TRANSPORTATION DEMAND MANAGEMENT
TECHNICAL JUSTIFICATION

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SFMTA Municipal Transportation Agency

San Francisco Planning

SAN FRANCISCO Office of Economic and Workforce Development

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We express our appreciation to numerous individuals involved in developing the TDM Program over the years. In addition to those current and elected appointed officials and current project team mentioned below, numerous others (e.g., public, advocacy groups, consultants, interns, other jurisdictions, other and past city staff) were instrumental and we appreciate the guidance and assistance you provided.

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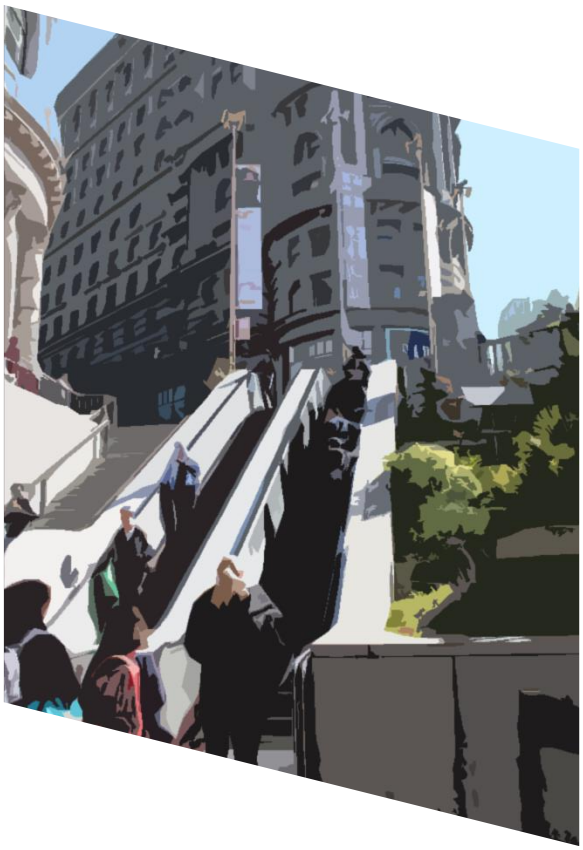


Preface

TDM Technical Justification

The City and County of San Francisco (City or San Francisco) is a popular place to work, live and visit, placing strains on the existing transportation network. According to Plan Bay Area, the City is projected to grow substantially between 2010 and 2040 – up to 100,000 new households and 190,000 new jobs. Without enhancements to our transportation network, this growth could result in more than 600,000 additional cars on our streets.[1]

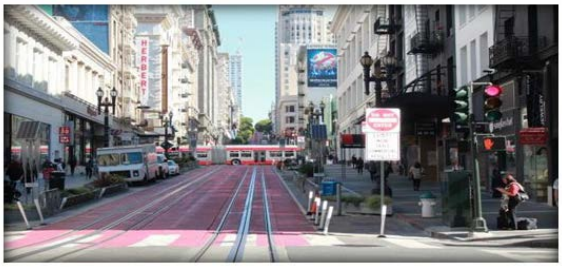
The Transportation Demand Management (TDM) Program is part of an initiative aimed at improving and expanding the transportation system to help accommodate new growth, and creating a policy framework for private development to contribute to minimizing its impact on the transportation system, including helping to pay for the system's enhancement and expansion. The TDM Program is one of the three interrelated policy initiatives comprising the Transportation Sustainability Program.

Purpose of the TDM Program

Applying TDM to new development will help maintain mobility as San Francisco grows. The TDM Program helps manage demand on the transportation network by making sure new developments are designed to make it easier for new residents, tenants, employees, and visitors to get around by sustainable travel modes such as transit, walking, and biking. Each measure included in the TDM Program is intended to reduce Vehicle Miles Traveled from new development.

TDM Technical Justification Contents

This publication serves as the technical justification for the Planning Commission's Standards for the Transportation Demand Management Program (TDM Program Standards) in compliance with Planning Code Section 169. The TDM Technical Justification is the culmination of several years of work and research.



[1] San Francisco County Transportation Authority, *San Francisco Transportation Plan 2040, Appendix B: Needs Analysis White Paper*, December 2013.

The TDM Technical Justification elaborates on the information provided in the TDM Program Standards. This document is organized as follows:

Chapter 1 introduces the context of TDM in San Francisco and outlines how the TDM Program fits within the framework of the Transportation Sustainability Program and other related transportation planning efforts.

Chapter 2 outlines the goals and targets of the TDM Program within the context of the Transportation Sustainability Program; and describes how these goals align with local, regional, and statewide planning efforts.

Chapter 3 provides a justification for the TDM Program applicability, including exemptions and targets

Chapter 4 provides a justification for the selection and assignment of points for TDM measures in the menu for the San Francisco TDM Program.

Chapter 5 provides a summary of potential updates that may occur to the TDM Program.

Note that several of the terms used throughout the document are defined in the Glossary of Terms, provided at the end of the TDM Program Standards. Terms defined in the Glossary for Terms are *italicized* the first time they appear in the remainder of the TDM Technical Justification, excluding tables and figures.

Chapter 1

Introduction

This publication serves as the technical justification for the Planning Commission's Standards for the Transportation Demand Management Program (*TDM Program Standards*) in compliance with Planning Code Section 169 (collectively *TDM Program*). This chapter introduces the context of TDM in the City and County of San Francisco (the City or San Francisco) and outlines how the TDM Program fits within the framework of the Transportation Sustainability Program.

Transportation Demand Management - Defined

Transportation demand management, or TDM, describes strategies or measures that encourage sustainable travel. At its core in San Francisco, TDM focuses on providing tools and incentives to make it easier to take advantage of transportation options and shift trips from driving alone in private vehicles to transit, biking, walking, or other more efficient and sustainable modes of travel.

For the TDM Program, TDM is designed to reduce *Vehicle Miles Traveled* by residents, tenants, employees, and visitors and must be under the control of the *property owner* for a *Development Project*. City agencies and private entities participate in TDM efforts outside of new development (e.g., employer education and outreach, demand based pricing, etc.). These are not the focus of the TDM Program.

Importance of Transportation Demand Management in San Francisco

Locating development in areas that are already developed (infill) like San Francisco leads to better outcomes for the environment than locating development in undeveloped areas such as farmlands and green fields. Often these outlying areas are characterized by sparse density and low diversity of land uses and with fewer transportation options. Given limited transportation options and local services in close proximity, development in these areas typically creates a need for people to drive by themselves, which, in turn, increases harmful air pollutant and greenhouse gas emissions, and contributes more broadly to regional traffic congestion and other related impacts.

Acknowledging significant demand for housing and jobs and the need for a more efficient regional transportation network and land use pattern, Plan Bay Area -- the region's transportation and land use plan -- identifies priority development areas to focus two thirds of the 1.1 million new jobs and 75 percent of the 660,000 new households anticipated between 2010 and 2040.[2] As the core of the region, San Francisco anticipates 190,000 jobs and 100,000 homes in the City between 2010 and 2040, with a substantial amount of that growth already underway. For example, the residential population has grown by an average of approximately 11,000 residents each year between 2010 and 2015 alone.[3]

[2] As the long-range regional transportation and land-use plan, Plan Bay Area is updated every four years. The existing Plan Bay Area was adopted jointly by ABAG and MTC in July 2013.

[3] California Department of Finance, *E-4 Population Estimates for Cities, Counties, and the State, 2011-2016 with 2010 Census Benchmark*, May 2016.

This recent and projected population growth poses challenges for San Francisco's transportation system. San Francisco encompasses approximately 49 square miles of land on the northern tip of a peninsula and is surrounded on three sides by water and on the fourth side by the cities of Brisbane and Daly City.

Due to the high level of existing traffic and the inability to expand existing roadways, the San Francisco and the region's transportation system will not function well if new development is permitted with the assumption that most residents, tenants, employees, and visitors will drive alone. In addition, a transportation system that relies extensively on single-occupancy vehicles would have negative environmental, safety, and economic outcomes. In order for new development to be sustainable, prioritizing the mobility of current and future residents, tenants, employees, and visitors, smart transportation policies and programs need to be place to protect, preserve, and economically stimulate the City while maintaining its livability. These types of transportation policies and programs have a long history in San Francisco and are summarized in Chapter 2 of the TDM Technical Justification. To further minimize the impacts of new development on the transportation system, the City has created the Transportation Sustainability Program.

Transportation Sustainability Program

The Transportation Sustainability Program is a joint effort by the Office of Economic and Workforce Development (OEWD), the Planning Department, the San Francisco County Transportation Authority (Transportation Authority), and the San Francisco Municipal Transportation Agency (SFMTA), and it is comprised of the following three components:

- ***Invest:*** a development impact fee that helps fund transit and safer streets, particularly as the City grows and our need for sustainable travel modes increases.
- ***Align:*** a modernization of the environmental review process which includes a more meaningful transportation analysis that better captures environmental effects.
- ***Shift:*** a TDM program for developers comprised of transportation amenities and programs that encourage sustainable travel and reduce Vehicle Miles Traveled. The focus of this document.

These three components are discrete policy initiatives that are programmatically linked through the Transportation Sustainability Program. While each component is useful and necessary on its own, staff recommends that all complement each other and are most effective together.

Invest

Fund Transportation Improvements to Support Growth. The City must invest in the transportation system to ensure that adequate capacity exists to accommodate additional trips associated with new development. On November 25, 2015, the City adopted the Transportation Sustainability Fee, which requires developers to pay a portion of their fair share to expand transit capacity to accommodate the increased ridership associated with new development.

The Transportation Sustainability Fee superseded the previous Transportation Impact Development Fee, which applied to non-residential development, and applied the fee to residential development for the first time. The amount of the fee is based on the number of motorized trips generated by new development, according to land use type. The Transportation Sustainability Fee is assessed on new development, including residential development, to help fund improvements to transit capacity and reliability, including regional transit, as well as improvements for people walking or bicycling.

Align

Modernize Environmental Review. Impacts to the transportation system from new projects are assessed as part of the environmental review process under the California Environmental Quality Act (CEQA), and other planning processes. CEQA was enacted in 1970 in response to the growing awareness that environmental impacts must be carefully considered in order to avoid unanticipated environmental problems resulting from discretionary actions such as approval of development projects or planning efforts. The environmental review process provides decision-makers and members of the public with an objective analysis of the immediate and long-range specific and cumulative impacts of a proposed project on its surrounding physical environment. In California, environmental review is two-fold in purpose: to disclose the impacts of a project and to ensure public participation.

Historically, impacts to the transportation system in San Francisco and elsewhere have been evaluated using a level of service (LOS) metric for vehicles. LOS measures vehicle delay at intersections and on roadways and is represented as a letter grade A through F. LOS A represents free flowing traffic, while LOS F represents congested conditions. The Planning Department used LOS to evaluate to measure potential transportation impacts of projects subject to CEQA, including development projects, transportation projects, and long range plans. In general, a project that changed LOS at an individual intersection from a LOS anywhere between A and D to LOS E or F was considered to have triggered a significant impact under CEQA.

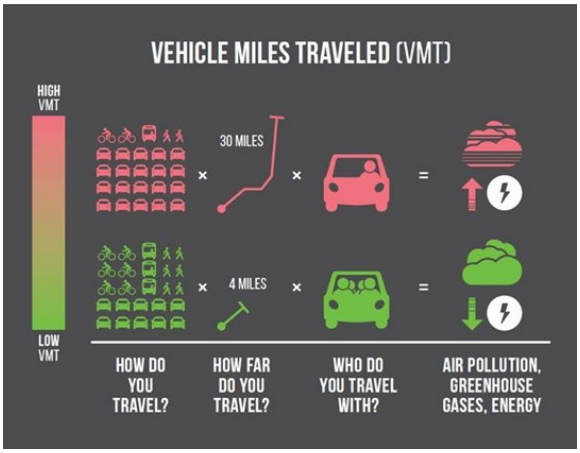
Senate Bill 743 (SB 743)

On September 27, 2013, Governor Brown signed California Senate Bill (SB) 743 (Steinberg, 2013). SB 743 requires that the Office of Planning and Research, the state's long range planning and research agency, to develop revisions to the CEQA Guidelines establishing criteria for determining the significance of transportation impacts of projects that "promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses." SB 743 states that upon certification of the revised guidelines for determining transportation impacts pursuant to the bill, automobile delay, as described solely by LOS or similar measures of vehicular capacity or traffic congestion shall not be considered a significant impact on the environment under CEQA.

In January 2016, the Office of Planning and Research published for public review and comment a *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA* (proposed transportation impact analysis guidelines) recommending that transportation impacts for projects be measured using a Vehicle Miles Traveled metric. On March 3, 2016, based on compelling evidence in that document and on the City's independent review of the literature on LOS and Vehicle Miles Traveled, the San Francisco Planning Commission adopted the Office of Planning and Research's recommendation to use the Vehicle Miles Traveled metric instead of automobile delay to evaluate the transportation impacts of projects (Resolution 19579). (Note: the Vehicle Miles Traveled metric does not apply to the analysis of project impacts on non-automobile modes of travel such as riding transit, walking, and bicycling.) The Planning Commission concluded that Vehicle Miles Traveled was a better metric to analyze transportation impacts under CEQA because it achieves the purpose of the criteria set forth in SB 743.

Vehicle Miles Traveled

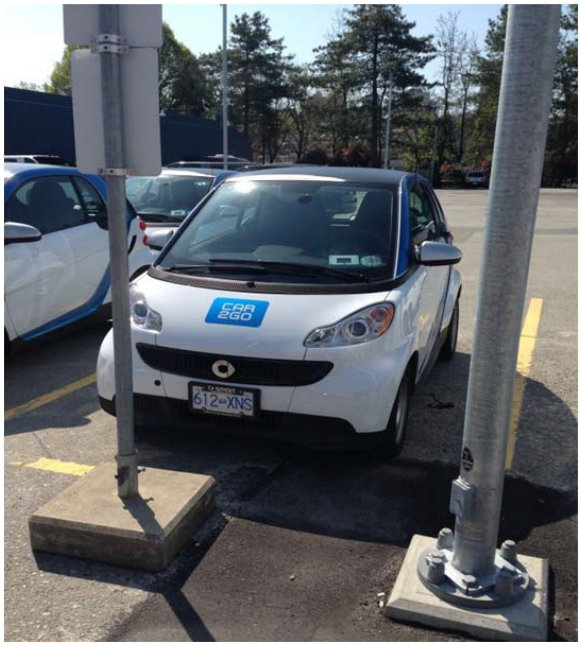
Vehicle Miles Traveled measures the amount and distance vehicles would travel on the roadway as a result of a project or plan. An increase in Vehicle Miles Traveled results in an increase of emissions of air pollutants, including greenhouse gases, as well as increased consumption of energy. [4] Typically, development at a greater distance from other uses, located in areas with poor access to non-auto modes of travel, would generate more driving than one that is located proximate to other complementary uses and/or where there are transportation options other than the car.[5]



Shift

Encourage Sustainable Travel. The Shift component of the Transportation Sustainability Program creates a TDM Program through an ordinance amending the Planning Code. TDM measures are recognized as effective in reducing Vehicle Miles Traveled generated by projects by supporting transportation choices, including walking, bicycling, public or private transit, car-share, carpooling and other sustainable modes. The TDM Program requires property owners to implement TDM measures that support project residents, tenants, employees, and visitors in making sustainable trip choices thereby reducing their Vehicle Miles Traveled.

