Mobility Management

Guidebook

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1. Introduction

As population and economic activity continue to grow in San Diego County, the region faces the challenge of ensuring high levels of mobility and accessibility while preserving the region's quality of life. Single occupancy vehicle (SOV) travel contributes to traffic congestion, greenhouse gas and local air pollutant emissions, and related public health and environmental impacts. Reducing SOV and its associated impacts can help the regional achieve a number of sustainability goals.

Improving access to multimodal travel options and reducing SOV also creates economic benefits for a region's residents, businesses, and local governments. A robust multimodal transportation system and less automobile reliance will help the San Diego metropolitan area remain competitive in attracting the creative and skilled workers needed to grow the region's economy.

Defining Mobility Management

Mobility management can help meet the mobility needs of the region without costly investment in large capital projects. Mobility management includes Transportation Demand Management (TDM) strategies such as programs and services that help encourage transportation alternatives, reduce reliance on the private automobile for travel, and reduce vehicle miles traveled (VMT) and greenhouse gas emissions. Examples of TDM strategies include carshare and vanpool programs, telework, commute benefit programs, active transportation improvements, and parking management.

Mobility management also encompasses Transportation System Management (TSM), which refers to strategies that optimize transportation system operations and performance. This can include strategies like traffic signal synchronization, traveler information systems, freeway ramp metering, and traffic incident management. Recent advancements in technology and active transportation demand management (ATDM) have multimodal benefits and can improve the mobility and safety of non-auto modes through improvements that prioritize and improve responsiveness to bicycles and pedestrians through strategies like transit signal priority and bike signal systems.

Mobility Management at the Regional Level

Mobility management is a key component of San Diego Forward: The Regional Plan (2015 Regional Plan). The 2015 Regional Plan, including its Sustainable Communities Strategy (SCS), is built on an integrated set of public policies, strategies, and investments to maintain, manage, and improve the transportation system so that it meets the diverse needs of the San Diego region through 2050. The SCS is a required element of the Regional Plan per California Senate Bill 375 (Steinberg, 2008) (SB 375) and details how integrated land use and transportation planning will lead to lower greenhouse gas (GHG) emissions and a more sustainable future for the San Diego region.

Mobility management strategies play a critical role in achieving regional VMT reductions to help achieve the GHG emission reduction targets established by the California Air Resources Board (CARB) as required by SB 375. To learn more about the 2015 Regional Plan, visit sdforward.com.

Senate Bill 743 and Transportation Impacts Under the California Environmental Quality Act

In 2013, Senate Bill 743 (Steinberg, 2013) (SB 743) was passed by the California legislature, which directed the Office of Planning & Research (OPR) to develop an alternative mechanism for evaluating transportation impacts under the California Environmental Quality Act (CEQA) in replacement of vehicle delay or level of service (LOS). SB 743 required OPR to provide a transportation

analysis framework that prioritizes greenhouse gas emissions, promotes alternative transportation, and encourages sustainable land uses. In December 2018, the California Natural Resource Agency certified and adopted the CEQA Guidelines update, which identifies VMT as the most appropriate measure of transportation impacts. With these changes, automobile delay, as measured by "level of service" and other similar metrics, generally no longer constitutes a significant environmental effect under CEQA.[1]

The implementation of mobility management strategies can help mitigate transportation impacts associated with proposed projects under the CEQA Guidelines update. For more information on the CEQA Guidelines updates, visit resources.ca.gov/ceqa. OPR has developed key resources and technical recommendations on SB 743; these resources are available at opr.ca.gov/ceqa/updates/sb-743/.

Climate Action Planning Efforts

Mobility management also supports local and regional climate action planning efforts. To help avoid the impacts of climate change, the State has the following statewide GHG reduction targets and goals, grounded in legislation or Executive Orders:

- Assembly Bill 32 (Nunez, 2006): Reduce Statewide GHG emissions to 1990 levels by 2020
- Senate Bill 32 (Pavley, 2016): Reduce Statewide GHG emissions to 40% below 1990 levels by 2030
- Executive Order S-3-05: Reduce Statewide GHG emissions to 80% below 1990 levels by 2050

The transportation sector is the largest contributor to GHG emissions in California. The State's climate change plans recognize that while some of the GHG reductions in the transportation sector will come from vehicle technologies and low carbon fuels, VMT-reduction strategies also are necessary to achieve the targets.

To aid in achieving statewide GHG reduction targets, CARB established GHG-reduction target recommendations for local governments. Many local governments in the San Diego region have adopted Climate Action Plans (CAPs) that detail local efforts to reduce GHG emissions. Mobility management strategies that reduce VMT at the community level are important components of these plans and contribute to local governments meeting their CAP goals and targets. To learn more about Regional CAP efforts, visit sandag.org/climate.

Toolbox Overview and Purpose

To respond to the multiple efforts outlined above, SANDAG has developed the Mobility Management Toolbox (Toolbox). The Toolbox will help local jurisdictions and developers evaluate and implement mobility management strategies at the project and community level. The Toolbox is intended to serve as a key resource as jurisdictions implement SB 743 and to support CAP implementation and monitoring.

The Toolbox in its entirety consists of the following resources:

- Mobility Management Guidebook
- VMT Reduction Calculator Tool
- Calculator Design Document
- Recommendations for Application
- User Training Videos

[1] Governor's Office of Planning and Research, "Technical Advisory on Evaluating Transportation Impacts in CEQA," December 2018.

The **Mobility Management Guidebook** identifies a wide array of mobility management strategies for implementation. Descriptions, implementation considerations, and key references are available for each of the strategies. Strategies in the Guidebook are organized into six main categories: Employer Commute Programs, Land Use Strategies, Parking Management, Neighborhood Enhancements, Transit Strategies, and Transportation System Management.

The **VMT Reduction Calculator** serves as an accompanying tool to this Guidebook. It allows users to estimate the percent reduction in VMT resulting from mobility management implementation. Strategies in the VMT-reduction tool are organized into two application scales: Project/Site-level and Community/City-level.

The **Calculator Design Document** details the methodology used to develop the VMT Reduction Calculator. This includes comprehensive documentation of the formulas, assumptions, data sources, and references used.

The **Recommendations for Application** highlights how the Toolbox can help support and complement existing local and regional efforts.

User Training Videos provide instructional guidance on how to use and update the VMT Reduction Calculator Tool.

Section 2 of this guidebook describes considerations for the selection of appropriate mobility-management strategies based on the project scale and type. **Section 3** contains one-page summaries of 39 different strategies. **Section 4** discusses some implementation considerations to maximize the effectiveness of mobility management, including opportunities to promote strategies during planning and project development and performance measures for monitoring effectiveness. **Section 5** provides a brief overview of the VMT Reduction Calculator Tool.

2. Selecting strategies

Mobility management can be applied throughout San Diego County and at different geographic levels – from a single site or development project to a corridor, neighborhood, city, or the entire region. Mobility management also addresses a variety of trip types. While TDM has historically focused on commute trips, many strategies also can address non-work trips such as those associated with shopping, recreation, school, and even commercial vehicle travel and goods movement.

An individual mobility management strategy is most effective when applied at the appropriate scale or to target specific types of trips. At the highest level, mobility management strategies can be categorized into those applied at the **project or site level** versus those for **community or city level** application. Within these two major categories, many factors affect the selection of appropriate strategies, as illustrated below.

When selecting strategies for evaluation, the following factors should be considered.

Level of urbanization

The level of urbanization is closely related to built environment parameters such as land use density, land use mixing, and parking prices, which influence which mobility management strategies may be most effective.

Urban core areas have the most intense development levels in the region. Most housing is in the form of multifamily buildings or attached dwelling units (townhouses). The land values and densities found in these areas are often needed to support strategies such as parking cash-out, carshare, and bikeshare.

Compact communities often surround urban core areas and feature a mix of multifamily residential buildings and single-family detached homes on relatively small lots.

Corridors in these areas often include a mix of commercial and residential land uses. Land use density and mixing are often effective strategies in these areas, along with parking pricing, transit improvements, and bikeway network expansion.

Suburban communities primarily consist of single-family detached homes. These communities also may include retail, office, and light industrial land uses, with little to no mixing with residential uses. Employment centers in suburban communities may be good candidates for employer commute trip-reduction programs.

Rural communities are usually located far from urban core areas. They feature almost exclusively single-family detached homes, often on large lots, interspersed with significant open space or agricultural land, with few or no employment centers. Many of the mobility management strategies presented in this document are not appropriate for rural communities, although long-distance commuters living in rural areas may be good candidates for rideshare or vanpool programs.

Level of transit service

The level of transit service available to a site or community affects the available transportation options and the appropriateness of certain mobility management strategies.

High transit service areas are served by multiple transit routes (bus or rail), often with headways of 15 minutes or less during peak periods. For an individual site, high proximity to transit typically means being less than one-half mile from a rail transit station or directly on a high-frequency bus route. The areas around transit hubs are often good locations for bicycle and pedestrian improvements as well as other mobility hub services such as carsharing and microtransit.

Low transit service areas may have only one or two routes, and headways are often 30 minutes or more. Transit service is infrequent or nonexistent during off-peak and evening hours. In these areas, transit network expansion and frequency improvements can help attract more transit riders.

No transit service areas have no regular fixed-route service. These areas may be served by demand-responsive paratransit providers.

Bicycle and pedestrian infrastructure

The presence of and proximity to bikeways and pedestrian infrastructure is another factor to be considered in strategy selection.

Bicycle travel is a more feasible option if a site is located on a Class II bikeway (striped bike path) or a Class IV separated bikeway (cycle track). At intersections, areas with robust bicycle infrastructure include features such as bike boxes, bike actuated signals, and colored pavement to demarcate conflict zones. The density of bicycle infrastructure can be measured as the miles of bike paths and bike lanes per square mile.

The **pedestrian environment** is determined by components such as the ratio of sidewalk coverage (linear miles of sidewalks to street centerline miles), sidewalk width, and the presence of crosswalks. The pedestrian environment also is influenced by traffic speeds, building accessibility to pedestrians, and amenities like signage and street furniture.

Property ownership versus tenant

Some strategies are more appropriate for the owner or developer of a property, while others can be implemented by a tenant. For example, project characteristics like density and land use mixing or capital improvements such as on-site bike amenities and flexible curb space are more appropriate for a developer or property owner to implement during the project build-out. Strategies such as vanpool programs and discounted transit passes are more appropriate for the occupant or tenant to implement and monitor.

Employer type

For strategies that are being considered by an individual employer or a large single site with multiple employers (e.g., a medical center), the size and nature of jobs can affect mobility management strategy selection. Job centers that feature large numbers of employees working regular hours (e.g., standardized shifts) often are good candidates for vanpool and rideshare programs. These sites can include urban and suburban office developments, industrial and warehousing facilities, medical centers, and some retail centers.

3. Strategy descriptions

This section presents one-page summaries of 39 mobility management strategies, listed on the following page. Strategies for which a VMT reduction can be estimated are indicated with a √ and are included in the accompanying VMT Reduction Calculator Tool. Strategies will be updated as more research becomes available.

Mobility management strategies in this toolbox are organized into the following six categories, with color-coding used help locate strategies both in this Guidebook and the VMT Reduction Calculator Tool:

- Employer Commute Programs
- Land Use Strategies
- Parking Management
- Neighborhood Enhancements
- Transit Strategies
- Transportation System Management

	Strategy Type	Strategy Name	Included in VMT Calculator?
Project/Site Level	Employer Commute Programs	Comprehensive Employer Commute Program	√
		Employer Carpool Program	√
		Employer Transit Pass Subsidy	√
		Employer Vanpool Program	√
		Employer Telework Program	√
		Employer Guaranteed Ride Home Program	
		On-Site Bike Amenities	
	Land Use Strategies	Higher-Density Development	
		Transit-Oriented Development	√
		Mixed-Use Development	√
	Parking Management	Parking Pricing	√
		Parking Cash-Out	√
		Reduced Parking	
		Unbundled Parking	
		Smart Parking	
		Shared Parking	
		Shared Mobility Parking	
		Flexible Curb Space	
Community/City Level	Neighborhood Enhancements	Street Connectivity Improvement	√
		Pedestrian Facility Improvement	√
		Bikeway Network Expansion	√
		Bike Facility Improvement	√
		Bikeshare	√
		Carshare	√
		Community-Based Travel Planning	√
	Transit Strategies	Transit Service Expansion	√
		Transit Frequency Improvements	√
		Transit-Supportive Treatments	√
		Transit Fare Reduction	√
		Microtransit NEV Shuttle	√
		Microtransit Commuter Shuttle	
	Transportation System Management	Adaptive Traffic Signal Systems	
		Smart Signals and Intersections	
		Optimized Signal Timing for Bicycles	
		Advanced Bicycle Detection	
		Real-Time Traveler Information	
		Active Traffic Management	
		Traffic Incident Management	
		Roadway Weather Management	

COMPREHENSIVE EMPLOYER COMMUTE PROGRAM

A comprehensive employer commute program offers a suite of services that incentivize employees to not drive alone to work. Elements can include a carpool program, vanpool program, discounted transit passes, bike amenities, encouragement for teleworking and alternative work schedules, trip-reduction marketing, commuter recognition program, and preferential parking permits. This program is most effective when paired with a TDM ordinance or requirement and incorporates regular performance monitoring and reporting.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Reduction of up to 26% of work trip VMT

VMT reduction affected by:

- Program elements
- Portion of employees eligible for participation
- To achieve the maximum VMT reduction, the program must include required performance standards (e.g., trip-reduction requirements) and regular monitoring and reporting of impacts.

IMPLEMENTATION CONSIDERATIONS

- The availability of transportation services and the land use characteristics will affect program design.
- The SANDAG iCommute program provides assistance and tools to help employers design and implement customized programs to meet employer goals.
- iCommute can coordinate on-site events and provide marketing materials and promotional incentives that are customized for employers.

COMPLEMENTARY STRATEGIES

- Parking Pricing
- Parking Cash-Out
- Reduced Parking

CASE STUDY

Genentech, a large biotechnology company in South San Francisco, provides a comprehensive and highly effective commute trip-reduction program. The program includes carpool incentives, a campus-wide bicycle program, guaranteed ride home services, campus shuttles, and commuter buses. Between 2006 and 2014, drive-alone mode share dropped from 74% to 55%, reflecting a 26% reduction in SOV trips.

IMPLEMENTATION RESOURCES

- iCommute San Diego Employer Services icommutesd.com/employers/employer-services
- SANDAG Integrating Transportation Demand Management into the Planning and Development Process sandag.org/uploads/publicationid/publicationid_1663_14425.pdf

REFERENCE

2015 Genentech Annual Report, City of South San Francisco, ci-ssf-ca.granicus.com/

Victoria Transport Policy Institute, TDM Encyclopedia, vtpi.org/tdm/.

