

# Appendix E

## Transportation System and Demand Management Programs, and Emerging Technologies

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# Transportation System and Demand Management Programs, and Emerging Technologies

Proposed Transportation System Management (TSM) and Transportation Demand Management (TDM) investments have been developed so as to maintain the greatest mobility benefits through the application of innovative technologies that maximize network efficiencies.

Such efficiencies can result in decreases in both fuel consumption and in overall air pollutant emissions. Research is underway to quantify decreases in greenhouse gas emissions due to these efforts. In particular, TSM investments such as the Multimodal Integration and Performance Based Management, Arterial Management, and Vehicle Automation are focused on how to best use data or information such as speeds, vehicle locations, and fuel consumption to mitigate and reduce emissions. Implementation of these initiatives would result in more reliable travel options that would reduce unnecessary trips and reductions in vehicle idling and unnecessary accelerations and decelerations, as well as reductions in frequency of accidents. TSM investments are expected to provide the underlying technological applications to promote greater multimodal system efficiencies that support mode and trip changes over time, which can ultimately lower greenhouse gas emissions.

The San Diego Association of Governments (SANDAG) regional TSM program includes subsystems to better manage and operate the region's freeways, roads, transit, active transportation, incidents, and emergency response special events, commercial vehicle operations, and traveler information. The TSM components proposed in San Diego Forward include seven TSM Core programs and four new TSM elements.

An increased level of investment has been developed so as to achieve the greatest mobility and emission reduction benefits across the regional network.

## Transportation System Management Program

TSM programs are comprised of the following major investment areas (expressed in 2019 dollars) through 2050 (Table E.1).

**Multimodal Management** includes important strategies that maximize efficiency of the current system by managing the entire transportation system as a unified and multi-modal "Corridor". This program includes an advanced Intelligent Transportation System (ITS) that uses integrated systems that enable performance-based operational management strategies to be enacted across modes and jurisdictions. The program delivers operation improvements through maximizing existing system efficiencies. The region is working to expand the benefits of this program that include real time multimodal and coordinated operations through the implementation of Integrated Corridor Management (ICM) Program that will complement the Active Traffic and Demand Management (ATDM) focus area under the TDM program. The proposed investment level for this program is \$84 million through 2050.

**Traveler Information Program** is responsible for delivery of projects that enhance access to traveler information services. This program aims to increase awareness and the information available on travel choice, and impact, such that travelers can actively participate in reducing both network demand and personal trip-impact. The program delivers both systems and education outreach campaigns to raise the awareness of the direct relationship that route choice, personal driving habits, and the trip timing have on reducing fuel consumption, vehicle operating expenses and vehicle emissions. The proposed investment level for this program is \$51 million through 2050.

**Arterial Management** is a TSM element that focuses on managing arterial roadways (major streets) in order to reduce delays and result in quicker trips and lower vehicle emissions. Improvements to arterial detection and signal interconnect will provide the ability to create a traffic signal system that is dynamic and coordinated throughout the region. Improving the flow of traffic on arterial roadways is among the most cost-effective TSM strategies for reducing stop-and-go traffic, cutting overall travel times, and lowering fuel consumption and pollution. This program is also responsible for managing a regional transition strategy that improves safety, mobility, and the environment for a more 'Connected Vehicle' fleet. Connected Vehicle is the term used by the U.S. Department of Transportation and the wider industry as a whole and represents the communication between vehicles and vehicles to infrastructure. The primary goal of the Connected Vehicle program is to improve safety through the use of vehicle-to-vehicle communication and the reduction of preventable accidents. Additionally, Connected Vehicles can improve mobility and reduce fuel consumptions through such strategies as car, or transit vehicle platooning – multiple vehicles safely following each other in car or bus 'trains.' This one aspect has been shown to increase throughput while reducing fuel consumption of all the vehicles in the platoon. The investment level for the Arterial Management Program is proposed at \$270 million through 2050.

