

# Transportation Demand Management Point System Technical Justification

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# ABBREVIATIONS

<b>AMI</b> Annual Median Income
<b>BPDA</b> Boston Planning and Development Agency
<b>BTD</b> Boston Transportation Department
<b>CAPCOA</b> California Air Pollution Control Officers Association
<b>EV</b> Electric Vehicle
<b>FTE</b> Full-Time Employee
<b>GHG</b> Greenhouse Gas
<b>LMA</b> Longwood Medical Area
<b>PNF</b> Project Notification Form
<b>SF</b> San Francisco
<b>SOV</b> Single Occupancy Vehicle
<b>TAPA</b> Transportation Access Plan Agreement
<b>TCRP</b> Transit Cooperative Research Program
<b>TDM</b> Transportation Demand Management
<b>TMA</b> Transportation Management Association
<b>VMT</b> Vehicle Miles Travelled
<b>VTPI</b> Victoria Transport Policy Institute

# SUMMARY

The proposed City of Boston Transportation Demand Management (TDM) Point System will reform the existing Boston Transportation Department (BTD) development review standards regarding TDM. Modeled after similar efforts elsewhere, including San Francisco's TDM Program, this system will set performance-based targets for the TDM programs of projects undergoing the BPDA Article 80 Large Project Review.

Whereas current standards obligate developers to select from baseline requirements and a menu of options by category (such as parking management and bicycling), the new system will define point totals for individual TDM strategies for developers to choose from. Using the Mobility Score developed by BTD as part of the Maximum Parking Ratio effort, development projects will need to select TDM strategies which is based on their Mobility Score (or reach a minimum requirement of 70 points) to satisfy BTD development review requirements. Strategy details are subject to change in future years to reflect emerging trends in travel.

This Technical Justification Document outlines the methodology behind the point system structure, informed by the study's research findings, related efforts within the Boston Transportation Department, and experiences from peer cities. Several dozen research sources were queried. Strategies were also closely tailored to citywide goals cited in the Go Boston 2030 long-range planning exercise, including:

- A reduction in drive alone rates by 50%
- Elimination of all traffic fatalities and severe injuries
- An increase in both access to and use of sustainable transportation modes; and
- Achievement of carbon neutrality by 2050

An overview of the research is highlighted along with key findings from stakeholder interviews conducted in fall 2020. Each strategy included in the TDM Point System is then discussed, with a table showing strategy details followed by a discussion of the research findings associated with each.



# RESEARCH OVERVIEW

The project team reviewed over 50 academic papers, research reports, and key documentation from TDM programs and trip reduction literature to document benefits of individual TDM strategies. Much of the same research which was used to inform the San Francisco's Transportation Demand Management Program (SF TDM) was used for this effort. This is due to both the breadth of research uncovered by that program as well as the body of more recent research since the San Francisco program came online in 2017. Several research sources were found to be particularly helpful for this effort, including:

The "Quantifying Greenhouse Gas Mitigation Measures" report from the California Air Pollution Control Officers Association (CAPCOA), published in 2010. This report served as a linchpin for the SF TDM effort. Transportation and non-transportation related mitigation measures were summarized for their range of effectiveness at reducing greenhouse gas (GHG) emissions, based on available research. As the report indicates a one-to-one relationship between GHG and vehicle miles travelled (VMT), the research allows for comparison of strategies on an equal scale when possible.

Research sources are cited with justifications provided for the GHG emission/VMT reductions which are cited. As with most of the research on the impact of transportation measures on GHG and VMT, the conversation largely focuses on regional-level policies and does not prioritize behavioral changes resulting from enacting TDM policies at a specific level such as a workplace or a residence.

- In addition to serving as an interview resource for this effort, Todd Litman of the Victoria Transport Policy Institute (VTPI) has put forward the Online TDM Encyclopedia

summarizing the research of benefits of TDM policy. The Commuter Financial Incentives (last updated in April 2017) chapter of the Encyclopedia was particularly insightful in helping fill in gaps regarding how commuters, residents, or visitors of different projects respond to changes in prices.

- The Transit Cooperative Research Program (TCRP) Report 95: Traveler Response to Transportation System Changes further defines of changes in the broader transportation network influence individual decision-making. Although the report as a whole was most recently updated in 2013, most of the research referenced was compiled across the 2000s. Chapters on vanpools and buspools, parking pricing and fees, pedestrian and bicycle facilities, and parking management were referenced.
- Fehr & Peers updated the findings of the CAPCOA report as part of a 2019 memo for the Western Riverside Council of Governments in Southern California. This memo directly compares the strategies outlined in CAPCOA with new research discovered since 2010. Where appropriate, more recent references were cited based on this memo.

## RESEARCH FINDINGS

High-level research findings of this effort found:

- **Parking-related and subsidy measures have highest impact** – across the board, the availability and cost of parking near a project site was found to be the most critical factor in determining travel choices. As national-level research presumes a higher share of driving and more scant availability of sustainable travel options than is available in an urban environment like Boston, the ability of reducing parking and incentivizing sustainable modes of transportation to affect mode share in Boston is even greater.
  - **Programmatic strategies boost success of all other strategies** – it is difficult to isolate the effect of any one programming strategy (such as TMA membership or marketing); however, resources indicate that strong programming boosts the success of all other TDM strategies by increasing awareness and facilitating use of these strategies.
  - **Bicycling strategies work best when bundled** – similar to programming strategies, the success of individual bicycle-related strategies in reducing VMT are difficult to call out. This may be due to the limited ability of bicycle trips to substitute for longer-distance vehicle trips.
- Nevertheless, providing several avenues to promote bicycle use allows users to better engage with bicycling. For instance, shower facilities can ease hygiene concerns for commuters and bike share memberships can introduce bicycling as a mode of transport for those who don't own a bicycle or facilitate one-way trips which can be paired with another mode of travel for a return journey.
- **Carpooling is more effective at reducing VMT** – given the longer-distance nature of vehicle commuting, carpooling can be a particularly effective means to reduce VMT. Carpool users are less likely to be residents of Boston if commuting to an office by vehicle but the reduction in vehicles in the proximity of a project site leads to localized environmental and safety benefits.
  - **Car share is less effective at reducing VMT** – carshare may not be the most appropriate for replacing weekday commuting trips; however, benefits accrue as the number of available cars and the network grows in a community and usefulness for residential projects is more pronounced.

One common thread (and limitation) of the available research was an inability to account for the environmental context by which a TDM strategy was instituted. Several research sources cited “regional business districts” and “activity centers” as environments to interpret research findings within, while others distinguished between environments where non-vehicular forms of travel were enabled by the surrounding travel network. Therefore, many vehicle trip reduction estimates are likely to trend higher in the City of Boston, and particularly higher in Downtown Boston, owing to the transit and multimodal travel network. As these travel modes are improved over time, a “knock-on” effect will continue to accrue, as the presence of more individuals bicycling, walking, and taking transit signal to others that these modes of travel are best for satisfying travel needs.

The multi-pronged goals of this effort also complicated the process of selecting point totals for each strategy. Ideally, point totals would reflect research findings with follow-up revisions to account for on-the-ground realities of implementing certain measures. The research was found to be inconsistent in finding vehicle trip reduction, VMT reduction, mode shift, and GHG reduction for each TDM strategy. For some strategies, many of these metrics were available; for others, little research could be found.

The point totals reflected in this effort are largely based on VMT reduction research identified for many strategies, allowing for the best possible strategy-to-strategy comparison of a single anticipated outcome.



