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The San Francisco Transportation Demand Management Ordinance: A tool for promoting sustainable travel options

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Abstract

This paper examines the evolution and application of the San Francisco Transportation Demand Management (TDM) Ordinance, an act of municipal legislation that requires the creation of a TDM Programme in the buildings that developers intend to build or renovate in San Francisco. This Ordinance, adopted in 2017, details the transport requirements and responsibilities of developers in their commercial and residential buildings. Since 1979, the municipality has developed TDM measures for new projects; however, many developers or owners have chosen not to comply with these approval conditions. The Ordinance establishes the need to formulate a TDM Programme at the beginning of the application process, forcing each developer to choose a series of measures to develop a TDM Programme for its workers. Each Programme is expected to reduce the number of vehicle-kilometres travelled (VKT) generated by building projects. In principle, the municipality proposes to work with developers and owners to promote new travel options. With the adoption of the TDM Ordinance, the TDM Programme is applied to all kinds of buildings and changes in building use throughout San Francisco, except at certain state institutions and affordable housing projects. The application process and the delivery of legal rights must be taken into account. Whilst it is still too early to effectively evaluate the new TDM Programme, in the best of cases, the Ordinance can generate more sustainable transport options for tenants, employees, residents and visitors to a building, benefitting not only the neighbourhood, but also the city and its metropolitan region.

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1. Introduction

Currently, one of the biggest urban challenges faced by cities is to reduce the negative impacts of private vehicles. With an increase in the number of cars worldwide, not only has there been an increase in the level of urban congestion and harmful air emissions, but also a serious imbalance between transport and land use in cities. In recent decades, transport planners have become increasingly aware of the need to promote mobility strategies, especially in light of the decentralisation of activities away from urban centres. The negative impacts of increasing private vehicle use (e.g., rising levels of traffic congestion and fatalities, deteriorating air quality conditions, lack of physical activity) on cities and suburban areas are well documented, causing a great deal of concern amongst local residents (WHO 2011). As a result, many local governments have sought to curb private vehicle use, employing practical, low-cost solutions, such as Transportation Demand Management (TDM) measures.

Increasingly, local and regional governments have found that whilst it is necessary to build urban infrastructure for the movement of goods and services, it is also important to make efficient use of existing facilities when designing mobility programmes and promoting alternative modes to the private vehicle. This is especially true in low density communities where public transport is limited. In order to be effective, a suite of TDM measures must form part of a comprehensive TDM programme.

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This paper begins with a description of TDM and its evolution, and provides a brief overview of the city of San Francisco and its surrounding region. It explores transport policy in San Francisco and recent efforts to coordinate transport investment with local land use planning. These efforts to provide new travel alternatives to the auto have been implemented in a number of European and Asian cities, as well as in a small number of cities in Latin America and Africa.

Next, the paper reviews San Francisco's Transportation Sustainability Programme (TSP) and the role that TDM plays in promoting mode shift through the further improvement of TDM programmes, i.e., which increasingly have been developed to closely respond to the access needs of specific population groups. It presents not only the complex myriad of issues facing the city in the next twenty years, but also the tools employed in ensuring that buildings commit to a specific set of TDM strategies aimed at increasing the number of travel options available.

1.1. Transportation Demand Management

Transportation Demand Management (TDM) encompasses a set of low-cost tools and short-term strategies that encourage the use of sustainable transport options whilst improving the efficiency of the transport system and reducing transport agglomeration. TDM is a layer of information, programmes and policies that make sustainable transport options (e.g., transit, active transport modes) more attractive and easier to use (Tumlin 2012). TDM raises the knowledge and experience of residents, workers and visitors with various transport options and reinforces wider transport goals in the city and region.

Rather than accept the traditional "predict and provide" practices of increasing the supply of road space to meet private vehicle demand, TDM strategies advocate increased use of alternative options, such as public transport, bicycling or walking (Goodwin 1999). This demand-side focus responds to evidence showing that increases in road capacity often do not provide long-term solutions to traffic congestion, but rather, promote vehicle use, leading to increases in traffic levels and congestion (Noland and Lem 2000). Demand-side options normally require far less space and are more energy-efficient than vehicle-oriented, supply-side options. In addition, they are far cheaper to use, i.e., when gas, maintenance, insurance and other costs are taken into consideration.

