SoHay Mixed Use Development Project

Transportation Demand Management Plan

Hayward, California

February 28, 2018

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INTRODUCTION

Transportation Demand Management (TDM) refers to strategies that result in a more efficient use of transportation resources to help relieve traffic congestion, parking demand, and air pollution problems. Typically, TDM combines different services, facilities, and actions that result in a reduction of single-occupant vehicle trips. A TDM Plan is developed to guide efficient use of an existing transportation system and to ensure new developments are designed to maximize sustainable transportation usage. This plan is prepared for the proposed SoHay Mixed Use Development Project in Hayward, California. The project is a 25 acre mixed use development with commercial and residential units. To propose effective and appropriate TDM measures, this plan is based on the project's size, location, and land uses.

To comply with City of Hayward's request, the TDM plan included in the Planning review submittal package to the City. The goal of this TDM Plan is to achieve a project vehicle trip reduction (VTR) by a minimum of nine percent, equivalent to the trip reduction credit taken for this project

Project Description

The project site is located along Mission Boulevard, Dixon Street, Industrial Parkway, and Valle Vista Avenue in the City of Hayward, California. Consisting of 400 for sale townhomes, 72 apartments and approximately 20,000 square feet of leasable retail space. The project site and vicinity are shown in **Figure 1**.

The proposed project site, to be constructed in multiple, noncontiguous planning areas, is within the South Hayward Bart/Mission Boulevard Form-Based Code zone with the following land use designations:

- MB-T4 Sub-Urban Zone, 17.5 to 35 units/net acre- located west of Dixon Street and north of Industrial Parkway and located east of Mission Boulevard;
- MB-T5 Urban Center Zone, 35 to 55 units/net acre – located on both sides of Valle Vista, along the Mission Boulevard frontage, and east of Dixon Street; and
- MB-CS Civic Space Zone- located on Mission Boulevard south of Valle Vista Avenue

There is designated park space for this project between Mission Boulevard and Dixon Street as well as bicycle and pedestrian trails throughout the development. The site plan shows site access via driveways located along Mission Boulevard, Dixon Street, Industrial Parkway, and Valle Vista Avenue. On-site parking consists of covered spaces, open space, and on-street spaces. The project site plan is shown in **Figure 2**.

To note, TJKM prepared the draft *SoHay Mixed Use Development Traffic Impact Study (*TIS). The TIS analysis and data is referenced in this TDM.

PROJECT TRIP GENERATION

An evaluation of the project's net trip generation was conducted for the daily, weekday a.m. peak hour, and weekday p.m. peak hour. A description of the analysis is discussed in the TIS.

The project is estimated to generate a net increase of 3,338 daily vehicle trips, with 211 trips occurring during the a.m. peak hour and 275 trips occurring during the p.m. peak hour. The project's trip generation is presented in **Table 1**.

Table 1: Trip Generation for Proposed Project Conditions

Proposed Land Use (ITE Code)	*Size*		*Daily*		*A.M. Peak*						*P.M. Peak*					
			Rate	*Trips*	*Rate*	*In %*	*Out %*	*In*	*Out*	*Total*	*Rate*	*In %*	*Out %*	*In*	*Out*	*Total*
Residential Condo/Townhouse (230)	402.0	d.u.	5.81	2,336	0.44	17	83	30	147	177	0.52	67	33	140	69	209
Apartment (220)	72.0	d.u.	6.65	479	0.51	20	80	7	29	37	0.62	65	35	29	16	45
Retail (820)	20.0	k.s.f.	42.70	854	0.96	62	38	12	7	19	3.71	48	52	36	39	74
Total Trips Before Discounts				**3,668**				**49**	**183**	**233**				**205**	**124**	**328**
TDM Measure Discount, 9%[1]				-330				-4	-18	-22				-18	-11	-29
Retail Peak Hour Pass By Trip Reduction (ITE), 34%[2]													-34%	-12	-13	-25
Total Net Trips After Discounts				**3,338**				**45**	**166**	**211**				**175**	**100**	**275**

Notes:

Source - ITE Trip Generation Manual, 9th Edition (2012)

k.s.f. = One Thousand Square Feet, d.u. = Dwelling Unit

[1] TDM Measure Reduction, 9% Consistent with industry standards used in Bay Area cities with similar development patterns as City of Hayward and in consultation with City of Hayward Staff

[2] TJKM applied a p.m. peak hour pass-by reduction rate of 34% for Retail land use consistent with ITE recommended average rates.

PARKING

Based on the project site plan, **Figure 2,** 890 parking spaces are provided for the proposed development. As per the South Hayward BART/Mission Boulevard Form-Based Code requirements, the site is split into ST4 and ST5 that have different maximum parking counts.

- ST4 parking requirements – 2 maximum per for sale residential unit;
- ST5 parking requirements – 1.5 maximum for rental units and 1.8 maximum per for sale unit; and,
- Commercial development – no minimum or maximum.
- ST4 areas include PA2-1, PA2-2, PA2-3, and PA3.
- ST5 areas include PA1-1, PA1-2, PA2-4 and PAMU.

In total, the project would be permitted to provide 898 maximum parking spaces. The project is expected to provide more spaces than required both overall and within each planning area. Therefore, no parking impacts are projected on City streets. **Table 2** provides a parking summary.

Bicycle Parking. Hayward Municipal Code (HMC) Section 10-24.245, Table 1 provides Short and Long Term Bicycle Parking requirements as follows:

- Short term bicycle parking:
    - Commercial (PA-1-MU) – one bicycle parking space per 5,000 square feet of retail;

  - Multi-Family Residential (PA-1-MU) – 0.1 bicycle parking spaces per bedroom;
  - Civic Area (Park) – one bicycle parking space per 10,000 square feet.
- Long term bicycle parking:
  - Commercial (PA-1-MU) – two bicycle parking spaces;
  - Multi-Family Residential (PA-1-MU) – 0.2 bicycle parking spaces per bedroom;
  - Civic Area (Park) – two minimum.

In total, the project would be required to provide 29 short term bicycle parking spaces: a total of 18 for the PA-1-MU (six for the retail portion and 12 for the residential portion), and 11 for the Park. A total of 26 long-term bicycle parking spaces: 25 for the PA-1-MU (two for the retail portion and 23 for the residential portion), and two for the Park.

Table 2 Parking Summary

Planning Area	Use	# Units	Total Provided
PA 1-1	Retail		89
PA 1-1	Apartments	72	72
PA 1-1	Cluster Towns	48	106
PA 1-2	Cluster Towns	28	69
PA 2-1	Row Towns	34	46
PA 2-2	Row Towns	88	129
PA 2-3	Row Towns	46	66
PA 2-4	Row Towns	30	35
PA 3-1	Row Towns	93	208
PA 3-2	Row Towns	33	70
Total		**472**	**890**

The development includes 35 bicycle parking spaces – 20 within the park; 10 within the PA-MU parcel; and five within the PA-3 parcel which does not meet the minimum requirements for short and long-term bicycle parking.

With the SoHay project's close proximity to transit, and infrastructure improvements for bicycles and pedestrians, the TDM plan will discuss opportunities to focus on less than the maximums required based on the Form-Based Code as per the City's Parking Standards (10-24.245).

REPORT ORGANIZATION

The remaining sections of this report describe transportation facilities and services provided in the project vicinity, TDM measures deemed appropriate for the proposed project, and the program for implementing and monitoring the TDM reductions.

Vicinity Map

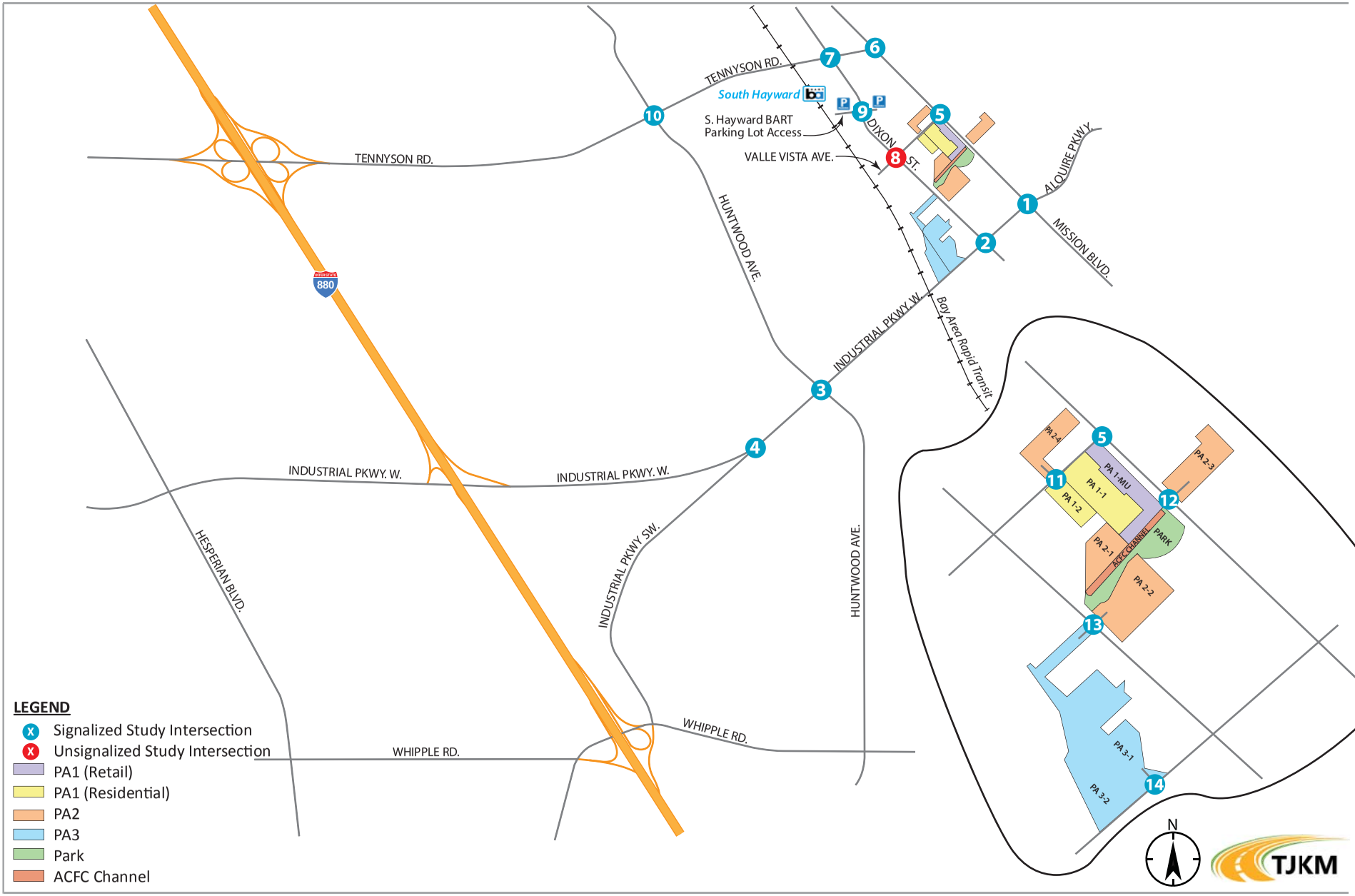

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Figure 1

Site Plan

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Figure 2

EXISTING TRANSPORTATION FACILITIES AND SERVICES

Transportation facilities and services that support sustainable transportation include light rail, buses and shuttles, bicycle facilities, and pedestrian facilities. This section describes the existing facilities and services near the project site that will support the TDM measures from this Plan.