# INTERVIEW FINDINGS

Over the week of September 28, 2020, the study team conducted interviews with eight peer cities and research stakeholders to inform the formulation of the point system framework. These eight stakeholders include five cities with robust TDM programs:

- Cambridge (MA)
- San Francisco (CA)
- Seattle (WA)
- Vancouver (BC)
- Watertown (MA)

and three research institutions knowledgeable about the impacts of TDM strategies on travel behavior:

- Metropolitan Area Planning Council
- University of South Florida Center for Urban Transportation Research (Phil Winters)
- Victoria Transport Policy Institute (Todd Litman)

Key findings from these stakeholder interviews are summarized below:

- The broader conversation should be framed. Introduce the opportunity costs of poor TDM and oversupply of parking within the larger development review conversation.
- Structuring point assignments around vehicle miles traveled or the number of parking spaces provided is a best practice.
- Some baseline items can be non-negotiable, such as pre-tax transit subsidies, but flexibility in allowing which TDM measures can be selected is helpful.
- Goal setting should be linked to neighborhoods, such as through BTDC's Mobility Score.
- To reduce negotiations between developers and BTDC, simplicity is important. The list of strategies with point assignments should be limited to the extent practicable.
- Application fees are used by several communities to cover monitoring expenses and program administration; developers prefer that these expenses are upfront.
  1. Vancouver charges by square meter or \$280 per parking space.
  2. San Francisco charges a \$6,000 application fee and a \$1,000 annual monitoring fee.
- Monitoring is important but a medium/long-term issue; it will take time for buildings to reach this stage.

# STRATEGY DEFINITIONS

Each strategy is detailed in the following format:

## POINTS

Point total or point total range

## UPFRONT COST

Cost to enact the strategy during the construction phase, typically for equipment and installation.

- \$ - little (< \$1,000)
- \$\$ - moderate cost (< \$10,000)
- \$\$\$ - significant cost (< \$100,000)
- \$\$\$\$ - major cost (> \$100,000)

## ONGOING COST

Annual cost to maintain the strategy, such as labor costs and upkeep.

- \$ - little (< \$1,000)
- \$\$ - moderate cost (< \$10,000)
- \$\$\$ - significant cost (< \$100,000)
- \$\$\$\$ - major cost (> \$100,000)

## DIFFICULTY LEVEL

Difficulty in implementation based on labor, time, and costs involved. Easy, intermediate, or hard

## DEFINITION

Strategy definition

## LAND USE APPLICABILITY

Land uses for which the strategy applies

## SUBMISSION REQUIREMENTS

Requirements which the project must demonstrate to be issued a TAPA

## MONITORING

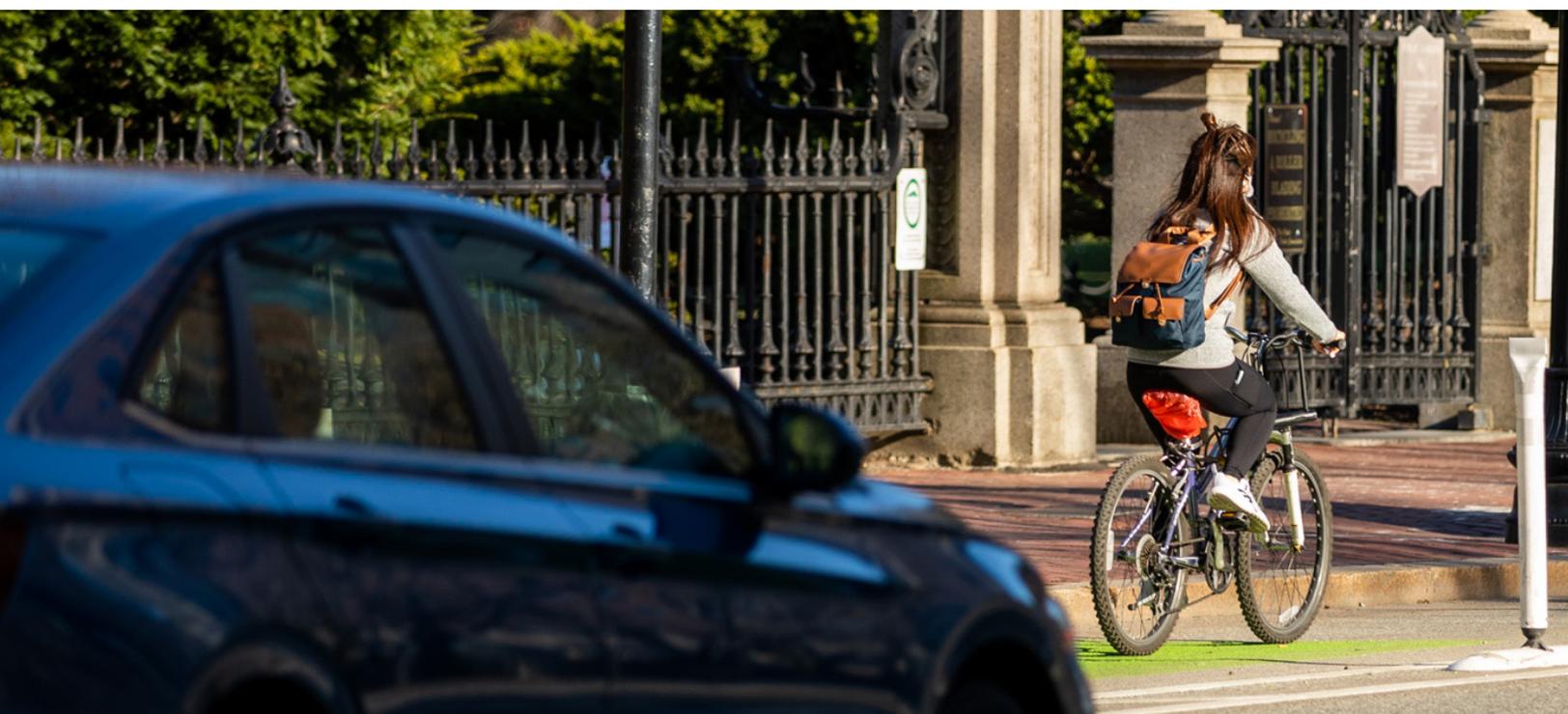
Ongoing monitoring requirements to be shared with BTM

## REDUCTION IMPACT

VMT reduction impacts cited by research, presented as a general range of values

## SOURCES

Research sources cited for anticipated VMT reduction



# BASELINE STRATEGIES

Baseline strategies are required for all Article 80 development projects that are subject to a TAPA, unless achievement of a particular measure is not possible. Points assigned to baseline measures can be applied to the overall point target for a project.

## TMA MEMBERSHIP

<b>Points</b>	5 (unless TMA does not exist in neighborhood) (in combination with other programming strategies)
<b>Upfront Cost</b>	None
<b>Ongoing Cost</b>	\$\$ of \$\$\$\$
<b>Difficulty Level</b>	Easy
<b>Definition</b>	Property owner joins and participates in the local Transportation Management Association (TMA), if available, or if one is formed during the life of the TAPA
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	Demonstrate proof of membership in the local TMA
<b>Monitoring</b>	Every Year - Confirm membership status
<b>Reduction Impact</b>	Anticipated VMT reduction of approximately 5 percent. Research shows 4-5 percent trip reduction impact difference between programs with little support and those with coordination services.
<b>Sources</b>	CAPCOA (2010), TCRP (2010)

Transportation Management Associations (TMAs), like other programming strategies, were found to facilitate the use of other TDM strategies by disseminating information that may not have otherwise reached potential users. Transportation Management Associations can advise property managers, residents, and employers of a project on how to best employ services (such as a carpool matching program) and provide equipment (such as bicycle racks) in pursuit of reducing drive alone rates.

Research which uniquely targets TMAs is largely unavailable given the different forms program support may take shape across the world. For instance, Commute Seattle is a public agency which works with large employers in Seattle, Washington to reduce drive alone commute trips in accordance with the statewide Commute Trip Reduction Law. In Boston, TMAs are privately-operated and tied to specific neighborhoods; they vary in their ability to leverage support programs, exemplified by the Longwood Medical Area's (LMA) MASCO shuttle services.

Public agencies such as the Metropolitan Area Planning Council (MAPC) also provide support services for communities, which in turn can apply assistance to development projects. This web of support service capabilities as well as the numerous built environments they operate in (dense inner cities to suburban, automobile-oriented communities) makes quantifying their effects difficult.

Research from CAPCOA (2010) and TCRP (2010) found programmatic support for TDM strategies result in between one and six percent commute VMT reduction. These numbers trended higher for urban areas, where more non-drive alone options are available. A four percent difference between "low support" and "high support" TDM programs were cited by TCRP in a sample of 82 programs, with high support defined as employers providing most of the possible strategies available.