**Freeway Management** is a program that deploys tools to better manage freeway traffic flows, thereby improving efficiency and reducing bottlenecks. This program is responsible for deploying systems that improve operational efficiency of freeway control infrastructure; enables freeway managers to have greater control over vehicle operating speeds; facilitates freeway manager's ability to communicate with the traveling public the impact of events, incidents, and congestion. It also provides freeway managers with greater operational visibility to operating conditions both on and off network. Some of the systems included in this program are traffic detection technologies, closed-circuit television cameras, ramp meters, electronic message signs, and the Advanced Transportation Management System, which provides central monitoring and sign control for managing incidents. The investment level for Freeway Management is proposed at \$87 million through 2050.

**Transit Management System (Bus and Rail)**, with a proposed investment level of \$108 million, the Transit Management System helps to ensure that bus and rail lines are safe and performing optimally. Beyond the traditional public transit industry standards of utilizing performance-based management techniques, the San Diego region continues to explore new ways to improve the operation, convenience, and safety of the public transit system. Transit Management program investments support the current management systems (Regional Scheduling System), Regional Transit Management System, Positive Train Control, and Centralized Train Control System, while also looking into the future application of advanced technologies to the transit system.

**Vehicle Technologies** includes 'autonomous,' or 'automated vehicles' and Connected Vehicles that operate with a decreasing level of human oversight. These vehicles utilize internal sensors to survey and respond to the surrounding transportation environment, including all vehicle classes and pedestrians. These vehicles will enable our transportation networks to not only implement performance-based management principles over the road network control infrastructure, but upon the vehicles themselves. An additional project investment of \$29 million would deliver increasing capabilities to reduce fuel consumption resulting from more efficient operations, while simultaneously promoting increased safety. Ultimately, it is envisioned that fully autonomous vehicles (driverless cars) could replace conventional cars. Autonomous cars are projected to be first available in 2025 with a significant percentage of the regional fleet described as 'Autonomous' from 2035 onwards.

**Advanced Transportation Technology Program**, with an estimated proposed investment level of \$57 million, this program incorporates a number of ITS and other transit planning strategies that can be deployed either together or independently. Such strategies may include transit priority lanes, queue jumps, transit signal priority, ramps/guideways, etc. This program is intended to optimize and support existing local routes, rather than new transit services, since those services will already incorporate a combination of these elements.

**Universal Transportation Account** - Electronic payment systems is a growing investment area in TSM, with an investment level of \$157 million due to the development of advanced applications such as transit smartcard systems and open road tolling. Both applications make collecting payments for services quicker and more efficient. Electronic Payment Systems also create opportunities for innovative pricing models such as the Universal Transportation Account which combines all forms of public transportation payment, including transit fares, municipal parking, bike parking, car, bike, and personal electronic vehicle sharing, as well as toll collection into a single, user-friendly interface. The goal is to influence mode shift from a single occupancy commute to a transit or shared ride by incentivizing the user through the use of rewards, toll discounts, or gamification — a method of challenging the user where points are earned to reach a goal.

**Transit Infrastructure Electrification/Regional Charger Program** supports emerging electric vehicle technologies as applied to our bus fleets (including Zero-Emission Vehicles and Plug-In Electric Vehicles) that help to reduce emission levels. This investment area is proposed to support electric bus recharging through wireless, inductive methods located at key transit stations and layover locations, such that electric buses can benefit from improved range capabilities.

The Regional Charger Program would lead to carbon dioxide emissions reductions by extending the electric range of plug-in hybrid electric vehicles (PHEVs) and displacing the use of gasoline. Currently, PHEVs drive 30 percent of their miles in electric mode with the remaining miles in gasoline mode. The build-out of a robust electric vehicle charger network would allow PHEVs more opportunities to charge and increase the percentage of miles driven in electric mode. The Regional Charger Program forecasts that one charger for every five PHEVs would increase the percentage of electric miles from 30 percent to 41 percent. Based on currently available data, this would translate to 36,000 charging stations in 2035 and 44,000 charging stations in 2050. The build-out of the charger network would be accomplished through a combination of regional planning and incentives for the installation of publicly available Level 2 charging stations, which add about 10 to 20 miles of range per hour of charging time. These two programs have an estimated level of investment of \$46 million.