Transit Facilities

Under transit facilities, BART, buses and shuttles in the surrounding area are documented. **Figure 3** shows existing transit services available in the project facility.

BART

Bay Area Rapid Transit (BART) provides commuter rail services throughout the San Francisco Bay Area. With end-line stations in Daly City, Dublin/Pleasanton, Fremont, Millbrae, Pittsburg/Bay Point, and Richmond, BART served over 400,000 weekday riders on average during Fiscal Year 2016.

The South Hayward BART station is located less than a quarter mile from the project site. Walking time to BART varies from about 10 minutes to 15 minutes, depending on location with the project.

The characteristics of the South Hayward BART station is as follows:

- BART operates at headways of 15 minutes or less between 4 a.m. and midnight on weekdays, from 6 a.m. to midnight on Saturdays, and from 8 a.m. to midnight on Sundays.
- Parking: Monthly Reserved Permit, Daily Fee ($*), Single Day Reserved Permit and Extended Weekend vehicle parking
- Bicycle services: Bicycle racks, no bike station, 16 shared use electronic lockers, 30 keyed bike lockers
- There is a bus transfer station that services AC Transit bus service

Bus Routes

There are six local bus routes (Routes 22, 37, 83, 85, 86 and 99) and one all-nighter bus route (Route 801) that serve the project site. The bus stops closest to the project site are located on Mission Boulevard near Valle Vista Avenue for northbound and southbound direction.

Currently, AC Transit offers local bus transit service on the following routes near the project site:

- AC Transit Route Line 22 provides weekday service at 30-minute headways between 6:26 a.m. and 12:18 a.m. and weekend service at one-hour headways between 6:46 a.m. and 12:28 a.m. The route runs a loop from the Hayward BART station and stops along Tennyson Road in the project vicinity.
- AC Transit Route Line 37 provides weekday service at one-hour headways between 5:05 a.m. and 7:50 p.m. The route runs a loop from the Hayward BART station and stops along Tennyson Road in the project vicinity.

- AC Transit Route Line 83 provides weekday service at one-hour headways between 5:03 a.m. and 8:44 p.m. The route stops along Tennyson Road in the project vicinity.
- AC Transit Route Line 85 provides weekday service at one-hour headways between 4:58 a.m. and 8:25 p.m. and one-hour headways between 5:25 a.m. and 8:52 p.m. on weekends. The route stops along Tennyson Road in the project vicinity.
- AC Transit Route Line 86 provides weekday service at 30-minute headways between 4:12 a.m. and 7:48 p.m. The route stops along Tennyson Road in the project vicinity.
- AC Transit Routes Line 99 provide weekday service at 20-minute headways from 5:00 a.m. to 1:01 a.m. The routes stops along Mission Boulevard in the project vicinity.
- AC transit Route 801 is an all-nighter service that provides weekday service from 11:43 p.m. to 6:20 a.m. The route stops along Mission Boulevard in the vicinity of the project area.

Bicycle Facilities

The existing bicycle facilities within the study area are shown in **Figure 4**, and include the following:

Class I Bikeway. Typically called a "bike path," a Class I bikeway provides bicycle travel on a paved right-of-way completely separated from any street or highway.

Class II Bike Lanes: A portion of the roadway designated for the exclusive use of bicyclists through striping, signage, and pavement markings.

Class III Bike Routes: Streets with low motorized traffic volumes and speeds designated and designed to give bicycle travel priority through signs, pavement markings, and speed.

The existing bicycle facilities in the study area mostly include bike paths and bike lanes as shown in **Figure 4**. Bike Paths are provided on one side along Industrial Parkway between Pacific Street and Huntwood Avenue near the project area. As per the Hayward general plan, bike paths are also proposed along Industrial Parkway east of Pacific Street. A buffered bike lane will be installed between Dixon Street and Mission Boulevard on eastbound Industrial Parkway as part of an upcoming development project.

Currently, bike lanes are provided in both directions along the following sections of roadways in the project vicinity:

1) Tennyson Road between Huntwood Avenue and Dixon Street,

2) Dixon Street between Tennyson Road and Industrial Parkway, and

3) Huntwood Avenue between Tennyson Road and Industrial Parkway.

There are no bike lanes or bike routes provided along segments of Mission Boulevard or Valle Vista Avenue near the project site.

Pedestrian Facilities

The project facilities will provide on-site circulation for pedestrians with street lighting, trails and wayfinding signs to enhance pedestrian mobility. On the public streets, high visibility crosswalks will be

added on Valle Vista Avenue and Dixon Street. These facilities provide a good connection with the project site and the BART Station.

Within the Project vicinity, Mission Boulevard has near-continuous sidewalks, and Industrial Parkway has discontinuous sidewalks on one side of the road. Valle Vista Avenue and Huntwood Avenue have discontinuous sidewalks on both sides of the road. Dixon Street has continuous sidewalks on both sides of the road and crosswalks at all intersections. A signal, with pedestrian signal heads and push buttons, is warranted under cumulative conditions at Dixon Street and Valle Vista Avenue, with a fair share contribution from the developer.

Figure 5 shows proposed on site pedestrian and bicycle circulation.

Existing Pedestrian Facilities

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Figure 3

Existing Bicycle Facilities

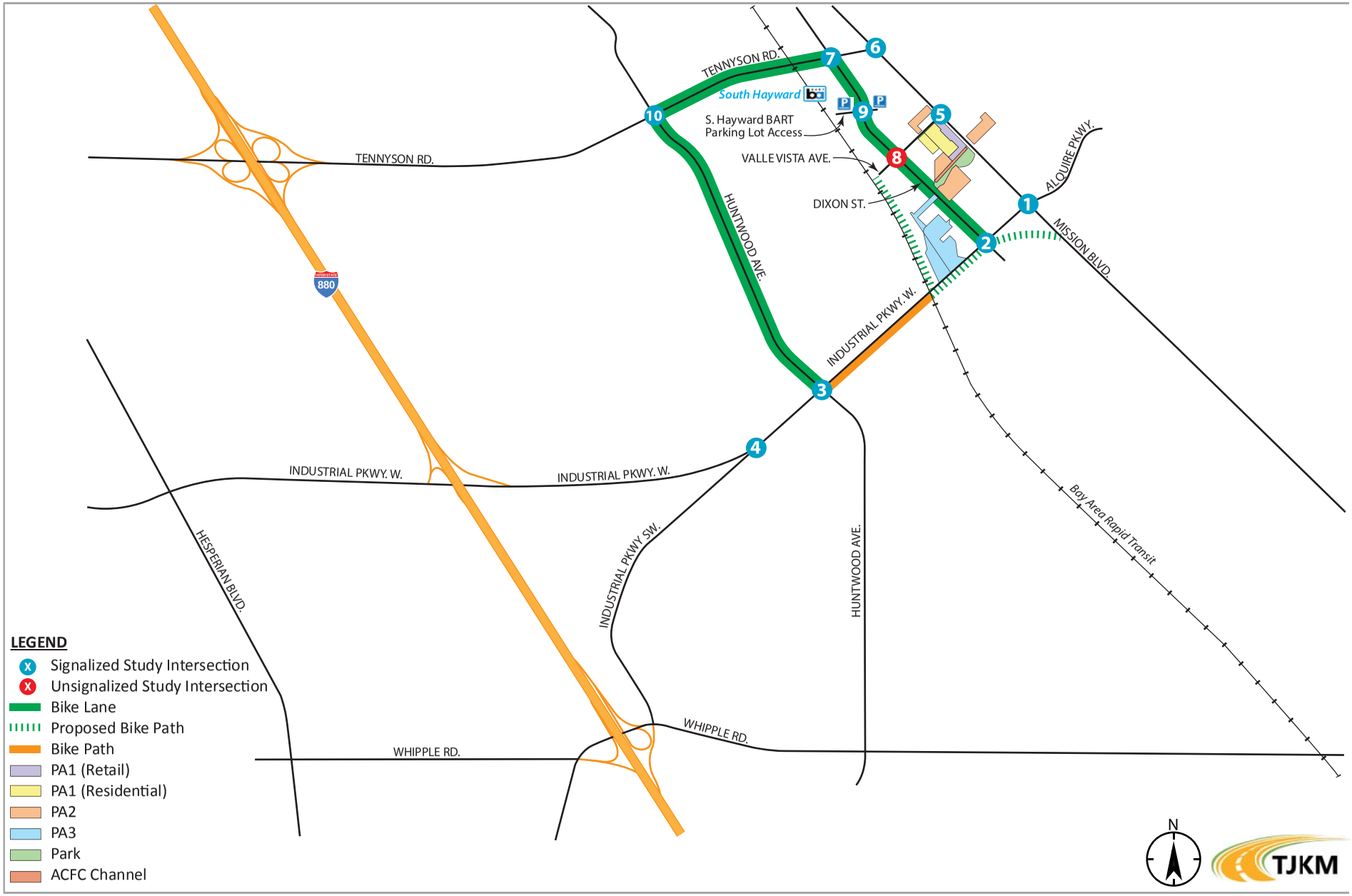

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Figure 4

Pedestrian and Bicycle Circulation

CIRCULATION LEGEND

SYMBOL	DESCRIPTION
	PEDESTRIAN CIRCULATION
	BICYCLE CIRCULATION

BICYCLE PARKING CALCS

AREA	QUANTITY
PARK	20
PA MU	10
PA 3	5

TOTAL BICYCLE PARKING SPOTS: 35

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TDM MEASURES

This section discusses TDM measures that are applicable to the proposed development. The measures to be implemented by the project include planning and design measures related to the attributes of the site design and on-site amenities. Such design measures encourage walking, bicycling, and public transit use. The TDM Plan includes measures that are focused on residential tenants and employees of the SoHay Project.

The project is located less than a quarter mile from the Hayward South BART station. At a typical walking pace, it would take about 10 minutes to walk from the furthest portion of the project site to the station. This encourages use of BART and AC Transit by residents and employees of the proposed project.

On-Site Amenities

Amenities on-site include provision of a TDM contact person, tenant welcome packet, bicycle storage, and high-bandwidth internet connections. Each is described below.

TDM Coordinator

A TDM contact person should provide information to tenants on alternative modes of transportation. The TDM contact person will be from an on-site employee and will coordinate with the Homeowners Association and Commercial lessors and will provide:

- Information and resources on transportation choices available to residents and employees.
- Transportation information packets to residents and employees.
- A current welcome packet with commute alternatives, transit maps, schedules, events and promotions. Distribution of Tenant Welcome Packet

New residents and commercial tenants will be provided transportation information packets that include information about transit routes and schedules (BART and AC Transit), bus stop locations, bike maps, ride matching services, transit planning resources, and on-site bicycle parking and amenities. Additional information, such as how to contact the SoHay TDM person for the development, will also be included.