EMPLOYER CARPOOL PROGRAM

Carpooling allows travelers to share a ride to a common destination. Common carpool models include casual carpooling, also known as slugging, or dynamic carpooling, which leverages a mobile app to facilitate carpool matching and pick-up arrangements. Employers can establish carpool programs to provide ride-matching assistance, rideshare promotion and discounts, or pretax commuter benefits, making it easier and more attractive for employees to carpool to work; reduce demand for parking; and provide financial and tax benefits for employers.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Reduction of up to 8% of work trip VMT

VMT reduction affected by:

- Location of project (urban, suburban center, low-density suburb).
- Portion of employees eligible for participation.
- Average trip distance.

IMPLEMENTATION CONSIDERATIONS

- Often implemented as part of comprehensive employer commute trip-reduction program.
- Most appropriate where the majority of employees are centralized in a location and working regular hours.
- Employees who carpool can travel on toll roads or managed lanes to reduce travel times.
- Employers can offer preferential parking locations for carpools to encourage carpooling.
- Employers can provide a monthly subsidy or cash incentive for employees who don't drive alone to work.

COMPLEMENTARY STRATEGIES

- Employer Guaranteed Ride Home Program
- Employer Telework Program
- Parking Cash-Out
- Priority Carpool Parking

CASE STUDY

Watkins Wellness is a leading producer of hot tubs, headquartered in Vista, CA. One in four employees at Watkins Wellness share a ride in a carpool or vanpool and take advantage of priority parking spaces. Employees may set aside pretax dollars through payroll to cover their commute expenses and reduce taxable income.

IMPLEMENTATION RESOURCES

- iCommute Carpool Incentive Pilot Program icommutesd.com/employers/employer-services
- iCommute carpooling resources for commuters icommutesd.com/carpool/carpool
- Waze Carpool step-by-step guide icommutesd.com/docs/default-source/rs13/waze-carpool--how-to-be-a-driver-or-rider-guide.pdf?sfvrsn=2

REFERENCE

Association for Commuter Transportation, "Getting to Work: Spotlight on employer-sponsored commuter programs, 2017, actweb.org/wp-content/uploads/2017/01/Getting-to-Work-Jan-2017-Final.pdf

TRIMMS (Trip Reduction Impacts of Mobility Management Strategies) tool, developed by the National Center for Transit Research and the Center for Urban Transportation Research at the University of South Florida, trimms.com/

EMPLOYER TRANSIT PASS SUBSIDY

Employers can provide subsidized or discounted transit passes to incentivize employees to commute via transit. Employers also may buy passes in bulk for a discounted rate or offer pre-tax savings for transportation assistance to pay for transit passes.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Reduction of up to 11% of work trip VMT

VMT reduction affected by:

- Portion of transit fare subsidized.
- Level of transit service in project area.

IMPLEMENTATION CONSIDERATIONS

- Applicable in areas where employees have reliable access to transit to and from work or home.
- Employers can elect to provide partial or full transit pass subsidies for employees.
- San Diego employers can buy transit passes in bulk at a discounted rate, 10%–25%, through the Metropolitan Transit System ECO Pass Program.
- Under the Transportation Equity Act, IRS code 132(f), and California state law, employees can save money by purchasing transit passes or vanpool vouchers with pre-tax dollars, up to $265 per month.
- San Diego's Try Transit program is an employee benefit program for employers located within 0.5 miles of a transit stop that provides eligible employees with a 30-day pass to try one of the region's transit options.

COMPLEMENTARY STRATEGIES

- Parking Pricing
- Parking Cash-Out
- Reduced Parking
- Comprehensive Employer Commute Program
- Employer Guaranteed Ride Home Program

CASE STUDY

Fairfax County is located in the Northern Virginia suburbs of the Washington metro area. The county's Smart Benefits "Plus50" program pays commuters $50 to try commuting with public transit. The incentive only requires employees to take one trip to qualify; however, one participating employer reports that 67% of employees who received the subsidy continued using transit a year later.

IMPLEMENTATION RESOURCES

- iCommute Employer Services: Try Transit icommutesd.com/employers/employer-services
- iCommute financial incentives icommutesd.com/employers/financial-incentives
- Compass Card ECO Pass Program sdmts.com/fares-passes-pass-programs/employer-programs
- Metropolitan Transit System, sdmts.com/
- North County Transit District, gonctd.com/

REFERENCE

California Air Resources Board. "Impacts of Transit Service Strategies on Passenger Vehicle Use and Greenhouse Gas Emission." October 8, 2013. arb.ca.gov/cc/sb375/policies/transitservice/transit_bkgd.pdf

City of Carlsbad. "Ordinance No. CS-350." Transportation Demand Management. March 12, 2019. edocs.carlsbadca.gov/HPRMWebDrawer/RecordHTML/533069

EMPLOYER VANPOOL PROGRAM

Vanpooling is a flexible form of public transportation that provides groups of 5–15 people with a cost-effective and convenient rideshare option for commuting. Vanpoolers typically meet at a common pick-up location like a Park & Ride for their commute and may share driving responsibilities. An employer can encourage ridesharing by subsidizing vanpooling for employees who have a similar origin and destination, providing priority parking for employees who vanpool, and pre-tax benefits savings.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Reduction of up to 7% of work trip VMT

VMT reduction affected by:

- The number of vanpools established.
- The extent to which vanpool riders previously were driving alone, carpooling, or other.
- The extent to which vanpool riders drive to a vanpool pick-up location.
- The average length of vanpool trips.

IMPLEMENTATION CONSIDERATIONS

- Most appropriate for larger employers with workers centralized in one location and working regular hours.
- Most appropriate for employers that have workers who are making long commutes.
- Employees who vanpool can travel on toll roads or managed lanes to reduce travel times.
- Employers can offer preferential parking locations for vanpools to encourage vanpooling.
- Employers can provide a monthly subsidy or cash incentive for employees who don't drive alone to work.
- Under federal and state law, employers are allowed to offer payroll pre-tax savings for transportation assistance—up to $265 a month per employee.

COMPLEMENTARY STRATEGIES

- Often implemented as part of a Comprehensive Employer Commute Program

CASE STUDY

Illumina, a global biotechnology company headquartered in San Diego, helps pay for those who vanpool by providing each person with $130 per month for expenses. The program grew to 18 vanpools in 2018.

IMPLEMENTATION RESOURCES

- The SANDAG Vanpool Program provides a subsidy of up to $400 per month to offset the lease cost. Employees may be eligible for additional incentives from their employer. See icommutesd.com/vanpool/vanpool

REFERENCE

TCRP Report 95: Traveler Response to Transportation System Changes Handbook, Third Edition, Chapter 5, Vanpools and Buspools, 2005.
trb.org/Publications/Blurbs/156124.aspx

EMPLOYER TELEWORK PROGRAM

Teleworking programs encourage employees to work from home or an alternative non-work location. Depending on the nature of the work, schedules can range from full-time, specific days of the week, or as needed. Teleworking has the potential to significantly reduce commuter VMT, depending on the distance the employee lives from work but may have indirect effects associated with employees making non-work trips (errands, etc.) during the day.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Reduction of up to 44% of work trip VMT

VMT reduction affected by:

- Percentage of participating employees.
- Telework schedule.

IMPLEMENTATION CONSIDERATIONS

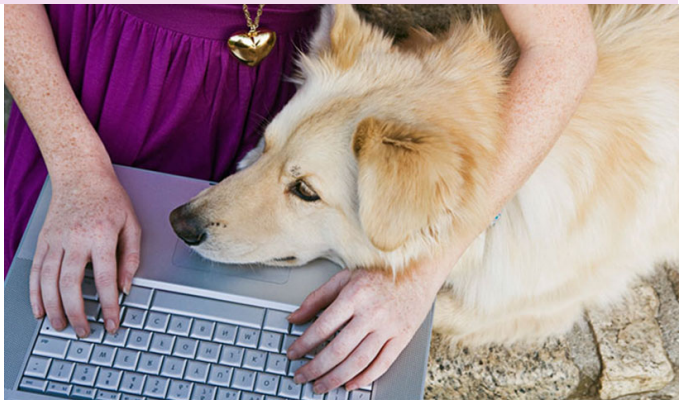
- Employees who telework may require office equipment or IT support during work hours. Many employers provide an employer-issued laptop for teleworking purposes.
- Teleworking is well-suited for all types of commuters, especially for those with longer commutes (greater than 20 miles one way).
- While teleworking may reduce commute trips, it may have unintended effects, such as increased driving during the day and incentivizing employees to live further from jobs, thereby inducing sprawl.

COMPLEMENTARY STRATEGIES

- Often implemented as part of a Comprehensive Employer Commute Program

CASE STUDY

The 2015/2016 TeleworkSD pilot project provided free consulting services and resources to four employers of varying sizes from different industries who wanted to explore and implement telework programs in San Diego County. Based on a survey of the 77 participating teleworkers, the pilot eliminated 22,656 trips annually. Further, managers of the teleworkers reported perceived gains in productivity after implementation of the pilot.



IMPLEMENTATION RESOURCES

- iCommute telework resources and benefits icommutesd.com/telework/telework-default
- iCommute telework FAQ icommutesd.com/docs/default-source/telework/telework-faqs.pdf?sfvrsn=0
- TeleworkSD Demonstration Project: Report icommutesd.com/docs/default-source/telework/recent-study.pdf?sfvrsn=0Waze Carpool step-by-step guide

REFERENCE

Cambridge Systematics. Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions. 2009. Technical Appendices. reconnectingamerica.org/assets/Uploads/2009movingcoolerexecsumandappend.pdf

California Air Pollution Control Officers Association. "Quantifying Greenhouse Gas Mitigation Measures." August 2010. capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

EMPLOYER GUARANTEED RIDE HOME PROGRAM

An Employer Guaranteed Ride Home (GRH) Program offers employees who choose to commute alternatively with an emergency ride home in the event of unanticipated circumstances like unexpected personal or family illness or unscheduled overtime. A Guaranteed Ride Home Program can provide a sense of security for employees who may want to commute alternatively but may have concerns about being stranded at work in the event of an emergency.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Minimal impact on VMT when implemented in isolation

VMT reduction occurs only if this strategy is implemented in conjunction with other employer-based TDM strategies.

IMPLEMENTATION CONSIDERATIONS

- This strategy is often implemented as part of a Comprehensive Employer Commute Program.
- Employers may sponsor and implement a GRH program for their employees.
- Employees in the San Diego region can register and participate in the regional Guaranteed Ride Home program offered by the SANDAG iCommute program (see Resources).

COMPLEMENTARY STRATEGIES

- Employer Carpool Program
- Employer Vanpool Program
- Employer Transit Pass Subsidy
- Microtransit Commuter Shuttle

CASE STUDY

San Luis Obispo County offers a Guaranteed Ride Home for commuters using alternative travel modes. In the event of an emergency or other unplanned circumstance, the program provides up to six GRH vouchers per fiscal year that allow participants to take a taxi, Uber, or Lyft or rent a car from Enterprise Rent-a-Car. The program reimburses participants who meet the GRH criteria at up to $55 per ride.

IMPLEMENTATION RESOURCES

- iCommute Guaranteed Ride Home program icommutesd.com/Commuters/Guaranteed-Ride-Home
- How to Get a Guaranteed Ride Home with iCommute youtube.com/watch?v=aSRSNpcN8Fk

REFERENCE

Victoria Transport Policy Institute, TDM Encyclopedia: Guaranteed Ride Home, vtpi.org/tdm/tdm18.htm

TRIMMS (Trip Reduction Impacts of Mobility Management Strategies) tool, developed by the National Center for Transit Research and the Center for Urban Transportation Research at the University of South Florida, trimms.com/

ON-SITE BIKE AMENITIES

Employers and property owners can encourage their tenants to commute by bike by providing on-site amenities such as secure bike parking, bike repair stations, and showers and changing facilities. On-site bike amenities paired with bike safety education and bike repair stations can help promote biking as a feasible alternative to driving. Bike education is typically offered by local and national bicycle advocacy groups that provide mechanical safety checks and instruction on safe riding skills.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Minimal impact on VMT when implemented in isolation

Most effective when implemented in conjunction with bike infrastructure improvements and employer commuter benefits programs.

IMPLEMENTATION CONSIDERATIONS

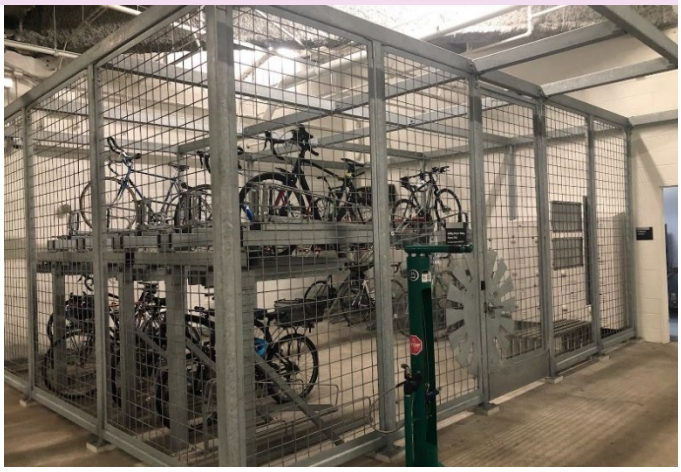
- Consider the overall needs for the operation, staffing, maintenance, and security of bike parking facilities.
- Consider providing bike amenities such as bike repair tools, tire pumps, and electric bike charging stations.
- Employers may further encourage biking to employees by hosting bike education courses and bike tune-ups for employees.
- Employers with robust bike programs can apply to be a "Bicycle Friendly Business" as designated by the League of American Bicyclists.

COMPLEMENTARY STRATEGIES

- Bikeway Network Expansion
- Employer Guaranteed Ride Home Program
- Parking Cash-Out
- Reduced Parking

CASE STUDY

Coca-Cola has been a leading employer in its hometown of Atlanta for over a century. The company's two-person transportation team works with employees and executives to encourage use of alternative modes including bicycle commuting. As part of this effort, the company converted a covered executive parking area into parking for 300 bikes, including seating and a bike repair station. The company also has installed showers and lockers adjacent to a main entrance.



IMPLEMENTATION RESOURCES

- iCommute GO by BIKE Employer Services icommutesd.com/bike/BTWDEmployerServices.aspx
- Bicycle Friendly Business℠ program of the League of American Bicyclists bicyclefriendly.secure-platform.com/a/page/business
- LEED/Green Buildings: The Positive Impact of Bike Amenities bikefixation.com/resources/leedgreen-building

REFERENCE

Victoria Transport Policy Institute, TDM Encyclopedia: Bicycle Parking vtpi.org/tdm/tdm85.htm

HIGHER-DENSITY DEVELOPMENT

Projects developed at higher density and located proximate to alternative transportation services demonstrate reduced drive-alone rates compared to lower-density developments. Higher-density development contributes to the viability of a wider range of businesses, ultimately resulting in more destinations for residents and employees to walk to. Areas with higher density have lower automobile mode share, and those who do travel by auto exhibit shorter vehicle trips because of the close proximity of destinations.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

VMT impact varies widely and depends on provision of other strategies

VMT reduction affected by:

- Project density as compared to current and surrounding area density.
- Availability of multimodal travel options.