The SHIFT component of the Transportation Sustainability Program is consistent with the approach being put forward by the Office of Planning and Research and SB 743, as well as numerous other local, regional, and state policies as described in Chapter 2 of the TDM Technical Justification. It is also consistent with best practices of other jurisdictions around the country, while being tailored to varying San Francisco settings.



[4] U.S. Environmental Protection Agency, *Our Built and Natural Environments 2nd Ed*, June 2013.
[5] Office of Planning and Research, *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA*, January 2016.

Chapter 2

Goals

This chapter outlines the goals and targets of the TDM Program within the context of the Transportation Sustainability Program and describes how these goals align with other local, regional, and statewide planning efforts.

Transportation Sustainability Program and TDM Program – Goals

Goal – Maintain Mobility

The overarching goal of the Transportation Sustainability Program is to maintain mobility, that is, to keep people moving as San Francisco grows. The SHIFT component of the Transportation Sustainability Program was developed to minimize the impact of new development on the transportation system. The product of SHIFT, a TDM Program, supports the goal of maintaining mobility and access by focusing on reducing the overall percentage of drive alone trips and Vehicle Miles Traveled.

As described in Chapter 1 of the TDM Technical Justification, based on the City's right-of-way and geographic limitations, the City cannot accommodate a substantial increase in vehicles. Therefore, the TDM Program reduces the impacts from growth to the transportation system by reducing Vehicle Miles Traveled from new residents, tenants, employees, and visitors. A reduction in Vehicle Miles Traveled may result from shifting auto trips to other travel modes, increasing vehicle occupancy, or reducing the average trip length.

Additional Benefits

In addition to meeting the primary goal of maintaining mobility while accommodating a significant growth in jobs and housing, the Transportation Sustainability Program has several additional benefits including: better environmental outcomes, better public health and safety, and improved development review process and projects, as summarized below.

Better Environmental Outcomes

Reducing Vehicle Miles Traveled from new development also results in better environmental outcomes. For each mile driven, vehicles emit pollutants. Despite technological advancements, the transportation sector continues to account for a large amount of emissions by an increase in Vehicle Miles Traveled.[6]

The transportation sector accounts for between 36 and 40 percent of all greenhouse gas emissions at the local, regional, and state levels.[7,8,9] The transportation sector is also responsible for a large percentage of air pollutants that affect the air quality locally and regionally, toxic air contaminants and criteria air pollutants. For example, the transportation sector accounted for 83 percent of oxides of nitrogen emissions statewide, which is a precursor to ozone (criteria air pollutant) and for which a larger area of the state is designated as nonattainment by both the state and federal

[6] U.S. Environmental Protection Agency, *Our Built and Natural Environments 2nd Ed*, June 2013.
[7] California Air Resources Board, *First Update to the Climate Change Scoping Plan*, May 2014.
[8] Plan Bay Area 2040, *Plan Bay Area Environmental Impact Report*, July 2013.
[9] San Francisco Department of Environment, *San Francisco Climate Action Strategy*, October 2013.

government.[10] Several state, regional, and local policies are aimed at reducing greenhouse gas emissions and criteria air pollutants.

In addition, vehicle travel consumes substantial amounts of energy. Over 40 percent of California's energy consumption occurs in the transportation sector.[11] Passenger vehicles account for 74 percent of emissions from the transportation sector.[12] Reducing Vehicle Miles Traveled can lead to a reduction in energy consumption.

Better public health and safety

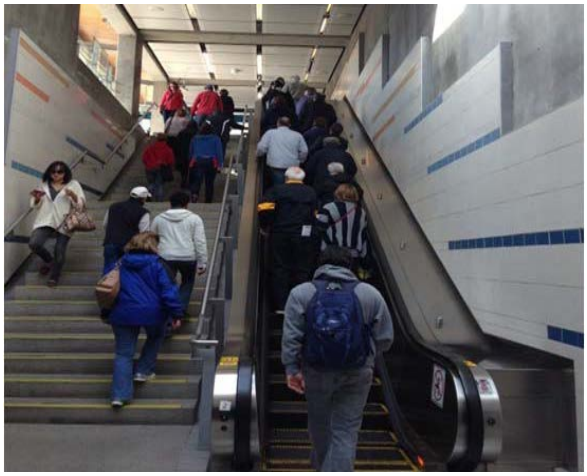
Reducing Vehicle Miles Traveled from new development also results in better public health and safety outcomes. Public health is improved when trips are made by active modes, primarily trips made by people walking and bicycling, and harmful air pollutants are reduced. The TDM Program includes measures that Development Projects can choose to encourage trips by active modes. In addition, higher total amounts of vehicle travel results in a higher crash exposure. Therefore, reducing Vehicle Miles Traveled enhances safety.[13]

Improved development review process, projects, and outcomes

Prior to implementation of the TDM Program, many decisions regarding TDM were made near the end of the development approval process. The framework developed for the TDM Program provides more certainty and flexibility for Development Projects. The TDM Program requirements are known upfront, prior to submitting a development review application. The TDM Program also provides flexibility to the property owner in crafting a *TDM Plan* that best fits the needs of the Development Project and neighborhood. Incorporating the TDM Program requirements upfront also provides information to the public about requirements for and transportation components of Development Projects earlier in the development review process.

Transportation options are amenities to residents, tenants, employees, and visitors. Real estate advertisements regularly rate the walkability of the project location, along with proximity to transit, and bicycle facilities. TDM measures that are incorporated into the design of a Development Project or consist of programmatic services to the Development Project are considered amenities because they enhance convenience and freedom by providing or facilitating easy-to-use travel options.

Lastly, the TDM Program includes a robust implementation strategy to ensure that TDM measures incorporated into a Development Project are implemented for the *Life of the Project*. It also includes a process for ongoing evaluation of the efficacy of *TDM measures* to refine the *TDM menu of options* (menu) to reflect interactions between TDM measures, specific neighborhood characteristics, and new data and research to ensure the program is effective in reducing Vehicle Miles Traveled.



[10] California Air Resources Board, *Almanac Emission Projection Data, Year 2012*.
[11] California Energy Commission, *Energy Aware Planning Guide*, February 2011.

[12] *Ibid*.

[13] Office of Planning and Research, *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA*, January 2016.

Chapter 3

Applicability and Targets

This chapter provides a justification for the TDM Program applicability, including exemptions and targets. In addition, this section describes a Cambridge, Massachusetts case study on which components of the TDM Program was modeled.

Land Use Categories and Accessory Parking

Planning Code Section 169 lists the types of Development Projects that the TDM Program applies to. Each Development Project is required to meet a target. The target is based upon the land use(s) associated with the Development Project and the number of Accessory Parking spaces proposed for the land use. The more *Accessory Parking* proposed for a land use, the higher the target for the Development Project to achieve.

The rationale for tying the target to Accessory Parking is based on relevant literature and local data collection, discussed further in Chapter 4 of the TDM Technical Justification, which indicate that areas with more parking are associated with more overall vehicular traffic than areas with less parking. Similarly, as discussed further in Chapter 4 of the TDM Technical Justification, individuals who do not have dedicated offsite parking at their origins or destinations are less likely to drive than those who do. Therefore, more incentives and tools to support non-auto modes and disincentives to using personal vehicles are needed at a site with a greater amount of Accessory Parking spaces than a site with fewer Accessory Parking spaces to encourage sustainable travel and reduce Vehicle Miles Traveled. These incentives, disincentives, and tools that affect mode choice are TDM measures. This approach does not restrict the ability of a property owner to build Accessory Parking up to existing Planning Code requirements or allowances; instead, it provides flexibility to property owners in developing a TDM Plan to reduce Vehicle Miles Traveled that best fits the needs of the Development Project and neighborhood.

The purpose of trips made to land uses often varies. In order to simplify application of the TDM Program, definitions were classified into four land use categories based upon reducing Vehicle Miles Traveled from the primary trip generator associated with that land use.[14] The four land use categories were organized, based upon research, into categories representing a continuum from highest to lowest estimated number of vehicle trips per parking space provided for primary users (visitors and customers, employees, or residents): Land Use Category A represents uses with the highest rate of vehicle trips per parking space and Land Use Category D represents uses with the lowest rate of vehicle trips per parking space.

[14] Exceptions are schools and hospitals, where those trips and associated parking are much shorter in duration and are often a side trip within a larger tour. Therefore, the visitor/customer trips are more effectively influenced at the origin (e.g., home) and/or ultimate destination (e.g., work) of those tours. In addition, it may be necessary to accommodate driving trips for medical visits.

- Land use Category A includes uses that function most like retail uses.
- Land Use Category B includes uses that function most like office uses.
- Land Use Category C includes uses that function most like residential uses.
- Land Use Category D includes uses with fewer Development Applications than the other three land uses category and uses that generate fewer vehicle trips than the other three land use categories.

Staff reviewed all land uses identified in Planning Code Section 102 and associated each with one of the four land use categories. The targets and land use categories are provided in Section 2.2(a) of the TDM Program Standards. The research to support the organization into these land use categories is included in Appendix A: Land Use Categorization in the TDM Technical Justification document.

Some TDM measures that affect users other than the primary user in that land use may be included in a Development Project's TDM Plan. For example, the primary trip generators in Land Use Category A are visitors and customers. Land use category A Development Projects also have employees that generate Vehicle Miles Traveled. Therefore, a TDM measure like Showers and Lockers, which is aimed at reducing Vehicle Miles Traveled from employees, can be provided for a Land use category A Development Project.

Exemptions and Non-Applicable Projects

Some types of projects are exempt or excluded from applicability from the TDM Program because of policy and/or practical reasons. The following are types of Development Projects not applicable or exempt from the TDM program:

- Residential projects with nine units or fewer;
- Less than 10,000 square feet of any use other than residential;
- One hundred percent affordable housing projects; and
- Parking garages and parking lots

Small Residential Developments

The TDM Program does not apply to residential projects with nine *Dwelling Units* or less. Developments of this size may not have space to accommodate or resources to implement many of the TDM measures. Additionally, based on the existing pipeline, these developments represent only a small portion of overall development in the City (three percent) [15] and associated vehicle trips. Furthermore, if the TDM Program were to apply to these small residential projects, it would take a disproportionate amount of staff resources to monitor compliance, compared to any reduction in the actual amount of Vehicle Miles Traveled that would be achieved. [16] Applicability for other existing Planning Code provisions regarding parking costs separated from housing costs in new residential buildings (i.e., parking unbundling) requirements (Section 167) and on-site affordable housing apply starting at 10 units.

Small Non-Residential Developments

Non-residential projects with less than 10,000 square feet are exempt from the TDM Program because many TDM measures are less relevant for a project of this size and these types of development often reduce overall vehicle trips or shorten vehicle trip length by increasing diversity of land uses in a neighborhood. Applicability for other existing Planning Code provisions such as shower facilities

[15] Based upon a San Francisco Development Pipeline, Quarter 1 2016 data. The data identifies a total of 70,740 Dwelling Units (not net) in the pipeline, of which 2,022 Dwelling Units (not net) are from projects with nine units or less.

[16] Based upon a San Francisco Development Pipeline, Quarter 1 2016 data. Although these projects represent only 3 percent of total Dwelling Units (not net) in the pipeline, they represent 72 percent (821 out of 1,146) of all projects with Dwelling Units in the pipeline.

and locker requirements (Section 155.4) apply starting at 10,000 square feet.

Affordable Housing

The TDM Program does not apply to one hundred percent affordable housing projects because data shows that these types of projects generally do not include much Accessory Parking. As shown in **Table 3-1**, a review of the 100 percent affordable housing projects built between 2006 and 2015, showed that 50 of 63 projects were built with little (20 Accessory Parking spaces or fewer) to no Accessory Parking. Affordable housing projects would still be subject to other Planning Code requirements related to TDM, through which the majority of projects would meet their targets. Therefore, the exemption from the TDM Program is essentially an exemption from the administrative requirements associated with monitoring and reporting.

Table 3-1: Survey of 100 Percent Affordable Housing Projects

# of Accessory Parking Spaces	# of Buildings	# of Projects
0 ≤ 20	50	26
21 ≤ 30	1	1
31 ≤ 40	5	5
41 ≤ 50	2	1
50 or more	5	5
Total	**63**	**38**

Source: San Francisco Planning Department, 2016.

Non-Accessory Parking Garages and Parking Lots

The purpose of the TDM Program is to reduce Vehicle Miles Traveled from new development. The purpose of parking lots and parking garages is to accommodate automobile use. Attempting to apply a TDM Program intended on reducing Vehicle Miles Traveled to a use that increase Vehicle Miles Traveled would defeat the purpose of the parking lots and parking garages and thus would be ineffective and counterintuitive. Second, the Planning Code requires a conditional use authorization for these uses in most Use Districts. Lastly, through the environmental review process, these types of uses may be considered to have significant impacts on Vehicle Miles Traveled, which would result in alternatives and mitigation measures that seek to reduce the Vehicle Miles Traveled impacts of such uses. Therefore, the TDM Program does not apply to non-accessory parking.

Targets

Land Use Categories A, B, and C

To identify the targets for Land Use Categories A, B, and C, staff identified the total measures available and the total number of points available for all TDM measures in the TDM menu: 26 TDM measures and 78 total points.[17] The TDM menu and assignment of points to TDM measures is described in Chapter 4 of the TDM Technical Justification. Some TDM measures were not applicable to certain land use categories. For example, points associated with On-site Affordable Housing are not available to the non-residential land use categories A and B. TDM measures that were not applicable to a certain land use category were not included in the number of points available for that land use category. TDM measures that were identified as applicable to a land use category were added together to identify the total number available: Land Use Category A = 70 points;[18] Land Use Category B = 66 points;[19] Land Use Category C = 69 points.[20] In addition, for six of the TDM measures in the TDM Menu, all of the associated points may not be available to all types of projects within one or more land use categories, as described below.

Affordable Housing

For land use category C, the available points for On-site Affordable Housing was reduced from a possibility of four points (25 percent on-site affordable housing at income levels less than or equal to 55 percent or some combination of income levels) to two points (greater than 7 percent and less than or equal to 14 percent on-site affordable housing at income levels less than or equal to 55 percent or greater than 10 percent and less than or equal to 20 percent on-site affordable housing at income levels greater than 55 percent and less than or equal to 80 percent or some combination thereof). The two point range of on-site affordable housing is consistent with the maximum amounts that some residential developments subject to the TDM Program (less than 25 dwelling units) are required to provide on-site pursuant to the inclusionary housing ordinance, if the property owner opts to provide on-site affordable housing.