**Smart Parking** - A “smart parking” system collects, analyzes, and reports parking data to figure out; for example, how public transit parking lots are being used. Smart parking technology can be deployed to let travelers know how much parking is available at their destination – before they even take their trip. Information like this can help people decide when to leave, what public transit service to take, and what route to choose and thus increasing awareness of transportation choices available for their complete trip. Smart Parking has an estimated level of investment of \$34 million.

Table E.1 included the proposed level of investment for each TSM program by phasing period.

	Investment Level (FY 2019\$)			
	2019-2025	2026-2035	2036-2050	2019-2050
<b>Table E.1 Transportation System Management</b>				
<i>Transportation System Management (TSM) Core Program Costs (2019-2050)</i>				
Multimodal Management	\$36	\$18	\$30	\$84
Traveler Information Program	\$13	\$19	\$19	\$51
Arterial Management	\$17	\$208	\$46	\$270
Freeway Management	\$17	\$48	\$22	\$87
Transit Management-Bus	\$30	\$30	\$0	\$60
Transit Management-Rail	\$18	\$18	\$11	\$48
<b>Subtotal</b>	<b>\$131</b>	<b>\$341</b>	<b>\$128</b>	<b>\$600</b>
<i>New TSM Elements Costs (2019-2050)</i>				
Vehicle Technologies	\$6	\$23	\$0	\$29
Advanced Transportation Technology Program	\$23	\$17	\$17	\$57
Universal Transportation Account	\$64	\$30	\$64	\$157
Transit Infrastructure Electrification/Regional Charger Program	\$0	\$17	\$29	\$46
Smart Parking	\$6	\$23	\$6	\$34
<b>Subtotal</b>	<b>\$99</b>	<b>\$110</b>	<b>\$116</b>	<b>\$325</b>
<b>Total Cost</b>	<b>\$230</b>	<b>\$451</b>	<b>\$244</b>	<b>\$925</b>

## Transportation Demand Management Program

SANDAG coordinates a number of transportation alternative programs that are increasing the number of commuters who carpool, vanpool, take transit, bike, walk, and telework. Program costs associated with each TDM component are a reflection of the total proposed level of investment (in 2019 dollars) out to 2050 (Table E.2).

	San Diego Forward Investment Level (FY 2019\$)			
	2019-2025	2025-2035	2036-2050	2019-2050
<i>Transportation Demand Management (TDM) Core Program Costs (2019-2050)</i>				
Regional Vanpool Program	\$36	\$114	\$171	\$321
Employer Services and Outreach	\$25	\$59	\$42	\$126
Commuter Services and Bike Program	\$7	\$11	\$11	\$29
Program Administration	\$11	\$23	\$22	\$56
<b>Subtotal</b>	<b>\$79</b>	<b>\$207</b>	<b>\$246</b>	<b>\$532</b>
<i>New TDM Elements Costs (2014-2050)</i>				
Mobility Hubs	\$59	\$235	\$0	\$294
Active Traffic and Demand Management	\$34	\$147	\$18	\$199
Shared Mobility Services	\$14	\$28	\$0	\$42
<b>Subtotal</b>	<b>\$186</b>	<b>\$410</b>	<b>\$18</b>	<b>\$535</b>
<b>Total Cost</b>	<b>\$163</b>	<b>\$617</b>	<b>\$264</b>	<b>\$1067</b>

The TDM Program is comprised of the following major investment areas:

The **Regional Vanpool Program** provides commuter groups of five or more with a cost-effective alternative to driving alone. SANDAG contracts with vanpool vendors that provide vehicles, maintenance, and insurance. SANDAG provides a \$400 per month subsidy to qualified vanpools, reducing the lease cost. This program, estimated at \$321 million, aims to increase the number of vanpools in the region 13 percent by 2020, 62 percent by 2035, and 110 percent (more than doubling) by 2050.