In general, a TDM programme is "an institutional framework for implementing a set of TDM strategies" for a target population (Litman 2018). TDM programmes and strategies have focused on producing changes in travel behaviour, improving access to public transport and non-motorised modes, making it more difficult to travel alone in a private vehicle. These strategies are charged with decreasing vehicle occupancy, often placing restrictions and/or fees on private vehicle use. The principal types of TDM measures are education, promotion and outreach, and travel incentives and disincentives, which are complemented by sustainable travel options and supportive land use practices (Transport Canada 2012). Under this framework, vehicle restrictions and congestion pricing are the principle TDM measures, complemented by enhanced urban public transport.

In concept, a TDM programme normally:

- Provides easily accessible information on sustainable travel options through effective user interfaces;
- Encourages mode shift from the single-occupant vehicle trips to other modes;
- Improves the efficiency of the transport system by managing the demand for transport facilities and services;
- Affects and complements land use planning; and
- Uses market prices to eliminate the hidden costs of solo driving and the barriers to active and collective modes of transport (e.g., through parking management, vehicle circulation).

In practice, these TDM strategies have been developed to address all kinds of trips, such as those based on geographic location, trip purpose, route, mode and time-of-day. The development and implementation of these strategies normally entail a good deal of planning and negotiation with authorities and businesses. Often, they are closely linked to wider government policies and actions advocating low cost solutions to many of the urban mobility issues encountered by both large and medium-size cities.

A number of cities have implemented city ordinances requiring that certain employers develop and manage an ongoing TDM programme of commute benefits. The city of Cambridge in the United States established an Ordinance in 1998 and has done evaluation studies. In Cambridge, the Parking and TDM Ordinance (PTDM) requires that projects reduce the motorisation rate by 10 percent below the current rate. Each year, commercial projects present a TDM plan: those with more than 20 parking spaces must reserve 10 percent of these for high occupancy vehicles (HOV) and build the same number of bicycle spaces (City of Cambridge 2018).

With the implementation of the PTDM Ordinance, a change in the size of parking lots has been noticed, there has been less traffic generated by the regulated projects, the air quality has improved markedly and the city has experienced increases in the use Daily bicycle and public transport.

In the same way, the Zoning Ordinance of the City of South San Francisco addresses TDM measures for new non-residential buildings that estimate generate 100 trips per day. All developers subject to this zoning must implement TDM measures that demonstrate a reduction in the number of trips and a partition of alternative modes of 28 percent or more.

However, each city is different and therefore, in San Francisco the impacts are not the same as in Cambridge or South San Francisco. San Francisco is bigger and is a main employment center. In addition, emerging modes, such as "ride sourcing" (Uber, Lyft, etc.) and "shuttles" (small shuttle buses or vans), have come to dominate the market and need to be taken into account.

1.2. San Francisco

San Francisco is a city of approximately 880,000 inhabitants, located within the Bay Area, a metropolitan region of more than seven million (U.S. Bureau of the Census, 2018). The city has been the historical and cultural centre of the region, with important financial and governmental institutions. Despite the importance of San Jose and Silicon Valley—a global centre of high technology—San Francisco has maintained its position in the region as an important commercial and tourist hub, as well as a key location for federal and state government agencies (e.g., California Supreme Court), as well as emerging private companies, such as Salesforce, Uber and Twitter.

Due to its location on a peninsula, transport has historically played an important role in the development of the city. Like many other cities in the United States, San Francisco had a dense network of streetcars and trains up until the end of World War II, when the country experienced a significant exodus of residents to outlying suburban areas. However, unlike many other cities in the U.S., San Francisco retained a good part of its public transport system (see Figure 1), converting some tram lines to bus (Rivasplata and Albert 1998), but preserving many of its rail lines. Consequently, the city did not witness the full effect of the automobile boom experienced in other cities, including Los Angeles. By the 1960s, there was actually a revolt against the state's planned expansion of freeways in the city, resulting in the eventual rejection of a number of freeway projects.



Figure 1. Market Street, Principal Corridor of San Francisco

Source: SFMTA

Meanwhile, in order to conserve its transport network, the municipality encouraged the use of public transport through new municipal legislations such as "Transit First", approved in 1972. According to this legislation, the project sponsor has the obligation to design development projects that facilitate the use of public transport. In 1999, this policy was expanded to also include non-motorised modes of transport, such as cycling and walking, and became an important component of the Municipal Charter (City and County of San Francisco 2007).