The welcome packet will provide a brief summary highlighting the most important features of the TDM program, which allows residents to be familiar with it and understand how to access additional information. It will also include hard-copy information pertaining to alternative transportation options and current transit maps and schedules.

Information Kiosk

A static kiosk or information center throughout the project sites will post transit resources, bicycle and pedestrian information, and any promotions that are beneficial to promoting vehicle trip reduction. These kiosks would be designed to be complementary to the design of the SoHay development. Flyers advertising upcoming multimodal events, Transit and bike maps, as well as other information you would see in a neighborhood development community (leasing information, homeowner's association meeting, change in rental agreements, etc.) Proposed locations are shown in **Figure 6.**

Multimodal Wayfinding Signage

The project will provide pedestrian wayfinding signage along its trail system. In addition to these, wayfinding signage that directs residents, employees, and visitors to transit, bike share, car-share, bicycle amenities, and other related items will be installed within and outside of the development. **Figure 7** details the wayfinding signs locations as shown in the proposed project package along with sample signs.

Real Time Transportation Information

The developer shall provide resources to find real time transit, bicycle and pedestrian information. This information can be a phone application and the information should be included in the welcome packet and information kiosk.

Bicycle Storage

The project will provide 35 bicycle parking spaces located near the commercial complex, park, and the complex on the southern portion of the project, adjacent to Industrial Parkway. As discussed in the Introduction section of this report, the project is required, per the municipal code to provide 29 short-term and 26 long-term bicycle parking spaces (55 total bicycle parking spaces)

Short-term bicycle parking is defined as unsheltered, unenclosed bike racks with an intended parking duration of less than two hours. The majority of public bike racks are considered short-term. These are often seen at shopping centers, parks, and other public facilities.

Long-term bicycle parking is defined as a facility that is sheltered and secure, such as lockers, rooms, or stations where the intent is for longer periods, more than two hours. Examples of long term are bicycle lockers, which have a security system, often seen at transit stations, unattended bicycle parking such as storage areas or rooms near transit stations or adjacent to high-density housing, or attended bicycle facilities, where staff is on hand to provide valet services.

The development includes 35 bicycle parking spaces 20 within the park; 10 within the PA-MU parcel; and five within the PA-3 parcel, which does not meet the minimum requirements for short, and long-term bicycle parking. The provided parking spaces are assumed to be short-term since they are located mostly in the park area. Based on the number of covered parking spaces, however, there is possible garage parking can suffice as long-term storage. The units lacking garages should have opportunities to store their bicycle at long-term facilities, in particular, the rental units and the retail tenants. The developer, as a Condition of Approval, should provide the required short and long term bicycle parking spaces as per defined in the City's municipal code.

The addition of a bicycle storage facility, or room, provides long-term bicycle parking that is secure and weather-protected in the retail commercial area to be shared between residents and employees.

Employer Commute Incentive

Employer commute incentives will be included in the new tenant packet for employers, providing information and resources to provide to their employees.

Commuter Tax Benefit

For the commercial portion of the development, a commuter tax benefit can be offered to the employers. Under the Transportation Equity Act, IRS code 132(f), and California state law, employers are allowed to offer payroll tax savings for transportation assistance. Employers also have the option of subsidizing part of their employees' commuting costs and allowing employees to pay for the remainder with pre-tax dollars.

The IRS has deemed the following monthly amounts allowable under IRS tax code 132a:

Transit or vanpool = $255 Bicycle Subsidy = $20

Qualified Commuter Parking = $255 Combined Parking & Transit Benefit = $255

The employer would administer this benefit as it deals with processing on a monthly basis, employee benefits and payroll.

Proposed Kiosk Locations

LEGEND

Kiosk Locations

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Figure 6

Wayfinding Sign Locations

INTERPRETIVE CENTER + DISCOVERY GARDEN

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Figure 7

Transit Elements

Clipper Card

Clipper Cards are all-in-one transit cards including BART, AC Transit, VTA, and most transit agencies in the nine County San Francisco Bay Area. As an incentive, the developer can purchase pre-loaded transit fare for residents and employees to try transit for a set amount of time, such as the equivalent to one week or a month. The Clipper Card costs $3 and can be reloaded or set to an auto load if the balance falls below $10. The Clipper Card can offer one clipper card per dwelling unit and one per employee. The investment can be over a set period of time, or until a set dollar amount has been reached. Per the SoHay development, one clipper card per dwelling unit will be provided, up to the expended amount of $200,000.

AC Transit EasyPass

EasyPass is a subsidized AC Transit pass that the project sponsor will provide for each new household for use during its first year of occupancy at SoHay, after which the HOA will assume responsibility for the management of the program. With over 100 dwelling units, SoHay qualifies to participate in the program in the cost range of approximately $49 to $154 per resident annually, based on location and level of transit service at the site, for unlimited rides on AC Transit.

BART Commuter Tax Benefits

For the 2016 taxable year, the Federal tax code allowed tax-free transportation fringe benefits of up to $225 per month per employee for transit expenses and up to $255 per month for qualified parking (including parking at BART stations). Qualified parking is defined as parking at or near an employer's worksite, or at a facility from which an employee commutes via transit, vanpool or carpool. Companies can offer the following:

- A tax-free employer paid subsidy
- A pre-tax employee-paid payroll deduction
- A deduction combination of both of the above

This employer benefit will be included in the new tenant packet for employers, providing information and resources to provide to their employees. This TDM measure is an encouragement measure and not counted towards the nine percent VTR goals.

Carpool and Vanpool Programs

Carpool and vanpool programs will be promoted to residents and employees through the complex's welcome packets. These TDM measures are considered encouragement measures and not counted towards the nine percent VTR goals.

511 Ride Matching Assistance

The 511 RideMatch service provides a system to help commuters find carpools, vanpools, or bicycle buddies to share your commute. This free service helps commuters find others with similar routes and travel patterns with whom they can share a ride. Registered users are provided with a listing of other commuters near their employment or residential ZIP code along with the closest cross street, email,

phone number, and hours they are available to commute to and from work. The participants can then choose and contact others who they can ride with. RideMatch also provides lists of existing car and vanpools in the area that may have available spaces.

Carpool/Vanpool Incentives for New Users

The 511 Regional Rideshare Program (RRP) offers a variety of incentives to those who try carpooling and vanpooling. Most of the programs reward people who form or try carpooling or vanpooling, and provide an award or subsidy after the first three or six months of participation.

Vanpool Formation Incentive – The 511 RRP provides up to $500 in gas to new vanpools that meet specific eligibility requirements and complete three to six months of operation. Gas cards are awarded on a first-come-first-serve basis until funds are depleted.

Vanpool Seat Subsidy – The 511 RRP subsidizes vanpool seats in the form of gas cards. The subsidy provides $100 per month, with a three-month limit per van during the program year, to help cover the fare of a lost participant. The gas cards are offered to eligible vans on first-come-first-serve basis until funds are depleted.

Guaranteed Ride Home

This program offers a free taxi or rental car ride home in case of an emergency (illness, family crisis, unscheduled overtime). Employees working in Alameda County and use an alternative transportation mode on the day of the emergency are eligible for the program, and it is open to all Alameda County employees living within 100 miles of their place of employment. Employees must pre-register with the program, and eligible taxi and rental car rides can be reimbursed by submitting a receipt through the program's website (grh.alamedactc.org).

Car Sharing

Car sharing programs help those who choose to travel to work by alternative means of transportation. Using transit, bicycling, carpooling or vanpooling, and walking can hinder mid-day trips for personal and business purposes. With car sharing (such as Getaround and Zipcar), individuals have access to a vehicle when they need it during the day so they are not required to drive their personal car.

A business account with Zipcar costs $75 for initial investment plus $35 annually for each driver. The program offers discounted rates for weekday business driving: gas, insurance, and up to 180 miles per day for the $72 full day rate. Hourly rates start at $7 and vary depending on the type of vehicle used. The developer will encourage tenants and employees to register for Zipcar upon move-in. Employers are responsible for Zipcar enrollment fees, and employees should be eligible for reimbursement for Zipcar expenses if they provide appropriate documentation.

Information about the Zipcar program and available nearby locations will be provided in the welcome packet. Promoting this program would encourage residents to utilize alternative transportation, reducing parking demand.

Three plans are available for users as discussed below and include gas, insurance, and up to 180 miles of driving:

1. Occasional Driving – Annual fee of $15 for the first year ($70 per year after that) and driving rates from $7 per hour and $79 per day.
2. Monthly Driving Plan – One-time $25 application fee, monthly fee of $7 per month, and driving rates from $7 per hour to $79 per day.
3. Extra Value – One-time $25 application fee, $50 per month (goes towards approximately eight hours of driving), and driving rates from $6.30 per hour and $71.10 per day.

The closest Zipcar location is at the Cal State University East Bay with three locations at the site.

The proposed site plan does not provide any on-site parking, to dedicate space exclusively for a car share service. The developer can engage Zipcar or any local vendor, to dedicate an on-street parking space for car sharing, or advocate for a space at the Hayward South BART location. Coordination with the City is essential for this measure. The provision of parking spaces is discussed in the Parking section of the TDM Measures.

Bicycle Programs

Contributions or Incentives

The developer will provide incentives to purchase and maintain a bicycle per dwelling unit (adult) and employee.

Bike Sharing

A Bike Share program is a network of commuter-style bikes that can be rented through self-service bike share stations for short trips. The idea behind the program is to make bikes available to transit users for a short journey between a transit station and workplace. Bikes become available the same way as car sharing vehicles for making business or personal trips during the day.

The program has an option for individuals to sign up, and residents will be provided information about the Bay Area BikeShare program, currently renamed to Ford GoBike. Annual memberships cost $88 and entitle a member to use a bike for half an hour as frequently as desired. Rides exceeding the 30-minute time limit cost an additional $4 under one hour, and $7 for each subsequent hour.

The program is only located in San Francisco, Oakland, and San Jose. The program does not provide service south of Oakland in the East Bay Area. The developer can coordinate or partner with the City to get a Ford GoBike Station, or any vendor with a vast connection to other bike share networks, at the BART South Hayward Station or even on site. The Welcome packet should be kept up-to-date with the program's scheduled expansions relative to the project site. *There are several bike sharing vendors the developer can explore and coordinate with the City. The GoBike is a regional program that many municipalities work with however; the development is not limited to this vendor.

Bicycle Maintenance Services

The developer shall offer coupons for bicycle maintenance at a bicycle shop once a year. The developer would have to secure this measure with a bicycle shop as part of the physical measures to be implemented prior to certificate of occupancy. The TDM Coordinator will provides the coupons and

maintain records of employees or residents that receive the coupon in order to eliminate misuse of the service.

Parking

Promote Shared and Mixed-Use Parking

The concept of shared and mixed-use parking should be considered for this development. In this instance, shared parking between the residential and non-residential uses should result in a substantial reduction of on-site parking for the overall SoHay development. Per the parking standards, within the zoned designation, accepting less than the maximum is supported. A Shared Parking Analysis and comparison with the *Institute of Traffic Engineers (ITE) Parking Generation Handbook,* can determine the demand based on surveys of similar uses.