## ON-SITE TDM COORDINATOR

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<b>Points</b>	5 (in combination with other programming strategies)
<b>Upfront Cost</b>	None
<b>Ongoing Cost</b>	\$\$ of \$\$\$\$
<b>Difficulty Level</b>	Intermediate
<b>Definition</b>	Property owner provides part- or full-time dedicated staff to coordinate TDM services
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	Demonstrate at least 0.25 FTE staff commitment to coordinate TDM services. Developments larger than 200,000 square feet must demonstrate at least 1 FTE staff commitment.
<b>Monitoring</b>	Every year - Identify staff member, contact information and number of hours spent on TDM coordination weekly
<b>Reduction Impact</b>	Anticipated VMT reduction of approximately 5 percent. Research shows 4-5 percent trip reduction impact difference between programs with little support and those with coordination services.
<b>Sources</b>	CAPCOA (2010), TCRP (2010)

On-site TDM coordinators, like other programming strategies, were found to facilitate the use of other TDM strategies by disseminating information that may not have otherwise reached potential users. On-site coordinators, which can include staff with other management responsibilities or employer-specific employees with oversight over employee benefits, typically oversee pursuit of tenant or property transportation goals. These individuals may be responsible for tracking the usage of TDM strategies, such as pre-tax benefits for transit or transit subsidies, and interfacing with consultants or public agencies with regards to monitoring.

On-site TDM coordinators are a common TDM strategy employed for development projects in Boston, with the level of involvement trending with the size of the project. The point system framework seeks to institutionalize this as a requirement for all future Article 80 projects. Like TMAs, on-site TDM coordinators implement TDM strategies and programming for a development's employees and residents. Unlike TMA's, coordinators often interact directly with residents or employees of a project, either in a property managerial capacity or as part of specific tenants.

Research from CAPCOA (2010) found programmatic support for TDM strategies result in between 0.8 and 4 percent commute VMT reduction. TCRP found between a four and five percent difference between "low support" and "high support" TDM programs in a sample of 82 programs; this data included marketing and promotional activities alongside presence of an on-site TDM coordinator.

## MARKETING, EVENTS, AND REAL-TIME TRANSIT INFORMATION

<b>Points</b>	5 (in combination with other programming strategies)
<b>Upfront Cost</b>	\$ of \$\$\$\$
<b>Ongoing Cost</b>	\$ of \$\$\$\$
<b>Difficulty Level</b>	Intermediate
<b>Definition</b>	Property owner distributes annual marketing materials promoting multimodal travel options and benefits, conducts at least two annual events promoting multimodal travel, and provides real-time transit information in building lobbies per BTD review.
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	<p>Distribute marketing materials detailing transportation-related benefits, promotions, and local transportation options, including MBTA stops, bikeshare locations, car share locations, and TDM options available to tenants or employees at beginning of tenant agreement or employment as part of onboarding, and on an annual basis.</p> <p>Conduct at least two events annually promoting multimodal travel, such as a Bike to Work Day or step count competition.</p> <p>Display real-time transit information in building lobbies, per BTD review.</p>
<b>Monitoring</b>	Every year - Share marketing materials and confirmation of events and presence of real-time information source
<b>Reduction Impact</b>	Anticipated VMT reduction of approximately 5 percent. More effective when grouped with other programming strategies.
<b>Sources</b>	CAPCOA (2010), Fehr & Peers (2019)

Marketing and events typically refer to regular programming offered by a TMA, an on-site transportation coordinator, or some other type of committee within a development project which promotes non-drive alone travel options for users of a project. Marketing speaks to materials made available to new users (such as an onboarding employee) and updated and re-distributed on a regular basis, notifying users of TDM options available for their use. Events can take the form of a “Bike to Work” day or week, where bicycle commuters are provided giveaways such as raffles or breakfasts, or an employer or building-wide challenge for individuals or groups to walk or bike.

Real-time transit information refers to the dynamic provision of transit information in building lobbies, allowing visitors to understand when various transit services are arriving at nearby stops and stations.

Research from CAPCOA (2010) found programmatic support for TDM strategies result in between 0.8 and 4 percent commute VMT reduction. Fehr & Peers (2019) found higher figures in support of information services for programs in Arlington, VA (eight percent drive alone trip reduction and 39 percent VMT reduction for county-provided services) and Portland, OR (nine to 13 percent reduction in drive alone trips). No conclusive research could be found at the building-level (as opposed to the station-level provided by a transit agency) of VMT reduction benefits for real-time transit information.

## EMERGENCY RIDE HOME

<b>Points</b>	5 (in combination with other programming strategies)
<b>Upfront Cost</b>	None
<b>Ongoing Cost</b>	\$\$ of \$\$\$\$
<b>Difficulty Level</b>	Easy
<b>Definition</b>	Property owner or employer provides ride services, such as reimbursement of taxi or rideshare trips, outside of peak travel periods, for tenants/employees who use sustainable transportation options
<b>Land Use Applicability</b>	Non-residential
<b>Submission Requirements</b>	<p>Provide a minimum of three emergency ride home trips or reimbursement of taxi or rideshare costs for employees/tenants who have commuted to work by bus, train, carpool, vanpool, bike, or on foot.</p> <p>Services must be provided outside of peak travel periods for transit, enabling use for unexpected emergencies or unscheduled overtime. This should be widely available to tenants with no pre-registration required.</p> <p>Reimbursement must be made no more than one month following submission of receipt.</p>
<b>Monitoring</b>	Every Year - Report usage
<b>Reduction Impact</b>	Inconclusive. Programs can see low utilization but be considered successful given peace of mind provided for multimodal users.
<b>Sources</b>	Nelson\Nygaard (2014)

Guaranteed ride home programs provide transportation, typically for registered users, who use sustainable travel to travel to and from a project site on a regular basis in instances where a ride is needed in an emergency or outside of regular hours for transit services. These services can be provided directly by the property manager or by the employer or be arranged by the user with costs reimbursed.

This programmatic strategy is particularly difficult to quantify benefits for; few commuters plan ahead to use a guaranteed ride home service. The benefit lies in the security of knowing this option is available should a user require immediate transportation in an emergency situation or expects to stay after hours.

A Nelson\Nygaard report in 2014 evaluated guaranteed ride home programs in Alameda County, CA. It estimated nearly 4,000 trips that would have otherwise been taken were eliminated with implementation of a guaranteed ride home program across nearly 300 businesses. However, over the year of analysis the program itself was used only 41 times. Given the research available, no reduction impact has been cited for guaranteed ride home programs.

## PARTICIPATION IN MBTA PERQ PROGRAM

<b>Points</b>	15
<b>Upfront Cost</b>	None
<b>Ongoing Cost</b>	\$ of \$\$\$\$
<b>Difficulty Level</b>	Easy
<b>Definition</b>	Property owner or employer facilitates transit pass purchases (with pre-tax benefits, if applicable) through participation in MBTA's Perq Program.
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	Demonstrate Perq participation
<b>Monitoring</b>	Every Year - Confirm participation
<b>Reduction Impact</b>	Inconclusive research on VMT reduction impact of pre-tax transit benefits. Employer-initiated programs are more likely to attract new transit riders than programs requiring more action of employees themselves.
<b>Sources</b>	TCRP (2005)

MBTA's Perq program allows employers to purchase MBTA transit passes for employees directly from the MBTA, deducting the cost of passes via pretax payroll deductions. This allows transit users to save money over purchasing passes themselves with post-tax dollars, as less taxes are paid. Employers benefit through lessened administrative costs for processing reimbursements. Staff support from the MBTA is available to enable changes to orders on a month-to-month basis, with orders renewing automatically and physical passes sent to Perq customers. Employers are also allowed to deduct less than the transit pass cost from employees paychecks if subsidizing a portion of the transit pass.

TCRP Report 107, published in 2005, details the effectiveness of commuter benefits programs, which includes any arrangement where pre-tax

dollars are used to buy transit passes. This report found evidence that commuter benefit programs are more likely to attract new riders who formerly drove alone as a commute. On average, between one and nine drive alone commutes per 100 employees at worksites are reduced following the introduction of a commuter benefit program. Additionally, transit pass recipients are more likely to use transit for work and nonwork trips. As with other programmatic strategies, reducing the steps needed by users to use a transportation service improves the usage of that service, with greater benefits likely for projects which are more transit accessible.