On several occasions, the voters of the city have supported transport policies that favor sustainable modes. In 1989 and 2003, voters approved an increase in the local sales tax (value-added tax) to finance new sustainable transport programmes. In 2014, San Francisco voters subsequently approved two funding measures to encourage the use of public transit and build safer streets in the city's neighborhoods (SFCTA 2014). Whilst critics rightly point out the fact that sales tax measures do not effectively provide a nexus between payers of the sales tax and transport users directly benefitted by sales tax programme improvements (Wachs 2003; Taylor 2017), these sales tax measures have become popular amongst voters, providing the revenue necessary to improve public transport service and active transport facilities.

2. San Francisco Transport Policy

San Francisco is an attractive place to work, live and visit because it offers a great deal of variety and a good number of travel mode options. In turn, this high level of activity places some pressure on the existing transport network. It is projected that the city will grow substantially in the next 25 years: by 2040, up to 100,000 new homes are expected (as the city reaches one million inhabitants) and 190,000 new jobs in San Francisco. This growth may generate as many as 600,000 additional trips per day. Without improvements in related transport infrastructure, this growth could result in hundreds of thousands of new solo trips each day (SFCTA 2013). TDM clearly has an important role to play.

San Francisco faces challenges related to expected growth in a geographically isolated peninsula. As the city increases in density, transport and land use planners seek solutions to make the city work better for residents of the region, as well as for the future. Due to the costs of building a new automotive infrastructure, San Francisco seeks to do more with the existing system, whilst concentrating on important public projects, such as the Central Subway and the Van Ness Bus Rapid Transit (BRT) project. To be successful, it is necessary to have an ambitious TDM programme that can face the challenges of maintaining mobility and access.

The implementation of Transit First has supported the conservation of sustainable modes, however, its scope has been limited by an ongoing increase in transport demand, the proliferation of the auto in some areas and the commercial construction in outlying areas. Since 1979, the San Francisco Planning Department (SF Planning) has attempted to control development impacts, requiring that owners of buildings with more than 2,500 square metres of office space develop and manage a TDM plan for workers. This effort has included the ongoing regulation of buildings through periodic evaluations. Unfortunately, this regulatory effort has often lacked the necessary resources, and consequently, some buildings have avoided their TDM programme responsibilities.

In response to growing public concern, city government has more recently prioritised the need to follow-through in consistently enforcing all kinds of developer requirements, and has called for greater cooperation between the private sector and the public sector, as well as an environment of greater transparency and trust. San Francisco has also identified the urgent need for a new comprehensive approach to address transport challenges, particularly one that seeks to achieve greater mode shift.

The Sustainable Transportation Programme (TSP) attempts to improve and expand San Francisco's transport system, in order to accommodate new growth (see Figure 2). In developing the TSP, smart planning and investment are designed to ensure safety and comfort now and in the future (San Francisco Planning Commission 2017). The TSP is composed of the following components:

- **Invest** - improve transport to accommodate growth, where developers are required to pay a Transportation Sustainability Fee ("TSF") for new projects, i.e., to improve transport capacity and reliability, as well as infrastructure;
- **Align** - modernise the environmental review process, changing how the city analyses project impacts on transport, and its relationship with the California Environmental Quality Act (CEQA); and
- **Shift** - encourage sustainable travel, regulating the overall demand for transport network through mobility management, and ensuring that new projects facilitate the use of sustainable transport modes by residents, workers and visitors.



Figure 2. San Francisco Transportation Sustainability Program (TSP)

Source: SF Planning

One of the principal tools of the Shift component is the San Francisco TDM Plan, which is based on the 2014 Transport Demand Management Strategy (San Francisco Municipal Transportation Agency 2017). This document describes the policies, projects and programmes that San Francisco uses to guarantee access and mobility for all sectors of the population. This work involves the efforts of four key partner agencies: Municipal Transportation Agency (SFMTA), Transportation Authority (SFCTA), SF Planning and Department of the Environment (SF Environment).

In order to implement and regulate the new TDM building plans, the city created a legislative mechanism requiring developers to develop and implement a plan. In 2017, after months of research and consultation on the part of the SF Planning, the Board of Supervisors approved the new TDM Ordinance. The following section describes the Ordinance and its principal components.