Car Share Parking Spaces

To be consistent with the City's sustainability and climate action goals, as a Condition of Approval, the SoHay development will provide 10 dedicated car-share parking spaces, to be distributed throughout the project area.

Electric Vehicle Charging Stations

As part of the project, dedicated Electric Vehicle (EV) parking spaces are required, per the City's Building Division. Paired with this requirement, the developer is required to provide EV Charging Stations at the dedicated public EV parking spaces for use by retail patrons, residential area visitors, and park visitors.

Rideshare or Ride-Hailing Services- *a brief discussion*

This is not considered a measure because it does not necessarily reduce VMT. Though there are limited studies on this type of service, the potential to reduce the need for parking spaces by less car ownership is possible. However based on mode substitution and frequency of use, there is a potential for the Uber and Lyft-type rideshare services to contribute to growth in VMT. For the purpose of this TDM, it is not included as a measure, but a statement that this type of travel mode is an option.

TDM PROGRAM IMPACTS

TDM measure impacts are difficult to quantify due to a lack of data, and variation of performance measures and evaluation methods. This section briefly discussed some of the known impacts of TDM strategies. The FHWA discusses results of studies that determine how vehicle trips are affected by a variety of TDM measures. **Table 3** details the TDM listed above and the estimated VTR percentages by the Federal Highway Administration (FHWA) Though the City of San Francisco has a point system that equates to a percentage of VTR, that City is more urban and multimodal than Hayward. For this reason, the VTR range in the FHWA report *Integrating Demand Management into the Transportation Planning Process: A Desk Reference* was used as an estimate. The excerpt from this report is included in **Appendix A.** The estimated potential trip reductions for SoHay is shown the final column.

Table 3: TDM Measures and Vehicle Trip Reduction Range

Program Elements	Implementation	Est. VTR Range*
On-Site Amenities		
Distribution of TDM Information	• The developer will compile and distribute information regarding all TDM measures to residents and commercial tenants through provision of a TDM Contact Person and Tenant Welcome Packet	3-5%
Multimodal Wayfinding Signage	• Throughout the project site, the developer will provide multimodal signs	3-5%
Real Time Transportation information Displays	• The developer will provide resources for real time transportation information in the Tenant Welcome Packet	3-5%
Bicycle Storage	• The developer includes long-term and short-term bicycle parking on-site	3-5%
Employer Incentive		
Commuter Tax Benefit	• Provide subsidies for multimodal use.	10-20%
Transit Elements		
Clipper Card	• The developer will provide clipper cards for a set period of time as an incentive to try transit	10-20%
AC Transit EasyPass	• The developer will work with AC Transit to arrange for purchasing the AC Transit EasyPass in bulk for residents up to one year	10-20%
BART Commuter Tax Benefits	• The developer will advertise and promote the program to residents	5-10%
Carpool and Vanpool Programs		
511 Ride Matching Assistance	• The developer will advertise and promote the program to residents	5-10%
Carpool/Vanpool Incentives for New Users	• The developer will advertise and promote the program to residents	5-10%
Guaranteed Ride Home	• The developer will advertise and promote the program to residents	5-10%
Bicycle Programs		
Contributions or Incentives	• The developer will provide incentives to purchase and maintain a bicycle	5-15%
Bike Sharing	• The developer and City can coordinate with a bike share vendor to place a station near the BART Station or on site.	5-10%
Bicycle Maintenance Service	• The developer will provide coupons for annual bicycle maintenance service	3-5%
Parking		
Shared/Mixed Use Parking	• Some parking will be available for either resident, visitor, employee or customer use	25-30%
Dedicated Car Share and Electric Vehicle Parking Spaces	• The developer will provide dedicated parking spaces for Car Share and Electric Vehicles	3-5%

* Source: Integrating Demand Management into the Transportation Planning Process: A Desk Reference, FHWA 2012

The developer reviewed the TDM Measures and provided a list of the measures SoHay would implement in **Table 4.** Most of the measures would be implemented except for a few bicycle related measures. The developer has provided bicycle storage on site and will not pursue a bicycle commute incentive at this time. The regional Bay Area bike share program is not forecasted to be in Hayward or any adjacent community in the near future, therefore it is not a feasible TDM measure to implement at time of occupancy.

Table 4: Proposed TDM Measures to be Implemented by the SoHay Development

Program Elements	Implementation	SoHay Benefit
On-Site Amenities		
Distribution of TDM Information	• The developer will compile and distribute information regarding all TDM measures to residents and commercial tenants through provision of a TDM Contact Person and Tenant Welcome Packet	2%
Multimodal Wayfinding Signage	• Throughout the project site, the developer will provide multimodal signs	<1%
Real Time Transportation information Displays	• The developer will provide resources for real time transportation information in the Tenant Welcome Packet	<1%
Bicycle Storage	• The developer will provide adequate short and long term bicycle storage per the City's bicycle parking requirements	1%
Employer Incentive*		
Commuter Tax Benefit	• Provide subsidies for multimodal use.	<1%
Transit Elements		
Clipper Card	• The developer will provide clipper cards,, one per household, until the amount of $200,000 is expended.	2%
AC Transit EasyPass	• The developer will work with AC Transit to arrange for purchasing the AC Transit EasyPass in bulk for residents up to one year	2%
BART Commuter Tax* Benefits	• The developer will advertise and promote the program to residents	2%
Carpool and Vanpool Programs*		
511 Ride Matching Assistance	• The developer will advertise and promote the program to residents	1%
Carpool/Vanpool Incentives for New Users	• The developer will advertise and promote the program to residents	1%
Guaranteed Ride Home	• The developer will advertise and promote the program to residents	<1%
Bicycle Programs		
Bicycle Maintenance Service	• The developer will provide coupons for annual bicycle maintenance service	1%
Parking		
Shared/Mixed Use Parking	• Some parking will be available for either resident, visitor, employee or customer use	2%
Car Share Parking	• The developer will provide 10 dedicated car share parking spaces throughout the project area	1%
EV Charging Stations	• The developer will provide EV Charging Stations with the dedicated public EV parking spaces for use by retail patrons, park visitors, and residential area visitors	1%
	Total VTR Benefit	**14%**

* These TDM Measures are encouragement measures that are not credited towards the VTR Benefit of the project.

The estimated SoHay Benefit, excluding items that are considered encouragement rather than enforcement, is approximately 14 percent. SoHay Benefits showing less than one percent benefit were

not included in the total percent benefit. The transit elements incentives can provide a substantial mode shift since the project is within a 10 minute walk to the BART Station. The SoHay development will provide a clipper card, one per household, until the amount of $200,000 is expended.

TDM IMPLEMENTATION AND MONITORING

The purpose of the TDM Plan is to reduce vehicle trips (nine percent VTR goal for the proposed development), traffic congestion, and encourage use of non-auto modes of transportation. The City will provide initial approval of the Plan as a part of the project review process. Upon 90 percent occupancy of the site, the City may request assessment reports regarding the TDM program.

Implementation

The building developer will submit this TDM Plan to the City of Hayward. The developer will be responsible for ensuring the trip reduction measures are implemented, as described in **Table 4,** requiring the aforementioned trip reduction measures to be incorporated into the project.

The building developer will be held responsible for implementing and maintaining the elements of the TDM Plan. After the project is constructed, it will be inspected for compliance with physical measures (bicycle facilities, kiosks, wayfinding signs, etc.) before the first Certificate of Occupancy is issued. Regular inspections will occur periodically.

Monitoring

The City of Hayward requires monitoring and inspection for the project, which can include a sunset period, should the project meet the goals over a certain time. Monitoring can start when the development is occupied at 90 percent or at the discretion of the City.

For programmatic measures (transit passes, car-share memberships, etc.) the developer will be required to report to the City. The City will work with non-compliant measures to bring them into compliance, and those that still do not comply would require additional measures to implement or a financial penalty. The developer will also be collecting data on the effectiveness of selected TDM measures to potentially update the percent assignments for specific measures. The most common measure is through annual surveys providing commute patterns of the residents and tenants.

The TDM Coordinator shall develop and administer an annual survey of commute characteristics of the residents and employees and report on the results of the survey, as well as on the status of their overall TDM program. A sample survey is located in **Appendix B.** This information will be reported to the City of Hayward. The following sections outline the survey process and the reporting requirements.

Annual Surveys

Surveys will be conducted annually, once fully occupied. Surveys shall not coincide with a special event or promotion geared at increasing alternative modes of transportation (e.g., Bike to Work Day, Walk to School Day, etc.).

Prior to distribution to the SoHay residents and employers, the TDM Coordinator will submit the proposed survey to the City for review and approval.

A minimum of 65 percent must respond to the survey each year. In order to achieve the 65 percent response rate, the developer will develop incentives / prizes to encourage response. Examples of incentives include raffles for gift certificates, transit passes, and electronic accessories.

Reporting

The TDM Coordinator will be responsible for summarizing the survey information received into a single SoHay TDM Annual Report. A copy of this TDM Annual Report will be submitted to the City for review and comments. Copies will also be sent to the employers and residents.

The first report documenting TDM program participation will be provided within one year of the issuance of the first occupancy permit for the first building constructed on-site. The first report shall document the establishment of a TDM Coordinator for SoHay, the implementation of recommended TDM measures, and a survey of participation.

In the second year and in all subsequent years, a complete TDM report shall be submitted to the City. The TDM Annual Report will be in a similar format as the first TDM Report, and will include the following information:

- Complex-wide results of the resident and employer surveys, including number of employees
- An update concerning the measures and activities discussed in the previous TDM Annual Report
- List of measures recommended to be discontinued based on their lack of success.
- Additional or alternate TDM measures that SoHay will implement during the following year to achieve the VTR goals set forth in the TDM Plan.

CONCLUSION

The TDM Measures detailed in this report can provide the project with an achievable nine percent vehicle trip reduction. Transit incentives will yield the largest result of VTR. Paired with unbundled parking, there is an opportunity to have VTR greater than nine percent, which is favorable for project approval as it is in alignment with the City of Hayward's Climate Action Plan and sustainability goals

Appendix A

FHWA Report Excerpt: Integrating Demand Management into the Transportation Planning Process: A Desk Reference

U.S. Department of Transportation
Federal Highway Administration

Integrating Demand Management into the Transportation Planning Process: A Desk Reference

August 2012
FHWA-HOP-12-035

10.2 Travel Impacts

TDM originated from commuter-based programs aimed at shifting commuters from drive alone travel choices to other modes. These mode shift impacts address several policy measures, namely congestion relief, accessibility improvement, air pollution mitigation, and smarter land use decisions. The principal means for evaluating TDM, and therefore the core performance measures, are related to travel impacts, especially changes in the use of drive-alone vehicles. At the core of these performance measures is a basic quantification or estimation of changes in travel behavior: changes reflecting adoption of new travel choices. This focuses the core performance measures on:

- Mode shift (change in % use of each travel mode).
- VTR (reduction in the number of vehicles used by travelers adopting other choices).
- VMT Reduction (reduction in the amount of travel represented by shift in travel mode or location).