IMPLEMENTATION CONSIDERATIONS

- Development density is often limited by the General Plan and/or zoning ordinance.
- Careful attention to design is needed to ensure that higher-density projects enhance neighborhood character and ensure a walkable environment.

COMPLEMENTARY STRATEGIES

- Mixed-Use Development
- Transit-Oriented Development
- Parking Cash-Out
- Reduced Parking
- Employer Transit Pass Subsidy
- Pedestrian Facility Improvement
- Real-Time Traveler Information

CASE STUDY

One Paseo Del Mar is a mixed-use development in the Carmel Valley neighborhood of San Diego. The project includes six- and four-story office buildings and 608 residential units in an urban village layout connected by walkways and public spaces.

IMPLEMENTATION RESOURCES

- SANDAG created an Excel tool and guidance to help users calculate trip-reduction potential for "smart growth" developments, Trip Generation for Smart Growth: Planning Tools for the San Diego Region. sandag.org/index.asp?projectid=334&fuseaction=projects.detail#generation
- The Local Government Commission and the U.S. EPA have documented community-led efforts to create vibrant neighborhoods through density. *Creating Great Neighborhoods: Density in Your Community*. epa.gov/smartgrowth/creating-great-neighborhoods-density-your-community

REFERENCE

Ewing, R., and Cervero, R., "Travel and the Built Environment – A Meta-Analysis." Journal of the American Planning Association, 2010.

Lewis, S., "Neighborhood density and travel mode: new survey findings for high densities." International Journal of Sustainable Development & World Ecology, 2018. tandfonline.com/doi/abs/10.1080/13504509.2017.1321052?journalCode=tsdw20.

TRANSIT-ORIENTED DEVELOPMENT

Transit-Oriented Development (TOD) refers to projects built in walkable areas that have easy access to public transit and typically offer a mix of uses, including housing, retail, offices, and/or community facilities. TOD should be built within a half-mile of a high-frequency rail transit station (e.g., SPRINTER, COASTER, Trolley) and, at a minimum, incorporate adequate bike and pedestrian facilities that facilitate connections to and from transit, encouraging transit use and reducing single-occupancy vehicle use.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Reduction of up to 14% of project VMT

VMT reduction affected by:

- Current transit mode share in project area.
- Proximity and access to transit station.
- Frequency of and accessibility provided by nearby transit service.

IMPLEMENTATION CONSIDERATIONS

- Transit corridors that provide direct connections to the region's downtown or major employment centers are significantly more likely to attract new TOD compared to transit lines that do not serve these destinations.
- Walking and biking are essential to the success of TOD.

COMPLEMENTARY STRATEGIES

- Higher-Density Development
- Mixed-Use Development
- Reduced Parking
- Employer Transit Pass Subsidy
- Bikeshare

CASE STUDY

Villa Encantada Apartments was completed in 2019 as a TOD that provides 67 affordable, high-quality apartments and 1,000 square feet of neighborhood-serving retail. Located at the 62nd/Encanto Trolley Station, the project was developed as a partnership between MTS and AMCAL Multi-Family Housing. The apartment complex is a 20-minute Trolley ride to downtown via the Orange Line.

Image source: San Diego Metropolitan Transit System

IMPLEMENTATION RESOURCES

- SANDAG developed a Regional TOD Strategy as part of San Diego Forward: The Regional Plan to promote and incentivize sustainable development throughout the region. A variety of reports are available at: arb.ca.gov/cc/sb375/policies/transitservice/transit_brief.pdf

REFERENCE

Lund, H., et al. 2004. "Travel Characteristics of Transit-Oriented Development in California." bart.gov/sites/default/files/docs/Travel_of_TOD.pdf

Tal, G., et al. 2013. "Technical Background Document on the Impacts of Transit Access (Distance to Transit) Based on a Review of the Empirical Literature." arb.ca.gov/cc/sb375/policies/transitservice/transit_brief.pdf

MIXED-USE DEVELOPMENT

Locating activities closer together can create vibrant and diverse communities, allow trips to be made by walking and bicycling rather than by driving, and increase the opportunity for trip chaining. Complementary mixed land uses can include a combination of housing, retail, services, offices, and other. Mixed land uses also minimize trip distances and tend to reduce automobile ownership among residents. In addition, mixed-use development helps minimize parking demand by encouraging people to park once and fulfill their trip purpose without needing to make additional trips.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Reduction of up to 30% of project VMT

VMT reduction affected by:

- Proposed mixed land uses compared to the current and surrounding land uses.
- Availability of multimodal travel options.

IMPLEMENTATION CONSIDERATIONS

- Incentives to encourage mixed-use development include innovative zoning tools, density bonuses (permitting greater density than permitted under zoning guidelines), relaxed requirements to provide parking, and impact fee credits.
- Consider siting mixed-use developments near high-frequency transit to reduce parking demand and minimize traffic impacts.

COMPLEMENTARY STRATEGIES

- Higher-Density Development
- Transit-Oriented Development
- Parking Cash-Out
- Reduced Parking
- Employer Transit Pass Subsidy
- Carshare and Bikeshare

CASE STUDY

The IDEA District is a mixed-use development in San Diego's East Village neighborhood. It includes live–work apartments, ground-floor office space, retail and restaurants, and a community social space in a courtyard. The project involved conversion of two former warehouses into creative office space.

IMPLEMENTATION RESOURCES

- SANDAG created an Excel tool and guidance to help users calculate trip-reduction potential for "smart growth" developments, Trip Generation for Smart Growth: Planning Tools for the San Diego Region. sandag.org/index.asp?projectid=334&fuseaction=projects.detail#generation

REFERENCE

Ewing, R., and Cervero, R., "Travel and the Built Environment – A Meta-Analysis." Journal of the American Planning Association, 2010.

Spears, Steven et al, "Impacts of Land-Use Mix on Passenger Vehicle Use and Greenhouse Gas Emissions: Policy Brief," California Air Resources Board, 2014. arb.ca.gov/cc/sb375/policies/mix/lu-mix_brief.pdf

PARKING PRICING

Parking pricing can encourage tenants to commute by alternative means, including transit, vanpools, bicycling, or walking. According to a study from the U.S. EPA, drivers are more sensitive to parking pricing than other related increases, such as fuel prices, likely because parking pricing is a very direct and noticeable charge.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Reduction of up to 7.5% of VMT

VMT reduction affected by:

- Magnitude of parking price increase.
- Availability of non-auto travel modes.
- Comparable parking prices in surrounding areas to prevent spillover effects.

IMPLEMENTATION CONSIDERATIONS

- Consider the availability of alternative transportation services near the project site before implementing paid parking.
- Parking pricing or restrictions, such as residential parking permits, should be considered to avoid spillover effects into surrounding neighborhoods.
- Pricing should be applied throughout an area to avoid simply shifting travel from one location to another.
- Parking-management strategies such as parking pricing are most effective when paired with other TDM strategies that encourage use of alternative modes.

COMPLEMENTARY STRATEGIES

- Reduced Parking
- Transit Frequency Improvements
- Transit-Supportive Treatments

CASE STUDY

A study of one Los Angeles company that ended employer-paid parking for solo drivers found that driving alone for affected commuters declined from 42% to 8% and carpooling among affected commuters increased from 17% to 58%. No change in mode split was seen at a nearby company that continued to offer free parking.

IMPLEMENTATION RESOURCES

- Shoup, Donald C. (2005), *The High Cost of Free Parking*, American Planning Association.
- Contemporary Approaches to Parking Pricing: A Primer, ops.fhwa.dot.gov/publications/fhwahop12026/fhwahop12026.pdf

REFERENCE

Spears, Steve et al., "Impacts of Parking Pricing and Parking Management on Passenger Vehicle Use and Greenhouse Gas Emissions: Policy Brief."
arb.ca.gov/cc/sb375/policies/pricing/parking_pricing_brief.pdf

CAPCOA, Quantifying Greenhouse Gas Mitigation Measures, capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

Parking Spaces/Community Places – Finding the Balance through Smart Growth Solutions. U.S. EPA. 2006. archive.epa.gov/greenbuilding/web/pdf/epaparkingspaces06.pdf

PARKING CASH-OUT

Employers who provide free or subsidized parking spaces for employees can offer a "parking cash-out" for employees who opt not to use company parking spaces. Providing a cash incentive not to drive and park at work encourages employees to commute by alternative means, including transit, vanpools, biking or walking. In California, employers with more than 50 employees with certain types of subsidized parking are required to offer this incentive for employees.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

Reduction of up to 12% of work trip VMT

VMT reduction affected by:

- Portion of employees who receive an employer-paid parking space.
- Portion of employees accepting parking cash-out.

IMPLEMENTATION CONSIDERATIONS

- Consider the availability of alternative transportation services near the project site.
- Parking pricing or restrictions, such as residential parking permits on adjacent streets and neighborhoods, should be considered to avoid parking spillover.
- Parking cash-out policies can be paired with complementary employer TDM benefits.

COMPLEMENTARY STRATEGIES

- Parking Pricing
- Reduced Parking
- Unbundled Parking
- Transit Service Expansion
- Transit Frequency Improvements
- Transit-Supportive Treatments
- Comprehensive Employer Commute Program

CASE STUDY

Sharp HealthCare is a not-for-profit integrated regional healthcare delivery company located in San Diego. The company offers to pay $156 per month in lieu of providing a parking spot to employees who leave their car at a specified location and ride a shuttle to their work site.

IMPLEMENTATION RESOURCES

- California's Parking Cash-Out Law arb.ca.gov/planning/tsaq/cashout/cashout.htm
- CARB Evaluating the effects of parking cash-out: eight case studies arb.ca.gov/research/single-project.php?row_id=55468

REFERENCE

Shoup, Donald C., Parking Cash-Out, Planners Advisory Service, American Planning Association, 2005. shoup.bol.ucla.edu/ParkingCashOut.pdf.

REDUCED PARKING

Employers can reduce the number of on-site parking spaces to encourage travel by modes other than single-occupant vehicles. Providing excessive vehicle parking tends to discourage access by walking, bicycling, and transit; raises development costs; and limits opportunities for higher-density developments and land use mixing. Reducing the supply of vehicle parking supports smart growth developments, which typically generate fewer auto trips and less demand for parking as compared to conventional developments due to an increased number of trips via transit, walking, or bicycling.

SCALE OF APPLICATION: Project

IMPACT ON VMT

VMT impact varies widely and depends on provision of other strategies

Effectiveness of this strategy will vary based on the surrounding land used and available transportation services that may complement a shift away from single-occupant vehicle travel.

IMPLEMENTATION CONSIDERATIONS

- Consider the diversity and density of the surrounding land uses.
- Cities can support reduced parking by reducing or eliminating minimum parking requirements, establishing maximum parking requirements, and encouraging shared or leased parking.

COMPLEMENTARY STRATEGIES

- Higher-Density Development
- Mixed-Use Development
- Transit Frequency Improvements
- Transit-Supportive Treatments
- Bicycle and Pedestrian Facility Improvements
- Unbundled and Shared Parking

CASE STUDY

In 2019, the City of San Diego adopted new parking regulations that eliminate minimum parking requirements for new housing developments built in "transit priority areas," defined as within a half-mile of a current or planned transit stop. In addition, the new regulations establish a parking maximum of one space per unit for new housing developments in the downtown area. Similar parking reforms have recently been adopted in several other California cities including Santa Monica, Sacramento, and San Francisco.

Image source: Google maps

IMPLEMENTATION RESOURCES

- SANDAG, Regional Parking Management Toolbox, sandag.org/uploads/publicationid/publicationid_1910_18614.pdf
- SANDAG, Parking Strategies for Smart Growth: Planning Tools for the San Diego Region, June 2010. sandag.org/uploads/publicationid/publicationid_1499_11603.pdf
- The cities of San Francisco, California; Minneapolis, Minnesota; Buffalo, New York; and Hartford, Connecticut have all recently taken steps to eliminate minimum parking requirements.

REFERENCE

Transit Cooperative Research Program, Traveler Response to Transportation System Changes: Chapter 18: Parking Management and Supply, 2003. trb.org/Publications/Blurbs/153345.aspx

CAPCOA, "Quantifying Greenhouse Gas Mitigation Measures." August 2010. capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

City of San Diego Municipal Code: Transit Priority Area Multifamily Residential Parking Standards sandiego.gov/sites/default/files/o-21057.pdf

UNBUNDLED PARKING

The true cost of parking for residential units often is hidden in rents or purchase costs that include or "bundle" parking. For example, a tenant might pay $1,000 per month for an apartment that includes two parking spaces whose market values equate to $100 each. This practice encourages car ownership because the tenant has no incentive to reduce off-street parking needs. By monetizing residential parking, the tenant or purchaser understands the true cost of parking and is incentivized to eliminate excess need.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

VMT impact varies widely and depends on provision of other strategies

Effectiveness of this strategy will vary based on the surrounding land used and available transportation services that may complement a shift away from single-occupant vehicle travel.

IMPLEMENTATION CONSIDERATIONS

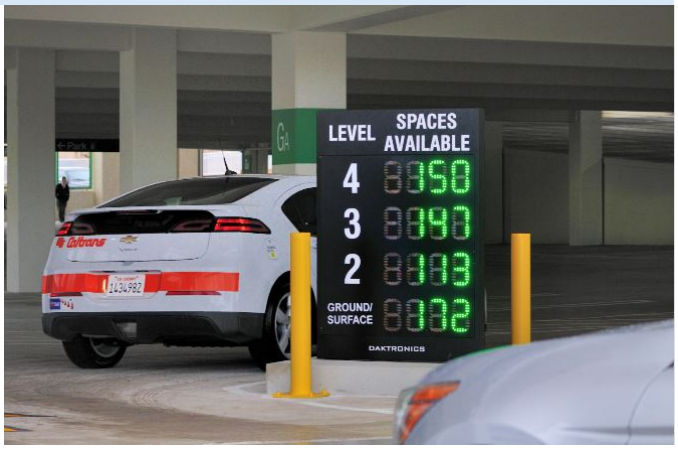
- Reductions in residential off-street parking are likely to reduce commuter vehicle trips.
- On-street parking impacts may happen near projects where unbundled parking has occurred unless such parking is priced and managed appropriately.
- Lease agreements can be itemized to make parking costs transparent and allow for negotiated reductions.
- Unbundling parking can promote affordable housing by lowering rents for households with fewer vehicles.
- Because unbundled parking may affect developers' ability to obtain loans and lower-than-anticipated parking utilization rates may affect developers' abilities to repay loans, cities should waive minimum parking where unbundled parking is encouraged.