## UNBUNDLED, MARKET RATE PARKING

<b>Points</b>	15
<b>Upfront Cost</b>	None
<b>Ongoing Cost</b>	\$ of \$\$\$\$
<b>Difficulty Level</b>	Easy
<b>Definition</b>	Property owner provides tenants the option to lease or purchase building space without inclusion of a market rate price for on-site parking. Parking may be leased or purchased by tenants separately at a market rate.
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	<p>Document monthly market rate parking price which reflects the capital and maintenance cost of parking provision.</p> <p>Demonstrate monthly market rate parking price is consistent with market rate parking prices found within one mile of the project site.</p> <p>Demonstrate examples of lease agreements with and without bundling of market rate parking price.</p>
<b>Monitoring</b>	<p>Every Year - Report usage of bundled and unbundled options</p> <p>Every 3 Years - Evaluate market rate charge</p>
<b>Reduction Impact</b>	<p>Anticipated VMT reduction of 10 to 15 percent.</p> <p>Reduction in VMT estimated at 2.6 to 13 percent, based on available research, with up to a 36 percent reduction in VMT found in high-quality transit areas.</p>
<b>Sources</b>	CAPCOA (2010), TCRP (2005)

Unbundled, market rate parking refers to a monetary benefit to forgoing access to on-site parking where that on-site parking would otherwise be made available to tenants of a project site. Commonly, unbundled parking refers to the separation of parking costs from rent for residential tenants. Free or subsidized parking accounts for higher construction costs and lost revenue opportunities. Building less parking would allow for more leasable spaces.

The cost of parking in residential and commercial projects is often passed along to all tenants (whether they use the parking or not). A 2016 journal article analyzing national American Housing Survey data found that the cost of garaged parking to renter households is approximately \$1,700 per year, or an additional 17% of a housing unit's rent<sup>1</sup>. In the article, the authors recommended two policies: first, remove parking minimums, and, second, unbundle parking costs from housing costs.

Many residential tenants may pay for parking that they don't need or office employers may pay for parking which is not fully used by employees. By defining this extra cost and allowing tenants to forego payment, housing and commercial office costs can be kept closer in line and developers can more flexibly allot parking to other users willing to pay for spaces. Over time, parking provision with new development projects will also more accurately reflect travel patterns as revenue for parking space construction will decrease if the space is not actively used.

This strategy is anticipated to produce a 10 to 15 percent decrease in VMT; available research from CAPCOA (2010) and TCRP (2010) estimated the impact to trend lower but evidence of greater results were found in areas with higher transit use, such as Boston.

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<sup>1</sup> Gabbe, C. J. & Pierce, G.. (2016). "Hidden Costs and Deadweight Losses: Bundled Parking and Residential Rents in the Metropolitan United States."

## BICYCLE PARKING/BIKE SHARE PROVISION

<b>Points</b>	5
<b>Upfront Cost</b>	\$\$\$ of \$\$\$\$
<b>Ongoing Cost</b>	\$ of \$\$\$\$
<b>Difficulty Level</b>	Easy
<b>Definition</b>	Developer complies with <a href="#">BTD Bike Parking Guidelines</a> , including provision of short- and long-term parking spaces, showers and changing facilities, monetary contribution to Boston’s bike share system (Bluebikes), space for a bike share station, and provision of an on-site repair station.
<b>Land Use Applicability</b>	All

Demonstrate compliance with BTD Bike Parking Guidelines prior to building occupancy.

Developers have the option of providing an interior on-site repair station or hosting quarterly on-site bicycle repair clinics. At minimum the repair station must include:

- A bike repair stand
- Two identical tire levers;
- Two screwdrivers: one flat head and one phillips;
- Double sided wrenches at the following sizes:  
8, 9, 10, 11, 15, 32 mm;
- Allen wrenches with the following standard sizes:  
2.5, 3, 5, 5, 6, 8mm;
- A pump that works with Schrader and Presta valves;

**Submission Requirements**

On-site bicycle repair clinics must be conducted by trained bicycle mechanics offering free tune-ups to building tenants, on a quarterly basis.

A state of good repair for both indoor and outdoor bike parking spaces, required every three years as part of ongoing project site monitoring, can be demonstrated by adhering BTD's Bike Parking Guidelines. A fully-stocked on-site repair station must also be demonstrated as part of monitoring if provided.

Developers and successors will be responsible for the maintenance of outdoor bike corrals or bike parking spaces, including keeping them clear of trash, debris, and snow.

## BICYCLE PARKING/BIKE SHARE PROVISION

<b>Monitoring</b>	Every 3 Years - Demonstrate state of good repair
<b>Reduction Impact</b>	Anticipated VMT reduction of 0 to 5 percent. Success dependent on provision of additional bicycle-related strategies
<b>Sources</b>	CAPCOA (2010), Pucher et al. (2010), Fehr & Peers (2019)

This measure involves compliance with the City of Boston's Bike Parking Guidelines. As of January 2020, these guidelines obligated different land use types to commit to a set rate of visitor (short-term) parking spaces and employee/resident (long-term) parking spaces, shower and locker facilities, bike share stations, and contribution to the bike share system. The Guidelines note how these requirements differ by land uses, building size, and location; as this is a baseline strategy of the point system, satisfaction of the Guidelines according to the project's specifications will be expected.

Research on bicycle-related incentives showed that strategies worked best in combination with one another; network-level conditions (e.g. on- and off-street bicycle accommodations) and location-specific amenities (e.g. bicycle racks) in tandem improve bicycling rates. The more prevalent a bicycle culture is in place, the more likely it will attract new riders. The inclusion of an interior on-site repair station as part of this strategy helps support a culture, comfort and safety of bicycling.

CAPCOA (2010) estimated a 3 to 21.3 percent reduction in VMT for bicycle-related strategies that are grouped together, including network enhancements, and noted that bicycle-related strategies as standalone measures have limited value. For instance, bicycle parking as a standalone measure in non-residential developments is tied with a 0.625 percent VMT reduction. Pucher et al. (2010) found between a nine and 22 percent increase in cycling with provision of bicycle parking, with higher figures tied to indoor bike parking and shower facilities.

For contributions to the bike share system, CAPCOA (2010) estimates seven percent of bike share users shifting from vehicle travel. Fehr & Peers (2019) estimates VMT reduction of 0.023 miles per day per member, based on estimates from Minneapolis/St. Paul and San Francisco.

# IMPACT STRATEGIES

At least **one of three impact strategies** must be selected due to the impact these strategies have on achieving mode shift and reducing drive alone behavior.

## TRANSIT SUBSIDY

15-30

### Points

**Option 1: 15 points** for subsidy of no less than 25% of transit pass cost

**Option 2: 20 points** for subsidy of no less than 50% of transit pass cost

**Option 3: 25 points** for subsidy of no less than 75% of transit pass cost

**Option 4: 30 points** for full subsidy of transit pass cost

An additional **5 points** is provided if a subsidy of no less than 50% of transit pass cost is combined with provision of platinum-level bike share memberships

### Upfront Cost

None

### Ongoing Cost

\$\$\$\$ of \$\$\$\$

### Difficulty Level

Intermediate

### Definition

Property owner or employer provides a subsidy for monthly MBTA transit passes

### Land Use Applicability

All

Provide subsidy for monthly MBTA transit passes at a 25, 50, 75, or 100 percent level.

### Submission Requirements

Subsidies must be provided based on the home or work location of the user.

Subsidies can be enabled through participation in the MBTA Perq program by deducting less than the full cost of passes from employees' paychecks.

For non-residential users, subsidies must be provided for the life of the TAPA.

For residential users, subsidies are reflected over the first year of resident tenancy, per unit.

## TRANSIT SUBSIDY

### Monitoring

Every Year - Report usage

Every 3 Years - Evaluate subsidy level

The MBTA may track participating developments and employers and may post participating companies on the MBTA website.