From these performance measures, especially VMT reduction, a host of other performance indicators can be derived, especially those related to emissions (environmental) and energy use. Table 10.1 shows estimated ranges of TDM program effectiveness by type of program or strategy and level of transit service, as developed for site-specific TDM programs in Fairfax County, VA.[178] In this table, "high" transit service corresponds to rail, "moderate" to peak-period bus headways of 20 minutes or less, and "low" to other conditions. These estimates of net mode shift were developed for the Fairfax County Department of Transportation, based on an assessment of various literature sources combined with professional judgment, in order to provide TDM planners with a basic understanding of the potential for mitigating trip generation, and therefore added traffic, from new developments.

Table 10.1: National Evidence on TDM Program Impacts
Vehicle Trip Reduction from Background Conditions

Source: Cambridge Systematics, 2010 (Fairfax County, VA)

TDM Program or Strategy	High Transit	Moderate Transit	Low Transit
Support, Promotion, Information	3-5%	1-3%	<1%
Alternative Commute Services	5-10%	5-10%	1-3%
Financial Incentives	10-20%	5-15%	1-5%
Combined Strategies			
With Free Parking	15-20%	10-15%	3-7%
With Paid Parking	25-30%	15-20%	N/A

Other guidance has gone further than this simple table. One of the earliest FHWA guidance documents on TDM provided dozens of effectiveness look-up tables derived from the FHWA predecessor to the COMMUTER Model. The 1993 report, "Implementing Effective TDM Measures: Inventory of Measures and Synthesis of Experience,"[179] provided charts showing the corresponding VTR for various employer TDM strategies applied to various starting conditions (as is the case with the transit conditions in Table 10.1).

[178] Cambridge Systematics, Inc, Increasing the Integration of TDM into the Land Use and Development Process, prepared for Fairfax County Department of Transportation, draft final report, May 2010.

[179] FHWA, "Implementing Effective TDM Measures: Inventory of Measures and Synthesis of Experience" DOT-T-94-02, September 1993, http://ntl.bts.gov/DOCS/474.html

A recent TCRP report on "Employer and Institutional TDM Strategies," published as one of a series of reports on Traveler Responses to Transportation System Changes,[180] provides an update to this knowledge base on trip reduction impacts of TDM strategies. This report includes a broad set of TDM strategies, including financial incentives and disincentives, service provision (shuttle buses and vanpools), support strategies for bike and walk commuting, alternative work arrangements (compressed work weeks, telecommuting), and institutional arrangements for implementing TDM programs. The report analyzed TDM impact data from 82 employer programs where sufficient (before and after) and rigorous (unbiased data collection) data existed. The TCRP report corroborates some of the information in Table 10.1 by revealing that worksites with good transit availability realized a vehicle trip reduction (VTR) rate of 26% versus 12% at worksites without good transit. Some other comparative findings showed that:

- The existence of aggressive employer support programs (e.g. , guaranteed ride home) results in a 4-5% VTR in and of itself.
- The offer of alternative commuting services (e.g. , shuttle bus, vanpool) resulted in an average VTR of 22% as compared to 14% among worksites with the offer of these services.
- The existence of financial incentives and disincentives produced VTR results in the range of 23-30%.

The TCRP report provides many look-up tables displaying the results of the 82-worksite analysis showing average VTR in the presence or absence of key TDM strategies and support elements. For example, Table 10.2 shows the relative effectiveness of combining financial incentives with other key employer program attributes, such as transit availability and support services. The case studies used in the analysis shown in the table are considered "top performers" and do not represent "average" impacts among all worksites implementing similar TDM measures. As such, these findings should be considered upper bounds of potential impacts.

Likewise, the WTRM development project examined 1,671 distinct incentive plan combinations in total, and out of these, 50 combinations are implemented by at least 75 records. And these 50 distinct incentive plan combinations have been implemented by 9,866 records in total. A series of look-up tables for these top 50 plan combinations vary based on starting VTR that show the ACTUAL changes report, WTRM predicted value, and the number of plans that fit that profile.[181]

[180] TCRP, Report 95 – Chapter 19 – Employer and Institutional TDM Strategies: Traveler Response to Transportation System Changes, 2010.

[181] See Chapter 5. Worksite Trip Reduction Model Report http://www.nctr.usf.edu/pdf/473-14.pdf

Table 10.2: Vehicle Trip Reduction Percentages Related to Monetary Incentives and Other Site Programs or Conditions

Source: TCRP, 2010

VTR by Type of Incentive Offered (Sample Size)																	
Other Condi-tions	Parking Pricing		HOV Discounts		Transit Subsidy		Vanpool Subsidy		Carpool Subsidy		Bike/Walk Subsidy		Travel Allowance		Other Monetary		All
	With	W/out	With	W/out	With	W/out	With	W/out	With	W/out	With	w/o	With	W/out	With	w/o	
All	24. 6%	12.3%	25.7%	13.8%	20.6%	13.1%	15.3%	17.2%	23.0%	16.6%	18.2%	16.9%	19.3%	16.0%	23.1%	16.1%	16. 9%
Transit Availability																	
High	27.0%	18.9%	26.4%	25.1%	27.4%	22.5%	26.2%	25. 9%	n/a	26.0%	n/a	26.0%	20.3%	26.8%	38.2%	24.9%	26%
Medium	13.7%	8.0%	19.0%	9.6%	11.2%	13.6%	10.5%	13.5%	20.5%	10.5%	12.1%	12.1%	19.6%	7.7	15.0%	11.5%	12.1%
Low	47.4%	12.9%	47.7%	12.9%	20.3%	10.5%	10.5%	14.4%	30.4%	13.3%	30.4%	13.3%	17.6%	12.1	22.0%	12.3%	13.8%
Level of Support																	
High	24.4%	12.5%	23.7%	16.6%	22.8%	15.7%	14.9%	19.6%	n/a	19.0%	n/a	19.0%	20.7%	18.1%	17.3	19.5%	19.0%
Medium	27.3%	12.9%	31.9%	13.1%	20.4%	11.7%	11.5%	17.1%	27.1%	14.8%	18.2%	15.7%	20.9%	14.3%	33.1	13.6%	15.9%
Low	22.8%	9.6%	24.0%	10.2%	17.8%	10.0%	44.2%	13.2%	10.5%	15.3%	n/a	15.0%	13.6%	15.6%	n/a	15.0%	15.0%
Transportation Services																	
Transit	35.3%	2.6%	35.3%	2.6%	35.3%	2.6%	n/a	18.9%	n/a	18.9%	n/a	18.9%	21.1%	16.7%	42.4	11.1%	18.9%
Vanpool	34.1%	10.7%	34.1%	10.7%	25.0%	17.0%	23.1%	20.3%	n/a	21.3%	n/a	21.3%	30.7%	17.8%	13.8	22.1%	21.3%
Both	23.6%	16.1%	38.0%	14.5%	30.2%	9.3%	16.0%	19.3%	42.4%	16.4%	n/a	18.8%	3.4%	20.0%	n/a	18.8%	18.8%
Co. Veh's	36.6%	14.6%	34.8%	18.9%	34.4%	7.6%	16.4%	27.5%	38.9%	23.2%	n/a	26.2%	40.0%	15.9%	20.7	23.8%	24.6%
No Serv's	18.2%	11.3%	15.6%	13.1%	13.1%	14.2%	5.8%	14.3%	17.7%	13.4%	18.2%	13.3%	13.5%	13.7%	19.2	12.5%	16.3%

One other means to induce a mode shift involves physical restrictions on the automobile, namely closing roads or areas of high pedestrian use to cars. Several European cities have closed their core central district to car traffic, at least on Saturdays (shopping days). This involves establishment of peripheral parking areas and good transit, bicycle, and pedestrian access. In South America, the Ciclovia concept has taken root and involves closing major thoroughfares on Sundays, allowing families to walk and bike. Such auto restrictions have created significant mode shift impacts. For example:

- In central Bremen, Germany, 58% of all shopping trips are made by bus and 22% of all trips in the downtown are made by bike.[182]
- In Rome, a Limited Traffic Zone, substantially limiting the number of cars into the historic center, has reduced traffic levels by almost 20 percent and increased public transit use by 5%. Such traffic restriction zones now exist in most Italian cities.[183]
- In Hasselt, Belgium, rather than build a third ring road, the mayor closed the second ring road, made it a bike/pedestrian way, and made transit free. Transit use increased 8 fold after the car restrictions and transit improvements were put in place.[184]
- Transit malls in the U.S., have increased downtown transit use, such as in Denver where the 16th St. transit mall serves 63,000 daily riders while the street is responsible for 6% of Denver's business tax revenue.[185]
- Several studies of limiting cars in shopping districts, in the UK and San Francisco, have revealed an interesting finding – patrons who walk to shopping districts spend more, on average, than car users.[186]

While many pedestrian streets were created in the 1970s (such as Boston's Downtown Crossing), they are experiencing a resurgence in places like New York City (recently banning cars from Times and Herald Squares) and San Francisco (currently closing streets in Golden Gate Park on Sundays and contemplating closing Market Street to cars). The VTPI TDM Encyclopedia[187] summarizes the likely impacts of car-free treatments in Table 10.3, differentiating the impacts based on size of the application area (e.g., one or two streets versus a whole district).

Finally, one other recent innovation is social marketing campaign to induce travel behavior change. TravelSmart Australia, a community and government based program encouraging the use of alternative modes, took a comprehensive community based social marketing approach to Adelaide in Western Australia. They compared participant behavior with non-participants and discovered that participants decreased in distance traveled over the study period at a rate of 10.4 km per household per day (18% reduction) and decreased car travel by 36 km. At the same time, non-participants actually reported an increase in distance traveled over the study period of 14 km on weekdays and an increase in car travel of 4.5 km on weekends.[188] Such measures, also called Travel Blending and Individualized Marketing, have also been tested in Japan, Germany, and the U.S.

[182] OECD, Road Travel Demand, Meeting the Challenge, 2002.

[183] FHWA, "Managing Travel Demand: Applying European Perspectives to U. S. Practice," Report No. FHWA-PL-06-015, May 2006

[184] VTPI, Online TDM Encyclopedia, updated 2010, http://www.vtpi.org/tdm/tdm118.htm and /tdm6.htm

[185] 21st Century Urban Solutions, Last Lessons from the Centennial State, updated September 3, 2009

[186] Accent Marketing & Research, Town Centres Survey, 2003-04, prepared for Transport for London 2004. and Elizabeth M Bent, Modal Choices and Spending Patterns of Travelers to Downtown San Francisco: Impacts of Congestion Pricing on Retail Trade, San Francisco County Transportation Authority, 2008

[187] VTPI, Online TDM Encyclopedia, updated 2010, http://www.vtpi.org/tdm/tdm118.htm and /tdm6.htm

[188] http://www.sa.gov.au/upload/franchise/Transport,%20travel%20and%20motoring/TravelSMART/TravelSMART_Households_in_the_West.pdf

Table 10.3: Travel Impact Summary – Car Free Areas

Source: VTPI, 2010

Objective	Small Area	Large Area
Reduces total traffic	1	2
Reduces peak period traffic	1	2
Shifts peak to off-peak periods	0	0
Shifts automobile travel to alternative modes	1	2
Improves access, reduces the need for travel	1	2
Increased ridesharing	1	2
Increased public transit	2	2
Increased cycling	2	2
Increased walking	3	2
Increased telework	0	0
Reduced freight traffic	0	1
Rating- From 3 (very beneficial) to –3 (very harmful). A 0 indicates no impact or mixed impacts.		

