



Twin Cities

Shared Mobility Collaborative

More Access and Less Traffic: Transportation Demand Management Recommendations for Minnesota Municipalities and Employers

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1 Executive Summary: TDM is a Powerful Tool for Advancing Public and Private Goals

Most Minnesota cities have an interest in attracting more people to visit, work, and live, all of which would contribute to their local economy. Many Minnesota cities also experience problems from vehicle traffic: congestion, pollution, and associated costs.

How can localities in Minnesota welcome people while limiting the impacts of vehicle traffic?

One answer is transportation demand management (TDM). Car traffic brings cost and benefits; therefore, cities and employers may want to *manage* traffic in the most cost-effective way.

The goal of this research is to support Minnesota localities as they work to:

- Support travel by people as they move around to get to their places of employment, education, accessing other services, and to see their families.
- Support travel by people as they fully participate in the life of their communities.
- Balance the benefits of vehicle traffic with its costs.

People across the country have benefitted from thoughtful TDM strategies. TDM can benefit:

- Individuals by expanding transportation options, saving money, and improving health and well-being.
- Employers by reducing overhead costs, reducing costs for office space, and lower parking needs; and by improving employee recruitment and retention.
- Cities by reducing congestion, improving land use, improving air quality, reducing carbon emissions, and improving the quality of life of the whole community.

This paper:

- Describes municipal-based and employer-based TDM best practices that reduce traffic and reduce emissions.
- Recommends best practices for municipalities and employers in Minnesota.

1.1 How do cities and employers successfully manage transportation demand?

Cities manage traffic in at least two ways: by managing traffic to its own destinations and by setting rules for how other employers generate and serve transportation needs. Cities are rule-setters as well as employers that might be subject to the rules they set. Throughout this paper, we do our best to distinguish between the role of rule-setter and the role of employer.

Cities can manage the need for transportation as well as traffic management in many ways. This paper focuses on TDM strategies including parking management, commuter benefits, commute-trip-reduction programs, and TDM plans for developments. Cities can require employers to implement TDM programs and implement these TDM programs as employers themselves.

The paper concludes with a set of recommendations for Minnesota municipalities and employers. These recommendations would either require or benefit from additional state and regional leadership, funding, and support. Some of the successful examples from outside of Minnesota required significant state and regional support as well as state-level regulation to achieve success in their TDM programs.

1.2 Best Practices in Municipal-Based TDM

We identified seven approaches that help cities succeed in TDM.

1. **Establish clear TDM goals**—Successful localities identify clear goals for their ordinances. Overall, the primary goals of the ordinances are to reduce SOV trips, reduce traffic congestion, and improve air quality. Some ordinances also include other related goals, but localities do not specify targets or directly measure whether these related goals are met.
2. **Specify applicability**—The majority of the ordinances apply to employers or developers based on certain size thresholds or on the type of development within specific geographic boundaries. While the commuter benefit ordinances apply to employers with 20 to 50 or more employees, the commute-trip-reduction ordinances apply to larger employers, typically with 100 or more employees. On the other hand, ordinances required of developers apply to nonresidential projects and, in some cases, residential projects within a specific floor area threshold or number of parking spaces.
3. **Identify TDM targets**—Most of the reviewed ordinances establish TDM targets set by the local or regional authority. In some cases, employers or developers can set their own goals with approval from the local authority. Most of the targets set by the local authorities are measurable, apply to a specific area or subject, and are expected to be achieved within a specific timeline. While some ordinances set short-term goals to be achieved within a period of one or three years, others establish long-term goals to be achieved within five or more years and regularly monitor progress and revise those goals as needed.
4. **Measure and report TDM goal achievement**—The majority of localities measure the extent to which set targets are achieved. Localities, additionally, use these measures to quantify program effectiveness. Overall, all the reviewed ordinances have had success in achieving their goals.
5. **Establish regular monitoring and reporting requirements**—All the ordinances require affected employers and developers to regularly monitor and report program progress. Ordinances that clearly identify measurable targets typically require affected employers and developers to conduct surveys of commute behavior and report program progress mostly on an annual basis. In addition, the reviewed ordinances often require maintaining records of program implementation with a few localities reserving the right to visit sites. To ensure compliance with the ordinances, all localities impose civil or administrative penalties or both in case of violations.
6. **Require program outreach and promotion**—Most of the reviewed ordinances specifically require affected employers, developers, and building managers to promote program elements regularly; at least once a year, when new employees are hired, and when buildings change ownership or management. Similarly, local authorities, particularly those that measure TDM goal achievement through program compliance, carry out promotional efforts.
7. **Specify program requirements**—The reviewed ordinances specify program requirements, some of which are common across most of the ordinances. Three program requirements may have contributed to the success of the ordinances.
 - a. First, requiring the appointment of a program coordinator who is responsible for program development, implementation and promotion, and monitoring.
 - b. Second, requiring affected employers and developers to develop and submit a TDM plan that outlines program-implementation plans and TDM targets.
 - c. Third, requiring affected employers and developers to implement specific TDM measures that contribute to achieving the programs' overall goals. Usually, the local authority provides a list of recommended TDM options for employers, developers, and building

managers to implement based on their needs and circumstances. However, employers, developers, and building managers can implement alternative measures with the localities' approval. In some cases, however, the ordinance specifies a minimum number of strategies to be adopted.

All reviewed ordinances are mandatory except for one, in which the participation is voluntary. The mandatory nature of the ordinances may have contributed to their success in some localities. However, despite the voluntary nature of the ordinance in one locality, it was effective due to an incentive that rewards developers that implement TDM measures to mitigate the transportation impacts of the development. In addition, state funding has enabled the implementation of TDM programs in the City of Seattle, and the counties of Spokane and Arlington.

In addition to the above factors, other factors that may have contributed to their success include state-level regulatory frameworks, collaboration with local authorities, public and private transportation agencies, employers, developers, and building managers. Some municipalities also have established TMAs as an extension of the ongoing TDM efforts to administer, oversee, support, and enforce TDM requirements, and, overall, to fulfill their TDM goals. Municipalities also may participate in collaborative networks with employers, developers, and other relevant stakeholders with employers or property owners funding the programs through special assessments. In some of the reviewed cases, much of their success can also be attributed to the regional funding that allows TMAs to support municipal enforcement. This is why regional and state funding and leadership is an important part of ensuring municipalities are properly resourced to carry out these best practices and achieve their goals.

1.3 Best Practices in Employer-Based TDM

Employers that reach their TDM goals do so through a combination of incentives and disincentives as their main strategy. Employers typically charge a daily parking fee and offer a daily cash incentive to employees. These allow employees to internalize costs and make transportation decisions on a daily basis.

This main strategy is usually complemented by offering a flexible range of programs to make other commute options available and more attractive for employees. Example programs include transit pass benefits, a guaranteed ride home option, carpool- and vanpool-matching services, and options like shuttles and bikes (with related amenities such as secure storage, lockers, and showers). Providing a variety of commute options has been critical to supporting employees' ability to choose and the overall success of TDM programs.

In addition to implementing these TDM actions, there are other key factors that support the TDM efforts of these employers. These include: *(i)* knowing how employees commute to work and their transportation needs; *(ii)* getting support from leadership to deliver the message to employees and get financial support to invest in TDM activities; *(iii)* educating and communicating with employees on a regular basis; *(iv)* defining TDM targets and monitoring goal achievement (in most cases, organizations rely on technology to ease the administrative process of TDM programs); *(v)* collaborating with public and private agencies to improve and expand the transportation options available to employees.

Overall, employers adopt TDM actions to benefit their business. It is also the case that regulatory requirements are important in giving an initial push to employers to adopt these TDM actions, creating minimum standards for employers to report and monitor TDM goal achievement, and ensuring a continuous enforcement. In addition, regulatory requirements may help transform the corporate culture.

Some employers, for instance, continue their TDM programs after relocating or offer them in other sites in which TDM is not required.

1.4 Recommendations

This research provides a set of recommendations for Minnesota municipalities and employers. Any new municipal-level implementation would greatly benefit from additional state and regional leadership, funding, and support to sufficiently resource this work.

1.4.1 Recommendations for Minnesota municipalities

A number of municipalities in Minnesota have implemented TDM ordinances through the land-use review process. Interviews with relevant stakeholders found that these ordinances have had marginal impacts. Based on the reviewed municipal-based practices, the researchers make the following recommendations for Minnesota municipalities.

1. ***Set municipal-level TDM goals and targets***—Municipalities should establish TDM goals and targets based on their needs and circumstances. TDM targets should be measurable and specify a timeline and applicability.
2. ***Create or enhance ordinances applicable to employers***—Given that commute trips have significant impacts on traffic congestion, municipalities should establish new ordinances or enhance their existing ordinances that require or incentivize employers to offer commuter benefits or implement other commute-reduction measures.
3. ***Monitor and report TDM goal achievement on a regular basis***—Municipalities should monitor and regularly report progress on the achievement of municipal-level TDM goals as well as progress made by affected employers, developers, or building managers.
4. ***Establish or improve enforcement mechanisms***—Municipalities should establish strong enforcement mechanisms, such as requiring employers, developers, and building managers to maintain records of TDM program implementation, making TDM a requirement for the life of a building regardless of ownership, imposing civil or administrative penalties or both in cases of violations, and conducting on-site inspections and audits.
5. ***Strengthen TDM education, outreach, and program promotion***—Outreach, education, and program promotion should include municipal efforts to increase program visibility and compliance as well as efforts to encourage the use of alternative transportation options.
6. ***Collaborate with public and private agencies to offer assistance programs to building managers, developers, and employers***—Municipalities should consider offering programming and support services to building managers, developers, and employers on a site-by-site basis and support the implementation of TDM measures tailored to their needs.
7. ***Encourage creation of collaborative networks***—Municipalities in metro areas with congested downtowns should explore partnership with transit authorities and downtown employers to discourage SOV trips.

1.4.2 Recommendations for Minnesota employers

Based on the reviewed employer-based practices, the researchers make the following recommendations for employers to implement or improve their existing TDM programs.

1. ***Understand employee commuting behaviors and needs***—Employers should conduct a baseline commute mode survey to identify commuting preferences, identify transportation opportunities and deficiencies, and assess willingness to adopt alternative commute modes to develop effective TDM programs.
2. ***Define TDM targets and regularly monitor goal achievement***—Employers should establish measurable TDM targets, specify a timeline to achieve their targets, and regularly monitor progress.
3. ***Offer a combination of incentives, disincentives, and flexible commute alternatives***—Employers should implement TDM actions that better serve the needs of its employees. In addition, employers should consider charging a daily parking fee and offer appropriate incentives and flexible programs to make alternative commute options available and more attractive for employees.
4. ***Collaborate with public and private agencies***—Employers should collaborate with public transit agencies, TMAs, and other private companies to improve and expand the transportation options available to employees. In the Twin Cities area, employers can collaborate with the Metropolitan Council and local TMOs to improve access to a variety of supporting and programming services as well as to a sharing network with experience in TDM programs.
5. ***Take advantage of technology***—Employers should take advantage of technology to support the integration of TDM strategies with their current systems to ease program administration and tracking progress.

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2 Introduction

People throughout Minnesota face fundamental challenges in reaching employment, education, and services that they need to lead full lives (Van Dort, Guthrie, Fan, & Bass, 2019). At the same time, the current transportation options lead to increasing congestion and air pollution. Therefore, there is a need for more sustainable and accessible transportation options to expand mode choice, reduce traffic congestion, and improve air quality.

Regional and local governments have responded to these challenges through policy.