Through its **Employer Services and Outreach Program**, SANDAG provides assistance to local businesses, helping them develop and implement customized employee commuter benefit programs that lower costs, increase productivity, and help the environment. This program aims to increase commuter awareness of, and participation in, TDM programs and campaigns; and, incentivize the formation of approximately 18,000 new carpools between now and 2050. The level of investment for this component is estimated at \$126 million.



**Commuter Services and Bike Program**, with a proposed investment level of \$29 million, this facilitates the use of transportation alternatives by providing supporting services. The Guaranteed Ride Home (GRH) Program provides a free ride home for alternative commuters up to three times per year in the event of a family emergency or illness, unscheduled overtime, carpool or vanpool driver not being available, or being stranded at work due to a bike problem. The Bike Program supports the regional bike network by providing mini-grants and offering complimentary bike education classes and rides for employers and schools as well as offering more than 700 bike lockers at over 60 locations throughout San Diego County.

**Program Administration** includes management of the regional online tools and technologies such as Salesforce to facilitate the use of transportation alternatives, with an investment level of \$56 million.

**Mobility Hubs** are transportation centers located in smart growth opportunity areas served by high frequency transit service. They provide an integrated suite of transportation services, amenities, and urban design enhancements that bridge the distance between transit and an individual's origin or destination. Mobility hubs are places of connectivity, where different modes of travel—walking, biking, ridesharing, *Rapid* and light rail services—come together seamlessly, and where there is a concentration of employment, housing, shopping, and/or recreation. Mobility hubs feature a range of transportation choices including: bikeshare, carshare, neighborhood electric vehicles, bike parking, dynamic parking management strategies, real-time traveler information, real-time ridesharing, demand-based shuttle or jitney services, bicycle and pedestrian improvements, wayfinding, urban design enhancements, and supporting systems like mobile applications, electric vehicle charging, smart intersections, and a universal payment system to make it easy to access a wide range of travel choices.

San Diego Forward investments such as Trolley, SPRINTER, COASTER, and *Rapid* services are all candidates for mobility hub investment. Twenty mobility hub opportunity areas would be identified for the Regional Transportation Plan at an investment level of \$294 million. SANDAG has developed a Regional Mobility Hub Strategy that demonstrates how mobility hubs can be implemented in the San Diego region to improve mobility for all users including seniors and individuals with disabilities. Pilot projects are being implemented to demonstrate how mobility hub concepts can support and complement transit.

**Active Traffic and Demand Management** builds on Integrated Corridor Management (ICM) to dynamically monitor, control, and influence travel demand, traffic demand, and traffic flow of key highway corridors. Active Traffic and Demand Management (ATDM) facilitates the use of transportation alternatives through various approaches, including dynamic ridesharing, dynamic speed limits, dynamically priced parking, and predictive traveler information to improve overall highway efficiency and to maximize investment in ICM. ATDM seeks to improve throughput and traveler safety on key High Occupancy Vehicle (HOV) or Managed Lanes corridors through a proposed \$199 million investment. Regional Transportation Plan ATDM investments are phased in conjunction with corridor HOV/Managed Lanes improvements.

**Shared Mobility Services** can fill gaps in the region's transit services and provide an efficient transportation alternative for commute and non-commute trips. Examples of shared mobility services include: carsharing, bikesharing, real-time ridesharing, Transportation Network Companies (e.g., Uber, Lyft), neighborhood electric vehicles, scootershare, and on-demand shuttle and jitney services.

The TDM Program for the Regional Transportation Plan seeks to expand the reach of shared mobility services to employment centers and urban communities, and to complement and improve access to regional transit services. The proposed level of investment is \$42 million through 2050.