### Reduction Impact

Anticipated VMT reduction of over 20 percent.

One research source estimated a 0.3 to 20 percent reduction in commuter VMT, based on available research. However, a 9 to 64 percent trip reduction was found with transit subsidies, depending on the level of subsidy, in regional central business districts.

Controlling for other factors, vehicle trips can also be reduced by 7 percent in TDM programs featuring financial incentives for transit, with estimates of up to 30 percent in areas with good transit and restricted parking.

### Sources

CAPCOA (2010), TCRP (2010), VTPI (2017)

Subsidizing transit expenses is identified as one of the most powerful TDM strategies. Many employers already provide partial or full subsidization of transit expenses for employees; available research found that transit-related subsidies achieved higher vehicle trip reduction rates than subsidies for other modes of travel. Given the robust transit services available in Boston, trip reduction rates are likely to trend higher than available research indicates. This research often captures environments where, even with a subsidy, use of available transit services is not sufficient to meet one's travel needs.

CAPCOA (2010) has estimated between a 0.3 to 20 percent reduction in commute VMT associated with transit subsidies. VTPI (2017) found between a nine and 64 percent trip reduction with transit subsidies, depending on the level of charge, in regional central business districts. This range is between five and 50 percent in activity centers. TCRP (2010) found a seven percent reduction in vehicle trips in employer programs featuring transit subsidies over programs which did not; this source also finds trip reductions of 30 percent in areas with good transit and restricted parking.

## PARKING REDUCTION

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15-30

**Points**

**Option 1: 15 points** for at least 25% less parking than the maximum  
**Option 2: 20 points** for at least 50% less parking than the maximum  
**Option 3: 25 points** for at least 75% less parking than the maximum  
**Option 4: 30 points** for no net new parking

**Upfront Cost**

None

**Ongoing Cost**

None

**Difficulty Level**

Easy

**Definition**

Developer provides on-site parking at a rate below the maximum allowed by BTD's Maximum Parking Ratios Guidelines

**Land Use Applicability**

All

**Submission Requirements**

Demonstrate compliance with Parking Ratios Guidelines prior to building occupancy. Applies to net new parking.

**Monitoring**

None

**Reduction Impact**

Anticipated VMT reduction of 10 to 15 percent, or more.

Reduction in commuter VMT estimated at 5 to 12.5 percent based on available research. Higher VMT reductions are more likely where alternative transportation options are available. Up to a 50 percent VMT reduction for residential land uses has also been cited.

**Sources**

CAPCOA (2010), Fehr & Peers (2019)

This strategy awards extra points for providing parking with new development projects at rates below those called for in BTD's Parking Ratio Guidelines. There is much evidence that parking is overbuilt in comparison to how it is utilized; the Metropolitan Area Planning Council (MAPC) released its [Perfect Fit Parking Study](#) in 2019, finding that the average 50-unit residential building has 50 parking spaces with 14 empty spaces. By cutting off access to the most impactful determinant for drive-alone rates of travel, this strategy builds off the intention of the Parking Ratio effort.

Parking reduction is a cost saving measure in addition to a TDM measure. Building parking is very expensive in Boston. The BPDA's rule of thumb for each garaged parking space is about \$100,000 per space.

A 10 to 15 percent or more reduction in VMT is anticipated with this strategy; CAPCOA (2010) estimated VMT reduction impacts of between five and 12.5 percent. As with many parking-related strategies, the presence of alternative transportation choices supports greater mode share and VMT reduction benefits from provision of less parking. Fehr & Peers (2019) has estimated up to 50 percent VMT reduction in residential land uses.

Provided that parking is not freely or inexpensively available in close proximity to the project site, providing less parking than users would occupy in an unconstrained condition may result in a one-to-one reduction from drive alone trips to alternative methods of travel.

## PARKING PRICING

5-30

**Points**

**Option 1: 5 points** for parking pricing with parking provision of no more than 25% of allotted parking maximum

**Option 2: 10 points** for parking pricing with parking provision of no more than 50% of allotted parking maximum

**Option 3: 15 points** for parking pricing with parking provision of no more than 75% of allotted parking maximum

**Option 4: 20 points** for parking pricing with parking provision of no less than 100% of allotted parking maximum

Additional **5 points** for instituting weekly-only pricing  
 Additional **10 points** for instituting hourly or daily-only pricing

**Upfront Cost**                      **None**

**Ongoing Cost**                      **\$ of \$\$\$\$**

**Difficulty Level**                      Intermediate

**Definition**                              Property owner charges market-rate pricing for use of on-site parking at an hourly, daily, weekly, or monthly rate

**Land Use Applicability**                      All

Document on-street and off-street parking facility rates within one mile of the project site, which may include municipal parking.

Define parking charge, which may not be lower than the lowest identified on- or off-street parking charge.

**Submission Requirements**

For commercial projects, [employees making less than 70% AMI](#) cannot be charged more than the identified market-rate. For residential projects, income-restricted tenants cannot be charged more than the identified market-rate.

Define whether the charge will be collected on an hourly, daily, weekly, or monthly basis.

Charges must be applied at the individual level; employers cannot pay on behalf of employees.

## PARKING PRICING

### Monitoring

Every Year - Report usage

Every 3 Years - Evaluate parking price

### Reduction Impact

Anticipated VMT reduction of 15 to 20 percent.

Reduction in commuter VMT estimated at 0.1 to 19.7 percent based on available research, assuming price is at or above market rate.

Higher estimates are more likely for higher charges in urban locations. A 12 to 47 percent trip reduction was found with parking fees, depending on the level of charge, in regional central business districts.

### Sources

CAPCOA (2010), Lovejoy et al. (2013), VTPI (2017),

Instituting parking pricing is one of the most powerful mechanisms for influencing individual changes in travel patterns. When faced with a direct charge for parking a vehicle, as opposed to the indirect charges that accumulate for maintenance and upkeep, users must contend with a “penalty” of sorts for driving. For this reason, this strategy provides more points for daily and weekly charges. Users are more likely to use other modes on certain days or weeks (such as nice weather days or weeks working less than a full schedule) than if a monthly charge ensured parking would be available.

The 15 to 20 percent VMT reduction estimate is based on the presence of sustainable travel options in Boston; the high market price in Boston (particularly downtown) is seen as prohibitive by potential users. However, pricing mechanisms can have little effect where few alternatives are available, or the price is set below market-level.

CAPCOA (2010) estimated a wide range of impacts of between 0 and 20 percent, speaking to the variability of the pricing scheme.

Trip reduction rates were found to approach 50 percent in downtown locations in instances where high rates were applied (VTPI 2017). In Portland, Oregon, every 10 percent increase in a parking charge was associated with a 5.8 percent decrease in demand for parking spaces, with a greater effect with higher baseline parking charges (Lovejoy et al. 2013).

This strategy also provides fewer points in the event that less parking is provided by the applicant; this offsets the greater number of points which can be acquired in the Parking Reduction strategy with less parking. By providing less on-site parking, fewer project site users confront the decision that a parking price demands and the influence of the strategy becomes more limited.

# ELECTIVE STRATEGIES

After selecting at least one impact strategy, all remaining elective strategies are eligible to be selected to satisfy the project's point target. Additionally, at least **one elective strategy each must be bicycle-related and SOV reduction-related**, unless the selected impact strategy satisfies this requirement.

## BIKE SHARE MEMBERSHIP SUBSIDY

5-8

### Points

**Option 1: 5 points** for bronze-level bike share memberships

**Option 2: 6 points** for silver-level bike share memberships

**Option 3: 7 points** for gold-level bike share memberships

**Option 4: 8 points** for platinum-level bike share memberships

An additional **5 points** is provided if platinum-level bike share memberships are combined with a subsidy of no less than 50% of transit pass costs.

### Upfront Cost

None

### Ongoing Cost

\$\$ of \$\$\$\$

### Difficulty Level

Easy

### Definition

Property owner or employer provides discounted bike share memberships as part of the Bluebikes Corporate Program

### Land Use Applicability

All

### Submission Requirements

Provide subsidy for bike share memberships as part of the [Bluebikes Corporate Program](#) at a bronze, silver, gold, or platinum level. For non-residential users, subsidy will be for life of the TAPA. For residential users, subsidy will be per unit for the first year of resident tenancy.