- In 2010, the region’s 2030 transportation policy plan (2030 TPP) was developed to advance a transportation system investment policy that aims to manage congestion through strong TDM initiatives such as increasing the use of alternative transportation modes and flexible work arrangements.
- A shared mobility action plan was created in 2017 to help improve mobility in the Twin Cities region. The plan outlined the goal to reduce private car trips and increase the use of other modes. It recommended to take 50,000 (8 to 10 percent) personal vehicles off the road in Minneapolis and Saint Paul within 10 years.
- Several cities have developed policies that call for the reduction of SOV trips and support the expansion of commuter options (City of St. Paul, 2020; City of Minneapolis, 2020).
- The Metropolitan Council and some cities carry out TDM efforts in the Twin Cities region.
 - The Metropolitan Council implements a range of TDM strategies through its Metro Transit subdivision, including promotion of transit use, operating the regional ride-share program, employer assistance with telework programs, administration of the regional guaranteed ride home programs, and leading transit-oriented development efforts.
 - The cities of Minneapolis, Saint Paul, Bloomington, and Eden Prairie have implemented TDM ordinances through the land-use review process, but these have had marginal impacts. In Minneapolis, there are no enforcement mechanisms, and, in Eden Prairie, staff may not be fully aware of the scope of the TDM program. In addition, in Eden Prairie owners are not fully transferring TDM requirements to new owners. In Saint Paul, developers often opt for cheaper, rather than effective measures (Thompson, 2020; Schulze, 2020).¹

Other localities across the country have implemented policies that have been successful in reducing SOV trips, reducing traffic congestion, and improving air quality. This paper identifies regulatory and employer-based approaches that have been successful in other municipalities, and it recommends best practices for Minnesota municipalities, employers, and others.

TDM is particularly important given the increase in new work arrangements and subsequent changes in commuting patterns due to COVID-19, which present an opportunity to municipalities and employers to implement policies that give people more mode choices. Reviewed cases were selected based on suggestions from the Technical Advisory Panel as well as identified best practices based on a literature review. Data sources include municipal ordinances or city codes, guidelines/handbooks, websites, and

¹ As of June 2020, Saint Paul is in the process of a new TDM ordinance that would incentivize developers to implement more effective strategies and infrastructure investments by utilizing a points system.

program annual reports. In addition, informational interviews and email conversations with relevant stakeholders supplemented the employer approaches section of this research.

The next section of this paper presents a literature review of TDM programs, including common practices and approaches, TDM benefits, and factors that affect individual commute decisions. Section 4 explains the research methodology. Section 5 provides an overview of best municipal- and employer-based TDM practices from across the country. Finally, section 6 provides recommendations for municipalities and employers, particularly in Minnesota.

3 Literature Review

3.1 Transportation Demand Management (TDM)

Transportation demand management focuses on managing vehicle travel demand to reduce congestion, VMT, and air pollution. In addition, TDM can shift trips from peak periods or reduce the need to travel through measures such as flexible working schedules and teleworking (Smart Growth America, 2013).

TDM activities can be categorized into actions and strategies. Actions affect commuters directly and are usually implemented by employers, while strategies refer to government policies or programs that encourage or require intermediaries to carry out TDM actions (Flynn & Glazer, 1989). Examples of TDM actions include ride-share matching programs, guaranteed ride home programs, preferential parking for carpools or vanpools, on-site transit information, and commuter benefits (National Academies of Sciences, Engineering, and Medicine, 2010; Smart Growth America, 2013). TDM strategies vary widely across the United States, ranging from encouraging voluntary participation to employing strict requirements on developers and employers (Bricka, Moran, Miller, & Hudson, 2015).

TDM activities vary based on how they affect travel. The Victoria Transport Policy Institute compiled a comprehensive encyclopedia, where TDM strategies are organized in categories based on their travel impact.² Using this source as well as TCRP Report 95 on employer-based TDM strategies, we summarize some of the common TDM efforts into seven categories. These are presented below from employer- to government-based efforts:³

- Outreach and education: Including trip reduction, outreach and education, wayfinding, and safe routes to school.
- Alternative work arrangements: Such as flexible work hours, compressed work week, staggered shifts, telework or telecommuting.
- Parking management: Such as preferential parking, maximum or minimum requirements, parking pricing, parking cash-out, and shared parking.
- Financial incentives and disincentives: Including transit and vanpool subsidies, in-kind subsidies,⁴ congestion pricing, distance-based pricing, and fuel tax.
- Provision of public transportation services: Such as bus rapid transit (BRT), regular bus services, shuttle services, guaranteed ride home, light rail transit (LRT), commuter rail, and shared mobility services.
- Improving public transportation: Including pedestrian and cycling improvements, transit improvements, and taxi service improvements.

² The Victoria Transport Policy Institute maintains an online TDM encyclopedia (authored by Todd Litman), which is updated on a regular basis.

³ This is not an exhaustive list.

⁴ Offering free or discounted products or services in lieu of cash. This includes, for instance, free transit passes for transit riders or bike accessories for bikers.

- Land-use management: Examples include car-free planning, transit-oriented development, connectivity, smart growth, and new urbanism.⁵

3.2 TDM Strategies: Approaches and Common Practices

Increasing environmental concerns, urban sprawl, high population growth rates, and changes in technology have led many U.S. localities to adopt TDM strategies. These strategies vary from encouraging participation in voluntary TDM programs and transportation management associations (TMAs), to employing strict requirements on developers and employers through ordinances, development codes, or environmental standards (Flynn & Glazer, 1989; Bricka, Moran, Miller, & Hudson, 2015). Although the implementation of TDM strategies vary widely across localities, they aim to reduce traffic congestion, reduce parking demand, and improve air quality and public health (RideAmigos, 2019).

TMAs are one type of TDM strategies. These are associations of public and private entities working together to address traffic congestion and transportation issues in a specific geographic area—typically commercial and industrial areas where parking and traffic costs are high (National Academies of Sciences, Engineering, and Medicine, 2010; Smart Growth America, 2013). TMAs generally provide programs and services to encourage and support the use of more sustainable commute modes. Common strategies implemented by TMAs include commute trip reduction, commuter financial incentives, alternative work arrangements, parking management, and outreach and assistance programs. While TMAs have been found to benefit all localities, they seem to be better-suited for areas with a history of business community involvement in local governance or with an orientation toward negotiation and consensus building (Sanford & Ferguson, 1991). TMAs allow small employers to provide transportation services that are comparable to those offered by large employers (Litman, Online TDM Encyclopedia, 2003; Smart Growth America, 2013). TMAs can lead to significant cost savings by increasing transportation options, reducing congestion and parking demand, improving air quality, and leading to more efficient land-use patterns (Litman, Online TDM Encyclopedia, 2003). In addition, TMAs are more effective than individual efforts as they integrate and coordinate TDM strategies across multiple employers, which leads to cost efficiencies for all participants and more efficient use of the transportation system (Smart Growth America, 2013).

Localities have also adopted TDM ordinances, which ensure that policies are consistently enforced. These ordinances typically apply to employers or developers with certain characteristics. Research in this area has found that localities face several challenges when implementing these ordinances, including ordinance requirements such as whether to require the implementation of specific TDM actions or to require meeting specific performance measures (Flynn & Glazer, 1989), and performance monitoring and evaluation (Sanford & Ferguson, 1991). Research indicates that localities are moving toward a reliance on verifiable performance requirements, and require annual reports, surveys, and the designation of transportation coordinators at the employment or development site (Flynn & Glazer, 1989). TDM ordinances discussed in this paper are parking-management ordinances, commuter benefit ordinances, commute-trip-reduction programs, and TDM plans for developments.

⁵ Connectivity refers to creating connected roadway and path networks. Smart growth refers to land-use practices to create more accessible, efficient, and livable communities. Lastly, new urbanism refers to accessible and livable community design.

Parking-management ordinances—These refer to strategies that encourage more efficient use of existing parking facilities, reduce parking demand, and shift travel demand from SOV modes (Litman, 2016; Seattle Urban Mobility Plan, 2008). Example strategies include minimum or maximum parking requirements, on-site residential and commercial parking management, peripheral parking, parking pricing, and park-and-ride (National Academies of Sciences, Engineering, and Medicine, 2004). These strategies not only affect travel behavior—they also have the potential to reduce facility costs, generate revenue, and reduce land consumption (Litman, 2016).

Parking management has a direct and significant impact on vehicle travel demand (Smart Growth America, 2013; National Academies of Sciences, Engineering, and Medicine, 2010). The availability of free or inexpensive parking is a key factor contributing to SOV travel mode as there is less incentive for commuters to use other modes of transportation instead of driving (Smart Growth America, 2013; Seattle Urban Mobility Plan, 2008; Shoup D. C., 2005). Parking pricing and strategies that limit parking availability are particularly effective in reducing parking demand and shifting travel to other modes (Smart Growth America, 2013; National Academies of Sciences, Engineering, and Medicine, 2004; Seattle Urban Mobility Plan, 2008). Effective pricing strategies include shifting from monthly to daily rates, setting variable parking rates that fluctuate with demand, unbundling parking costs from rent, and offering employer-based parking cash-out. These strategies reduce the use (and ownership) of personal vehicles and encourage the use of alternative modes such as transit, buses, walking, and carpooling (Seattle Urban Mobility Plan, 2008; Lutenecker, 2017).

While individual strategies have only modest impacts on travel demand, comprehensive parking management programs that use a combination of strategies can have a larger impact. For instance, implementing supply restrictions coupled with pricing and preferential space allocation measures can have major impacts on parking and travel demand (National Academies of Sciences, Engineering, and Medicine, 2004). Similarly, supply-management measures, along with financial incentives such as, cash-out options, and commuter benefits or other financial incentives to use alternative modes, can discourage solo-driving and encourage the use of alternative transportation modes (National Academies of Sciences, Engineering, and Medicine, 2005).

Commuter benefit ordinances—These ordinances require employers meeting certain criteria to offer commuter benefits such as partially or fully paid transit or vanpool, parking cash-out, and bicycle benefits. Commuter benefits can be offered in three ways: employer covers full cost of the benefit, employer offers a pretax benefit, or employer and employee share costs. Employers can offer any amount of qualified benefits, however, there is a limit on the pretax amount.⁶ Employers and employees are taxed on the value that exceeds the pretax limit. These benefits can be offered either through purchase of transit passes, vouchers for employees, or reimbursements for qualified benefits. Only employers can provide commuter benefits, and they typically partner with transit agencies or third-party voucher providers to offer discounted transit passes (Federal Transit Administration, 2002).

Commuter benefit programs offer transportation fringe benefits to employees as allowed under the federal tax law. Section 132(f) of the Internal Revenue Code allows the use of pretax dollars for qualified transportation purposes. Qualified transportation fringe benefits for which employees are

⁶ Currently the combined limit for transit and vanpool benefits is \$270 and \$270 for qualified parking per month.

not required to pay income or payroll taxes include transit passes,⁷ vanpool services, and qualified parking.⁸

Commuter benefit programs are beneficial to employers and employees and can influence travel behavior towards the use of alternative travel modes. Commuter benefits can, for instance, help employers and employees save taxes up to the IRS pretax deduction limit. Employers offering the benefits do not pay federal payroll taxes on the benefit amount, while employees using the benefits save on federal and, in most states, on state and local income taxes (Federal Transit Administration, 2002; Seattle Urban Mobility Plan, 2008). These payroll deductions allow employees to save between 20 and 40 percent of their transit commuting expenses (Seattle City Council, 2020). In addition, offering these benefits help employers with employee recruitment and retention. Other research has found that transit benefits encourage workers to commute by public transit more and reduce their commute VMT, while parking benefits facilitate driving (Shin, 2020). Moreover, commuter benefits also can influence workers' noncommute VMT, which indicates that they have spillover effects (Shin, 2020).

Employee trip reduction—These provide commuters with the resources or incentives to reduce their vehicle trips. Local governments in some communities require large employers (typically those with at least 50 or 100 employees) or developers to implement TDM actions that shift commuter behavior to more sustainable modes. CTR programs typically include commuter financial incentives such as parking cash-out and transit allowances or discounts, guaranteed ride home, bicycle parking and changing facilities, alternative work schedules and teleworking, and preferred parking (Litman, 2003).

CTR programs can roughly fall into the four major categories: provision of transportation facilities and services, such as shuttle bus services and bike parking and shower; financial incentives or disincentives, such as transit and vanpool subsidies and parking pricing; alternative work arrangements, such as telework, flexible and staggered work hours; and user information and other support actions, such as on-site transit information and transportation coordinators. (National Academies of Sciences, Engineering, and Medicine, 2010; Seattle Urban Mobility Plan, 2008).

CTR programs have the potential to change commute travel. In a study, Sanford & Ferguson (1991) found that these programs have been successful in altering the timing of commute travel, primarily through encouraging employers to provide alternative work hours to their employees. Other research indicates that CTR programs lead to reduced SOV trips and shifts to alternative modes that are more environmentally sustainable, especially as program intensity grows from providing user information and support actions to provision of services and incentives (National Academies of Sciences, Engineering, and Medicine, 2010). These modal shifts, in turn, result in reduced VMT, congestion, and carbon emissions and improved air quality (Seattle Urban Mobility Plan, 2008).