[17] A Development Project could not provide several TDM measures related to parking if no parking is provided. Therefore, for the purposes of the subsequent calculations in this paragraph the Parking Supply measure was reduced from 11 points to 10 points.

[18] TDM measures not applicable to land use category A are: Family TDM – Amenities; Family TDM Package; and On-site Affordable Housing.

[19] TDM measures not applicable to land use category B are: Bicycle Valet Parking; Provide Delivery Services; Family TDM – Amenities; Family TDM Package; Healthy Food Retail in Underserved Area; and On-site Affordable Housing.

[20] TDM measures not applicable to land use category C are: Showers and Lockers; Bicycle Valet Parking; Provide Delivery Services; Vanpool Program; Healthy Food Retail in Underserved Area; Parking Pricing; and Parking Cash Out – Non-Residential Tenants.

Childcare

Although the provision of childcare is applicable to any land use category, City staff determined that it may not be feasible for development projects of all sizes that are subject to the TDM Program. Therefore, for land use categories A, B, and C, the available points associated with On-site Childcare was reduced from the possibility of two points to zero points for the purposes of determining the target.

Bike Share Membership, Unbundle Parking, Bicycle Valet Parking, Healthy Food Retail in Underserved Area

The points associated with Bike Share Membership, Unbundle Parking, and Healthy Food Retail in Underserved Area are based on location. Development Projects in many locations of the City would not be able to achieve the maximum number of available points for any of these TDM measures, regardless of the TDM Plan submitted for the Development Project because of locational constraints. Therefore, the available points associated with Bike Share Membership was reduced from a possibility of two points to one point (land use categories A, B, and C) and Unbundle Parking was reduced from a possibility of five points to one point (land use categories A, B, and C). Additionally, given the unique land use associated with Bicycle Valet Parking and Healthy Food Retail in Underserved Area, the available points associated with these TDM measures were reduced from a possibility of one or two points to zero points (land use category A).

Parking Supply

The points associated with Parking Supply are based on the Development Project's parking rate compared to the *neighborhood parking rate*. The available points was reduced from a possibility of 11 points (no parking) to one point, or the number allocated for Development Projects providing less than or equal to 100 percent of the neighborhood parking rate, even though all Development Projects could reduce their parking supply further.

Taking these seven measures into account, the point totals resulted in an available number for each category: land use category A = 51 points; land use category B = 50 points; and land use category C = 51 points.

The baseline target that all Development Projects within land use categories A, B, and C are required to meet is set at 25 percent of the total available number of points available to the project's relevant land use categories. Establishing the 25 percent and base number of Accessory Parking Spaces was based upon a review of San Francisco specific case studies examining the relationship between parking and travel behavior, as described in Chapter 4 of the TDM Technical Justification. More TDM measures are needed at a site with a greater amount of Accessory Parking spaces, and therefore are required to achieve a higher points target, than a site with fewer Accessory Parking spaces in order to offset the Vehicle Miles Traveled associated with the additional Accessory Parking spaces. **Table 3-2** summarizes the target justification by land use category.

Additionally, although the base target is not adjusted for land use category C, the TDM Program Standards allow projects containing fewer than 16 accessory parking spaces to have a required target as low as 10 points. Reducing the target for projects with fewer than 16 accessory parking spaces addresses particular challenges for small residential projects (e.g., reducing two accessory parking spaces is likely a greater proportion of overall amount of accessory parking reduction for a smaller residential project than a larger residential project).

In the future, if the total number of points available increases or decreases, the base target may also be adjusted accordingly. Ongoing planning efforts (e.g., the San Francisco Transportation Plan, Plan Bay Area, etc.) may define a City or regional Vehicle Miles Traveled goal which may inform the TDM Ordinance targets in the future. TDM menu updates that increase or decrease a target for any land use category by three points or more (or 10 points cumulatively across measures) requires Planning Commission approval, as described in Section 4 of the TDM Program Standards.

Table 3-2: San Francisco TDM Program Target Justification

Land Use Category	Applicability *(# of accessory parking spaces proposed by Use)*	Total Number Available[1,2] ***Points***	Base Target Score % of Total Number Available	Base Target[2]
A	Base number: 0 ≤ 4	51	25%	13 points
B	Base number: 0 ≤ 20	50		13 points
C	Base number: 0 ≤ 20	51		13 points

1. Seven of the TDM measures in the TDM menu were determined not available to all types of projects within one or more land use categories: On-site Affordable Housing, On-Site Childcare, Bike Share Membership, Unbundle Parking, Healthy Food Retail in Underserved Area, Bicycle Valet Parking and Parking Supply. This is reflected in the total points and targets for each land use.
2. Total number available and target may change over time as TDM measures are added or removed from the TDM menu or points associated with existing measures are refined.

Land Use Category D

Land uses associated with land use category D are required to achieve a target of three out of seven possible points. Due to the lower level of trips that can be affected by TDM associated with these land uses, this category focused only on capital measures that require less effort for the property owner to document and less effort for City staff to monitor and enforce. Land uses within land use category D also have a lower frequency of development applications and thus have a lower effect on citywide Vehicle Miles Traveled.

Case Study: Parking and TDM Ordinance Cambridge, Massachusetts

Connecting TDM requirements to the number of Accessory Parking spaces for the San Francisco TDM Ordinance is most similar to a Parking and TDM Ordinance in Cambridge, Massachusetts ("Cambridge Parking and TDM Ordinance"), which

was adopted in 1998 and made permanent in 2006. [21] In Cambridge, TDM requirements for development projects vary based on anticipated vehicle trip generation, with parking supply used as a proxy for future vehicular trip generation.

Exemptions

The Cambridge Parking and TDM Ordinance is applicable to non-residential projects with five or more off-street vehicular parking spaces. The Ordinance does not apply to residential and non-residential projects with fewer than five parking spaces.

PTDM Applicability

Non-exempt projects require either a Small Project Parking and TDM Plan (PTDM Plan) or a Large Project PTDM Plan.

Small Project PTDM Plan

For non-residential projects with 5 to 19 off-street vehicular parking spaces, a sponsor must select three measures from a menu of TDM measures. These smaller projects are not subject to performance targets or reporting requirements.

Large Project PTDM Plan

Non-residential developments with 20 or more off-street vehicular parking spaces are required to submit a Large Project PTDM Plan which includes a single occupancy vehicle mode share reduction commitment. This commitment is typically set at 10 percent [22] below the average single occupancy vehicle mode share for the census tract for the project site, based on 1990 census tract data. The project sponsor selects a comprehensive set of TDM measures that would result in this reduction which are included in the PTDM Plan.

The Large Project PTDM Plan requires annual monitoring and reporting, including:

(1) Employee and/or patron survey, including single occupancy vehicle mode share
(2) Biennial counts of car and bike parking occupancy and driveway ins/outs
(3) Status of TDM measures

If monitoring demonstrates that a project does not meet its drive-alone mode split commitment, then the Large Project PTDM Plan is adjusted for increased effectiveness. If the Parking and TDM Plan is not adjusted, Cambridge may impose fines or restrict a development's access to off-street vehicular parking until it comes into compliance.

The Cambridge Parking and TDM Ordinance provides flexibility to the project sponsor in choosing any combination of TDM measures for the Parking and TDM Plan which would result in the requisite reduction of single occupancy vehicle mode share of 10 percentage points.

In 2014, 40 projects were subject to the Cambridge Parking and TDM Ordinance Large Project TDM Plans. Of those, 35 projects, or 88 percent completed monitoring reports. Of the 35 projects, 30 projects exceeded non-drive-alone mode split commitments. **Table 3-3** summarizes 2014 data regarding the Cambridge Parking TDM Ordinance. [23]

[21] City of Cambridge, *Parking and Transportation Demand Management Ordinance*, 2011. Available online at: http://www.cambridgema.gov/CDD/Transportation/fordevelopers/ptdm.

[22] The reduction commitment is 10 percent, rather than 10 percentage points. For example if a census tract has a 1990 mode split of 75 percent, the commitment for the project would be [75 percent * 0.90] = 67.5 percent. A 10 percentage point reduction commitment would be 65 percent.

[23] Email communication between Susan Rasmussen, Director of Environmental and Transportation Planning, City of Cambridge, and Wade Wietgrefe, Senior Planner, San Francisco Planning Department, "TDM Association for Commuter Transportation Follow-up," August 3, 2015.

Table 3-3: Cambridge Parking and TDM Ordinance Data – Year 2014

Description	Active Projects
Total Number of Projects with PTDM Plan	40
Number of Projects that Completed Monitoring Report	35 (88%)
Square Feet of Development	
Commercial	9.1 million square feet
Institutional	15.5 million square feet
Total Number of Parking Spaces	17,045
Effectiveness	30 of 35 projects (86%) exceeded non-drive alone mode split commitments

It should be noted that currently the San Francisco TDM Program does not require a Development Project to meet a performance standard for single occupancy vehicle mode split or Vehicle Miles Traveled reduction. Reasons for exclusion include lack of comprehensive data relating individual and groups of measures to specific Vehicle Miles Traveled reductions at individual sites.

Chapter 4

TDM Menu of Options

Best practice research, as described below, indicates that most jurisdictions with TDM requirements require a property owner to provide a plan that outlines the TDM measures that will be incorporated into the project. Property owners are often provided a variety of TDM measures to select from in developing the plan. Examples of jurisdictions that provide a variety of TDM measures are Santa Monica, California; Rockville, Maryland; Cambridge, Massachusetts; Arlington County, Virginia; Fairfax County, Virginia; and Seattle, Washington. For the purposes of the San Francisco TDM Program, this variety of TDM measures to select from is called a TDM Menu of Options (menu). The menu provides property owners flexibility to select TDM measures that best fit the needs of their Development Project and neighborhood.

Best practice research also indicates that individual measures are often assigned a value based on their effectiveness, taking into account geographical variations. This chapter provides a justification for the selection and assignment of points for TDM measures in the menu for the San Francisco TDM Program.

Selection of TDM Measures in the Menu

Many factors affect travel behavior. These factors include density, diversity of land uses, design of the transportation network, access to regional destinations, distance to high-quality transit, development scale, demographics, and TDM.[24] The Transportation Authority's San Francisco Chained Activity Model Process (SF-CHAMP) accounts for a variety of these factors to estimate Vehicle Miles Traveled throughout San Francisco. The outputs from SF-CHAMP used to calculate Vehicle Miles Traveled, automobile modal split, vehicle occupancy, and vehicle trip length, can be estimated throughout San Francisco geographically via transportation analysis zones. Transportation analysis zones in San Francisco vary in size from single blocks in the downtown core, multiple blocks in outer neighborhoods, to even larger zones in historically industrial zones like Hunters Point.

SF-CHAMP is not sensitive to site level characteristics like TDM measures. The purpose of the TDM Program is to reduce the Vehicle Miles Traveled that would be otherwise estimated to occur from new development (in SF-CHAMP or other transportation modeling software) based upon the new development's transportation analysis zone location. In order to achieve this Vehicle Miles Traveled reduction, property owners must select from TDM measures, defined as measures that reduce Vehicle Miles Traveled by residents, tenants, employees, and visitors and are under the control of the property owner. A reduction in Vehicle Miles Traveled may result from shifting vehicle trips to sustainable travel modes or reducing vehicle trips, increasing vehicle occupancy, or reducing the average vehicle trip length.

City staff used literature review, local data collection, best practice research, and professional transportation opinion to develop a menu of 26 TDM measures that meet the definition of a TDM measure, as provided in the Glossary of Terms for

[24] Institute of Transportation Studies, *California Smart-Growth Trip Generation Rates Study, Appendix A*, March 2013.

the TDM Program Standards. For the San Francisco TDM Program menu, refer to Section 2.2(b) in the TDM Program Standards. This sub-chapter describes the work conducted to include or exclude measures from the menu. **Table 4-1** summarizes the source for inclusion of the TDM measure in the menu.

Literature Review

In 2010, the California Air Pollution Control Officers Association (CAPCOA) published a report that quantifies project-level land use, transportation, energy use, and other measures effects on greenhouse gas emissions based upon a literature review of research conducted to date.[25] Vehicle Miles Traveled is a metric used to estimate transportation-related greenhouse gas emissions from projects. City staff used the CAPCOA report as a starting point to identify measures that could potentially meet the definition of a TDM measure. In addition, City staff conducted subsequent literature review that focused on articles and reports published after the CAPCOA report. This literature review was summarized in a memorandum prepared by Fehr & Peers in 2015 (Fehr & Peers 2015a).[26] The Fehr & Peers 2015a memorandum identified potential measures to be included in the menu, although the definition used in the TDM Program Standards had yet to be established.

Following the Fehr & Peers 2015a memorandum, City staff identified additional potential measures based upon review of existing San Francisco Municipal or California Code provisions, best practices, and feedback received on outreach.

Existing Municipal or State Code Provisions

Based upon the Fehr & Peers 2015a memorandum and subsequent research, 13 separate sections within the San Francisco Municipal and California Code were identified that contained requirements that qualify as a TDM measure, although the requirements may not specifically be identified as TDM-related. Many of the TDM requirements are only applicable to certain geographic locations, land use types, and/or projects of a certain size. Most TDM requirements are also finite, in that no options are provided for more than the minimum required for compliance.

For the TDM menu, the San Francisco Municipal and California Code TDM requirements were refined in some instances. The refinements expanded the geography, land use type, and project size applicability and to provided requirements or options that exceed minimum San Francisco Municipal and California Code TDM requirements. The refinements led to the creation of 14 TDM measures in the menu: Improve Walking Conditions, Bicycle Parking, Showers and Lockers, Bicycle Valet Parking, Car-Share Parking, On-site Childcare, Shuttle Bus Service, Vanpool Program, Tailored Transportation Marketing Services, On-site Affordable Housing, Unbundle Parking, Parking Pricing, Parking Cash-Out: Non-residential Tenants, and Parking Supply.

[25] California Air Pollution Control Officers Association (CAPCOA), *Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures,* August 2010.

[26] Fehr and Peers, *San Francisco TDM Framework for Growth: Summary of Findings – Literature Review,* March 2015 (2015a).

Other Measures From Fehr & Peers 2015a Memorandum

The Fehr & Peers 2015a memorandum identified seven other TDM measures that are included in the menu, although the naming convention may be slightly different. These seven TDM measures are Bicycle Repair Station, Bike Share Membership, Fleet of Bicycles, Provide Delivery Services, Contributions or Incentives for Sustainable Transportation, Multimodal Wayfinding Signage, and Real Time Transportation Information Displays.

Remaining TDM Measures in Menu

The remaining five TDM measures included in the menu were added based upon best practice research and outreach with stakeholders conducted subsequent to the Fehr & Peers 2015a memorandum. These five TDM measures are Bicycle Repair Services, Delivery Supportive Amenities, Family TDM – Amenities, Family TDM Package (although it is a combination of two other TDM measures), and Healthy Food Retail in Underserved Area.

