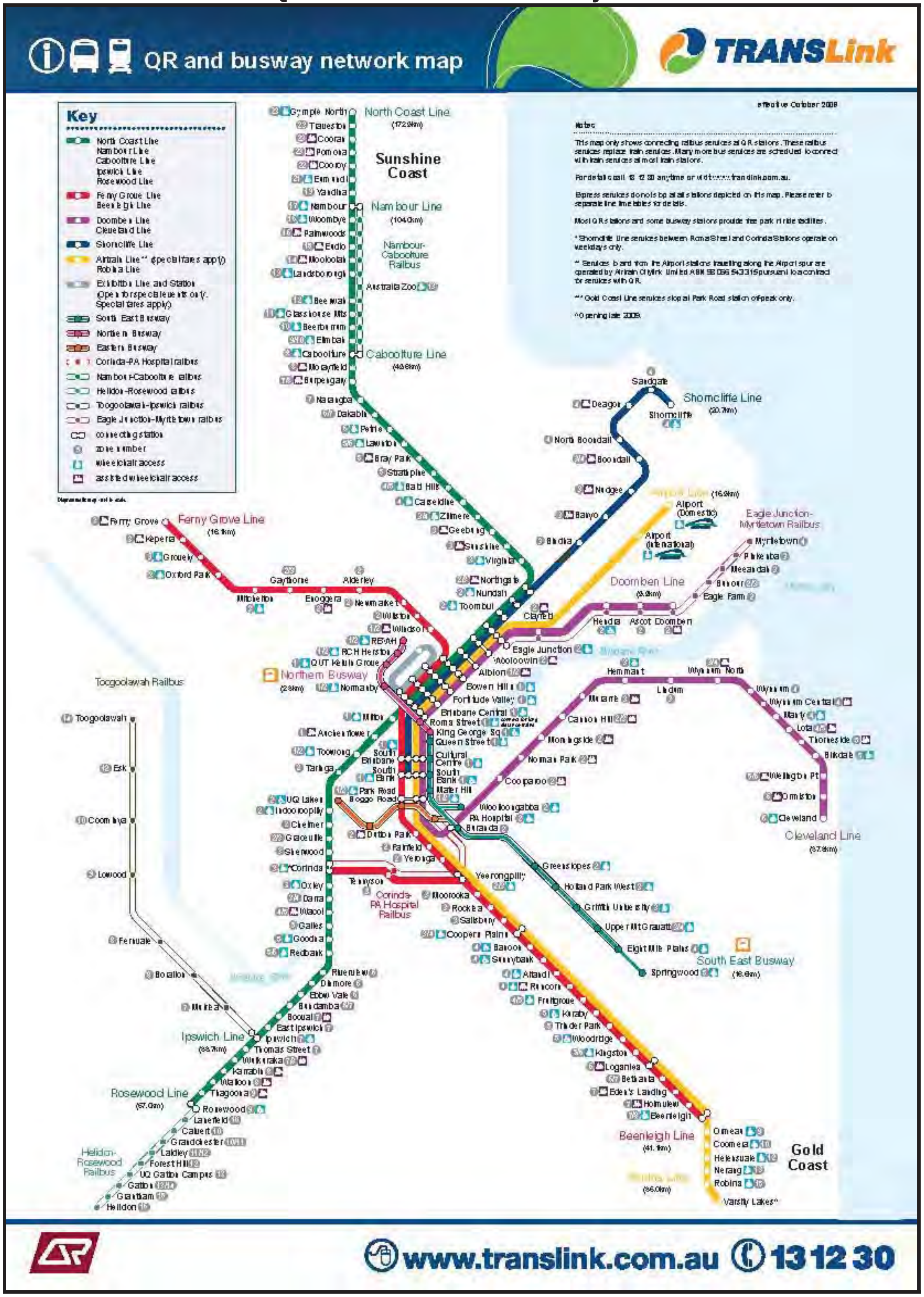


Exhibit 8 Brisbane Translink Busway Network


TransLink busway network
Bracken Ridge
Chermside
Northern Busway
Kedron
RCH Herston
CITY
Northern Busway to Windsor
South Bank
Coorparoo
Eastern Busway (Buranda to Capalaba)
Carindale
Buranda
Greenslopes
Capalaba
Griffith University
South East Busway
Eastern Busway (University of Qld to Buranda)
Springwood
Key
rail network
existing busway network
future busways
proposed busways
Please note: this map is not to scale and indicative only

2. Bordeaux

Bordeaux's public transit system consists of three tram (streetcar) lines, 72 bus routes that all connect to the tramway network and electric bus shuttle in the city center, and a boat shuttle on the Garonne River. The tram network connects Bordeaux with surrounding suburban areas. The first phase of the network consists of a 24.5 km (approximately 15 miles) network and 53 stations. The second phase will extend the three lines a total of 20 km (12.5 miles) and incorporate an additional 28 stations and eight park-and-ride lots.

Many downtown streets and plazas along the tram lines have become pedestrian areas with limited car access – pedestrian mobility is supported by an electric shuttle bus (la navette du centre-ville) in the downtown core that has no set stops. The city of Bordeaux implemented the Urban Project to improve the center city environment for pedestrians and cyclists and established principles of pedestrian-friendly environments in their Street Code document for improved streetscapes and pedestrian connectivity. The city also established car-free zones and pedestrian-only days within the center city. Bordeaux has seen a dramatic increase in the number of cyclists since these measures have been enacted.

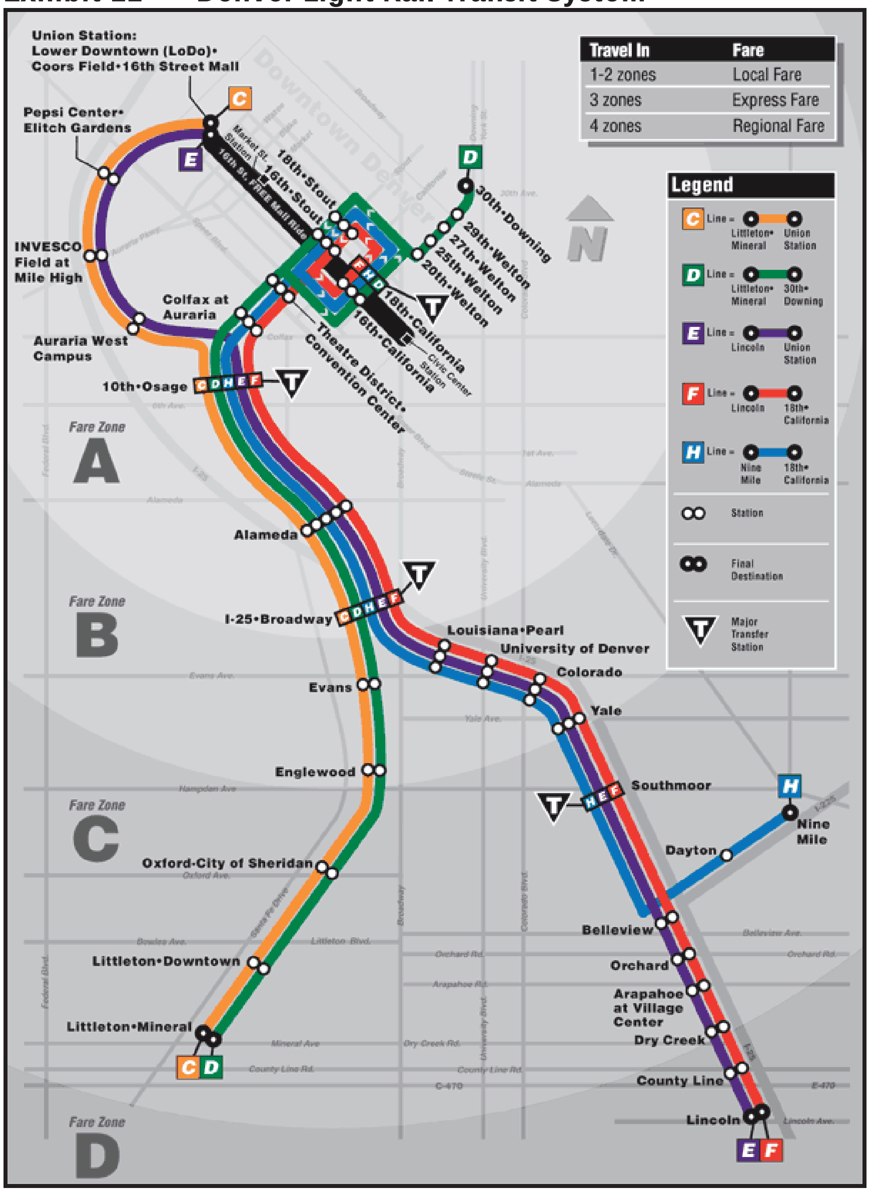
Exhibit 9 Tramway de Bordeaux System Map

Exhibit 10 la navette du centre-ville Route Map (electric shuttle bus)

3. Denver

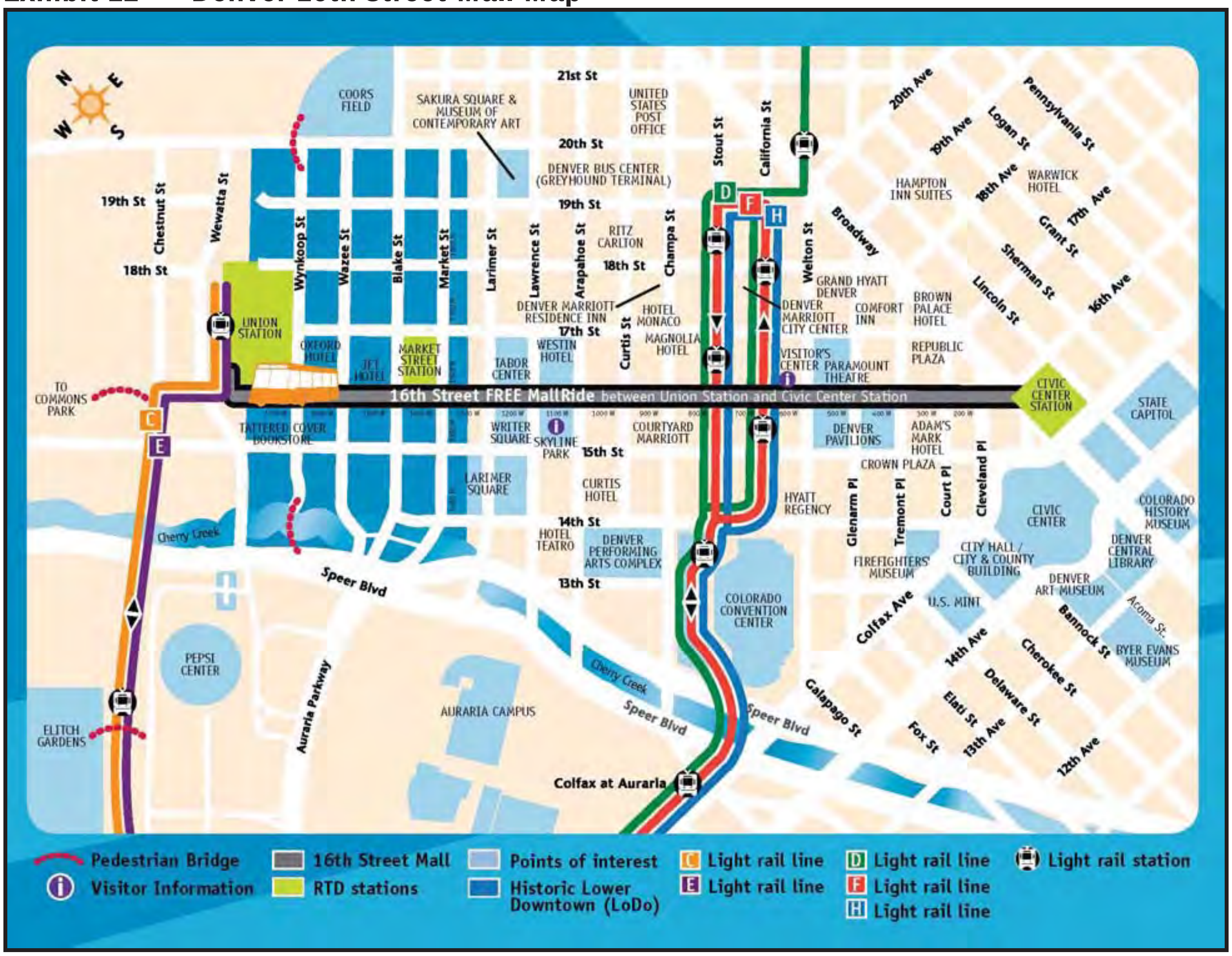
The Regional Transportation District (RTD) manages and coordinates public transportation in the greater Denver area (eight of the twelve counties) and provides service on 140 local, express, and regional bus routes, six light rail lines (totaling 35 miles), and nearly 80 park-and-rides. In 2004, voters approved FasTracks, a light rail, bus, and commuter rail expansion project that will serve neighboring suburbs and communities. It will add 122 miles of new commuter and light rail, 18 miles of bus rapid transit service, 21,000 new parking spaces at rail and bus stations, and enhance bus service within the eight-county district.

Exhibit 11 Denver Light Rail Transit System



Within the central business district, the 16th Street Mall is a pedestrian and transit mall running 1.25 miles from Union Station (Wewatta Street) to Civic Center Station (Broadway). Since its opening in 1982, the Mall has become the city's busiest transit artery and a premier public space. Originally, from Market Street to Broadway, the Mall was extended in 2001 to Wynkoop Street and then to Union Station in 2002 with the completion of the Central Platte Valley (C line) light rail extension. The FREE MallRide, a free high-frequency electric shuttle bus service operated by RTD runs the length of the Mall. The frequency of service is very high, with buses approximately every 1-2 minutes during rush hour. The total travel time from Union Station to Civic Center Station is approximately 11 minutes. Stops are located at every intersection. The FREE MallRide connects to other RTD transit: light rail at Union, 16th/California and 16th/Stout Stations; and bus service at Civic Center and Market Street Stations. The connecting bus services enter below grade bus stations at these locations.

Exhibit 12 Denver 16th Street Mall Map



4. Los Angeles

The Los Angeles County Metropolitan Transportation Authority and several other agencies operate the region's bus, heavy rail, and light rail lines throughout Los Angeles County. Since the 1980s, the region has undergone a fundamental refocusing of its transportation policy from freeways to transit. Los Angeles has invested heavily in transit over the past 20 years, beginning with Proposition A in 1980, which provided a half-cent sales tax specifically for transit, Measure C in 1990, another half-cent sales tax of which at least 40 percent is dedicated to transit (the remaining is for highways and roads), and Measure R in 2008, the most recent half-cent transportation sales tax of which at least 65 percent is dedicated to transit. The combination of the three sales tax measures results in an approximately one-cent sales tax for transit. Transit service in the Los Angeles area includes light rail (Blue, Green, and Gold lines), heavy rail subway (Red and Purple Lines), BRT guideway (the Orange Line, El Monte Busway, and Harbor Transitway), and 20 Rapid Bus projects, tying rail and bus together into a backbone system in a relatively short time. In addition, MetroLink provides commuter rail service within and between Los Angeles, surrounding counties and many suburban areas, and an extensive local bus network supports the backbone system.

Downtown Los Angeles is the hub of the city's rail transit system and on the northeastern edge of downtown, the Los Angeles Union Station (known as the "Last of the Great Railway Stations") serves as the region's main transportation hub. However, the region includes a number of non-downtown serving rail and bus facilities, particularly the Metro Rapid bus services, which now operate on a 450 mile network, complementing light and heavy rail transit throughout Los Angeles County.

Exhibit 13 System Map of Los Angeles Metro (LRT), MetroLink (Commuter Rail), and Orange Line (BRT Guideway)

Exhibit 14 Los Angeles Metro Rapid (Arterial Bus) and Rail System Map

5. Melbourne

Public transportation in Melbourne includes train, tram (streetcar), and bus networks. MetTrain, the rail network, consists of 16 suburban lines that feed into City Loop, a partially underground one-way loop that is serviced by five stations. Melbourne's tram network has 29 routes and 250 km (155 miles) of double track, approximately 80 percent of which shares surface roads with other vehicles and users. In addition, Melbourne has a bus network of approximately 300 routes that are provided by about 50 privately-owned bus companies under a franchise system. Melbourne also has a fare free transit service (CityCircle) within the downtown area.

Unlike other cities post World War II, Melbourne did not abandon its tram system. Because of the long history of trams in the central area, Melbourne has retained a strong focus on compact development in the central business district. Also contributing to the high central business district densities is the City's reluctance to connect the core and lower density suburban areas with high capacity freeway links. When the 1969 Metropolitan Transportation Plan proposed that a 500-kilometer freeway network would be needed within 15 years to avoid citywide gridlock, the Committee for Urban Action did not want a freeway to take over the city and mobilized against the proposal in order to preserve the unique design of the inner city from "imposing freeway structures."

In the mid-1980's, an effort was made to strengthen the region's core through the adoption of the "Central City Plan" that focused on infill development in the established areas and creating "green wedges" between the urban and rural areas. This plan transformed Melbourne's central city through urban design and planning, including the implementation of height limits, design standards and public amenities, private investment, and new land uses in the central city. The addition of a designated urban growth boundary within its Melbourne 2030 Plan also strives to focus growth within the central city.

Exhibit 15 Melbourne Train Network

Exhibit 16 Melbourne Tram (Streetcar) Network

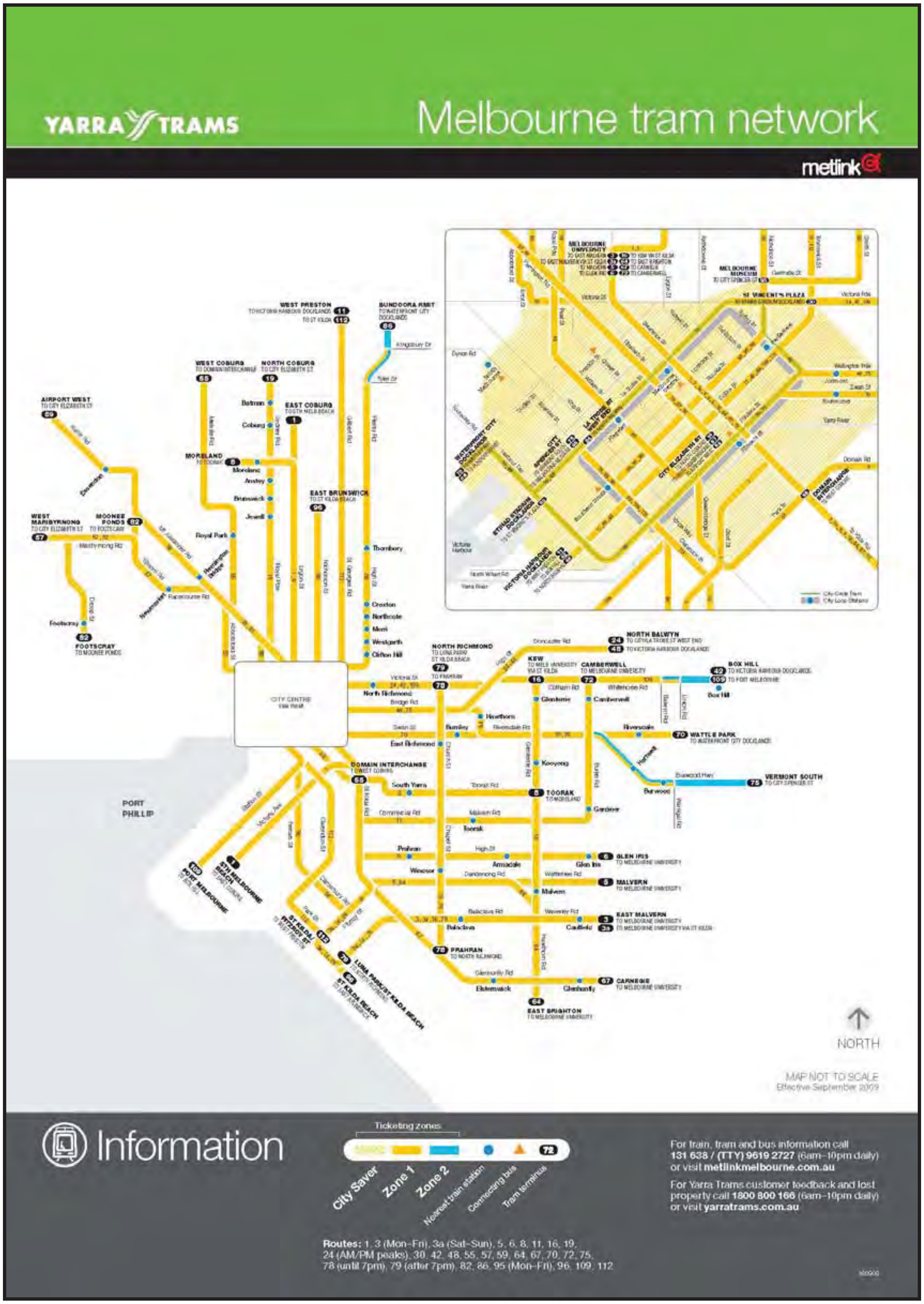
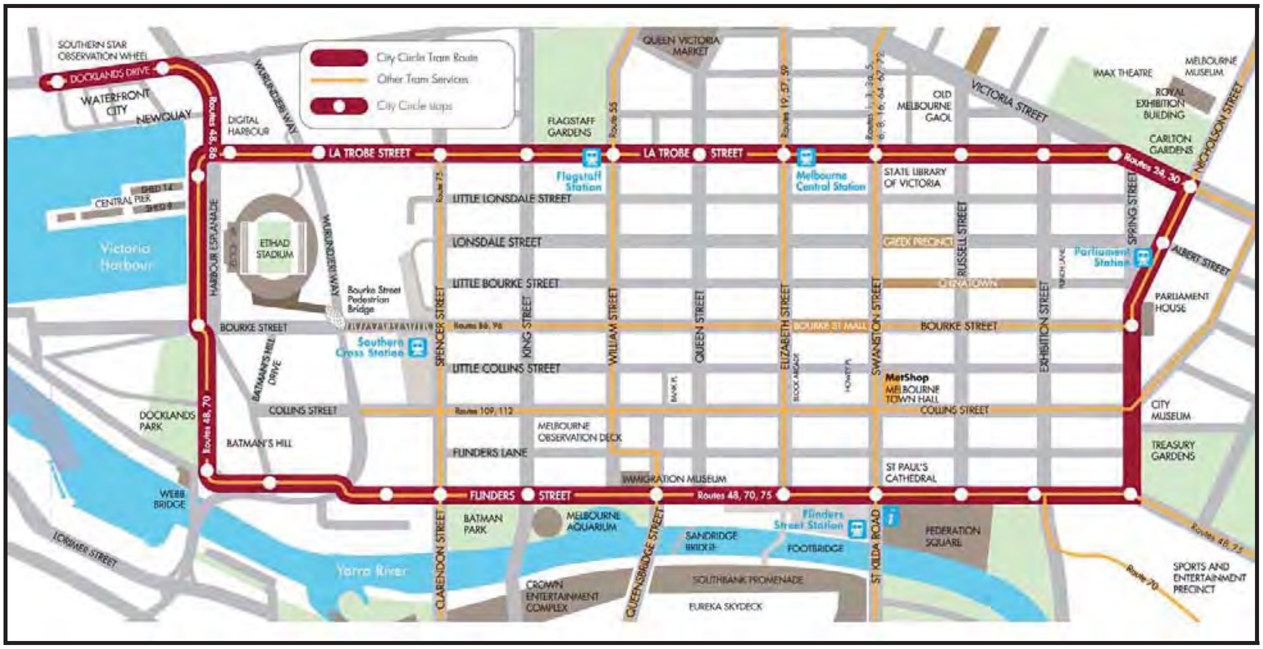


Exhibit 17 Melbourne Free City Circle Service


City Circle Tram Route
Other Tram Services
City Circle stops
SOUTHERN STAR OBSERVATION WHEEL
DOCKLANDS DRIVE
WATERFRONT CITY
NEWQUAY
DIGITAL HARBOUR
WURUNDJERI WAY
Routes 48, 86
CENTRAL PIER
Victoria Harbour
HARBOUR ESPLANADE
ETIHAD STADIUM
Bourke Street Pedestrian Bridge
BOURKE STREET
BATMAN'S HILL DRIVE
Southern Cross Station
DOCKLANDS PARK
Routes 48, 70
COLLINS STREET
BATMAN'S HILL
WEBB BRIDGE
LORIMER STREET
Yarra River
LA TROBE STREET
FLAGSTAFF GARDENS
Route 55
Flagstaff Station
Route 75
LITTLE LONSDALE STREET
LONSDALE STREET
LITTLE BOURKE STREET
SPENCER STREET
KING STREET
WILLIAM STREET
Routes 86, 96
LITTLE COLLINS STREET
Routes 109, 112
MELBOURNE OBSERVATION DECK
FLINDERS LANE
FLINDERS STREET
CLARENDON STREET
BATMAN PARK
MELBOURNE AQUARIUM
CROWN ENTERTAINMENT COMPLEX
QUEENSBRIDGE STREET
QUEEN VICTORIA MARKET
Routes 19, 57, 59
Melbourne Central Station
QUEEN STREET
ELIZABETH STREET
BOURKE ST MALL
BLOCK ARCADE
IMMIGRATION MUSEUM
Routes 48, 70, 75
Flinders Street Station
SANDRIDGE BRIDGE
FOOTBRIDGE
SOUTHBANK PROMENADE
EUREKA SKYDECK
ST KILDA ROAD
SWANSTON STREET
OLD MELBOURNE GAOL
VICTORIA STREET
STATE LIBRARY OF VICTORIA
GREEK PRECINCT
RUSSELL STREET
CHINATOWN
BOURKE STREET
MetShop
MELBOURNE TOWN HALL
COLLINS STREET
ST PAUL'S CATHEDRAL
FEDERATION SQUARE
EXHIBITION STREET
IMAX THEATRE
MELBOURNE MUSEUM
ROYAL EXHIBITION BUILDING
CARLTON GARDENS
NICHOLSON STREET
Routes 24, 30
SPRING STREET
Parliament Station
ALBERT STREET
PARLIAMENT HOUSE
CITY MUSEUM
TREASURY GARDENS
Routes 48, 75
Route 70
SPORTS AND ENTERTAINMENT PRECINCT

6. Minneapolis

Metro Transit is the transit service provider in the seven-county region surrounding Minneapolis and St. Paul, providing service on approximately 130 routes, the Hiawatha Line light rail, and the Northstar commuter rail line. In addition to these more traditional transit services, Minneapolis has over 250 miles of bus-only shoulders in the metro area. The bus-only shoulder concept provides more reliable service and faster transit travel times in congested corridors, which is designed to promote and increase transit ridership. The Metropolitan Council is currently undertaking a project that is assessing opportunities to 'right size' their highway system by analyzing future infrastructure scenarios that range from traditional highway expansion infrastructure investments to various scenarios utilizing lower-cost/high-benefit projects that could include investment in managed lane facilities, pricing strategies, and other operational strategies. In addition, Minneapolis has an urban service area boundary, which is not a strict growth boundary, but a framework to direct development to areas with existing roads and sewers to efficiently use existing infrastructure.

Running through downtown Minneapolis is the Nicollet Mall – a pedestrian and bus transit mall that, in addition to Hennepin Avenue, is considered the cultural and commercial heart of the city. In addition to serving many Metro Transit bus routes, Nicollet Mall also connects to the current and future light rail system. The Hiawatha light rail line connects downtown Minneapolis to the airport and the Mall of Americas, crosses the Nicollet Mall at one end, and the planned Central Corridor line to downtown St. Paul will also include a stop on Nicollet Mall.