3. TDM Ordinance

The primary goal of the TDM Ordinance is to establish a new transportation demand management programme for employers, residents and other transport users. It requires that each developer create a building-based TDM plan that features measures for reducing vehicle-kilometers travelled, or VKT (San Francisco Planning Department (2017). Planners of the city agencies involved in TDM (SF Planning, SFMTA and SFCTA) developed a menu of TDM measures for implementation. Each measure represents a certain number of points toward compliance, depending on its level of effectiveness in effecting mode shift (SF Planning 2017).

3.1. TDM Programme

The TDM programme is part of an initiative to improve and expand the transport system in order to accommodate local growth and ensure that the development sector contributes to minimising project impacts on the transport system. This includes helping pay for managing and improving the transport system (San Francisco Planning Commission 2017).

Each new project is assigned a goal (a specific score), based on the project's land use and its provision of on-site vehicular parking. Developers must choose a combination of measures (from a TDM Menu of eight themes) that collectively achieve the point total. That is to say, the sum of the points from each measure must counterbalance the total goal points established by the city. With more than 25 measures in total, this menu offers options for the developer to comfortably reach its corresponding goal total. The TDM Menu measures are designed to reduce the number of single occupant vehicle trips and the VKT (San Francisco Planning Commission 2017). It includes some of the same measures previously identified by the city. At the bottom of the diagram (Figure 3) the point values of these measures are listed, such as the installation of wayfinding signage (one point), or reduction in parking supply (10 points).

The implementation of the TDM Plan of the project is the responsibility of the developer and the eventual owner of the new building. However, he/she has the option of becoming a member of the Transportation Management Association (TMA), a building association that collectively (and with the annual fees paid by its members) offers professional help to its members to comply with their TDM Plans. Each measure of the TDM Menu is assigned a point value based on the relative effectiveness of each measure with respect to other measures in terms of VKT reduction. The scoring system approved by the four agencies of the city is based on a review of the available literature, the collection of local data, the research of best practices and the professional opinions of transport experts. A maximum number of points is also provided for certain categories in the TDM menu (San Francisco Planning Commission 2017).

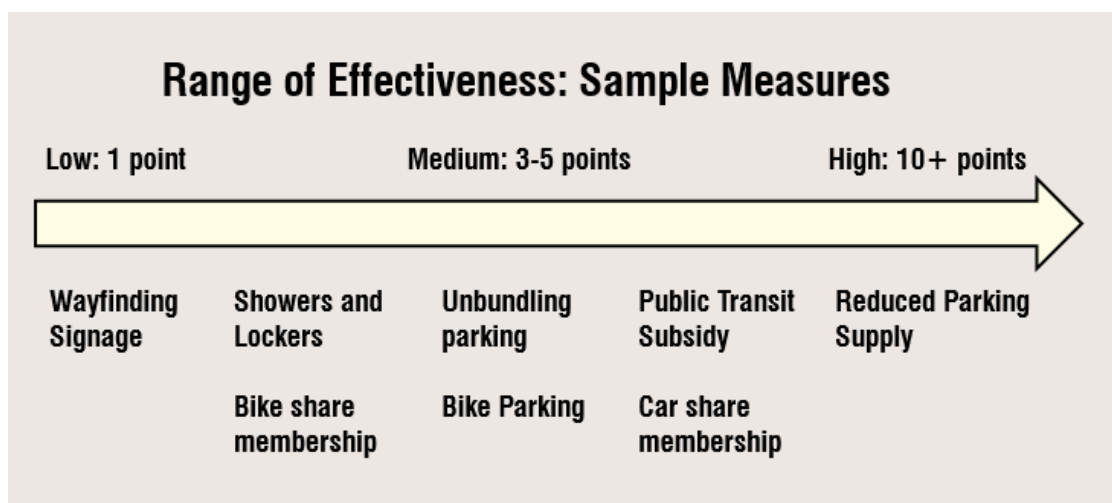


Figure 3. Scale of TDM Measurement Values
Source: SFMTA

Some TDM measures, such as bicycle lockers, showers and parking fees, were already included in the San Francisco Planning Code, however, many of these were voluntary measures, or tied to a specific mitigation action. Now, new projects are required to incorporate TDM measures in order to be approved by SF Planning. This requires that the developer study and consider a range of different options. For example, if a project is assigned a goal of 20 points, is it sensible to provide 50 parking spaces, or is it better to sharply decrease the number of parking spaces provided so that goal is overall project lowered? Each developer must carefully measure the costs and benefits of these options at the beginning of the application process and consider formulating a TDM programme strategy.