Table 4-1: Sources for Transportation Demand Management Measures in Menu

TDM Measure Title in Menu	Sources					
	Existing Municipal and State Code					
	Location	Section	Title	CAPCOA	Other Literature/Source	Best Practice
Improve Walking Conditions	San Francisco Planning	138.1(c)(2)	Other Streetscape and Pedestrian Elements for Large Projects	SDT-1	CARB, VTPI	Arlington County
Bicycle Parking	San Francisco Planning	155.2	Bicycle parking	SDT-6 SDT-7	CARB, VTPI	Santa Monica, Cambridge, Arlington County, Fairfax County, Seattle
Showers and Lockers	San Francisco Planning	155.4	Shower facilities and lockers	TRT-5	CARB, VTPI	Santa Monica, Cambridge, Arlington County, Fairfax County, Seattle
Bike Share Membership	--	--	--	TRT-12	Capital Bikeshare, CARB, VTPI	Santa Monica
Bicycle Repair Station	--	--	--	--	CARB	Santa Monica
Bicycle Repair Services	--	--	--	--	CARB	Santa Monica
Fleet of Bicycles	--	--	--	--	SF Environment	--
Bicycle Valet Parking	San Francisco Transportation	6.15	Monitored bicycle parking at public events	--	Professional Transportation Expert Opinion	--
Car-Share Parking	San Francisco Planning	166	Car Sharing	TRT-9	CARB, VTPI	Arlington County, Fairfax County
Delivery Supportive Amenities	--	--	--	--	Professional Transportation Expert Opinion	--
Provide Delivery Services	--	--	--	--	Professional Transportation Expert Opinion	--
Family TDM Amenities	--	--	--	--	Professional Transportation Expert Opinion	--
On-site Childcare	San Francisco Planning	165	Child-Care Plans and Child-Care Brokerage Services in C-3 Districts	--	APA	--
Family TDM Package	Refer to Car-Share and Family TDM Amenities					

Table 4-1: Sources for Transportation Demand Management Measures in Menu

TDM Measure Title in Menu	Sources					
	Existing Municipal and State Code					
	Location	Section	Title	CAPCOA	Other Literature/Source	Best Practice
Contributions or Incentives for Sustainable Transportation	--	--	--	TRT-4	VTPI	Santa Monica, Rockville, Cambridge, Arlington County, Fairfax County, Seattle
Shuttle Bus Service	San Francisco Environment	427	Commuter benefits program	TRT-11	VTPI	Santa Monica, Cambridge, Arlington County, Fairfax County, Seattle
Vanpool Program	San Francisco Environment	427	Commuter benefits program	TRT-11	CARB, VTPI	Santa Monica, Cambridge, Fairfax County, Seattle
Multimodal Wayfinding Signage	--	--	--	--	Professional Transportation Expert Opinion	Santa Monica
Real Time Transportation Information Displays	--	--	--	--	Professional Transportation Expert Opinion	Santa Monica, Rockville
Tailored Transportation Marketing Services	San Francisco Planning	163	Transportation brokerage services in Commercial and Mixed Use Districts	TRT-7	CARB, VTPI	Santa Monica, Rockville, Cambridge, Arlington County, Fairfax County
Health Food Retail in Underserved Area	--	--	--	--	Frank	--
On-site Affordable Housing	San Francisco Planning	415	Housing Requirements for Residential and Live/Work Development Projects	LUT-6	--	--
Unbundle Parking	San Francisco Planning	167	Parking costs separated from housing costs in new residential buildings	PDT-2	VTPI	Rockville, Arlington County

Table 4-1: Sources for Transportation Demand Management Measures in Menu

TDM Measure Title in Menu	Sources					
	Existing Municipal and State Code					
	Location	Section	Title	CAPCOA	Other Literature/Source	Best Practice
Parking Pricing	San Francisco Planning	155(g)	General standards as to location and arrangement of off-street parking, freight loading, and service vehicle facilities	TRT-14	CARB, PSUS, VTPI	Santa Monica, Rockville, Cambridge, Arlington County, Seattle
Parking Cash Out: Non-residential Tenants	California Health and Safety	43845	Parking cash-out program	TRT-15	CARB, PSUS, VTPI	Santa Monica, Seattle
Parking Supply	San Francisco Planning	151.1	Scheduled of permitted off-street parking spaces in specified districts	PDT-1	Chatman, Fehr and Peers 2015d, McCahill, Weinberger, Zhan, VTPI	Rockville

APA = American Planning Association, *The Importance of Ensuring Adequate Child Care in Planning Practice*, 2011.

CAPCOA = California Air Pollution Control Officers Association, *Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures,* August 2010. The acronyms (i.e., LUT, PDT, SDT, TRT) and numbers refer to specific measure numbers in the report.

Capital Bikeshare = LDA Consulting, *2011 Capital Bikeshare Member Survey Report*, 2012 and LDA Consulting, *2013 Capital Bikeshare Member Survey Report*, 2013.

CARB = California Air Resources Board, Senate Bill 375 – Research on Impacts of Transportation and Land Use-Related Policies, updated regularly, Available online at: http://arb.ca.gov/cc/sb375/policies/policies.htm. Various policy and technical background documents with more information regarding specific measures are found on this website.

Chatman = Daniel Chatman, "Does Transit-Oriented Development Need the Transit?", Access, Fall 2015.

Fehr and Peers, 2015d = Fehr and Peers, *San Francisco TDM Framework for Growth: Summary of Survey Results,* May 2015.

Frank = Lawrence Frank, *Travel Behavior, Environmental, & Health Impacts of Community Design & Transportation Investment. A Study of Land Use, Transportation, Air Quality, and Health in King County, WA*, 2005.

McCahill = Chris McCahill, et al., "Effects of Parking Provision on Automobile Use in Cities: Inferring Causality," Transportation Research Board, November 13, 2015.

PSUS = San Francisco County Transportation Authority, Parking Supply and Utilization Study, anticipated adoption July 2016.

SF Environment = San Francisco Department of Environment, *City and County of San Francisco Employee Transportation Survey Report*, November 2013.

VTPI = Victoria Transport Policy Institute, Online TDM Encyclopedia, updated regularly, available online at http://www.vtpi.org/tdm/.

Weinberger = Rachel Weinberger, "Death by a thousand curb-cuts: Evidence on the effect of minimum parking requirements on the choice to drive," *Transport Policy, 20,* March 2012.

Zhan = Guo Zhan, "Residential Street Parking and Car Ownership," *Journal of the American Planning Association, 79:1*, 32-48, May 9 2013.

Measures Rejected from TDM Menu

Several of the measures identified in the Fehr & Peers 2015a memorandum and from additional effort conducted subsequent to Fehr & Peers 2015a memorandum were dismissed from further consideration for one or more of the reasons described below.

Does Not Meet Definition of TDM Measure for Development Projects

Following the Fehr & Peers 2015a memorandum, the definition of a TDM measure for the TDM Program Standards was established. Many potential measures were dismissed because they did not meet this definition. These potential measures included, but not limited to:

- Flexible hours; peak period parking fees (address peak hour Vehicle Miles Traveled, not all day Vehicle Miles Traveled)
- Transportation network company and taxi measures (literature does not provide evidence of relationship between these services and Vehicle Miles Traveled)
- Transportation Sustainability Fee; in-lieu fees (does not directly reduced Vehicle Miles Traveled from the subject development as fee can be applied citywide)
- Joint parking; remote/satellite/peripheral parking; space-efficient parking; density bonus for parking reduction; parking for non-shared motorcycles, mopeds, scooters; space for off-street loading (Vehicles Miles Traveled not reduced)
- Space for electric non-shared vehicles (while this measure may be an air pollutant reducing measure, including greenhouse gases, depending on the source of the electricity, the measure does not negate other impacts associated with Vehicle Miles Traveled (e.g., energy, noise, sprawl, space constraints in San Francisco)).
- Tenant bicycle parking in existing commercial buildings (TDM Program does not apply to existing buildings with no development application)
- Pre-tax election for transportation (the benefit is not provided by the property owner; the benefit is provided by the federal government in the form of reduced income taxes).

Measures Related to Areawide Vehicle Miles Traveled

Most Development Projects are not of a large enough scale and/or contain unique land uses to substantially influence the Vehicle Miles Traveled estimated in SF-CHAMP for the transportation analysis zone the Development Project site is located in. Therefore, potential measures related to density and diversity of land uses were dismissed from consideration, with some exceptions, although they may be more appropriate for jurisdictions in other less urban settings. For projects of a large enough scale and/or contain unique land uses, it is possible a project-specific analysis of Vehicle Miles Traveled will be conducted in the environmental review process, separate from the TDM Program.

Difficulty in Monitoring or Implementation

Some potential measures were dismissed from consideration because City staff may find it difficult to monitor the particular potential measure or the potential measure is not under Planning Code jurisdiction. For other measures, monitoring may be possible, but privacy concerns may render the reporting unlikely. These potential measures included, but not limited to:

- Bike Share Station (contracting between two private entities; at this point in time, City staff cannot guarantee measure will be implemented at time of Development Project approval)
- Telecommuting; compressed work weeks; flexible hours; hire local residents; carpool program; guaranteed ride home (difficult to monitor, including the level of implementation to assign point values;

difficult for property owner to ensure a future tenant will comply at time of Development Project approval)

Assignment of Point Values to TDM Measures in the Menu

Each of the TDM measures on the menu is assigned a number of points, reflecting its relative effectiveness in reducing Vehicle Miles Traveled. This relative effectiveness determination is grounded in literature review, local data collection, best practices research, and professional transportation expert opinion, as described below.

The CAPCOA report, subsequent work conducted by the Bay Area Air Quality Management District (BAAQMD), and local data collection was used as a basis for assigning point values for 14 of the 26 TDM measures in the menu. Using the CAPCOA report Vehicle Miles Traveled calculations as a starting point, Fehr & Peers developed a spreadsheet for the BAAQMD that calculates the Vehicle Miles Traveled and associated greenhouse gas emissions reduction from the transportation measures identified in the CAPCOA report for the San Francisco Bay Area. This spreadsheet was validated for the BAAQMD by comparing actual performance of transportation measures in the San Francisco Bay Area with modeled outcomes.[27]

[27] Institute for Local Government, *Transportation Demand Management Tool,* posted by the BAAQMD, updated June 2012.

For the TDM Program, San Francisco hired Fehr and Peers to develop a similar spreadsheet as developed for the BAAQMD, but to refine it further to be San Francisco-specific based upon local data collection. This local data collection and subsequent analysis was conducted between 2014 and 2016 and is documented in a series of reports.[28,29,30] In summary of those reports, substantial documentation exists to quantify the relationship between nine TDM measures in the menu and Vehicle Miles Traveled reduction in San Francisco. These nine TDM measures are Bike Share Membership, Car Sharing, Contributions or Incentives for Sustainable Transportation, Shuttle Bus Service, Vanpool Program, Tailored Transportation Marketing Services, On-site Affordable Housing, Unbundle Parking, and Parking Cash Out: Non-residential Tenants.

For these nine TDM measures, the maximum point value for these measures was generally assigned using the following simple formula: one percent reduction in Vehicle Miles Traveled = one point, rounding up to next highest point for any value over 0.1. For example, 4.1 percent reduction in Vehicle Miles Traveled = 5 points. However, there were instances when individual measures were adjusted to reflect background conditions unique to San Francisco and likely accounted for in SF-CHAMP.

For the remaining five TDM measures identified in the CAPCOA report, the same simple formula identified above was used, if available. However, there were instances when individual measures were adjusted to account for local data collection results and to reflect background conditions unique to San Francisco and likely accounted for in SF-

[28] Fehr and Peers, *Parking Analysis and Methodology Memo – Final*, April 2015 (2015b).
[29] Fehr and Peers, *San Francisco TDM Quantification Data Collection Strategy*, May 2015 (2015c).
[30] Fehr and Peers, *San Francisco TDM Framework for Growth: Summary of Survey Results,* May 2015 (2015d).

CHAMP. These five TDM measures are Improve Walking Conditions, Bicycle Parking, Showers and Lockers, Parking Pricing, and Parking Supply.

For the remaining 12 TDM measures in the menu, literature review, best practice research, and professional transportation expert opinion demonstrates that these TDM measures reduce Vehicle Miles Traveled, but there is not sufficient data to quantify the specific relationship between the TDM measure and a specific percent reduction in Vehicle Miles Traveled.[31] These resources were used for the relative effectiveness determination. Given this lack of data, these TDM measures were assigned point values on the low to low-medium (one to two points) end of the point spectrum. These 12 TDM measures are Bicycle Repair Station, Bicycle Repair Services, Fleet of Bicycles, Temporary Bicycle Valet Parking, Delivery Supportive Amenities, Provide Delivery Services, Family TDM Amenities, On-site Childcare, Family TDM Package (although it is a combination of two other TDM measures), Multimodal Wayfinding Signage, Real Time Transportation Information Displays, and Healthy Food Retail in Underserved Area.

[31] Note: in addition to the jurisdictions mentioned at the introduction to this chapter, several resources are available that document TDM best practices or serve as a repository for studies related to TDM. Resources consulted for the TDM Program include, but not limited to: A Better City, *Establish an Effective Commute Trip Reduction Policy in Massachusetts: Lessons Learned from Leading Programs*, August 2014; Urbantrans North America and Kimley Horn Associates, *City of Boulder Developer TDM Requirements Best Practices Research*, August 2014; Metropolitan Area Planning Council, *Transportation Demand Management Studies*, July 2015; California Air Resources Board, Senate Bill 375 – Research on Impacts of Transportation and Land Use-Related Policies, updated regularly, Available online at: http://arb.ca.gov/cc/sb375/policies/policies.htm; Victoria Transport Policy Institute, Online TDM Encyclopedia, updated regularly, Available online at http://www.vtpi.org/tdm/; and Mobility Lab, What is TDM?, updated regularly, available online at: http://mobilitylab.org/about-us/what-is-tdm/.

The following provides more detail regarding the assignment of point values for each of the 26 measures in the menu, presented in the eight categories that appear in the TDM menu: Active Transportation, Car-Share, Delivery, Family, High-Occupancy Vehicles, Communications and Information, Land Use, and Parking.

Active Transportation

Improve Walking Conditions

The CAPCOA report identifies a pedestrian network improvement measure (SDT-1), with a maximum of 2.0 percent reduction in Vehicle Miles Traveled. The CAPCOA report measure requires a project to provide a pedestrian access network that internally links all uses and connects to all existing or planned external streets and pedestrian facilities contiguous with the project site. The Improve Walking Conditions measure in the TDM Program requires a Development Project to provide streetscape improvements consistent with the *Better Streets Plan* and any local streetscape plan so that the public right-of-way is safe, accessible, convenient and attractive to persons walking. SF-CHAMP already accounts for several pedestrian factors to estimate background Vehicle Miles Traveled. Therefore, for the purposes of the TDM Program, the point value a Development Project could receive from the Improve Walking Conditions measure was reduced from two points to one point. Two options are provided, depending upon whether the Development Project is subject to the large project requirements of Planning Code Section 138.1.