Exhibit 18 Minneapolis Transit System

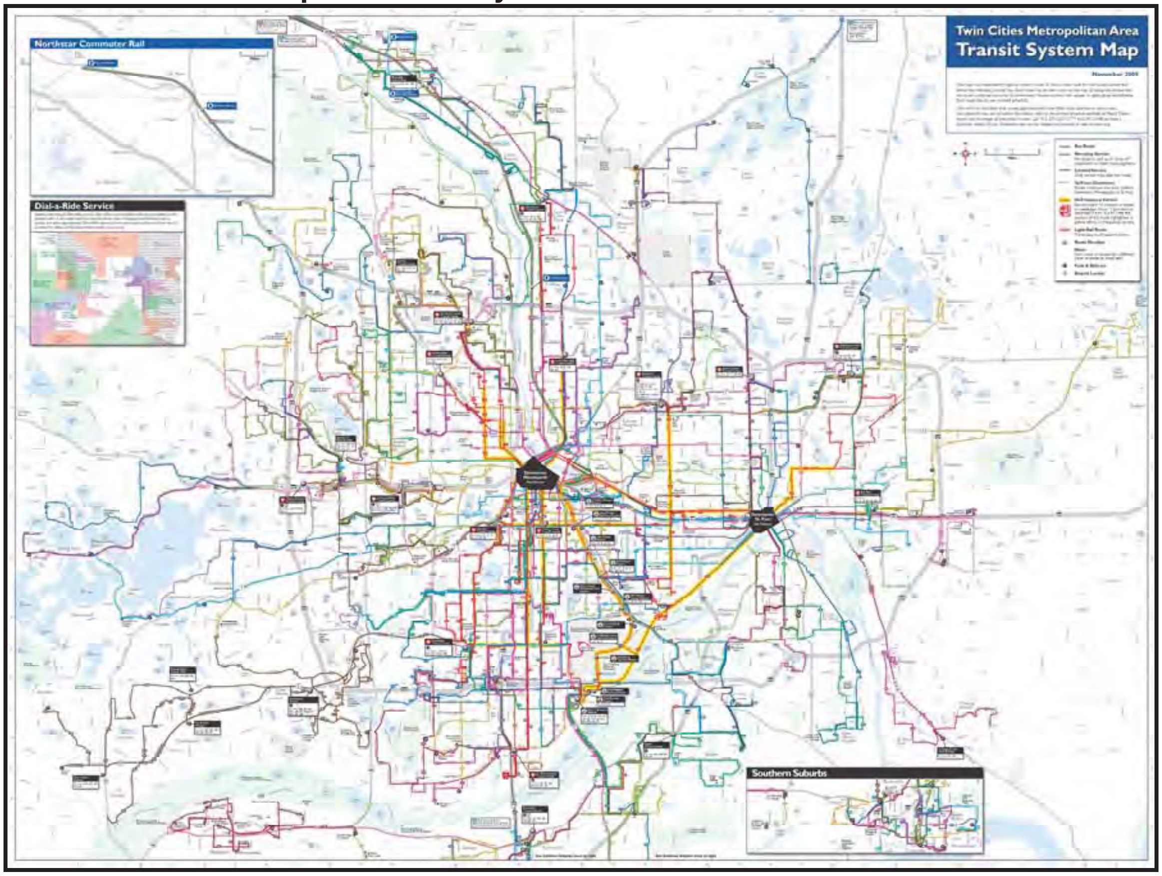
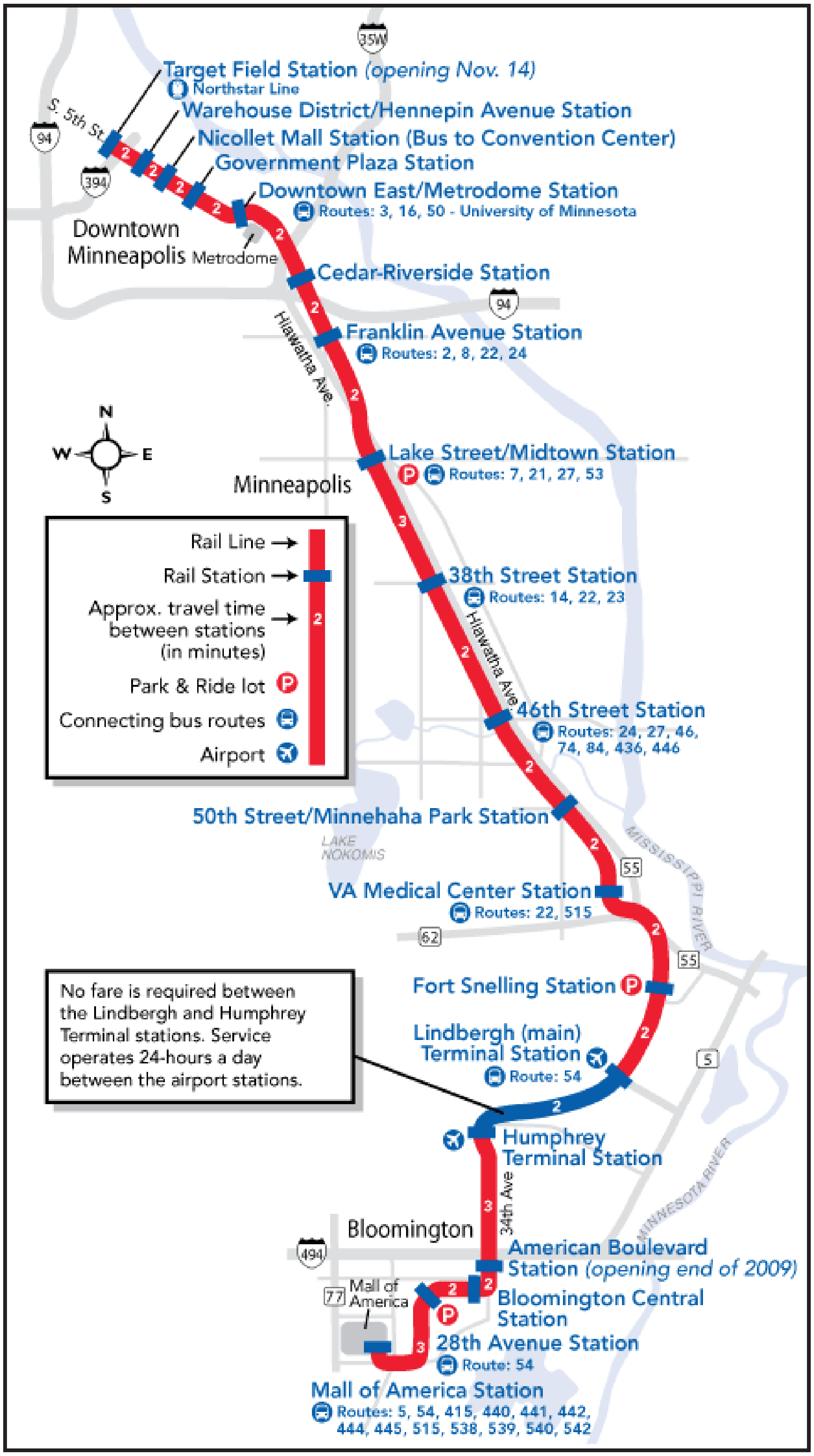


Exhibit 19 Minneapolis Hiawatha Light Rail Line



7. Seattle

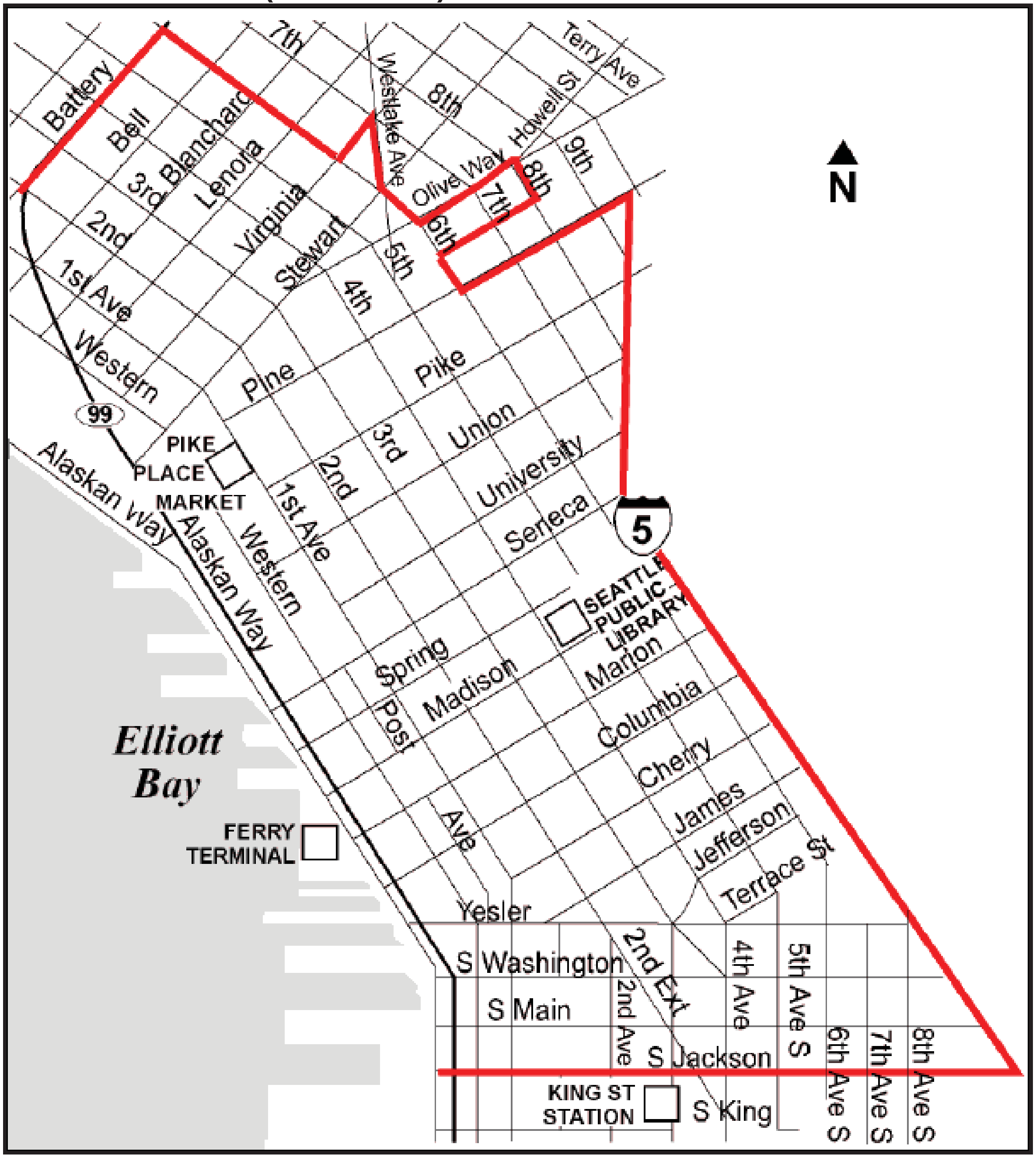
Sound Transit is the provider of regional express bus, commuter rail, and light rail service in the greater Seattle and Puget Sound region. The City of Seattle is the primary focus of transit service in the region and accommodates multiple modes of transit through the use of a transit tunnel and dedicated street right-of-way through the downtown. The Downtown Seattle Transit Tunnel (DSTT) runs underground, the length of downtown Seattle, approximately 2.1 miles from Ninth Avenue and Pike Street to Fifth Avenue South and South Jackson Street. The tunnel opened for service in 1990 and has recently been retrofitted to accommodate Sound Transit's new light rail service, which commenced operation in 2009. Seventeen bus routes and the light rail line operate in the tunnel and serve a total of five tunnel stations.

During reconstruction of the DSTT for light rail use, Third Avenue through downtown was designated as a transit only street during the morning and evening peak hours. These operational designations are currently being maintained even though reconstruction of the tunnel is complete, providing transit priority and facilitating transit travel through downtown. In addition to Third Avenue, both Second and Fourth Avenues include dedicated transit lanes from approximately Stewart Street to Washington Street on Second Avenue and from Yesler Way to Pike Street on Fourth Avenue (about 12 city blocks in length). Downtown Seattle also has a Ride Free Zone, where fares are not required for anyone traveling with the designated downtown travel zone.

In 2007, the City of Seattle opened service on the South Lake Union Streetcar, which runs from Westlake Center in downtown to and through the newly redeveloping neighborhood of South Lake Union immediately north of the downtown area. Infill development is encouraged in Seattle and the surrounding region through the use of an urban growth boundary.

Exhibit 20 Sound Transit Regional Transit System

Exhibit 21 Seattle (Metro Transit) Ride Free Area



Appendix A – Comparative Demographic Data

Urban Core Transit Strategy
US Comparison Cities: Transit and Demographic Information

		San Diego	Denver	Los Angeles	Minneapolis	Portland	Seattle
Rail	Heavy Rail						
	Commuter Rail						
	Light Rail						
BRT	Guideway						
	HOV/Express						
	Rapid Bus						
Bus	Local Bus						
Other			Electric Shuttle		Bus on Freeway Shoulder	Streetcar & aerial tram	Streetcar
Urbanized Area Population (1)		2.7m	2.3m	11.4m	2.4m	1.6m	2.7m
Unlinked Annual Transit Trips (2)		99.4m	94.2m	717.4m (7)	88.9m	106.7m	181.9m (9)
Passenger Miles (2)		591.0m	538.0m	3220.2m (7)	444.6m	448.8m	1183.6m (9)
Urbanized Area Population/Square Mile (density) (1)		3419	3979	7068	2671	3340	2844
Service Area (square miles) (1)		782	499	1500	894	474	954
Service Area Population (3)		2.2m	2.0m	8.6m	2.4m	1.5m	2.7m
Metropolitan Area Employment		1.4m (6)	1.3m (10)	4.4m (10)	1.7m (10)	1.0m (10)	1.4m (10)
Downtown Employment /Regional Employment		5.6%	8% (11)		8.5% (12)	8.0%	8.1% (13)
Auto Ownership Estimates (4)		90%	86%	84%	80%	86%	84%
Vehicles per Household (14)		1.85	1.80	1.79	1.80	1.80	1.83
Transit Annual Operating Budget 2008 (5)		$271.7m	$374.8m	$1352.8m	$315.7m	$338.0m (8)	$657.4m

(1) 2008 National Transit Database Appendix D: 2000 US Urbanized Areas
(2) APTA Fact Book, Appendix B, Transit Agency and Urbanized Area Operating Statistics, Table 9
(3) 2008 National Transit Database
(4) Carfree Census Data Estimates
(5) 2008 National Transit Database, Table 12 (regional or major transit providers)
(6) SANDAG Regional Employment Data Year 2000
(7) Includes Los Angeles/Orange UZA and Metrolink
(8) Does not include Portland Streetcar, Inc.
(9) Includes WA State Ferries and Monorail
(10) Bureau of Labor Statistics 2009
(11) Denver Region Council of Governments
(12) Metropolitan Council data request (Minneapolis 2008)
(13) Puget Sound Trends, Puget Sound Regional Council, October 2009
(14) Demographia, MSA Vehicles per Household, 2008

Appendix B – References and Resources

- Arrington, GB. "Portland's TOD Evolution: From Planning to Lifestyle," *Transit Oriented Development, Making it Happen*, Ashgate Press, 2009
- Boddy, Trevor, "Vancouverism vs. Lower Manhattanism: Shaping the High Density City," *The Vancouver Sun*, September 20, 2005
- Bowers, Lew, The Pearl District: From Brownfield to Goldmine, powerpoint, October 2009.
- Carinci, Justin, "A tale of two cities' crossings: different takes on congestion," *Daily Journal of Commerce*, November 17, 2009
- Centre City Development Corporation, Downtown San Diego Complete Community/Mobility, September, 2008
- Cervero, Robert. "The Transit Metropolis: A Global Inquiry," Island Press, 1998
- City of Vancouver Transportation Plan Update, October 2007
- City of Vancouver Information Sheet 2005
- Dick Fleming interview and powerpoint, November 2009
- Fleming, Dick, John Stott and Don Bletchly, "The Effectiveness of Bus Rapid Transit in Low Density Cities – A Review of Australian Experience"
- Gordon Price interview and powerpoint, November 2009
- Melbourne 2030 – Planning for Sustainable Growth
- Metro.kingcounty.gov
- Metro, Draft 2035 Regional Transportation Plan (Portland)
- Urban Transport Fact Book, October 2003
- www.bordeaux.fr (translated)
- www.dse.vic.gov.au
- www.infotbc.com (translated)
- www.metlinkmelbourne.com.au
- www.metro.net
- www.metrocouncil.org
- www.metrostrategy.nsw.gov.au
- www.metrovancouver.org
- www.rtd-denver.com
- www.rtd-fastracts.com
- www.soundtransit.org
- www.translink.com.au
- www.vancouver.ca

Technical Appendix D

Urban Area Transit Strategy - Initial Performance of Transit Network Alternatives (Relative Values)

Key: ● Most Effective ◉ Middle ○ Least Effective □ No Significant Change

A. Mode Share

Mode Share Measures	2008 Existing	Baseline[1]	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
A1. Peak-Period Transit Mode Share as Applied to the Identified Corridors/Areas		Not yet available.			
A2. All-Day Transit Mode Share as Applied to the Identified Corridors/Areas					
A3. Change in Peak Period Urban Area Transit Mode Share					

B. Transit Ridership

Ridership Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
B1. Change in Transit Person Trips (Regional)	202,000	401,000	◉	○	●
B2. Change in Transit Passenger Miles (Regional)	1,593,000	5,197,000	◉	◉	●
B3. Change in Transit Peak-Period Person Trips (Regional)	79,000	178,000	◉	○	●
B4. Change in Mode of Access to Transit (Non-Motorized and Auto)					
Walking/Biking	85.4%	89.8%	□	□	□
Auto (drove and driven)	14.6%	10.2%	●	○	◉

C. Cost-Effectiveness

Cost-Effectiveness Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
C1. Rough Order of Magnitude (ROM) Capital Cost Estimate			Middle	Lowest	Highest
C2. Cost-Effectiveness of Network (Region)			Not yet available.		
C3. Operating Subsidy Required (Region)					
C4. Total Transit System Capital Cost vs. SANDAG Revenue-Constrained Funding Scenario					
C5. Ability to Phase Major System Components/Elements					

D. Efficient Transportation Network

Efficiency Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
Transit System Performance					
D1. Passenger Miles to Transit Seat Mile Ratio	36%	47%	◉	◉	○
Regional Transportation System Performance					
D2. Change in Auto Vehicle Miles Traveled (VMT) per capita	26.9	26.9	□	□	□
D3. Change in Auto Vehicle Hours Traveled (VHT) per capita	0.7	0.8	□	□	□
D4. Change in Auto Vehicle Trips per capita	3.6	3.5	□	□	□

[1] Baseline scenario consists of an overlay between the highway and transit networks included in the 2030 RTP and the land use assumptions included in the 2050 Regional Growth Forecast.

Urban Area Transit Strategy - Initial Performance of Transit Network Alternatives (Relative Values)

E. Sustainability

Sustainability Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
Greenhouse Gas Reduction					
E1. Estimated Change in GHG (tentative)		Not yet available.			
Non-Motorized Travel					
E2. Peak-Period Non-Motorized Mode Share in Urban Area	3.7%	3.3%	□	□	□
E3. All-Day Non-Motorized Mode Share in Urban Area	3.4%	3.0%	□	□	□
E4. Compatibility with Regional Bike Plan (mi. of bike fac. within 1/2 mile of major station)	73	146	◎	●	●
Land-Use/Transportation Connection					
E5a. % of Jobs within 1/2 Mile of Major Transit Stations	21.1%	38.9%	◎	●	●
E5b. % of Jobs within 1/4 Mile of Major Transit Stations	10.7%	21.3%	◎	●	●
E6a. % of Housing Units within 1/2 Mile of Major Transit Stations	9.4%	31.2%	◎	●	●
E6b. % of Housing Units w/in 1/2 Mile of Major Transit Stations with 10 Minute or Better Service	0.0%	23.4%	◎	○	●
E6c. % of Housing Units w/in 1/2 Mile of Major Transit Stations with 15 Minute or Better Service	7.3%	30.6%	●	◎	●
E7. Compatibility with current Regional Activity Centers (Hospitals, Universities/Colleges, Shopping Malls, and Tourist Attractions within 1/2 Mile of Major Transit Stations)	17	40	⊙	●	●

F. Social Equity/Environmental Justice

Social Equity/Environmental Justice Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
Title VI Requirements[2]					
F1a. % of Minority Populations within 1/2 Mile of Major Transit Stations (% Improvement)	11.2%	34.4%	2	2	2
F1b. % of Non-Minority Populations within 1/2 Mile of Major Transit Stations (% Improvement)	7.0%	20.2%	2	2	2
F1c. % of Low-Income Households within 1/2 Mile of Major Transit Stations (% Improvement)	13.2%	41.4%	2	2	2
F1d. % of Non-Low-Income Households within 1/2 Mile of Major Transit Stations (% Improvement)	9.2%	18.0%	2	2	2
Other Meaningful Social Equity/Environmental Justice Measures					
F2a. % of 75+ Population within 1/4 Mile of Major Transit Stations	3.0%	12.7%	□	□	□
F2b. % of 75+ Population within 1/4 Mile of All Stations	54.8%	58.7%	●	●	●
F3. % Zero-Car Households within 1/2 Mile of Major Transit Stations (2000 census data)	16.7%	43.9%	◎	●	●

[2] Title VI requires analysis of the burdens of regional transportation system investments on low-income and minority populations. Measures in this category evaluate the comparative percent improvement between low-income and non-low-income populations and minority and non-minority populations.

Key: A "1" indicates disparate impact and a "2" indicates no disparate impact.

Urban Area Transit Strategy - Initial Performance of Transit Network Alternatives (Relative Values)

G. Time-Competitiveness

	Time Competiveness Measures	2008 Existing	Baseline	Transit Network Performance Compared to Baseline		
				Transit Propensity	Commuter Point-to-Point	Many Centers
G1.	Oceanside - Downtown San Diego Travel Times (in Minutes)					
	SOV	55	81	☐	☐	☐
	Carpool	53	52	☐	☐	☐
	Transit - Walk Access	104	85	☐	☐	●
	Transit - Drive Access	93	77	☐	☐	●
G2.	Escondido - Downtown San Diego Travel Times (in Minutes)					
	SOV	48	75	☐	☐	☐
	Carpool	45	49	☐	☐	☐
	Transit - Walk Access	78	70	●	◉	●
	Transit - Drive Access	78	66	●	●	●
G3.	El Cajon - Downtown San Diego Travel Times (in Minutes)					
	SOV	32	46	☐	☐	☐
	Carpool	32	34	☐	☐	☐
	Transit - Walk Access	76	72	●	◉	●
	Transit - Drive Access	62	58	◉	◉	◉
G4.	Mid City San Diego - Sorrento Valley Travel Times (in Minutes)					
	SOV	31	49	☐	☐	☐
	Carpool	30	27	☐	☐	☐
	Transit - Walk Access	89	41	☐	●	○
	Transit - Drive Access	82	42	☐	●	○
G5.	Chula Vista - Sorrento Valley Travel Times (in Minutes)					
	SOV	41	69	☐	☐	☐
	Carpool	41	31	☐	☐	☐
	Transit - Walk Access	136	68	☐	●	◉
	Transit - Drive Access	120	54	○	●	◉
G6.	San Ysidro - Downtown San Diego Travel Times (in Minutes)					
	SOV	28	33	☐	☐	☐
	Carpool	28	29	☐	☐	☐
	Transit - Walk Access	44	44	●	●	●
	Transit - Drive Access	46	42	☐	☐	◉
G7.	El Cajon - Sorrento Valley Travel Times (in Minutes)					
	SOV	44	58	☐	☐	☐
	Carpool	44	33	☐	☐	☐
	Transit - Walk Access	130	79	◉	●	◉
	Transit - Drive Access	111	64	☐	●	☐

Urban Area Transit Strategy - Initial Performance of Transit Network Alternatives (Numeric Values)

A. Mode Share

Mode Share Measures		2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
A1.	Peak-Period Transit Mode Share as Applied to the Identified Corridors/Areas		Not yet available.			
A2.	All-Day Transit Mode Share as Applied to the Identified Corridors/Areas					
A3.	Change in Peak Period Urban Area Transit Mode Share					

B. Transit Ridership

Ridership Measures		2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
B1.	Change in Transit Person Trips (Regional)	202,000	401,000	7.3%	1.0%	15.3%
B2.	Change in Transit Passenger Miles (Regional)	1,593,000	5,197,000	3.9%	4.0%	14.7%
B3.	Change in Transit Peak-Period Person Trips (Regional)	79,000	178,000	7.4%	4.5%	17.5%
B4.	Change in Mode of Access to Transit (Non-Motorized and Auto)					
	Walking/Biking	85.4%	89.8%	0.7%	-0.9%	-0.5%
	Auto (drove and driven)	14.6%	10.2%	-6.1%	7.9%	4.7%

C. Cost-Effectiveness

Cost-Effectiveness Measures		2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
C1.	Rough Order of Magnitude (ROM) Capital Cost Estimate		Not yet available.			
C2.	Cost-Effectiveness of Network (Region)					
C3.	Operating Subsidy Required (Region)					
C4.	Total Transit System Capital Cost vs. SANDAG Revenue-Constrained Funding Scenario					
C5.	Ability to Phase Major System Components/Elements					

D. Efficient Transportation Network

Efficiency Measures		2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
Transit System Performance						
D1.	Passenger Miles to Transit Seat Mile Ratio	36%	47%	38%	38%	34%
Regional Transportation System Performance						
D2.	Change in Auto Vehicle Miles Traveled (VMT) per capita	26.9	26.9	-0.1%	-0.1%	-0.4%
D3.	Change in Auto Vehicle Hours Traveled (VHT) per capita	0.7	0.8	-0.3%	-0.2%	-0.8%
D4.	Change in Auto Vehicle Trips per capita	3.6	3.5	-0.1%	0.0%	-0.3%

E. Sustainability and Environmental Justice

Sustainability Measures		2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
Greenhouse Gas Reduction						
E1.	Estimated Change in GHG (tentative)		Not yet available.			
Non-Motorized Travel						
E2.	Peak-Period Non-Motorized Mode Share in Urban Area	3.7%	3.3%	3.3%	3.3%	3.3%
E3.	All-Day Non-Motorized Mode Share in Urban Area	3.4%	3.0%	3.0%	3.0%	3.0%
E4.	Compatibility with Regional Bike Plan (mi. of bike fac. within 1/2 mile of major station)	73	146	166	190	192
Land-Use/Transportation Connection						
E5a.	% of Jobs within 1/2 Mile of Major Transit Stations	21.1%	38.9%	44.2%	52.9%	50.0%
E5b.	% of Jobs within 1/4 Mile of Major Transit Stations	10.7%	21.3%	25.5%	30.8%	28.1%
E6a.	% of Housing Units within 1/2 Mile of Major Transit Stations	9.4%	31.2%	36.6%	39.8%	39.4%
E6b.	% of Housing Units w/in 1/2 Mile of Major Transit Stations with 10 Minute or Better Service	0.0%	23.4%	31.5%	19.1%	38.8%
E6c.	% of Housing Units w/in 1/2 Mile of Major Transit Stations with 15 Minute or Better Service	7.3%	30.6%	36.0%	32.8%	38.8%
E7.	Compatibility with current Regional Activity Centers (Hospitals, Universities/Colleges, Shopping Malls, and Tourist Attractions within 1/2 Mile of Major Transit Stations)	17	40	45	47	48

F. Social Equity and Environmental Justice

Social Equity and Environmental Justice Measures		2008 Existing	Baseline	Transit Network Performance Compared to Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
Title VI Requirements*						
F1a.	% of Minority Populations within 1/2 Mile of Major Transit Stations	11.2%	34.4%	5.4%	8.3%	8.1%
F1b.	% of Non-Minority Populations within 1/2 Mile of Major Transit Stations	7.0%	20.2%	3.2%	6.0%	5.4%
F1c.	% of Low Income Households within 1/2 Mile of Major Transit Stations	13.2%	41.4%	6.7%	9.0%	9.1%
F1d.	% of Non-Low Income Households within 1/2 Mile of Major Transit Stations	9.2%	18.0%	2.8%	5.9%	5.2%
Other Meaningful Social Equity/Environmental Justice Measures						
F2a.	% of 75+ Population within 1/4 Mile of Major Transit Stations	3.0%	12.7%	15.3%	15.6%	16.6%
F2b.	% of 75+ Population within 1/4 Mile of All Stations	54.8%	58.7%	58.5%	58.3%	57.0%
F3.	% Zero-Car Households within 1/2 Mile of Major Transit Stations (2000 census data)	16.7%	43.9%	52.1%	55.0%	54.6%

Urban Area Transit Strategy - Initial Performance of Transit Network Alternatives (Numeric Values)

G. Time-Competitiveness

Time Competiveness Measures		2008 Existing	2050 RE Baseline	Transit Network Performance Compared to 2050 RE Baseline: Transit Propensity	Commuter Point-to-Point	Many Centers
G1.	Oceanside - Downtown San Diego Travel Times (in Minutes)					
	SOV	55	81	0	0	0
	Carpool	53	52	0	0	0
	Transit - Walk Access	104	85	0	+1	-2
	Transit - Drive Access	93	77	0	+1	-3
G2.	Escondido - Downtown San Diego Travel Times (in Minutes)					
	SOV	48	75	0	0	0
	Carpool	45	49	0	0	0
	Transit - Walk Access	78	70	-9	-6	-9
	Transit - Drive Access	78	66	-21	-21	-21
G3.	El Cajon - Downtown San Diego Travel Times (in Minutes)					
	SOV	32	46	0	0	0
	Carpool	32	34	0	0	0
	Transit - Walk Access	76	72	-7	-4	-7
	Transit - Drive Access	62	58	-4	-4	-4
G4.	Mid City San Diego - Sorrento Valley Travel Times (in Minutes)					
	SOV	31	49	0	0	0
	Carpool	30	27	0	0	0
	Transit - Walk Access	89	41	0	-6	+5
	Transit - Drive Access	82	42	0	-6	+5
G5.	Chula Vista - Sorrento Valley Travel Times (in Minutes)					
	SOV	41	69	0	0	0
	Carpool	41	31	0	0	0
	Transit - Walk Access	136	68	+1	-8	-4
	Transit - Drive Access	120	54	+2	-12	-8
G6.	San Ysidro - Downtown San Diego Travel Times (in Minutes)					
	SOV	28	33	0	0	0
	Carpool	28	29	0	0	0
	Transit - Walk Access	44	44	-4	-4	-4
	Transit - Drive Access	46	42	0	0	-2
G7.	El Cajon - Sorrento Valley Travel Times (in Minutes)					
	SOV	44	58	0	0	0
	Carpool	44	33	0	0	0
	Transit - Walk Access	130	79	-3	-15	-8
	Transit - Drive Access	111	64	0	-16	+1

Technical Appendix E

PARSONS BRINKERHOFF (PB) PROFESSIONAL CONSULTING TEAM BIOGRAPHIES

CATHY J. STROMBOM, AICP

Vice President
Senior Planning Manager
Principal Professional Associate
Certified Principal Project Manager

Key Qualifications

Cathy Strombom has 35-plus years experience as a transportation planner and senior project manager on a wide range of projects in the Puget Sound region, as well as on projects in Oregon, Hawaii, and internationally. Projects have included multimodal transportation/environmental impact studies, traffic impact assessments, bus and rail feasibility studies, marine transportation planning, central business district circulation analyses, and TOD projects.