TDM plan ordinances—Land-use factors such as density, mix, connectivity, and site design, affect accessibility and travel behavior. These factors affect the distance between destinations and the relative efficiency of different travel modes, which, in turn, affects vehicle ownership, vehicle travel, mode share, and the overall transportation system. Various land-use-management strategies can help achieve TDM objectives. Examples of these include transit-oriented development, parking and transportation demand management, smart growth, and new urbanism (Litman, 2020). While

⁷ Access to mass transit that is publicly or privately operated, which includes, buses, trains, and ferries.

⁸ Parking that is near or at the worksite, or located at a place where employees commute to work by transit, vanpool, or carpools.

usually TDM has been used as an effort to change commute patterns, there is a growing interest to integrate TDM into the land-use planning and zoning codes to influence travel patterns of residents, visitors, and others as well (Seggerman & Hendricks, 2005). When TDM is implemented on a site-by-site basis through land use and zoning, the focus is typically on building supportive infrastructure, such as TOD and parking maximum and minimum standards, which involves a one-time decision. However, there are localities that implement programmatic TDM measures through land-use review, such as transit passes for employees and parking cash-out programs that require ongoing monitoring (Angelo Planning Group & Nelson Nygaard, 2013). In this paper, we focus on these programmatic TDM measures implemented through land-use review processes.

Recognizing the effects of private development on transportation, many localities across the country have established TDM programs to address the travel impacts of new development or expansion of existing development. TDM requirements often are incorporated into the land-use review process where developers are required to submit a TDM plan. Typically, a TDM plan outlines the process through which an applicant or developer and subsequent owners and/or tenants will take measures to reduce the transportation impacts of the development over time.

3.3 TDM Benefits

TDM has the potential to benefit individuals, businesses, and communities. TDM can bring important benefits to individuals by expanding transportation options, providing cost-saving opportunities, and improving well-being. For instance, they can reduce commute cost, stress, and time as well as make better use of available transportation options. In particular, TDM measures that account for equity in resource allocation processes benefit physically or socially disadvantaged people and provide the mobility needed for employment, education, and other critical resources. In addition, using public or active transportation increases safety and physical activity and brings many health benefits that contribute to an improved quality of life (Litman, Online TDM Encyclopedia, 2003; Cambridge Community Development Department, 2011; District of Columbia Department of Transportation, 2010). Research in this area shows that active commuters, such as those who walk or cycle to work, enjoy improved mental health and concentration, while public transit commuters similarly experienced improved psychological well-being compared to drivers (EurekAlert, 2014).

TDM also has the potential to benefit businesses and employers in various ways. TDM actions such as parking management, pretax commuter benefits, and teleworking can cut overhead costs by reducing office space and parking requirements. These also can help employers with improved employee satisfaction, reduced stress and absenteeism, improved productivity, and employee recruitment and retention, which, in turn, benefit the employer by reducing costs (District of Columbia Department of Transportation, 2010; Winters & Hendricks, 2003). In addition, these actions can help employers expand service hours and enhance customer service with flexible work-hour schedules such as flextime, staggered work hour programs, compressed work-week programs with the same total number of employees (Winters & Hendricks, 2003). Studies have shown that these actions, particularly those that incorporate financial incentives or disincentives such as commuter benefits and parking pricing, are the most cost effective. For instance, a study found that incentive/disincentive programs result in an average net-cost savings of \$111.47 per employee annually (National Academies of Sciences, Engineering, and Medicine, 2010).

These TDM benefits to individuals and employers result in reduced congestion and fuel consumption, more efficient land use, improved air quality, expanded transportation options, and

greater mobility, which lead to an improved quality of life for the whole (Shaheen, Cohen, & Bayed, 2018; District of Columbia Department of Transportation, 2010; Litman, Online TDM Encyclopedia, 2003).

3.4 Individual Commute Decisions

Understanding individual commute decisions is crucial to implementing successful TDM strategies. In this subsection, we review the factors that influence commute decision making, which may also be relevant to noncommute trips while some may also be context specific.

A review of the existing literature shows that individual commute mode-choice decisions are influenced by various factors. We divide these in three categories: urban-form factors, commute-related traits, and commuter-specific traits (Zhou, 2012; De-Witte, Hollevoet, Dobruszkes, Hubert, & Macharis, 2013). *Urban-form factors* refer to the characteristics of the area, including population density, land-use mixture, topography, availability of infrastructure, and connectivity. *Commute-related traits* refer to mode-specific factors, work characteristics, and trip characteristics. Lastly, *commuter-specific traits* refer to commuter personal and psychological attributes.

Studies focusing on the impact of *urban-form factors* such as population density have found that those living in dense neighborhoods are more likely to use transit (RSG, 2014; Hu & Schneider, 2017). Other studies have found that increasing land-use mix and walkability reduces nonwork vehicle trips, while increasing regional accessibility and improved transit accessibility reduces commute trips by cars (Litman, 2020). Similarly, research shows that weather affects commute decisions, particularly, the day-to-day decision to cycle to work (Heinen, Maat, & Wee, 2011a; Spencer, Watts, Vivanco, & Flynn, 2013). For instance, frequent cyclists are discouraged from cycling to work due to bad weather conditions (Heinen, Maat, & Wee, 2011a).

Research related to *commute-related traits* looks at mode-specific factors, which include availability, access, convenience, comfort, privacy, freedom, safety, travel time, and costs of travel modes. Research in this area has found that those with access to high-quality local transit are more likely to use it (RSG, 2014; Chakrabarti, 2017). In addition, the availability of frequent feeder bus services makes it more likely for office workers to commute by rail (Cervero, 2006). In terms of travel time, Hu & Schneider (2017) found that a high ratio of automobile to transit travel time discourages automobile commutes, while Liu, Gao, Ni, & Ye, 2020 (2020) found that transfer times discourage commuting by public transit. Research regarding costs is inconclusive. Some studies indicate that the costs of mode do not significantly influence mode choice (RSG, 2014; Liu, Gao, Ni, & Ye, 2020), while others indicate that the costs of commuting by a private vehicle are influenced by the cost of operating a car (DeLoach & Tiemann, 2012). Studies looking at fuel taxes and parking prices have found that higher costs result in less commuting by a private car and more commuting by public transit or active transportation (Giménez-Nadala & Molina, 2019; Khordagui, 2019).

Other studies in this area focus on work characteristics, particularly at the presence of TDM measures, proximity to transit stations, and workplace culture. Research regarding the presence of employer-based TDM measures shows commuters offered public-transportation benefits or other amenities, such as bike parking or showers and lockers, are more likely to use transit or active transportation. However, these benefits work best when free car parking is limited or not offered (Cervero, 2006; Hamre & Buehler, 2014; Chakrabarti, 2017). In particular, a survey found a high percentage of commuters who are offered transit benefits from their employers, commute by transit

at least three times per week (RSG, 2014). Other research shows that workers in closer proximity to rail stations were more likely to regularly commute by transit than those working away from rail stations (Cervero, 2006; Liu, Gao, Ni, & Ye, 2020). Younger populations, however, are less concerned about the proximity of stations to their home or workplace than older populations (RSG, 2014). In addition, the absence of restaurants and retail shops near suburban offices deter transit commuting (Cervero, 2006). Similarly, workplace culture and employer attitudes affect commute decisions as these affect the provision of amenities and financial incentives in the workplace (Heinen, Maat, & Wee, 2011a).

Trip characteristics such as time of travel, purpose, and distance also affect commute decisions. In terms of time of travel, studies have found that transit modes are considerably less attractive during off-peak periods due to lower service levels, while automobiles are more attractive due to lower traffic congestion (Habib, Day, & Miller, 2009). With regard to travel purpose, research indicates that the need to make stops (trip-chaining) during commute trips deter transit commuting (Cervero, 2006). Another study found that while combining commute trips with trips made for child care, social and cultural activities, and education reduces the likelihood of cycling to work, combining commute and daily errands increases the likelihood of cycling to work (Heinen, Maat, & Wee, 2011a). In terms of commute distance, some research shows that shorter commutes are more likely to be taken by transit or walking (RSG, 2014; Ferrer, Cooper, & Audrey, 2018), while other research indicates that longer commute distances also discourage the use of private vehicles in favor of public transportation (DeLoach & Tiemann, 2012; Hu & Schneider, 2017).

Lastly, in terms of *commuter-specific traits*, particularly personal attributes, scholars have investigated income, marital status, gender, and care responsibilities. Research results indicate that higher income people are more likely to drive alone and less likely to use transit, although this does not hold in very dense urban areas such as New York City, Chicago, D.C., and San Francisco (DeLoach & Tiemann, 2012; RSG, 2014). In addition, commuters who are female, married, older, living in households with more cars per worker or with children are more likely to commute by automobile (DeLoach & Tiemann, 2012; Hu & Schneider, 2017). According to the RSG (2014), people under 30 are more likely to use transit, while baby boomers avoid it. Other research indicates that ethnic minorities are more likely to use transit and carpool (RSG, 2014; Blumenberg & Smart, Getting by with a Little Help from my Friends...and Family: Immigrants and Carpooling, 2010; Blumenberg & Smart, Brother Can you Spare a Ride? Carpooling in Immigrant Neighbourhoods, 2014).

In terms of psychological factors, studies have looked into habit, attitudes, and concerns over health as determinants of commute mode choice. Scholars have found that perceived health and environmental benefits of active modes positively influence their use to commute (Heinen, Maat, & Wee, The Role of Attitudes toward Characteristics of Bicycle Commuting on the Choice to Cycle to Work over Various Distances, 2011b; Ko, Lee, & Byun, 2019). For instance, using data from England, Roberts, Popli, & Harris (2018) found that pro-environmental behaviors reduce the probability of commuting by car. Ko, Lee, & Byun (2019) found that South Korean commuters with a negative perception of their health tend to use active modes or transit.

In new research, Millard-Ball, et al (2021) assess the impact of the built environment on travel decision making. By using San Francisco's affordable housing lotteries, which randomly allow specific households to move to specific residences, the authors find that public transportation accessibility, parking availability, and bicycle infrastructure significantly affect transportation mode choices. In particular, the authors find that random variation in on-site parking availability greatly changes households' car ownership and driving frequency, with substitution away from

public transit. In contrast, the authors find that parking availability does not affect employment or job mobility.

In conclusion, the literature on many—though not all—TDM practices, particularly TDM ordinances, is limited, scattered, and outdated. This white paper aims to fill that gap by assessing municipal TDM ordinances such as parking-management ordinances, commuter benefit ordinances, commute-trip-reduction programs, and TDM plans for developments. We examine the common elements in these ordinances that may have contributed to their success. In addition, we identify effective employer-based best practices as well as factors contributing to their effectiveness.

4 Methodology

This paper uses a document review approach to identify successful municipal- and employer-based practices in the United States. Municipal ordinances are reviewed because they set ground rules for negotiated or regulated TDM planning activities (FHWA, 2020), because they ensure that policies are enforced, and because some voluntary strategies may be incorporated inconsistently or not applied at all (Metro, 2020). In this paper, we focus on programmatic TDM measures implemented through land-use review processes as well as TDM efforts that aim to influence commute behavior.

In terms of the municipal-based practices, four main categories of ordinances were reviewed: parking management, commuter benefits, commute trip reduction, and TDM plan ordinances. Similarly, we reviewed employer TDM practices and their implementation. The overall success of the reviewed TDM ordinances and employer-based practices is assessed based on their ability to achieve their set goals or targets. A total of 12 ordinances were reviewed but this document only discusses seven that succeeded in achieving their TDM goals or reported progress. In addition, 11 employer-based cases from 15 different sites were reviewed but only seven successful cases from 10 different sites are discussed in this paper.

The reviewed cases were selected based on suggestions from members of the Technical Advisory Panel and relevant stakeholders as well as best-practice examples identified from the literature review. The data for the municipal-based practices comes from publicly available documents including municipal ordinances or city codes, guidelines or handbooks, websites, and program annual reports, while data for the employer-based practices comes from publicly available online sources and supplemented with informational interviews and email conversations with involved stakeholders.