Bicycle Parking

The CAPCOA report did not quantify Vehicle Miles Traveled for providing bicycle parking (SDT-6 and SDT-7). The Victoria Transport Policy Institute rates strategies that facilitate bicycling as “very beneficial” (highest rating) in shifting automobile travel to

alternative modes.[32] A California Air Resource Board policy brief cites studies showing that the provision of trip-end infrastructure, including bicycle parking, is an effective strategy that facilitates increased bicycle use and reduced driving, and articulates a direct correlation between perceived availability of bicycle parking and the likelihood of cycling.[33] The supply of bicycle parking provided at a site will affect the ability of a person to bicycle to a site, as the supply of vehicular parking affects the ability for a person to drive to a site. In addition, the perception that one's bicycle may be stolen or vandalized may create a barrier to making a trip by bicycle. Thus, access to secured bicycle parking is an important factor that affects whether a person will bicycle to a site. The maximum point value a Development Project could receive from the Bicycle Parking measure was assigned a medium value of four points, which reflects the relative effectiveness of bicycle parking. Four options are provided for this TDM measure, depending upon the amount of bicycle parking provided. For land use categories A and B, the amount of bicycle parking that would receive the maximum points is approximately one space for every five employees or visitors, which is commensurate with the San Francisco Board of Supervisors' Resolution 0511-10, which encourages City departments and agencies "…to adopt a goal of 20 percent of trips by bicycle by 2020." For land use category C, the amount of bicycle parking that would receive the maximum points supports this goal by providing families and other multi-person households with sufficient bicycle parking spaces.

Shower Facilities and Lockers

The CAPCOA report did not quantify Vehicle Miles Traveled for providing a showers and lockers (TRT-5), although the literature presented in the CAPCOA report suggests these facilities would represent less than one percent reduction in Vehicle Miles Traveled. Using the simple formula identified above, this equates to a one point value. A California Air Resource Board policy brief includes showers at work places in the bicycle trip-end infrastructure category, the provision of which is an effective strategy that facilitates increased bicycle use and reduced driving.[34]

Bike Share Membership

The CAPCOA report did not quantify Vehicle Miles Traveled for providing a bike share membership (TRT-12). The Fehr & Peers spreadsheet developed for San Francisco identifies a maximum of 0.2 percent reduction in Vehicle Miles Traveled for locating within 1,000 feet of a bike share station and 1.1 percent reduction for providing a bike share membership based upon literature from Washington D.C.'s Capital Bikeshare Program.[35] Using the simple formula identified above, this equates to a maximum two point value, if a bike share membership is offered at a location in proximity to a Bay Area Bike Share location. Two options are provided for Bike Share Membership, depending upon the site's location in proximity to a Bay Area Bike Share station. Using the site's location as a basis for assigning points accounts for the variability in geography throughout San Francisco and the effect this can have on travel behavior.

Bicycle Repair Station

On-site bicycle repair tools and space to use these supports on-going use of bicycles for transportation. A California Air Resource Board policy brief includes "Bike Stations", facilities which combine secure bicycle parking with repair services or tools, in the bicycle trip-end infrastructure category, the provision of which is an effective strategy that

[32] http://www.vtpi.org/tdm/tdm93.htm
[33] http://www.arb.ca.gov/cc/sb375/policies/bicycling/bicycling_brief.pdf

[34] *Ibid.*
[35] LDA Consulting, *2011 Capital Bikeshare Member Survey Report*, 2012 and LDA Consulting, *2013 Capital Bikeshare Member Survey Report*, 2013.

facilitates increased bicycle use and reduced driving.[36] No literature was found to document the incremental effect that repair stations have in reducing Vehicle Miles Traveled over what is provided by bicycle parking. Therefore, the point value a Development Project could receive from the Bicycle Repair Station measure was assigned a low value of one point.

Bicycle Repair Services

Provision of bicycle repair services supports on-going use of bicycles for transportation. A California Air Resource Board policy brief includes "Bike Stations", facilities which combine secure bicycle parking with repair services or tools, in the bicycle trip-end infrastructure category, the provision of which is an effective strategy that facilitates increased bicycle use and reduced driving.[37] No literature was found to document the specific effect these services have individually on reducing Vehicle Miles Traveled. Therefore, the point value a Development Project could receive from the Bicycle Repair Services measure was assigned a low value of one point.

Fleet of Bicycles

Provision and maintenance of a fleet of bicycles for resident or employee use supports occasional bicycle need and use, and may introduce bicycling for transportation to those who do not regularly bicycle. Although this measure is similar to Bay Area Bike Share in that a person can use a shared bicycle, this measure only influences trips at the origin (home) or ultimate destination (work) of a tour, where as a Bay Area Bike Share network could influence both the origin and ultimate destination of a tour, as well as trips in between the origin and destination. Therefore, the point value a Development Project could receive from the Fleet of Bicycles measure was assigned a low value of one point.

Bicycle Valet Parking

Monitored parking for bicycles supports use of bicycles for transportation. No literature was found to document the effect monitoring parking for bicycles has individually in reducing Vehicle Miles Traveled. However, the nature of the effect is similar in regards to the bicycle parking measure described above, but more limited in applicability to uses with large events. Therefore, the point value a Development Project could receive from the Bicycle Valet Parking measure was assigned a low value of one point.

Car-Share

Car-Sharing.

The CAPCOA report identifies a maximum of 0.7 percent reduction Vehicle Miles Traveled for providing car-share (TRT-9). The Fehr & Peers spreadsheet developed for San Francisco identifies a maximum of 0.5 percent reduction in Vehicle Miles Traveled for providing on-site car-share parking and 4.1 percent reduction for providing a car-share membership based upon California Air Resources Board policy brief.[38] Using the simple formula identified above, this equates to a maximum five point value. Five options are provided for Car-Sharing, depending upon the amount of on-site car-share provided and whether or not a membership is provided.

Delivery

Delivery Supportive Amenities

Delivery supportive amenities may reduce Vehicle Miles Traveled by reducing number of trips that may otherwise have been by single occupancy vehicle. No

[36] *Ibid.*
[37] *Ibid.*

[38] http://www.arb.ca.gov/cc/sb375/policies/carsharing/carsharing_brief.pdf

literature was found to document the effect these services have individually in reducing Vehicle Miles Traveled. Therefore, the point value a Development Project could receive from the Delivery Supportive Amenities measure was assigned a low value of one point.

Provide Delivery Services.

Provided delivery services may reduce Vehicle Miles Traveled from single-stop motorized deliveries, by providing delivery services by bicycle, on foot, or in a delivery vehicle that makes multiple stops. No literature was found to document the effect delivery services have individually in reducing Vehicle Miles Traveled. Therefore, the point value a Development Project could receive from the Provide Delivery Services measure was assigned a low value of one point.

Family

Family TDM – Amenities

Providing amenities for families may reduce Vehicle Miles Traveled by addressing particular challenges that families face in making trips without a private vehicle. No literature was found to document the effect these amenities have individually in reducing Vehicle Miles Traveled. Therefore, the point value a Development Project could receive from the Family TDM – Amenities measure was assigned a low to low-medium value of two points. Two options are provided for Family TDM – Amenities, with the potential of selecting both options, depending upon the amount of provided amenities.

On-Site Childcare

One of the important factors in affecting travel behavior is diversity of land uses (also known as land use mix). SF-CHAMP accounts for a diversity of land uses to estimate Vehicle Miles Traveled throughout San Francisco. However, childcare is not a specific land use documented in SF-CHAMP, although trips associated with these land uses typically function similar to office. While this use may have some visitor trips associated with them (childcare drop-off and pick-up), those trips are often a side trip within a larger tour. For example, the visitor trips are influenced by the origin (home) and/or ultimate destination (work) of those tours. Given the unmet need of child care in San Francisco [39] and the influence that locating child care near a person's home or work may have in shorting vehicle trip length or shifting vehicle trips to sustainable modes or reducing vehicle trips,[40] this TDM measure was added to the TDM Program. While this TDM measure may have a substantial effect on reducing Vehicle Miles Traveled for families with children, no literature was found to document this effect and families with children under the agencies 0-12 are a smaller subset of the total population in San Francisco. [41] Therefore, the point value a Development Project could receive from the On-site Childcare measure was assigned a low to low-medium value of two points.

Family TDM Package

This TDM measure, which is a combination of the Car-Sharing and Family TDM – Amenities measures, acknowledges the complementary and synergistic effects of family-supportive measures in the TDM menu when packaged together. Projects can address the particular challenges that families face in making trips without a private vehicle by providing a suite of measures. No literature was found to document the effect this package has individually in reducing Vehicle Miles Traveled. Therefore, the point value a Development Project could receive from the Family TDM Package measure was assigned a low to low-medium value of two points.

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[39] San Francisco Child Care Planning & Advisory Council, *San Francisco Early Care and Education Needs Assessmen*t, 2012-2013.
[40] American Planning Association, *The Importance of Ensuring Adequate Child Care in Planning Practice*, 2011.
[41] As of 2010, approximately 79,210 children aged 0 – 12 resided in San Francisco. This represented approximately 9.7 percent of the total San Francisco population. Source: San Francisco Child Care Planning & Advisory Council, 2012-2013.

High-Occupancy Travel

Contributions or Incentives for Sustainable Transportation

The CAPCOA report identifies a maximum of 20.0 percent reduction in Vehicle Miles Traveled for providing a public transit subsidy (TRT-4). The Fehr & Peers spreadsheet developed for San Francisco identifies a maximum of 7.5 percent reduction in Vehicle Miles Traveled for providing a public transit subsidy.[42] Using the simple formula identified above, this equates to a maximum eight point value. Four options are provided for Contributions or Incentives for Sustainable Transportation, depending upon the percent amount of provided contribution or incentives.

Shuttle Bus Service

The CAPCOA report identifies a maximum of 13.4 percent reduction in Vehicle Miles Traveled for providing shuttles (TRT-11). Using the simple formula identified above, this equates to a maximum 14 point value. Two options are provided for Shuttle Bus Service, depending upon the service frequency provided for the shuttle.

Vanpool Program

Shuttle and vanpool are grouped together in the CAPCOA report (TRT-11). Given this grouping, although a property owner could select both the Shuttle Bus Service and Vanpool Program, the maximum point value a property owner could receive between the two TDM measures is 14 points. The Vanpool Program requires the property owner to purchase or lease vans for employee use and pay for mileage and maintenance of the vehicles. The frequency of the Vanpool Program service is intended to serve trips at the beginning and end of the workday to and from employee's residences. Conversely, the Shuttle Bus Service measure offer service generally throughout the day. This longer and more frequent service provides more freedom for people participating in the Shuttle Bus Service than the Vanpool Program because people know they can catch a shuttle if appointments, emergencies, and other activities come up and they need to return home. Therefore, for the purposes of the TDM Program, the maximum point value a Development Project could receive from the Vanpool Program measure was reduced from 14 points to seven points. Seven options are provided for this TDM measure, depending upon the number of employees eligible for the program.

Information and Communications

Multimodal Wayfinding Signage

Wayfinding signage orients users to locations of sustainable transportation choices. No literature was found to document the effect signage has individually in reducing Vehicle Miles Traveled. Therefore, the point value a Development Project could receive from the Multimodal Wayfinding Signage measure was assigned a low value of one point.

Real Time Transportation Information Displays

Real time transportation information displays support on-the-go decision making to support sustainable trip making. No literature was found to document the effect these displays have individually in reducing Vehicle Miles Traveled. Therefore, the point value a Development Project could receive from the Real Time Transportation Information Displays measure was assigned a low value of one point.

Tailored Transportation Marketing Services

The CAPCOA report identifies a maximum of 4.0 percent reduction in Vehicle Miles Traveled for

[42] The 20.0 percent reduction in Vehicle Miles Traveled identified in the CAPCOA report was dampened in the Fehr & Peers spreadsheet based on San Francisco Department of Environment, *San Francisco Commuter Benefits Ordinance, 2012-2013 Annual Report*, April 2014, which documents 25 percent participation rates of employees eligible to participate in the Commuter Benefits Ordinance and then by 50 percent assuming SF-CHAMP already accounts for public transit subsidies.

providing marketing services (TRT-7). Using the simple formula identified above, this equates to a maximum four point value. Four options are provided for Tailored Transportation Market Services, depending upon the amount of activities provided in the marketing services.

Land Use

Healthy Food Retail in Underserved Area

One of the important factors in affecting travel behavior is diversity of land uses (also known as land use mix). SF-CHAMP accounts for a diversity of land uses to estimate Vehicle Miles Traveled throughout San Francisco. However, SF-CHAMP does not account specifically identify retail destinations, nor could it understand the granular level difference between places with healthy and unhealthy food options. By locating grocery stores and other retailers that provide healthy food options in areas that are underserved, new development can create the option for existing residents and workers to travel shorter distances and by other modes to perform their food shopping, thereby reducing Vehicle Miles Traveled. Although some literature exists to document this effect, [43] the literature is limited and does not quantify the individual effect on reducing Vehicle Miles Traveled. Therefore, the point value a Development Project could receive from the Healthy Food Retail in Underserved Area measure was assigned a low to low-medium value of two points.

On-site Affordable Housing

Demographics are a factor that influence travel behavior. The CAPCOA report identifies a maximum of 4.0 percent reduction in Vehicle Miles Traveled for providing on-site affordable housing (LUT-6), assuming 100 percent on-site affordable housing. [44]

More recent research within Transform and California Housing Partnership Corporation (Transform), Why Creating and Preserving Affordable Homes Near Transit is a Highly Effective Climate Protection Strategy, May 2014 substantiates that affordable housing reduces VMT more than estimated in the CAPCOA study. The table below summarizes the VMT estimates for households with various income levels that live within one quarter-mile of a high-quality transit (like San Francisco) as shown in the Transform study.

As shown in **Table 4-2**, households with income levels that do not exceed 80 percent and 50 percent are estimated to have VMT that is 20 percent and 29 percent less than moderate income households, respectively. SF-CHAMP accounts for demographics in estimating background VMT. Therefore, for purposes of the TDM Program, the percentage reduction in VMT compared to moderate income was adjusted by half to reflect background conditions unique to San Francisco and likely accounted for in SF-CHAMP. In other words, it is assumed that households within income levels that do not exceed 80 percent and 55 percent [45] would have a maximum of 10 percent and 15 percent reduction in VMT compared to moderate income households, respectively. Using the simple formula established in the TDM Technical Justification of one percent reduction in VMT = one point, this equates to a maximum of 10 points and 15 points, depending on income levels provided for on-site affordable housing.