Most recently, Ms. Strombom managed a $12 million study to update Sound Transit's long-range regional transit system plan that includes light rail, commuter rail, regional express bus, as well as transit center projects, park-and-rides, and HOV direct access ramps. She also led the development of the implementation plan that included evaluation of alternative packages of capital and service improvements with respect to costs and benefits, potential environmental impacts, compatibility with existing projects, as well as consistency with the long-range Vision. The implementation plan was presented to and approved by the voters in 2008 and is now being implemented. Ms. Strombom managed an intermediate-capacity transit study for the City of Seattle that analyzed alternative modes (streetcar, light rail, and elevated guideway) in seven major corridors. She was the project manager for a legislative study under the auspices of the Washington State Rail Development Commission that created the Regional Transit Authority to implement high-capacity transit in the Puget Sound region—now known as Sound Transit, this study evaluated a wide range of alternative institutional arrangements and funding mechanisms.

Ms. Strombom was co-leader for a team of Turkish planners in modeling travel demand for seven transportation alternatives, including a metro system, light rail transit, commuter railroad improvements, express and local bus service improvements, passenger and auto ferry service improvements, and a railroad tunnel beneath the Bosphorus Strait connecting the European and Asian sides of Istanbul. Ms. Strombom has promoted sustainability on projects through the development of user-friendly, menu-driven Transit and Highway Sustainability Checklists, as well as a project management module on how sustainability can be incorporated into transportation projects.

GERALD B. (G.B.) ARRINGTON

Vice President, Senior Planning Manager
Principal Practice Leader, PlaceMaking
Senior Professional Associate

Key Qualifications

G.B. Arrington provides strategic direction and leads PB's global transit-oriented development (TOD) practice. He is internationally recognized as a leader in TOD and for his skills in linking transit and land use to create livable communities of lasting value. Mr. Arrington served on PB's global sustainability task force and helped shape PB's commitment and involvement in sustainable practices.

Mr. Arrington specializes in policy, research, planning, and design services that assist public and private sector clients in solving politically and technically complex land use and transportation challenges. His work has taken him across the United States, to China, Australia, New Zealand, Dubai, and the Caribbean. Mr. Arrington has directed the preparation of over 125 TOD plans.

His career has been defined by a commitment to continuous innovation to reinvent how cities grow while enhancing their quality of life. Before joining PB, he charted a new, award-winning direction for Portland, Oregon's transit agency. His innovative planning and community involvement strategies changed the face of transit and land use in the region and received awards from the White House and the Federal Transit Administration (FTA). Mr. Arrington is one of the founders of the Rail~Volution conference and is an active New Urbanist.

BILL A. DAVIDSON

Senior Vice President, PB Americas, Inc.
Principal Professional Associate
Senior Technical Manager

Key Qualifications

Bill Davidson is a nationally recognized leader in the field of travel demand model development and forecasting. Using original travel survey data, he has estimated and developed complete travel forecasting model sets and advanced-practice, tour-based models in some of this country's largest regions. He is particularly well known for his work in mode choice model development and is one of a small number who pioneered the development and application of fully nested logit models. This includes recent work in the area of nested logit mode choice modeling for Los Angeles, San Francisco, Miami, Raleigh-Durham, Salt Lake City, Atlanta, Baltimore, Washington, D.C., San Diego, San Juan, Houston, Chicago, Kansas City, Phoenix, Las Vegas, and Reno. Mr. Davidson has also developed station choice models for the METRA Commuter Rail system in Chicago and the Metrolink system in Los Angeles. Also, he is a leader in the development of travel models for specialized trip purposes, most notably, visitor travel models.

Mr. Davidson is nationally recognized for his extensive work for the FTA New Starts projects. In addition to project-related efforts, he has worked closely with the FTA to develop travel forecasting-related guidelines and best practice procedures. Mr. Davidson has directed the travel forecasting component of at least 30 major investment studies and 18 alternatives analysis studies ranging from system planning to preliminary engineering and final design.

Mr. Davidson has extensive experience in toll road and value/congestion pricing studies. This experience includes the ongoing San Francisco Congestion Pricing Study, Montreal Traffic and Revenue Study, the Orange County Transportation Authority Toll Road Forecasting Study, the Interstate 680 Value Pricing Study, the Sonoma 101 Highway High Occupancy Toll (HOT) Lane Study, and the Colorado Department of Transportation HOT Lane Study. Within the context of regional nested logit mode choice models, Mr. Davidson has developed lower-level nesting structures that address the toll/non-toll choice. He is also the principal-in-charge for the NCHRP 8-57 and SHRP 2 C04 projects, which will develop an improved framework and tools for highway pricing decisions.

DICK FLEMING

National Technical Executive – Transit Planning
Principal Professional Associate

Key Qualifications

Dick Fleming is the national technical executive of transit planning for PB Australia. He has been engaged as a specialist in planning for urban transit systems, multimodal interchange planning and design, road-based priority systems, and integrated land use/transport planning for nearly 30 years. Mr. Fleming is an internationally recognized expert in BRT systems and has worked throughout Australia, New Zealand, the United Kingdom, China, the Philippines, and Pakistan.

Mr. Fleming advised the City of Beijing on the development of its BRT strategy and has acted as technical advisor for the Cambridgeshire Guided Busway and the East London Transit Project in the United Kingdom. He was deeply involved in surface transportation planning for the highly successful Sydney 2000 Olympics, developed the transportation master plan for Beijing's Olympic Green, and has since advised London's 2012 and Tokyo's 2016 bid for the Olympics. Mr. Fleming is a vice chair of the board of the International Association of Public Transport (Australia/New Zealand) and a past national president of the Australian Institute of Traffic Planning and Management.

DAVID B. MCBRAYER, AICP, PTP

Senior Engineering Manager
Principal Professional Associate, Transportation Planning
Certified Project Manager

Key Qualifications

David McBrayer is an expert in urban transportation improvement planning, including alternatives formulation and analysis, transit operations planning, transportation economic evaluation, and financial analysis. He has served in project management and key technical roles for numerous projects in the United States, England, Africa, the Middle East, the Far East, Australia, and South America.

Mr. McBrayer was recently the quality control manager for the Gwinnett County Transportation Plan in Georgia; the project or task manager for transit studies in Los Angeles, the U.S. Territory of Guam, Phoenix, and Laredo, Texas; planning advisor for a proposed Fredericksburg Corridor BRT project in San Antonio, Texas; operations planner for a BRT/HOV project in Atlanta, Georgia; and manager of transit planning services for a Great Street project in Uptown Houston, Texas. These and other transit planning studies in the United States follow a variety of road and transit projects in Asia and South America, as well as earlier experience in numerous transit and transportation improvement studies in the United States and elsewhere.

PAUL B. ARNOLD

Senior Planning Manager
Professional Associate
Certified Senior Project Manager

Key Qualifications

Paul Arnold is a senior planning manager at PB and a recognized technical leader in the area of transportation planning. Over his 20-year career, Mr. Arnold has focused on intermodal operations, particularly in the areas of transit operations serving as technical lead or project manager for transit system planning projects, park-and-ride lot demand estimation and siting, transit routing, bus and high occupancy vehicle (HOV) system planning and evaluation, and nonmotorized planning and operational analysis of interfaces between modes.

Mr. Arnold has a degree in economics (an MBA), leads our Virtual Design and Construction community of practice, and serves on the corporate Geospatial community of practice. Mr. Arnold is quantitatively focused and understands market influences, especially their impact on transit demand. Also, he has a background in travel demand forecasting and traffic operations analysis, which allows him to understand the strengths and weaknesses of macro and micro travel demand and simulations models and apply them appropriately in a variety of project environments.
One recent example of Mr. Arnold's unique approach to transit system planning and program development was the use of interactive work sessions with the planning and financial modeling staff of Sound Transit. Sound Transit identified over 100 potential projects for inclusion in their ST2

program. Through a series of interactive sessions with a comprehensive financial model, Mr. Arnold was able to collaboratively lead Sound Transit staff through the decision process to select the projects to be included in the plan, identify the optimal timing for implementation, and select the tax rate required to adequately fund the plan. Through the development of a better user interface on the financial model and the facilitation of interdisciplinary work sessions, Mr. Arnold was able to reduce dramatically the cycle time on the evaluation of plan options. The end result was a plan that was broadly accepted by all levels of staff, the Sound Transit board, and ultimately, the public, which passed the 0.5 percent tax increase in the November 2008 ballot.

TONI BATES

Senior Planning Manager
Senior Professional Associate
Certified Project Manager

Key Qualifications

Toni Bates is a senior planning manager with 28 years experience in transportation planning and programming, bus and rail facilities development, short- and long-range transit service planning, transportation/land use coordination, environmental analysis and documentation, public involvement programs, and interagency coordination. Her experience includes policy and strategic planning for regional transit systems, short- and long-range transit system planning, managing small and large transit development projects, leading the analysis and concept planning for transit and land use integration, analyzing complex technical and stakeholder situations, and developing recommendations and solutions.

Ms. Bates joined PB after 20 years as director of planning and development and project manager for the San Diego Metropolitan Transit Development Board and three years as director of transit planning for the San Diego Association of Governments. She has managed the planning, preliminary engineering, and environmental document preparation for rail extension projects; has led planning and concept development of a modern streetcar project; and has overseen planning and design of bus rapid transit (BRT) and intermodal transportation center projects, including the incorporation of community-sensitive design features and public art. Ms. Bates has also designed and implemented local and regional bus service plans and developed strategic long-range transit plans.

ELIZABETH (LIZ) G. YOUNG, AICP

Senior Supervising Transportation Planner
Certified Project Manager

Key Qualifications

Liz Young brings nearly 15 years of experience as a transportation planner on both transit and highway projects in the greater Seattle area, various projects across the United States, and she lived and worked in Brisbane, Australia, for nine months. While in Seattle, Ms. Young led the East King County Subarea High-Capacity Transit (HCT) analysis work for Sound Transit's Phase 2 planning effort, which included development, screening, conceptual design, and cost elements for three HCT corridors between Seattle and major destinations east of Lake Washington. The project also incorporated development of planning-level HOV project elements and cost estimates for highway-related improvements such as direct access facilities, park-and-ride lots, in-line transit stations, and arterial HOV lanes. Ms. Young also had a key lead role in the Seattle Mercer Corridor/South Lake Union Transportation Study that defined and evaluated a range of multimodal improvements to South Lake Union neighborhood to support the city's goal of creating an urban village in this neighborhood adjacent to downtown. The study recommended a set of roadway, transit, bicycle, and pedestrian improvements as part of a multimodal transportation plan.

Ms. Young is currently working with the Metropolitan Council and Minnesota Department of Transportation to assess opportunities to 'right size' their highway system using flexible design and operational and management strategies. This effort includes analyzing future infrastructure scenarios that range from traditional highway expansion investments to various scenarios utilizing lower-cost/high-benefit operational improvements that could include investment in managed lane facilities, pricing strategies, intelligent transportation systems, and European Active Traffic Management strategies.

Technical Appendix F

Peer Review Panel Member Biographies
Urban Area Transit Strategy

John M. Inglish – General Manager/CEO, Utah Transit Authority (UTA)

John Inglish has worked in the transportation industry for more than 35 years. With an engineering background, Mr. Inglish began his career in 1970 as a systems planning engineer for the Utah State Highway Department. In the early 1970s he began working for the Wasatch Front Regional council on the early initiatives that formed today's UTA. In 1977, he became the director of Transit Development for UTA, and in August 1997, the UTA Board of Trustees appointed Mr. Inglish as the general manager for the Authority. Under his leadership, UTA has garnered national and worldwide recognition for its transportation systems. He oversaw funding and construction of the $312.5 million Sandy to Salt Lake TRAX light rail line, completing the 15-mile TRAX line one year ahead of schedule and under budget, as well as the $118.5 million University TRAX light rail line connecting downtown Salt Lake City and the University of Utah in time for the 2002 Winter Olympics.

Martin Tuttle – Deputy Director, Planning and Modal Programs for the California Department of Transportation

Martin Tuttle has more than 25 years of top transportation and innovative land use planning management experience at the local, regional and state levels of government. As Deputy Director of Planning and Modal Programs at Caltrans, Mr. Tuttle is responsible for the Caltrans Divisions of Local Assistance, Mass Transportation, Planning, Rail, Aeronautics and Transportation System Information. As the executive director of the Sacramento Area Council of Governments (SACOG), he launched its nationally-recognized "Blueprint" transportation and land use growth plan. Mr. Tuttle also has served as the executive director of the Solano Transportation Authority (STA). As a top staff member to Assembly Majority Leader Tom Hannigan in the California State Legislature for 13 years, Mr. Tuttle managed innovative land-use and transportation reform legislation, including the bill establishing the successful Capitol Corridor intercity rail service between Sacramento and San Jose. Prior to joining Caltrans, he oversaw transit oriented development and urban infill housing projects for URS Corporation and New Faze Development.

George Hazel – Chairman, MRC McLean Hazel Ltd

George Hazel has extensive experience in all aspects of transport and communications, both urban and rural. He has specific expertise in strategic planning and policy development, the integration of transportation with other related areas, the prioritization of projects with respect to economic, environmental, and social objectives, and innovative funding of transportation infrastructure around the world. He has studied all forms of transportation policy around the world, including congestion charging and demand management, mode shift, goods movement, and growth management. Mr. Hazel has worked in the public, private, and academic sectors at a senior level and has acted as advisor to the Academy of Sustainable Communities, the Commission for Integrated Transport, Transport for London, the Queensland State Government, the Greater Toronto and Hamilton Region, the City of San Diego and many government agencies around the United Kingdom. Currently an honorary professor at the Robert Gordon University and adjunct professor at the Queensland University of Technology, Mr. Hazel has published a book on Making Cities Work and presents at conferences around the world.

Aidan Hughes – Principal, Arup

Aidan Hughes is the leader of Arup's planning practice in the US, which focuses on integrated urbanism and sustainable planning and design. Mr. Hughes brings over 20 years experience and a proven track record in the management of complex multi-disciplinary projects. He consults to municipal governments, transportation agencies, and developers, and is currently leading the sustainable redevelopment of the Concord Naval Weapons Station in Concord, CA. A major part of the redevelopment program is compliance with California AB 32 (global warming act) and evaluating and mitigating carbon emissions from transportation, energy, and other sources for each redevelopment alternative. He also is involved in the Treasure Island Sustainability Planning project in San Francisco. Mr. Hughes is a USGBC LEED Accredited Professional, has worked in Europe, Asia and the United States, and has a broad understanding of the global approaches to delivering successful planning and infrastructure projects.

Technical Appendix G

Peer Review Panel Comments
(As reported to the Joint Meeting of the Transportation and Regional Planning Committees on June 4, 2010)

Peer Review Panel's Global Observations

The Peer Review Panel convened in San Diego from April 19 – 21, 2010, to review and assess the work completed on the Urban Area Transit Strategy in relation to the preparation of the broader 2050 Regional Transportation Plan (RTP). In addition to the Panel's comments on the three alternative transit networks outlined in the Technical Documentation report, the Panel also made a number of global observations, as follows.

- **Economic Competitiveness**: Transportation is seen as the major driver of regions' economic competitiveness, and an increased focus on developing public transit systems is seen as a key factor in cities around the world for meeting mobility needs that ensure long-term economic sustainability.

- **Technological Savviness**: All over the world, technology is increasingly being used to market transportation options and other services to individuals based on user-preferences. Integrated electronic cards, such as the Octopus Card in Hong Kong and the Oyster Card in England, are providing tremendous potential to the private sector for marketing goods and services to end users; to the public sector for tailoring, directing, and providing incentives for transit/transportation services to end users; and for users who receive incentives and discounts for many kinds of products and services based on established purchasing choices. Global technology firms are actively seeking opportunities to develop markets. The Compass Card in the San Diego region is a solid start, and the region should proactively work to expand the Compass Card services beyond transportation to provide users with more convenience and incentives, and to maximize the region's ability to direct future transportation marketing decisions.

- **World Class Region**: The San Diego region has true potential of becoming a world class region. The focus of the Urban Area Transit Strategy should shift from developing a "world class transit system" to developing a "transportation system that supports a world class region and its local communities."

- **Sustainability and Co-Benefits**: In addition to pursuing transit as a means to help meet the Senate Bill 375 (SB 375) (Steinberg, 2008) regulatory mandates to reduce greenhouse gas emissions, transit also can help provide alternative transportation options, reduce foreign energy dependency, improve air quality, and reduce the proportion of American budgets spent on transportation. In addition, any co-benefits from smart growth development patterns and integrated transit systems should be highlighted and promoted, including internal trip capture, increased walking and biking, and carbon reductions in energy, waste, and water resulting from green building programs.

- **Land Use Development around Transit Stations**: Land use developers around the world recognize the economic potential for redevelopment around transit stations. Increasingly, the public sector is participating more directly with the private sector in the planning, design, and implementation of these types of redevelopment projects that result in more transit-oriented uses and direct economic benefits to the public sector that can then be invested back into transit infrastructure development. The Panel cited the proposed Tecolote Road, Clairemont Drive, and Balboa Avenue station sites along the Mid-Coast light-rail transit alignment as prime examples where such public/private partnerships could be forged. Additionally, the Panel expressed concern over the proposed Genesee Avenue alignment in the University City area, where an elevated trackway and station are currently proposed in order to minimize impacts on auto traffic. The Panel felt that the added costs of grade-separation versus an at-grade alignment may not be justified given the benefit that would accrue to the overall transportation system with the addition of the Mid-Coast project. They emphasized the importance of having transit facilities at the ground level as a means to better integrate into the surrounding community rather than forcing a separation from vehicle traffic as a traditional method of addressing congestion.

- **Land Use, Freeways, and Parking**: Land use density, design, and mix are essential components of a successful urban fabric and transit system. Locations that have limited parking and freeway expansions, and have simultaneously added an array transit services, have increased the overall performance of their transit systems and have increased transit mode share. The Panel felt that SANDAG should more directly reward communities that currently have high land use densities near transit stations, and should more directly influence land development in areas that currently have regional transit services. In addition, the Panel encouraged SANDAG to work more directly with the development community to build higher-density projects at stations, and to evaluate the allocation of affordable housing through the Regional Housing Needs Assessment process. In addition, the Panel expressed concerns that the region's Managed Lanes could be counterproductive toward transit if not properly implemented and operated, and suggested that SANDAG should monitor transit productivity as the Managed Lanes and Bus Rapid Transit (BRT) systems are implemented.

- **Project Prioritization**: The process to prioritize the funding of transportation projects needs to be easily understood by policymakers and the public, and needs to be conducted through a transparent process. A "policy audit table" example was provided. The audit helps to bridge the gap between the goals and objectives included in policy documents and the proposed transportation projects to help identify which transportation projects align with which policies, and alternatively which policies may not be addressed by any transportation projects.

- **Leadership and Champions**: Places that have successful transit systems have had strong leaders and champions to promote transit. Increasingly, bicycle and pedestrian advocates are supporting transit when they see opportunities for enhancements between the various modes. All successful transit systems need proactive and well-informed champions.

- **Dedicated Funding Sources**: Obtaining dedicated funding sources for transit is critical. In some cases, placing initiatives on the ballot solely for transit (versus for additional transportation modes and/or for other services) has culminated in success. (Within this context, the Panel recognized the difficulty of reaching California's two-thirds voter approval threshold for new special taxes.) The Panel also noted the potential of exploring a subregional funding approach in San Diego as an innovative concept that should be pursued.

Peer Review Panel Individual Observations

Peer review panelists were also invited to submit individual observations, if desired. The following comments were submitted by the noted panelists.

AIDAN HUGHES – PRINCIPAL, ARUP

Strengths

1. SANDAG has a strong relationship with the two transit operators and has good relationships with the Cities. This allows you to establish bold visions and work together to deliver on the vision. A more fractured relationship can get mired in delay and compromise.
2. SANDAG and the two operators have a very capable and experienced staff complemented with strong and committed leadership at the political and executive level. This translates into an ambition for leadership – learning from global best practice and seeking innovation in delivery and operation.
3. The existing system is operating successfully with strong farebox recovery and good coverage in the core areas. Much of the backbone system is in place through the LRT, Coaster and Sprinter systems linked into regional and international transport networks. While from the "inside" there is a recognition of some of the operational difficulties (for example, operating the trolley in the downtown), the public perception appears to be very positive. This establishes a strong platform for getting acceptance of system expansion and support for raising new capital. This also brings a responsibility to continue to deliver high quality service with clear benefits for riders as new projects are delivered.

Weaknesses

1. The Smart Growth plan is valuable as a comprehensive tool and it is being used appropriately as the basis for the transit networks. However, it is a bottom-up plan (the best the Cities are prepared to do right now) and it is not directly related to the availability of transit. There is an opportunity for SANDAG to take a lead in punching up the Smart Growth plan by using the carrot of transit investment to encourage Smart(er) Growth. Where there are proposed transit investments, they should be directly linked to some "threshold" metrics for smart growth.
2. The discussion we had around elevated light rail was interesting. It points to a fundamental issue that will face all projects, namely whether a case can (or should) be made to give transit priority in terms of road space at the expense of the auto. A greater

commitment should be made to support trade-offs in favor of transit – case studies around the nation and world have demonstrated that this can be achieved with little downside. The upside is an ability to increase ridership, demonstrate the benefits of transit and make more complete communities with transit at its core. In many ways, this philosophical change in emphasis will be the platform for the world class community vision.

3. As we noted "parking is a big issue" and it is interesting that you have experience of the negative consequences in relation to parking for the downtown ballpark. We didn't have time to address parking in all its complexities as part of the peer review, but parking policies should be dealt with as essential complementary measures to support successful transit.

GEORGE HAZEL – CHAIRMAN, MRC MCLEAN HAZEL LTD

Strengths

1. Enthusiasm, understanding, and competence of the team.
2. History of what you've done to date to build on.
3. In general, an exciting plan to deliver in a potentially world class city – you're not there yet!

Weaknesses

1. Attitudes to not inconveniencing cars - unless you sort this out and the leadership backs and understands that it is the city's and the car drivers' best interests to have a world class transit system and give it top priority and road space, then you will find it very difficult. Discussion on elevated section of Mid-Coast is a key example.
2. Governance needs to be sorted - too many agencies saying different things and doing different things.
3. I worry about managed lanes as a transit policy, specifically that they could be counterproductive toward the performance of transit. I would suggest experimenting with peak time express transit service or local off-peak service and monitor the results.

In addition you should really look at the potential of Intelligent Commuting Technology (ICT) and the Transport Retail Model, building on the Compass Card you have, and also the potential regarding capturing increased land value to fund transit.

Technical Appendix H

URBAN AREA TRANSIT STRATEGY:

A COMPONENT OF THE 2050 REGIONAL TRANSPORTATION PLAN

PLANNING LEVEL CAPITAL COST ESTIMATING METHODOLOGY REPORT

(NEW PROJECTS)

NOVEMBER 2010

Prepared by:

PARSONS BRINCKERHOFF

1.0 INTRODUCTION

System planning level capital cost estimates were developed for several transit modes being considered as part of the Urban Area Transit Strategy Project. These modes include:

- Light Rail Transit (LRT)
- Bus Rapid Transit (BRT)
- Rapid Bus
- Commuter Rail
- Streetcar

These system planning level capital costs were developed using a methodology that is consistent with Federal Transit Administration (FTA) guidelines, the basis of which is the Standard Cost Category (SCC) format. The SCC cost structure is described below.

2.0 FTA STANDARD COST CATEGORIES

In accordance with the latest FTA SCCs, the capital cost components were classified into the following cost categories:

10 Guideway and Track Elements
20 Station, Stops, Terminals, and Intermodal
30 Support Facilities: Yards, Shops, and Administration Buildings (Not Used)
40 Sitework and Special Conditions
50 Systems
60 Right-of-Way, Land, and Existing Improvements
70 Vehicles (Not Used)
80 Professional Services
90 Unallocated Contingency (10%)
100 Finance Charges (Not Used)

2.1 SCC 10 – Guideway and Track Elements

The guideway and track elements are portions of the transit system that can be assigned costs at a fairly aggregate level, with an acceptable level of accuracy. Most commonly, these elements are linear and can be represented by typical cross sections.

The guideway costs are divided into the following sub categories:

10.01 Guideway: At-grade exclusive right-of-way
10.02 Guideway: At-grade semi-exclusive right-of-way (allows cross-traffic)
10.03 Guideway: At-grade right-of-way (in mixed traffic)

10.04 Guideway: Aerial structure
10.05 Guideway: Built-up fill
10.06 Guideway: Underground cut and cover
10.07 Guideway: Underground tunnel
10.08 Guideway: Retained cut or fill

These costs include all foundational construction elements up to the point where track construction typically begins (at the top of sub ballast). The guideway cost estimates are based on parametric unit cost information specifically developed for each construction type.

2.2 SCC 20 – Stations, Stops, Terminals, and Intermodal

Station costs represent the fixed facilities and amenities for transit stations. The passenger station cost estimates are based on historical costs of similar stations. The station cost category is made up of a number of sub categories. The following is a list of these sub categories:

20.01 At-grade station, stop, shelter, mall, terminal, and platform
20.02 Aerial station, stop, shelter, mall, terminal, and platform
20.03 Underground station, stop, shelter, mall, terminal, and platform
20.04 Other stations, landings, and terminals: intermodal, ferry, trolley, etc.
20.05 Joint development
20.06 Automobile parking multi-story structure
20.07 Elevators and escalators

2.3 SCC 30 – Support Facilities: Yards, Shops, and Administration Buildings

This cost category includes vehicle storage and maintenance buildings, trackwork for the storage of rail vehicles, vehicle cleaning and painting facilities, office support areas, maintenance-of-way facilities, and general and major shop equipment. At this time, the extent of support facilities have not been identified and the capital costs developed to date do not include the cost of such facilities. Once these features have been identified, their costs will be distributed to each of the transit project in that alternative.

2.4 SCC 40 – Sitework and Special Conditions

The development of a functional transit system often requires that a number of ancillary mitigation requirements, which may or may not be directly related to the transit system service, be addressed. Sitework and special conditions costs often include items that cannot be adequately represented by a typical cross-section because of complexities, uncertain alignments, special site conditions, or other unique circumstances. The sitework and special conditions cost category is sub divided into the following:

40.01 Demolition, clearing, and fine grading
40.02 Site utilities and utility relocation
40.03 Hazardous materials, contaminated soil removal/mitigation and ground water treatments

40.04 Environmental mitigation, e.g. wetlands, historic/archaeological, and parks
40.05 Site structures, including retaining walls and sound walls
40.06 Pedestrian/bike access and accommodation, including landscaping
40.07 Automobile, bus, and van accessways, including roads and parking lots
40.08 Temporary facilities and other indirect costs during construction including mobilization

2.5 SCC 50 – Systems

This cost category includes the following cost elements:

50.01 Train control and signals
50.02 Traffic signals and crossing protection
50.03 Traction power supply substations
50.04 Traction power distribution catenary
50.05 Communications
50.06 Fare collection system and equipment
50.07 Central control

2.6 SCC 60 – Right-of-Way, Land, and Existing Improvements

This cost category covers all land acquisition and acquisition-related costs required to obtain various real property needed for the construction, operation, and maintenance of the proposed alignments. Costs include the fee acquisition of permanent takes and temporary easements, relocation costs, business damages, and other miscellaneous costs. This cost was developed based on historical cost real estate per transit project, as a percentage of the construction cost. Both purchase and relocation costs were included in a single line item.

60.01 Purchase or lease of real estate

2.7 SCC 70 – Vehicles

This cost category is generally subdivided into revenue (identified by transit mode) and non-revenue vehicles (where non-revenue vehicles include maintenance-of-way vehicles and agency trucks and automobiles). During this phase of the project development process, the unit costs for vehicles typically include costs for engineering, procurement, and spare parts, and are based on current quotes received by MTS or other transit authorities with similar vehicles.