The cities of Boulder, Cambridge and Los Angeles also have TDM ordinances, but their policies have been applied mainly to commercial and office projects (City of Los Angeles 1993). Instead, with the support of the San Francisco Planning Code, the Ordinance applies to all new buildings of a certain size (more than nine units in residential buildings or more than 930 square meters in commercial or institutional buildings). In addition, the San Francisco TDM Ordinance requires that developers commit to supporting and encouraging the use of public transport amongst the occupants of their building.

3.2. Objectives and benefits of the Ordinance

Like all of the municipal ordinances currently in operation in San Francisco, this TDM Ordinance represents a legal norm. That is to say, all parties subject to these standards are obliged to follow the *legal requirements*, without distinction. Noncompliance with the norms of the TDM Ordinance can result in monetary penalties, as well as the inability to secure subsequent building permits to undertake building alterations or additions. With these guarantees, the Ordinance is more effectively capable of ultimately achieving some of the objectives listed below.

3.2.1. Objective: maintain mobility

The objective of the TSP is to maintain a standard level of mobility whilst the city continues to grow. The Shift component of the Programme was developed around the desire to minimise the impact of new construction on the urban transport system. The primary tool of Shift is the TDM Ordinance, since it is designed to achieve its principal objective: to improve personal mobility, focusing on a reduction in the number of single-occupant vehicle trips and a corresponding reduction in the total number of vehicle-kilometres travelled.

Due to its geographic and spatial constraints as a densely populated city at the head of a peninsula, San Francisco cannot accommodate a substantial increase in the number of vehicles on its streets and highways. To this end, the TDM Ordinance is designed to reduce growth impacts on the transport system by reducing the number of vehicle kilometres travelled for new residents, employees and visitors. A reduction in the VKT can be achieved through a substantial change in mode share; or an increase in the average occupancy rates of vehicles (more shared trips).

3.2.2. Secondary benefit: better environmental results.

Both a reduction in the percentage of single-occupant vehicle trips and a reduction in the VKT generated by the construction of a new project can improve or at least stabilise environmental conditions. The single-occupant vehicle is the least efficient mode of transport, given the number of seats that are left empty and the sheer amount of space that it occupies on the road. In addition, most vehicles still emit pollutants into the air.

Despite technological advances, the transport sector still contributes to environmental deterioration. For example, the transport sector accounts for 36 percent of greenhouse gas emissions in California, 37 percent of emissions in the San Francisco region and 40 percent of emissions in the city of San Francisco (San Francisco Planning Department 2017). The transport sector also emits other pollutants: it accounts for 83 percent of nitrogen oxide emissions in California, a precursor to ozone, a major environmental criterion at the state level (California Air Resources Board 2012).

3.2.3. Secondary benefit: better public health and safety

By reducing both the percentage of trips in single-occupant vehicles and the VKT--two figures commonly generated by the construction of a new project--it is feasible to improve the state of public health and safety. Public health is improved when trips are made on active transport modes, that is, trips made by people who walk and ride bicycles, since they do not emit pollutants. The TDM Ordinance includes several measures that developers can find out about and choose from when developing a TDM programme. Clearly, reducing the VKT improves security.

3.2.4. Secondary benefit - better process of review of development and projects

The TDM Ordinance also provides more certainty and flexibility to new developments, providing project sponsors with a clear path toward compliance (see Figure 4). When the process begins, each developer determines the amount of parking that is to be provided and thus, determines the goal of his/her TDM plan before submitting an application. The legislation also provides development sponsors flexibility in the development of a TDM plan that best suits the project and area needs of a new project.

The transport options offered by the new projects required to develop a TDM plan clearly work in favour of the occupants (owners and tenants) of the building, representing important benefits. For example, real estate ads have increasingly promoted the public transport access that a project can offer, along with the bicycle facilities provided on site. TDM measures that are incorporated into the design of a project provide operational services that are considered benefits because they improve comfort and create travel options. The earlier that these measures are incorporated into the design of the building, the easier it is to make improvements.

In addition, in the environmental review analysis undertaken for a project, development impacts on air quality, greenhouse gases and CEQA analyses are taken into account. The City's wider effort to implement TDM as a way to reduce the VKT is also consistent with the recent changes to CEQA, according to California Senate Bill (SB) 743 (State of California. OPR 2016).