### Monitoring

Every year - Report usage

Every 3 Years - Evaluate subsidy level

BTD may collaborate with Bluebikes to monitor participation.

### Reduction Impact

Anticipated VMT reduction of 0 to 2 percent. Available estimate of VMT reduction of 0.023 miles per day per member.

### Sources

CAPCOA (2010), Fehr & Peers (2019)

Since launching in 2011, more than 12 million trips have been taken on Bluebikes. At the end of 2020, 365 stations and 3,750 bicycles were in operation. This wide-ranging network positions bike sharing as a readily-available option to complete short-distance trips in Boston.

The average Bluebikes trip distance in 2019 was 2.05 miles. Given the ability of bike sharing to complete short-distance trips, it is unlikely that a bike share trip is directly substituting for an automobile trip. Rather, a bike share trip may facilitate first and last mile connections between a project and a connecting transportation service, such as a transit station, providing an indirect substitute for a longer-distance automobile trip.

Research on the influence of bike share on mode shift is mixed. CAPCOA (2010) estimated seven percent of bike share users are shifting from vehicle travel, also finding that 23 and 43 percent of bike

share trips would have been made by automobile in Minneapolis and Denver, respectively. Fehr & Peers (2019) estimated VMT reduction of 0.023 miles per day per member, based on estimates from Minneapolis/St. Paul and San Francisco.



## E-BIKE/E-CARGO BIKE PROGRAM

<b>Points</b>	5
<b>Upfront Cost</b>	\$\$ of \$\$\$\$
<b>Ongoing Cost</b>	\$\$ of \$\$\$\$
<b>Difficulty Level</b>	Easy
<b>Definition</b>	Property owner provides on-site e-bikes and/or e-cargo bikes for use by project tenants. This strategy is more appropriate for use at project sites with challenging topography.
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	<p>E-bikes and/or e-cargo bikes must be made available to all building residents and tenants. Either type of bike may be provided; at least three e-bikes or at least one e-cargo bike can be provided to meet the submission requirement; specific e-bike and e-cargo bike purchases subject to review by BTB.</p> <p>Bicycles must be in working order with pedal assist/electric assist; if broken, repair or replacement of the bicycle must take place within one month following the report of the issue.</p> <p>Space for developer-provided e-bike/e-cargo bikes cannot count towards bike parking provision.</p> <p>Charging mechanism must be in place.</p> <p>Refer to <a href="#">BTB's Bike Parking Guidelines</a> or the BTB website for more information on e-bikes and e-cargo bikes.</p>
<b>Monitoring</b>	<p>Every year - Report usage</p> <p>Every 3 years - Demonstrate state of good repair</p>
<b>Reduction Impact</b>	Anticipated VMT reduction of 0 to 5 percent. Research shows every 1 percent increase in e-bike mode share leads to a 0.66 percent decrease in VMT.
<b>Sources</b>	MacArthur et al. (2018)

E-bikes and e-cargo bikes are a relatively new urban transportation technology. Due in part to the infancy of this technology, limited research is available showing the influence of e-bikes and e-cargo bikes on mode share and VMT reduction. MacArthur et al. (2018) found that 72.4 percent of e-bike utilitarian miles replaced person miles that otherwise would have been traveled by car; every one percent increase in e-bike mode share led to a 0.66 percent decrease in VMT.

Research indicated that the average e-cargo bike cost roughly three times more than the average e-bike; to satisfy the submission requirement, at least one e-cargo bike or at least three e-bikes can be purchased.<sup>2 3 4</sup>

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<sup>2</sup> <https://easybiking.com/how-much-does-a-cargo-e-bike-cost-what-is-the-price/>

<sup>3</sup> <https://reallygoodebikes.com/collections/class-1-pedal-assist-pas>

<sup>4</sup> [https://www.thebikeshoppe.com/product-list/class-1-electric-bikes-pg1427?&rb\\_ct=1272](https://www.thebikeshoppe.com/product-list/class-1-electric-bikes-pg1427?&rb_ct=1272)

## ADDITIONAL BIKE PARKING SPACES

2-5

### Points

**Option 1: 2 points** for bike parking provision of no less than 125% of requirement

**Option 2: 3 points** for bike parking provision of no less than 150% of requirement

**Option 3: 4 points** for bike parking provision of no less than 175% of requirement

**Option 4: 5 points** for bike parking provision of no less than 200% of requirement

### Upfront Cost

\$\$ of \$\$\$\$

### Ongoing Cost

\$ of \$\$\$\$

### Difficulty Level

Easy

### Definition

Developer provides additional short- or long-term bike parking spaces above the minimum rates in [BTD's Bike Parking Guidelines](#)

### Land Use Applicability

All

Demonstrate compliance with [BTD Bike Parking Guidelines](#) prior to building occupancy.

A state of good repair for both indoor and outdoor bike parking spaces, required every three years as part of ongoing project site monitoring, can be demonstrated by adhering to [BTD's Bike Parking Guidelines](#).

For indoor bike parking, all additional bike parking must be on the first floor.

### Submission Requirements

Developers and successors will be responsible for maintenance of bike parking spaces, including keeping them clear of trash, debris, and snow.

If a development is near or adjacent to an MBTA transit station or key bus stop, the project proponent may, with MBTA approval, install the additional bike parking spaces at MBTA property. The project proponent must receive MBTA approval of the installation before BTD will consider whether the installation qualifies for points.

### Monitoring

Every 3 Years - Demonstrate state of good repair

## ADDITIONAL BIKE PARKING SPACES

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**Reduction Impact** Anticipated VMT reduction of 3 to 5 percent. Success depends on provision of additional bicycle-related strategies.

**Sources** CAPCOA (2010), Pucher et al. (2010)

Proponents can earn extra points for providing bicycle parking above the City of Boston's Bike Parking Guidelines. As noted elsewhere, research on bicycle-related incentives showed that strategies worked best in combination with one another; network-level conditions (e.g. on- and off-street bicycle accommodations) and location-specific amenities (e.g. bicycle racks) in tandem improve bicycling rates. The more prevalent a bicycle culture is in place, the more likely it will attract new riders.

CAPCOA (2010) estimated a three to 21.3 percent reduction in VMT for all bicycle-related strategies are grouped, including network enhancements. Bicycle parking as a standalone measure in non-residential developments is tied with a 0.625 percent VMT reduction. Pucher et al. (2010) found between a nine and 22 percent increase in cycling with provision of bicycle parking.

## MULTIMODAL TRANSPORTATION SUBSIDY

<b>Points</b>	10
<b>Upfront Cost</b>	None
<b>Ongoing Cost</b>	\$\$ of \$\$\$\$
<b>Difficulty Level</b>	Intermediate
<b>Definition</b>	Property owner or tenant provides a monthly subsidy for multimodal travel expenses, such as bicycle maintenance
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	<p>Provide subsidy for monthly multimodal travel expenses at a rate equivalent to 25 percent of a monthly <a href="#">MBTA Link Pass</a> cost.</p> <p>Eligible expenses include: purchase of a bicycle, e-bike, kick scooter, or kick e-scooter; bicycle maintenance; clothing and gear, including footwear; safety devices and equipment; mileage reimbursement for carpooling and vanpooling; reimbursement for travel on RTA and other non-MBTA transit services; and other expenses as raised by a user.</p> <p>Subsidy should be provided as a pre-tax benefit.</p>
<b>Monitoring</b>	<p>Every year - Report usage</p> <p>Every 3 years - Evaluate subsidy level</p>
<b>Reduction Impact</b>	Anticipated VMT reduction of 10 to 15 percent. Mode-neutral subsidies show strong experience in VMT reduction, whereas bicycle-centric subsidies trend lower.
<b>Sources</b>	VTPI (2017)

This strategy aims to be more diverse than the Transit Subsidy strategy by expanding support services for all types of multimodal commuters. Direct provision of or reimbursement for equipment and maintenance of bicycles, bicycle-related gear (including clothing and safety devices), as well as reimbursement for carpool or vanpool mileage or travel on non-MBTA services are all expenses this strategy aims to subsidize for users.