An estimate for vehicles has not been developed. Once the overall system needs are determined, the total number of transit vehicles will be identified and included in the overall system cost.

2.8 SCC 80 – Professional Services

This cost category includes allowances for preliminary engineering, final design, project and construction management, agency program management, project insurance, surveys and testing, and start-up costs. These allowances are computed by applying a percentage to the total construction costs estimated for each cost category (excluding right-of-way and vehicle costs). Right-of-way and vehicle costs are typically calculated to include the management and administration costs associated with these activities and are therefore excluded from the calculation of professional services. The following is a list of the percentage multipliers being applied to the total construction costs to cover these items:

80.01	Preliminary Engineering	5.0%
80.02	Final Design	10.0%
80.03	Project Management for Design and Construction	7.0%
80.04	Construction Administration and Management	10.0%
80.05	Insurance	2.5%
80.06	Legal: Permits, Review Fees, Etc.	1.0%
80.07	Surveys, Testing, Investigation, and Inspection	2.0%
80.10	Start Up	1.5%
	Total Professional Services Costs	**39.0%**

2.9 SCC 90 – Unallocated Contingency

An unallocated contingency is intended to cover bid risks and construction risks that cannot reasonably be allocated to specific SCCs, such as change orders during construction (allocated contingencies are included in each of the construction subcategories). This cost category is intended to cover unknowns that cannot be anticipated, but nonetheless are prudent to include for planning purposes. The unallocated contingency is calculated as 10 percent of the total capital cost estimate.

2.10 SCC 100 – Finance Charges

Finance charges are not included in the scope of the initial project cost estimate.

3.0 ESTIMATING METHODOLOGY

Cost estimates were developed for each mode and for most of the FTA's Standard Cost Categories (SCC). These cost estimates were developed using historical prices for similar types of work. Right-of-way costs were developed based on historical right-of-way costs incurred as a percentage of construction cost in San Diego on Transit projects.

At this time, support facilities such maintenance facilities, yard, administration buildings, etc, have not been accounted for. The cost of these facilities would be determined when the overall system needs have been defined. When the needs of the overall system have been identified, those costs can be distributed to individual routes based on a reasonable distribution of such costs.

In order to arrive at the capital cost in a reasonable timeframe, a significant number of simplifying assumptions were made. It is noted that these costs are "high-level" costs used for system planning and no engineering was performed to verify these costs. Although the actual cost of each project may vary significantly from that developed here, the overall cost of the system improvements is expected to be a reasonable estimate when used for comparison of system wide alternatives.

3.1 Allocated Contingency

An allocated contingency is typically included in a cost estimate to address the lack of scope and/or quantity definition during the in-progress design stages. Using the SCC format, this is now a required step in the preparation of cost estimates. In the early stages, an allocated contingency may represent a significant portion of the cost estimate for any particular SCC. As the design progresses and more detailed quantity take-offs are developed, the allowance will be reduced. At 100 percent design completion, the allocated contingency, by definition, will be zero.

For the current project development phase, an allocated contingency will be applied to address the lack of scope definition and the inability to measure exact quantities. The amount of the allocated contingency will depend upon the complexity of the particular SCC, as well as the stage of engineering completion, but will typically be in the 10 to 30 percent range. The percentages shown in Table 3-1 are typical allocated contingency values; however, slightly higher or lower values may be used if warranted by a project-specific element.

Table 3-1. Allocated Contingency Percentages for Planning Estimates

FTA SCC	Description	Allocated Contingency Percentage
10	Guideway and Track Elements	
	Guideway Elements (Except Underground)	25
	Guideway Elements (Underground)	35
	Track Elements	15
20	Stations, Stops, Terminals, and Intermodals	
	At-grade or Aerial	25
	Below Grade	40
30	Support Facilities: Yards, Shops, and Administration Buildings	25
40	Sitework and Special Conditions	
	Demolition, Clearing, and Earthwork	25
	Site Utilities and Utility Relocation	50
	Hazardous Materials, Contaminated Soil Removal/Mitigation, and Groundwater Treatments	25
	Environmental Mitigation, e.g., Wetlands, Historic/Archaeological, and Parks	25
	Site Structures, including Retaining Walls and Sound Walls	25
	Pedestrian/Bike Access and Accommodation, including Landscaping	25
	Automobile, Bus, and Van Access, including Roads and Parking Lots	25
50	Systems	25
60	Right-of-Way, Land, and Existing Improvements	25 (unless otherwise noted)
70	Vehicles	5

3.2 Unit Pricing

Detailed quantity take-offs are generally not performed during the initial system planning stages of project development. Hence, rough order of magnitude (ROM) costs were used. Tables 3-2 through 3-6 show the ROM costs for the various transit modes being studied. All historical ROM costs are based on 2009 dollars.

Cost Categories 60 through 100 are the same for all transit modes. These costs are shown on Table 3-2 (LRT mode). They have not been repeated for the other modes.

Table 3-2: Light Rail Transit			
		Units	Base Year (2009) Unit Price (X000)
10 GUIDEWAY & TRACK ELEMENTS			
10.01	Guideway: At-grade exclusive right-of-way	Route Mile	3,800
10.02	Guideway: At-grade semi-exclusive (allows cross-traffic)	Route Mile	5,900
10.04	Guideway: Aerial structure	Route Mile	47,000
10.06	Guideway: Underground cut & cover	Route Mile	140,000
10.07	Guideway: Underground tunnel	Route Mile	160,000
10.08	Guideway: Retained cut or fill	Route Mile	21,500
10.09	Track: Direct fixation	Route Mile	4,800
10.11	Track: Ballasted	Route Mile	2,700
10.12	Track: Special (switches, turnouts)	Route Mile	600
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)			
20.01	At-grade station, stop, shelter, mall, terminal, platform	Each	5,000
20.02	Aerial station, stop, shelter, mall, terminal, platform	Each	12,000
20.03	Underground station, stop, shelter, mall, terminal, platform	Each	90,000
	Transit Center and Parking Facility, small	Each	5,000
	Transit Center and Parking Facility, medium	Each	10,000
20.06	Automobile parking multi-story structure	Per Space	20
20.07	Elevators, escalators	Each	500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			**NA**
40 SITEWORK & SPECIAL CONDITIONS			
40.01	Demolition, Clearing, Earthwork	Route Mile	100
40.02	Site Utilities, Utility Relocation	Route Mile	500
40.03	Haz. mat'l, contam'd soil removal/mitigation, ground water treatments	Route Mile	100
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	Route Mile	300

Table 3-2: Light Rail Transit (Cont.)

40.05	Site structures including retaining walls, sound walls	Route Mile	1000
40.06	Pedestrian / bike access and accommodation, landscaping	Route Mile	300
40.08	Temporary Facilities and other indirect costs during construction	Lump Sum	12% of other Construction Cost
50 SYSTEMS			
50.01	Train control and signals	Route Mile	1500
50.02	Traffic signals and crossing protection	Route Mile	500
50.03	Traction power supply: substations	Route Mile	800
50.04	Traction power distribution: catenary and third rail	Route Mile	1000
50.05	Communications	Route Mile	400
50.06	Fare collection system and equipment	Route Mile	400
50.07	Central Control	Route Mile	100
60 ROW, LAND, EXISTING IMPROVEMENTS			
60.01	Purchase or lease of real estate	Lump Sum	20% of Construction Cost
70 VEHICLES (number)			**NA**
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)			
80.01	Preliminary Engineering	Lump Sum	5% of Construction Cost
80.02	Final Design	Lump Sum	10% of Construction Cost
80.03	Project Management for Design and Construction	Lump Sum	7% of Construction Cost
80.04	Construction Administration & Management	Lump Sum	10% of Construction Cost
80.05	Professional Liability and other Non-Construction Insurance	Lump Sum	2.5% of Construction Cost
80.06	Legal; Permits; Review Fees by other agencies, cities, etc.	Lump Sum	1% of Construction Cost
80.07	Surveys, Testing, Investigation, Inspection	Lump Sum	2% of Construction Cost
80.08	Start up	Lump Sum	1.5% of Construction Cost
90 UNALLOCATED CONTINGENCY			10% of all Cost
100 FINANCE CHARGES			**NA**

Table 3-3: Bus Rapid Transit			
		Units	Base Year (2009) Unit Price (X000)
10 GUIDEWAY & TRACK ELEMENTS			
10.01	Guideway: At-grade exclusive right-of-way	Route Mile	5,500
10.02	Guideway: At-grade semi-exclusive (allows cross-traffic)	Route Mile	850
10.03	Guideway: At-grade in mixed traffic	Route Mile	500
10.04	Guideway: Aerial structure	Route Mile	70,000
10.06	Guideway: Underground cut & cover	Route Mile	160,000
10.07	Guideway: Underground tunnel	Route Mile	180,000
10.08	Guideway: Retained cut or fill	Route Mile	10,000
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)			
20.01	At-grade station, stop, shelter, mall, terminal, platform	Each	5,000
20.02	Aerial station, stop, shelter, mall, terminal, platform	Each	15,000
20.03	Underground station, stop, shelter, mall, terminal, platform	Each	90,000
	Transit Center and Parking Facility, small	Each	5,000
	Transit Center and Parking Facility, medium	Each	10,000
20.06	Automobile parking multi-story structure	Per Space	20
20.07	Elevators, escalators	Each	500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			**NA**
40 SITEWORK & SPECIAL CONDITIONS			
40.01	Demolition, Clearing, Earthwork	Route Mile	100
40.02	Site Utilities, Utility Relocation	Route Mile	500
40.03	Haz. mat'l, contam'd soil removal/mitigation, ground water treatments	Route Mile	100
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	Route Mile	300
40.05	Site structures including retaining walls, sound walls	Route Mile	1000
40.06	Pedestrian / bike access and accommodation, landscaping	Route Mile	300
40.08	Temporary Facilities and other indirect costs during construction	Lump Sum	12% of other Construction Cost
50 SYSTEMS			
50.02	Traffic signals and crossing protection	Route Mile	100
50.05	Communications	Route Mile	200
50.06	Fare collection system and equipment	Route Mile	200

Table 3-4: Rapid Bus			
		Units	Base Year (2009) Unit Price (X000)
10 GUIDEWAY & TRACK ELEMENTS			
10.03	Guideway: At-grade in mixed traffic	Route Mile	200
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)			
20.01	At-grade station, stop, shelter, mall, terminal, platform	Each	500
	Transit Center and Parking Facility, small	Each	5,000
	Transit Center and Parking Facility, medium	Each	10,000
20.06	Automobile parking multi-story structure	Per Space	20
20.07	Elevators, escalators	Each	500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			**NA**
40 SITEWORK & SPECIAL CONDITIONS			
40.01	Demolition, Clearing, Earthwork	Route Mile	50
40.02	Site Utilities, Utility Relocation	Route Mile	50
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	Route Mile	20
40.05	Site structures including retaining walls, sound walls	Route Mile	20
40.06	Pedestrian / bike access and accommodation, landscaping	Route Mile	100
40.07	Automobile, bus, van accessways including roads, parking lots	Route Mile	100
40.08	Temporary Facilities and other indirect costs during construction	Lump Sum	12% of other Construction Cost
50 SYSTEMS			
50.02	Traffic signals and crossing protection	Route Mile	200
50.05	Communications	Route Mile	200
50.06	Fare collection system and equipment	Route Mile	100

Table 3-5: Commuter Rail			
		Units	Base Year (2009) Unit Price (X000)
10 GUIDEWAY & TRACK ELEMENTS			
10.01	Guideway: At-grade exclusive right-of-way	Route Mile	3,800
10.04	Guideway: Aerial structure	Route Mile	53,000
10.06	Guideway: Underground cut & cover	Route Mile	160,000
10.07	Guideway: Underground tunnel	Route Mile	180,000
10.08	Guideway: Retained cut or fill	Route Mile	21,500
10.09	Track: Direct Fixation	Route Mile	4,800
10.11	Track: Ballasted	Route Mile	2,700
10.12	Track: Special (switches, turnouts)	Route Mile	600
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)			
20.01	At-grade station, stop, shelter, mall, terminal, platform	Each	15,000
20.03	Underground station, stop, shelter, mall, terminal, platform	Each	200,000
	Transit Center and Parking Facility, small	Each	5,000
	Transit Center and Parking Facility, medium	Each	10,000
20.06	Automobile parking multi-story structure	Per Space	20
20.07	Elevators, escalators	Each	500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			**NA**
40 SITEWORK & SPECIAL CONDITIONS			
40.01	Demolition, Clearing, Earthwork	Route Mile	100
40.02	Site Utilities, Utility Relocation	Route Mile	500
40.03	Haz. mat'l, contam'd soil removal/mitigation, ground water treatments	Route Mile	100
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	Route Mile	300
40.05	Site structures including retaining walls, sound walls	Route Mile	1000
40.06	Pedestrian / bike access and accommodation, landscaping	Route Mile	300
40.08	Temporary Facilities and other indirect costs during construction	Lump Sum	12% of other Construction Cost
50 SYSTEMS			
50.01	Train control and signals	Route Mile	1500
50.02	Traffic signals and crossing protection	Route Mile	500
50.05	Communications	Route Mile	400
50.06	Fare collection system and equipment	Route Mile	400
50.07	Central Control	Route Mile	100

Table 3-6: Streetcar			
		Units	Base Year (2009) Unit Price (X000)
10 GUIDEWAY & TRACK ELEMENTS			
10.01	Guideway: At-grade exclusive right-of-way	Route Mile	3,800
10.02	Guideway: At-grade semi-exclusive (allows cross-traffic)	Route Mile	5,900
10.03	Guideway: At-grade in mixed traffic	Route Mile	2,500
10.04	Guideway: Aerial structure	Route Mile	47,000
10.06	Guideway: Underground cut & cover	Route Mile	140,000
10.07	Guideway: Underground tunnel	Route Mile	160,000
10.08	Guideway: Retained cut or fill	Route Mile	21,500
10.09	Track: Direct fixation	Route Mile	4,800
10.11	Track: Ballasted	Route Mile	2,700
10.12	Track: Special (switches, turnouts)	Route Mile	600
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)			
20.01	At-grade station, stop, shelter, mall, terminal, platform	Each	500
20.02	Aerial station, stop, shelter, mall, terminal, platform	Each	12,000
20.03	Underground station, stop, shelter, mall, terminal, platform	Each	90,000
	Transit Center and Parking Facility, small	Each	5,000
	Transit Center and Parking Facility, medium	Each	10,000
20.06	Automobile parking multi-story structure	Per Space	20
20.07	Elevators, escalators	Each	500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			**NA**
40 SITEWORK & SPECIAL CONDITIONS			
40.01	Demolition, Clearing, Earthwork	Route Mile	200
40.02	Site Utilities, Utility Relocation	Route Mile	500
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	Route Mile	20
40.05	Site structures including retaining walls, sound walls	Route Mile	50
40.06	Pedestrian / bike access and accommodation, landscaping	Route Mile	100
40.07	Automobile, bus, van accessways including roads, parking lots	Route Mile	100
40.08	Temporary Facilities and other indirect costs during construction	Lump Sum	12% of other Construction Cost
50 SYSTEMS			
50.01	Train control and signals	Route Mile	1500
50.02	Traffic signals and crossing protection	Route Mile	200
50.03	Traction power supply: substations	Route Mile	800
50.04	Traction power distribution: catenary	Route Mile	2,000
50.05	Communications	Route Mile	400
50.06	Fare collection system and equipment	Route Mile	400
50.07	Central Control	Route Mile	100

4.0 ESTIMATE LIMITATIONS

During the early stages of design, significant uncertainties exist to the extent that the work scope is often limited to a broad description of horizontal and vertical alignments. At this phase of the project development process, inherent uncertainties that could limit capital cost estimates include:

- Standard Design Criteria
- Scope and Quantity Definition
- Commodity Pricing
- Unforeseen Problems

Technical Appendix I

Draft Transit Evaluation Ranking (Ranked Order)

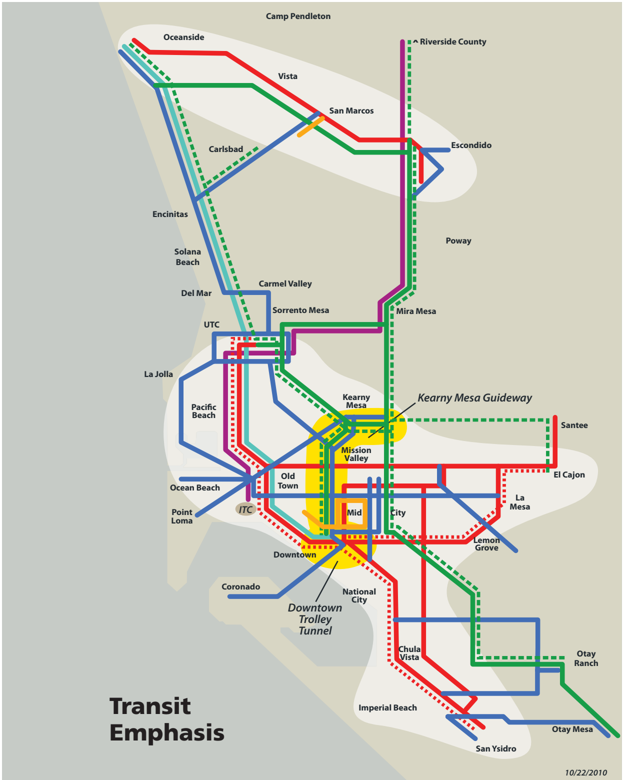
Project ID	*TransNet*	Route	Mode	Description	Capital Cost Est. (mil)	Operating Subsidy Est. (mil)	Total Cost Est. (mil)	Total Score	2050 RTP Project Rank
4		510	LRT	Blue Line UTC to San Ysidro via Downtown San Diego	$540	$424	$964	72.37	1
6		530	LRT	Green Line Santee to 12th/Imperial	$0	$367	$367	70.39	2
17		610	Peak BRT	Temecula/Escondido to Downtown via I-15, Kearny Mesa Guideway	$920	$310	$1,230	68.64	3
14		540	Express LRT	Blue Line UTC to San Ysidro via Downtown San Diego	$316	$229	$546	61.90	4
15		566	Express LRT	Otay (EUC) to UTC via Mid-City, Kearny Mesa	$227	$219	$446	56.40	5
13		522	Express LRT	Orange Line El Cajon to Downtown San Diego via Euclid	$160	$145	$305	52.45	6
22		870	Peak BRT	El Cajon to UTC via Santee, SR 52, Kearny Mesa	$7	$17	$24	52.36	7
1		598	CR	High Speed Rail - Commuter Rail Service from Riverside to Int'l Border	$3,753	$912	$4,665	52.22	8
11		563	LRT	Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, SDSU	$1,051	$272	$1,323	51.09	9
2	*TransNet*	398	CR	COASTER with Del Mar and University Town Center (UTC) Tunnels, Permanent Station at Del Mar Fairgrounds, and New Station at Convention Center in Downtown San Diego	$4,630	$825	$5,455	50.02	10
5		520	LRT	Orange Line with Extension to Airport and Downtown Tunnel	$540	$330	$869	49.02	11
32		120	Rapid	Kearny Mesa to Downtown via Sharp Hospital, Mission Valley, Hillcrest	$917	$57	$974	47.64	12
8		560	LRT	SDSU to Downtown via El Cajon Blvd/Mid-City	$1,025	$171	$1,196	47.42	13
10		562	LRT	UTC to Chula Vista via Kearny Mesa, Mission Valley, Mid-City, National City	$1,612	$269	$1,881	45.92	14
27		10	Rapid	La Mesa to Ocean Beach via Mid-City, Hillcrest, Old Town	$71	$124	$196	45.29	15
20		652	BRT	Downtown to UTC via Hillcrest, Mission Valley, via Kearny Mesa Guideway	$950	$74	$1,024	44.56	16
25		430	BRT	Oceanside to Escondido via SR 78 HOV Lanes	$196	$57	$252	43.40	17
44		910	Rapid	Coronado to Downtown via Coronado Bridge	$21	$55	$76	43.28	18
35		473	Rapid	Oceanside to UTC via Hwy 101 Coastal Communities, Carmel Valley	$106	$165	$270	41.85	19
7		550	LRT	SDSU to San Ysidro via East San Diego, SE San Diego, National City	$1,388	$286	$1,674	40.19	20
3	Partial *TransNet*	399	LRT	SPRINTER Oceanside to Escondido (with Branch Extensions to North County Fair and East Escondido)	$609	$341	$950	39.82	21
21		692	BRT	El Cajon to Otay Mesa via Spring Valley, SR 125, Millenia	$6	$82	$88	36.07	22
16		588	Express LRT	SPRINTER - Stops at Oceanside, Vista, Escondido Transit Centers	$197	$118	$315	35.08	23
30		30	Rapid	Old Town to Sorrento Mesa via Pacific Beach, La Jolla, UTC	$81	$161	$242	34.88	24
18		650	Peak BRT	Otay Ranch/Chula Vista to Palomar Airport Road Business Park via I-805/I-5	$67	$28	$96	34.68	25
28		11	Rapid	Spring Valley to SDSU via SE San Diego, Downtown, Hillcrest, Mid-City	$92	$150	$242	34.56	26

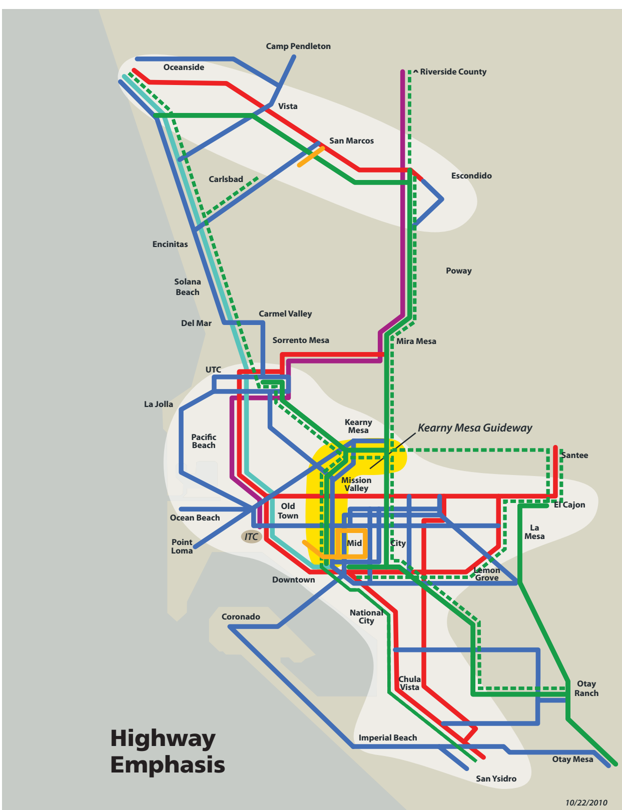
Draft Transit Evaluation Ranking (Ranked Order)

Project ID	*TransNet*	Route	Mode	Description	Capital Cost Est. (mil)	Operating Subsidy Est. (mil)	Total Cost Est. (mil)	Total Score	2050 RTP Project Rank
29		28	Rapid	Point Loma to Kearny Mesa via Old Town, Linda Vista	$40	$76	$117	33.89	27
9		561	LRT	UTC to Mira Mesa via Sorrento Mesa	$1,173	$131	$1,304	33.17	28
49		555	Streetcar	30th St. to downtown San Diego via North Park/Golden Hill	$207	$164	$371	32.61	29
47		553	Streetcar	San Diego Downtown - Little Italy to East Village	$113	$81	$194	31.37	30
48		554	Streetcar	Hillcrest/Balboa Park/Downtown San Diego Loop	$231	$160	$391	30.74	31
12		564	LRT	Otay Mesa to Chula Vista via Otay Ranch/Millenia	$668	$186	$854	29.73	32
19		653	Peak BRT	SE San Diego/Mid-City to Palomar Airport Road Business Park via I-	$10	$30	$40	29.63	33
31		41	Rapid	Old Town to UTC via Linda Vista, Clairemont	$45	$64	$109	27.71	34
26		2	Rapid	30th Ave to Downtown San Diego via North Park	$32	$68	$100	27.33	35
24		940	Peak BRT	Oceanside to Sorrento Mesa via I-5, Carlsbad, Encinitas	$36	$14	$50	26.94	36
43		709	Rapid	H St Trolley to Millenia via H St Corridor, Southwestern College	$30	$55	$85	26.07	37
39		636	Rapid	SDSU to Spring Valley via East San Diego, Lemon Grove, Skyline	$32	$55	$87	25.60	38
23		890	Peak BRT	El Cajon to Sorrento Mesa via Santee, SR 52	$10	$23	$33	25.16	39
33		440	Rapid	Carlsbad to San Marcos via Palomar Airport Road Corridor	$42	$57	$98	23.38	40
38		635	Rapid	Millenia to Palomar Trolley via Main St Corridor	$45	$70	$115	22.29	41
45		551	Streetcar	Chula Vista Downtown	$112	$89	$201	22.15	42
40		637	Rapid	North Park to 32nd St Trolley via Golden Hill, SE San Diego	$26	$46	$72	21.95	43
50		557	Streetcar	El Cajon Downtown	$133	$98	$231	21.86	44
51		558	Streetcar	Escondido Downtown	$42	$33	$74	19.91	45
36		474	Rapid	Oceanside to Vista via Mission Ave/Santa Fe Road Corridor	$41	$76	$117	19.64	46
34		471	Rapid	Downtown Escondido to East Escondido	$26	$32	$58	19.14	47
41		638	Rapid	San Ysidro to Otay Mesa via Otay, SR 905 Corridor	$44	$67	$111	19.10	48
46		552	Streetcar	National City Downtown	$33	$48	$81	18.69	49
53		565	Streetcar	Mission Beach to La Jolla via Pacific Beach	$199	$154	$354	17.55	50
42		639	Rapid	Otay to North Island via Imperial Beach, Silver Strand, Coronado	$44	$65	$109	17.18	51
52		559	Streetcar	Oceanside Downtown	$37	$25	$62	16.48	52
37		477	Rapid	Camp Pendleton to Carlsbad Village via College Blvd, Plaza Camino Real	$65	$92	$156	15.62	53
54		567*	Streetcar	San Marcos Downtown to Palomar College to CSUSM	$60	$179	$239	12.26	54

* This project was ranked as a streetcar. The City of San Marcos has proposed to fund this service (capital and operations) as a shuttle/circulator.