COMPLEMENTARY STRATEGIES

- Carshare
- Smart Parking
- Transit-Oriented Development

CASE STUDY

A study on managed residential parking in San Francisco found that the combined effect of unbundling and offering carsharing spaces for projects of 50 units or more significantly reduced household vehicle ownership and increased carsharing membership. This study suggests a latent demand for residential projects with unbundled parking and carsharing.



IMPLEMENTATION RESOURCES

- SANDAG Regional Parking Management Toolbox sandag.org/uploads/publicationid/publicationid_1910_18614.pdf
- Parking Strategies for Smart Growth: Planning Tools for the San Diego Region sandag.org/uploads/publicationid/publicationid_1499_11603.pdf
- FHWA Contemporary Approaches to Parking Pricing: A Primer ops.fhwa.dot.gov/publications/fhwahop12026/index.htm

REFERENCE

Parking Management: Strategies, Evaluation and Planning. Victoria Transport Policy Institute. 2016. vtpi.org/park_man.pdf

Metropolitan Transportation Commission, Regional Parking Strategies for Climate Protection, 2010.

SMART PARKING

Smart parking uses technology to make searching and paying for parking more convenient and efficient. Smart parking solutions can be used to better inform people of available parking, streamline enforcement and maintenance, provide data on parking patterns within the community, facilitate real-time parking demand management, and give people a better parking experience overall. Sample smart parking solutions include smart meters, pay-by-phone, in-street sensors, real-time info, and parking guidance/reservation systems.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

VMT impact varies widely and depends on provision of other strategies

Effectiveness of this strategy will vary based on the surrounding land used and available transportation services that may complement a shift away from single-occupant vehicle travel.

IMPLEMENTATION CONSIDERATIONS

- Before implementing any smart parking technology, conduct a comprehensive study that examines community characteristics, parking inventory, occupancy, and turnover.
- Smart parking technology should be integrated in a way that fits the needs of the local community, makes it easier for people to use multiple transportation options, and improves the entire parking system.
- Consider demand-based pricing that can be updated in real time to improve the availability of parking and reduce congestion.

COMPLEMENTARY STRATEGIES

- Parking Pricing
- Flexible Curb Space
- Mixed-Use Development

CASE STUDY

In 2014, the City of San Diego began upgrading on-street parking meters so that drivers could use their credit cards or pay by phone or with coins. The ability to collect real-time data helps streamline operations and provide better insight regarding how meters are used. Additionally, Civic Diego unveiled a supporting mobile app (ParkItDTSD) that provides real-time parking info.

IMPLEMENTATION RESOURCES

- SANDAG Mobility Hub Features Catalog: Regional Mobility Hub Implementation Strategy sdforward.com/fwddoc/mobipdfs/mobilityhubcatalog-features.pdf
- SANDAG Regional Parking Management Toolbox sandag.org/uploads/publicationid/publicationid_1910_18614.pdf

REFERENCE

San Francisco Municipal Transportation Agency, Evaluation of SFpark Pilot Project, sfmta.com/getting-around/drive-park/demand-responsive-pricing/sfpark-evaluation

Dey, Soumya S. et al, "If You Price It, Will They Change? Assessing the Effects of Demand-Based Parking Pricing on Customer Behavior in Washington, D.C.," Paper presented at the Transportation Research Board 97th Annual Meeting, 2018.

SHARED PARKING

Shared parking allows a single parking facility to serve multiple land uses where peak demand for these uses occurs at different times of day (e.g., residential and office). Additionally, parking can be shared among destinations whose patrons park at one facility and walk to multiple nearby destinations. Shared parking has been shown to reduce parking requirements significantly. Land conserved from parking uses can be used more productively to allow for denser development and promote vitality and economic development.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

VMT impact varies widely and depends on provision of other strategies

Effectiveness of this strategy will vary based on the surrounding land used and available transportation services that may complement a shift away from single-occupant vehicle travel.

IMPLEMENTATION CONSIDERATIONS

- Understanding peak parking demand for different land use types is important for efficient shared parking.
- Shared parking can be facilitated through mixture of land uses on a single site or through agreements between nearby sites.
- Planners should actively promote shared parking within the entire system, including mixed-use developments, centralized shared parking facilities, and private parking with underutilized peak periods.
- A database of public and private parking can be used to better understand existing assets and evaluate shared parking opportunities.

COMPLEMENTARY STRATEGIES

- Reduced Parking
- Higher-Density Development
- Mixed-Use Development

CASE STUDY

SANDAG partnered with Westfield North County Shopping Center in Escondido to provide the use of up to 40 parking spaces at the shopping mall for ridesharing purposes. This shared parking agreement provides commuters with a safe place to meet their carpool or vanpool partners and convenient access to Interstate 15 managed lanes.

IMPLEMENTATION RESOURCES

- SANDAG Regional Parking Management Toolbox sandag.org/uploads/publicationid/publicationid_1910_18614.pdf
- Parking Strategies for Smart Growth: Planning Tools for the San Diego Region sandag.org/uploads/publicationid/publicationid_1499_11603.pdf
- Shared Parking, Second Edition – Study coordinated by the ULI, Copyright – The Urban Land Institute, Mary S. Smith, Washington, D.C., 2005.

REFERENCE

Parking Management: Strategies, Evaluation and Planning. Victoria Transport Policy Institute. 2016. vtpi.org/park_man.pdf

SHARED MOBILITY PARKING

Providing free or reduced parking rates for registered carpools, vanpools, and carshare incentivizes reductions in single-occupancy vehicle trips. Employers can support carpooling and vanpooling by providing priority parking for designated vehicles at the workplace. Cities can support carsharing by encouraging designated parking in residential developments, facilitating agreements between carshare and parking operators in off-street commercial facilities, and designating on-street parking for carsharing.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

VMT impact varies widely and depends on provision of other strategies

Effectiveness of this strategy will vary based on the surrounding land used and available transportation services that may complement a shift away from single-occupant vehicle travel.

IMPLEMENTATION CONSIDERATIONS

- Zoning codes can be drafted to support shared mobility parking allocation and free or discounted rates for ridesharing vehicles.
- On-site carshare offers a market advantage for developers and can help to obtain LEED certification.
- Cities can allocate on-street parking to carshare operators by: 1) soliciting applications for designated spaces or 2) auctioning off designated spaces (this is advantageous where multiple vendors are competing).
- Public education on reduction in parking demand from carsharing is important in high parking demand areas.

COMPLEMENTARY STRATEGIES

- Parking Cash-Out
- Unbundled Parking
- Employer Carpool/Vanpool Program

CASE STUDY

Minneapolis's carshare program includes 500 vehicles that can be parked at any metered or non-restricted on-street space within a designated area. Additionally, the City offers reduced rates at specific parking facilities to carpool vehicles registered through the Commuter Connections Program.

IMPLEMENTATION RESOURCES

- SANDAG Regional Parking Management Toolbox sandag.org/uploads/publicationid/publicationid_1910_18614.pdf
- SANDAG Mobility Hub Features Catalog, 2017, sdforward.com/fwddoc/mobipdfs/mobilityhubcatalog-features.pdf
- FHWA Contemporary Approaches to Parking Pricing: A Primer ops.fhwa.dot.gov/publications/fhwahop12026/index.htm

REFERENCE

- SANDAG Regional Parking Management Toolbox sandag.org/uploads/publicationid/publicationid_1910_18614.pdf
- FHWA Contemporary Approaches to Parking Pricing: A Primer ops.fhwa.dot.gov/publications/fhwahop12026/index.htm

FLEXIBLE CURB SPACE

For a wide variety of transit, shared mobility, and supporting services to operate efficiently within a multimodal environment, curb space should be used flexibly. For example, specific curb space can be designated for some mobility services during their peak demand periods, while the same space can be designated for other uses during off-peak periods. "Flexible curb space" allows the mobility network to better balance street demands as they change throughout the day.

SCALE OF APPLICATION: Project Scale

IMPACT ON VMT

VMT impact varies widely and depends on provision of other strategies

Effectiveness of this strategy will vary based on the surrounding land used and available transportation services that may complement a shift away from single-occupant vehicle travel.

IMPLEMENTATION CONSIDERATIONS

- Clear curb markings and signs could designate how curbs can be reserved for a variety of uses.
- Dynamic parking policies should not be set in a vacuum and must be open to small adjustments.
- Some flexible curb space zones may require supporting urban, civil, and safety design elements.
- Shared mobility services can efficiently use flexible curb space if passenger loading is restricted to hours when transit service is light and there is excess space.
- Flexible curb space should be actively monitored and managed in order to operate successfully.

COMPLEMENTARY STRATEGIES

- Smart Parking
- Shared Mobility Parking
- Microtransit NEV Shuttle

CASE STUDY

In 2016, the San Diego City Council approved a Fifth Avenue Passenger Loading Zone as a two-year pilot program along the main artery of San Diego's Gaslamp Quarter. The zone prohibits vehicles from parking on-street between 8 p.m. and 3 a.m. on Friday and Saturday evenings so that a wide variety of shared mobility services can access the limited curb space.

IMPLEMENTATION RESOURCES

- SANDAG Mobility Hub Features Catalog: Regional Mobility Hub Implementation Strategy sdforward.com/fwddoc/mobipdfs/mobilityhubcatalog-features.pdf
- ITE. Curbside Management Practitioners Guide ite.org/pub/?id=C75A6B8B-E210-5EB3-F4A6-A2FDDA8AE4AA
- NACTO. Curb Appeal: Curbside Management Strategies for Improving Transit Reliability nacto.org/wp-content/uploads/2017/11/NACTO-Curb-Appeal-Curbside-Management.pdf

REFERENCE

- SANDAG Mobility Hub Features Catalog: Regional Mobility Hub Implementation Strategy sdforward.com/fwddoc/mobipdfs/mobilityhubcatalog-features.pdf

STREET CONNECTIVITY IMPROVEMENT

A connected and complete street network improves access to destinations, safety, and livability of the community. Traditional grid street patterns with short blocks offer a high degree of connectivity compared to street networks with curvilinear designs and cul-de-sacs. Strategically increasing the number of intersections within a community results in more efficient and direct routes between origins and destinations, especially for non-motorized users.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 6% of community VMT

VMT reduction affected by:

- Percent increase in intersection density
- Percentage of three-leg intersections vs. four-leg intersections

IMPLEMENTATION CONSIDERATIONS

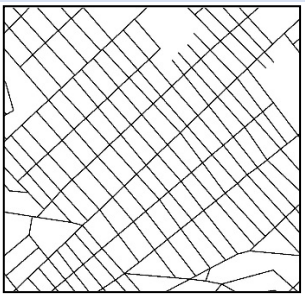
- Variations on the grid network can increase pedestrian activity in an area by providing visual interest.
- Encourage developments to incorporate human-scale networks while accommodating topography needs.
- Street networks should consist of a diverse set of urban street types.

COMPLEMENTARY STRATEGIES

- Pedestrian Facility Improvement
- Mixed-Use Development
- Higher-Density Development
- Bikeway Network Expansion
- Transit Service Expansion

CASE STUDY

Planners in Charlotte, North Carolina observed that traffic flowed better in historic neighborhoods built around a grid pattern when compared to subdivisions that followed a cul-de-sac pattern. Consequently, Charlotte City Council unanimously approved a change in the subdivision ordinance that permits construction of cul-de-sacs only when geographic barriers prevent street connections.



Well-connected network

Poorly connected network

IMPLEMENTATION RESOURCES

- NACTO Urban Street Design Guide nacto.org/publication/urban-street-design-guide/
- Transportation Efficient Communities, "Improve Street Network Connectivity" transportationefficient.org/transportation/improve-street-network-connectivity/
  Victoria Transport Policy Institute, "Roadway Connectivity: Creating More Connected Roadways and Pathway Networks," vtpi.org/tdm/tdm116.htm

REFERENCE

Ewing, R., and Cervero, R., "Travel and the Built Environment – A Meta-Analysis." Journal of the American Planning Association, 2010.

Handy, Susan et al, "Impacts of Network Connectivity on Passenger Vehicle Use and Greenhouse Gas Emissions, Technical Background Document," 2014.

PEDESTRIAN FACILITY IMPROVEMENT

Expanding or improving pedestrian facilities improves pedestrian safety, walkability, and accessibility to goods and services. Improvements to the pedestrian environment, such as adding street trees and lighting, can enhance comfort and security for pedestrians and thereby encourage walking. Sidewalk improvements also support public health and active transportation community goals, including complementary programs like Safe Routes to School.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 1.4% of community VMT

VMT reduction affected by:

- Percent change in community sidewalk coverage (measured as ratio of sidewalk length to street length).

IMPLEMENTATION CONSIDERATIONS

- Accessible sidewalks should be provided and maintained along both sides of streets in urban areas, particularly where there is frequent pedestrian activity like school zones and near transit.
- Include pedestrian amenities such as street trees that provide a canopy over the sidewalk, seats where people can rest, and pedestrian-scaled lighting.
- Average sidewalk width, proportion of route with sidewalks, sidewalk length, and walking quality factor also have been shown to impact walking propensity.

COMPLEMENTARY STRATEGIES

- Mixed-Use Development
- Higher-Density Development
- Street Connectivity Improvement
- Bikeway Network Expansion
- Transit Service Expansion

CASE STUDY

Dale Mabry Highway (SR 580) is a six-lane commercial corridor in Tampa, Florida that includes transit service. Many vehicles along this corridor traveled faster than the posted 45 mph speed limit, and pedestrian crashes rates were high. Installation of accessible sidewalks along the corridor have provided pedestrians with a safe alternative to walking along the highway shoulder and saw significant use even before completion of construction.

IMPLEMENTATION RESOURCES

- NACTO Urban Bikeway Design Guide nacto.org/publication/urban-bikeway-design-guide/
- SANDAG Smart Growth Guidelines: Multimodal Streets sandag.org/uploads/projectid/projectid_344_9163.pdf
- Planning and Designing for Pedestrians: Model Guidelines for the San Diego Region, sandag.org/uploads/publicationid/publicationid_713_3269.pdf

REFERENCE

Frank, L., Greenwald, M., Kavage, S. and Devlin, A. (2011). An Assessment of Urban Form and Pedestrian and Transit Improvements as an Integrated GHG Reduction Strategy. Washington State DOT. wsdot.wa.gov/research/reports/fullreports/765.1.pdf

Handy, Susan, et al, "Impacts of Pedestrian Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions: Policy Brief" arb.ca.gov/cc/sb375/policies/ped/walking_brief.pdf

BIKEWAY NETWORK EXPANSION

Bicycle networks include interconnected bike lanes, cycle tracks, bicycle boulevards, and other facilities that support safe and convenient bicycling. A comprehensive bike network also may include wayfinding, signalization improvements, and amenities designed to support biking. The expansion of bikeway networks promotes alternatives to single-occupancy vehicle travel and can help facilitate safe connections to transit.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 5% of community VMT

VMT reduction affected by:

- Percent increase in density of bikeways.
- Existing bicycle and auto mode share.