Given the universe of potential expenses, applicants should be flexible in considering the needs of potential users of this strategy. Many bicycles cost in the range of \$1,000 and e-bikes can retail for less than \$2,000. Annual maintenance costs for bicycles are difficult to estimate given many conduct their own repairs, but \$300 has been cited in reports.<sup>5</sup> Conversely, owning and operating a new vehicle exceeded \$9,000 per year in 2020<sup>6</sup>, according to AAA, whereas annual costs for an MBTA LinkPass begin at \$1,080 as of spring 2021.

With this strategy defined as subjectively as it is, related research is difficult to find. VTPI (2017) found between a six and 54 percent trip reduction with mode-neutral subsidies, depending on the level of subsidy, in regional central business districts. VTPI also references other research sources define results by mode-specific strategies, such as a finding of 2.7 percent reduction in drive alone mode share with bicycle subsidies. A 10 to 15 percent VMT reduction has been cited for this effort given the expansiveness of eligible expenses.

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<sup>5</sup> <https://www.bicycling.com/rides/a20024531/how-much-do-you-spend-on-cycling-gear-every-year/>

<sup>6</sup> <https://www.aaa.com/autorepair/articles/average-annual-cost-of-new-vehicle-ownership>

## PARKING CASH OUT

<b>Points</b>	<b>10</b>
<b>Upfront Cost</b>	<b>None</b>
<b>Ongoing Cost</b>	<b>\$\$ of \$\$\$\$</b>
<b>Difficulty Level</b>	Intermediate
<b>Definition</b>	Property owner or employer provides monthly payment for users to forgo on-site parking when parking is made available for free or at a subsidized rate. Payment is equivalent to the monthly market cost of the space.
<b>Land Use Applicability</b>	Non-residential
<b>Submission Requirements</b>	Document monthly market rate parking price which reflects the capital and maintenance cost of parking provision.  Demonstrate monthly market rate parking price is consistent with market rate parking prices found on site or within one mile of the project site.
<b>Monitoring</b>	Every Year - Report usage  Every 3 Years - Evaluate market rate charge
<b>Reduction Impact</b>	Anticipated VMT reduction of 5 to 10 percent reduction.  Reduction in commuter VMT estimated at 0.6 to 7.7 percent based on available research, with higher estimates in large metropolitan, high transit-use areas.  Other research sources have estimated a 12 percent potential reduction in VMT as well as a 26 percent reduction in parking demand in areas with good public transit
<b>Sources</b>	Shoup (1997), CAPCOA (2010), VTPI (2017)

Parking cashout refers paying users whom would otherwise have access to on-site parking to forego use of that parking when it is otherwise made available for free or at a below market rate. This benefits developers and property owners by more properly distributing the on-site parking supply to users who require or desire on-site parking on a regular basis. Any remaining capacity can be rented to nearby users, creating an extra revenue stream. Those accepting cashouts benefit from extra revenue in exchange for a perk that is not well-valued and are prevented from engaging in single-occupancy vehicle use to the project site.

A lower VMT reduction benefit is associated with this strategy, as reflected in the scoring. Similar to other parking-related strategies, higher reduction estimates are associated with denser environments with higher transit-use, but CAPCOA (2010) caps the reduction in commuter VMT at below eight percent. Other research sources estimate an average 12 percent reduction in VMT (Shoup 1997) as well as a 26 percent reduction in parking demand in areas with good public transit (VTPI 2017).

One of the key benefits of parking cashout is the influence of long-term behavioral change from bringing about restricted access to free or subsidized parking. However, the continued provision of inexpensive parking does little to influence behavioral change from those who would prefer to park.

## CARPOOL PROGRAM WITH PREFERENTIAL SPACES

	5-10
	5 points for selecting strategy
<b>Points</b>	<p><b>Additional 5 points if:</b></p> <ul style="list-style-type: none"> <li>• an institution, medical campus, or other development of more than 200,000 square feet, or</li> <li>• if carpool parking is priced at a discount of at least 50% of the normal rate</li> </ul>
<b>Upfront Cost</b>	\$\$ of \$\$\$\$
<b>Ongoing Cost</b>	\$\$ of \$\$\$\$
<b>Difficulty Level</b>	Intermediate
<b>Definition</b>	Property owner or employer provides carpool matching services with preferential and (if parking pricing exists) discounted parking close to building entrances
<b>Land Use Applicability</b>	All
	Provide car matching as a service for tenants and employees, either through the on-site transportation coordinator or TMA.
<b>Submission Requirements</b>	<p>Car matching services must allow users to identify and track availability of rides to/from home and work destinations, such as through a website or app.</p> <p>Signage and pavement markings must designate the parking space(s), with vehicles identified by hangtags. Active enforcement must be practiced.</p>
<b>Monitoring</b>	Every Year - Report usage
<b>Reduction Impact</b>	Anticipated VMT reduction of 5 to 10 percent. Estimates are higher with support from TMAs and in urban areas
<b>Sources</b>	CAPCOA (2010), VTPI (2017)

Carpooling holds a distinct place among TDM programs in that it is uniquely aimed at diverting long-distance drive alone trips. Long encouraged at the state level, incentivizing carpooling trips reduces congestion on state highways and local roadways while achieving cost savings for users. Perks to facilitate carpool trips, including matching programs and preferential parking, have long been hallmarks of TMA programs. However, it's worth noting that many work-related trips beginning and ending within Boston are unlikely to involve carpooling, and incentives to shift any type of driving trip to transit, bicycling, or walking is more heavily-incentivized by the point system.

CAPCOA (2010) estimated between a one and 15 percent reduction in commute VMT, when implemented in the context of support services (such as a matching program provided through a TMA or on-site TDM coordinator) with full funding. Estimates are closer to 15 percent in urban areas. Other data cited by VTPI (2017) found vanpool and high-occupancy vehicle subsidies with a drive alone mode share could result in a VMT reduction of 5.4 percent and up to 28 percent in regional central business districts, respectively.



## CAR SHARE MEMBERSHIP/SUBSIDY

	2-4
<b>Points</b>	<p><b>Option 1: 2 points</b> for subsidy of no less than 50% of car share membership cost</p> <p><b>Option 2: 4 points</b> for full subsidy of car share membership cost</p>
<b>Upfront Cost</b>	None
<b>Ongoing Cost</b>	\$\$ of \$\$\$\$
<b>Difficulty Level</b>	Easy
<b>Definition</b>	Property owner or tenant provides a subsidized membership to a car share service for users
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	Provide a 50% or 100% annual subsidy for car share memberships through a service that has vehicle availability within one-half mile.
<b>Monitoring</b>	<p>Every Year - Report usage</p> <p>Every 3 Years - Evaluate subsidy level</p>
<b>Reduction Impact</b>	Anticipated VMT reduction of 0 to 5 percent. The size and age of citywide car share reductions are linked with higher VMT reduction, suggesting higher estimates in Boston.
<b>Sources</b>	Cervero et al. (2007), CAPCOA (2010), Martin et al. (2011)

Provision of a car share membership, or subsidy to be applied towards a membership, allows residents and workers in the city to have access to an automobile if needed for certain trips. This achieves cost savings for the user; by forgoing ownership and operation of a personal automobile, carshare users can save \$9,282 annually<sup>7</sup> (assuming new vehicle ownership). Meanwhile, expansive car share networks such as Zipcar provide several locations to start and end trips from, allowing for simple trips such as errand running or longer daytrips outside the city.

Research on the effect of carshare in reducing drive alone trips is mixed; CAPCOA (2010) estimated a small impact of 0.4 to 0.7 percent reduction in VMT. The size and age of citywide programs are positively linked with VMT reduction (Cervero et al. 2007 and Martin et al. 2011), suggesting more impactful VMT reductions in a Boston context. These studies measured long-term buildout of city and regional car share networks; given the presence of car share services in Boston for several years, many potential users are likely to be familiar and accustomed to programs.