Technical Appendix J





Draft 2050 Revenue Constrained Network Scenarios

Transit Network Maps

November 12, 2010

Legend

- High Speed and Commuter Rail
- COASTER Rail
- Light Rail Transit
- Express Light Rail Transit
- Bus Rapid Transit
- Peak Bus Rapid Transit
- Rapid Bus
- Streetcar/Shuttle-Circulator
- High Frequency Local Bus Services
- Major Capital Investments Projects

✓ = Included
= Smaller Investment
= Larger Investment

Major Capital Investments	Transit	Rail/ Freight	Highway	Fusion
Downtown Trolley Tunnel	✓	✓		
Kearny Mesa Guideway	✓		✓	✓
UTC COASTER Station/Tunnel		✓		

New Routes	Transit	Rail/ Freight	Highway	Fusion
LRT	Larger	Larger	Smaller	Larger
BRT	Smaller	Smaller	Larger	Smaller
Rapid Bus	Larger	Smaller	Larger	Smaller
Streetcars/Shuttles	Smaller	Smaller	Smaller	Larger

Technical Appendix K-1

Attachment 6

Draft 2050 RTP Revenue Constrained Network Scenarios
Constant Projects List
December 17, 2010

	***TransNet* Projects**					**Estimated UNC Cost* ($2010)**	**Project Ranking**	**Scenario #1** Transit Emphasis	**Scenario #2** Rail/Freight Emphasis	**Scenario #3** Highway Emphasis	**Scenario #4** Fusion	**Scenario #5** Hybrid
	FREEWAY/HIGHWAY IMPROVEMENT PROJECTS											
	Route	**From**	**To**	**Existing**	**Improvement**							
1	I-5	SR 905	SR 54	8F	8F+2ML	$220	15	✓	✓	✓	✓	✓
2	I-5	SR 54	I-15	8F	8F+2ML	$100	14	✓	✓	✓	✓	✓
3	I-5	I-15	I-8	8F	8F+Operational	$1,130	17	✓	✓	✓	✓	✓
4	I-5	I-8	La Jolla Village Dr	8F/10F	8F/10F+2ML	$530	6	✓	✓	✓	✓	✓
5	I-5	La Jolla Village Dr	I-5/I-805 Merge	8F/14F	8F/14F+2ML	$303	28	✓	✓	✓	✓	✓
6	I-5	I-5/I-805 Merge	Manchester Ave	8F/14F+ 2HOV	8F/14F+4ML	$427	32	✓	✓	✓	✓	✓
7	I-5	Manchester Ave	Palomar Airport Rd	8F	8F+4ML	$2,059	4	✓	✓	✓	✓	✓
8	I-5	Palomar Airport Rd	Vandegrift Boulevard	8F	8F+4ML	$1,311	25	✓	✓	✓	✓	✓
9	I-8	2nd Street	Los Coches	4F/6F	6F	$54	41	✓	✓	✓	✓	✓
10	SR 15	SR 94	I-8	8F	8F+2ML	$120	19	✓	✓	✓	✓	✓
11	I-15	Viaduct		8F	8F+2ML	$720	42	✓	✓	✓	✓	✓
12	I-15	I-8	SR 163	8F	8F+2ML	$130	3	✓	✓	✓	✓	✓
13	I-15	SR 163	SR 56	8F+2ML(R)	10F+4ML/MB	$419	N/A	✓	✓	✓	✓	✓
14	I-15	Centre City Pkwy	SR 78	8F	8F+4ML	$210	N/A	✓	✓	✓	✓	✓
15	SR 52	I-15	SR 125	4F	6F+2ML(R)	$325	11	✓	✓	✓	✓	✓
16	SR 54	I-5	SR 125	6F	6F+2ML	$100	37	✓	✓	✓	✓	✓
17	SR 56	I-5	I-15	4F	6F	$221	46	✓	✓	✓	✓	✓
18	SR 67	Mapleview St	Dye Rd	2C/4C	4C	$570	8	✓	✓	✓	✓	✓
19	SR 76	Melrose Drive	I-15	2C	4C	$404	N/A	✓	✓	✓	✓	✓
20	SR 78	I-5	I-15	6F	6F+2ML/Ops	$570	5	✓	✓	✓	✓	✓
21	SR 94	I-5	I-805	8F	8F+2ML	$480	22	✓	✓	✓	✓	✓
22	SR 94	I-805	College Ave	8F	8F+2ML	$220	27	✓	✓	✓	✓	✓
23	SR 94	College Ave	SR 125	8F	8F+2ML	$230	44	✓	✓	✓	✓	✓
24	SR 94	SR 125	Avocado Blvd	4F	6F	$90	34	✓	✓	✓	✓	✓
25	SR 94	Avocado Blvd	Steele Canyon Rd	2C/4C	4C	$50	45, 24	✓	✓	✓	✓	✓
26	SR 125	SR 54	SR 94	6F	6F+2ML	$100	16	✓	✓	✓	✓	✓
27	SR 125	SR 94	I-8	8F	8F+2ML	$70	2	✓	✓	✓	✓	✓
28	I-805	Palomar St	Carroll Canyon Rd	8F/10F	8F+2ML	$2,003	18, 9, 10, 1	✓	✓	✓	✓	✓
29	I-805	Mission Valley Viaduct		8F	8F+2ML	$401	10	✓	✓	✓	✓	✓
30	I-805	Carroll Canyon Rd	I-5 (north)	8F/10F	8F+2ML	$86	7	✓	✓	✓	✓	✓

	TransNet Projects				Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #4 Hybrid
	FREEWAY CONNECTORS										
	Fwy	**Intersecting Freeway**	**Movement**								
31	I-5	SR 56	West to North		$33	9	✓	✓	✓	✓	✓
32	I-5	SR 56	South to East		$98	10	✓	✓	✓	✓	✓
33	I-5	SR 78	South to East		$60	2	✓	✓	✓	✓	✓
34	I-5	SR 78	West to South		$46	4	✓	✓	✓	✓	✓
35	SR 94	SR 125	West to North		$180	1	✓	✓	✓	✓	✓
36	SR 94	SR 125	South to East		$139	5	✓	✓	✓	✓	✓
	HOV CONNECTORS										
	Route	**Intersecting Freeway**	**Movement**								
37	I-5	I-805	North to North and South to South		$170	3	✓	✓	✓	✓	✓
38	I-15	SR 78	East to South and North to West		$105	1	✓	✓	✓	✓	✓
39	I-15	SR 94	East to North and South to West		$80	19	✓	✓	✓	✓	✓
	TRANSIT PROJECTS										
40	COASTER - Double Tracking (including Fairgrounds and Convention Center Stations, and grade separation at Leucadia) + two additional grade separations + quiet zone improvements (Rte 398)				$1,996	10	✓	✓	✓	✓	✓
41	Trolley - Mid-Coast LRT Extension (Rte 510)				$1,350	N/A	✓	✓	✓	✓	✓
42	Trolley - Trolley System Rehabilitation				$510	N/A	✓	✓	✓	✓	✓
43	SPRINTER - Double Tracking (Oceanside-Escondido); (including rail grade separations assumed at El Camino Real, Vista Village, Melrose, and Mission/San Marcos Stations) + 2 additional rail grade separations (Rte 399)				$798	21	✓	✓	✓	✓	✓
44	BRT - North I-15 (Sabre Springs/Mira Mesa PNRs, Mid-City Stations) (Rte 610)				$103	3	✓	✓	✓	✓	✓
45	BRT - Escondido-UTC via Mira Mesa Blvd (Rt 470 Project) (Peak only)				$20	N/A	✓	✓	✓	✓	✓
46	BRT - South Bay BRT (Otay Mesa-Downtown) (Rte 628)				$200	N/A	✓	✓	✓	✓	✓
47	BRT - South Bay Maintenance Facility				$51	N/A	✓	✓	✓	✓	✓
48	BRT - Downtown BRT stations/layovers				$110	N/A	✓	✓	✓	✓	✓
49	BRT - Otay Mesa to Sorrento Mesa via I-805, Kearny Mesa (Rt 680)				$200	N/A	✓	✓	✓	✓	✓
50	Rapid - Mid-City Rapid - Phase 1				$44	N/A	✓	✓	✓	✓	✓
51	Rapid - Mid-City Rapid – Phase 2 Balboa Park (Rte 15)				$24	N/A	✓	✓	✓	✓	✓
52	Rapid - UTC Area Super Loop (Rte 180)				$0	N/A	✓	✓	✓	✓	✓
				Total			**$19,970**	**$19,970**	**$19,970**	**$19,970**	**$19,970**

	OTHER CONSTANT PROJECTS					Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #4 Hybrid
	FREEWAY/HIGHWAY IMPROVEMENT PROJECTS											
	Route	**From**	**To**	**Existing**	**Improvement**							
53	I-5	Vandegrift Boulevard	Orange County	8F	8F+4T	$754	N/A	✓	✓	✓	✓	✓
54	I-8	SR 125	2nd Street	6F/8F	6F/8F+Operational	$125	13	✓	✓	✓	✓	✓
55	SR 11	SR 905	Mexico	--	4T	$356	N/A	✓	✓	✓	✓	✓
56	SR 15	I-5	SR 94	6F	8F+2ML	$90	23	✓	✓	✓	✓	✓
57	I-15	SR 78	Riverside County	8F	8F+4T	$1,005	N/A	✓	✓	✓	✓	✓
58	SR 52	I-5	I-805	4F	6F	$110	31	✓	✓	✓	✓	✓

	OTHER CONSTANT PROJECTS					Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #4 Hybrid
59	SR 52	I-805	I-15	6F	6F+2ML	$190	30	✓	✓	✓	✓	✓
60	SR 125	SR 905	San Miguel Rd	4T	8F	$110	N/A	✓	✓	✓	✓	✓
61	SR 125	San Miguel Rd	SR 54	4F	8F	$60	N/A	✓	✓	✓	✓	✓
62	SR 241	Orange County	I-5	--	4T/6T	$443	N/A	✓	✓	✓	✓	✓
63	SR 905	I-805	Mexico	--	6F	$595	N/A	✓	✓	✓	✓	✓
	FREEWAY CONNECTORS											
	Fwy	**Intersecting Freeway**	**Movement**									
64	I-15	SR 56	North to West			$100	7	✓	✓	✓	✓	✓
	HOV CONNECTORS											
	Route	**Intersecting Freeway**	**Movement**									
65	I-15	I-805	North to North and South to South			$90	4	✓	✓	✓	✓	✓
66	I-805	SR 52	West to North and South to East			$90	2	✓	✓	✓	✓	✓
67	I-805	SR 94	East to South and North to West			$160	6	✓	✓	✓	✓	✓
	TRANSIT PROJECTS											
68	High Speed Rail (HSR) Intercity - Temecula to Lindbergh Field ITC					$0	N/A	✓	✓	✓	✓	✓
69	COASTER - Tunnel (Del Mar) (Rte 398)					$1,184	N/A	✓	✓	✓	✓	✓
70	COASTER - Positive Train Control					$108	N/A	✓	✓	✓	✓	✓
71	Trolley - Blue Line Frequency Enhancements (rail grade seps at: Taylor, Palomar St, H St, E St, 32nd St, 28th St, Washington St/Sassafras St + Blue/Orange Track Connection at 12th/Imperial) (Rte 510)					$572	1	✓	✓	✓	✓	✓
72	Trolley - Orange Line Frequency Enhancements (rail grade seps at: Allison/University, Severin Dr, Broadway/Lemon Grove Ave, Euclid Ave) (Rte 520)					$312	11	✓	✓	✓	✓	✓
73	Trolley - Green Line Frequency Enhancements (Rte 530)					$0	2	✓	✓	✓	✓	✓
74	Rapid - La Mesa to Ocean Beach via Mid-City, Hillcrest, Old Town (Rte 10)					$85	15	✓	✓	✓	✓	✓
75	Rapid - Point Loma to Kearny Mesa via Old Town, Linda Vista (Rte 28)					$48	27	✓	✓	✓	✓	✓
76	Rapid - Kearny Mesa to Downtown via KM Guideway (Rte 120)					$0	12	✓	✓	✓	✓	✓
77	Rapid - Escondido to Del Lago via Escondido Blvd & Bear Valley (Rte 350)					$0	N/A	✓	✓	✓	✓	✓
78	Shuttles - San Marcos					$0	N/A	✓	✓	✓	✓	✓
79	Local Bus Routes - 10 min in key corridors					$0	N/A	✓	✓	✓	✓	✓
80	Feeder Bus System					$0	N/A	✓	✓	✓	✓	✓
81	Lindbergh Intermodal Transit Center (ITC)					$215	N/A	✓	✓	✓	✓	✓
82	Bike/Pedestrian Access Improvements					$500	N/A	✓	✓	✓	✓	✓
83	Other (Maintenance facilities, transit system rehab, park and ride, ITS)					$3,020	N/A	✓	✓	✓	✓	✓
	ADDITIONAL GOODS MOVEMENT PROJECTS											
84	Vesta Street Bridge - Mobility connector over Harbor Drvie at Naval Base San Diego					$60	1	✓	✓	✓	✓	✓
85	32nd Street - Freeway Access Enhancement					$119	3	✓	✓	✓	✓	✓
86	10th Ave Marine Terminal Entrance - Rail Line Grade Separation/Barrio Logan Enhancement					$67	3	✓	✓	✓	✓	✓
87	National City Marine Terminal - Bay Marina Drive, Civic Center Freeway Access Improvements					$7	6	✓	✓	✓	✓	✓
88	National City Rail Yard					$7	1	✓	✓	✓	✓	✓
	Total							**$10,582**	**$10,582**	**$10,582**	**$10,582**	**$10,582**

Note: All Managed Lane facilities will have a HOV-3+ occupancy requirement after 2020. HOV-2 and SOVs will be required to pay a fee to use these facilities.
TransNet projects are included in all scenarios with the exception of the I-805 corridor where different improvements are being tested in some scenarios.
N/A - Projects were not ranked using Board-approved project evaluation criteria.
* Capital costs only. Operating costs, which include vehicle and vehicle replacement costs, will be based on phasing.
** Project Rankings was from Temecula to International Border.

Technical Appendix K-2

Attachment 7

Draft 2050 RTP Revenue Constrained Network Scenarios
Variable Projects List
December 17, 2010

	VARIABLE PROJECTS					Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #5 Hybrid
	FREEWAY/HIGHWAY IMPROVEMENT PROJECTS											
	Route	**From**	**To**	**Constant**	**Add'l Improvement**							
89	I-5	SR 54	I-15	8F+2ML	10F+2ML	$100	14	-	-	✓	✓	✓
90	I-5	SR 56	Palomar Airport Rd	8F+4ML	10F+4ML	$136	4	-	-	✓	-	✓
91	I-5	Palomar Airport Rd	Vandegrift	8F+4ML	10F+4ML	$87	25	-	-	✓	-	-
92	I-8	I-5	I-15	8F	8F+Operational	$440	33	✓	-	✓	✓	✓
93	I-8	I-15	SR 125	8F/10F	8F/10F+Operational	$125	40	✓	-	✓	✓	✓
94	I-8	Los Coches	Dunbar Rd	4F/6F	6F	$335	41	-	-	✓	-	-
95	SR 52	I-15	SR 125	6F+2ML(R)	6F+3ML/MB	$115	11	-	-	✓	-	-
96	SR 52	SR 125	SR 67	4F	6F	$120	36	-	-	✓	-	-
97	SR 54	I-5	SR 125	6F+2ML	6F/8F+2ML	$40	37	-	-	✓	-	-
98	SR 56	I-5	I-15	6F	6F+2ML	$69	46	-	-	✓	-	-
99	SR 67	I-8	Mapleview St	4F/6F	6F/8F	$180	29	-	✓	✓	-	-
100	SR 76	I-5	Melrose Drive	4E	6E	$225	39	-	-	✓	-	-
101	SR 76	Melrose Drive	Mission Rd	4C	6C	$190	20	-	-	✓	-	-
102	SR 76	I-15	Couser Canyon	2C	4C/6C + Ops	$130	26	-	-	✓	✓	✓
103	SR 94	I-805	College Ave	8F+2ML	10F+2ML	$70	27	-	-	✓	✓	-
104	SR 94	Steele Canyon Rd	Melody Rd	2C	4C	$90	45, 24	-	✓	✓	-	-
105	SR 125	SR 54	SR 94	6F+2ML	8F+2ML	$40	16	-	-	✓	-	-
106	SR 125	SR 94	I-8	8F+2ML	10F+2ML	$215	2	-	-	✓	✓	✓
107	SR 125	I-8	SR 52	6F	6F+2ML	$440	38	-	✓	✓	-	-
108	SR 163	I-805	I-15	8F	8F+2ML	$320	35	-	-	✓	-	-
109	I-805	SR 905	Telegraph Canyon Rd.	8F	8F+4ML	$140	12	-	-	✓	-	✓
110	I-805	Telegraph Canyon Rd.	SR 54	8F+2ML	8F+4ML	$100	18	-	-	✓	-	✓
111	I-805	SR 54	I-8	8F+2ML	8F+4ML	$160	9	-	-	✓	-	✓
112	I-805	Mission Valley Viaduct		8F+2ML	8F+4ML	$160	10	-	-	✓	-	✓
113	I-805	I-8	La Jolla Village Dr	8F/10F+2ML	8F/10F+4ML	$100	1	-	-	✓	-	✓
114	I-805	Palomar St	SR 94	8F+2ML	8F+4ML	$516	18	✓	-	-	-	-
115	I-805	SR 52	Carroll Canyon Rd	8F/10F+2ML	8F/10F+4ML	$180	1	✓	-	-	-	-
116	I-805	SR 905	Palomar St	8F	8F+2ML	$200	12	-	✓	-	-	-
117	SR 905	I-5	I-805	4F	8F	$150	43	-	✓	✓	-	-
118	SR 905	I-805	Mexico	6F	8F	$426	21	-	✓	✓	-	-
	FREEWAY CONNECTORS											
	Fwy	**Intersecting Freeway**	**Movement**									
119	I-5	I-8	East to North			$220	6	-	-	✓	-	-
120	I-5	I-8	South to West			$100	3	-	-	✓	-	-
121	I-5	SR 94	North to East			$120	8	-	✓	-	-	-
	HOV CONNECTORS											
	Route	**Intersecting Freeway**	**Movement**									
122	I-5	SR 56	North to East and West to South			$80	5	-	-	✓	-	-
123	I-5	SR 78	South to East and West to North			$120	8	✓	-	✓	-	✓
124	I-5	SR 78	North to East and West to South			$120	7	✓	-	✓	-	✓
125	I-15	SR 52	West to North and South to East			$140	10	✓	-	-	✓	✓

	VARIABLE PROJECTS	Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #5 Hybrid
	TRANSIT PROJECTS							
126	High Speed Rail (HSR) Commuter Rail Overlay - Temecula to Lindbergh ITC (Rte 598)	$330	8**	✓	✓	✓	✓	-
127	COASTER - UTC Tunnel and UTC COASTER Station (Rte 398)	$2,989	See Note A	-	✓	-	-	-
128	SPRINTER - Branch Extensions to North County Fair (Rte 399)	$172	See Note B	✓	✓	-	✓	✓
129	SPRINTER Express (Rte 588)	$207	23	-	✓	-	✓	✓
130	Trolley - Downtown Trolley Tunnel betw. Park/Island and Ash St (facilitates frequency enhancements for Blue/Orange Lines and Blue/Orange Express) (Rtes 510 & 520)	$2,592	See Note C	✓	✓	-	-	✓
131	Trolley Express - Blue Line Express - UTC to San Ysidro via Downtown (Rte 540)	$455	4	✓	✓	-	-	✓
132	Trolley Express - Orange Line Express - El Cajon to Downtown San Diego via Euclid (Rte 522)	$230	6	✓	✓	-	-	✓
133	Trolley Express - H St Trolley Station (formerly EUC) to UTC via Mid-City, Kearny Mesa (Rte 566)	$327	5	-	✓	-	-	-
134	Trolley - SDSU to Downtown via El Cajon Blvd/Mid-City (transition of Mid-City Rapid to LRT) (Rte 560)	$1,921	13	✓	-	-	-	✓
135	Trolley - Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, SDSU (Rte 563)	$1,262	9	-	✓	-	✓	✓
136	Trolley - SDSU to San Ysidro via East San Diego, SE San Diego, National City (Rte 550)	$1,665	20	✓	-	✓	-	-
137	Trolley - UTC to H St Trolley Station via Kearny Mesa, Mission Valley, Mid-City, National City (Rte 562)	$1,935	14	-	✓	-	✓	-
138	Trolley - UTC to Palomar Trolley Station via Kearny Mesa, Mission Valley, Mid-City, National City/Chula Vista via Highland Ave/4th Ave (Modified Rte 562)	$2,548	N/A	-	-	-	-	✓
139	Trolley - UTC to Mira Mesa via Sorrento Mesa (Rte 561)	$1,408	28	-	-	✓	✓	-
140	Trolley - UTC to Mira Mesa via Sorrento Mesa/Carroll Cyn (Modified Rte 561)	$1,140	N/A	-	-	-	-	✓
141	Guideway - Downtown to Kearny Mesa Guideway (facilitates direct access for BRT, Rapid Bus, and local bus - Rtes 120, 610, 640, 652)	$3,302	See Note D	✓	-	✓	✓	-
142	Modified Guideway - Hillcrest to Mission Valley Transit Priority Measures (facilitates direct access for BRT, Rapid Bus, and local bus - Rtes 120, 610, and 640)	$500	See Note E	-	-	-	-	✓
143	BRT - I-5 - San Ysidro to Kearny Mesa via I-5 shoulder lanes/HOV lanes, Downtown, Kearny Mesa Guideway (Rte 640) (eventually replaced by Blue Line Express Route 540)	$90	N/A	-	-	✓	✓	✓
144	BRT - Downtown to UTC via Kearny Mesa Guideway/I-805 (Rte 652)	$2	16	✓	-	✓	✓	-
145	BRT - El Cajon to UTC/Campus Pt via Santee, SR 52, I-805 (Rte 870) (Peak Only)	$7	7	✓	-	✓	-	✓
146	BRT - Oceanside to Escondido via SR 78 HOV Lanes (Rte 430)	$234	17	✓	-	✓	-	-
147	BRT - Chula Vista to Palomar Airport Road Bus. Park via I-805/5 (Rte 650) (Peak Only)	$80	25	-	-	✓	-	-
148	BRT - El Cajon to Sorrento Mesa via SR 52, Kearny Mesa (Rte 890) (Peak Only)	$12	39	✓	-	✓	-	✓
149	BRT - El Cajon to Otay Mesa via Spring Valley, SR 125, Millenia (Rte 692)	$6	22	-	-	✓	✓	-
150	BRT - Mid City to Palomar Airport Road via Kearny Mesa/I-805/I-5 (Rte 653) (Peak Only)	$10	33	✓	-	✓	-	✓
151	BRT - Oceanside to UTC via I-5, Carlsbad, Encinitas (Rte 940) (Peak Only)	$38	N/A	✓	-	✓	✓	-
152	BRT - Santee/El Cajon Transit Centers to Downtown via SR 94 (Rte 90) (Peak Only) (eventually replaced by Orange Line Express Route 522)	$0	N/A	-	-	✓	✓	✓
153	BRT - Millenia/Otay Ranch to Sorrento Mesa Express (Rte 688) (Peak Only)	$0	N/A	✓	-	✓	✓	✓
154	BRT - Millenia/Otay Ranch to UTC/Torrey Pines Express (Rte 689) (Peak Only)	$0	N/A	✓	-	✓	✓	✓

#	VARIABLE PROJECTS	Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #5 Hybrid
155	Rapid - Oceanside to UTC via Hwy 101 Coastal Communities, Carmel Valley (Rte 473)	$127	19	✓	-	✓	✓	✓
156	Rapid - Old Town to Sorrento Mesa via Pacific Beach, La Jolla, UTC (Rte 30)	$102	24	✓	-	✓	✓	✓
157	Rapid - Carlsbad to San Marcos via Palomar Airport Road Corridor (Rte 440)	$50	40	✓	-	✓	-	-
158	Rapid - Coronado to Downtown via Coronado Bridge (Rte 910)	$25	18	✓	-	✓	-	✓
159	Rapid - Spring Valley to SDSU via SE San Diego, Downtown, Hillcrest, Mid-City (Rte 11)	$110	26	-	✓	✓	✓	✓
160	Rapid - Fashion Valley to UTC/UCSD via Linda Vista and Clairemont (Rte 41)	$54	34	✓	-	✓	-	-
161	Rapid - SDSU to Spring Valley via East San Diego, Lemon Grove, Skyline (Rte 636)	$39	38	✓	✓	✓	-	✓
162	Rapid - North Park to 32nd Street Trolley via Golden Hill (Rte 637)	$32	43	✓	-	✓	-	✓
163	Rapid - Downtown Escondido to East Escondido (Rte 471)	$31	47	✓	-	✓	-	✓
164	Rapid - Eastlake/EUC to Palomar Trolley via Main Street Corridor (Rte 635)	$54	41	✓	-	✓	-	✓
165	Rapid - San Ysidro to Otay Mesa via Otay, SR 905 Corridor (Rte 638)	$53	48	✓	-	✓	-	✓
166	Rapid - Otay to North Island via Imperial Beach and Silver Strand, Coronado (Rte 639)	$53	51	-	-	✓	-	-
167	Rapid - H Street Trolley to Millenia via H Street Corridor, Southwestern College (Rte 709)	$36	37	✓	-	✓	-	✓
168	Rapid - North Park to Downtown San Diego via 30th St (Rte 2)	$38	35	✓	-	✓	-	✓
169	Rapid - Oceanside to Vista via Mission Ave/Santa Fe Road Corridor (Rte 474)	$49	46	-	-	✓	-	✓
170	Rapid - Camp Pendleton to Carlsbad Village via College Blvd, Plaza Camino Real (Rte 477)	$78	53	-	-	✓	-	-
171	Streetcar - Hillcrest/Balboa Park/Downtown San Diego Loop (Rte 554)***	$277	31	✓	-	✓	✓	✓
172	Streetcar - 30th St to Downtown San Diego via North Park/Golden Hill (Rte 555)***	$249	29	✓	-	-	✓	✓
173	Streetcar - Downtown San Diego: Little Italy to East Village (Rte 553)***	$135	30	✓	-	✓	✓	✓
174	Streetcar - El Cajon Downtown (Rte 557)***	$160	44	-	-	-	✓	-
175	Streetcar - Chula Vista Downtown (Rte 551)***	$134	42	-	-	-	✓	-
176	Streetcar - Escondido Downtown (Rte 558)***	$50	47	-	-	-	✓	-
177	San Ysidro Intermodal Center	$50	N/A	-	-	-	-	✓
	Total			**$13,317**	**$12,254**	**$13,749**	**$10,412**	**$14,144**

#	UNCONSTRAINED PROJECTS ONLY					Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #5 Hybrid
	FREEWAY/HIGHWAY IMPROVEMENT PROJECTS											
	Route	**From**	**To**	**Constant**	**Add'l Improvement**							
178	I-15	Centre City Pkwy	SR 78	8F+4ML	10F+4ML	TBD	N/A****	-	-	-	-	-
	HOV CONNECTORS											
	Route	**Intersecting Freeway**	**Movement**									
179	I-5	SR 15	North to North and South to South			$183	11	-	-	-	-	-
180	I-5	SR 54	West to South and North to East			$120	21	-	-	-	-	-
181	I-5	SR 54	South to East and West to North			$120	22	-	-	-	-	-
182	I-5	SR 56	South to East and West to North			$170	13	-	-	-	-	-
183	I-15	SR 52	West to South and North to East			$140	23	-	-	-	-	-
184	I-15	SR 56	East to North and South to West			$180	13	-	-	-	-	-

UNCONSTRAINED PROJECTS ONLY					Estimated UNC Cost* ($2010)	Project Ranking	Scenario #1 Transit Emphasis	Scenario #2 Rail/Freight Emphasis	Scenario #3 Highway Emphasis	Scenario #4 Fusion	Scenario #5 Hybrid
185	I-15	SR 163	North to North and South to South		$160	9	-	-	-	-	-
186	SR 52	SR 125	North to West and East to South		$100	16	-	-	-	-	-
187	SR 94	SR 125	East to North and South to West		$140	12	-	-	-	-	-
188	I-805	SR 54	South to East and West to North		$140	15	-	-	-	-	-
189	I-805	SR 94	West to South and North to East		$160	20	-	-	-	-	-
190	I-805	SR 94	East to North and South to East		$160	14	-	-	-	-	-
191	I-805	SR 163	North to North and South to South		$150	17	-	-	-	-	-
	TRANSIT PROJECTS										
192	High Speed Rail (HSR) Extension from Lindbergh Field ITC to International Border				$3,557	N/A	-	-	-	-	-
193	SPRINTER - Branch Extensions to East Escondido (Rte 399)				$59	N/A	-	-	-	-	-
194	Trolley - Otay Mesa East Border Crossing to western Chula Vista via Otay Ranch/Millenia (Rte 564)				$854	32	-	-	-	-	-
195	Trolley - Downtown Bus Tunnel and Hubs				$2,917	N/A	-	-	-	-	-
196	Streetcar - National City Downtown (Rte 552)				$40	49	-	-	-	-	-
197	Streetcar - Oceanside Downtown (Rte 559)				$45	52	-	-	-	-	-
198	Streetcar - Mission Beach to La Jolla via Pacific Beach (Rte 565)				$239	50	-	-	-	-	-
199	Otay Mesa East Intermodal Transit Center				-	N/A	-	-	-	-	-
				Total			**$9,634**	**$9,634**	**$9,634**	**$9,634**	**$9,634**

Note: All Managed Lane facilities will have a HOV-3+ occupancy requirement after 2020. HOV-2 and SOVs will be required to pay a fee to use these facilities.

TransNet projects are included in all scenarios with the exception of the I-805 corridor where different improvements are being tested in some scenarios.

N/A - Projects were not ranked using Board-approved project evaluation criteria.

* Capital costs only. Operating costs, which include vehicle and vehicle replacement costs, will be based on phasing.

** Project Ranking was from Temecula to International Border

*** Only 10% of the project cost is assumed for regional funding.

**** This project was recommended to be added to the Unconstrained Network by the Transportation Committee at its December 10, 2010 meeting.

Note A: Included in COASTER double-tracking ranking

Note B: Included in SPRINTER double-tracking ranking

Note C: Included in several LRT project rankings

Note D: Included in several BRT project rankings; cost and length of guideway modified for Hybrid Scenario

Note E: Guideway and/or transit priority measures designed to improve transit speeds in Hillcrest and Mission Valley.