5 Successful TDM Practices

5.1 Successful Municipal-Based Practices

This subsection provides a summary of the municipal-based TDM best practices. We reviewed parking-management ordinances, commuter benefit ordinances, commute-trip-reduction programs, and TDM plan ordinances. Specifically, this section discusses the following ordinances: two parking-management programs—the Cambridge parking and transportation demand management (PTDM) and the TDM ordinance in Santa Monica that requires compliance with the state parking cash-out law; two commuter benefit (CB) ordinances in San Francisco, California, and the San Francisco Bay Area; commute-trip-reduction (CTR) programs implemented by the City of Seattle, Washington, and Spokane County, Washington; and three TDM plan ordinances in Arlington, Virginia, Pasadena, California, and Montgomery County, Maryland (see *Table 1* in Appendix A for a summary of key features of the reviewed ordinances).

Several factors may have contributed to the success of the reviewed ordinances. While some factors are common across the ordinances, others are specific to the site where it is implemented. We identified seven factors that are detailed below.

Establish clear TDM goals—All localities identify clear goals to be achieved through the ordinances. Overall, the primary goals of the ordinances are to reduce SOV trips, reduce traffic congestion, and improve air quality. Some ordinances also include other related goals. For instance, the Montgomery ordinance also seeks to reduce noise pollution, increase transportation capacity, and promote traffic safety. However, localities do not specify targets or directly measure whether these related goals are met.

Specify applicability—The majority of the ordinances apply to employers or developers based on certain size thresholds or on the type of development within specific geographic boundaries. Ordinances that apply to employers typically use the number of employees as a basis to set the threshold. While the reviewed commuter benefit ordinances try to reach more employers and set the threshold at a lower level, ranging from employers with 20 to 50 or more employees, the commute-trip-reduction ordinances apply to larger employers, usually those with 100 or more employees. On the other hand, ordinances required of developers apply to nonresidential projects and, in some cases, residential projects within a specific floor area threshold or number of parking spaces.

Identify TDM targets—Most of the reviewed ordinances establish TDM targets that are set by the local authority or the employer or developer and approved by the local authority. Most of the targets set by the local authorities tend to have three main characteristics: they are measurable (either a specific target measure or a percentage reduction from a baseline level), they specify applicability (city or countywide, district, employer, or development project), and they are expected to be achieved within a specific timeline. While some ordinances set short-term goals to be achieved within a period of one or three years, others establish long-term goals to be achieved within five or more years and regularly monitor progress and make revisions to those goals as needed.

The TDM ordinance in Santa Monica and the TDM plan ordinance in Pasadena are examples of ordinances with targets to be achieved in the short term. The former requires an average vehicle ridership (AVR) of 1.50 or the equivalent in emission reductions for employers with 100 employees or more within one year and a similar citywide commuter AVR within three years. The latter requires all projects to meet an AVR of 1.5 starting one year from the effective date of the ordinance, and all projects within a transit-oriented development (TOD) area to meet a 1.75 AVR starting three years from the effective date of the ordinance. The CTR program in Seattle is an example of ordinances with short- and long-term targets.

The city, for instance, adopted a citywide goal of a 10-percent reduction in the drive-alone rate (DAR) from a 2011–12 baseline in its 2013–17 plan and updated this target to a citywide DAR target of 28.8 percent by 2023. These biennium targets are expected to contribute to the city’s 2035 DAR target of 25 percent (from a 2017–18 baseline DAR of 31.46 percent). Lastly, the CB program in San Francisco is an example of an ordinance with a long-term target that aims to contribute to an 80 percent GHG-emissions reduction below 1990 levels by reducing transportation-related emissions by 2050.

Another ordinance only had two of the three main characteristics. In Montgomery, each of the county’s six transportation management districts (TMDs) is required to have numerical TDM goals, but no timeline is explicitly identified in the ordinance. TMDs have morning peak-period, non-auto driver-mode share (NADMS) targets ranging from 18 to 46 percent and morning peak-period transit-use targets ranging from 16 to 25 percent. As of 2016, of the six TMDs, only one did not establish NADMS targets and three did not establish transit-use targets (Montgomery County Department of Transportation, 2016). One TMD master plan established a specific traffic-reduction goal of 18 percent for morning peak-period NADMS commuters before moving to Stage 2 of its development plan and 23 percent NADMS before moving to Stage 3. The Stage 4 target is 28 percent NADMS (Montgomery County Department of Transportation, 2014c).

Other reviewed ordinances require affected employers or participating developers to set their own targets with approval from the local authority. Ordinances in Seattle, Spokane, Arlington, and Cambridge are examples of this. Usually, the local authority approves individual site targets based on their contribution to the locality’s overall goal. In Seattle and Arlington, specifically, TDM plans and goals are developed in collaboration with the local TMA or the local authority.

Measure and report TDM goal achievement—The majority of localities measure the extent to which set targets are achieved. Localities, additionally, use these measures to quantify program effectiveness. The CTR ordinances in Seattle and Spokane, for instance, measure program success through reductions in DAR and VMT per employee. Seattle is divided into geographic areas, with each area assigned a DAR target to be achieved by affected employers. Between 2007 to 2018, the citywide DAR for affected employers in Seattle decreased by 16 percent (from 37.3 to 31.5 percent) and the citywide VMT per employee also decreased by 23 percent (from 5.9 to 4.4). The City’s latest survey in the fall of 2019 indicated that it was ahead of its 2019–2023 citywide DAR target of 28.8 percent with a citywide DAR of 27.9 percent (Spicer, 2020). In Spokane, the program reduced over 6,300 trips and over 136,000 VMT daily in between 2007–2016 (Commute Smart Northwest, 2017).

San Francisco and the Bay Area ordinances report the number of employers in compliance and the number of employees taking advantage of the benefits offered by affected employers. Based on this information, a reduction in VMT and GHG emissions is estimated. In San Francisco, between 2013 and 2016, more than 3,500 businesses filed compliance reports, with more than 900 of them starting the program due to the ordinance. In addition, over 33,000 San Francisco employees were using commuter benefits, which led to an estimated reduction of one million VMT per day and about 104,000 metric tons of carbon dioxide (CO₂) in one year. The ordinance is reported to have an impact beyond San Francisco because one-third of the employers that started a commuter-benefits program due to the ordinance reported offering benefits to their employees nationwide (San Francisco Department of Environment, 2017). Similarly, as a result of the Bay Area ordinance, an estimated 44,400 employees switched from driving alone to using alternative modes of transportation. That led to reduction of over 4 million vehicle trips, 85.5 million VMT, and over 35 tons of CO₂ emissions during its first year (Bay Area Air Quality Management District, 2016). Overall, these CB ordinances have been successful in reducing VMT, which has resulted in significant reductions in annual GHG emissions.

The ordinances in Santa Monica and Pasadena measure AVR. Overall, the Santa Monica ordinance exceeded its target in 2012 with an AVR of 1.67. In Pasadena, although no information specific to the ordinance effectiveness was found, the city reported an AVR for city yards of 1.75 and an AVR for the civic center of 2.10 in 2013. In Cambridge, the ordinance requires employers to achieve numeric reduction in the percent of SOV trips. The results of annual mode-split surveys from 2011 and 2018 showed that, overall, the majority of the monitored projects met their mode-split commitments, and all showed reductions in SOV driving rates. For projects that did not meet their goals, excess parking space and distance from the rapid transit were the main factors contributing to higher SOV rates (City of Cambridge, 2012; City of Cambridge, 2019). Lastly, in Montgomery, the county's six TMDs primarily measure the peak period NADMS and transit use. Between 2011 and 2015, three of the TMDs exceeded their NADMS goals, two did not meet the goals, and one achieved a 16 percent NADMS but had no prior established goal. With regard to transit use, two TMDs exceeded their targets, one did not meet its target, and three did not have established targets, but experienced increased transit use in the period. Some of the TMDs report additional measures, such as off-peak commuters, average auto occupancy (AAO), telework/compressed work weeks, and the use of capital bikeshare stations and overall report progress.

There is limited information on Arlington's TDM ordinance goal achievement. Furthermore, the information available is not up-to-date. By 2010, traffic growth was reported to have remained modest, with low peak-hour SOV trip rates despite the county's intense development (Baker, 2010). Additionally, though some developers may be required to conduct transportation studies at set intervals to evaluate the transportation patterns of residents, tenants, and visitors, the vast majority of sites did not fulfill this obligation by 2010 (Mobility Lab, 2018). The ordinance is known by its success in attracting new developers to participate in the process. Over 110 site plans were approved by the county in 2010. Participants in Arlington's TDM program for site-plan development are required to implement TDM measures from a range of county-recommended options. The county assesses the intensity of the measures and matches them with the assessed impact of different developments on the transportation system. The greater the impact, the more intense the mitigation measures in the approved site plan will be (District of Columbia Department of Transportation, 2010).

Establish regular monitoring and reporting requirements—All the ordinances require affected employers and developers to regularly monitor and report program progress. Ordinances that clearly identify measurable targets typically require affected employers and developers to conduct surveys of commute behavior and report program progress mostly on an annual basis (in some cases, biennially). Some of these ordinances have specific requirements about report content and survey administration. For instance, the CTR in Spokane requires a 70-percent response rate for the survey. Ordinances with broader goals or without specific numeric targets typically require a compliance form. In addition, the reviewed ordinances often require maintaining records of program implementation with a few localities reserving the right to visit sites. To ensure compliance with the ordinances, all localities impose civil or administrative penalties—or both in case of violations.

Require outreach and program promotion—Most of the reviewed ordinances specifically require affected employers and developers to promote program elements, particularly alternative commute options, periodically—at least once a year or when new employees are hired. The ordinances in Santa Monica, Seattle, Spokane, Montgomery, and the Bay Area, for instance, require employers to provide employees with information about alternative commute options or benefits offered. In Santa Monica and Montgomery, employers must designate a space for information on commuting options, while in Spokane and Seattle, employers must distribute the information to employees at least once and twice a year, respectively, and to new employees at the time of hire. Similarly, in the Bay Area, employers are required to inform employees about the commuter benefit when it is first made available and at least once a year.

Other ordinances may require affected employers and developers to promote the programs and benefits they offer without explicit information distribution requirements. In San Francisco, for instance, the ordinance does not explicitly include such requirements. However, it requires employers to maintain signed copies of employer waiver forms for every employee who waives participation in a commuter-benefits program.

Similarly, to increase program visibility and compliance, local authorities carry out promotional efforts—in particular, those that measure TDM-goal achievement through program compliance. In San Francisco, the program’s outreach through email and postal mail has increased the visibility of the ordinance as well as compliance and reporting (San Francisco Department of Environment, 2017). Similarly, in the Bay Area, the Air District and the Metropolitan Transportation Commission (MTC) worked together to notify employers about the program and to help them comply with program requirements. These efforts included creating a commuter-benefits program page, purchase of an employer database for direct mailings, and sending out regular mailings to employers as well as promoting the program through their existing networks. Similarly, the government agencies, transit agencies, congestion-management agencies, and business groups provided substantial support in publicizing the program (Bay Area Air Quality Management District, 2016). Lastly, in Santa Monica, the locality’s proactive outreach and monitoring efforts have been cited as one of the main factors contributing to the program success (Medina, 2019).

Specify program requirements—The reviewed ordinances specify program requirements, some of which are common across most of the ordinances. We identified three requirements that may contribute to the success of the ordinances. First, some ordinances require appointing a program coordinator who is responsible for program development, implementation (including outreach and promotion), and monitoring. This is a required element in the Seattle and Spokane CTR programs as well as in the ordinances adopted in Santa Monica, Montgomery, and the Bay Area.

Second, some ordinances require affected employers and developers to develop and submit a TDM plan that outlines program-implementation plans and TDM targets. This plan needs to be approved by the local authority. For instance, Cambridge requires a PTDM plan to minimize the amount of parking demand and Santa Monica requires an annual emission-reduction plan that outlines a specific emission-reduction target for the subsequent year. Montgomery also requires affected employers to submit a traffic-mitigation plan and developers a traffic-mitigation agreement.