IMPLEMENTATION CONSIDERATIONS

- Bike network design treatments should consider design best practices and analysis of network connectivity impacts and support Vision Zero and Complete Streets principles.
- Standardized methods for measuring the quality and safety of the bicycle network, like Bicycle Level of Service (LOS), can be used to identify gaps and problem areas and model impacts of proposed changes.
- Implement wayfinding to encourage biking and promote safe bike parking practices.

COMPLEMENTARY STRATEGIES

- Bikeshare
- Bike Facility Improvement
- Transit Service Expansion
- Mixed-Use Development
- Community-Based Travel Planning

CASE STUDY

Baldwin Park in the San Gabriel Valley region of Greater Los Angeles has adopted one of the strongest Complete Streets policies in the nation. The city currently is retrofitting a section of Maine Avenue that will include dedicated bike lanes in both directions and improve rail transit connections for residents.

IMPLEMENTATION RESOURCES

- Riding to 2050: San Diego Regional Bicycle Plan, sandag.org/uploads/publicationid/publicationid_1674_14591.pdf
- Designing for Smart Growth: Multimodal Streets sandag.org/uploads/projectid/projectid_344_9163.pdf
- NACTO Urban Bikeway Design Guide nacto.org/publication/urban-bikeway-design-guide/
- Guidebook for Measuring Multimodal Connectivity fhwa.dot.gov/environment/bicycle_pedestrian/publications/multimodal_connectivity/fhwahep18032.pdf

REFERENCE

Pucher, J. and R. Buehler, "Analysis of Bicycling Trends and Policies in Large North American Cities: Lessons for New York," Report for US Department of Transportation, 2011.

Dill, J. and T. Carr, Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them – Another Look." Transportation Research Record 1828, 2003.

BIKE FACILITY IMPROVEMENT

Development of new bike facilities can encourage bicycling and reduce drive-alone trips. Class I bike facilities are paths that are physically separated from vehicle traffic. Class II facilities are striped bike lanes that give preferential or exclusive use to bicycles. Class IV facilities are protected on-street bikeways, also called cycle tracks. Bike lanes should meet the Caltrans full-width standard depending on street facility type.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 0.3% of corridor VMT

VMT reduction affected by:

- Travel demand in the corridor.
- Length and connectivity of bike lane.
- Presence of nearby activity centers.

IMPLEMENTATION CONSIDERATIONS

- The facility design should reflect the context of the street, street network, and potential users.
- Most appropriate for locations that close gaps in the bike facility network.
- Should be considered for locations that connect mobility hubs to employment, school, or residential destinations.

COMPLEMENTARY STRATEGIES

- Reduced Parking
- On-Site Bike Amenities
- Bikeway Network Expansion
- Street Connectivity Improvement

CASE STUDY

Arlington County, Virginia is an inner-ring suburb of Washington, D.C. and a national leader in integrated transportation/land use policies and TDM. Arlington adopted a multi-pronged strategy that encouraged walkable, mixed-use development and use of alternative modes. These strategies were supported by a robust TDM program. Consequently, the County was able to accommodate substantial residential and commercial growth while applying road diets and installing bike lanes along major arterials in the Rosslyn–Ballston corridor.

Image source: Caltrans

IMPLEMENTATION RESOURCES

- NACTO, Urban Bikeway Design Guide, nacto.org/publication/urban-bikeway-design-guide/bike-lanes/conventional-bike-lanes/
- San Diego Regional Bike Plan, sandag.org/uploads/publicationid/publicationid_1674_14591.pdf

REFERENCE

California Air Resources Board, "Methods to Find the Cost-Effectiveness of Funding Air Quality Projects," 2005. arb.ca.gov/planning/tsaq/eval/mv_fees_cost-effectiveness_methods_may05.doc

BIKESHARE

Bikeshare programs make bicycles for shared use available to individuals on a short-term basis. These systems provide an affordable way to use bicycles for short-distance trips as an alternative to driving or as a means of connecting to transit. Different bikeshare models include station-based bikeshare, employee bikeshare, dockless bikeshare, and peer-to-peer bikeshare. Recently, mobility service providers have introduced fleets of dockless scooters that may complement existing bikeshare programs.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 0.1% of community VMT

VMT reduction affected by:

- Percentage of community that will have access to bikeshare bikes.
- Density of area.
- Bikeshare trip length.
- Automobile trip-substitution factor.

IMPLEMENTATION CONSIDERATIONS

- To facilitate connections to transit, consider siting station-based bikeshare stations near transit stops, major bikeway facilities, and community destinations.
- Consider implementing wayfinding throughout the community to help instruct users how to use and where to park dockless bikes and scooters.

COMPLEMENTARY STRATEGIES

- Street Connectivity Improvement
- Bikeway Network Expansion
- Bike Facility Improvement
- Transit Service Expansion
- Mixed-Use Development
- On-Site Bike Amenities

CASE STUDY

The Los Angeles County Metropolitan Transportation Authority (Metro) is expanding its bikeshare program utilizing new Smart Bikes that do not require ending or starting a trip at a station and do not have to be docked (although designated stations will still be available). Further, Metro has implemented reduced and flexible fare structures and the ability to use a Transit Access Pass card to pay for bikeshare trips.

Image source: JUMP by Uber

RESOURCES

- NACTO Guidelines for the Regulation and Management of Shared Active Transportation nacto.org/wp-content/uploads/2018/07/NACTO-Shared-Active-Transportation-Guidelines.pdf
- NACTO Bikeshare Station Siting Guide, nacto.org/wp-content/uploads/2016/04/NACTO-Bike-Share-Siting-Guide_FINAL.pdf
- Institute for Transportation and Development Policy, Bikeshare Planning Guide 2018, bikeshare.itdp.org/

REFERENCE

Hosford, K., et al. "Assessing the Modal Impacts of Public Bike Share Systems: A Comparison of Survey Tools," International Society of Behavioral Nutrition and Physical Activity Annual Meeting, 2017.

Cairns, S., et al, "Electrically-assisted bikes: potential impacts on travel behavior," Transportation Research Part A, Vol 103, 2017.

CARSHARE

Carshare services provide members with on-demand access to a shared fleet of vehicles for use at any time of the day. Carshare operating models include round-trip carshare, one-way carshare, free-floating carshare, and peer-to-peer carshare. Based on the mobility service provider, vehicles may be located within specified services areas, transit stations, universities, employment centers, or other locations. Carshare services help encourage transportation alternatives and reductions in vehicle ownership.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 0.7% of community VMT

VMT reduction affected by:

- Increase in portion of residents with access to carsharing.
- Land use density in areas of program implementation.

IMPLEMENTATION CONSIDERATIONS

- Consider incentivizing carshare use by providing dedicated and priority parking for carshare on site for tenants.
- The provision of subsidized or discounted carshare memberships could be incorporated into the suite of available transportation services for both residential and commercial developments.

COMPLEMENTARY STRATEGIES

- Higher-Density Development
- Mixed-Use Development
- Reduced Parking

CASE STUDY

The Metropolitan Transportation Commission (MTC) has awarded more than $3 million in grants to expand carsharing in the Bay Area. Grants funding is being used to establish or expand carsharing pods outside of core urban areas, develop model policies and regulations for Jurisdictions, integrate carshare vehicles into city fleets, and encourage carshare deployment at mobility hubs.

IMPLEMENTATION RESOURCES

- SANDAG Mobility Hub Features Catalog, 2017, sdforward.com/fwddoc/mobipdfs/mobilityhubcatalog-features.pdf
- Bay Area Carsharing Implementation Strategy, Shared-Use Mobility Center, 2018, policies.sharedusemobilitycenter.org/#/policies/1049
- Seattle DOT Car Sharing and Parking Regulations, seattle.gov/transportation/projects-and-programs/programs/parking-program/parking-regulations/car-sharing-and-parking-regulations

REFERENCE

Lovejoy, K. et al, "Impacts of Carsharing on Passenger Vehicle Use and Greenhouse Gas Emissions: Policy Brief," California Air Resources Board, 2013.

Martin, E., and Shaheen, S., The Impacts of Car2Go on Vehicle Ownership, Modal Shift, Vehicle Miles Traveled, and Greenhouse Gas Emissions: An Analysis of Five North American Cities, 2016.

Cervero, R. et al, "City CarShare: Longer-Term Travel Demand and Car Ownership Impacts," Transportation Research Record: No. 1992, 2007.

COMMUNITY-BASED TRAVEL PLANNING

Community-based travel planning (CBTP) involves residential-based outreach that provides households with customized information, incentives, and support to reduce drive-alone trips and encourage the use of transportation alternatives. CBTP outreach not only provides information, but also plays a key role in educating residents on how to use transportation services by providing step-by-step support with planning a transit trip, using shared mobility programs, using online trip planning tools, enrolling in the vanpool or carpool program, and more.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 2% of community VMT

VMT reduction affected by:

- Number of households targeted for CBTP outreach within a community.
- Availability of transportation options.

IMPLEMENTATION CONSIDERATIONS

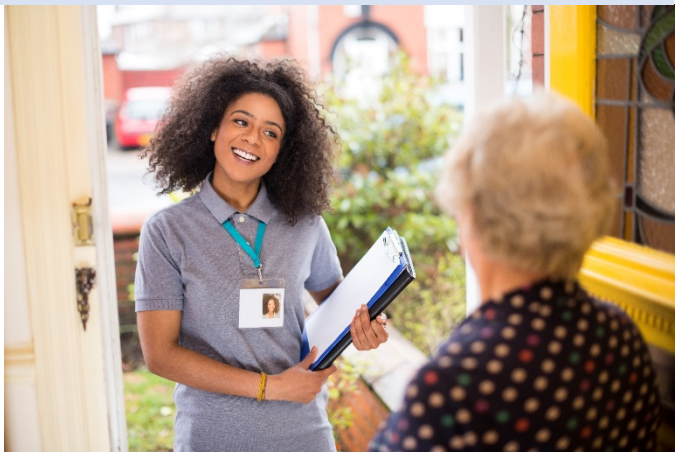
- Outreach materials should be tailored for each community based on availability of transportation alternatives and household travel needs.
- Programs can conduct outreach to different communities using a phased approach, typically focusing on one or several select communities in a given year, then shift focus for the next year. CBTP also can be implemented to coincide with the unveiling of new transportation services, like a new bikeway or new transit services, in a community.

COMPLEMENTARY STRATEGIES

- Bikeway Network Expansion
- Transit Service Expansion

CASE STUDY

SANDAG conducted a pilot project in Encinitas, California in March 2014. The "Travel Encinitas" pilot targeted nearly 400 households to encourage residents to try transportation alternatives for commuting purposes or for local trips. The pilot demonstrated that CBTP has good potential for the San Diego region, with 12% of participants reporting that they changed their travel behavior. Following the pilot study, these participants indicated that they drove less and walked, biked, and carpooled more frequently.



IMPLEMENTATION RESOURCES

- Travel Encinitas: A Personalized approach to community-based TDM on San Diego's North Coast sandag.org/uploads/projectid/projectid_19_18056.pdf
- Portland Bureau of Transportation: portlandoregon.gov/transportation/article/625239
- King County Metro In Motion: kingcounty.gov/depts/transportation/metro/programs-projects/transit-education-outreach/in-motion.aspx

REFERENCE

Portland SmartTrips evaluation information available at: toolsofchange.com/en/case-studies/detail/658

TRANSIT SERVICE EXPANSION

Transit service expansion increases transportation capacity to accommodate existing and future travel demand, particularly for peak-period commute trips. This strategy provides an effective alternative to congested freeways and roadways for travelers and can reduce VMT. Transit service expansion can include new conventional or rapid bus routes as well as rail service expansion. New transit service can incorporate amenities to improve the rider experience, thereby helping to encourage new riders to try transit.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 5.9% of community VMT

VMT reduction affected by:

- Percent increase in transit route miles in study area.
- Existing transit and drive-alone mode share.

IMPLEMENTATION CONSIDERATIONS

- Strategy will be most effective when accompanied by transit speed and frequency improvements.
- Expansions in the transit network should be paired with bike and pedestrian facility enhancements that facilitate safe and easy access to transit services.
- Consider implementing mobility hub improvements that may improve the overall transit rider experience.

COMPLEMENTARY STRATEGIES

- Transit-Supportive Treatments
- Transit Fare Reduction
- Transit Frequency Improvements
- Bikeway Network Expansion
- Pedestrian Facility Improvement
- Transit-Oriented Development

CASE STUDY

The South Bay *Rapid* bus route opened in early 2019. Average weekday ridership on the line is about 1,500 and climbing. The addition of this service from Otay Mesa to Downtown San Diego, as well as the opening of a modern transit center just north of the Otay Mesa Border Crossing, has caused other routes serving the area to increase ridership as well.

IMPLEMENTATION RESOURCES

- SANDAG Mobility Hub Features Catalog, 2017, sdforward.com/fwddoc/mobipdfs/mobilityhubcatalog-features.pdf
- Transit Cooperative Research Program (TCRP) Report 167: Making Effective Fixed-Guideway Transit Investments: Indicators of Success, 2014.
- Transit Cooperative Research Program, Report 118: Bus Rapid Transit Practitioners Guide, 2007.

REFERENCE

Transit Cooperative Research Program, Report 95, Traveler Response to Transportation System Changes Handbook: Chapter 10, Bus Routing and Coverage. trb.org/Publications/Blurbs/154974.aspx

Handy, Susan, et al, "Impacts of Transit Service Strategies on Passenger Vehicle Use and GHG Emissions: Policy Brief," 2013. arb.ca.gov/cc/sb375/policies/transitservice/transit_brief.pdf

TRANSIT FREQUENCY IMPROVEMENTS

Improving the frequency of transit service reduces transit-passenger travel time by reducing headways and decreasing wait times. This increases the attractiveness of transit service and can create a shift away from personal vehicle travel, thereby decreasing VMT. Operational transit service improvements such as transit frequency enhancements produce the greatest mode shifts to transit when paired with complementary strategies that disincentivize driving alone.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 8.2% of community VMT

VMT reduction affected by:

- Increase in transit frequency.
- Portions of transit lines improved.
- Current transit and auto mode share.

IMPLEMENTATION CONSIDERATIONS

- Observations suggest that a 10% increase in bus frequency will lead to a 3–4% increase in ridership. Generally, the greatest ridership gains occur for discretionary trips and in locations where service previously has been infrequent (e.g., greater than 20-minute headways).
- Consider pairing transit service improvements with the implementation of mobility hub amenities that improve the transit rider experience (i.e., lighting, signage) and last-mile connections.

COMPLEMENTARY STRATEGIES

- Transit Service Expansion
- Transit Supportive Treatments
- Transit Fare Reduction
- Transit-Oriented Development

CASE STUDY

Santa Clarita is an outlying suburb of Los Angeles. In 1992, Metrolink commuter rail service to Los Angeles was initiated, with the Metrolink station serving as a common origin and destination for local bus routes. To better serve these routes, Santa Clarita Transit increased bus frequencies. The results showed that cutting headways in half more than doubled bus ridership on the affected routes.