Technical Appendix L

Draft 2050 RTP Revenue Constrained Transportation Scenario
Transit Phasing
January 28, 2011

	TRANSIT PROJECTS	Estimated Capital Cost	Phasing Year	Project Ranking
	ONGOING TRANSIT PROJECTS			
	2010-2020			
34	Rapid - UTC Area Super Loop (Rte 180)	$0	✓	N/A
38	Rapid - Escondido to Del Lago via Escondido Blvd & Bear Valley (Rte 350)	$0	✓	N/A
6	Trolley - Mid-Coast LRT Extension (Rte 510)	$1,200	✓	N/A
7	Trolley - Trolley System Rehabilitation (Blue and Orange Lines)	$510	✓	N/A
20	BRT - Escondido-UTC via Mira Mesa Blvd (Rte 470 Project)	$20	✓	N/A
21	BRT - South Bay BRT (Otay Mesa-Downtown) (Rte 628)	$200	✓	N/A
22	BRT - South Bay Maintenance Facility	$51	✓	N/A
23	BRT - Downtown BRT stations/layovers	$110	✓	N/A
24	BRT - Otay Mesa to Sorrento Mesa via I-805, Kearny Mesa (Rte 680 and Peak Rtes 688/689) (includes I-15/Green Line transfer station (facilitates Green Line, and BRT Rtes 610, 680)	$300	✓	N/A
32	Rapid - Mid-City Rapid - Phase 1 (Rte 15)	$44	✓	N/A
33	Rapid - Mid-City Rapid – Phase 2 Balboa Park (Rte 15)	$24	✓	N/A
	TRANSIT PROJECTS			
	2010-2020			
19	BRT - North I-15 (Sabre Springs/Mira Mesa PNRs, Mid-City Stations) (Rte 610)	$103	✓	3
26	BRT - El Cajon to UTC/Campus Pt via Santee, SR 52, I-805 (Rte 870) (Peak Only)	$7	✓	7
2a	COASTER - Positive Train Control	$88	✓	10
2b	COASTER - Convention Ctr Station	$20	✓	10
2c	COASTER - Double Tracking (Rte 398) (includes near term improvements from LOSSAN Project Prioritization Analysis	$465	✓	10
2d	COASTER - Quiet Zone Improvements (1)	$6	✓	10
35	Rapid - La Mesa to Ocean Beach via Mid-City, Hillcrest, Old Town (Rte 10)	$85	✓	15
3a	SPRINTER Double Tracking (Oceanside-Escondido) short term improvements	$100	✓	21
51	Streetcar - Hillcrest/Balboa Park/Downtown San Diego Loop (Rte 554) (2)	$28	✓	31
25	BRT - I-5 - San Ysidro to Kearny Mesa via I-5 shoulder lanes/HOV lanes, Downtown, Hillcrest/Mission Valley Guideway (Rte 640) (eventually replaced by Blue Line Express Route 540)	$90	✓	N/A - Rte 540 ranked 4
29	BRT - Santee/El Cajon Transit Centers to Downtown via SR 94 (Rte 90) (Peak Only) (eventually replaced by Orange Line Express Route 522)	$0	✓	N/A - Rte 522 ranked 6
54	Shuttles - San Marcos	$0	✓	N/A - locally funded
55	Local Bus Routes - 15 min in key corridors	$0	✓	N/A (3)
58	Lindbergh Intermodal Transit Center (ITC)	$215	✓	N/A (4)
63a	Other (Vehicles/vehicle replacement, maintenance facilities, transit system rehab, regulatory compliance, park and ride, ITS)	$1,368	✓	N/A (5)
	2021-2030			
8a	Trolley - Blue Line Frequency Enhancements, incl.rail grade seps at: Palomar St, H St, E St, 32nd St, 28th St, Blue/Orange Track Connection at 12th/Imperial (Rte 510)	$260	✓	1
2e	COASTER - Double Tracking (Rte 398) (includes mid term improvements from LOSSAN Project Prioritization Analysis + Fairgrounds Station + Station Parking Improvements)	$424	✓	10
37	Rapid - Kearny Mesa to Downtown (Rte 120)	$0	✓	12
41	Rapid - Coronado to Downtown via Coronado Bridge (Rte 910)	$25	✓	18
39	Rapid - Oceanside to UTC via Hwy 101 Coastal Communities, Carmel Valley (Rte 473)	$127	✓	19
3b	SPRINTER - Double Tracking (Oceanside-Escondido) completion of doubletracking (including rail grade separations assumed at El Camino Real, Vista Village, Melrose, and Mission/San Marcos Stations) + 2 additional rail grade separations (Rte 399)	$698	✓	21
4	SPRINTER - Branch Extension to South Escondido (Rte 399)	$172	✓	21
5	SPRINTER Express (Rte 588)	$284	✓	23
40	Rapid - Old Town to Sorrento Mesa via Pacific Beach, La Jolla, UTC (Rte 30)	$102	✓	24
36	Rapid - Point Loma to Kearny Mesa via Old Town, Linda Vista (Rte 28)	$48	✓	27
17	Trolley - UTC to Mira Mesa via Sorrento Mesa/Carroll Cyn (Rte 561)	$1,140	✓	28
53	Streetcar - Downtown San Diego: Little Italy to East Village (Rte 553) (2)	$14	✓	30
49	Rapid - North Park to Downtown San Diego via 30th St (Rte 2)	$38	✓	35

	TRANSIT PROJECTS	Estimated Capital Cost	Phasing Year	Project Ranking
	TRANSIT PROJECTS (Continued)			
	2021-2030 (Continued)			
48	Rapid - H Street Trolley to Millenia via H Street Corridor, Southwestern College (Rte 709)	$36	✓	37
27	BRT - El Cajon to Sorrento Mesa via SR 52, Kearny Mesa (Rte 890) (Peak Only)	$12	✓	39
18	Hillcrest to Mission Valley Transit Priority Measures and I-15 Green Line transfer station (facilitates direct access for BRT, Rapid Bus, and local bus - Rtes 120, 610, 640)	$500	✓	12, 3
62a	Bike/Pedestrian Access Improvements for Transit Facilities	$100	✓	N/A (6)
63b	Other (Vehicles/vehicle replacement, maintenance facilities, transit system rehab, regulatory compliance, park and ride, ITS)	$1,807	✓	N/A (5)
	2031-2035			
1	High Speed Rail (HSR) Intercity - Temecula to Lindbergh Field ITC	$0	✓	N/A
15	Trolley - Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, SDSU (Rte 563)	$1,262	✓	9
9	Trolley - Orange Line Enhancements (rail grade seps at: Allison/University, Severin Dr, Broadway/Lemon Grove Ave, Euclid Ave) (Rte 520)	$312	✓	11
42	Rapid - Spring Valley to SDSU via SE San Diego, Downtown, Hillcrest, Mid-City (Rte 11)	$110	✓	26
52	Streetcar - 30th St to Downtown San Diego via North Park/Golden Hill (Rte 555) (2)	$25	✓	29
28	BRT - Mid City to Palomar Airport Road via Kearny Mesa/I-805/I-5 (Rte 653) (Peak Only)	$10	✓	33
46	Rapid - Eastlake/EUC to Palomar Trolley via Main Street Corridor (Rte 635)	$54	✓	41
44	Rapid - North Park to 32nd Street Trolley via Golden Hill (Rte 637)	$32	✓	43
50	Rapid - Oceanside to Vista via Mission Ave/Santa Fe Road Corridor (Rte 474)	$49	✓	46
45	Rapid - Downtown Escondido to East Escondido (Rte 471)	$31	✓	47
47	Rapid - San Ysidro to Otay Mesa via Otay, SR 905 Corridor (Rte 638)	$53	✓	48
43	Rapid - SDSU to Spring Valley via East San Diego, Lemon Grove, Skyline (Rte 636)	$39	✓	38
56	Local Bus Routes - 10 min in key corridors	$0	✓	N/A (3)
62b	Bike/Pedestrian Access Improvements for Transit Facilities	$50	✓	N/A (6)
63c	Other (Vehicles/vehicle replacement, maintenance facilities, transit system rehab, regulatory compliance, park and ride, ITS)	$1,142	✓	N/A (5)
	2036-2040			
8b	Trolley - Blue Line Enhancements (rail grade seps at Taylor St, Washington St/Sassafras St) (Rte 510)	$290	✓	1
10	Trolley - Green Line Frequency Enhancements (Rte 530)	$0	✓	2
9	Trolley Orange Line Frequency Enhancements (Rt 520)	$0	✓	11
12	Trolley Express - Blue Line Express - UTC to San Ysidro via Downtown (Rte 540)	$455	✓	4
13	Trolley Express - Orange Line Express - El Cajon to Downtown San Diego (Rte 522)	$230	✓	6
11	Trolley - Downtown Trolley Tunnel btwn Park/Island and Ash St -- Phase 1 (facilitates frequency enhancements for Blue/Orange Lines and implementation of Blue/Orange Express & Mid-City LRT) (Rtes	$2,592	✓	1, 11, 4, 6, 13
63d	Other (Vehicles/vehicle replacement, maintenance facilities, transit system rehab, regulatory compliance, park and ride, ITS)	$0	✓	N/A (5)
	2041-2050			
2f	COASTER - (Rt 398) (including long term improvements from LOSSAN Project Prioritization Analysis + Del Mar tunnel + two additional grade separations)	$1,614	✓	10
14	Trolley - SDSU to Downtown via El Cajon Blvd/Mid-City (transition of Mid-City Rapid to LRT) (Rte 560)	$1,921	✓	13
16	Trolley - UTC to Palomar Trolley Station via Kearny Mesa, Mission Valley, Mid-City, National City/Chula Vista via Highland Ave/4th Ave (Modified Rte 562)	$2,548	✓	14
59	San Ysidro Intermodal Center	$50	✓	N/A
62c	Bike/Pedestrian Access Improvements for Transit Facilities	$350	✓	N/A (6)
63e	Other (Vehicles/vehicle replacement, maintenance facilities, transit system rehab, regulatory compliance, park and ride, ITS)	$1,267	✓	N/A (5)
57	Feeder Bus System	$0	✓	N/A (3)

2010-2020 Phasing
2021-2030 Phasing
2031-2035 Phasing
2036-2040 Phasing
2041-2050 Phasing
Included in all phases

Bold project numbers are *TransNet* projects
N/A - projects not ranked
(1) - Quiet zone improvements represent 10% of total project costs; other 90% assumed to come from non-transit sources
(2) - Streetcar capital costs represent 10% of total project costs; other 90% assumed to come from non-transit sources
(3) - Local bus are service frequency improvements only (no capital); feeder bus system are service improvements to local bus system to support new rail and BRT services.
(4) - Lindbergh and San Ysidro Intermodal Centers not ranked since they are facility/station improvements supporting other rail/BRT capital projects
(5) - Support facilities for existing transit infrastructure and new rail/bus capital projects
(6) - Infrastructure improvements at existing and new rail/bus stations/transit centers to improve pedestrian access

Technical Appendix M

Final 2050 RTP Revenue Constrained Network Transit Projects and Phasing

Decade	Service	Route	Description	Peak Headway (Minutes)	Off-Peak Headway (Minutes)
2018	COASTER	398	Double tracking/Increased Frequency between Oceanside and downtown San Diego with extension to Convention Center/Petco Park	20	Current
2018	Trolley	510	Mid-Coast LRT Extension (peak frequencies 7.5 to downtown/15 to UTC)	7.5/15	15
2018	Trolley	530	Green Line Extend to downtown – Bayside	15	15
2018	BRT	470	Escondido – UTC/UCSD via Mira Mesa Blvd	10	-
2018	BRT	607	Rancho Bernardo – downtown Express	10	-
2018	BRT	608	Escondido – downtown Express	10	-
2018	BRT	610	Temecula (Peak Only)/Escondido – downtown	10	10
2018	BRT	628	South Bay BRT (Otay Mesa – downtown) via Otay Ranch/Millenia	15	-
2018	BRT	680	Otay Mesa to Sorrento Mesa via I-805 Corridor, Otay Ranch/Millenia, National City, Southeastern San Diego, Kearny Mesa	15	15
2018	BRT	688	San Ysidro to Sorrento Mesa Express	15	-
2018	BRT	689	Millenia/Otay Ranch to UTC/Torrey Pines Express	15	-
2018	Rapid	15	Mid-City Rapid (SDSU – downtown) via Mid-City, El Cajon and Park Blvds	10	10
2018	Rapid	201/202	UTC Area Super Loop	10	15
2018	Rapid	350	Escondido to Del Lago via Escondido Blvd & Bear Valley	10	10
2020	Streetcar	554	Hillcrest/Balboa Park/downtown San Diego Loop	10	10
2020	BRT	90	Santee/El Cajon Transit Centers to downtown via SR 94	15	-
2020	BRT	640	I-5 – San Ysidro to downtown & Kearny Mesa via I-5 shoulder lanes/HOV lanes, downtown, Hillcrest, Mission Valley	15	15
2020	BRT	870	El Cajon to UTC via Santee, SR 52, I-805 (Peak only)	10	-
2020	Rapid	10	La Mesa to Ocean Beach via Mid-City, Hillcrest, Old Town	10	10
2020	Shuttle	448/449	San Marcos Shuttle	15	15
2020	Airport Express		I-5 from McClellan-Palomar Airport to San Diego International Airport	30	30
2020	Airport Express		I-15 from Escondido Transit Center to San Diego International Airport	30	30
2020	Airport Express		I-15 from Escondido Transit Center to Cross Border Facility	30	30
2020			Local Bus Routes - 15 minutes in key corridors	15	15

Final 2050 RTP Revenue Constrained Network Transit Projects and Phasing (Continued)

Decade	Service	Route	Description	Peak Headway (Minutes)	Off-Peak Headway (Minutes)
2030	COASTER	398	Additional Double tracking/Increased Frequency	20	60
2030	SPRINTER	399	Double tracking (Oceanside-Escondido) Increased Frequencies	10	10
2030	Trolley	561	UTC to Mira Mesa via Sorrento Mesa/Carroll Canyon (extension of route 510)	7.5	7.5
2030	Trolley	520	Orange Line - Increased Frequency (existing 15/15)	7.5	15
2030	Streetcar	553	Downtown San Diego: Little Italy to East Village	10	10
2030	SPRINTER	588	SPRINTER Express	10	15
2030	BRT	890	El Cajon to Sorrento Mesa via SR 52, Kearny Mesa	10	-
2030	Rapid	2	North Park to downtown San Diego via North Park, Golden Hill	10	10
2030	Rapid	28	Point Loma to Kearny Mesa via Old Town, Linda Vista	10	10
2030	Rapid	30	Old Town to Sorrento Mesa via Pacific Beach, La Jolla, UTC	10	10
2030	Rapid	120	Kearny Mesa to downtown via Mission Valley	10	10
2030	Rapid	473	Oceanside to UTC via Hwy 101 Coastal Communities, Carmel Valley	10	10
2030	Rapid	709	H Street Trolley to Otay Ranch/Millenia via H Street Corridor, Southwestern College	10	10
2030	Rapid	910	Coronado to downtown via Coronado Bridge	10	10
2035	Trolley	520	Orange Line - Extend to Airport Intermodal Transit Center	7.5	15
2035	Streetcar	555	30th St to downtown San Diego via North Park/Golden Hill	10	10
2035	Trolley	560	Mid-City to downtown (Phase 1) via El Cajon and Park Blvds	7.5	7.5
2035	Trolley	563	Pacific Beach to El Cajon via Clairemont, Kearny Mesa, Mission Valley, SDSU	7.5	10
2035	BRT	653	Mid-City to Palomar Airport Road via Kearny Mesa/I-805/I-5	15	-
2035	Rapid	11	Spring Valley to SDSU via Southeastern San Diego, Downtown, Hillcrest, Mid-City	10	10
2035	Rapid	201/202	UTC Area Super Loop - Increase Frequencies	10	10
2035	Rapid	471	Downtown Escondido to East Escondido	10	10
2035	Rapid	474	Oceanside to Vista via Mission Ave/Santa Fe Road Corridor	10	10
2035	Rapid	635	Eastlake/EUC to Palomar Trolley via Main Street Corridor	10	10
2035	Rapid	636	SDSU to Spring Valley via East San Diego, Lemon Grove, Skyline	10	10
2035	Rapid	637	North Park to 32nd Street Trolley via Golden Hill	10	10

Final 2050 RTP Revenue Constrained Network Transit Projects and Phasing (Continued)

Decade	Service	Route	Description	Peak Headway (Minutes)	Off-Peak Headway (Minutes)
2035	Rapid	638	San Ysidro to Otay Mesa via Otay, SR 905 Corridor	10	10
2035	Shuttle	448/449	San Marcos - Increase Frequencies	10	10
2035			Local Bus Routes - 10 minutes in key corridors	10	10
2040	Trolley	520	Orange Line - Increased Frequencies	7.5	7.5
2040	Trolley	522	Orange Line Express - El Cajon to downtown San Diego	10	10
2040	Trolley	530	Green Line Extend to downtown - Bayside	7.5	7.5
2040	Trolley	540	Blue Line Express - UTC to San Ysidro via downtown	10	10
2050	Trolley	560	SDSU to downtown (Phase 2) via Mid-City, El Cajon and Park Blvds	7.5	7.5
2050	Trolley	562	UTC to San Ysidro via Kearny Mesa, Mission Valley, Mid-City, Southeastern San Diego, National City/Chula Vista via Highland Ave/4th Ave	7.5	10

Technical Appendix N

Urban Area Transit Strategy:

A Component of the

2050 Regional Transportation Plan

Menu of Policy Options to Support the Transit Network

November 19, 2010

Prepared by:

PARSONS BRINCKERHOFF

Introduction

As part of the development of the 2050 Regional Transportation Plan (RTP), the San Diego Association of Governments (SANDAG) has been preparing a visionary Urban Area Transit Strategy (UATS) for the San Diego region to significantly increase the use of transit, walking, and biking in the urbanized areas of the region. The strategy focuses on maximizing the use of transit during the peak periods, reducing greenhouse gas (GHG) emissions and vehicle miles traveled, and increasing the share of regional trips made on transit (the transit mode share). The transit network resulting from the UATS will be incorporated into the 2050 RTP and Sustainable Communities Strategy (SCS).

Developing and funding a robust transit network is essential to achieve SANDAG's goals. However, a number of other factors also influence the use and success of the regional transit system. Related transportation and land use policies and strategies can directly or indirectly create incentives (or disincentives) to transit use. By incorporating supporting policies and strategies into the RTP, SANDAG can enhance the ability of the future transit network to increase transit use and transit mode share, and help achieve regional, state, and federal goals and legislative requirements related to Smart Growth, GHG emissions, and sustainability.

This report identifies a "menu" of policies and strategies that influence transit ridership and mode share. The menu is organized into three categories: parking, land use, and funding. These policies and strategies were culled from technical and academic research, experience in other cities and regions, input from the UATS Strategic Transit Team and Peer Review Panel, and suggestions by UATS project stakeholders including the San Diego Council of Design Professionals[1], SANDAG's Stakeholder Working Group[2], and RTP community workshops[3]. The paper also includes information on transit fares, services, and facilities to help maximize the effectiveness of the region's transit network. This additional information is included in the latter half of the paper.

Menu of Policies and Strategies

A. Parking

Parking policy and its relationship to travel behavior is a complex topic[4], especially because drivers do not directly pay the true cost of providing parking. Parking policy generally falls into two interrelated categories; parking supply and parking cost. A third component, parking management, relates to both supply and cost.

Results from international studies provide interesting data confirming the overall importance of parking policies as a management tool, and although many of the more stringent parking (and smart growth) policies implemented in other countries would find limited acceptance in the United States, both international and domestic research strongly points to the importance of parking availability and price on travel behavior. ***The research also shows that transit usage is more sensitive to parking cost than to transit service levels or fare prices, and that the combination of increased transit service and increased parking prices are more effective than either of the two strategies separately.*** There are other effective and feasible parking management strategies, such as changes to parking minimums or

[1] At an UATS workshop conducted on April 14, 2010.

[2] The SWG was formed by SANDAG to provide input into the development of the 2050 RTP.

[3] Conducted in five communities in April and May 2010.

[4] When examining the details of parking supply and its impact on travel behavior and urban form, the results of analyses can be somewhat ambiguous due to dependency on indirect and long-term strategies. Although the vast majority of studies show an inverse relationship between parking costs, vehicle trips, and transit ridership, the magnitude of this relationship varies depending on the study location, the geographic scope of the research (i.e., whether investigators were looking at individual work places or regional data), and the type of parking management technique (supply constraint, taxation, time of day pricing, parking cash-out, etc.).

maximums in zoning codes, although some of these may take decades to show results. Parking cost can offer more immediate gains in transit ridership and transit mode share.

One of the key first policy steps for SANDAG is to address whether or not parking is a high priority topic to be considered at the regional level. Is there a willingness to address parking as an important part of the tool box for managing urban form and transportation issues? Are there broad policy statements that can be included in the RTP that can lay the groundwork for future inclusion of more detailed discussions regarding the implementation of specific parking policies? If parking supply, pricing, and management strategies are considered an important tool, then a future possible step would be to determine SANDAG's role in supporting cities who must ultimately implement the strategies at a local level.

Assuming parking strategies are on the menu of policies under consideration to increase transit ridership and mode share, and support the SCS, SANDAG will need to wade through the varying opinions and research related to how parking should be provided and at what price to meet overall regional goals. Although the implications of large supplies of free parking have been discussed more frequently in the planning community over the past decade, given the current embedded zoning policies and existing land use characteristics in much of the United States and in the San Diego region, it is still important to review a few key facts regarding parking to put the issue into context. The following information was presented in numerous studies on parking performed over the past several decades:

- 99 percent of all automobile trips end in free parking. *(1990 Nationwide Personal Transportation Survey (NPTS)).* In the San Diego Region, 88 percent of solo driver work trips have free parking at the place of employment.[5]
- The number of parking spaces per car (excluding home) has been estimated to range from 2 to 4 spaces per registered vehicle. (Davis, 2009)
- Employer paid parking increases the propensity for workers to travel alone in single-occupant vehicles (SOV) to work. (Vaca, Kuzmyak, 2005)
- In general, individuals are more responsive to increases in marginal changes in parking costs than to other vehicle operating costs. (Bianco, 1998)
- Mode choice is sensitive to parking cost. (Vaca, Kuzmyak, 2005)
- The impact of parking costs on mode shift to transit is location-sensitive. Parking charges have different impacts on commuter mode choice, depending on residential location choices and access to transit. (Dueker, Stratham, Bianco, 1998)
- Increasing parking costs while simultaneously increasing transit service has more impact than increasing transit service alone. (Bianco, 1998)

To summarize, the United States in general, as well as the greater San Diego region, have an ample supply of parking and the vast majority of it is not priced. As a result, the end user of the good (the driver) does not pay directly for parking, rather the cost of parking is embedded in the costs of residential, retail, and employment activity in the region. Parking costs help shift the true cost of parking to the user and both parking supply and cost have been shown to directly impact vehicle miles traveled (VMT) and transit mode share. When implemented properly, especially when coordinated with the provision of other transportation choices, parking policies and management strategies that shift the true cost of parking to the end user can be valuable tools for supporting regional goals regarding Smart Growth, VMT reduction, and increasing transit mode share. In fact, SANDAG's 2010 *Parking Strategies for Smart Growth* study notes that less available parking leads to higher parking costs and can reinforce lower vehicle trip generation rates as drivers re-evaluate their mode choice and some change

[5] 2050 RTP, Public Opinion Survey Report, prepared for SANDAG, True North Research, June 23, 2010.

their travel behavior.[6] In SANDAG's recent 2050 RTP Public Opinion Survey, nearly half (47%) of the respondents who currently drive alone to work and have free parking (88 percent of all work trip commuters) indicated that a $10 a day charge for parking would get them to change their travel behavior to an alternative mode.[7]

However, implementation and technical issues can complicate regional parking policy decisions. Projecting the impact of various parking strategies and policies on a regional level is challenging because they are primarily implemented under location specific conditions. Beyond that, modeling specific strategies at the regional scale is difficult when using a traditional transportation modeling platform. Usually proxies must be used in the travel demand model and typically they only apply to downtown regions where parking is coded into the more detailed zonal network – other strategies, such as parking cash-out, zoning changes, or shared parking are difficult to incorporate. As a result, there is a wealth of data regarding case studies, strategies, and guidebooks about the impact of parking strategies, but only a few studies that could be applied at the regional level to predict likely impact on region-wide transportation measures, such as VMT and transit use. Even studies regarding the elasticity of vehicle trips to parking costs have failed to reach a standard consensus on equations that can be successfully applied at the regional level.

Parking management also can be a highly debated topic and is often considered at a subregional level. One example of this would be the Comprehensive Parking Plan for Downtown San Diego prepared for the City Centre Development Corporation in March 2009. This study looked at parking supply and demand in the downtown San Diego area and recommended a number of parking management strategies for the near-, medium-, and long-term. The Plan mentioned the potential for reduced parking demand in the long-term resulting from projected increases in transit ridership, but it does not directly address whether parking supply should be adjusted to incentivize transit ridership to downtown and support regional transit mode share and GHG reduction goals.

Parking Strategies

There are a variety of parking strategies that could be incorporated into policies and implemented at the local or regional levels. SANDAG as the regional planning and transportation funding agency, and local jurisdictions as the local land use, planning, zoning, and regulatory agencies, have different roles in promoting, implementing, and enforcing the various strategies and policies. SANDAG could establish parking policies at the regional level to influence, but not mandate, implementation by local jurisdictions. To influence parking policy, SANDAG could identify parking policies and strategies that would support regional land use and transportation goals, spearhead a regional approach or consensus on specific policy issues, develop regional parking policy guidelines, identify implementation tools, provide staff and technical resources to local jurisdictions, and support local implementation of specific strategies. SANDAG also could choose to use local parking policy as a criterion for awarding transportation and/or smart growth incentive funding (similar to the way in which the Federal Transit Administration uses regional and local land use policies as criteria for awarding federal New Starts transit funding). At the local level, cities could both establish and implement specific parking policies for their jurisdictions. Local jurisdiction implementation of parking policies generally occurs through zoning codes which, over the long-term, results in changes in private parking supply and cost.

Table 1 identifies a number of parking strategies that SANDAG could address regionally and jurisdictions could implement locally to influence a shift in transit use. These policies are discussed in detail in documents referenced in Appendix A. In particular, the U.S. Environmental Protection Agency (EPA) document "Parking Spaces/Community Places", the Metropolitan Transportation Commission's

[6] SANDAG, Trip Generation for Smart Growth, June 2010, page 1.
[7] 2050 RTP, Public Opinion Survey Report, prepared for SANDAG, True North Research, June 23, 2010, page 12.

"Tool Box/Handbook: Parking Best Practices & Strategies for Supporting Transit Oriented Development In the San Francisco Bay Area" and the parking management section of the Victoria Policy Institute's Online Transportation Demand Management (TDM) encyclopedia provide excellent case studies of each type of implementation. Several local jurisdictions have already moved to implement versions of some of the identified strategies, as identified in SANDAG's *Parking Strategies for Smart* Growth study. The strategies identified in Table 1 fall into four general policy categories: (1) Availability Standards Policies, (2) Location Specific Policies, (3) Pricing Policies, and (4) Management Policies.

Table 1: Examples of Parking Strategies

Strategy	Strategy Category	Strategy Description
Shared Parking	1, 2	Parking spaces serve multiple users and destinations typically taking advantage of different time of day peaking characteristics.
Parking Regulations	1, 4	Regulations favor short-term uses, such as service vehicles, deliveries, customers, quick errands, and people with special needs and are generally applied to on-street parking.
More Accurate and Flexible Standards	1, 2	Adjust parking standards to more accurately reflect demand in a particular situation.
Parking Maximums	1, 2	Establish maximum parking standards in zoning codes.
Parking Minimums	1, 2	Reduce/delete minimum parking requirements in zoning codes.
Remote Parking	2, 4	Provide off-site or urban fringe parking facilities with transit connections to reduce long SOV trips into urban areas and reduce parking in urban areas.
Smart Growth	1, 2	Encourage more compact, mixed, multimodal development to allow more parking sharing and use of alternative modes.
Parking Pricing	3, 4	Charge motorists directly and efficiently for using parking facilities.
Improve Pricing Implementation	4	Use better charging techniques and equipment to make pricing more convenient and cost effective. (e.g., smart parking meters)
Financial Incentives	3	Provide financial incentives to shift mode, such as parking cash-out.
Unbundle Parking	2, 3	Rent or sell parking facilities separately from building space.
Improve User Information & Marketing	4	Provide convenient and accurate information on parking availability and price, using maps, signs, brochures, and electronic communication.
Improve Enforcement	4	Ensure that parking regulation enforcement is efficient, considerate, and fair.
Transportation Management Associations	2, 4	Establish member-controlled organizations that provide transport and parking management services in a particular area.
Overflow Parking Plans and Management	2, 3, 4	Establish plans to manage occasional peak parking demands. Use management, enforcement, and pricing to address spillover problems.

1 = Availability Standards Policies
2 = Location Specific Policies
3 = Pricing Policies
4 = Management Policies

The effectiveness of the various parking strategies is dependent on many factors. One of the best pieces of research regarding the overall sensitivity of transit ridership to different parking strategies is Transit Research Cooperative Report 40 "Strategies to Attract Auto Users to Public Transport" (1998). This document addressed the following questions:

- How does parking price and transit service affect transit use in United States cities?
- How does parking price and transit service affect transit use for downtown-destined work trips?
- How does increasing parking price compare with other strategies in reducing work trip SOV travel?

- How do different parking strategies compare with one another in reducing SOV work trips?

The study's main conclusions were:

- In general, higher transit ridership levels exist in cities with higher parking prices and more restrictive parking programs, but because of the wide variation among cities and their circumstances, no specific formula was developed for determining which levels of parking price and transit service would result in certain transit mode shares.
- In general, parking pricing policies have the greatest effect on travel behavior for residents of urban core, inner ring, or suburbs of large cities.
- The impact of parking pricing is highest when transit service levels also are high.

The Transit Research Cooperative study also presented the relative effectiveness of several parking strategies on transit usage as summarized in Table 2.