Third, all ordinances require affected employers and developers to implement TDM measures that contribute to achieving the programs’ overall goals. Usually, the local authority provides a list of recommended TDM options for employers and developers to implement based on their needs and circumstances. However, employers and developers are not limited to the recommended options. They can implement alternative measures with the localities’ approval. In some cases, however, the ordinance specifies a minimum number of strategies to be adopted. For instance, the CB programs in San Francisco and the Bay Area require employers to offer at least one of the four benefits options, while the CTR programs in Spokane and Seattle require the implementation of at least two and six additional TDM strategies, respectively.

All reviewed ordinances are mandatory, except for Arlington’s TDM for site-plan development. In some localities, the mandatory nature of the ordinance may have contributed to their success. For instance, the parking cash-out program in Santa Monica was found to be effective due to its mandatory nature (Medina, 2019). In Arlington, despite the program’s voluntary nature, the county has been recognized as a national leader in having embedded TDM program requirements as a condition of the building permit process (Mobility Lab, 2018). This is due to its attractive incentive rewarding developers that implement TDM measures to mitigate the transportation impacts of the development with density bonus that allows for some flexibility in use, density, and form of development beyond normally permitted use and type of

development by the zoning district. The incentive has been an effective tool to motivate developers to participate in the program (District of Columbia Department of Transportation, 2010).

In addition to the above factors identified from the ordinances, other factors that may have contributed to ease the implementation of the ordinances and to their success include state-level regulatory frameworks, collaboration between local authorities, public and private transportation agencies and employers and developers.

Regulatory framework at the state level—State laws can facilitate the adoption of TDM ordinances in localities. In the state of Washington, for instance, the Commute Trip Reduction Law (Washington Clean Air Act -RCW 70A.15.4020) specifically requires counties and cities within an urban growth area to adopt a commute trip reduction plan and ordinance. Several localities in Washington have adopted a commute-trip-reduction program to comply with this law. As a result, between 2007 and 2018, statewide alternative commute trips reduced 13 percent of the daily VMT per employee, which led to an annual reduction of 75,000 metric tons of GHG emissions (WSDOT, 2020).

Through its ordinance, Santa Monica was the first to make the state parking cash-out law a city-level requirement (Smart Growth America, 2013). The Parking Cash-Out Law (AB 2109, KATZ) in California requires employers of certain size who provide subsidized parking for their employees to offer a cash allowance instead of parking. Statewide, the law has been largely ineffective because of missing data, loosely defined objectives, limited applicability,⁹ and the lack of reporting requirements. In particular, there is no information regarding the number of employers offering parking cash-out or the number of employees participating in it (Long, 2002). Despite all these limitations, Santa Monica has successfully implemented it, particularly due to its monitoring and compliance mechanisms (Medina, 2019).

In addition to providing a regulatory framework, some states contribute funding to TDM programs. For instance, the Washington CTR program has had a static biennial budget of approximately \$6.4 million for over 20 years, a portion of which is distributed to jurisdictions to administer their CTR programs. This state base funding accounted for 55.2 percent of the 2017–19 budget of the CTR program in Seattle. The remainder of the funding for the same cycle also came from the state congestion mitigation and air quality (CMAQ) funding.¹⁰ The city matches the state funding with in-kind local funding to cover staff time. In the 2019–21 grant period, the City of Seattle and Spokane County received approximately \$897,000 and \$367,000, respectively (Seattle Department of Transportation, 2019; Washington State Department of Transportation, 2021). Similarly, the program in Arlington County relies on federal and state funding (Baker, 2010).¹¹

Collaboration with other public and private transportation agencies as well as with employers and developers—Collaboration between local authorities and other public and private transportation agencies has helped with program administration as well as to better assist affected employers and developers in some localities. In the Bay Area, for instance, joint outreach and marketing efforts between the Air District and the Metropolitan Transportation Commission supported employer compliance with program requirements.

Similarly, the partnership between the City of Seattle and Commute Seattle, has helped the city with the administration of programs and services, reaching out to newly affected employers and with overall

⁹ There is a large number of employers that are exempt from the law because the law does not apply to employers that bundle parking space with lease agreement, or that own their parking.

¹⁰ This funding expired at the end of the cycle.

¹¹ Lack of dedicated county funding for the Arlington County Commuter Services (ACCS) has been cited as a fundamental obstacle to long-term operation of the TDM program.

employer compliance as well as with commuter survey and program reporting (Seattle Department of Transportation, 2017; Spicer, 2020). In addition, through the TMA, the city works closely with employees on solving their commuting needs collaboratively instead of just focusing on enforcing state requirements (Spicer, 2020). Commute Seattle works with employers to set site-specific goals and implement strategies tailored to their needs. The TMA offers free support services, free programming, and a solid peer-to-peer sharing network aimed to help employers solve the commute for better employee retention, meeting their sustainability goals, and make good business sense of transportation benefits (Spicer, 2020).

In Santa Monica, the transportation management organization (TMO) has helped provide personalized assistance to affected employers and developers. A study found this factor to have contributed to the success of the ordinance (Medina, 2019). According to the study's interviews, the TMO provided examples of how other companies implement their own commuter program, provided assistance to seek other emission-reduction strategies aside from the cash-out program, and provided templates to communicate information to new employees. Similarly, in Pasadena, the city works collaboratively with the developers to make necessary adjustments to the TDM program plan if the city determines performance objectives have not been met (City of Pasadena, 2008).

In addition to adopting ordinances that require employers and developers to implement TDM strategies, some municipalities also establish TMAs to fulfill their TDM goals. TMAs could be established by municipalities as an extension of the ongoing TDM efforts to administer, oversee, support, and enforce TDM requirements (Baker, 2010). Localities, for instance, may authorize and fund TMAs or require certain groups to participate in them and provide funding. The Palo Alto TMA (PATMA) and the Mission Bay TMA (MBTMA) in California are examples of this.

The City of Palo Alto authorized and played an important role in the development and funding of the Palo Alto TMA. The City Council authorized the provision of funding for the TMA's programs through a funding agreement between the city, PATMA, and a foundation. The funding received through this agreement represents the most important source of revenue—about 80 percent of its total funding (City of Palo Alto, 2020). The TMA's funding agreement also specifies other requirements, such as monitoring and reporting requirements for the TMA to meet. The city also played a leadership role in developing the metrics and programs by which the TMA tracks performance. The goal set for the TMA, for instance, was to reduce single-occupant vehicle trips by 30 percent by 2018 (City of Palo Alto, 2015).

PATMA primarily focuses on reducing SOV trips, traffic congestion, and parking demand in downtown Palo Alto. The TMA offers services mainly to employees commuting in and out of the downtown area to achieve its goals. As of 2020, it offers three employee programs and is developing its employer program. Its employee programs include free transit passes and subsidized Lyft for short trips to qualified downtown commuters¹² as well as subsidized carpools for commuters using Scoop or Waze apps. In addition, it offers information on parking and transportation options, such as bus schedules and parking garage locations, to residents and employees in the city (Palo Alto TMA, 2019). At the end of 2019, 85 downtown employers participated in the transit-pass program, and 11.42 percent of service workers and 3.50 percent of office workers were served by PATMA programs (City of Palo Alto, 2020).

According to PATMA, their TDM programs are cost-effective and impactful, but labor intensive, particularly the transit pass subsidy program. The TMA's 2017 survey results showed that downtown commuters' driving alone decreased, while the use of transit increased slightly—which was largely due to transit benefits, particularly to service industry and light office employees.¹³ The results also showed that

¹² Those earning less than \$70,000 annually.

¹³ Service industry refers to restaurants, retail, salons, etc.; and light office refers to law firms, insurance, dentist, realtor, etc.

the rate of driving alone was higher for commuters having parking permits, which indicated that if parking permits were less accessible and readily available, commuters would explore other commute options (Palo Alto TMA, 2017). In 2018, mode shift led to an estimated reduction of 1.3 million VMT and 543 tons of GHG emissions, and over \$278,500 in societal benefits (City of Palo Alto, 2019a).

MBTMA was formed in conformance with the Mitigation Measure E-47 of the Mission Bay South Redevelopment Plan (City and County of San Francisco, 2020). The TMA's primary goal is to reduce SOV travel in the area and VMT at peak commute periods through TDM strategies as described in the city-mandated Mission Bay Transportation Systems Management Plan. Residential and commercial property owners within the boundaries of the Mission Bay area are required to participate in the TMA and make financial contributions. Affordable housing, city and state agencies, and University of California San Francisco (UCSF) occupied properties have the option to exempt themselves from making these contributions.

To achieve its goal, MBTMA provides programs and services to both employees and residents within its area of operation. These include shuttle services, guaranteed ride home, transit pass sales and subsidies, bicycle parking, transit, pedestrian and bicycle route information, alternative work arrangements, and a scooter program for low-income riders (Mission Bay TMA, 2020). Shuttles services are free for all residents and employees in the area. Between 2018 and 2019, shuttle boarding increased 25 percent. The future of this program, in particular, is challenging as several agencies exempt themselves from contributing funds for the services while increasing the demand for them. The TMA estimates that around 40 percent of the shuttle users came from properties that did not contribute (Mission Bay TMA, 2020).

The Mission Bay TMA has had challenges in reducing SOV travel rates. Between 2016 and 2019, SOV travel rate increased, and carpool and transit use declined. Growing concerns about public transit safety is cited as the main factor contributing to these changes. In response to these concerns, transit hubs were relocated to safer locations in early 2020 (Mission Bay TMA, 2020). Despite these concerns, Mission Bay's DAR is among the lowest of any district in San Francisco, at just 22.2 percent in 2019.

Municipalities may also participate in collaborative networks to address transportation-demand concerns. The C-Pass program in Ohio is an example of this. The C-Pass program is a collaboration between downtown property owners in the Capital Crossroads Special Improvement District (CCSID), the Central Ohio Transit Authority (COTA), and the Mid-Ohio Regional Planning Commission (MORPC). Property owners within the special district agreed to be assessed a tax to fund the program.¹⁴ The program also receives some funding from MORPC.

The program offers free, unlimited transit access to eligible employees¹⁵ and residents within specific downtown areas to mitigate growing parking price concerns and to increase transit ridership. Employers within the specified area can register their employees at no additional cost to them or their employees (Gohio Mobility Hub, 2020).

The program has been an innovative and effective way to reduce SOV trips into downtown and parking demand that resulted in an increase of 17 percent in COTA rush-hour ridership between June and November 2019 (MORPC, 2019). The C-pass program has resulted in significant increase in transit ridership and has helped with boosting employee morale, recruitment, and retention. Within six months of the program launch, 45 percent of eligible employers had enrolled in the program (Columbus

¹⁴ CCSID is the first special-improvement district in the country to fund transit for workers through special assessments (Smart Columbus, 2020). Initially, the program was funded through December 2020, but in November 2020 all program partners renewed the program through 2025.

¹⁵ Employees working on average 15 hours a week for a participating company.

Underground, 2019; MORPC, 2019). As of August 2019, 430 employers and close to 14,800 employees had registered for the program (MORPC, 2019).

5.2 Successful Employer-Based Practices

This subsection provides a summary of the employer-based TDM best practices. We reviewed a total of 11 employers who have adopted TDM actions. For each case, the researchers looked into four elements that may have contributed to employer success in achieving their TDM goals. First, employer motivations to adopt TDM actions. Second, common TDM strategies implemented by employers and strategies that have contributed to achieving their goals. Third, the challenges employers faced when implementing their TDM programs and how they addressed them. Lastly, other factors that may have helped them to achieve their TDM goals.

Seattle Children’s Hospital in Washington—Seattle Children’s Hospital (SCH) is located in a neighborhood outside a secondary business district in Seattle with about 10,000 employees, thousands of daily patients, and 1,100 parking spaces. SCH was able to reduce the percentage of employees driving alone from 73 percent in 1995 to 33 percent in 2017 through the implementation of TDM actions (Luum, 2020; Commute Seattle, 2018).