IMPLEMENTATION RESOURCES

- Based on a Transit Optimization Plan (TOP) launched in 2016, MTS is making changes to the MTS bus network, adding significantly to the network of high-frequency services (15 minutes or better) as well as shortening some travel times. sdmts.com/inside-mts-current-projects/transit-optimization-plan

REFERENCE

TCRP 95 Traveler Response to Transportation System Changes Handbook: Chapter 9, Transit Scheduling and Frequency trb.org/Publications/Blurbs/154748.aspx

Handy, Susan, et al, "Impacts of Transit Service Strategies on Passenger Vehicle Use and GHG Emissions: Policy Brief," 2013. arb.ca.gov/cc/sb375/policies/transitservice/transit_brief.pdf

TRANSIT-SUPPORTIVE TREATMENTS

Transit-supportive treatments incorporate a mix of roadway infrastructure improvements and/or traffic signal modifications to improve transit travel times and reliability, leading to increased transit ridership. As riders reach their destinations more quickly, transit becomes a more convenient and competitive option to driving alone. Additionally, increasing the reliability of transit relative to existing levels and relative to other modes further encourages users to shift from personal vehicles to transit. Treatments can include transit signal priority, bus-only signal phases, queue jumps, curb extensions to speed passenger loading, and dedicated bus lanes. Transit-supportive treatments should be closely coordinated with the operating transit agency.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 0.4% of community VMT

VMT reduction affected by:

- Portion of transit lines improved.
- Increase in transit speed resulting from treatments.
- Current transit and auto mode shares.

IMPLEMENTATION CONSIDERATIONS

- Transit signal priority installations require the cooperation of the transit agency and the agency that operates the traffic signals.
- Transit signal priority is particularly effective for bus rapid transit routes where there is an overall effort to provide an enhanced transit experience.
- Improvements in transit speed or reliability should be combined with other complementary programs that incentivize multimodal travel as opposed to driving.

COMPLEMENTARY STRATEGIES

- Transit Service Expansion
- Transit Frequency Improvements
- Transit Fare Reduction
- Adaptive Traffic Signal Systems

CASE STUDY

Portland, Oregon implemented a timed-transfer system between two transit centers as part of a network redesign. These changes led to consistent departure times and improvements in schedule efficiency and reliability. Daily ridership increased by 40% within a year of implementing these improvements.

IMPLEMENTATION RESOURCES

- Transit Cooperative Research Program (TCRP) Report 183: *A Guidebook on Transit-Supportive Roadway Strategies*. This document is a resource for transit and roadway agency staff seeking to improve bus speed and reliability on surface streets. trb.org/Publications/Blurbs/173932.aspx
- TCRP Synthesis 83: Bus and Rail Transit Preferential Treatments in Mixed Traffic, 2010, Transportation Research Board, nap.edu/catalog/13614/bus-and-rail-transit-preferential-treatments-in-mixed-traffic

REFERENCE

TCRP 95 Traveler Response to Transportation System Changes Handbook: Chapter 9, Transit Scheduling and Frequency trb.org/Publications/Blurbs/154748.aspx

Handy, Susan, et al, "Impacts of Transit Service Strategies on Passenger Vehicle Use and GHG Emissions: Policy Brief," 2013. arb.ca.gov/cc/sb375/policies/transitservice/transit_brief.pdf

TRANSIT FARE REDUCTION

A reduction in transit fares will cut the cost associated with using transit, thereby creating incentives for people to shift from other traveling modes. Transit fare reductions can be implemented systemwide, in specific fare-free or reduced-fare zones, or offered through employer-based benefits programs that are fully or partially paid by the employer. Observations suggest that cutting bus fares in half will increase ridership by 15% to 25%.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Reduction of up to 1.2% of community VMT

VMT reduction affected by:

- Reduction in transit fare.
- Current transit and auto mode shares.

IMPLEMENTATION CONSIDERATIONS

- Fare changes implemented in conjunction with other supporting strategies, and particularly when focused on congested areas with adequate high-frequency transit service such as downtowns, universities, and major urban employment centers, can produce more notable reductions in traffic and emissions.

COMPLEMENTARY STRATEGIES

- Transit Service Expansion
- Transit Frequency Improvements
- Transit-Supportive Treatments
- Employer Transit Pass Subsidy

CASE STUDY

Chapel Hill is a town in the Research Triangle area of North Carolina and is home to the University of North Carolina at Chapel Hill. In 2002, Chapel Hill Transit began operating fare-free. Ridership began increasing shortly after fares were eliminated and ultimately doubled from 3.5 million to nearly 7 million between 2002 and 2012.

IMPLEMENTATION RESOURCES

- TCRP Report 95: Traveler Response to Transportation System Changes Handbook, Chapter 12: Transit Pricing and Fares
  trb.org/Publications/Blurbs/152419.aspx

REFERENCE

Handy, Susan, et al, "Impacts of Transit Service Strategies on Passenger Vehicle Use and GHG Emissions: Policy Brief," 2013.
arb.ca.gov/cc/sb375/policies/transitservice/transit_brief.pdf

MICROTRANSIT NEV SHUTTLE

Neighborhood electric vehicle (NEV) shuttles are a type of microtransit that can be hailed in real-time or via an app-based reservation system. NEV shuttles operate within designated areas, generally corresponding to mixed-use areas, transit corridors, and urban and town centers, to fulfill short trips less than two miles in length. NEV shuttles often are operated by private mobility service providers and offered to riders at little or no cost. Funding for these services typically is generated through ad revenue and/or civic partnerships.

SCALE OF APPLICATION: Community/City

IMPACT ON VMT

Reduction of up to 0.1% of community VMT

VMT reduction affected by:

- Coverage of service.
- Number of buses deployed.
- Hours of operation.
- Level of existing transit service.

IMPLEMENTATION CONSIDERATIONS

- NEV shuttle trips may replace short-distance walking, taxi, or ridehailing trips that start and end within the designated service area.

COMPLEMENTARY STRATEGIES

- Street Connectivity Improvement
- Pedestrian Facility Improvement
- Higher-Density Development
- Mixed-Use Development

CASE STUDY

Free Ride Everywhere Downtown (FRED) electric microtransit shuttles have been in operation in downtown San Diego since 2016. Riders can request a free ride in one of FRED's five-passenger NEVs through a proprietary app available in iPhone and Android app stores. FRED is funded in part by the City of San Diego in an effort to reduce congestion and shrink the City's carbon footprint. Additional funding for the service is generated through ad sales.

IMPLEMENTATION RESOURCES

- FRED San Diego, thefreeride.com/fred/

REFERENCE

Microtransit: An assessment of potential to drive greenhouse gas reductions, MaRS Discovery District, marsdd.com/wp-content/uploads/2016/12/Microtransit-report-2016.pdf.

MICROTRANSIT COMMUTER SHUTTLE

Microtransit offers a flexible, on-demand option for small groups of people. Microtransit can provide a convenient alternative to travelers where high-frequency transit is not available or to provide outlying communities with critical connections to and from transit or major employment centers. Microtransit services use smaller vehicles that carry between 5 and 12 passengers, and riders typically can order service through a mobile app that directs them to gather at common locations along the service route for pick-up.

SCALE OF APPLICATION: Community/City

IMPACT ON VMT

VMT impact varies widely and depends on provision of other strategies

VMT reduction affected by:

- Level of existing transit service.
- Level of urbanization and travel demand.
- Microtransit service frequency and hours of operation.

IMPLEMENTATION CONSIDERATIONS

- Commuter shuttle mode shares are dependent on time and cost, as compared to driving alone.
- Microtransit commuter shuttles must coordinate with local municipalities and transit agencies to establish service stops (e.g., mobility hubs or Park & Rides).
- Shuttle services could work well with fixed-route services during periods of high demand or during off-peak hours.

COMPLEMENTARY STRATEGIES

- Parking Pricing
- Parking Cash-Out
- Reduced Parking
- Employer Guaranteed Ride Home Program

CASE STUDY

In 2019, Los Angeles Metro partnered with microtransit provider Via to provide a shared and low-cost transportation option to and from rail and bus stations in the Compton, El Monte, and North Hollywood communities. Participants in Metro's Low-Income Fare is Easy program can use Via free of charge.

IMPLEMENTATION RESOURCES

- Los Angeles MicroTransit Pilot Project, metro.net/projects/microtransit/

REFERENCE

Microtransit: An assessment of potential to drive greenhouse gas reductions, MaRS Discovery District, marsdd.com/wp-content/uploads/2016/12/Microtransit-report-2016.pdf.

City of Arlington, Texas, Via Rideshare program, arlingtontx.gov/city_hall/departments/office_of_strategic_initiatives/transportation_planning/via_rideshare

ADAPTIVE TRAFFIC SIGNAL SYSTEMS

Adaptive traffic signal systems monitor real-time traffic conditions and automatically change traffic signal settings to improve roadway traffic conditions. For example, green light times could be extended for a particular approach to an intersection that is experiencing heavy traffic or the cycle length for an entire system of signals could be adjusted up or down to match prevailing traffic conditions. Adaptive traffic signal systems, both with and without fixed cycle lengths, have been implemented in the San Diego region and other locations nationwide.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

No research on VMT available

Other benefits can include:

- Reduction in vehicle delay of 10% to 20%.
- Better system-management response to incidents and special events.

IMPLEMENTATION CONSIDERATIONS

- Some adaptive traffic signal systems do not use a common cycle length for the signals that are controlled within the system. Instead, a master algorithm controls each signal and each movement to optimize the efficiency of all movements.
- Adaptive traffic signal control can have benefits in any congested traffic signal network, but they are best suited to networks with variable traffic conditions due to special events or other considerations.
- Adaptive traffic signal systems often require greater agency staff time to maintain than traditional signal systems.

COMPLEMENTARY STRATEGIES

- Transit-Supportive Treatments
- Optimized Signal Timing for Bicycles
- Smart Signals and Intersections

CASE STUDY

The Sorrento Valley Adaptive Traffic Signal System was the City of San Diego's first use of this technology. The City has since installed adaptive signals along Friars Road, La Jolla Parkway, Mira Mesa Boulevard Vista, and Rosecrans Street, where morning commute times decreased from seven minutes to five minutes.

IMPLEMENTATION RESOURCES

- FHWA Adaptive Signal Control Technology website, fhwa.dot.gov/innovation/everydaycounts/edc-1/asct.cfm
- ITE Traffic Signal Audit Guide, ite.org/pub/?id=e2654d52-2354-d714-5126-ca1779c02831
- Consortium for ITS training and Education citeconsortium.org

REFERENCES

Adaptive Signal Control FHWA Research and Technology Evaluation, June 2018, Federal Highway Administration. fhwa.dot.gov/publications/research/randt/evaluations/17007/index.cfm

NCHRP Synthesis 403: Adaptive Traffic Control Systems: Domestic and Foreign State of Practice, Transportation Research Board, 2010, trb.org/Publications/Blurbs/163323.aspx

SMART SIGNALS AND INTERSECTIONS

Smart traffic signals, according to FHWA's Exploratory Advanced Research Program, are traffic signals controlled by a system that—with little human intervention—continuously monitors, learns, predicts, and responds to traffic demands and conditions with optimal signal timing for prevailing conditions. This approach is similar to adaptive traffic signal control except it relies more heavily on the machine learning capabilities of the system rather than parameters input by technicians who set up the system.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

No research on VMT available

Other benefits can include:

- Reduction in vehicle delay.
- Better response to incidents and special events.

IMPLEMENTATION CONSIDERATIONS

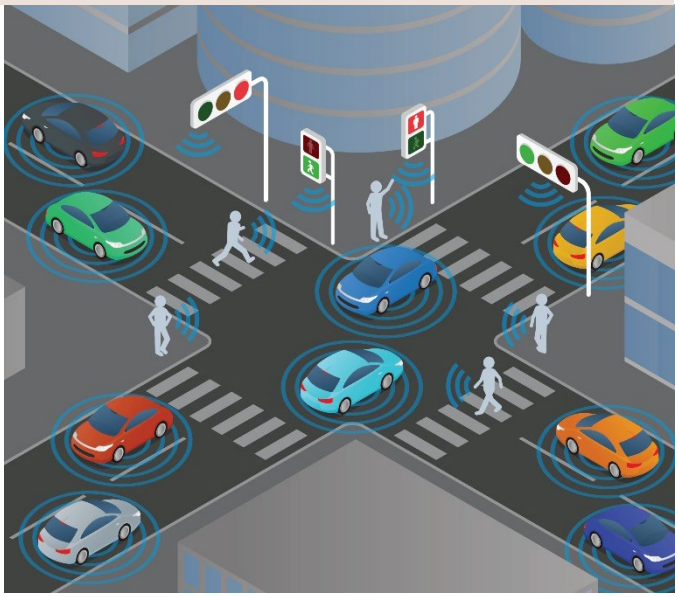
- This is an advanced strategy that is not ready for implementation but is included in order to provide information on upcoming technology.

COMPLEMENTARY STRATEGIES

- Transit-Supportive Treatments
- Optimized Signal Timing for Bicycles

CASE STUDY

The City of San Diego has installed smart streetlights—energy-efficient LED lights equipped with sensor technology and advanced controls—to improve efficiency and collect real-time counts of vehicles, bikes, and parking occupancy. Based on experiences with prior deployments of similar technology solutions, the City expects a 40% reduction in time spent looking for parking. San Diego's smart sensors also will provide valuable data to enhance traffic flow. Studies conducted by application providers indicate that there is potential to improve traffic by 10–20% by optimizing management of traffic and providing en-route guidance improvements.



IMPLEMENTATION RESOURCES

- San Francisco Municipal Transportation Agency, Smart Traffic Signals Pilot. sfmta.com/projects/smart-traffic-signals-pilot
- Intersection Safety Strategies Brochure, 2nd Edition. FHWA. 2015. safety.fhwa.dot.gov/intersection/conventional/signalized/FHWA-SA-15-085_Strategies_2.pdf
- Minnesota DOT, Putting research into Practice: Improving Traffic Signal Timing with the SMART-SIGNAL System, 2013. dot.state.mn.us/research/TS/2013/201306TS.pdf

REFERENCES

Federal Highway Administration, Exploratory Advanced Research (EAR) Program Next-Generation Smart Traffic Signals (website) fhwa.dot.gov/publications/research/ear/SmartTrafficSignal.pdf

OPTIMIZED SIGNAL TIMING FOR BICYCLES

Bicycles have different operating characteristics than motor vehicles in terms of speed, acceleration, and deceleration. Optimized signal timing traffic signal for bicycles provides adjustments to green intervals, red clearance time, and extension time to ensure that bicyclists can cross intersections safely. Optimized signal timing for bicycles also can include signal progression that gives bicyclists a green indication at each signal as they proceed through a series of traffic signals. These strategies can be used on streets with high levels of bicycle traffic or streets that are specifically designated as bicycle corridors.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Slight reduction in VMT

Other benefits can include:

- Improved travel times for bicycles.
- Improved safety for bicycles.
- Signals timed for the slower speeds of bicycles generally will result in a traffic calming effect for other vehicles.