10.3 Traffic and Network Impacts

Of course, mode shift, trip reduction, and VMT reduction do not indicate the impact on the road system. Obviously, fewer cars and less travel contribute to highway performance, but the correlation is not always clear. Performance indicators for TDM's role in highway operations need to be related to highway performance, such as:

- LOS.
- Vehicle Hours of Travel.
- Delay.
- Travel time reliability.
- Person throughput.

LOS indicators have been developed for other travel choices (such as transit and bicycle LOS or HOV travel time reliability). The Florida DOT has adopted a multimodal Quality/LOS system for four modes: car, bus, bike, and walk.[189] Figure 10.1 provides a simple, visual representation of what the various LOS might look like, based on work developed by Florida DOT.

[189] Florida DOT, FDOT Quality/LOS Handbook, 2009

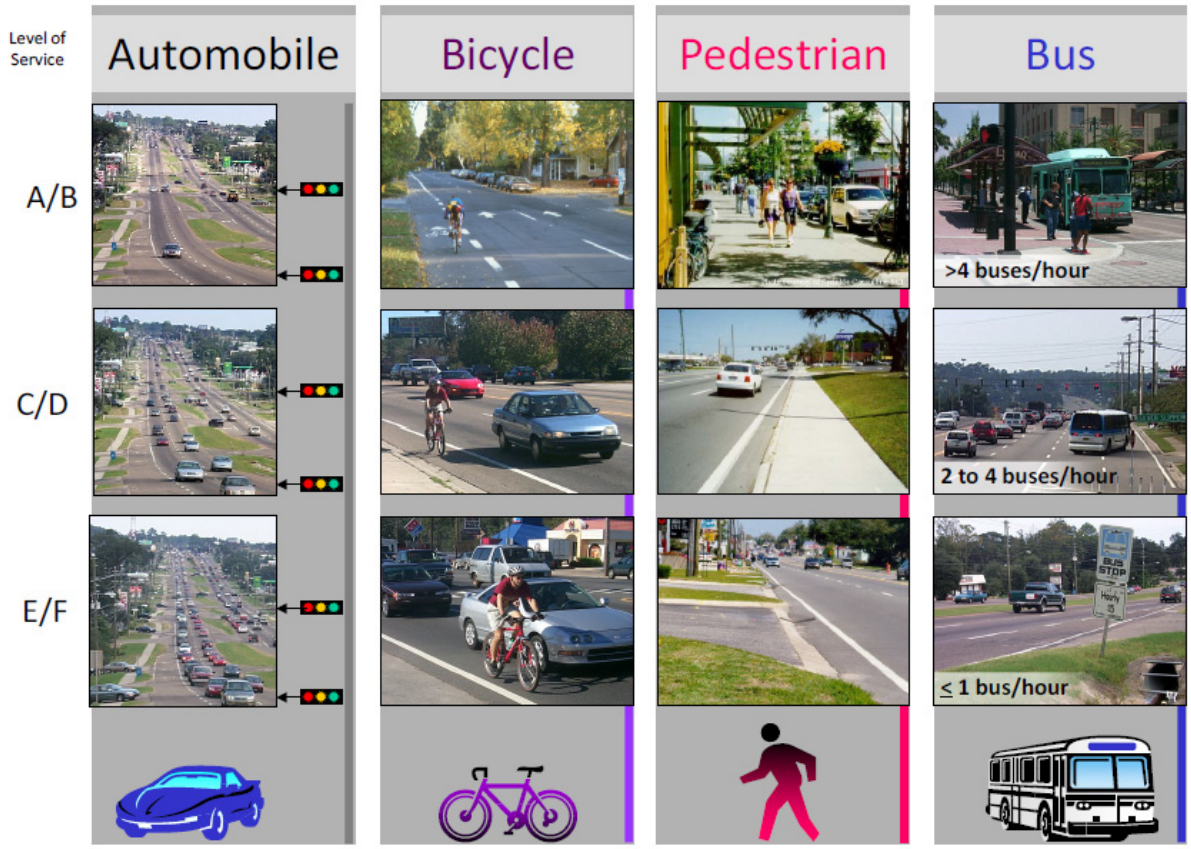

Figure 10.1: Florida State Multi-Modal LOS Standards

Source: Florida DOT

The direct traffic impacts of demand management are amply demonstrated in three areas: pricing-related strategies including managed lanes, real-time traveler information, and active traffic management.

Congestion pricing benefits drivers and businesses by reducing delays and stress, by increasing the predictability of trip times, and by allowing for more deliveries per hour for businesses. Pricing, in combination with transit services, provides bus riders with travel-time savings equivalent to those for drivers and reduces waiting time for express bus riders due to more frequent service. Introduction of pricing in central London and Stockholm has resulted in significant shifts of commuters to transit, particularly buses. Bus-related delays in central London dropped by 50 percent after the introduction of the pricing scheme. There was a 7 percent increase in bus riders. In Stockholm, 200 new buses were put into service in August 2005, several months in advance of the pricing trial, which began in January 2006. After the pricing scheme was implemented, daily public transportation use, compared with the same month in 2005, was up by 40,000 riders daily. Ridership on inner-city bus routes rose 9 percent compared with a year earlier. On the State Route 91 priced lanes in Orange County, California, traffic during rush hours moves at over 60 mph, whereas the traffic in adjacent lanes crawls at average speeds of 15 mph or less. Commuters on the priced express lanes thus save as much as half an hour each way on the 10-mile trip, or as much as an hour a day.[190]

[190] FHWA, Congestion Pricing: A Primer – Overview, FHWA-HOP-08-039, 2008

As has been noted in Chapters 2 and 3, real-time traveler information is transforming the way transportation professionals can manage travel demand with technology and new dissemination mechanisms enabling short-term, spur-of-the-moment decisions made just before a trip takes place or even en-route. Individual benefits from traveler information are well-documented and range from avoiding congestion to reducing uncertainty and stress, saving time, and improving travel safety.[191] These benefits are the direct effect of providing travelers with choices about the time, route, mode, and destination of travel. The value of these services is often gauged by the increased participation in and usage of these services. Nationally, the growth of 511 systems (both in number and in use) and traffic information websites is a well-documented phenomenon. Surveys of travelers and users of such systems show changes in behavior at an individual level; however, system-level impacts due to traveler choices have been evaluated through several simulation models.

10.4 Environmental Impacts

In addition to our knowledge on TDM effectiveness being focused on employer trip reduction programs, other evaluation results come from environmental studies. This is to be expected given the role of TDM in emission-reduction programs and conformity analyses. TDM impacts on reducing emissions not only address environmental policies, but can contribute to other policies, such as livability, sustainability, and even economic development (in the long run). The evaluation of TDM tends to assess TDM in terms of VMT reduction and convert these findings into emissions reductions via per-mile emission factors. VMT reductions can also be converted to energy impacts by applying energy consumption (miles per gallon) factors to travel reductions.

A recent study analyzed a host of GHG emission reduction strategies to assess the ability of transportation strategies to address climate change. That study corroborated many of the conclusions already noted in this chapter. Regarding packaging, the study concluded that "an integrated, multi-strategy approach that combines techniques such as travel activity, local and regional pricing, and operational and efficiency strategies can contribute to significant GHG reductions" and that "implementing various 'bundles' of transportation efficiency strategies could achieve annual GHG emission reductions of up to 24 percent less than expected Baseline levels in 2050, by changing current transportation systems and operations, travel behavior, land use patterns, and public policy and regulations."[192]

Moving Cooler[193] noted that the strategies that contribute the most to GHG reductions are:

- Local and regional pricing and regulatory strategies that increase the cost of single-occupancy vehicle travel.
- Regulatory strategies that reduce and enforce speed limits.
- Educational strategies to encourage eco-driving behavior that achieves better fuel efficiency.
- Land use and smart growth strategies that reduce travel distances.
- Multimodal strategies that expand travel options.

This last finding, on multimodalism, is critical in that it confirms the importance of providing more travel options as a cornerstone to TDM and sustainable travel in general, and it is also cited in the Urban Mobility Index reporting, prepared by the Texas Transportation Institute.

[191] RITA, ITS Benefits Database, Traveler Information, http://www.itsbenefits.its.dot.gov/its/benecost.nsf/SingleTax?OpenForm&Query=Traveler+Information

[192] Urban Land Institute (ULI), Moving Cooler _An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions : Executive Summary prepared by Cambridge Systematics for Moving Cooler Steering Committee, June 2009. http://movingcooler. info/Library/Documents/Moving%20 [189] Cooler%20Executive%20Summary.pdf

[193] Moving Coller: An Analysis of Transportation Strategies to Reducing Greenhouse Gas Emissions, available at http://www.movingcooler.info/

TDM strategies can impact emissions in more ways than simply reducing VMT. One FHWA study of the ability of transportation strategies to impact multiple pollutants (Table 10.4) to shows how TDM strategies reduce emissions (e.g., VMT, trip, speed, idling reductions, time shift, or shift in fleet mix or fuels) for various pollutants.[194] While the table does not provide estimates on the amount of emission reduction that might be expected, it serves as useful guidance on precisely how TDM strategies influence air quality and can assist planners in understanding the relationship between specific TDM strategies and air quality.

Table 10.4: General Emissions Impacts of TDM Strategies

Source: FHWA, 2006

	Category of Primary Effect						General Pollutant Effect						
Strategy	**Reduce VMT**	**Reduce vehicle trips**	**Shift travel time**	**Reduce idling**	**Change speeds**	**Change vehicle stock or fuels**	**PM-2.5**	**PM-10**	**CO**	**NOx**	**VOCs**	**SOx**	**NH3**
1. Park-and-Ride Facilities	√	-					↓	↓	↓	↓	↓	↓	↓
2. HOV Lanes	√	√			√		↓	↓	↓	↓	↓	↓	↓
3. Ridesharing	√	+					↓	↓	↓	↓	↓	↓	↓
4. Vanpools	√	+					↓	↓	↓	↓	↓	↓	↓
5. Bicycle/Pedestrian	√	√					↓	↓	↓	↓	↓	↓	↓
6. Transit Service Enhancement	√	√					↓*	↓*	↓	↓*	↓	↓*	↓
7. Transit Marketing, Information and Amenities	√	√					↓	↓	↓	↓	↓	↓	↓
8. Transit Pricing	√	√					↓	↓	↓	↓	↓	↓	↓
9. Parking Pricing/Management	√	√					↓	↓	↓	↓	↓	↓	↓
10. Road Pricing	√	√	+				↓	↓				↓	↓
11. VMT Pricing	√	√					↓	↓	↓	↓	↓	↓	↓
12. Fuel Pricing	√	√				√	↓	↓	↓	↓	↓	↓	↓
13. Employer-based TDM Programs	√	√	+				↓	↓	↓*	↓*	↓*	↓	↓
14. Non-Employer-based TDM	√	√	+				↓	↓	↓*	↓*	↓*	↓	↓
15. Land-Use Strategies	√	√			√		↓	↓	↓*	↓*	↓*	↓	↓

√=primary effect; +=may be a notable effect, but not in all cases; -=may have the opposite effect, in some cases ↓=decrease; ↓*=generally decreases, but possibility of an increase; ↓/↑=varies; ↓=increase; N=no change/not quantified

[194] FHWA, Multi-Pollutant Emissions Benefits of Transportation Strategies - Summary of Findings, 2006.