Table 2: Relative Effectiveness of Parking Strategies on Transit Usage

Strategy	Definition	Effectiveness	Scope
Parking Tax on Revenue	Tax applied to commercial off-street parking on gross or net revenue.	Moderate	Narrow spatial scope as it would apply only to areas that are already priced
Parking Tax on Spaces	Taxation is applied on a per space basis. Can be applied to suburban employers.	High in areas with good transit	Broad spatial scope
Parking Cash-out	Parking cash-out allows employees to opt out of having a parking space and instead receive compensation. The employer who leases (or owns) a space pays the employee not to park.	Moderate	Narrow spatial scope
Expand the use of meters and residential permit programs	Implement parking meters in combination with residential permit programs to manage parking and reduce spillover.	Low to Moderate	Narrow spatial scope
Zoning Changes • Decreased Minimums • Establish/Reduce Parking Maximums • Conditional Use Permits	Reduce the growth of future parking spaces through modifications to parking related zoning requirements.	Low short-term/ Moderate Long-term	Broad spatial scope depending on implementation
Shared Parking	Increase the efficiency of parking spaces through shared use based on the typical use patterns for multiple user types (e.g., employer parking and movie theater parking).	Low	Narrow spatial scope

Source: Transit Research Cooperative Report 40 "Strategies to Attract Auto Users to Public Transport"

Because parking policy and strategy implementation is such a complex issue, implementing incremental steps in a longer term parking strategy roadmap can initiate change and point the way to effective long-term policy. The Seattle, Washington experience, outlined in Table 3, provides a 30-year case study on initial steps and incremental implementation of effective parking policy and strategies.

Table 3: Seattle, Washington Parking Strategy Implementation Timeline

Year	Strategy	Source
1974	Commuter Pool Program begins to encourage carpools with a matching service, marketing, and discounted parking.	Seattle Office of Policy Planning, 1979
1976	Comprehensive Downtown Parking Policy adopted. The Policy made the following changes: • Some maximum limitations were placed on parking spaces for new developments and rehabilitated buildings, depending on type of land use. • Principal use parking (not accessory to some other use) was prohibited within part of downtown. • New open parking lots prohibited in part of downtown, only permitted if accessory to rehabilitated buildings.	Seattle Office of Policy Planning, 1979
1976-1978	Metro Transit increased service to downtown Seattle during rush hour by 25 percent to meet the demand created by shortage of parking.	Seattle Office of Policy Planning, 1979
1985 - 1990	John Doan, of the City of Seattle's Department of Construction and Land Use, puts it succinctly: 'There's an intent, policywise, to make them (parking places) dry up. We look for mechanisms to accomplish it.' "In the past five years, the requirement has been pegged at .75 to 1.0 parking spaces per 1,000 square feet of new office space in the downtown core."	Seattle Times, 3/16/90
2005	Seattle eliminates commercial parking requirements downtown.	Seattle, 12/12/06
2006	Seattle City Council votes to eliminate parking minimums for businesses and developers in Capitol Hill, First Hill, Lower Queen Anne, the University District, Northgate, and South Lake Union.	Seattle Times, 12/12/06
2010	Current Seattle codes have minimums for some areas/uses, as well as some maximums (1.0 spaces per 1,000 square feet of office space downtown).	Code is available at: http://clerk.ci.seattle.wa.us/~scripts/nph-brs.exe?s1=&s2=&S3=Title+23&Sect4=AND&l=20&Sect1=IMAGE&Sect3=PLURON&Sect5=CODE1&d=CODE&p=22&u=%2F%7Epublic%2Fcode1.htm&r=422&Sect6=HITOFF&f=G

Seattle's move toward transit supportive parking policies, as shown in Figures 1 and 2, has resulted in a 15-year stabilization of parking supply (and supply reduction in recent years), increases in parking costs, and growth in transit mode share into downtown Seattle to a 40 percent peak period transit mode share in 2007.

Figure 1: Downtown Seattle Parking Spaces and Daily Cost 1980-2007

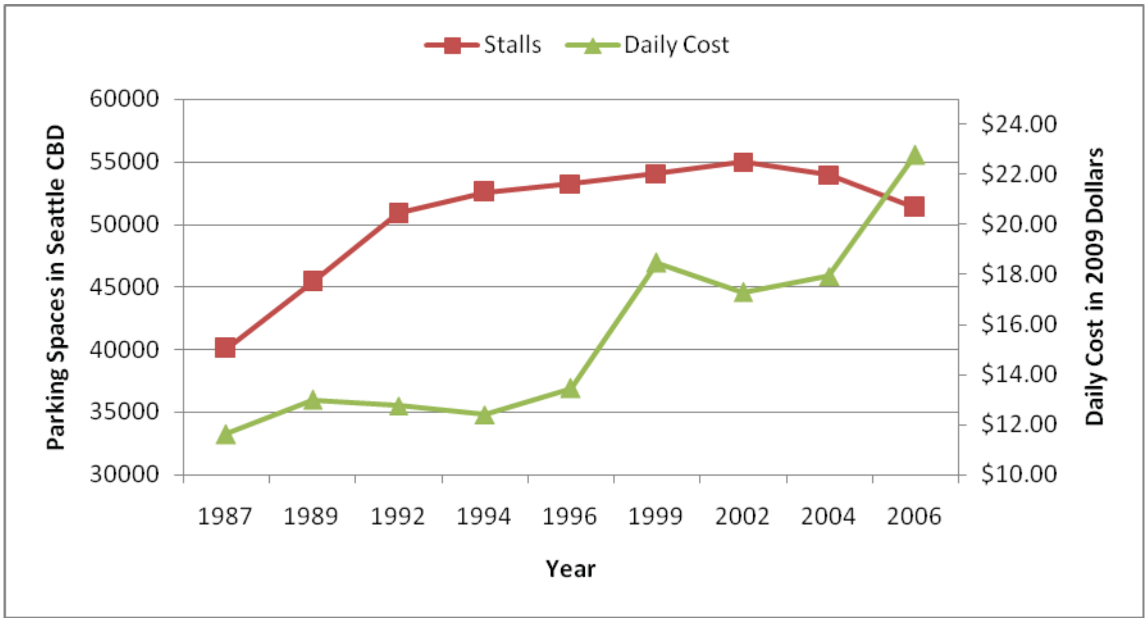
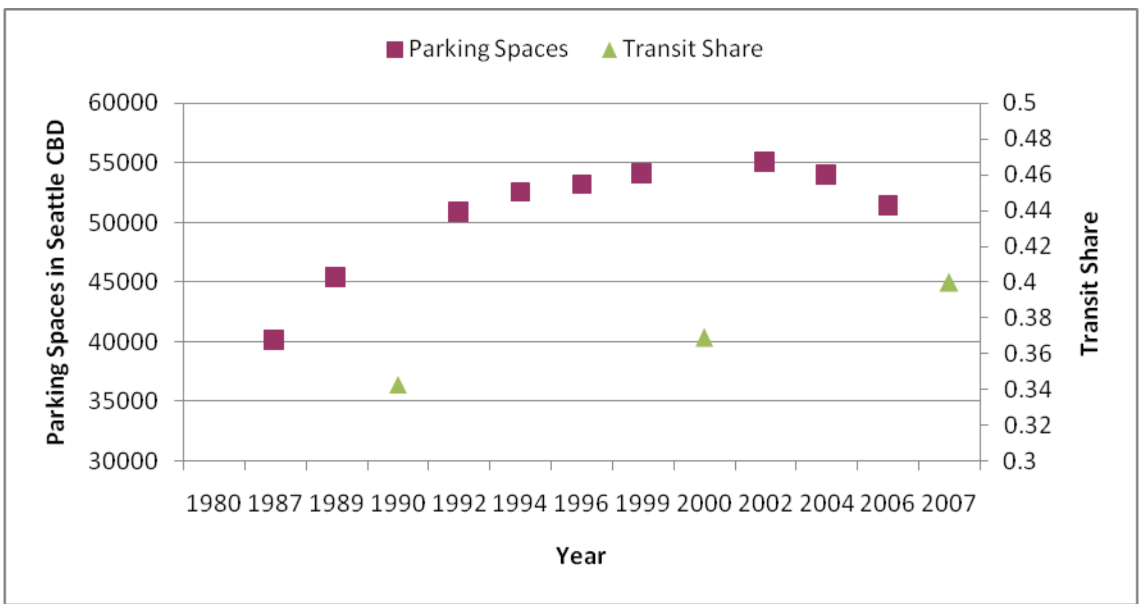


Figure 2: Downtown Seattle Parking Spaces and Peak Period Transit Mode Share 1980-2007



Observations/Policy Options Related to Parking:

Parking policies can play a significant role in increasing transit use and transit mode share. However, establishing and implementing parking policies and strategies is complex because they are generally applied and enforced at the local level, but have significant consequences for regional travel behavior. At the regional level, SANDAG could guide and influence local parking policy to support regional transit and sustainability goals, both in the short- and long-term. A menu of parking policies and strategies that could be considered on a regional and/or local basis includes the following, several of which are identified in SANDAG's 2010 *Parking Policies for Smart Growth* study report (as designated with an asterisk below):

1. Organize the region into subregional areas, and in collaboration with affected jurisdictions, develop guidelines for parking availability and pricing for each subregion
2. Encourage a regional employer/business assessment on employer-provided parking to be used for transit improvements or transit pass subsidies
3. Support a remote parking program tied to transit service
4. Establish regional policies promoting shared parking, particularly at transit stations*
5. Establish Transportation Management Associations in key employment or urban locations*
6. Create a tool box of localized parking strategies and policies for local jurisdictions that may include:
   - Parking pricing (on- and off-street)*
   - Zoning to reduce/eliminate parking minimums*
   - Zoning to reduce parking maximums*
   - Shared parking programs and standards*
   - Employer parking cost cash-outs*
   - Unbundling of parking costs from housing costs in targeted areas
   - Local parking districts
   - Others as requested by local jurisdictions
7. Initiate regional education programs regarding the effects of free parking on congestion and mode choice
8. Initiate discussion regarding the establishment of long-term goals for a reduction in parking spaces per capita
9. Establish grant programs to fund local parking utilization surveys and provide technical assistance to jurisdictions and transit operators within the SANDAG jurisdiction to promote changes in parking management and zoning requirements related to parking
10. Establish programs to measure and document the amount of parking available in selected areas of the region and use this sample as a baseline to track changes in parking supply over the long-term

B. Land Use

Land use patterns and characteristics play a significant role in influencing how people choose to travel. Low density, use-separated housing, retail and employment areas with circuitous and disconnected streets, and limited pedestrian paths are difficult to serve with transit and encourage auto use. More intense mixed use communities with interconnecting street and pedestrian networks (typically a grid street system) are more transit-supportive because they provide active streets and a mixture of housing and employment with convenient access to transit service. Regional, local, and station area land use policies that guide smart growth (including transit oriented development and urban design), and employment and housing concentrations and locations, can lead to development patterns and communities that promote transit use and reduce auto use, resulting in increased transit (and walk/bike) mode share.

<u>Smart Growth and Urban Form</u>

Smart growth policies have been adopted in urban areas throughout the country to discourage urban sprawl, preserve environmental amenities, and encourage more town-centered, transit, and pedestrian-oriented mixed-use communities. Studies and experience across the country, including SANDAG's own June 2010 *Trip Generation for Smart Growth* study, have concluded that smart growth development leads to a reduction in vehicle trip generation and a higher transit, pedestrian, and bicycle mode share. SANDAG has been a leader in establishing regional smart growth policies and programs and using these to help guide transit and other public investments. The 2004 SANDAG Regional Comprehensive Plan (RCP) and subsequent Smart Growth Concept Map define a hierarchy and locations for almost 200 existing, planned, and potential smart growth areas throughout the region. SANDAG's Transportation Project Evaluation Criteria give these smart growth areas higher priority for regional transportation improvement funding, and SANDAG annually provides approximately $5 million to $6 million in smart growth incentive funding to local jurisdictions for infrastructure and/or planning that supports smart growth areas.

Other regions across the country have implemented similar financial incentives to encourage smart growth. The Maryland Department of Transportation (MDOT) established priority funding for very focused smart growth areas as a centerpiece of statewide smart growth legislation. For example, in Harford County, northeast of Baltimore, the priority funding area encompasses only 20 percent of the county.[8] The Urban Area Transit Strategy Peer Review Panel that convened in April 2010 noted that SANDAG's Smart Growth Concept Map identifies a large number of smart growth areas, many of which are relatively small in area and limited in defined intensity, and cautioned against diluting the region's Smart Growth impact and funding with too many identified Smart Growth areas. Although SANDAG's hierarchy of Smart Growth place-types is intended to encourage better land use throughout the region, and its Smart Growth Incentive Program funding has primarily been awarded to the larger, more intense smart growth areas, the Peer Review Panel felt that SANDAG's Smart Growth map and policies should emphasize, "smarter Smart Growth" by focusing on fewer priority Smart Growth areas that have the greatest potential for high land use intensities and concentrated infrastructure investment, and can effectively support enough transit service to increase transit mode share.

There are a number of regional and local tools that are already embraced by SANDAG that support implementation of smart growth policies and objectives:

- Transit Oriented Development
- Pedestrian and Bicycle Friendly Urban Design
- Complete Streets and Context Sensitive Solutions (CSS)

An additional tool is form-based building codes. Form-based codes differ from conventional zoning codes, which tend to focus on the distinction or separation of the land use types rather than creating a community vision or establishing a sense of place. As an alternative to conventional zoning policies, form-based codes are typically used to cultivate predictable physical results that establish a higher quality urban form. This is accomplished by focusing on the overall built environment rather than the separation of land uses. Form-based codes address the relationship between building facades and the public realm, the form and massing of buildings in relation to one another, and the scale of streets and blocks to establish the character of future development. Form-based codes can be used as tools to achieve a vision and are widely held as an effective methodology for implementing Smart Growth objectives through private development. SANDAG has already established a regional policy basis for adoption of local form-based codes through its Smart Growth Design Guidelines. This policy document provides broad principles for infill development, including guidelines for:

[8] *Smart Transportation in* Maryland, Neil Pedersen, Maryland State Highway Administration, pages 93-94, Transportation Research Board, Conference Proceedings 32 September 8-10, 2002.

- Site Design – related to where buildings are located on a site, how they fit with their surroundings, and how landscaping can be integrated with the site
- Building Design – to explain how new buildings can be designed to enhance community character and reflect their local context
- Multimodal Streets – describing how to create streets that balance the needs of all modes of transportation, including pedestrians, bicyclists, vehicles, and transit[9]

Form-based building codes could be created as a regulatory process implemented through county or city law and should not be confused as design guidelines or advisory policies. Form-based codes can be used as a tool to create pedestrian and transit-friendly environments (in which walk access to transit is comfortable, pleasant, and convenient), which in turn help increase transit ridership and transit mode share. Table 4 identifies some specific form-based code tools.

Table 4: Form-Based Code Tools

Form-Based Code Tool	Description	Prevalence of Use
Regulating Plan	A map of the regulated area designating the locations where different building form standards apply, based on clear community intentions regarding the physical character of the area being coded.	Common
Public Space Standards	Specifications for the elements within the public realm (e.g., sidewalks, travel lanes, on-street parking, street trees, street furniture, etc.).	Common
Building Form Standards	Regulations controlling the configuration, features, and functions of buildings that define and shape the public realm.	Common
Architectural Standards	Regulations controlling external architectural materials and quality.	Sometimes
Landscaping Standards	Regulations controlling landscape design and plant materials on private property as they impact public spaces (e.g., regulations about parking lot screening and shading, maintaining sight lines, insuring unobstructed pedestrian movements, etc.).	Sometimes
Signage Standards	Regulations controlling allowable signage sizes, materials, illumination, and placement.	Sometimes
Environmental Resource Standards	Regulations controlling issues such as storm water drainage and infiltration, development on slopes, tree protection, solar access.	Sometimes

Source: FBIC (Form-Based Codes Institute) Definition of Form-Based Code (draft 2.17.09)

<u>Regional Employment Centers</u>

Local jurisdictions within the region compete against one another to attract major employers and create employment nodes to reap the tax and investment benefits. This practice results in dispersed employment and relatively small employment centers throughout the region that are difficult to serve by transit due to the lack of employment concentration and employee volumes. Few single employment centers in the San Diego region are large enough or concentrated enough to generate the ridership levels necessary to support significant transit investments, and without adequate transit services and facilities, would-be transit users are discouraged by the lack of viable alternatives and continue to use personal vehicles.

In the San Diego region, the trend toward dispersed employment is projected to continue through 2050 and is exacerbated by the following:

[9] Designing for Smart Growth: Creating Great Places in the San Diego Region, SANDAG, June 2009.

- Downtown San Diego is not the largest employment center in the region
- Downtown San Diego contains a smaller percent of regional employment than the downtowns of comparable cities (see Table 5)
- There is a lack of a single dominant employment center in the region
- No employment center in the region will increase its regional employment share by more than two percent between 2008 and 2050
- The four largest employment centers in the region (University City, Kearny Mesa, downtown San Diego, and Sorrento Mesa/Mira Mesa) are all projected to lose regional employment share through 2050

Table 5: Downtown Employment as a Percent of Regional Employment

City	Downtown Employment
San Diego	5.2%
Denver	8.0%
Minneapolis	8.5%
Portland	8.0%
Seattle	8.1%
Sydney, Australia	12.0%
Vancouver, BC	9.0%

Source: SANDAG Urban Area Transit Strategy, *Lessons Learned from Peer Regions*, December 9, 2009

Table 6 identifies the four largest employment centers in the region. Although all four are projected to grow in absolute numbers of employees between 2008 and 2050, none will experience employment growth close to the 33.4 percent growth projected for the region by 2050. As a result, all will lose regional employment share.

Table 6: Trends for the Largest Employment Centers in the San Diego Region

Employment Area	2008		2030		2050		Percent Change 2008 - 2050
	#	%	#	%	#	%	
Downtown San Diego	78,600	5.2	86,300	4.9	95,800	4.8	21.8
University City	90,300	6.0	97,300	5.6	108,500	5.4	20.2
Kearny Mesa	87,300	5.8	92,700	5.2	104,300	5.2	19.4
Sorrento Mesa/ Mira Mesa	76,200	5.1	82,500	4.7	91,900	4.5	19.6
Region	1,501,100		1,752,600		2,003,000		33.4

Source: SANDAG Series 12 Regional Growth Forecast, City of San Diego Planning Areas

Table 7 further reveals the degree of regional dispersal of employment projected through 2050. Communities with at least one percent of regional employment in 2008 and/or 2050 are included in the table. All other communities not listed have less than one percent of regional employment in 2008 and/or 2050. Of the communities with at least one percent share of regional employment in 2008, Otay Mesa is projected to have the largest increase in regional employment share by 2050, but will only increase it share 1.56 percent to a total of 2.6 percent of regional employment. Most other communities will lose employment share by 2050. And the land use patterns in the vast majority of these employment communities are characterized by low density and/or business park development with large amounts of free parking and limited pedestrian environments. The absence of large, concentrated, and growing employment centers, and the ongoing trend of employment dispersal highlight the challenges of providing efficient transit service for commute trips in the region.

Table 7: San Diego Region Employment Share by Community and City – 2008 and 2050

	Number of Jobs 2008	Number of Jobs 2050	Change	Percent of Regional Share 2008	Percent of Regional Share 2050	Increase in Regional Share
Communities*						
Otay Mesa	14,360	51,110	36,750	1.0%	2.6%	1.59
Otay	2,828	15,385	12,557	0.2%	0.8%	0.58
Navajo	21,190	29,402	8,212	1.4%	1.5%	0.10
Lakeside	14,205	19,204	4,999	0.9%	1.0%	0.01
Rancho Bernardo	20,786	26,532	5,746	1.4%	1.3%	-0.06
Peninsula	15,126	18,589	3,463	1.0%	0.9%	-0.10
College Area	15,184	17,785	2,601	1.0%	0.9%	-0.10
Torrey Pines	15,801	17,791	1,990	1.1%	0.9%	-0.20
Linda Vista	16,672	18,379	1,707	1.1%	0.9%	-0.20
Midway/Pacific Hwy Corridor	21,416	24,070	2,654	1.4%	1.2%	-0.23
La Jolla	21,196	23,271	2,075	1.4%	1.2%	-0.25
Clairemont Mesa	22,447	24,891	2,444	1.5%	1.2%	-0.25
Uptown	29,361	34,046	4,685	2.0%	1.7%	-0.26
Mission Valley	52,551	64,920	12,369	3.5%	3.2%	-0.26
Pendleton-De Luz	30,959	35,459	4,500	2.1%	1.8%	-0.29
Palomar Airport Road	13,052	19,020	5,968	1.3%	0.9%	-0.32
Downtown San Diego	78,614	95,780	17,166	5.2%	4.8%	-0.46
Mira Mesa	76,172	91,111	14,939	5.1%	4.5%	-0.53
University	90,300	108,547	18,247	6.0%	5.4%	-0.60
Kearny Mesa	87,331	104,303	16,972	5.8%	5.2%	-0.61
Cities**						
Carlsbad	61,999	87,100	25,101	4.1%	4.3%	0.22
Chula Vista	70,230	121,555	51,325	4.7%	6.1%	1.39
Coronado	27,994	33,251	5,257	1.9%	1.7%	-0.20
El Cajon	41,686	58,630	16,944	2.8%	2.9%	0.15
Encinitas	26,985	31,481	4,496	1.8%	1.6%	-0.23
Escondido	61,143	75,004	13,861	4.1%	3.7%	-0.33
La Mesa	27,579	32,018	4,439	1.8%	1.6%	-0.24
National City	28,743	37,668	8,925	1.9%	1.9%	-0.03
Oceanside	43,977	67,410	23,433	2.9%	3.4%	0.44
Poway	31,176	41,005	9,829	2.1%	2.0%	-0.03
San Marcos	37,383	61,585	24,202	2.5%	3.1%	0.58
Santee	15,304	26,554	11,250	1.0%	1.3%	0.31
Vista	41,315	61,293	19,978	2.8%	3.1%	0.31
Subtotal	1,175,065	1,574,149	399,084			
Remainder of Region	326,015	428,889	102,874			
Region TOTAL	**1,501,080**	**2,003,038**	**501,958**			

*City of San Diego and County of San Diego communities with 1.0 percent or more of regional job share in 2008 and/or 2050.

**Cities with 1.0 percent of more of regional job share in 2008 and/or 2050. Some cities include community data.

Source: SANDAG, Series 12 Regional Growth Forecast

Policies that reverse projected declines in regional employment share in the largest employment centers and promote a greater share of employment growth in downtown San Diego and a limited number of employment areas (for example, the largest three to five employment centers outside of downtown) would support efficient provision of transit and increase transit ridership and mode share to these centers. This is particularly true for downtown San Diego where land use patterns and limited free parking create the environment that supports transit investments. Other regions across the country have recognized the regional economic and mobility value of ensuring that the central business district or primary employment center is dynamic, accessible, and well connected to the rest of the region by transit.

For example, in the late 1990s, the Chicago Department of Transportation (CDOT) found that 73 percent of downtown businesses indicated that the availability of transit was the strongest factor in locating downtown. As a result, the CDOT established a program to further enhance transit services to achieve a 70 percent transit mode share into downtown Chicago. The Chicago Central Area Plan "is based on a core belief that directing growth to the historic center of the region will eliminate sprawl [and] enable the greatest number of people to commute on transit…"[10] Downtown San Diego is the region's cultural, entertainment, and recognized central core characterized by high density land uses, an urban-grid street system and a large employment base that support transit use. The region has made large investments in transit infrastructure and service to and within downtown, which is reflected in the 24 percent existing peak period work trip transit mode share in downtown in 2008, by far the largest transit mode share in the region. Policies that strengthen the region's urban core by supporting higher concentrations of employment and housing will lead to further increases in transit use and mode share and support the extensive existing and planned transit infrastructure and service investment to and within downtown.

In addition, SANDAG's RCP addresses regional employment growth and location policy in two primary ways:

- The *Economic Prosperity* analysis states that the region and jurisdictions should focus on creating employment clusters for key industries – concentrations of like industries in one location
- The *Smart Growth* policy promotes job growth in higher density, mixed use areas to create a jobs and housing balance

Both of these job location policies can be served by and support transit investments and ridership if implemented in high enough densities with large volumes of employees. SANDAG's RCP states that an inventory of employment land conducted by the San Diego Regional Economic Development Corporation and SANDAG found that there is sufficient employment land in the region, but most of it is not generally located near housing, freeways, or transit, and much of what is will require redevelopment to accommodate employment growth. Therefore, in parallel to strengthening employment in downtown, and as stated in the RCP, "the region also should consider more efficient and compact use of existing and planned employment lands, possibly through redevelopment and other mechanisms."[11]

Observations/Policy Options Related to Land Use:

The crux of the strategies to increase transit use and mode share focuses on making transit investments where transit can be most efficient and effective. Research and experience across the country and world demonstrate that integrating transit with transit-supportive land uses is the key to increasing transit use and transit mode share. SANDAG could consider a variety of land use and integrated transit/land use policies to help achieve higher transit mode share in the region, including the following:

1. During the next update of the SANDAG RTP and Smart Growth Concept Map, work with local jurisdictions to identify a limited number of "Smarter Smart Growth" areas which would be large geographic areas with the best potential for accommodating regional growth through high density, mixed use development

[10] *Smart Transportation in Chicago*, Luann Hamilton, Chicago Department of Transportation, "Smart Growth and Transportation, Issues and Lessons Learned", pages 73-74, Transportation Research Board, Conference Proceedings 32 September 8-10, 2002.
[11] SANDAG 2004 RCP, pages 199-200.

2. Reward the "Smarter Smart Growth" areas with smart growth incentive funding, transit facilities, and transit service investments

3. Encourage jurisdictions to streamline the development and entitlement process in identified Smart Growth areas to encourage development in these designated areas

4. Update the SANDAG Smart Growth "tool box" to include form-based codes as a means to implement Smart Growth polices and encourage jurisdictional agencies to adopt these policies as part of their development codes

5. Update the SANDAG Smart Growth "tool box" to include Complete Street concepts as a means to implement Smart Growth policies and facilitate greater access to transit, and encourage jurisdictions to adopt these policies as part of their development codes

6. Review Smart Growth Incentive Program criteria and consider providing higher priority to local jurisdictions that have adopted TOD, urban design, complete street and/or form-based codes, policies, and standards for receiving incentive funding and/or regional transit investment priority, or use the adoption of these policies and standards as criteria for transit project priority phasing in the next update of the RTP

7. Identify a limited number (three to five) key strategic employment centers/locations in addition to downtown San Diego (possibly for cluster industry employment) that can accommodate higher employment concentrations sufficient to support transit, and create programs that help concentrate employment in these areas by strategically linking employment center growth and transit investment

C. Funding

Adequate levels of transportation funding are essential to meet expected future transportation needs, transit mode share goals, and GHG reduction requirements. Currently, transportation expenditures are funded by a broad range of sources at multiple levels of government. Successful implementation of an expanded transit network will require consistent and stable revenue, as well as an expansion of revenues and revenue sources. Potential local and regional funding sources that may support the transit system include facilities assessments, taxes and fees, and others. New development typically contributes to the road network by building parts of that network directly, providing parking, and paying assessments that contribute to the costs of building, operating, and maintaining roads and similar approaches could be considered for transit.

Other funding approaches also have been used to garner support for regional transit infrastructure and service investments. Some of these focus on specific projects or subregions, providing targeted localized support that directly links funding to specific infrastructure or services. The *TransNet* sales tax, while collected countywide, specifies funding for specific projects and services. Future similar measures could more directly link revenue collected with transit improvements on a subregional basis, providing opportunities for areas with high transit ridership and mode share propensity to generate higher levels of funding for transit to realize that potential. This approach provides a means to invest in appropriate modal and service levels based on the specific needs of each area or subregion.

Partnering with private entities may have a growing role in transit system funding. To the extent that the use of privately-contributed funds for transit produces measurable financial benefit to the private side of this equation, transit improvement projects may be self-financing. Or, the private investor may become a source of up-front financing subject to future repayment from other sources available to the public agency. However, SANDAG's experience has been that the public sector generally is required to provide subsidies for projects entered into with the private sector, and most of these projects are for joint development at stations rather than for the transit infrastructure itself. Other less direct methods for garnering private sector funding for transit could include creation of Local Improvement Districts (LIDs), including transit in local jurisdiction development facilities financing mechanisms, and/or bonding against public parking revenues. In Portland, Oregon, the Portland Streetcar funding package included $14.6 million in property owner contributions through a LID on non-owner occupied residences and $28.6 million in bonds backed by revenues from a $0.20 per hour short-term parking rate increase in city-owned parking garages. The Seattle South Lake Union Streetcar funding package included $25.7 million in LID funds, and an assessment district in Tampa provided funds for the TECO Line streetcar.[12]

Observations/Policy Options Related to Funding:

Funding policies can be challenging to change or implement on a regional basis because many of them are established by state and federal legislation. However, SANDAG could take a leadership role in initiating discussions that would establish funding policy and strategies beneficial to and/or specifically focused on transit. Some options for discussion include:

1. Encourage the creation of LIDs and facilities financing mechanisms
2. Promote bonding against public parking revenues
3. Seek private partners in cases of promising funding advantages

Additional Supporting Information

As stated in the introduction, this paper also includes a discussion on how strategies related to transit fares, services, and facilities can enhance the effectiveness of the region's future transit network. The region is currently making progress in many of these areas, and SANDAG and the transit operators should continue to work to make additional refinements over the long-term that would support the performance of the overall system.