[43] Lawrence Frank, *Travel Behavior, Environmental, & Health Impacts of Community Design & Transportation Investment. A Study of Land Use, Transportation, Air Quality, and Health in King County, WA*, 2005.

[44] Note: the research used to support this estimate assumes an average of 25 percent below median income for the on-site affordable Dwelling Units.

[45] 55 percent was chosen to match the income level cutoff in the Planning Code.

The scale and associated options were reduced to three and four points, respectively, to reflect the Planning Code on-site affordable housing permitted amounts up to 25 percent. If the Planning Code were to be amended to permit lower or higher amounts of on-site affordable housing in the future, the scale for this TDM measure could be amended to reflect those changes to the Planning Code.

Table 4-2: Household VMT for Households within 1/4 Mile of High-Quality Transit

	Income Range				
	High	**Moderate**	**Low**	**Very Low**	**Extremely Low**
	> 120%	**80% - 120%**	**50% - 80%**	**30% - 50%**	**< 30%**
Daily Household VMT	49.3	32.8	26.3	23.4	20.7
% difference in daily household VMT from moderate income			-20%	-29%	-37%

VMT = vehicle miles traveled

Source: Transform and California Housing Partnership Corporation, Why Creating and Preserving Affordable Homes Near Transit is a Highly Effective Climate Protection Strategy, May 2014.

Parking Management

Unbundle Parking

The CAPCOA report identifies a maximum of 13.0 percent reduction in Vehicle Miles Traveled for providing unbundle parking (PDT-2). The Fehr & Peers spreadsheet developed for San Francisco identifies a maximum of 4.5 percent reduction in Vehicle Miles Traveled for unbundle parking. [46] Using the simple formula identified above, this equates to a maximum five point value. Five options are provided for Unbundle Parking, depending upon the neighborhood parking rate. A lower neighborhood parking rate will result in a higher point value possible for this TDM measure. The rationale for this connection is parking costs are higher in more constricted parking supply setting and thus the effectiveness of unbundling the cost of a parking space from the unit or leased space increases. Using the neighborhood parking rate as a basis for assigning points accounts for the variability in geography throughout San Francisco and the effect this can have on travel behavior.

Parking Pricing

The CAPCOA report identifies a maximum of 19.7 percent reduction in Vehicle Miles Traveled for parking pricing (TRT-14). This measure is defined as charging for parking (or eliminating a parking subsidy) instead of providing it free to the consumer. Most research cited in the CAPCOA report studied impacts of workplace parking subsidy elimination on individual sites and not regionally. However, the measure proposed in the TDM ordinance reflects the elimination of bulk parking (i.e., consumers are unable to purchase parking for a duration longer than a day) requiring travelers to consider the cost

[46] The 13.0 percent reduction in Vehicle Miles Traveled identified in the CAPCOA report was dampened in the Fehr & Peers spreadsheet based on updated California Statewide Household Travel Survey data and by 50 percent assuming SF-CHAMP already accounts for parking unbundling.

of parking each day (and being able to save money if they choose not to drive on a given day) as opposed to using a weekly or monthly pass. Based on the San Francisco Parking Supply and Utilization Study (adoption anticipated in July, 2016), this TDM measure could reduce Vehicle Miles Traveled by two percent. Using the simple formula identified above, this equates to a maximum two point value.

Parking Cash Out: Non-residential Tenants

The CAPCOA report identifies a maximum of 7.7 percent reduction in Vehicle Miles Traveled for parking cash-out (TRT-15) in an urban setting. However, the San Francisco Parking Supply and Utilization Study (adoption anticipated in July, 2016) found that requiring parking cash out citywide had a much smaller effect within San Francisco – closer to one percent reduction in neighborhood Vehicle Miles Traveled. This finding is reflective of the fact that very few workers in San Francisco have their parking paid by their employers and those that do are not very price sensitive when making travel decisions. In addition, most employees are already offered a subsidy for public transportation, vanpools, or bicycling (or the ability to purchase these services tax free), which mirrors many of the benefits of cash out. Therefore, the effects of a cash out measure were estimated to be much lower than what is described in the CAPCOA report, and the maximum point value a Development Project could receive from the Parking Cash Out measure was reduced from eight points to two points.

Parking Supply

The CAPCOA report identifies a maximum of 12.5 percent reduction in Vehicle Miles Traveled related to parking supply (PDT-1). Recent research, described further below, indicates that an area with more parking influences a higher demand for more automobile use. This research was used to confirm and refine the CAPCOA report parking supply Vehicle Miles Traveled reduction estimates to tailor them to San Francisco conditions.

A New York City study of three boroughs showed a clear relationship between guaranteed vehicular parking at home and a greater tendency to use the automobile for trips made to and from work, even when both work and home are well served by transit. The study also infers that driving to other non-work activities is also likely to be higher for households with guaranteed vehicular parking. [47] Related literature focused on the relationship between the availability of free on-street parking supply and the number of cars per household supports the findings that the availability of parking increases private car ownership by approximately nine percent.[48] A study of households within a two-mile radius of ten rail stations in New Jersey concluded that if development near transit stations is developed with a high parking supply (on- and off-street), then those developments will not reduce automobile use compared to developments located further away from transit stations, and that parking supply can undermine the incentive to use transit that proximity to transit provides.[49] A study of nine cities across the United States looked at the question of whether citywide changes in vehicular parking cause automobile use to increase, or whether minimum parking requirements an appropriate response the already rising automobile use. The study concluded that: "parking provision in cities is a likely cause of increased driving among residents and employees in those places".[50]

Research conducted in San Francisco focused on whether or not a relationship exists between the

[47] Rachel Weinberger, *Death by a thousand curb-cuts: Evidence on the effect of minimum parking requirements on the choice to drive. Transport Policy, 20*, March 2012.
[48] Guo Zhan, *Residential Street Parking and Car Ownership*. *Journal of the American Planning Association, 79:1*, 32-48, May 9 2013.
[49] Daniel Chatman, *Does Transit-Oriented Development Need the Transit?, Access,* Fall 2015.
[50] Chris McCahill, et al., *Effects of Parking Provision on Automobile Use in Cities: Inferring Causality, Transportation Research Board,* November 13, 2015.

provision of off-street parking and the choice to drive among individuals traveling to or from the site (similar to the focus of one of the questions in the nine city United States study). Following data collection and an empirical review of the data, this research found that reductions in off-street vehicular parking for office, residential, and retail developments reduce the overall automobile mode share associated with those developments, relative to projects with the same land uses in similar contexts that provide more off-street vehicular parking.[51] In other words, more off-street vehicular parking is linked to more driving and that people without dedicated parking spaces are less likely to drive.

Based upon the recent research, besides Shuttle Bus Service, a reduced Parking Supply is the most effective TDM measure available in the menu. Therefore, for the purposes of the TDM Program, the maximum point value a Development Project could receive from the Parking Supply measure was assigned a high value of 11 points. Eleven options are provided for this TDM measure, depending upon the Development Project's parking supply compared to the neighborhood parking rate.

The neighborhood parking rate is number of existing Accessory Parking spaces provided per Dwelling Unit or per 1,000 square feet of non-residential uses for each transportation analysis zone within San Francisco. A full description of the methodology for estimating the neighborhood parking rate is included in Appendix B of the TDM Technical Justification document and may be refined over time. If a Development Project is parked at or below the neighborhood parking rate, the Development project would receive points for this TDM measure.[52]

Using the neighborhood parking rate as a basis for assigning points accounts for the variability in geography throughout San Francisco and the effect this can have on travel behavior. The purpose of the TDM Program is to reduce the Vehicle Miles Traveled that would be otherwise estimated to occur from new development (in SF-CHAMP or other transportation modeling software) based upon the new development's transportation analysis zone location. SF-CHAMP provides an estimate of Vehicle Miles Traveled at the geographic scale of a transportation analysis zone, but it does not include inputs for site level characteristics like TDM measures, including Accessory Parking supply. Although not an input into SF-CHAMP, based upon the recent research, the existing Accessory Parking supply within a transportation analysis zone has a relationship with the Vehicle Miles Traveled for that transportation analysis zone. Therefore, a new development would mostly likely not reduce Vehicle Miles Traveled as it relates to Parking Supply, if the new development is not parked at least at or below the neighborhood parking rate.

Factors Rejected for Point Value Assignment

Other factors were considered in assigning point values, such as cost, other City policy goals, and Municipal Code requirements, but those factors were dismissed because they do not reflect the core purpose of the TDM Program of reducing Vehicle Miles Traveled. In regards to cost, the economics of each project will vary greatly as to whether the TDM measures selected for the project will result in an additional cost or cost savings. For example, the upfront cost of constructing a garage structure parking and underground parking is approximately $50,000 to $80,000 per space, respectively, in 2014

[51] Fehr and Peers, 2015b.

[52] In the future, as more research is conducted and as part of updates to the TDM Program Standards, Planning staff may recommend to the Planning Commission that Development Projects parked above the neighborhood parking rate should receive negative points.

dollars.[53] If a developer chooses not to construct parking, the developer saves that cost. Conversely, some luxury housing developers may sell those parking spaces at a greater amount than it costs to construct the parking spaces, taking into account the unbundling of the parking space from a dwelling unit. In addition, transportation options such as TDM measures are amenities to residents, tenants, employees, and visitors because they the enhance convenience and freedom by providing or facilitating easy-to-use travel options. Thus, developers may be able to recover some of the costs from providing those amenities. Resources are available for developers to use in estimating costs of some TDM measures in the menu.[54]

Development Projects with a Substantial Amount of Parking

A Development Project may initially propose more Accessory Parking spaces than the menu can address. Assuming every TDM measure applicable to a land use category is available to a Development Project, the following identifies the number of Accessory Parking spaces that may be included for land use categories A, B, and C when all points have been exhausted for the Development Project:

- Land use category A (Retail Type Uses) = 118 Accessory Parking spaces (70 points)
- Land use category B (Office Type Uses) = 550 Accessory Parking spaces (66 points)
- Land use category C (Residential Type Uses) = 590 Accessory Parking spaces (70 points)

However, for seven TDM measures in the TDM Menu, all of the associated points may not be available to all types of projects within the land use categories as described in Chapter 3 of the TDM Technical Justification. Taking these seven TDM measures into account, the following identifies the approximate number of Accessory Parking spaces that may be included for land use categories A, B, and C when no more points associated with TDM measures are available for the Development Project:

- Land use category A (Retail Type Uses) = 80 Accessory Parking spaces (51 points)
- Land use category B (Office Type Uses) = 390 Accessory Parking spaces (50 points)
- Land use category C (Residential Type Uses) = 400 Accessory Parking spaces (51 points)

The previous amount assumes a Development Project would be able to select the Shuttle Bus Service measure. If this TDM measure is not available (e.g., it would replicate a high frequency Muni line), the following identifies the number of Accessory Parking spaces that may be included for land use categories A, B, and C when no more points associated with TDM measures are available, excluding Shuttle Bus Service and Vanpool Program for land use categories A and B, for the Development Project and stated in Section 2.2(b)(3) of the TDM Program Standards:

- Land use category A (Retail Type Uses) = 52 Accessory Parking spaces (37 points)
- Land use category B (Office Type Uses) = 250 Accessory Parking spaces (36 points)
- Land use category C (Residential Type Uses) = 260 Accessory Parking spaces (37 points)

A Development Project may propose more Accessory Parking spaces than the amounts identified above. Given no more TDM measures or points are available for these Development Projects, excluding the Parking Supply measure, the TDM Program Standards require these projects to include all measures and points, up to 80% of the total number of points available for the applicable land use category in the Development Project's TDM Plan.

[53] Refer to TransForm, *GreenTrip Certified, How to Guide, A Step by Step Guide to the GreenTRIP Certification Process*, April 1, 2015.
[54] Refer to TransForm, GreenTrip Certified, How to Guide, A Step by Step Guide to the GreenTRIP Certification Process, April 1, 2015.

The overarching goal of the TDM Program is to maintain mobility, that is, to keep people moving as our city grows. One of the additional benefits is to improve the development review process. One way this would occur is to provide flexibility to the property owner in developing a TDM Plan that best fits the needs of their project and neighborhood. By capping the target at 80% of the total number of points available for those projects that include more Accessory Parking space than the amounts above, all property owners would have flexibility in choosing from a variety of TDM measures from the TDM menu.

The Planning Commission has discretion to reduce a project's parking for policy reasons, and projects with a substantial amount of parking may have a vehicle miles traveled impact pursuant to the California Environmental Quality Act, which could require the Planning Department to identify mitigation measures and/or project alternatives to reduce that impact.

> **Example:** A property owner proposes new construction that includes 500 Dwelling Units (40 percent two-bedrooms or more and 12 percent on-site affordable housing for income levels greater than 55 percent and less than or equal to 80 percent) and 400 Accessory Parking spaces. The neighborhood parking rate for the location of the project site, Transportation Analysis Zone 579, is 0.63 parking spaces per dwelling unit.
>
> Dwelling Units are identified as land use category C. Land use category C has a base target of 13 points. For every additional 10 Accessory Parking spaces provided above 20, rounding up, one additional point is required. If the TDM menu included enough TDM measures and points to account for this amount of Accessory Parking and the target were not capped at 80% for these types of projects, the land use category C target for this project is 61 points.
>
> The available TDM measures for land use category C, except Parking Supply, at this location totals 40 points: Unbundle Parking – Location d = 4 points; Improve Walking Conditions – Option a = 1 point; Bicycle Parking – Option d = 4 points; Bike Share Membership – Location b = 2 points; Bicycle Repair Station = 1 point; Bicycle Repair Services = 1 point; Fleet of Bicycles = 1 point; Car-Share Parking – Option e = 5 points; Delivery Supportive Amenities = 1 point; Family TDM Amenities – Options a & b = 2 points; Family TDM Package = 2 points; Contributions or Incentives – Option d = 8 points; Multimodal Wayfinding Signage = 1 point; Real Time Transportation Information Displays = 1 point; Tailored Transportation Marketing Services = 4 points; and On-site Affordable Housing – Option b = 2 points. Shuttle Bus Service is not available to the property owner at this location.
>
> Given no more TDM measures and points are available for the property owner, excluding the Parking Supply measure, the TDM Program Standards require these projects to include all measures and points, up to 80% of the total number of points available, for the applicable land use category in the Development Project's TDM Plan. Therefore, the land use category C target for this project is 32 points (40 points * 80%).

Chapter 5

TDM Program Updates

As stated in the Section 4 of TDM Program Standards, potential updates to TDM menu may occur to reflect new findings on the efficacy of the measures in the TDM menu or for measures not previously included in the TDM menu. TDM measures will be revisited in light of research findings and the results of local data collection efforts (e.g., at sites subject to the TDM Program). The menu may be updated to reflect a deeper understanding regarding relative effectiveness determinations, including the efficacies of individual (e.g., Parking Supply) or multiple TDM measures (e.g., Bicycle Parking and Car-Share Parking) within varying San Francisco contexts (e.g., geographies or land use types). The menu and points may also be updated to reflect citywide and regional Vehicle Miles Traveled targets outlined in ongoing planning efforts (e.g., the San Francisco Transportation Plan and Plan Bay Area).