Finally, as stated in Chapter 9, one of the most powerful evaluation findings that can be developed will show the relative cost effectiveness of TDM versus other projects or programs intended to meet the same policy objective. One study that provided an insight into the cost effectiveness of many TDM strategies was TRB Special Report 264.[195] The 2002 report states that TDM strategies represented a significant proportion of the projects funded by CMAQ, and an analysis was performed among projects with quantifiable, reported impacts to show the relative cost per ton of pollution reduced by various categories of emission-reducing projects. The results, shown in Table 10.5, reveal that TDM related strategies were among the most cost effective. Among the top 10 strategies, the most cost effective alternative mode strategies are:

- Regional ridesharing programs (including carpool matching).
- Pricing programs (including parking pricing and congestion pricing).
- Vanpool programs.
- Miscellaneous TDM programs (efforts to promote alternative modes).
- Conventional transit service improvements (new lines, more frequency).
- Employer trip reduction.

Table 10.5: CMAQ Project Category Cost Effectiveness
Source: TRB, 2002

CMAQ Strategy	Cost Per Pound of Emissions Reduced
Inspection and maintenance	$0.95/lb.
Regional rideshare programs	$3.70/lb.
Charges and fees	$5.15/lb.
Vanpool programs	$5.25/lb.
Miscellaneous TDM	$6.25/lb.
Conventional fuel bus replacement	$8.05/lb.
Alternative fuel vehicles	$8.09/lb.
Traffic signalization	$10.05/lb.
Employer trip reduction	$11.35/lb.
Conventional transit service upgrades	$12.30/lb.
Park-and-ride lots (rideshare and transit)	$21.50/lb.
Modal subsidies and vouchers	$23.30/lb.
New transit capital systems/vehicles	$33.20/lb.
Bicycle and pedestrian programs	$42.05/lb.
Shuttles, feeders, and paratransit	$43.75/lb.
Freeway/incident management	$51.20/lb.
Alternative fuel buses	$63.20/lb.
HOV facilities	$88.10/lb.
Telework	$125.90/lb.

Telework, a common TDM strategy, was rated at the bottom of the list, as the least cost effective, due to the fact that the CMAQ analysis was evaluating public sector programs to promote telecommuting and that the programs evaluated largely consisted of telework centers, which can be costly in terms of capital and operating expenses, not the cost effectiveness of telecommute arrangements themselves. This type

[195] Transportation Research Board, The Congestion Mitigation Air Quality Improvement Program: Assessing Ten Years of Experience, Special Report 264, National Academies, 2002.

of analysis provides powerful evidence of the effectiveness and cost of TDM in meeting environmental objectives.

10.5 Other Impacts

The sections above have discussed the documented impacts of TDM on travel behavior, traffic, and air quality. Clearly, this report suggests that TDM can have a positive impact on other policy objectives, such as goods movement, land use, livability, and economic development. Unfortunately, very little empirical research exists documenting the impact of TDM strategies toward these policies in a comprehensive, systematic, and comparative manner. As such, individual case studies and experiential information from earlier in the desk reference is summarized below:

- **Goods movement** - Two strategies have been discussed in this report: consolidated deliveries and pricing. Consolidated deliveries has been shown to reduce the number of delivery vehicles, in places like Burgos, Spain, but other impacts have not been documented, such as congestion reduction.[196] A delivery scheme in two French cities, using electric vehicles, reduced related CO_2 by 58%. Pricing, on the other hand, has been proven to be quite effective. Truck tolling in Germany has resulted in a small shift from truck to rail and a reduction in empty deadheading trips. Peak period fees (Pier Pass) at the Port of Los Angeles have reduced congestion in the terminal areas and have reduced midday truck volumes on I-710.[197]
- **Land use** – TDM is often used as a mitigation strategy to reduce the additional trips generated by new development, and success cases revealing trip reductions on the order of 10-25% are fairly abundant. Land use and design issues, as a longer-term strategy, have the potential to increase non-automobile modes, as revealed in comparisons of the mode split between towns with and without good bike, pedestrian, and transit infrastructure.
- **Livability** – Measuring the impact of TDM on livability can be a subjective process. But livability might be seen as the product of several other effective roles for TDM, namely reduced congestion, increased safety, improved environment, and healthy economic conditions. Mostly, livability can be associated with increased travel choices, a fundamental purpose of demand management.
- **Economic Development** – In mitigating the negative impacts associated with growth (congestion, air pollution, energy consumption, reduced safety), TDM can improve the attractiveness of a region or city to prosper economically. As seen in cases such as Lund, Sweden, and the Sustainable Travel Town pilots in the U.K., economic growth can be decoupled from traffic growth. In Lund, the region grew substantially (population and employment) during a period when TDM was being implemented, reducing VMT by 1-2% overall. The growth in travel demand was met by increases in transit use and bicycling.[198]

10.6 Summary of TDM Effectiveness – Relative Impact on Policy Objectives

The preceding sections have summarized some of the research on the known effectiveness of TDM strategies. The available impact information is largely based on the VTR impacts of employer-based TDM strategies and the emission reduction impacts based on the application of TDM to address air quality policy objectives. The impact of TDM on all the policy objectives enumerated in Chapter 3 have been

[196] FGM-AMOR, CIVITAS II: 2005-2009 Final Brochure, prepared for European Commission and CIVITAS GUARD, September 2010 (www.civitas.eu)

[197] FHWA, Port Peak Pricing Program Evaluation, FHWA-HOP-09-014, 2009, http://ops.fhwa.dot.gov/publications/fhwahop09014/sect2.htm

[198] FHWA, "Managing Travel Demand: Applying European Perspectives to U. S. Practice," Report No. FHWA-PL-06-015, May 2006 and Transport for Quality of Life, et al., The Effects of Smarter Choice Programmes in the Sustainable Travel Towns – Summary Report, prepared for UK Department for Transport, February 2010.

touched upon in this chapter, However, this is an incomplete picture of the impact of the wide variety of TDM strategies included in this desk reference. Empirical evidence, in a form and amount sufficient to warrant comparative analysis, is not available for many strategies, beyond individual case studies. Likewise, impacts are often not expressed in comparative terms to allow for the evaluation of one type of TDM strategy against another.

However, policy-makers and planners make decisions every day as to which TDM strategies to apply to a given project, problem, or policy objective. In order to assist in this process, the authors of this desk reference have produced a "master table" (Table 10.6) showing the relative effectiveness of some 32 TDM strategies in six categories (traditional employer TDM, land use, transit, parking, pricing, and systems management) as applied to the seven policy objectives discussed in Chapter 3. The key word here is "relative" as we are attempting to show whether a given TDM strategy will influence a particular policy objective in a significant way or simply contribute in a modest manner. Clearly, attached to each policy objective are a number of performance measures that would be used to measure effectiveness. In very general terms, highly effective equates to a greater than 10 percent reduction in travel among the target population; moderately effective to a 2 to 10 percent reduction in travel; and nominally effective up to a 2 percent reduction in travel (acknowledging that small reductions can have significant impacts on congested facilities). As implied, many strategies have not yet been evaluated in terms of their impact on a given policy objective. For example, we do not know the impact of HOT lanes on economic development, given the relatively new nature of this measure. We believe that these strategies will have a positive impact on addressing key policy objectives, but empirical evidence is not available from which to make a relative assessment.

These relative ratings are based on the professional judgment of the authors of this report and are based on a review of available studies on TDM effectiveness and the authors' extensive experience with TDM evaluation. If used properly (as an initial screening tool to select TDM strategies to address particular policy objectives before further, more detailed analysis and modeling), this matrix can be a useful first step.

Table 10.6: TDM Strategies and Their Relative Effectiveness in Addressing Key Policy Objectives

	Traditional TDM								Land Use/Active Transportation					Transit			Parking			Pricing				Systems Management			
STRATEGIES	HOV/HOT/Managed Lanes	Employer Trip Reduction Programs	Alternative Work Arrangements	School-based Trip Reduction	Event-based Trip Reduction	Recreation-based Trip Reduction	Car-Sharing	Vanpool Programs	Developer Trip Reduction	Land Use Strategies	Car-free or Access-Restricted Zones	Bicycle Facilities and Programs	Pedestrian Facilities and Continuity	Transit Service Improvements	Transit Prioritization/BRT	Transit Fare Discounts	Parking Information	Parking Supply Management	Parking Pricing	Cordon Pricing	Congestion Pricing	General Financial Incentives	VMT Tax	Ramp Metering	Integrated Corridor Management	Traveler Information	Eco-Driving
POLICY OBJECTIVES																											
Mobility	O	O	O	O	O	O	O	○	○	O	○	O	O	○	O	○	O	✕	✕	✕	✕	●	✕	✕	○	O	N
Congestion Relief	✱	○	○	○	○	○	✕	○	○	○	O	○	○	○	○	○	○	O	○	●	●	○	●	O	○	O	✕
Air Quality	✱	O	O	O	○	○	O	●	○	○	O	O	O	O	O	O	○	O	O	●	●	●	●	✕	✱	○	○
Economic Development	✱	✕	○	✱	✱	✱	○	○	✕	○	✕	○	○	✱	○	○	○	✕	✕	✱	✱	O	✕	N	✱	○	✕
Land Use Interaction	○	N	○	✱	✱	✱	○	✱	O	O	O	O	O	○	○	○	○	O	O	○	○	○	O	N	N	N	✕
Goods Movement	○	○	○	N	○	○	N	○	N	N	○	✱	✱	✱	✕	✕	○	N	○	O	O	O	O	○	O	○	O
Livability	○	○	●	●	○	○	O	○	○	●	●	●	●	○	○	○	○	O	O	✱	✱	○	✱	✕	N	○	O

KEY: ● = highly effective; O = moderately effective; ○ = nominally effective; ✱ = likely effective (but still undocumented); N = not applicable; ✕ =minimal to no impacts