IMPLEMENTATION CONSIDERATIONS

- Effects of optimized bicycle timing on other roadway users (pedestrians, transit riders, vehicles) should be considered.
- Bike signals can be timed to accommodate typical biking speeds.

COMPLEMENTARY STRATEGIES

- Bikeway Network Expansion
- Bike Facility Improvement
- Smart Signals and Intersections
- Advanced Bicycle Detection

CASE STUDY

In 2009, signal timing was adjusted on Valencia Street in San Francisco between 16th and 21st to improve vehicle flow, calm traffic, and improve conditions for bicyclists. The traffic signals create a "green wave" for bicyclists and motorists traveling at a speed of around 13 mph. The signal timing allows bicyclists to avoid the strenuous stops and starts that often occur with conventionally timed signals and were shown to reduce travel times for motorists by more than a minute at peak commuting times.

Source: pedbikeimages.org – Adam Coppola Photography

IMPLEMENTATION RESOURCES

- *Urban Bikeway Design Guide*, National Association of City Transportation Officials, September 2014. nacto.org/cities-for-cycling/design-guide/
- Bicycle Safety Guide and Countermeasure Selection System (BIKESAFE), Federal Highway Administration. pedbikesafe.org/BIKESAFE/index.cfm

REFERENCES

Bicycle Safety Guide and Countermeasure Selection System, September 2014, Federal Highway Administration, Office of Safety. pedbikesafe.org/bikesafe/countermeasures_detail.cfm?CM_NUM=35

ADVANCED BICYCLE DETECTION

Advanced bicycle detection at traffic signals informs the traffic signal controller of the presence of bicycles so that the controller can adjust signal timing to accommodate bicycle traffic. At many standard traffic signals, bicyclists must push a pedestrian push button in order to indicate their presence. One level of advanced bicycle detection is detectors that can determine the presence of a bicycle at the stop line. A higher level of detection would allow for the bicycle to be detected in advance of the stop bar to allow the traffic signal to extend the green time for approaching bicyclists.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

Slight reduction in VMT

Other benefits can include:

- Reduction in bicycle delay.
- Safety improvements.

IMPLEMENTATION CONSIDERATIONS

- Bicycle-detection technology is in the early stages of implementation, and detection strategies are being improved upon.
- There are large numbers of existing traffic signals that do not adequately detect bicycles, and retrofitting these signals can be expensive. Cost-efficiency can be achieved by requiring advanced bicycle detection at new or modified traffic signals and by focusing on intersections with relatively high levels of bicycle traffic.

COMPLEMENTARY STRATEGIES

- Optimized Signal Timing for Bicycles
- Bikeway Network Expansion
- Bike Facility Improvement

CASE STUDY

The Portland, Oregon bicycle detection system mainly uses loop detectors. City electricians use a bicycle to test that the loop consistently detects bicycles. The spot is then permanently marked with the shape of a small bicycle – i.e., a small version of a bike lane marker.

Source: pedbikeimages.org – Russ Roca

RESOURCES

- *Urban Bikeway Design Guide*, National Association of City Transportation Officials, September 2014. nacto.org/cities-for-cycling/design-guide/
- Bicycle Safety Guide and Countermeasure Selection System (BIKESAFE), Federal Highway Administration. pedbikesafe.org/BIKESAFE/index.cfm

REFERENCE

Urban Bikeway Design Guide, National Association of City Transportation Officials. nacto.org/publication/urban-bikeway-design-guide/bicycle-signals/signal-detection-and-actuation/

REAL-TIME TRAVELER INFORMATION

Real-time traveler information systems use changeable message signs, smartphone apps, highway advisory radio, and other mechanisms to inform travelers about travel times, traffic incidents, construction zones, road closures, and transit service challenges. This information enables travelers to reschedule or reroute trips, thereby improving travel time reliability, safety, and quality of life. Traveler information systems should provide travelers with consistent, real-time information both pre-trip and en route.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

No research on VMT available

Other benefits can include:

- Reduction in travel time.
- Improved travel time reliability.
- Improved safety.

IMPLEMENTATION CONSIDERATIONS

- Traveler information systems typically require considerable amounts of data, communications infrastructure, and interagency cooperation.
- Traveler information systems are most effective in the presence of travel alternatives. This can include alternative routes and alternative modes of travel.

COMPLEMENTARY STRATEGIES

- Traffic Incident Management
- Active Traffic Management
- Roadway Weather Management

CASE STUDIES

The Interstate 15 (I-15) Integrated Corridor (State Route 163 to State Route 78 in San Diego) project manages the state-of-the-art I-15 Express Lanes and major arterial routes on either side of I-15 within several miles of the freeway. The system is designed to guide drivers around incidents efficiently with minimal impact to local streets.

Image source: Caltrans

IMPLEMENTATION RESOURCES

- FHWA, Office of Operations Real Time Traveler Information Website, ops.fhwa.dot.gov/travelinfo/
- Caltrans Changeable Message Sign Guidelines, dot.ca.gov/trafficops/tm/docs/CMS_Guidelines.pdf

REFERENCE

Federal Highway Administration, *Effectiveness of Disseminating Traveler Information on Travel Time Reliability: Implementation Plan and Survey Results Report,* December 2016. ops.fhwa.dot.gov/publications/fhwahop16066/fhwahop16066.pdf

ACTIVE TRAFFIC MANAGEMENT

Active traffic management is the ability to dynamically manage recurrent and nonrecurrent roadway demands based on prevailing and predicted traffic conditions. Focusing on trip reliability, active traffic management maximizes the effectiveness, safety, and efficiency of the roadway by using integrated systems and technology, including the automation of dynamic traffic operations. Specific strategies include adaptive ramp metering, adaptive traffic signal control, dynamic speed limits, and transit signal priority.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

No research on VMT available

Other benefits can include:

- Reduction in vehicle delay.
- Increased travel-time reliability.
- Reduction in traffic incidents.
- System efficiency for carpool and transit vehicles.

IMPLEMENTATION CONSIDERATIONS

- Active traffic management strategies can vary depending on the setting but can include any actions that change the traffic-control features of a facility as traffic patterns change.
- Examples of active traffic-management strategies include adaptive ramp metering, dynamic or reversible lane control, and dynamic speed limits.
- Deployment requires cross-agency collaboration and advanced information technology infrastructure.

COMPLEMENTARY STRATEGIES

- Adaptive Traffic Signal Systems
- Real-Time Traveler Information
- Traffic Incident Management
- Roadway Weather Management

CASE STUDY

In 2008, Missouri DOT installed a "Variable Speed Limit" (VSL) system along the Interstate 270/Interstate 255 corridor. Noticeable benefits have been seen with respect to reduction in the number of crashes. However, VSL is not performing as well as expected in terms of improvements to overall mobility.

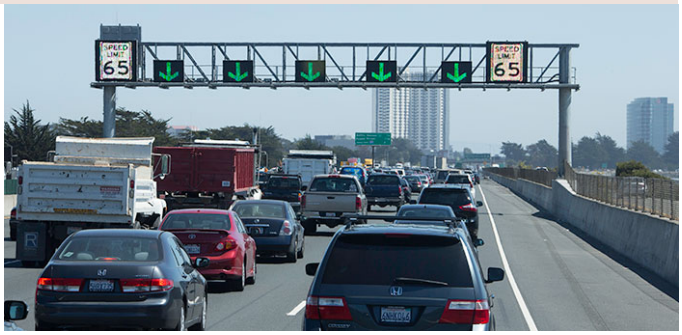


Image source: Caltrans

RESOURCES

FHWA, *Active Traffic Management: The Next Step in Congestion Management*, 2007. transportationops.org/publications/active-traffic-management-next-step-congestion-management

ITS International, "Active traffic management - challenges and benefits," 2013. itsinternational.com/sections/nafta/features/active-traffic-management-challenges-and-benefits/

REFERENCES

FHWA Active Traffic Management Website: ops.fhwa.dot.gov/atdm/approaches/atm.htm

TRAFFIC INCIDENT MANAGEMENT

Traffic incident management consists of a planned and coordinated multidisciplinary process to detect, respond to, and clear traffic incidents so that transportation operations can be restored as safely and quickly as possible. Effective traffic incident management reduces the duration and impacts of traffic incidents and improves the safety of motorists, crash victims, and emergency responders.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

No research on VMT available

Other benefits can include:

- Reduction in vehicle delay.
- Improved safety.

IMPLEMENTATION CONSIDERATIONS

- Effective traffic incident management should be implemented at the regional level and include coordination among a variety of public and private sector partners, including Caltrans, law enforcement, fire and rescue, emergency medical services, towing and recovery, hazardous materials contractors, and traffic information media.
- Traffic incident management should leverage traveler information systems to ensure a comprehensive outreach and messaging approach.

COMPLEMENTARY STRATEGIES

- Active Traffic Management
- Real-Time Traveler Information

CASE STUDY

As part of the Interstate 15 (I-15) Integrated Corridor (State Route 163 to State Route 78 in San Diego), a coordinated detour messaging system was activated in April 2016 with 40 alternate route signs. When major freeway incidents occur, changeable message signs on I-15 direct motorists off the freeway to avoid delays, and alternate route signs guide motorists through surface streets and back onto the freeway.

Image source: Caltrans

RESOURCES

- Caltrans Traffic Incident Management website, dot.ca.gov/programs/traffic-operations/tim
- FHWA, Best Practices in Traffic Incident Management, 2010. ops.fhwa.dot.gov/publications/fhwahop10050x/index.htm

REFERENCE

Traffic Incident Management Handbook, January 2010, Federal Highway Administration, Office of Traffic Operations. ops.fhwa.dot.gov/eto_tim_pse/publications/timhandbook/index.htm

ROADWAY WEATHER MANAGEMENT

Roadway weather management is a strategy that seeks to minimize the adverse effects of weather on the roadway system by implementing traffic-management techniques and traveler information tailored to prevailing weather conditions. Specific strategies applicable to the San Diego region include advanced freeway management/variable speed limits, traffic signal optimization through adaptive control, accelerated incident response, and real-time information delivered to drivers and system operators.

SCALE OF APPLICATION: Community/city scale

IMPACT ON VMT

No research on VMT available

Other benefits can include:

- Reduction in vehicle delay.
- Improved safety.
- Encourage transit use.

IMPLEMENTATION CONSIDERATIONS

- To make roadway weather management decisions, transportation agencies need access to reliable data on environmental conditions from observing systems and forecast providers.
- Roadway weather information should be disseminated to travelers to influence their decisions, such as mode, route selection, departure time, and driving behavior.
- Effective roadway weather management.
- Traffic Management Centers can integrate environmental data with traffic monitoring and control software.

COMPLEMENTARY STRATEGIES

- Real-Time Traveler Information
- Traffic Incident Management
- Adaptive Traffic Signal Systems

CASE STUDY

Missouri DOT conducted a Weather Response System pilot project from 2004 to 2006. The project brought together advanced weather and road condition technologies for addressing roadway operational categories, including traffic, incident, and emergency management; maintenance activities; and winter storm response.

Image source: Federal Highway Administration, Guidelines for Deploying Connected Vehicle-Enabled Weather Responsive Traffic Management Strategies, Pub No. FHWA-JP0-17-478

IMPLEMENTATION RESOURCES

- FHWA, Best Practices for Road Weather Management, 2013. ops.fhwa.dot.gov/publications/fhwahop12046/index.htm
- FHWA, *Weather Response System Operational Observations Report*, August 2006. ops.fhwa.dot.gov/publications/wrsrpt/wrs_report.pdf

REFERENCES

Federal Highway Administration Road Weather Management Program website, ops.fhwa.dot.gov/weather/overview.htm

4. Mobility management implementation

The implementation of mobility management strategies can occur at different points during the planning and project development processes. These opportunities relate to the variety of reasons that local governments may be interested in mobility management, including:

- Mitigating transportation impacts as part of environmental review
- Improving mobility for city residents and businesses
- Implementing an urban design vision for a community
- Reducing emissions of greenhouse gases and local air pollutants
- Promoting public health through physical activity
- Supporting economic development and neighborhood revitalization

This section discusses opportunities to apply the Mobility Management Toolbox during planning and project development.

Development Review Under CEQA

Every agency has a process for reviewing and permitting public and private development projects. All projects requiring discretionary approval, whether a physical development project or plan, are subject to the California Environmental Quality Act (CEQA). In general, the submittal of complete project applications and plans for discretionary projects initiates the environmental review (i.e., CEQA) process. Agency staff will then determine the appropriate CEQA document for the project, which could include an environmental impact report, mitigated negative declaration, negative declaration, or notice of exemption (i.e., an exemption from further CEQA review).

Governor Jerry Brown signed Senate Bill 743 (SB 743) on September 27, 2013, mandating a change in the way that public agencies evaluate transportation impacts of projects under CEQA, focusing on VMT rather than level of service (LOS) and other delay-based metrics. With the passage of SB 743, the focus of transportation impact analysis in CEQA documents has shifted from automobile delay, which is measured by LOS and other similar metrics, to VMT. Accordingly, automobile delay will no longer be considered a significant impact under CEQA. Per State CEQA Guidelines Section 15064.3(c), July 1, 2020, is the statewide implementation date for using VMT to determine the significance of transportation impacts in CEQA analysis.

The Mobility Management Toolbox is a resource for jurisdictions and developers to provide a consistent regional framework for evaluating VMT reduction strategies as part of the development review and transportation analysis processes as required under CEQA. The Toolbox supports the goals of SB 743 by providing jurisdictions with a resource to quantify VMT reductions resulting from mobility management implementation. The Toolbox can be applied during the local development review process in the following ways:

- Used by project applicants (e.g., developers) and public agencies to calculate evidence-based VMT reductions for both project planning purposes and CEQA compliance.
- Used by project applicants during the preliminary project-planning process to identify mobility management strategies that can be incorporated into the preliminary project design to reduce their project's VMT (along with air quality and greenhouse gas emissions) and proactively avoid transportation impacts that may otherwise be identified during the development review process.
- Used by transportation and environmental planners of public agencies during the development review process for discretionary projects. The strategies from the Toolbox can be required by agency staff during preparation of the environmental document and incorporated into the project design to mitigate or avoid transportation impacts of the project under CEQA.
- Used by transportation planning agencies such as SANDAG during the intergovernmental review process to identify and suggest VMT-reduction measures that could be incorporated into regionally significant projects.

Development Agreements and Incentives

A development agreement is a contract between a local government and a developer. Local governments sign development agreements to get assurances that the developer will provide specified infrastructure and other improvements in return for project approval. Development agreements provide a mechanism to secure investment in many types of mobility-management strategies. For

example, a developer might provide on-site improvements such as bicycle parking, priority parking for carpools and vanpools, or pedestrian facilities. Development agreements also can be used to secure off-site improvements associated with the project, such as a bikeway improvement, a bus shelter, or a commuter shuttle.