Appendix A: Land Use Categorization

San Francisco County Transportation Authority

1455 Market Street, 22nd Floor
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info@sfcta.org www.sfcta.org

Memorandum

Date: 04.04.2016

To: Wade Wietgrefe, San Francisco Planning Department

Carli Paine, San Francisco Municipal Transportation agency

From: Drew Cooper, Michael Schwartz, San Francisco County Transportation Authority

Subject: Land Use Categories

The City and County of San Francisco recommends introduction of a Transportation Demand Management (TDM) ordinance which, if approved, will require developers to choose from a menu of improvements to reduce their project's impact on the transportation network through a reduction in vehicle miles traveled (VMT). While the goal of reduced VMT applies to all new development, the applicable measures and points target varies depending on the land use. With this in mind, the TDM Program (Program) has four (4) land use categories. Each use outlined in Section 102 of the Planning Code (Definitions) has been assigned to a category and must meet the requirements of that category.

The remainder of this memo describes the trips associated with the land use and parking spaces for each of the categories.

Category A: Land uses in Category A most closely reflect retail use. Sample land uses include formula retail, museums, entertainment venues, and grocery stores. Many Category A trips are associated with visitors and customers. These trips tend to be shorter in nature, and each parking space accommodates significantly more driving than parking spaces in other groups (see Attachment 1). TDM measures in this category are intended to reduce VMT from visitors and customers (as opposed to store employees), and the targets reflect the higher trip rate associated with each parking space.

Category B: Land uses in Category B most closely reflect office use. Sample land uses include Office, Child Care Facility, and School. While these uses may be associated with some visitor/customer trips, many of the trips will be made by employees and the TDM measures should focus on reducing employee related VMT. Since parking spaces associated with Category B land uses tend to have less turnover (and therefore lower VMT) than Category A, the Program assigns lower targets per parking space.

Category C: Projects in Category C reflect residential use. Parking spaces in Category C generate fewer trips than Category B, reflected in the Program targets. TDM measures for projects in this category target VMT reduction for residents.

Category D: Land uses in Category D are associated with the lowest amount of trip generation, due to lower employment density and a low rate of visitors/customers. Sample land uses in Category D include Manufacturing, Power Plant, and Shipyard. TDM measures for Category D target employee VMT reduction and Program targets are commensurately lower than all other categories.

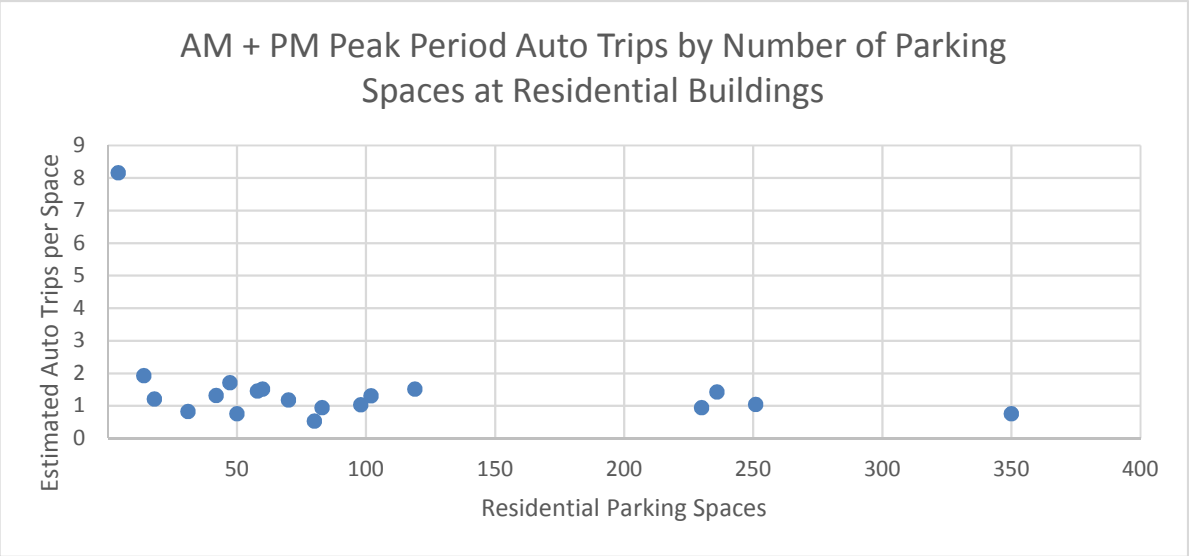
Attachment

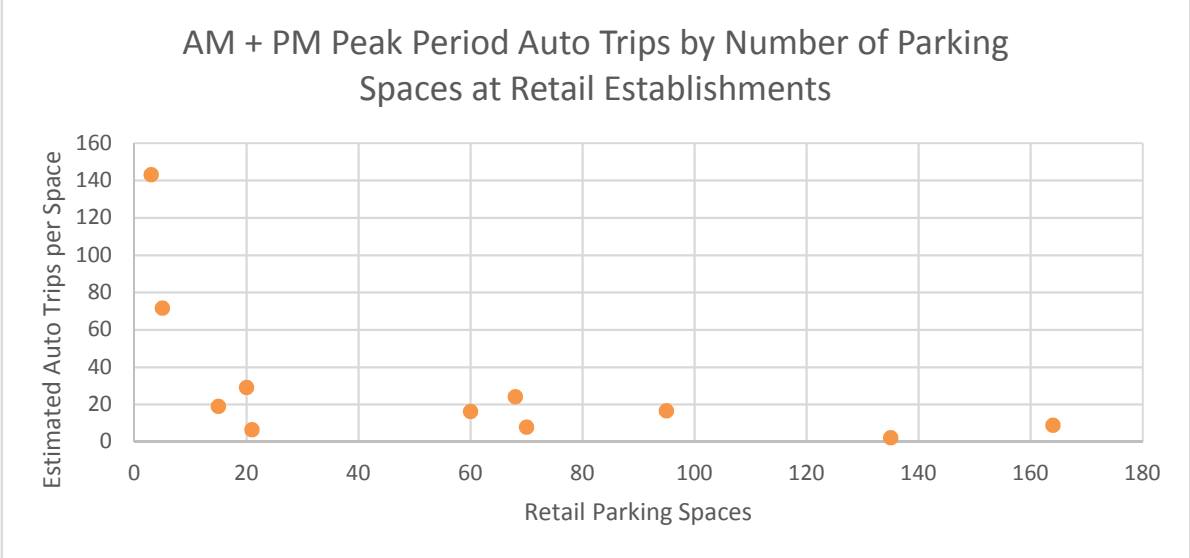
1. Estimated Auto Trips Per Parking Space by Land Use, Results of 2014/15 SF Field Survey

cc: A. Ben-Pazi, R. Schuett – Planning
M. Munowitch – SFMTA
S. Cleveland-Knowles, A. Ruiz-Esquide -- CAO
JC, RGR – File: TSP (TDM Ordinance)

Average Peak Period Auto Trips Per Parking Space
Summer 2014/15 SF Field Data Collection

	AM	PM	Combined
Residential	0.37	0.50	0.87
Retail	3.75	9.87	13.61
Ratio -- Retail:Residential	*10.03*	*19.71*	*15.58*





Appendix B: Neighborhood Parking Rate Methodology

San Francisco County Transportation Authority

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Memorandum

Date: 04.06.2016

To: Wade Wietgrefe, San Francisco Planning Department

From: Drew Cooper, SFCTA

Subject: General Non-Residential Off-Street Parking Rate Estimation for San Francisco

The purpose of this memo is to document the estimation of a generalized non-residential off-street parking rate to be used in the TDM program in order to evaluate the parking requirements for new development at a fine-grained spatial level. The Transportation Authority did not make any attempt to separate or consider the distinctions of the various types of non-residential land uses, due to complications in relating off-street publicly available parking to the particular land uses it serves, although this analysis could be done if deemed desirable.

METHODOLOGY

The Transportation Authority estimated a general non-residential off-street parking rate as the number of public and private off-street parking spaces per 1000 square feet of non-residential land use. For each TAZ, we summarize the non-residential square footage and off-street parking supply for the TAZ and other nearby TAZs within 0.75 miles of network-based walking distance, with decreasing weight given to more distant TAZs.[1] We did this in order to derive a parking rate that is representative of the neighborhood and is not artificially truncated at arbitrary TAZ boundaries, and because parking for land uses within the TAZ may actually be located outside of the TAZ.

Land Use Data: Land use data were provided at a parcel level by the San Francisco Planning Department for 2013, and summarized to Traffic Analysis Zones (TAZs), which are the geographic unit used by SF-CHAMP travel demand model. Table 1 describes the types of land use included.

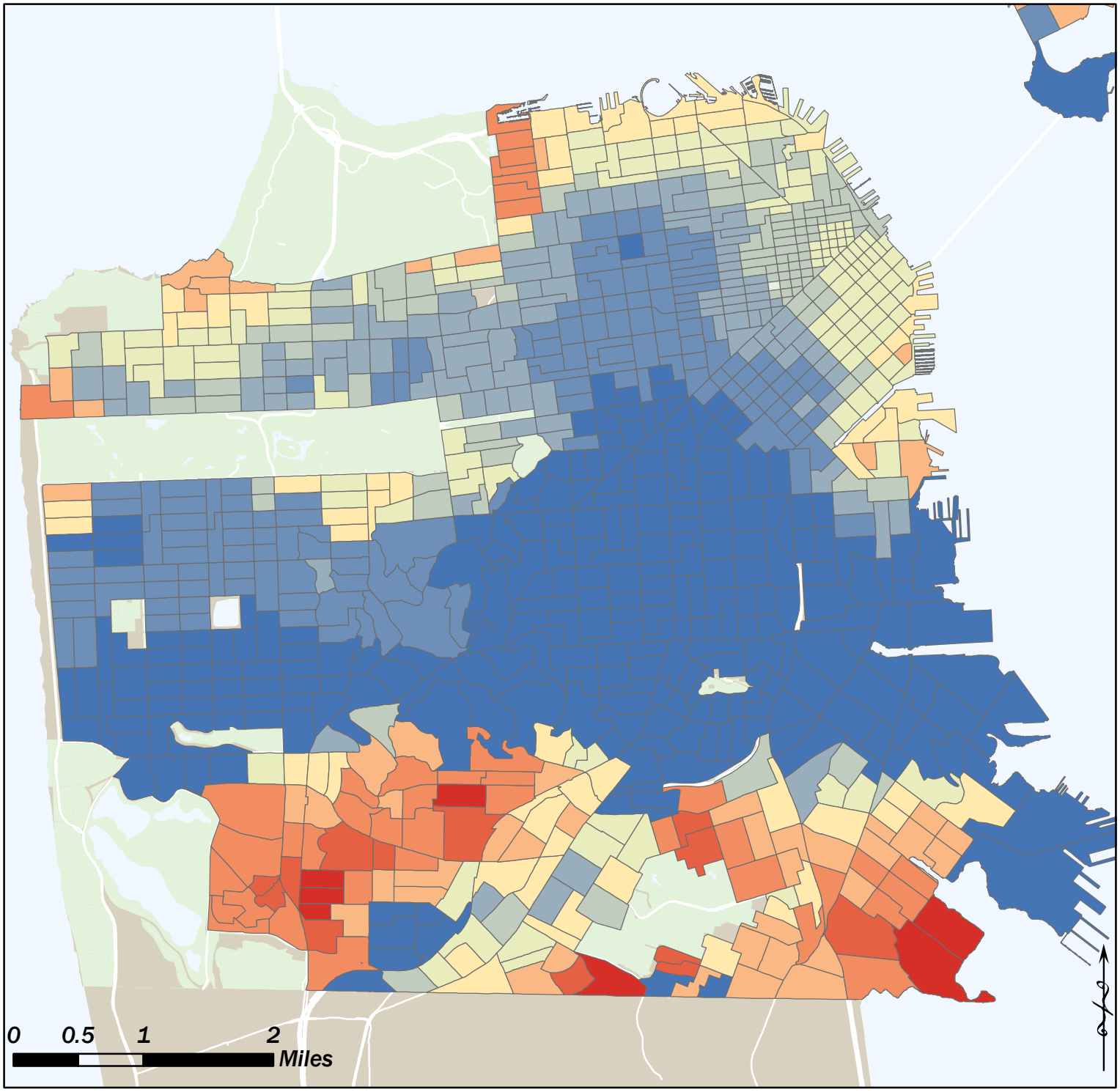
Table 1: Non-Residential Land Uses for Parking Rate Estimation

LAND USE CATEGORY	DESCRIPTION
CIE	Cultural, Institutional & Educational Services
MED	Medical and Health Services
MIPS	Management, Information & Professional Services
PDR	Production, Distribution & Repair
RETAIL	Retail / Entertainment
VISITOR	Visitor Lodging

[1] The weight is a function of distance in the formula w = e^-11.8d, where d is the distance in miles.

Parking Data: Off-street, publicly available parking data were available through SFPark. Off-street, private parking estimates were taken from the Transportation Authority's Parking Supply and Utilization Study.

Network Data: Pedestrian network-based walking distances were taken from SF-CHAMP 2012 Base Year model run.



Non-Residential Parking Supply Rate (Parking Spaces per kSF)

0.00 - 0.10 | 0.11 - 0.26 | 0.27 - 0.43 | 0.44 - 0.59 | 0.60 - 0.87 | 0.88 - 1.34 | 1.35 - 1.98 | 1.99 - 2.97 | 2.98 - 4.74 | 4.75 - 6.32

Non-Residential Parking Supply Estimated from SF Park Data

This map shows TAZ-level estimates of parking supply rates for San Francisco, based off-street parking supply from SFPark and scaled up by 3% to match citywide totals to match the estimated supply from the PSUS parking estimation model

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Source: 2013 Parcel Land Use and Zoning District Methodology, San Francisco Planning Department

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Memorandum

Date: 01.10.2017

To: Wade Wietgrefe; TDM Working Group

From: Drew Cooper — Transportation Planner, SFCTA

Subject: Parking Quantification Methodology for the San Francisco TDM Ordinance

Overview

Existing, or "background", parking rates are employed in the TDM Menu to determine whether and how many points should be awarded a project for the its parking provision. Different methodologies were employed in to estimate and quantify residential, and non-residential parking supply. This memo describes the methodology for estimating residential off-street parking supply

INTRODUCTION

Parking is an important factor in travel behavior. Parking at homes, offices, retail, and other locations supports the ability to own and drive cars. Until recently, there has been little data available on the amount of parking in San Francisco. Additionally, parking supply and parking rates (the ratio of parking spaces to land use) are changing as new developments are built. Therefore, the TDM parking quantification includes leveraging existing data, developing new data and estimation models, and a framework to incorporate new data over time.