SCH has adopted TDM actions motivated by five factors. First, SCH is subject to the Commute Trip Reduction Law and has been working to reduce their employee commute trips since 1995. Second, SCH started its plans to develop more clinical space on their campus in 2010 and worked with the City of Seattle to obtain building permits. To get building permits, SCH must meet 42 conditions stipulated in the development agreement, one of which particularly demands them to reduce their SOV rates to 30 percent by 2030. Third, SCH has limited parking and works to reduce the demand for it and prioritize it for its customers. Fourth, to support workforce attraction and retention. Lastly, to support its mission of preventing and treating pediatric diseases.¹⁶

To achieve its TDM targets, SCH implemented a framework looking at three spheres of influence: policy change, enhancing or changing amenities, and improving the external environment. In terms of policy change, SCH adopted two policies. First, there is no free parking on-site. SCH charges a daily parking fee¹⁷ that varies with time of day (peak times and off-peak times) between \$3.25 and \$11.50. SCH reinvests all the proceeds from the parking fees into the TDM program. Second, SCH pays its staff for not driving alone. Employees that do not drive alone to work receive \$4.50 each day, and up to \$1,000 annually through the *Commute Bonus*. Similarly, the company undertook several amenity changes or enhancements to make alternative commute options more attractive for employees. SCH offers very low-cost transit passes, carpool and vanpool matching services, free employee shuttle, and personal commute planning. Other amenities include free company bikes and a full-service bike shop. Lastly, SCH has been working with local transit agencies and the DOT to improve the proximity and frequency of transit. For instance, it bought transit services to increase their availability from every 30 minutes to every 15 minutes.

Several other factors have contributed to the success of SCH TDM programs and ultimately helped it obtain building permits for their campus expansion. One factor is having an internal culture and goal to reduce SOV rates to 30 percent by 2030. SCH shares communications materials so that everybody at the hospital knows that they are part of the effort and that all need to reach that target together, including new

¹⁶ Bronchiolitis and asthma are two of the top five reasons for children's admission into the hospital. These are related to air-quality, which is threatened by traffic and carbon emissions.

¹⁷ SCH eliminated monthly parking permits a decade ago.

employees. Another important factor is having support from the organization's leadership. The CEO, for instance, takes transit and rides the shuttle. According to the director of transportation at SCH, "this makes a big difference when it comes from the top—having executive leadership, it makes all the difference." Lastly, SCH was able to double their TDM efforts given their experience in reducing their employee commute trips since 1995.

Google sites in Colorado, California, and Washington—Google has been implementing parking programs in five of its sites across the United States. These programs involved the use of incentives in three of the sites and the use of both incentives and disincentives in two of its sites. The company implemented different approaches based on their motivation in each of these sites. In two of the sites, the company implemented programs to comply with city requirements, while in the other three locations, it implemented measures due to parking shortage (Luum, 2020).

The company's sites in Boulder, Colorado, and Santa Monica, California, started parking cash-out programs to fulfill city requirements. The City of Boulder required the company to implement an incentive-based program to continue to grow, while the City of Santa Monica requires employers of certain size to offer a parking cash-out program. In addition to the \$5 daily incentive program, the company also offers rewards to employees for choosing alternative commute options in Boulder. This mixed-incentive approach rewards employees based on the type of alternative commute mode they choose on any given day. Biking has been the most popular alternative mode in recent years, even though Boulder is not a very bike-friendly city (with 20 percent of known trips in winter and 40 percent in summer). Google's Los Angeles office continued to offer the parking cash-out program after relocating from Santa Monica. However, under that program, employees had to commit not to drive for the whole month in advance. The company decided to make the program more flexible by changing to a daily cash-incentive program in 2019. As a result, 40 percent of eligible employees started logging an alternative trip, which would have been only 5 percent under the old program.

Google's sites in Kirkland and Seattle, Washington, experienced parking shortage and took measures to address this. In Kirkland, the site is located in a suburban area with limited access to transit and faced parking challenges due to site growth. To address this, the company created an incentive program that resulted in a SOV reduction of about 7 percent (from 95 to 52 percent), lower than the company had hoped for. This indicated that only incentive does not have as great of an impact. However, given the site's suburban location and limited access to transit, the company decided not to impose a parking fee. In the company's two other sites in Seattle, the company took a combined approach to address the parking issue and offered a commute bonus coupled with charging employees for parking. Compared to the company's other sites, the impacts in their Seattle sites have been greater. When the Seattle location commute bonus went into effect in July 2019, it resulted in a 29 percent reduction in parking demand across all Seattle employees and a 131 percent increase in the use of alternative modes. When the parking fee went into effect a month later, the sites experienced an additional 21 percent reduction in parking use, and 9 percent increase in the use of alternative modes. From a subset of about 500 employees who parked almost every single day in May before the programs went into effect, in September they logged 3,100 alternative trips, reduced parking by 34 percent, and saved 8,000 drive-alone trips.

The company identifies four key factors that contributed to their success. First, infrastructure played a key role in their success. According to the company, having parking integration is important as seen from the comparison of their different sites. The amount of participation varies across the sites with the incentives, based on whether parking integration is automatic. In Kirkland, because parking is integrated into the system, there is a lot more engagement, while in Boulder and LA, the participation is low because parking events are not automatically captured. Employees must manually log their parking events. Therefore, having a commute-management platform was important to capturing data as well as putting policies in place and communicating them. Second, education and communication. The company constantly

communicated with their employees through focus groups, presentations, town hall events, email, and their website. Third, change management. The company was aware that implementing change would be hard and demand time, particularly with its disincentives, but they managed to adapt, be flexible, and patient. Lastly, strong internal partnership with the senior leadership team at the local level as well as with facilities managers, human resources, legal, benefits, policy teams—and with external vendor partners—helped ensure the programs were successful.

Bedrock in Michigan—Bedrock is the real estate arm of the Quicken Loans family of companies that comprises more than 17,000 employees in Detroit. The company owns over 100 commercial properties, residential properties equating to more than 20 million square feet, 350 tenants, and 19,000 parking spaces. The company owns, operates, or manages over 29 percent of the 66,400 parking spaces in the City of Detroit. On any given day, the company has oversold spaces due to the high level of demand (Luum, 2020).

In addition, due to its growth plans over the next several years and an anticipated increase in parking demand (nearly 13,000 additional spaces) as well as employee satisfaction and retention, the company started embracing TDM programs. The additional 13,000 parking spaces would cost the company an estimated \$515 million in construction costs. This high cost of construction as well as concerns about land-use management and their commitment to the resurrection and revitalization of the city led the company to adopt an incentive approach.

Bedrock changed their legacy parking program, which allowed employees to opt out of parking, to a daily cash-incentive program in December 2018. The old program required employees to completely opt out of parking availability in exchange for \$150 pretax. The new program offered \$8 cash daily for any alternative mode of transportation. The alternative mode of transportation (AMT) increased from 16.9 percent in January 2019 to 20.5 percent in August. This translates to an additional 311 open spaces in their parking garages that have parking integration. They estimate an additional 80–100 open spaces in their properties that do not have parking integrated. The company also reports an increase in the number of employees that had logged at least one AMT commute from 1,459 on January 1, 2019, to 4,181 on August 31 (a 186 percent increase). They also conducted an internal campaign—their internal audience had an AMT rate of 23.6 percent at the launch of the program, and this rate increased to 29.2 percent during the campaign and remained consistent despite the cold weather.

Bedrock offers several programs to support alternative commute modes. The company considers its guaranteed ride home program through Lyft their single most important element. In addition, the company uses a carpool app (Scoop) that connects drivers and riders, offering day-to-day flexibility. Since its launch, 8,200 unique riders and 7,800 unique drivers have used the platform, making over 16,000 trips, which has saved 162,000 miles and 147,000 pounds of CO₂. The company also funds a transit-pass program, a free regional bus-pass program, and an autonomous shuttle program. The transit-pass program, launched in September 2018, sold over 27,000 passes by October 2019 and generated nearly \$33,000 farebox revenue. The regional bus program, launched in September 2019, sold 469 bus passes by October 2019. The shuttle program first launched as a pilot program in 2016, gave over 90,000 rides by summer 2019, improved rider experience, and provided first- and last-mile connectivity. The company is working to establish a low-cost bikeshare pass program. They do not expect to have a lot of robust usage during winter, but they anticipate that it will get a lot of use spring through fall.

The company started their program with a focus on culture change by collecting data, educating their team members, and changing narratives. They also leaned on technology through an online platform to communicate program information and announcements, and allow employees to make daily commute decisions, log their commute modes, and receive incentives for desired forms of commute behavior. Similarly, parking integration has helped the company with getting reliable and consistent information.

Delta Dental of Washington (DDWA)—DDWA was located in a suburban area for nearly 30 years and had ample free parking and a 75 percent drive-alone rate. In 2017, the company relocated to a thriving neighborhood, which translated to limited parking spaces for only 40 percent of their employees. To address its parking shortage, DDWA implemented a combination of incentives and disincentives to reduce SOV trips and encourage alternative modes. The company started charging for parking at a daily rate, offering a daily bonus for alternative modes including telecommuting, and fully paid transit and vanpool pass programs. In addition, the company offers reduced parking charges for vanpools and carpools to discourage SOV trips. DDWA uses an online platform to provide program information as well as allow its employees to make daily commute decisions. In the two months following the move, the company experienced a 60 percent drop in its drive-alone rate, going down to 15 percent (Luum, 2019).

Oregon Health and Science University (OHSU)—OHSU, one of Oregon’s largest employers, was experiencing a parking shortage on its site. To address this, the company shifted from a monthly parking permit to a daily parking rate accommodating tiered parking models. The company priced the parking at \$12 a day for the first eight weekday parking events in the pay period, which then jumps to \$15 for the ninth and tenth parking events. Under this structure, employees who commute to work one day a week using an alternative mode would see a slight reduction in the parking costs (from \$99.5 to \$96 per pay period). This discourages employees from driving every day due to the increased cost on the last two days. In addition, OHSU introduced a carpool program (with an average daily carpool trip of 20 percent by 2020), improved their guaranteed ride home program, and offered a transit bonus. OHSU’s old guaranteed ride home program was inefficient and cumbersome because it required employees to physically go to the transportation and parking office, get a cab voucher, and wait for a cab. The new program is integrated with Lyft and has resulted in an average 100 monthly rides compared to 20 annual rides in the old program. OHSU aims to reduce its drive-alone rate to 30 percent by 2027 (Luum, 2020b).

Bill and Melinda Gates Foundation in Washington—The foundation headquarters commute program aims to support its goal to become carbon-neutral in its Seattle campus operations. The commute program reached its goal of 35 percent SOV in recent years and aims to further reduce that to 30 percent by 2025. The company attributes its program robustness to charging a daily market rate for parking as well as a \$4 daily cash-incentive program.¹⁸ The organization also offers a fully paid bus, monorail and ferry passes, a vanpool, a guaranteed ride home program through Lyft, and a robust bike program that provides secure facilities, storage, lockers, showers, gym, and low-cost maintenance (Luum, 2020a; Commute Seattle, 2018).

Amazon in Washington—The company’s commute program in its Bellevue, Washington, site was motivated by the company’s exponential growth, employee concerns around sustainability, and system fatigue (overwhelming parking demand and transit ridership). To address these concerns, Amazon rolled out its flex commuter subsidy program, which offers subsidies to employees who take alternative commute options such as offsite parking, Lyft Line, and UberPool. The program was built to allow for future growth and commuter flexibility. The company offers a separate subsidy for transit cards and vanpools. Similarly, the company is exploring the start of a pilot bike program to address the gaps existing in the transit system (Luum, 2020c).

Lessons learned—The employers featured in this subsection have implemented TDM actions and have had measurable success in achieving their TDM goals. Overall, employers have implemented different actions based on their motivations and circumstances, but some elements are common among the

¹⁸ The organization allows employees to donate a portion or all of the cash incentive through a matching program, which is triple-matched.

reviewed cases that may have contributed to their program success. It is important to mention that what may have worked for one employer may not necessarily work for another.

To achieve their TDM goals, most employers have implemented a combination of incentives and disincentives as their main strategy. Employers often charge a parking fee and offer a daily cash incentive (some time called a *commute bonus*) to employees. Most of these employers have adopted a daily (and, in some cases, a tiered) parking fee to allow employees to internalize costs and make transportation decisions on a daily basis.