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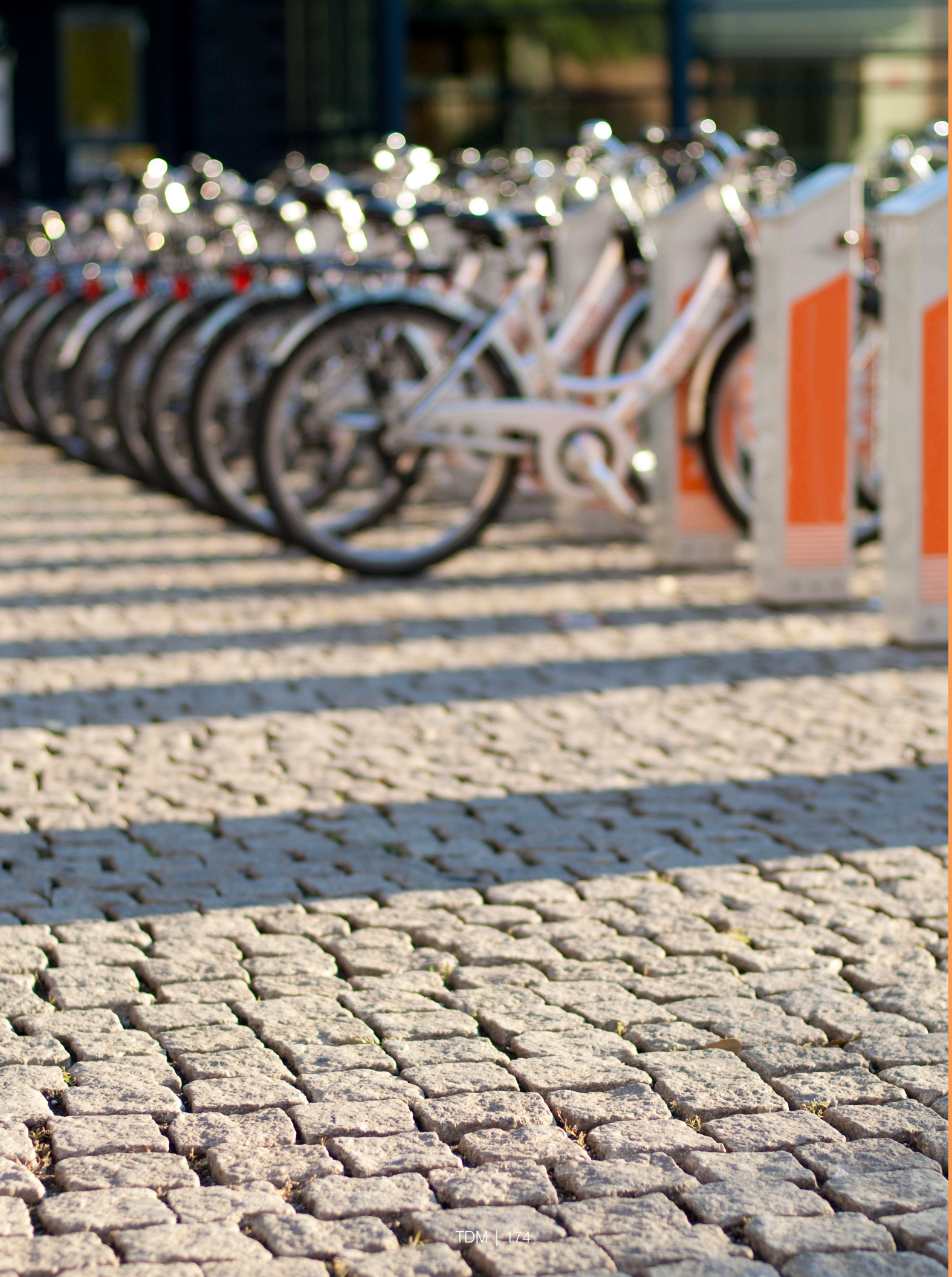

11 Transitioning from Planning to Implementation

This chapter examines TDM programs nationwide to identify examples of successful implementation and support of demand management programs by state DOTs, MPOs, and TMAs, corridor-level projects, and local planning organizations. It concludes with a discussion of how TDM programs are funded, focused largely on federal sources.

CHAPTER ACRONYM LIST	
CMAQ	Congestion Mitigation and Air Quality
CTE	Center for Transportation and the Environment
DOT	Department of Transportation
DRPT	Department of Rail and Public Transportation
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GRH	Guaranteed Ride Home
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
ITS	Intelligent Transportation Systems
LOS	Level of Service
MPO	Metropolitan Planning Organization
MTC	Metropolitan Transportation Commission
MAAQS	National Ambient Air Quality Standards
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
SOV	Single Occupancy Vehicle
STP	Surface Transportation Program
TCM	Transportation Control Measures
TCSP	Transportation Community and System Preservation Program
TDM	Travel Demand Management
TMA	Transportation Management Association
TMD	Transportation Management District
TOD	Transit Oriented Development
TSM	Transportation Systems Management
VMT	Vehicle Miles Travelled
VTR	Vehicle Trip Reduction
WTRM	Worksite Trip Reduction Model

11.1 State Level

Based on an extensive outreach effort in executing NCHRP Project 20-65 Task 24, "State Department of Transportation Role in the Implementation of Transportation Demand Management Programs," a nationwide survey of state DOTs was conducted to identify national trends regarding the extent of their involvement in TDM and related activities. Over 90 percent of responding state DOTs indicated that their agencies play a role in TDM.[199] The most commonly identified roles were the use of TDM on project-level activities and providing funding/technical assistance to local organizations focused on TDM. However, state DOTs can play many different roles in implementing TDM services. Some potential roles are listed below:

- Administering TDM Services – Through this role, state DOTs focus on various programmatic TDM activities, such as encouraging alternative modes by offering assistance to employers in setting up worksite programs, maintaining ridematching databases, offering transit incentives, and providing a Guaranteed Ride Home (GRH) program. An example of this type of involvement is the Virginia DOT's efforts to support teleworking by providing funds to the Telework!VA program, a public/

[199] National Highway Cooperative Research Program, "State Department of Transportation Role in the Implementation of Transportation Demand Management Programs," Project 20-65 Task 24, July 2010.

Appendix B

Sample TDM Survey

Transportation Survey
Company: _____ Location: _____
Date:_____

Unique ID: _____

1. What is your home city/town?

_____

2. What is your home zip code?

_____

3. What time do you usually begin work in the morning?

☐ Before 6AM ☐ 6-7AM ☐ 7-7:30AM ☐ 7:30-8AM

☐ 8-8:30AM ☐ 8:30-9AM ☐ 9-10 AM ☐ After 10AM

4. What time do you usually end work in the evening?

☐ Before 4PM ☐ 4:30-5PM ☐ 5-5:30PM ☐ 5:30-6PM ☐ 6-6:30PM

☐ 6:30-7PM ☐ 7-7:30PM ☐ 7:30-8PM ☐ After 8PM

5. How often do you vary your hours by more than 30 minutes from these times?

☐ Never ☐ 1-2 days per month ☐ 1-2 days per week ☐ 3+ days per week

6. How many hours are you scheduled to work each week?

☐ Less than 17 ☐ 17-25 ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐ More than 40

7. How long does it take you to travel to work on a typical day (minutes one way)?

☐ 5 to 15 ☐ 16 to 30 ☐ 31 to 45 ☐ 45 to 60 ☐ 61 to 90 ☐ More than 90

8. How many miles (one way, approximately) do you travel from home to work on a typical day?

☐ 1 to 10 ☐ 11 to 20 ☐ 21 to 40 ☐ 41 to 60 ☐ 61+

9. Please indicate how you commuted to work each day this week:

(Please note primary mode only)	Monday	Tuesday	Wednesday	Thursday	Friday
a) Drove alone the entire way	☐	☐	☐	☐	☐
b) Drove alone, then took public transportation	☐	☐	☐	☐	☐
c) Took public transportation the entire way	☐	☐	☐	☐	☐
d) Shared ride, then took public transportation	☐	☐	☐	☐	☐
e) Rode in a two-person carpool	☐	☐	☐	☐	☐
f) Rode in a three- to seven-person carpool	☐	☐	☐	☐	☐
g) Rode in an eight- or more person vanpool	☐	☐	☐	☐	☐
h) Dropped off at work	☐	☐	☐	☐	☐
i) Bicycled	☐	☐	☐	☐	☐
j) Walked	☐	☐	☐	☐	☐
k) Out of the office (sick, vacation, jury duty, etc.)	☐	☐	☐	☐	☐
l) Scheduled day off	☐	☐	☐	☐	☐
m) Worked at home	☐	☐	☐	☐	☐
n) Other	☐	☐	☐	☐	☐

10. If you took public transportation for all or part of your commute, which route(s) did you use?
(Please check all used)

☐ Bus Route #s _____ ☐ Red Line ☐ Green Line

☐ Commuter Rail to Porter Sq ☐ Commuter Rail to North Station ☐ Commuter Rail to South Station

11. Why have you chosen your commute method? (check all that apply)

☐ Convenience ☐ Cost ☐ No Other Option ☐ Other (describe) _____

12. How many times a month (on average) do you use your own vehicle for work-related business during the day?

☐ None ☐ 1 to 4 ☐ 5 or More

13. If you drive to work, where is the vehicle usually parked?

☐ Parking lot/structure at worksite ☐ Parking lot/structure off-site ☐ On-street

14. If you drive only part of the way, where do you usually park?

☐ Train Station ☐ Park & Ride lot ☐ Parking lot/structure off-site ☐ On-street

Please answer Questions 15-18 only if you drive alone to work

15. What are your reasons for driving alone to work?

(Mark all that apply)

Enjoy my privacy, prefer driving alone	☐
Work hours are irregular	☐
Need car for work-related trips	☐
Need a car for errands before/after work	☐
Do not have any other option	☐
Need car in case of emergencies	☐
Difficulty finding others to carpool with	☐
Driving alone takes less time	☐
Take children to school or daycare	☐
Other modes/routes are not safe	☐
Other modes cost too much	☐
Transit schedules or routes do not work for me	☐
Shift is outside of peak commuting period	☐
Other	☐

16. What concerns you most about your commute?

(Mark all that apply)

Overall travel time from home to work	☐
Cost of commute	☐
Finding a convenient parking space	☐
Congestion on streets and highways	☐
Frustration of commuting	☐
Concerned about bad weather	☐
Other (please explain)	☐

17. How likely would you be to change to ridesharing, transit or other commuting alternatives IF THE FOLLOWING INCENTIVES, SERVICES WERE IN PLACE? (Mark one space for each option)

	Very Likely	Somewhat Likely	Not Likely	Already Available
Guaranteed Ride Home program in case of emergency or unscheduled overtime	☐	☐	☐	☐
On-site information on transit routes and schedules	☐	☐	☐	☐
Shuttle to train/bus station	☐	☐	☐	☐
Subsidy for transit fares	☐	☐	☐	☐
Subsidy for vanpool fares	☐	☐	☐	☐
Vans available for ridesharing	☐	☐	☐	☐
Preferential or reserved parking for employees who rideshare	☐	☐	☐	☐
Help finding someone with whom to carpool/vanpool	☐	☐	☐	☐
Company car made available for business use during the day	☐	☐	☐	☐
Bicycle storage made available	☐	☐	☐	☐
Showers and lockers made available	☐	☐	☐	☐
Financial incentives for biking and walking	☐	☐	☐	☐
On-site parking rates raised by 10% or more	☐	☐	☐	☐
Other	☐	☐	☐	☐

18. Please rank, in order of preference, the TOP THREE commute options you would consider using instead of driving alone:

	Transit	Bicycle	Walk	Carpool	Vanpool
1st Choice	☐	☐	☐	☐	☐
2nd Choice	☐	☐	☐	☐	☐
3rd Choice	☐	☐	☐	☐	☐
Would not consider	☐	☐	☐	☐	☐