Existing, or "background", parking rates are employed in the TDM Menu to determine whether and how many points should be awarded a project for the its parking provision. Different methodologies were employed in to estimate and quantify residential, office, and retail parking supply. This memo describes the methodology for estimating residential off-street parking supply, and updates residential parking estimation methodology first presented in the TDM Technical Justification dated 6/21/2016.

RESIDENTIAL PARKING ESTIMATION

There is limited available data on off-street residential parking supply in San Francisco, so the Transportation Authority, with support from SFMTA and SF-Planning, developed a process to collect data and a model to estimate parking supply. This section describes the structure and data for cross-classification model to estimate residential off-street parking.[1]

The residential parking estimation process proceeded with the following steps: 1) determine a model structure; 2) determine data needs; 3) determine a desired sample of data; 4) build the model; 5) estimate parking supply.

[1] A cross-classification model is a simple model to estimate an attribute of a population by dividing the population into subgroups using a set of characteristics, and measuring that attribute for a sample within each of those subgroups.

CLASSIFICATION SCHEME

There are many factors which may affect how much parking is built, such as the type of structure being built, its location and proximity to other locations, its proximity to transit, the year it is built, the price market the development is catering to, and others. The number of categories or bins (and the data needed to build the model) will increase exponentially with the number of factors being considered, so the chosen axes should be limited to those: 1) for which building-level data is available; 2) which are most likely to affect the parking rate, and; 3) for which we have comprehensive citywide data. The team considered multiple classification schemes and determined to use the following factors for the initial version of the model:

- Year constructed
- Number of units
- Planning district/area type

It is possible that the model may be refined with a different classification scheme or model structure as the TDM program and understanding of the relationship between parking, building attributes, and locational factors evolves.

Year Constructed: This is used to control for major changes in parking regulations in the San Francisco Planning Code. In 1955, minimum parking requirements were first introduced for residential uses in San Francisco.

- Pre 1955
- Post 1955

Number of Units (Residential Only): This is used to indicate the character and size of the development: single units, and small, medium, and large developments.

- 1
- 2-9
- 10-19
- 20+

Area Type: This is an indicator of surrounding land use, access to transportation infrastructure, and access to other destinations. It is based on estimates of automobile mode share from the SF-CHAMP travel demand model, which models travel behavior based on location, land use patterns, and multimodal transportation networks.

- High Auto Mode Share (> 65%)
- Medium Auto Mode Share (40%-65%)
- Low Auto Mode Share (< 40%)

The model resulting from this classification contains 3 land use categories, 2 year-built categories, 4 size categories, and 3 area type categories, resulting in 72 bins. The team developed an initial target of 30 samples per bin, resulting in 720 total samples.

$$2 \text{ year bins} \times 4 \text{ project sizes} \times 3 \text{ area types} = 24 \text{ bins}$$

$$24 \text{ bins} \times 30 \text{ samples per bin} = 720 \text{ total sample}$$

DATA DESCRIPTION

The team combined the 2013 San Francisco Parcel dataset with automobile mode share estimates from SF-CHAMP to classify parcels into the bins described in the previous section. The San Francisco Parcel dataset contains land use characteristics including the number of residential units, the year of construction, land use category, and other attributes. Additional documentation can be found here: https://data.sfgov.org/Housing-and-Buildings/Land-Use/ngem-gcfs.

From a global target of 720 building samples, the team determined bin-level targets for data collection, with a desired minimum of 10 samples per bin and remaining samples allocated proportionally to the number of buildings in each bin.

Table 1: San Francisco Parcels by Bin

Year	Size	Low AMS	Med AMS	High AMS	**Total**
before 1955	1	2,333	46,028	35,957	**84,318**
	2 to 9	8,758	20,473	1,104	**30,335**
	10 to 19	1,232	695	27	**1,954**
	20+	1,033	190	27	**1,250**
after 1955	1	218	4,772	7,818	**12,808**
	2 to 9	1,008	5,070	734	**6,812**
	10 to 19	265	475	79	**819**
	20+	460	225	42	**727**
Total		**15,307**	**77,928**	**45,788**	**139,023**

Table 2: Desired Samples by Bin

Year	Size	Low AMS	Med AMS	High AMS	**Total**
before 1955	1	12	177	173	**362**
	2 to 9	41	82	10	**133**
	10 to 19	10	10	10	**30**
	20+	10	10	10	**30**
after 1955	1	10	18	37	**65**
	2 to 9	10	22	10	**42**
	10 to 19	10	10	10	**30**
	20+	10	10	10	**30**
Total		**133**	**339**	**270**	**722**

RESULTS

Of the targeted 720 building samples, 277 have been collected to date. Samples by Bin are shown in Table 3. Using these samples, the model estimates a parking rate (parking spaces per residential unit for each bin. The team used the bin-level parking rate estimates to produce residential parking supply estimates for each parcel, displayed in Table 4. By applying parking rates from the cross-classification model to buildings with known residential units, the team estimates a total of 342,121 off-street residential parking spaces, shown in Table 5.

Table 3: Samples Collected by Bin

Year	Size	Low AMS	Med AMS	High AMS	**Total**
before 1955	1	12	54	19	**85**
	2 to 9	12	13	2	**27**
	10 to 19	8	10	3	**21**
	20+	22	6	1	**29**
after 1955	1	3	7	10	**20**
	2 to 10	9	18	10	**37**
	10 to 20	6	17	5	**28**
	20+	11	13	6	**30**
Total		**83**	**138**	**56**	**277**

Table 4: Parking Rate Estimate by Bin

Year	Size	Low AMS	Med AMS	High AMS	**Mean**
before 1955	1	1.33	1.54	1.63	**1.53**
	2 to 9	0.75	0.58	1.25	**0.70**
	10 to 19	0.16	0.31	0.36	**0.26**
	20+	0.17	0.46	0.94	**0.26**
after 1955	1	2.00	3.00	2.50	**2.60**
	2 to 9	1.33	1.07	1.28	**1.19**
	10 to 19	0.72	0.70	0.78	**0.72**
	20+	1.05	0.93	1.05	**1.00**
Mean		**0.77**	**1.16**	**1.49**	**1.11**

Table 5: Parking Supply by Bin

Year	Size	Low AMS	Med AMS	High AMS	**Total**
before 1955	1	3,111	70,747	58,667	**132,524**
	2 to 9	23,821	33,628	3,556	**61,006**
	10 to 19	2,703	2,871	121	**5,695**
	20+	8,345	3,962	3,592	**15,900**
after 1955	1	436	14,316	19,545	**34,297**

2 to 9	5,570	18,736	3,206	**27,512**
10 to 19	2,610	4,362	787	**7,759**
20+	45,443	8,941	3,043	**57,428**
Total	**92,039**	**157,564**	**92,519**	**342,121**

Figure 1 shows the total parking supply estimated in each Traffic Analysis Zone (zones ranging in size from blocks to block-groups). The team then derived neighborhood parking rates for each TAZ. The neighborhood parking rate accounts for parking in the zone as well as parking in nearby zones through a distance-weighting function. Parking rate estimates based on all building-types are shown in Figure 2. Because the TDM Ordinance will only apply to multi-unit buildings, neighborhood parking rates used in point calculations are estimated using multi-unit buildings, and these rates are shown in Figure 3.

Figure 1: Parking Supply by TAZ

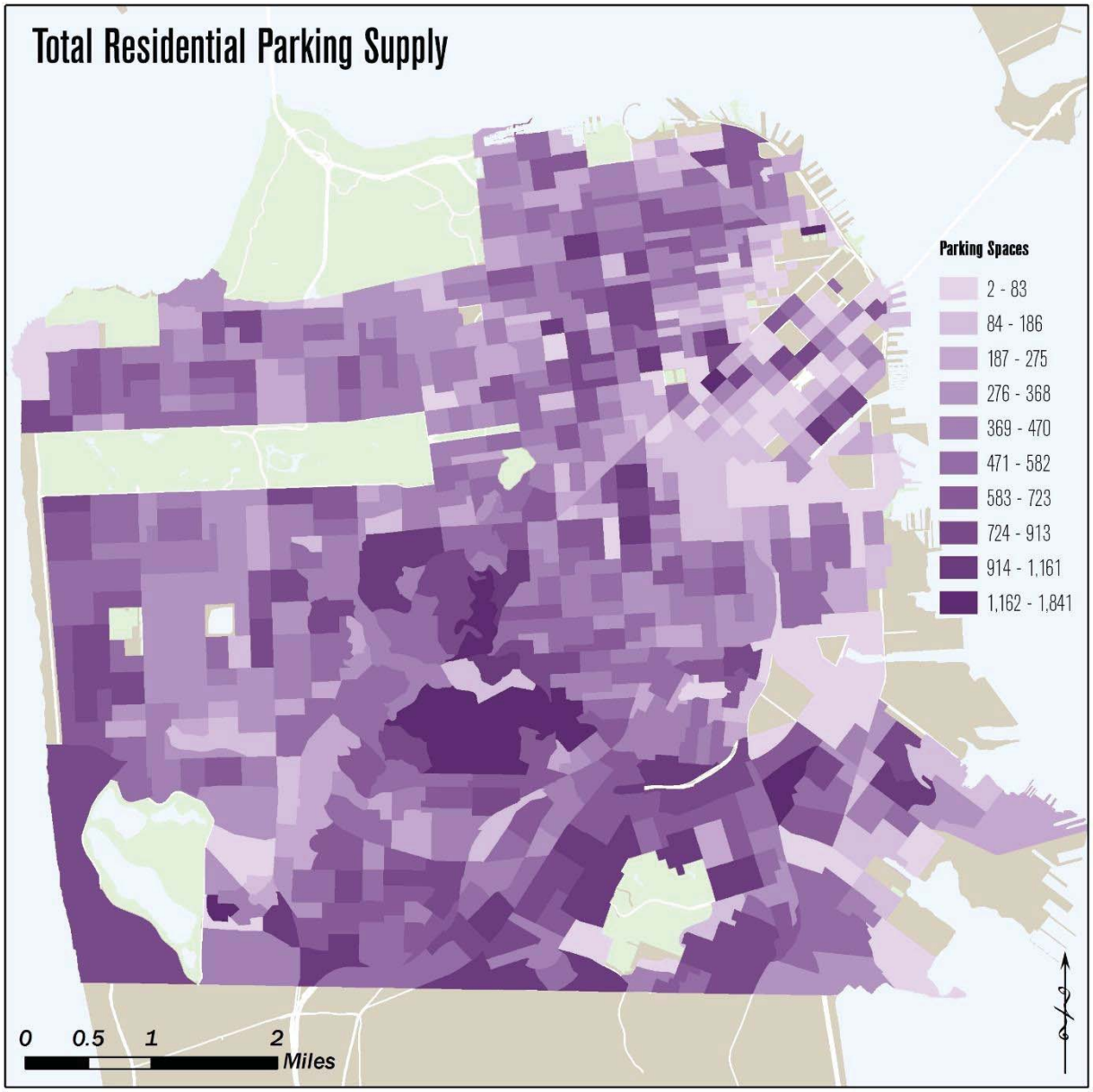
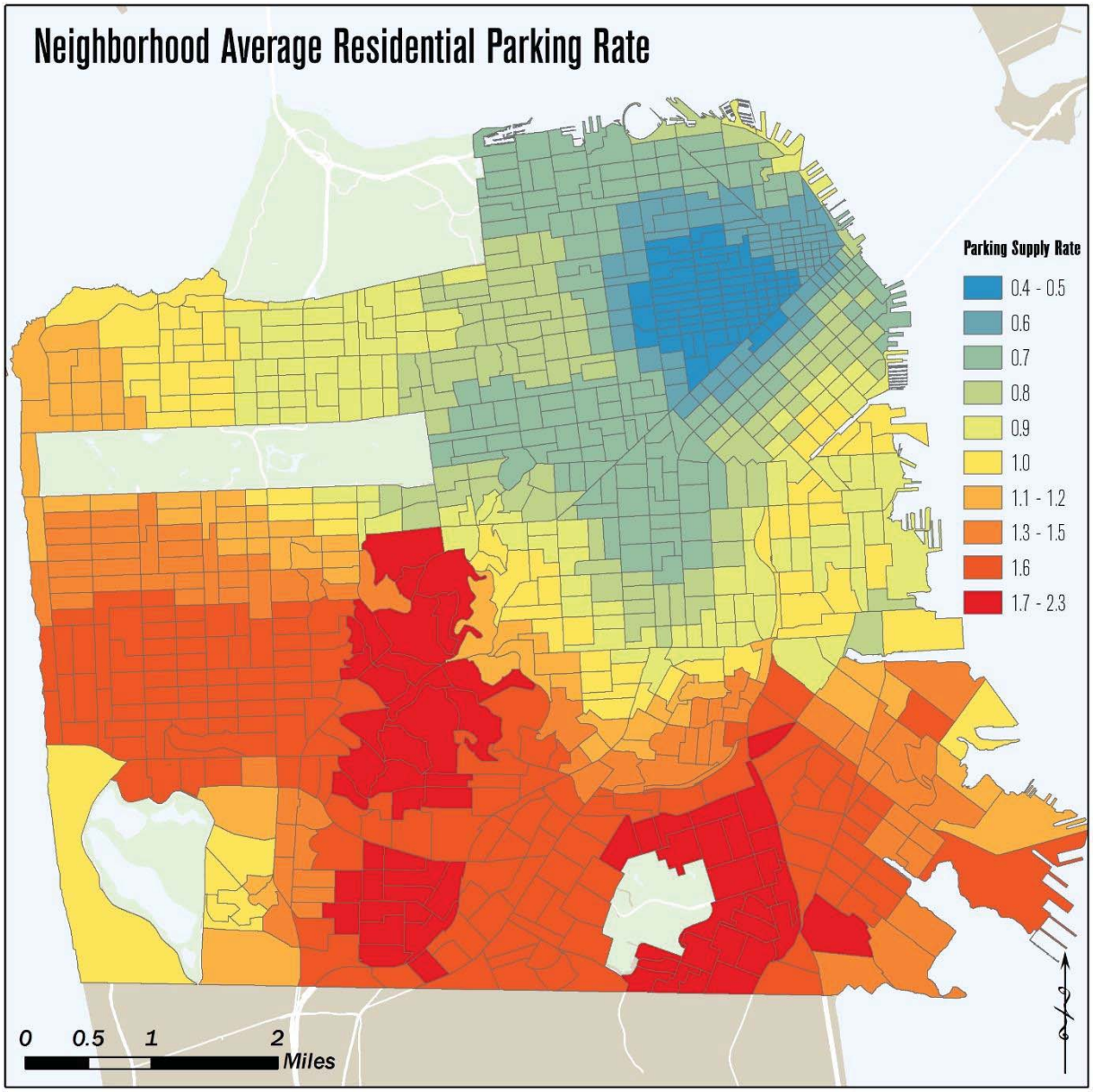


Figure 2: Parking Rate by TAZ



Parking Rate by TAZ Buildings with More Than One Residential Unit