A. Transit Fares

Transit fares generate revenue that supports the provision of transit service. The price of a transit trip can be an incentive or disincentive to transit use that affects the willingness of potential riders to choose transit over other modes, as well as their frequency of transit travel. Consequently, establishing fare policy and fare levels can be a balancing act for transit agencies and regions between two competing objectives:

- Generating passenger payment for transit service to cover a portion of the operating costs; and
- Achieving desired levels of transit use and transit mode share.

Paying for Transit Service

Fare revenue provides just one source of funding for transit operations and often covers less than half of a transit system's operating and maintenance cost. Farebox recovery ratio (or farebox ratio) is defined as the proportion of total transit operating and maintenance cost covered by fare revenue. For transit systems in the United States, the farebox ratio is typically between 25 percent and 35 percent, with the remaining costs generally covered by local, state, and/or federal subsidies. For the San Diego region, the fiscal year 2009 farebox ratio for fixed-route services (bus and rail) was almost 40 percent. This relatively

[12] Santa Ana & Garden Grove Transit Vision and Go Local Project Concept Study, May 2008, Parsons Brinckerhoff, Table 4C.

high farebox ratio denotes the importance of fare revenue in supporting transit service and operations in the region. FY 2009 farebox ratio broken down by mode and operator is provided in Table 8:

Table 8: San Diego Region FY 2009 Fixed Route Farebox Ratio

Operator/Service	Farebox Ratio
MTS	
Fixed Route Bus	39.52%
Rail (San Diego Trolley)	57.20%
Total Fixed Route Bus and Rail	44.85%
NCTD	
Fixed Route Bus	20.66%
Rail (Coaster and Sprinter)	29.34%
Total Fixed Route Bus and Rail	24.42%
Region Total Fixed Route Bus and Rail	**39.28%**

Source: SANDAG: MTS and NCTD TDA Quarterly Report Statistics.

Generally, increases in transit fares lead to decreases in transit ridership, while decreases in fares lead to increases in ridership. However, fare changes are never implemented in a vacuum and changing external factors, such as the economy, gas prices, changes in the regional transportation system (i.e., opening of a new rail line), and military deployments, influence the response of ridership to fare changes.

Without a fare change, increases in ridership that can be accommodated within the existing level of service can increase farebox recovery by generating more fare revenue to cover the established operating and maintenance cost. However, there is a capacity and network threshold at which increased ridership requires increased expenditures for service, facilities, and capital equipment to accommodate new transit demand. In this case, while transit mode share may increase with higher ridership, farebox ratio does not necessarily improve. In addition, depending on the fare structure and pricing, increases in transit ridership resulting from decreases in fares may not necessarily offset the revenue lost through the fare reduction. As a result, regions and transit agencies are constantly seeking to balance fare policy and farebox ratio needs with ridership and mode share goals.

<u>Sensitivity of Transit Ridership to Transit Fares</u>

Transit fare sensitivity can generally be measured using elasticities, which is defined as the percent change in ridership resulting from a one percent change in fares, if all other factors are held constant. Research conducted by Todd Litman of the Victoria Transport Policy Institute indicates that transit ridership elasticity to fare changes ranges from -0.2 to -0.5 in the first year after a fare change. This means that in the first year, a ten percent increase in fares should produce a two to five percent decrease in ridership.[13] While elasticities can be applied to both fare increases and decreases, Litman found evidence that fare reductions are much less elastic than fare increases (i.e., fare reductions do not result in ridership increases to the same extent that fare increases result in ridership declines).[14]

However, the sensitivity of transit ridership to fare levels and changes is dependent on a variety of factors, including the characteristics of the transit service (trip type, trip purpose, time of day, mode), the demographics of riders (income, age, gender), and the external factors noted above (i.e., economy, gas prices, parking prices, etc.). In the San Diego region, recent fare changes have generally been implemented with services changes and in the context of fluctuating gas prices and military deployments, making it difficult to isolate the relationship of fares to ridership. Regardless, it appears that both revenue and ridership have increased despite recent changes in fare structure, and increases in some fare types. These regional results are encouraging and suggest that targeted fare policy,

[13] Litman, Todd, *Transit Price Elasticities and Cross-Elasticities*, August 17, 2007, page 14, Victoria Transport Policy Institute.
[14] Litman, Todd, *Transit Price Elasticities and Cross-Elasticities*, August 17, 2007, page 5, Victoria Transport Policy Institute.

structure and pricing changes (versus direct fare reductions) can have a significant effect on attaining transit ridership and mode share goals in specific markets. Still, most fare structure and level changes are implemented to increase fare revenue (vs. increase ridership) since nonfare operating funding for transit is limited. Any consideration of fare reductions to increase transit ridership also would need to consider complementary policies and programs that increase nonfare transit revenues to ensure sustainable attainment of transit ridership and mode share goals, as discussed below.

Perception of the Cost of Transit

Most transit systems need to generate fare revenue as a source of transit operating funding and therefore, must balance the financial issues associated with fare reductions with the desire to attract more riders with lower fares. As a result, there may be a need for policies that reach beyond fares. An important aspect of fare policies and programs relates to how users perceive fares.

People who travel are likely to think of the *per trip* cost of transit as being higher than the *per trip* cost of using a car, despite the fact that the actual total cost of transit that an individual traveler pays is generally less than the true cost of travel by car. Table 9 displays the personal commute costs for comparable drive alone and transit trips for the San Diego region using SANDAG's Commute Cost Calculator. In general, the true cost of driving is more than transit for all but the shortest trips, and driving costs are even higher when parking fees are part of the driving trip. Note that SANDAG's drive alone calculation does not include full-coverage insurance, license, registration, taxes, depreciation (15,000 miles annually), vehicle loan payments, or finance charges, which are some of the key hidden costs of driving and which would make the cost of driving shown in Table 9 even higher.

Table 9: San Diego Region Commute Trip Cost Comparison – Drive Alone and Transit

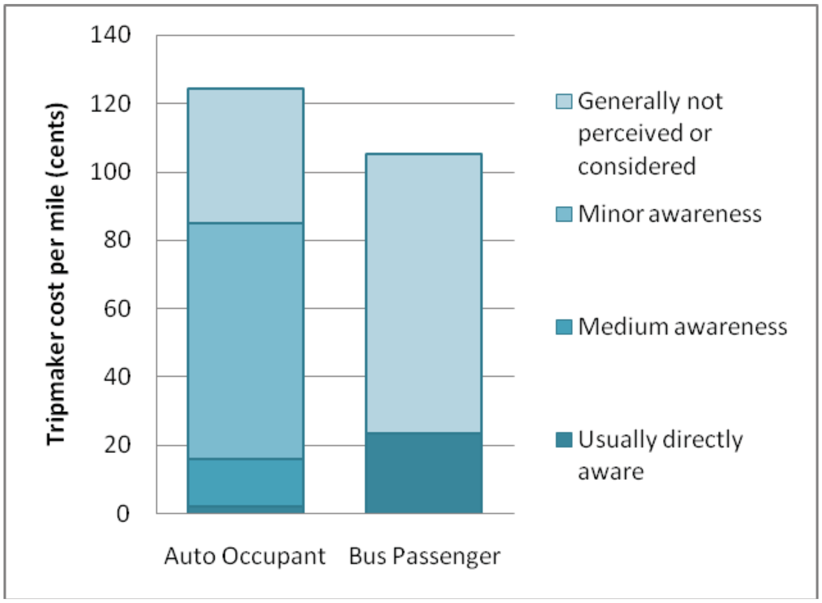
Trip	Daily	Monthly	Yearly
Drive Alone - 10 Mile Round Trip			
Free Parking	$2.13	$46.86	$562.32
$100/Month Parking	$5.68	$146.86	$1,762.32
Drive Alone - 20 Mile Round Trip			
Free Parking	$4.26	$93.72	$1,124.64
$100/Month Parking	$8.81	$193.72	$2,324.64
Drive Alone - 40 Mile Round Trip			
Drive Alone – Free Parking	$8.52	$187.44	$2,249.28
Drive Alone - $100/Month Parking	$13.07	$287.44	$3,449.28
Transit			
MTS Local/Express Bus	$5.00	$72.00	$816.00
MTS Premium Bus	$14.00	$100.00	$1,080.00
Trolley	$5.00	$72.00	$816.00
NCTD BREEZE Bus	$5.00	$59.00	$708.00
SPRINTER	$5.00	$59.00	$708.00
COASTER	$14.00	$144.00 - $182.00	$1,728.00 - $2,184.00

Source: www.sandag.org, iCommute Commute Cost Calculator

- Based on 22 commute days/month, 20 miles/gallon (auto trips), and $3.20 gallon gasoline.
- Drive alone cost estimates include an average 5 cents/mile maintenance and tire cost based on AAA "Your Driving Costs 2008" brochure. Cost estimates do not include full-coverage insurance, license, registration, taxes, depreciation (15,000 miles annually), vehicle loan payments, or finance charges.
- Transit prices are based on purchase of full fare adult Day or Monthly Pass. COASTER daily ticket prices reflect round trip purchase. Yearly transit costs equal Monthly Pass price x 12.

User perception of travel cost also is strongly influenced by the way in which one pays the cost, and who pays the cost – the user or others. Increasingly removing the user from direct, per-trip payment decreases their overall perception of per-trip costs. Figure 3 illustrates this situation.

Figure 3: Total and Perceived Costs of Travel by Car and Transit



Sources: www.commutesolutions.org; National Transit Database; PB analysis

In the case of transit fares, fare instruments such as multiple-trip passes tend to reduce user perception of per-trip cost and thereby tend to be less of a disincentive to transit use. Fare media that are automatically replenished are less likely to have a disincentive effect than media requiring a conscious periodic transaction. Fares paid for or subsidized by employers or others remove the individual from fare payment entirely and thus remove the fare disincentive from a potential transit user's travel mode choice.

From these observations one can see that the choice of fare media, and the presence or absence of fare programs that enlist employers or others in helping to pay transit fares, can materially affect potential transit users' perception of transit travel costs, and consequently their willingness to use transit. In a recent survey of San Diego residents, half of all respondents indicated that having a transit pass paid for by their employer (or school) would increase their use of transit.[15] As significant, however, is the application of technology to fare payment as a way to create incentives for use transit. Technology is increasingly being used around the world to market transportation options and other services based on user-preferences. SANDAG's Urban Area Transit Strategy Peer Review Panel noted that integrated electronic cards, such as the Octopus Card in Hong Kong and the Oyster Card in England, are providing tremendous potential to the private sector for marketing goods and services to end users, to the public sector for tailoring, directing, and providing incentives for transit and transportation services to end users, and for the users themselves who receive incentives and discounts for many kinds of products and services based on established purchasing choices. To take advantage of these technological applications, the region could proactively work to expand the Compass Card services beyond transportation to provide users with more convenience and incentives, and to maximize the region's ability to direct future transportation marketing decisions.[16]

[15] 2050 RTP, Public Opinion Survey Report, prepared for SANDAG, True North Research, June 23, 2010.

[16] SANDAG Peer Review Panel, Week of April 19, 2010 and SANDAG Board of Directors Agenda Item No. 10-05-5, May 14, 2010, pages 4-5.

Some options for obtaining nonrider partners in transit fare payment include:

- Expanding employer pass subsidy programs;
- Unbundling parking from housing or office costs and providing an option for housing developers and residential and commercial landlords to include a transit pass in the cost of housing or office space in lieu of a parking space;
- Expanding partnerships with colleges and universities to include transit costs in student fees to include all campuses; and
- Establishing partnerships with businesses to:
    - Integrate transit fare payment with retail debit cards
    - Provide retail discounts to transit riders through debit cards or the Compass Card

At the same time, the region also might consider ways to continue to increase the awareness of the cost associated with travel by car. Such actions could encourage the use of transit, a lower-cost alternative, without also reducing transit cost recovery. There also is the potential to have a larger effect on transit use than can be achieved by means of policies and programs aimed at transit fares and fare payment. For example, most trips are made by car rather than transit – therefore, influencing a small percentage of drivers to change modes based on a better understanding of the full cost of vehicle ownership per trip may be easier than influencing mode change by lowering per trip transit costs.

B. Transit Service and Facilities

Transit services and facilities can have an impact on transit ridership and mode share. Discussion related to transit service generally relates to the quantity of transit service, including geographic coverage, system linkages, frequency, and span of service. Discussion related to transit facilities generally relates to the quality of transit service and falls into two categories:

- Strategies that enhance passenger service (including travel time); and
- Strategies that address provision of passenger amenities

The two areas that can be most directly measured for impact on ridership are service frequency (headway) and speed (in-vehicle travel time).

However, their cost implications are quite different. Increasing the frequency of service can be costly; every added trip requires added operator and vehicle hours. Reducing headways (improving frequency), unless accomplished by means of extensive route re-design, would increase operating and maintenance cost, and could require capital expenditures to increase the transit vehicle fleet and provide maintenance and storage facilities for added vehicles. Reducing in-vehicle travel time (increasing speed) would decrease transit operating and maintenance cost, and while it can sometimes be achieved through operating modifications, such as limited-stop or express service, it most often requires some level of capital investment in the form of dedicated transit lanes, traffic signal priority, and/or off-board fare payment to achieve higher average operating speeds.

Service Frequency (Headway)

Frequency improvements can be gained in two ways. If headways are regular, halving the headway requires twice as many transit vehicle trips. If headways are irregular, either by design or by unpredictable delays, achieving uniform headways can effectively reduce the average headway. For example, if a transit corridor with one or more bus routes has 12 buses per hour, but they arrive at the same time, the effective average headway is ten minutes, rather than five minutes if they are evenly spaced.

Also, the effect of headway improvement on a particular route is a function of the current headway; improvements to vehicle headways that are already closely spaced will have relatively little effect on ridership, while improvements to widely-spaced headways can have a dramatic effect.

The financial impact of service improvements in many cases may be more severe than the financial impact of fare reductions. This is because lost fare revenues resulting from a fare reduction are partly offset by the gain in transit riders, while ridership increases resulting from service increases do not generally offset the increase in required operating subsidy. For example, increased ridership resulting from frequency reductions will most often require increased service, which increases operating and maintenance cost and often increases capital costs for fleet expansion and vehicle maintenance and storage facilities.

Speed (In-Vehicle Travel Time)

Transit's in-vehicle travel time is the combined total of trip length (running time), delay caused by traffic and traffic signals, and dwell time at transit stops or stations. Buses in urban corridors sometimes have as much as half their in-vehicle travel time expended in the form of traffic signal delay and transit stops. Traffic signal delay can be reduced significantly by measures such as transit signal priority and queue jumps. Transit stop delay time can be reduced by using off-vehicle fare collection and multi-door boarding and alighting. Traffic signal delays and reductions in time spent at passenger stops have yielded bus running time reductions of more than 20 percent in some cases. For example, the initial demonstration implementation of the Los Angeles Metro Rapid service, which employs transit signal priority and other operating enhancements, reduced transit travel time on the Wilshire corridor by 29 percent and on the Ventura corridor by 23 percent.[17]

Forms of transit priority treatment include:

- *Dedicated Transit Lanes:* Where transit service is frequent and road space permits, especially on congested streets, transit travel time (and reliability) will benefit from the establishment of reserved lanes. The best reserved-lane situation is one that does not require buses to change lanes. On arterial and local streets and roads, transit lanes can take many forms. They can be designed and built into new streets and roads. Or, they can be retrofitted into existing roadways in a variety of configurations:

    - Converted auto lanes – these are regular travel lanes selectively converted to transit only use. Transit only use can be continuous for the length of the street or discontinuous and applied only in specific areas. It also can designed for transit only use by time of day (i.e., peak period only or all day).
    - Converted parking lanes - parking lanes adjacent to curbs can be converted to transit only lanes. As with converted auto lanes, these can be continuous or discontinuous and designated for transit use by time of day.
    - Shared transit lanes – these lanes give priority to transit, but allow shared auto use for right turns, driveway access, and even continuous auto travel. In the latter case, autos may be delayed in shared transit lanes by buses stopping in the lane at transit stops.
    - Converted roadway shoulders – on regional roadways and highways, shoulders can be converted to transit only lanes with specific operational procedures and appropriate signage.

- *Transit Streets/Busways/Rail Corridors/Grade-Separated Transit:* Ambitious expansion of transit will lead to the need for even greater transit priority, and for projects to fill in "missing links" for more direct connectivity serving major passenger flows. Dedicated transitways for bus or rail provide competitive advantages in favor of transit.

[17] LAMTA, Metro Rapid Planning and Programming Committee Presentation, March 1999.

- *Managed Lanes/Direct Access Ramps:* The San Diego region has an extensive program to establish a managed lanes system on regional freeways that provide congestion-free travel for carpools, vanpools, bus transit, and toll-paying single-occupant autos. The managed lanes and direct access ramps provide free-flow priority for regional transit.

- *Traffic Signal Priority:* Traffic signal priority for transit can take on two forms – signal preemption and signal priority. Signal preemption gives transit vehicles the privilege of changing a traffic signal to allow passage without delay. This technique tends to disrupt general traffic flow, including preventing signal-to-signal progression and its use is generally limited for this reason. Traffic signal priority allows transit vehicles to obtain, within certain set limits, an extension of a green light or advancement of green light, thereby reducing delay caused by signals. Signal priority is valuable where signal-caused delay is significant and there is a dominant transit flow. If transit volumes on cross streets are similar there may be no advantage to implementing signal priority.

- *Queue Jumps:* Queue jumps provide short transit lanes at signalized intersections, allowing transit buses to move to the beginning of the queue of vehicles waiting at a red light and transit signal priority, which provides a bus-only green light that precedes that for general purpose traffic, allowing the buses to cross into the intersection and proceed ahead of the auto traffic.

The purpose of transit priority treatments is to make transit travel time competitive with auto travel times by offsetting or overcoming the time impacts of accessing and waiting for transit, multiple stops, transfers, and indirect routings for particular trips. Improving transit's level of service will help make transit a more viable travel option.

<u>Other Service and Facility Measures</u>

It is well established that the introduction of measures improving the comfort, convenience, attractiveness, and permanence of transit can lead to higher ridership and transit mode share. Less well established is how to predict the magnitude of these ridership increases. However, there is a growing body of knowledge drawn from experience with various transit modes (vehicle and system technologies), such as Bus Rapid Transit (BRT), Light Rail (LRT), and express buses, and with the use of passenger information systems, service branding, and other transit attribute modifications that link these service and facility measures to ridership improvements.

Service and facility strategies can have a positive effect on ridership by refining and augmenting the transit system. Many of these strategies are being incorporated into the Urban Area Transit Strategy network planning and include:

- *Direct Routing:* Increased use of direct routes, which includes limited-stop or express service if warranted, to minimize the need for passenger transfers and minimize in-vehicle travel times. Priority for establishing direct route services should be given to origin-destination pairs with sufficient passenger volumes to support reasonable service frequency.

- *Span of Service:* Increasing the span of service; some travel cannot be made by transit because it must or may take place during hours when service is not provided. This includes off-peak trips in areas having only peak period service, or late night trips when almost all transit service is absent. Periodic review of span-of-service criteria is needed to maximize hours of operation where there is sufficient need.

- *Transit Centers*: Establishing transit centers, especially in conjunction with Smart Growth areas, increases regional accessibility via transit by providing timed-transfer route meeting points for trips that do not support direct route service. By facilitating multiple origin-destination trip patterns with a minimal number of routes, service frequency can be optimized.

- *Access to Transit:* Often the biggest impediment to transit use is getting to and from the transit stop or station. Land use patterns, street networks, topography, and distances between trip origins and transit stations ("first-mile") or transit stations and trip destinations ("last-mile") create barriers that are difficult for transit vehicles to negotiate and are difficult or impractical for those wishing to access transit to overcome. Strategies and programs that promote first-mile/last-mile solution can help encourage transit use and increase transit mode share, especially in suburban and low density employment areas where walking to transit is impractical. Potential solutions to address first-mile/last-mile access include:

    - Pedestrian access improvements
    - Bicycle policies and programs that include the expansion of bicycle lanes and paths to transit stations and the inclusion of bike space on roadways, incorporation of secure bicycle storage facilities at stations, establishment of policies and designated facilities/space that allow for bicycles on board transit vehicles (including distribution of folding bikes to riders), and bike rental/sharing programs that allow transit riders to "borrow" bikes to complete their trips
    - Ample park/ride and kiss/ride facilities at stations
    - Feeder-distributor bus and shuttle routes which are generally provided by the transit operator from major transit centers and stations
    - Employer shuttles provided from transit to major employment centers by a large employer or a group of employers
    - Privately operated jitney or taxi services that provide for shared rides and integrated fares
    - Car sharing and station car programs and services that provide on-demand access to shared vehicles for short trips to and from the transit station
    - Casual carpooling (also known as "slugging") that establishes a recognized market and method for informal "on-the-spot" rides to and from transit stations
    - Rideshare match programs

- *Unique Downtown Transit Applications:* The December 2009 "Lessons Learned from Peer Regions" case study report conducted for the Urban Area Transit Strategy project revealed that most cities with successful, high profile transit systems had unique services and facilities for transit in their downtowns. These services and facilities demonstrate a commitment to transit in the region and increase the awareness, improve the image, and enhance the convenience of transit for travelers and trips extending well beyond the downtown. Some applications also can be applied in secondary downtowns in the region. Examples of unique transit applications include:

    - Dedicated transit streets or malls (Denver, Portland, Minneapolis)
    - Downtown edge transit hubs connected by very high-frequency shuttles (Denver)
    - Network of high-frequency circulator shuttle routes (Los Angeles DASH)
    - Streetcars (Seattle, Portland, San Francisco)
    - Downtown rail and bus transit tunnel (Seattle)
    - Dedicated bus lanes (Seattle, Los Angeles)
    - Fare free zones (Seattle)

- *Design Quality and Passenger Amenities:* Transit systems should ensure that capital facilities are well designed, constructed, and maintained and provide a level of comfort, convenience, and safety that will help attract and retain riders. Well designed and constructed stops, stations, transit centers, transit vehicles, and travel-ways provide passengers with a comfortable environment and smooth ride. Shelters, lighting, passenger information, fare vending, convenience retail, low-floor vehicles, and security cameras and personnel at stations all serve to make transit easier and more comfortable to use.

- *Community Integration:* Transit systems that provide the most access and convenience are those that physically and intrinsically weave transit into communities and neighborhoods. While different areas require different transit applications, regional land use and transportation strategies should strive to balance freeway-based transit investments (i.e., transit stations at managed lane direct access ramps) with community based investments in which transit penetrates and directly serves neighborhoods (and is accessible by foot or bike).

Summary: Menu of Policy Options

Table 10 below provides a summary of the menu of policy options discussed in this paper for consideration in the RTP development process. *(Please note: The policy options have been listed in order of priority based on an interactive exercise conducted on September 21, 2010, with SANDAG's Regional Planning Technical Working Group, Cities/County Transportation Advisory Committee, and Regional Planning Stakeholders Working Group, and on October 20, 2010, with local members of the design and planning community.)*

Table 10: Menu of Policy Options

Policy Area	Policy Options
A. Parking	1. Create a tool box of localized parking strategies and policies for local jurisdictions that may include: o Parking pricing (on- and off-street) o Zoning to reduce/eliminate parking minimums o Zoning to reduce parking maximums o Shared parking programs and standards o Employer parking cost cash-outs o Unbundling of parking costs from housing costs in targeted areas o Local parking districts o Others as requested by local jurisdictions 2. Establish grant programs to fund local parking utilization surveys and provide technical assistance to jurisdictions and transit operators within the SANDAG jurisdiction to promote changes in parking management and zoning requirements related to parking 3. Support a remote parking program tied to transit service 4. Encourage a regional employer/business assessment on employer-provided parking to be used for transit improvements or transit pass subsidies 5. Establish regional policies promoting shared parking, particularly at transit stations 6. Establish programs to measure and document the amount of parking available in selected areas of the region and use this sample as a baseline to track changes in parking supply over the long-term 7. Initiate regional education programs regarding the effects of free parking on congestion and mode choice 8. Organize the region into subregional areas, and in collaboration with affected jurisdictions, develop guidelines for parking availability and pricing for each subregion 9. Initiate discussion regarding the establishment of long-term goals for a reduction in parking spaces per capita 10. Establish Transportation Management Associations in key employment or urban locations

Policy Area	Policy Options
B. Land Use	1. Reward the "Smarter Smart Growth" areas with smart growth incentive funding, transit facilities, and transit service investments *(Note: Tied with #1 in interactive exercise)* 2. Update the SANDAG Smart Growth "tool box" to include Complete Street concepts as a means to implement Smart Growth policies and facilitate greater access to transit, and encourage jurisdictions to adopt these policies as part of their development codes 3. Identify a limited number (three to five) key strategic employment centers/locations in addition to downtown San Diego (possibly for cluster industry employment) that can accommodate higher employment concentrations sufficient to support transit, and create programs that help concentrate employment in these areas by strategically linking employment center growth and transit investment *(Note: Tied with #2 in interactive exercise)* 4. During the next update of the SANDAG RCP and Smart Growth Concept Map, work with local jurisdictions to identify a limited number of "Smarter Smart Growth" areas which would be large geographic areas with the best potential for accommodating regional growth through high density, mixed use development 5. Review Smart Growth Incentive Program criteria and consider providing higher priority to local jurisdictions that have adopted TOD, urban design, complete street, and/or form-based codes, policies, and standards for receiving incentive funding and/or regional transit investment priority, or use the adoption of these policies and standards as criteria for transit project priority phasing in the next update of the RTP 6. Encourage jurisdictions to streamline the development and entitlement process in identified Smart Growth areas to encourage development in these designated areas 7. Update the SANDAG Smart Growth "tool box" to include form-based codes as a means to implement Smart Growth policies and encourage jurisdictions to adopt these policies as part of their development codes
C. Funding	1. Encourage the creation of LIDs and facilities financing mechanisms 2. Seek private partners in cases of promising funding advantages 3. Promote bonding against public parking revenues

Appendix A

Parking Policy and Strategy Resources/References

Deakin, E., Harvey, G., Pozdena, R., and Yarema, G., Transportation Pricing Strategies for California: An Assessment of Congestion, Emissions, Energy and Equity Impacts. Final Report. Prepared for California Air Resources Board, Sacramento, CA (1996).

Dowling, R., Feltham, D., and Wycko, W., "Factors Affecting Transportation Demand Management Program Effectiveness at Six San Francisco Medical Institutions." Transportation Research Record 1321 (1991).

Dueker, K. J., Strathman, J. G., and Bianco, M. J., "Strategies to Attract Auto Users to Public Transportation." TCRP Report 40, Transportation Research Board, Washington, DC (1998).

Feeney, B. P., "A Review of the Impact of Parking Policy Measures on Travel Demand." Transportation Planning and Technology, Vol. 13 (1989).

Kolozsvari, D., and Shoup, D., "Turning Small Change into Big Changes." Access, No. 23 (Fall, 2003)
K.T. Analytics, Inc., "Parking Cash-Out." TDM Status Report, Federal Transit Administration, Washington, DC (February, 1994).

Kuppam, A., Pendyala, R., and Gollakoti, M., Analysis of the Potential Effectiveness of Parking Pricing Based Transportation Control Measures Using Stated Response Data. University of South Florida, Department of Civil and Environmental Engineering, Tampa, FL (1997).

Metropolitan Transportation Commission, "Developing Parking Policies to Support Smart Growth in Local Jurisdictions: Best Practices," 2007.

Portland State University, "Policy Options to Attract Auto Users to Public Transportation." Volume II: Technical Report (Preliminary Draft Final Report), prepared for the Transit Cooperative Research Program. Portland, OR (December, 1995).

Shoup, D., Evaluating the Effects of Parking Cash-Out: Eight Case Studies. Final Report. Prepared for California Air Resources Board Research Division, Sacramento, CA (1997).

Taylor, B., Fink, C.; The Factors Influencing Transit Ridership: A review and Analysis of the Ridership Literature, UCLA Department of Urban Planning Working Paper.

Vaca, E., Kuzmyak, R., "Traveler Response to Transportation System Changes Chapter 13—Parking Pricing and Fees;" TCRP Report 95, Transportation Research Board, Washington, DC (2005).

Victoria Transport Policy Institute, "Online TDM Encyclopedia." http://www.vtpi.org/tdm/ (Web site updated December 17, 2003).

Weinberger, Kaehny, Refu; U.S. Parking Policies: An Overview of Management Strategies; Institute for Transportation and Development Policy.

http://www.smgov.net/Departments/OSE/Categories/Sustainability/Sustainable_City_Progress_Report/Transportation/Average_Vehicle_Ridership.aspx.