Figure 4. Steps for Complying with TDM Programme Requirements
Source: SF Planning

3.3 Regulation and Evaluation

As the principal municipal agency regulating land use decisions in the City and County of San Francisco, SF Planning is the lead agency overseeing the regulation of buildings with TDM requirements and has the same authority to enforce these as they do any other Planning Code requirement. However, unlike most requirements in the San Francisco Planning Code, this program will include proactive monitoring.

For physical measures, such as bicycle facilities, appropriate signage, and the supply of car share spaces, monitoring will be determined by inspection both prior to occupancy, and on an ongoing basis. For programmatic measures such as transit passes, carshare memberships and marketing, monitoring will be determined through ongoing reporting. The City will work with non-compliant projects to bring them into compliance, and those that do not come into compliance would face monetary penalties.

SF Planning has committed resources to monitor and evaluate the efficacy of the TDM Plans that projects put in place. This will allow the city to study individual measures at the project and city levels over time. If certain measures are found to be less effective than desired, or not appropriate for certain land uses or locations, the TDM Programme may be amended. SF Planning will also track new research that looks at effectiveness of TDM measures not currently included in the program.

4. Impacts

Whilst a significant proportion of TDM strategies have somewhat modest impacts, only impacting a small percentage of total trips, programme impacts are cumulative and synergistic in nature. A comprehensive TDM programme often impacts a significant portion of travel, resulting in substantial benefits. For this reason, it is important to carefully evaluate entire TDM programmes rather than individual components.

The Ordinance effectively converts new buildings into transport demand laboratories. After approving the TDM Programme Plan for a building, officials regulate these documents, surveying residents and building workers to see travel patterns in different

ways. In addition to revealing how travel patterns in regulated buildings compare with patterns in unregulated buildings, the data also help establish sustainability objectives and serve as important benchmarks for later studies.

However, since this ordinance was only adopted in 2017 and its implementation began at the end of that year, a full evaluation of its impacts has yet to be undertaken and the overall effectiveness of the Ordinance is still uncertain. The corresponding 2017 legislation requires a series of evaluations starting in the second year of operation. In two or three years, there will be sufficient data to perform this analysis.

Cities including Boulder, Cambridge, and Santa Monica have established TDM ordinances as a means of forcing developers to comply with TDM programme standards. However, the policies of these cities have almost exclusively applied to either commercial developments or office space (Citilab 2017). In contrast, the San Francisco TDM Ordinance applies to all new buildings of a specific size. As a result, it applies to a much larger area of the city and more effectively ensures that transit and active transport modes are not an afterthought, but rather, are immediately given priority and are appropriately incorporated into the design of the project.

5. Conclusion

This paper has explored the recent development of TDM measures that propose to distribute mobility benefits to a wider target population. Whilst the San Francisco TDM Ordinance promises to change residents' patterns and disseminate important information about the network of travel options for residents and workers, the new TDM programme requirements have only been in operation for 18 months and it is too soon to determine their full impact. Only time will determine to what degree benefits will outweigh costs. Over time, we may be able to determine, for example, that there is a high influx of passengers in high density neighbourhoods, or that a specific bicycle programme has generated a reduction of X percent in the VKT, compared to the percentage in other neighbourhoods. Only the expected increase in construction will give us an idea of the level of pressure it exerts on networks and infrastructure. In addition, it will provide us with a profile of the type of passenger, cyclist and pedestrian using the system.

For a number of years, the detailed estimation of development impacts has become increasingly commonplace. San Francisco is interested in acquiring reliable data on programmes and their impacts from the TDM Ordinance, providing an example and case study for the rest of the world. In San Francisco, we can move from assumptions about the mobility of residents and workers - exemplified by the old parking requirements - to the objectives supported by the research, in accordance with the trends of "smart cities" (and also with the urban culture infused by Bay Area technology). Are there valuable lessons that other major cities in the Bay Area (e.g., San Jose) and the country can learn from San Francisco?

Finally, other world cities can surely learn from and make use of some of San Francisco's TDM programme components and results to do their own planning and future programme development. However, it should be noted that each city has a unique set of urban characteristics related to such factors as local land use patterns, political orientation, existing transport patterns and mode split. For this reason, TDM programmes and ordinances must be developed on a case-by-case basis. Whilst vital, the mere adoption of a programme does not, in itself, guarantee widespread success. First, it is essential that programme planners seek input from city, state and federal agencies, transport experts and the general public. This process will help planners as they explore the various alternatives for implementing TDM programmes within an established set of constraints and responding to a unique set of local needs and resources.

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