A development agreement should clearly document the specific improvements that will be made. The agreement could include items such as the following:[2]

- What specific mobility-management strategies are to be implemented, when they will start, and how long they will be operated?
- Who will be responsible for funding and operating the programs once the development is built and/or occupied?
- What is the expected outcome of the in terms of vehicle trips reduced?
- If reports on mobility-management actions are to be provided, how frequently, and to whom?
- What is the penalty for non-achievement of program goals or failure to continue mobility-management programs?

In some cases, local governments may need to offer additional incentives to developers to secure the inclusion of desired mobility-management strategies. There are a variety of developer incentive programs used by local governments, both monetary and non-monetary, such as reductions in development fees, density bonuses, and flexible parking requirements.

Impact Fees

Developer impact fees are required by local governments of new development for the purpose of funding new or expanded public infrastructure or facilities required to serve the proposed development. To help attract development in their jurisdictions, cities sometimes provide reduced development fees. This mechanism also can be applied to development that supports mobility-management objectives. Cities can establish a policy that reduces fees by a specified amount for developers that meet certain criteria. These criteria could include building in a specified location (such as a redevelopment area), building a specified use (such as housing), or building in a specified style (such as providing pedestrian amenities). The size of the reduction could vary depending on the size and cost of the developer action.

In response to SB 743, many cities are evaluating the effectiveness of impact fee structures. For example, the City of Pasadena conducted a comprehensive Fee Study to evaluate the development of a transportation impact fee.[3] To address the requirements of SB 743, the fees were calculated based on VMT rather than LOS. The study assigned average VMT to different land use categories based on the City's 2035 travel modeling. The VMT by land use types was used in combination with the cost of transportation facility needs to estimate the share of the facility costs that should be apportioned to each land use type.

Similarly, the City of San Francisco has been implementing a Transportation Sustainability Program (TSP) to plan and develop a transportation system that can accommodate residential and employment growth in the city. As part of the TSP, in 2015, San Francisco instituted a Transportation Sustainability Fee,[4] which replaced the Transit Impact Development Fee, to provide funding for transit, bicycle, and pedestrian improvements. In 2016, the City replaced LOS with VMT to measure project impacts and meet the requirements of SB 743. The final component of the TSP was implementation of the TDM Program in 2017, which requires land use developments to include on-site TDM amenities that support the reduction of commute vehicle trips.

Density Bonuses

A density bonus allows developers to build at a higher density than otherwise allowed in exchange for meeting criteria specified by the city. These criteria can include provision of certain amenities or building space for certain uses. Cities can encourage mixed-use development by granting a density bonus for commercial projects that include residential space. Density bonuses also can be used to encourage pedestrian amenities.

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[2] SANDAG. "Integrating Transportation Demand Management Into the Planning and Development Process: A Reference for Cities", May 2012. Available at: sandag.org/uploads/publicationid/publicationid_1663_14425.pdf

[3] City of Pasadena, "Transportation Development Impact Fee Study," January 24, 2017 (revised July 20, 2017). Available at: cityofpasadena.net/councilagendas/2017%20Agendas/Jul_24_17/AR%2018%20ATTACHMENT%20B.pdf

[4] City of San Francisco. Transportation Sustainability Fee. Available at: sfplanning.org/transportation-sustainability-program#invest

Parking Management

Several studies suggest that parking availability and cost are significantly associated with car ownership and mode choice. The higher the parking supply and the lower the cost to park, the higher the chance of someone owning a car and/or choosing to drive as their primary means of transportation. Establishing high minimum parking requirements for new developments may diminish the effectiveness of mobility-management strategies. Large surface parking lots often are underutilized for the majority of the day, and they can discourage access by pedestrians, bicyclists, and transit users.

High parking requirements can raise the cost of development and can discourage new infill developments. This can diminish the realization of higher densities that are critical to the success of thriving and mixed-use communities. Several of the parking-management strategies included in this guidebook support mobility management by discouraging single-occupant auto trips, including Parking Pricing, Parking Cash-Out, Reduced Parking, and Shared Mobility Parking. Strategies like Shared Parking and Unbundled Parking also can reduce developer costs and thereby encourage transit-oriented development and the provision of amenities that may encourage transportation alternatives.

Transportation Demand Management Ordinances

Some local governments have adopted TDM ordinances to advance the transportation goals of their general plans, climate action plans, and other community planning efforts. Adoption of a TDM ordinance usually codifies any identified programs, plans, and strategies, making them mandatory requirements for both ministerial and discretionary projects. A TDM ordinance typically requires actions by a developer in order to receive a building permit for a project. Some TDM ordinances include both voluntary and required elements.

For example, the City of Carlsbad adopted a TDM ordinance on February 26, 2019. The purpose of the ordinance is to: "reduce the number of Carlsbad employees driving alone to and from work and increase alternative commuting options like transit, biking, carpool and vanpool, to meet 2035 greenhouse gas reduction targets." [5] The ordinance requires that a TDM Plan be created for any new nonresidential development project that is anticipated to generate 110 or more average daily employee trips.

The Mobility Management Toolbox could be used to support the implementation of a TDM ordinance by both city staff and developers. For example, if the ordinance requires development of a TDM plan, developers could use the Toolbox to identify and assess effective strategies for inclusion in their required TDM plan. City staff who review and approve the TDM plan can use the Toolbox to assess the adequacy of plan strategies for reducing vehicle trips.

Local jurisdictions interested in developing new TDM ordinances or related city programs can use the Toolbox to evaluate program effectiveness and structure. Programs in some cities throughout the State require that developments achieve specified levels of vehicle trip or VMT reduction in order to receive approval. For example, the City of San Francisco requires that development subject to the TDM program requirements projects must submit a TDM Plan.[6] Based on the project characteristics, a point target is generated for the proposed project. Project applications can select from a list of 66 TDM options, each with points assigned to them, to include in their required TDM plan and achieve the point target. The Toolbox can be used to determine the appropriate scoring or points assigned to various mobility management strategy considerations.

Monitoring and Enforcement

Once implemented, local government and other stakeholders can monitor the effectiveness of mobility management strategies using a variety of performance measures. Monitoring and enforcement mechanisms are critical in ensuring that mobility-management solutions are implemented in an effective manner. Consistent program monitoring also can act as a means to collect data that may be used to inform CAP updates and other planning efforts.

At the project/site level, appropriate performance measures could include:

- Participation – the number or percentage of employees or tenants who participate in a TDM program

[5] City of Carlsbad. Transportation Demand Management Ordinance. Available at: carlsbadca.gov/services/depts/pw/environment/cap/transport.asp

[6] City of San Francisco. Transportation Demand Management Program. Available at: sfplanning.org/transportation-demand-management-program#program-applicability-process

- Vehicle trips – the number of private vehicles arriving at a site in a typical day or during peak commute periods
- Average vehicle occupancy – the number of individuals arriving in private vehicles divided by the number of private vehicle trips
- Mode shares – the number and percentage of employees or tenants who arrive at a site by mode (single-occupant vehicle, carpool, vanpool, transit, bike, walk)

At the community/city level, appropriate performance measures could include:

- Bike and pedestrian utilization – counts of bicyclists and pedestrians in selected corridors
- Transit ridership – transit passenger boardings systemwide, in select corridors, or at selected stops/stations
- VMT – typically calculated using travel model data based on number of trips and auto trip length
- Participation – the number or percentage of community/city residents who participate in a TDM program
- Mode shares – the number and percentage of community/city residents who travel by each mode, typically determined using a survey

5. Introduction to the VMT Reduction Calculator Tool

This Guidebook is intended to accompany the Mobility Management VMT Reduction Calculator Tool, which produces estimates of the percent reduction in VMT resulting from the implementation of mobility management strategies. This Microsoft Excel–based tool is a resource for evaluating and quantifying the impacts of mobility-management strategies as part of the development review and transportation analysis process at various scales.

The tool operates at two geographic scales: Project/Site-level and Community/City-level. Depending on the project location and project type, tool users can select appropriate strategies of interest for mitigating transportation impacts.

Each strategy requires that the user input values that are used to calculate the percent reduction in VMT for the selected strategy. For many strategies, the tool offers default parameters that can be replaced with user-provided values if available.

The tool includes instructions and should be self-explanatory for most users. Users of the tool should begin on the Main page, where the user selects the analysis scale (project/site-level versus community/city-level) and the city in which the analysis occurs. Users who select the City of San Diego or Unincorporated San Diego County can further select the Community Plan Area of analysis.

Each of the 22 strategies contained in the tool is on a separate Excel worksheet. Using hyperlinks, the user can navigate to the appropriate Results page to see the individual strategy and cumulative results. The user also can access a printable page with a summary of project information, percent VMT reduction, and citations for the strategies.

A screenshot of the tool main page is shown on the following page.

MOBILITY MANAGEMENT VMT REDUCTION CALCULATOR TOOL

I. Overview

The Mobility Management VMT Reduction Calculator Tool estimates the percent reduction in vehicle miles traveled (VMT) resulting from the application of mobility management strategies. This Excel-based tool is intended to act as a resource for identifying and evaluating the impacts of mobility management strategies as part of the development review and transportation analysis process. The tool supports the goals of SB 743 (Steinberg, 2013) by providing jurisdictions and developers with a resource to quantify VMT reductions resulting from implementation of a variety of mitigation strategies at various scales. The tool also supports local government planning efforts including implementation of general and community plans, transportation demand management (TDM) ordinances, and climate action plans.

The tool operates at two geographic scales: project/site-level and community/city-level. Depending on the project location and project type, users can select appropriate strategies of interest for mitigating transportation impacts. Some strategies reduce VMT only from employee commute trips. Other strategies reduce VMT from all project-generated trips or all community/city trips. The type of VMT affected is shown on the Results pages and on the individual strategy pages. Each strategy requires that the user inputs values that are used to calculate the percent reduction in VMT. For many strategies, the tool offers default parameters that can be replaced with user-provided values if available.

This tool was developed as part of a project funded by a Caltrans Strategic Partnerships Planning Grant. The tool is available as a resource for local jurisdictions. Local jurisdictions are under no obligation to use this tool in their development approval processes or transportation analyses under SB 743. VMT reduction estimate results should be closely reviewed by the local jurisdiction or lead agency.

A separate Mobility Management Strategy Guidebook serves as a complement to this tool. The Guidebook includes summary descriptions and resources for a variety of mobility management strategies, including all strategies contained in the tool as well as others for which VMT reductions cannot be reliably estimated.

II. Instructions

Follow the steps below:

1. Under the "Project Information" section below, select the scale of analysis.

2. Select the location of analysis, using the drop-down menus below. If San Diego City or Unincorporated San County is selected, the user has the ability to select the Community Plan Area (CPA) location.

3. Depending on the scale of analysis, different mobility management strategies are available for consideration. Click on a strategy of interest by selecting the strategy name. The hyperlink will take the user to that strategy page. Each strategy page requires the user to input data into cells to estimate the percent VMT reduction. See the **Legend** for a display of the different cell styles present in the strategy pages.

4. Using hyperlinks, the user can navigate to the appropriate Results page to see the individual strategy an cumulative results.

5. Additional strategies can be selected, and the Results page will reflect the combined impact of multiple strategies. If the user does not want to include a strategy with the cumulative results, click "Exclude from Results" on the strategy page (see **Legend**).

6. Once the user has reviewed the individual strategy and cumulative results on the appropriate Results page, click the "Print Results" hyperlink to go to a printable page with a summary of project information, percent VMT reduction, and literature citations for the calculations at the selected scale of analysis.

III. Legend

Below are the different cell styles the user will see in the formulae of the strategy pages. Not all strategies use each cell style.

constant, coefficient, or default	=	constant, coefficient, or default value, locked
user input	=	required user input, values may be restricted, unlocked
user input, optional	=	optional user input, values may be restricted, unlocked
overridden default	=	if optional input entered, then default will be overridden, locked
	=	hidden help text visible if user hovers cursor over cell, locked
calculation	=	intermediate calculation in formula, locked
% change in VMT	=	strategy output, locked
% change in VMT, max decrease	=	strategy output, max achievable reduction, may be capped, locked
% change in VMT, increase	=	strategy output, VMT increase, may be capped, locked
☑ Exclude from Results	=	optional user input, checkbox to exclude strategy output from results

IV. Project Information

Project Name (optional):		
Project Address (optional):		Not applicable if scale of analysis is city/community.
Project Type (optional):		E.g., residential, commercial
Scale of Analysis:	Project/Site	"Project/site" refers to strategies that occur at the scale of a parcel, employer, or development project. "Community/city" refers to strategies that occur at a scale of a neighborhood, corridor, on entire municipality.
Analysis Location:	San Diego	If necessary, determine location using SANDAG's online Parcel Lookup Tool. Be sure to turn on the Jurisdictions and Community Plan Areas layers.
CPA (if applicable):	Rancho Encantada	If the Analysis Location is in a CPA in San Diego City or Unincorporated San Diego County, select the CPA from the dropdown list. See the Parcel Lookup Tool above for more information. If the Analysis Location is the entire San Diego City or entire Unincorporated San Diego County, leave the CPA input blank. Follow hyperlinks below for lists of CPAs in San Diego City and Unincorporated County.
Is analysis in a rural area? See Question #11 of the FAQ page for information about tool applicability.		**CPAs:** San Diego City Inincorporated County

V. Mobility Management Strategies

Project/Site-Level Strategies

Community/City-Level Strategies

Project-Level Results

Community-Level Results

Employer Commute Programs

Strategies implemented by employers that encourage workers to commute by modes other than auto

1A	Voluntary Employer Commute Program
1B	Mandatory Employer Commute Program
1C	Employer Carpool Program
1D	Employer Transit Pass Subsidy
1E	Employer Vanpool Program
1F	Employer Telework Program

Land Use Strategies

Strategies that modify the location or characteristics of land development projects to encourage non-auto travel modes

2A	Transit Oriented Development
2B	Mixed Use Development

Parking Management

Strategies that discourage auto travel by modifying the price or supply of vehicle parking

3A	Parking Pricing
3B	Parking Cash Out

Neighborhood Enhancements

Strategies that improve or encourage neighborhood-level bicycle, pedestrian, and other multimodal travel options

4A	Street Connectivity Improvement
4B	Pedestrian Facility Improvement
4C	Bikeway Network Expansion
4D	Bike Facility Improvement
4E	Bikeshare
4F	Carshare
4G	Community-Based Travel Planning

Transit Strategies

Strategies that improve transit service and cause a mode shift from auto to transit

5A	Transit Service Expansion
5B	Transit Frequency Improvements
5C	Transit-Supportive Treatments
5D	Transit Fare Reduction
5E	Microtransit NEV Shuttle