This main strategy is usually complemented by offering a flexible range of programs to make a wide range of commute options available and more attractive for employees. These programs include transit passes (which, in most cases, are partially paid for by the employer—but some organizations fully pay for them), a guaranteed ride home option, carpool and vanpool matching services, and options like free shuttles and bikes. Similarly, in some cases, companies offer or improve amenities to support bicycling, such as secure storage, lockers, and showers. Some organizations have been creative in sharing the costs of various commute options. For instance, Amazon’s flex-commuter subsidy program offers payment to employees for modes that are not transit or vanpool (such as Lyft Line, UberPool, and off-site parking). Similarly, Bedrock offers an autonomous shuttle program that provides first- and last-mile connectivity and has improved rider experience. Providing a variety of commute options has been critical to the overall success of TDM programs.

In addition to these TDM actions, there are other key components that support the TDM efforts of these employers. First, knowing how employees commute to work and their transportation needs. This is a crucial step to inform the development of TDM programs. According to the transportation program manager at Google, “the behavior change is really going to also come from knowing the culture of your employees and what’s going to culturally drive them to change their behavior.” Second, getting support from leadership. Leadership plays a key role in helping organizations to deliver the message to employees and gain support for it as well as to get financial support to invest in implementing TDM activities. Third, educating and communicating with employees. In most cases employers had constantly communicated with their current and new employees through various tools to engage them in their TDM efforts and to inform them about the benefits and transportation options available to them. Fourth, defining TDM targets and monitoring goal achievement. All the reviewed companies have defined goals and are constantly monitoring the use of parking and alternative commute modes. This information informs adjustments in TDM actions to better serve employees. In most cases, organizations rely on services from technology companies to automatically track the effectiveness of the measures adopted, ease the administrative process of TDM programs, and manage communications from a centralized hub. Lastly, collaborating with public and private agencies. Employers are partnering with public transit agencies, TMAs, and other private companies (such as Lyft, Zipcar, and Scoop) to improve and expand the transportation options available to employees.

Overall, employers adopt TDM actions to benefit their business, but regulatory requirements are important for their enforcement. Employers are driven to maximize their benefits by maximizing revenues or minimizing internal costs. The reviewed cases indicate that employers implement TDM actions that help them do so by improving employee recruitment and retention and productivity, obtaining permits to expand current facilities, or reducing or avoiding the costs of building new parking facilities. In some cases, regulatory requirements have been important in giving an initial push to employers to adopt these TDM actions, creating minimum standards for employers to report and monitor TDM goal achievement, and ensuring a continuous enforcement. In addition, regulatory requirements may help transform the corporate culture. Some employers, for instance, continued their TDM programs after relocating or offered them at other sites in which TDM is not required.

5.3 COVID-19 Impacts on Commuting

Commuting has decreased with stay-at-home orders in place across the country due to the COVID-19 pandemic. Part of the decrease is due to the adoption of alternative work arrangements and part due to increased unemployment (Klein, et al., 2020). In this section we discuss the normalization of alternative working arrangements, particularly teleworking, and their impact on the future of workplace policies and commuting.

The pandemic has normalized alternative working arrangements. These arrangements offer flexibility in terms of location, like working from home or other locations remotely, as well as schedule, such as flextime, compressed workweek, and shift work. Working from home, for instance, has experienced a significant increase in the last year. Around 5 percent of all employees worked from home at least once a month in the period 2017–2018 (U.S. Bureau of Labor Statistics, 2019), while 35 percent of employed people teleworked at some point in May 2020 (U.S. Bureau of Labor Statistics, 2020). Although the current teleworking rates are high, only 37 percent of U.S. jobs can be performed entirely at home (Dingel & Neiman, 2020), and there is considerable variation across industries and occupations¹⁹ (Dingel & Neiman, 2020; Bartik, Cullen, Glaeser, Luca, & Stanton, 2020). Similarly, more employers have offered alternative working arrangements to their employees, while only 7 percent of civilian workers had access to telework in 2019²⁰ (Desilver, 2020). In addition, a number of companies have invested heavily in the tools needed for these alternative work arrangements. Several companies, for instance, have prioritized tech and digital infrastructure investments, others are paying for their employee’s home-office equipment, and others are providing credits to pay for food and office supplies, up to a percentage of the Wi-Fi bill, and computer hardware (Nova, 2020; Dahik, et al., 2020).

Given the recent surge in remote work, several surveys have been conducted to explore the impact of COVID-19 on workplace policies. Overall, the results indicate that there is a growing shift in both employee expectations in terms of both work location and schedules, as well as employers’ willingness to accommodate employee work mode preference. For instance, a JLL study in October 2020 concluded that workforce preferences are shifting workplace priorities, with a renewed focus on quality of life, human scale, and engaging values. According to the survey results, hybrid work will be the new normal and the preferred way of working, with a majority of the respondents (75 percent) expecting their employers to support their work from home. It is anticipated that the number of days worked remotely will double from 1.2 days pre-pandemic to 2.4 days a week post-pandemic. Similarly, recent studies indicate an increased openness to flexible work arrangements from employers. One survey result found that companies expect about 40 percent of their employees to work remotely in the future (Dahik, et al., 2020). Over 60 percent of respondents who were managers said they are more open to flexible models for their teams than they were before the pandemic. This may be a result of increased productivity and the investments companies have already made to provide the necessary tools and equipment needed to work remotely during the pandemic (Dahik, et al., 2020; Keith, 2020). In addition, several companies have already announced a remodel of their work policies for even after the pandemic. For instance, Twitter, Starbucks, and

¹⁹ According to Dingel & Neiman (2020), telework feasibility is high in the information, financial activities, professional and business services, and public administration industries, but low in the leisure and hospitality, agriculture, and construction industries. Similarly, working at home is generally feasible in management, professional, and administrative-support jobs, but not in most service, construction, transportation, and production jobs.

²⁰ According to the 2019 National Compensation Survey (NCS), those workers who have access to telework are largely managers, white-collar professionals. In addition, employees of larger firms were more likely to be offered telework as an option (Desilver, 2020).

Microsoft have announced flexibility in work location and schedules (Kelly, 2020; Guarente, 2020; Bariso, 2020).

Several surveys have been conducted to examine the future of commutes post-COVID-19. Overall, the results suggest a higher percentage of workers working from home, an increased percentage of people driving to work, and a reduction in the use of transit and shared mobility to commute. Results from a survey conducted in May 2020 indicated that companies anticipated 10 percent of their full-time workforce working from home five days a week after the pandemic (Federal Reserve Bank of Atlanta, 2020). Recent survey results from October 2020 indicate that 72 percent of employees want to continue working from home on a regular basis (26 percent exclusively outside the office and 50 percent in a hybrid mode), while 24 percent want to work exclusively at the office (JLL, 2020). In addition, a study by IBM conducted in April showed that 20 percent of people who regularly used buses, subways, or trains no longer would, and another 28 percent will likely use public transportation less often. Similarly, 50 percent of those who used ride-sharing services would either use these less or stop using them completely (IBM, 2020). An informal survey from Kittelson & Associates (2020) conducted between May and July 2020 indicated that 70 percent of respondents plan to drive to work post-pandemic compared to 60 percent who drove to work before the pandemic; 11 percent will use transit compared 20 percent who used transit to commute before the pandemic; and 19 percent will use active transportation modes to commute after the pandemic compared to 14 percent who walked or biked to work before the pandemic. These changes would result in 36 percent more people biking or walking to work, but 45 percent fewer people taking transit to work.

With the increase in alternative work arrangements and subsequent changes in commuting patterns due to COVID-19, managing travel demands remains critical. Commutes during peak periods have undergone a tremendous change, with reduced congestion during peak periods (AASHTO, 2020; Descant, 2020). However, the overall traffic volumes have stayed relatively stable (AASHTO, 2020). For instance, data from five major metropolitan areas shows that overall VMT is going back to pre-COVID levels. Given the anticipated increase in SOV travel for noncommuting trips and decreased use of public transit and shared mobility, there is a growing concern that VMT could go even beyond pre-pandemic levels, especially if many abandon public transit in favor of driving alone or move to suburbs (Descant, 2020). Any shift in commute patterns towards personal vehicles, even in regions that are traditionally assumed as car-centric, can further exacerbate congestion and traffic (JLL, 2020). In addition, many individuals will continue to depend on SOV travel, public transit, or other commute modes as they cannot work remotely due to the nature of their jobs or lack of facilities and equipment necessary to work remotely (Wong, 2020). Therefore, as people continue to re-evaluate their transportation decisions, this presents an opportunity to municipalities and employers to implement policies that shift mode-choice decisions by making alternative modes more readily available and attractive.

6 Recommendations

This section provides a set of recommendations for Minnesota municipalities and employers as well as others based on the review of municipal ordinances and employer-based case studies. Any new municipal-level implementation would greatly benefit from additional state and regional leadership, funding, and support to sufficiently resource this work, particularly education and enforcement. Consistent state and regional funding would add stability and continuity to TMA programming, which would support long-term regional TDM success.

6.1 Recommendations for Minnesota Municipalities

A number of municipalities in Minnesota have implemented TDM ordinances through the land-use review process, but there is little evidence about their effectiveness. The cities of Minneapolis, Saint Paul, Bloomington, and Eden Prairie are examples of this. These cities require a TDM plan as a condition for development proposals to address the transportation impacts of development on air quality, parking, and roadway infrastructure. The ordinances apply to residential or nonresidential development or redevelopment of a certain size or with a certain number of parking spaces. Informational interviews with relevant stakeholders revealed that the ordinances have had marginal impacts due to enforcement issues and developers and building managers not giving sufficient priority to TDM goals. Based on the reviewed municipal-based practices, the researchers make the following recommendations for Minnesota municipalities to improve the effectiveness of their TDM ordinances.

Set municipal-level TDM goals and targets—Municipalities should establish TDM goals and TDM targets aligned with those goals. TDM targets should be measurable (either a specific target measure or a percentage reduction from a baseline level), specify a timeline to be achieved, and specify area of application (city or countywide, district). Specific TDM targets will depend on the needs and circumstances of each municipality (such as availability and frequency of transit services, public transit safety, demand and supply of parking spaces). Setting municipal-level TDM goals and measurable targets help guide municipal efforts as well as developers or employers' contributions towards those goals.

Create or enhance ordinances applicable to employers—Municipalities should establish new ordinances or enhance their existing ordinances that require or incentivize employers to offer commuter benefits such as partially or fully paid transit or vanpool passes, and parking cash-out options, or other commute-reduction measures. In Minnesota, 77.7 percent of residents drove alone to work in 2018 and this pattern has stayed consistent since 1990 (U.S. Census Bureau, 2018). These commuting patterns have resulted in increased congestion, with an increase in the average commuting time from 20.8 minutes in 1990 to 24.7 minutes in 2018 (Metropolitan Council, 2020). Commuting is a large contributor to congestion and traffic, but currently there are no TDM ordinances in Minnesota that apply specifically to employers that aim to improve these patterns.

Monitor and report TDM goal achievement on a regular basis—Municipalities should monitor and report progress on the achievement of municipal-level TDM goals. This municipal report should include progress made by affected employers, building managers, or developers in achieving their TDM target measures. Monitoring and reporting should be performed on an annual or biennial basis, depending on staff capacity and budget available in each municipality. Regular monitoring and reporting on TDM goal achievement help track progress toward established goals and inform municipal decision making regarding any changes needed.

Establish or improve enforcement mechanisms—Municipalities should require employers, building managers, and developers to maintain records of TDM program implementation as well as reserve the

right to conduct on-site inspections and audits. Municipalities with ordinances applicable to developers should, in addition, make TDM a requirement for the life of a building through Covenant and Agreement²¹ that makes the TDM program a condition of property ownership. Localities should impose civil or administrative penalties or both in case of violations. Establishing enforcement mechanisms help municipalities ensure building managers, developers, and employers comply with the TDM requirements. Municipalities would greatly benefit from regional funding of TMA enforcement support.

Strengthen TDM education, outreach, and program promotion—Education, outreach, and program promotion should include two components. First, municipal promotional efforts to increase program visibility and compliance among building managers, developers and employers. Second, efforts of municipalities, building managers, developers, and employers to regularly inform residents and employees about the benefits offered or the alternative transportation options available to them. These efforts should provide updated information and be performed on a regular basis. Municipalities can partner with other government agencies, transit agencies, TMAs, and business groups to regularly promote TDM programs and increase compliance and encourage alternative modes.

Collaborate with public and private agencies to offer assistance programs to developers and employers—Municipalities should consider offering assistance to developers and employers on a site-by-site basis and support the implementation of TDM measures tailored to their needs. This collaboration could offer support services, programming, and a solid network to help employers and developers solve their commuting needs collaboratively. In situations when developers or employers fail to meet their TDM targets, these collaborations could assist them to adjust their TDM plans.

Encourage creation of collaborative networks—Metro area cities often have problems with congestion, especially in their downtowns. Municipalities should explore arrangements similar to the Downtown Columbus C-Pass program in order to discourage SOV trips to and from downtown. A program like this could be offered in partnership with transit authorities and downtown employers, where employers fund the program through special assessments.

6.2 Recommendations for Minnesota Employers

Based on the reviewed employer-based practices, the researchers make the following recommendations for Minnesota employers to implement or improve their existing TDM programs.

Understand employee commuting behaviors and needs—Employers should conduct a baseline commute-mode survey to inform the development of their TDM programs. These surveys would be helpful to identify commuting preferences, assess perceptions about congestion in the area, identify transportation opportunities and deficiencies, and assess willingness to adopt alternative commute modes.

Define TDM targets and regularly monitor goal achievement—Employers should establish TDM targets aligned with their goals. TDM targets should be measurable (either a specific target measure or a percentage reduction from a baseline level) and specify a timeline to be achieved. Setting measurable TDM targets help guide employer efforts. In addition, employers should regularly monitor TDM goal achievement to help track progress towards established goals and inform decision making with regard to any changes needed in the program.

²¹ A Covenant and Agreement can be recorded to property's codes that makes the TDM program a condition of property ownership and include TDM provisions in space use agreements (lease documents) to inform and commit tenants to participate in the property's TDM program.

Offer a combination of incentives, disincentives, and flexible commute alternatives—Each employer should select the TDM actions that better serve the needs of its employees given the internal and external constraints. However, having a combination of incentives and disincentives has proven to be effective based on the reviewed cases. The main strategy of several employers typically included two components: (i) charging a daily parking fee, which in some cases included charging tiered rates and market prices; and (ii) offering cash incentives for not driving alone. In all cases, the main strategy was complemented by offering a range of flexible programs to make alternative commute options available and more attractive for employees. The flexible range of programs included (but not limited to) the following options:

- Employer-paid transit passes
- Support for employees who use a variety of commute options
- Carpool and vanpool matching services
- Free employee shuttle
- Guaranteed ride home program
- Bike programs and the enhancement of related amenities (lockers, storage, showers)
- Personal commute planning

Active communication and promotion of the offered benefits and programs is critical to inform employees about their availability and the benefits to them.

Collaborate with public and private agencies—Employers should collaborate with public transit agencies, TMAs, and other private companies in order to improve and expand the transportation options available to employees. In the Twin Cities area, employers can collaborate with the Metropolitan Council, which operates the regional ride-share program, provides employer assistance with telework programs, administers the regional guaranteed ride home program, and leads transit-oriented development efforts with support from four local TMOs (Metropolitan Council, 2010; Metropolitan Council, 2020).²² The collaboration can improve access to a variety of supporting and programming services as well as to a sharing network with experience in TDM programs.

Take advantage of technology—Employers should consider enhancing internal technology departments or acquiring external technology services. Technology services are beneficial to support the integration of TDM strategies with their current systems (e.g., integration with human resources/payroll platforms, parking systems). This system integration would make programs and benefits more accessible to employees and helps employers get reliable and consistent information to guide TDM efforts and ease program administration.

²² These TMOs are: Move Minnesota, Move Minneapolis, Anoka Commute Solutions, and Commuter Services. The TMOs work with employers, residents, and agencies to promote the use of sustainable commute options to reduce congestion and improve air quality in the Twin Cities region (Metropolitan Council, 2010).

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8 Appendix A

Table 1. Summary of Reviewed Ordinances

Location	Goals and Targets	Applicability	Program Requirements	Compliance, Enforcement, Penalties	Measurement	Goal Achievement
Parking Management						
Cambridge, MA (Code of Ordinances Chapter 10.18)	Improve mobility, reduce traffic congestion and air pollution, and increase safety	Nonresidential projects: *Small projects with 5- 19 parking spaces *Large projects with 20+ parking spaces	A wide variety of measures including transit subsidies, preferential parking for carpools, shuttles to transit stations, bicycle, and pedestrian facilities, ride-sharing services	*Annual mode-split survey, reports, and implementation records *On-site inspection and audits *Civil and administrative penalties	*Percentage of projects meeting their mode-split commitments *SOV driving rate (large projects)	88% of the monitored projects met their PTDM mode-split commitments (2018)
Santa Monica, CA (Ordinance 1604) (1)	Reduce traffic congestion and improve air quality <hr/> *AVR of 1.5 (2) within one year for employers of 100+ *City-wide commuter AVR of 1.50 (2) within three years	Employers with 10+ employees Cash-out law applies to employers with 50+ employees	*Emission reduction plan and mandatory compliance with the parking cash-out law (Assembly Bill 2109) *Transportation fee	*AVR survey *Marketing plan *Update information annually * On-site inspection and audit *Civil and administrative penalties	*Peak period (a.m. or p.m.) AVR *Emission reduction	AVR of 1.67 (2012)
Commute Trip Reduction						

Seattle, WA (Municipal code, Chapter 25.02)	Reduce commuter drive alone rates, particularly during peak hours	Employers with 100+ employees	*Employee transportation coordinator *At least two strategies from each category: (a) employee information and amenities; (b) subsidies and modal support; (c) parking management strategies	*Biennial progress report *Biennial survey of commute behavior patterns *Civil penalties	*DAR reduction *VMT per employee	Reductions from 2007/08 to 2017/18: DAR: 16% VMT: 23%
2017 Citywide goals: *10% DAR reduction from the 2011/2012 baseline 2035 Citywide goals: *DAR: 25% *VMT per employee: 3.5						
Spokane, WA (County code, Chapter 46.80)	Reduce proportion of drive-alone commute trips and VMT per employee by affected employers in the county's jurisdiction, major employment installations, and other designated areas	Employers with 100+ employees	*Employee transportation coordinator *At least two TDM strategies to meet CTR program goals	*Annual progress report *Biennial survey of commute behavior patterns (with 70% response rate) *Civil penalties	*Number of employees affected by the program *Number of employees at the site	Daily reductions between 2007 and 2016: Trips: 6,300 VMT: 136,000
Commuter Benefits						

San Francisco, CA (SF Environment Code Section 427)	Help the City achieve an 80% GHG emission reduction below 1990 levels by 2050 by reducing transportation related emissions	Employers with 20+ employees	At least one of the following: Employee- paid pretax deductions from monthly paycheck; employer- paid transit pass or vanpool reimbursement; employer-provided transportation services to and from employee residential area to worksite; any combination of the above	*Compliance form *Maintain program records and documentation *Civil penalties	*Number of employers in compliance *Estimated emission reduction	Employers in compliance: 3,500 (2013– 2016) Reduced metric tons of CO2: 104,000 (2016)
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Bay Area, CA (Regulation 14)	Improve air quality, reduce GHG emissions and other air pollutants, and decrease traffic congestion by encouraging employees to commute to work by transit and other alternative commute modes	Employers with 50+ full time employees within the geographic boundaries of the Bay Area Air Quality Management District	One of the following options: Employee- paid pretax deductions from monthly salary; employer-paid transit or vanpool subsidies; employer-provided transportation services to and from employee residential area to worksite; pre- approved alternative commuter-benefit program	*Compliance form *Maintain program records and documentation *Civil penalties	*Number of employers offering commuter benefits as a result of the ordinance *Commuter mode shift to non-SOV modes *Vehicle trips reduced *VMT reduced *GHG reductions	*55% of employers offering commuter benefits, offered as a result of the ordinance (2015) *44,400 employees (est.) switched from driving alone to an alternative mode, resulting in reduction of over 4 million vehicle trips, 85.5 million VMT, and over 35 tons of CO2 emissions during its first year
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TDM Plan Ordinances

Arlington, VA (Administrative Regulation 4.1.)	Reduce peak- hour traffic by reducing SOV trips	Voluntary developments with or without projected traffic problems that are consistent with the General Land Use Plan (GLUP) and developments requesting GLUP amendments	TDM programs from the County's TDM Matrix including ride- sharing promotion, transit subsidies, parking management, on-site amenities, and alternative work schedules	*Annual site visits *Transportation performance study (required by some site plan buildings)	NA
Pasadena, CA (Code of Ordinances, Chapter 10.64)	Congestion management *AVR of 1.5 for all projects starting 1 year from the effective date of the ordinance. *AVR of 1.75 for projects within a TOD area starting 3 years from the effective date of the ordinance.	*Small nonresidential projects *Large residential and nonresidential projects	Small nonresidential projects: employee transportation information services, preferential parking, on-site bicycle parking, and commuter matching services Large projects: All of the above and carpool and vanpool loading area, connecting sidewalks, bus stop improvements and a city-approved TDM program plan	*Annual survey and TDM status report *Commitment to maintain compliance for the project life *Civil and administrative penalties	NA

<p>Montgomery, MD (County Code, Article II, Sections 42A)</p>	<p>Increase transportation capacity, reduce existing and future levels of traffic congestion, reduce air and noise pollution, and promote traffic safety and pedestrian access</p>	<p>*Employers with 25+ employees *Developers</p>	<p>Employers: Traffic mitigation plan that may require implementing measures that encourage alternative modes Developers: Traffic mitigation agreement that may require appointing a transportation coordinator and implementing measures that discourage parking SOV's and encourage alternative modes</p>	<p>*Annual survey *Traffic mitigation agreement may also require adequate financial security including bonds, letters of credit, or similar guarantees; bind future tenants; and specify liquidated damages, specific performance, or other contractual remedies as appropriate *Civil penalties</p>	<p>Main measures: *Mode-share patterns/Transit ridership *NADMS during peak periods (a.m.)</p>	<p>Main measures between 2011-2015 (available for 6 TDMs): *NADMS goals: 3 met goals, 2 did not meet goals, and 1 had not established goals *Transit use: 2 met goals, 1 did not meet goals, and 3 had no established goals Additional measures by TDMs: *Off-peak commuters *Average auto occupancy (AAO) *Telework/compressed work weeks *Use of capital bikeshare stations</p>
<p>The County's six TDMs are required to have numerical goals regarding NADMS commuting during peak periods</p>	<p>Additional measures by TDMs: *Off-peak commuters *Average auto occupancy (AAO) *Telework/compressed work weeks *Use of capital bikeshare stations</p>	<p>Additional measures by TDMs: *Off-peak commuters *Average auto occupancy (AAO) *Telework/compressed work weeks *Use of capital bikeshare stations</p>	<p>Additional measures by TDMs: *Off-peak commuters *Average auto occupancy (AAO) *Telework/compressed work weeks *Use of capital bikeshare stations</p>	<p>Additional measures by TDMs: *Off-peak commuters *Average auto occupancy (AAO) *Telework/compressed work weeks *Use of capital bikeshare stations</p>	<p>Additional measures by TDMs: *Off-peak commuters *Average auto occupancy (AAO) *Telework/compressed work weeks *Use of capital bikeshare stations</p>	

Notes: (1) Goals and measures are required of the TDM ordinance, rather than the parking cash-out element. (2) Or equivalent in emission reductions.

9 List of Acronyms

AVR	Average Vehicle Ridership
BRT	Bus Rapid Transit
CCSID	Capital Crossroads Special Improvement District
CEDAR	Centre for Diet and Activity Research
CO2	Carbon Dioxide
COTA	Central Ohio Transit Authority
CTR	Commute Trip Reduction
DAR	Drive Alone Rate
GHG	Greenhouse Gas
HOV	High-Occupancy Vehicle
LRT	Light Rail Transit
MBTMA	Mission Bay Transportation Management Agency
MORPC	Mid-Ohio Regional Planning Commission
MTC	Metropolitan Transportation Commission
NADMS	Non-Auto Driver Mode Share
PATMA	Palo Alto Transportation Management Association
PTDM	Parking and Transportation Demand Management
SOV	Single-Occupancy Vehicle
TDM	Transportation Demand Management
TMA	Transportation Management Association
TMDs	Transportation Management Districts
TMO	Transportation Management Organization
TOD	Transit Oriented Development
UCSF	University of California San Francisco
VMT	Vehicle Miles Traveled