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<sup>7</sup> <https://www.aaa.com/autorepair/articles/average-annual-cost-of-new-vehicle-ownership>

## CAR SHARE PARKING

3-6

### Points

**Option 1: 3 points** for car share parking

**Option 2: 4 points** for EV car share parking

**Option 3: 5 points** for publicly-accessible car share parking

**Option 4: 6 points** for publicly-accessible EV car share parking

### Upfront Cost

\$\$\$ of \$\$\$\$ (based on the average cost of a parking space in Boston)

### Ongoing Cost

\$ of \$\$\$\$

### Difficulty Level

Intermediate

### Definition

Developer provides a minimum of one car share vehicle(s) that is accessible 24 hours a day, seven days a week.

### Land Use Applicability

All

Provide a minimum of one car-share vehicle accessible 24 hours a day, seven days a week. The car-share vehicle can be privately managed or be provided by a third-party car share operator.

If a third-party car share operator is chosen, the parking space and infrastructure necessary to operate the car share service must be provided.

The car-share vehicle(s) must have its own designated parking space identified through signage and pavement markings.

If an EV car share, EV charging infrastructure must be accessible on the property, and if not dedicated to the car share vehicle, a plan of how the car share vehicle will be able to access the EV charging infrastructure must be provided.

### Submission Requirements

Developers must provide documentation that a car share company will be operating the space. Documentation may include a signed contract with a car share operator or, if privately managed, a sales invoice for car share vehicle and operating policies and procedures that indicate how users will have 24-hour access to the vehicles.

To receive points for being publicly-accessible, the car share vehicle(s) must be available to the public 24 hours a day, 7 days a week.

## CAR SHARE PARKING

<b>Monitoring</b>	Every year – Report Usage
<b>Reduction Impact</b>	Anticipated VMT reduction of 0 to 5 percent. The size and age of citywide car share reductions are linked with higher VMT reduction, suggesting higher estimates in Boston.
<b>Sources</b>	Cervero et al. (2007), CAPCOA (2010), Martin et al. (2011)

Access to on-site car share services allows for a higher likelihood that potential car share users will take up car share memberships and existing members will take more trips. Improving access to car share allows the service to take on a more prominent role in users' day-to-day experiences, providing further incentive to forego ownership and operation of a personal automobile.

Research on the effect of carshare in reducing drive along trips is mixed; CAPCOA (2010) estimated a small impact of 0.4 to 0.7 percent reduction in VMT. The size and age of citywide programs are positively linked with VMT reduction (Cervero et al. 2007 and Martin et al. 2011), suggesting more impactful VMT reductions in a Boston context. These studies measured long-term buildout of city and regional car share networks; given the presence of car share services in Boston for several years, many potential users are likely to be familiar and accustomed to programs.

## SHUTTLE SERVICE

	<b>5-10</b>
<b>Points</b>	<p><b>Option 1: 5 points</b> if service operates during peak periods only</p> <p><b>Option 2: 10 points</b> if service operates both during and outside of peak periods</p>
<b>Upfront Cost</b>	\$\$\$ of \$\$\$\$
<b>Ongoing Cost</b>	\$\$\$\$ of \$\$\$\$
<b>Difficulty Level</b>	Difficult
<b>Definition</b>	Property owner provides a shuttle service to connect project users with nearby transit stations or activity centers
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	<p>Shuttle service schedule must, at a minimum, coincide with increased activity at the nearby transit station or activity center, such as the arrival or departure of a bus or train.</p> <p>At least three morning and evening peak period (7-9A and 4-6P) services must be provided.</p> <p>Shuttles cannot be redundant of existing MBTA services unless it enhances the service.</p> <p>All services must be made available for public use. A small fee may be charged for public use of shuttles.</p> <p>A schedule and routing for service will be required as part of the Article 80 review process. These must be made available on a project website for public consumption.</p> <p>If shuttle services are provided within one mile of the project site, the developer must contact the service provider to evaluate the feasibility of jointly operating service. This includes on-demand shuttle services.</p> <p>All new shuttle routes must be approved by BTM and the MBTA. Requirements may be pared back if operated by a TMA.</p>

## SHUTTLE SERVICE

<b>Monitoring</b>	Every Year (and as requested) - Report usage, including ridership figures
<b>Reduction Impact</b>	Anticipated VMT reduction of 0 to 5 percent. Services operate best when connecting large sites without last-mile connections to transit services.
<b>Sources</b>	CAPCOA (2010), Fehr & Peers (2019)

In Boston, the context of the shuttle service is critical; provision may be more appropriate for project sites with lacking last mile connections to transit with a large potential user base, such as through a partnership with a local TMA. However, redundancy with available transit services may result in unnecessary congestion on local roadways, and a stronger focus on transit subsidies and other transit-supportive strategies more appropriate.

In San Francisco's TDM program, shuttle bus services allow for the satisfaction of many points, but services cannot replicate existing transit service lines.

CAPCOA (2010) has estimated between a 0.3 to 13.4 percent reduction in commuter VMT, although these findings cover vanpool provision as well. Fehr & Peers (2019) estimates between 1.4 and 6.8 percent reduction in commute vehicle trips due to employer shuttle programs. This program encourages shuttle services in areas with minimal last-mile connections to existing transit and should be discouraged in other contexts.

## BUS STOP IMPROVEMENTS

<b>Points</b>	2-4  <i>Option 1: 2 points</i> for provision of a bench <i>Option 2: 4 points</i> for provision of a shelter
<b>Upfront Cost</b>	\$\$\$ of \$\$\$\$
<b>Ongoing Cost</b>	\$\$ of \$\$\$\$
<b>Difficulty Level</b>	Intermediate
<b>Definition</b>	Developer provides improvements, including accessibility upgrades and installation or upgrade of shelters, for bus stops which serve the project
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	<p>Identify all bus stops anticipated to provide access to the project site.</p> <p>Follow guidelines of the MBTA Bus Stop Planning &amp; Design Guide for all identified stops.</p> <p>If sidewalk space is available for a bus shelter, this must be provided. An option to provide a bench if sidewalk space is limited is also available.</p> <p>A state of good repair (including maintenance), required every three years as part of ongoing project site monitoring, can be demonstrated by adhering the MBTA Bus Stop Planning &amp; Design Guide.</p>
<b>Monitoring</b>	Every 3 Years - Demonstrate state of good repair
<b>Reduction Impact</b>	Inconclusive. Little research is available linking bus stop improvements and VMT reductions.
<b>Sources</b>	

Research was limited on the ability of bus shelter improvements to entice new transit ridership from motorists. Much in the same way of transit vehicle quality, including amenities such as on-board wireless internet, provision of bus shelters is considered a measure which affords a greater degree of respect for transit users. Creating a more welcoming travel experience may attract new trips as the gulf between operation of a private vehicle and use of a public transit service becomes less pronounced.



## MIXED-USE DEVELOPMENT

5-20

**Points**

**Option 1: 5 points** for a fitness center component  
**Option 2: 10 points** for a convenience store or grocery store component  
**Option 3: 15 points** for a child care component

Additional **5 points** for a centralized parcel drop-off/receiving station

**Upfront Cost**                      **None**

**Ongoing Cost**                      **None**

**Difficulty Level**                      Easy

**Definition**

Developer constructs secondary land uses which can offset trips elsewhere or incorporates a centralized parcel drop-off/receiving stations into any residential component of the project.

**Land Use Applicability**                      All

**Submission Requirements**

With the exception of centralized parcel drop-off/receiving stations, points are not additive. Presence of more than one component will result in provision of highest-scoring component.

Mixed-use components subject to interpretation by BTM during the development review process; additional points may be considered in conversation with BTM.

**Monitoring**                              Every Year - Confirm mixed-use status

**Reduction Impact**

Anticipated VMT reduction of 0 to 10 percent. Research is focused on diversity of land uses nearby project sites, suggesting impact of any one project may be limited in a setting such as Boston's.

**Sources**                                      CAPCOA (2010)

As is broadly demonstrated throughout this report, increasing urban form density is associated with fewer vehicle trips. This is due to the increased mix of uses within close proximity to one's home or workplace; as demand for walking, biking, and transit use increases due to the inappropriateness of vehicle travel to satisfy these types of trips, the quality of these travel networks adjusts as well.

Research on the benefits of mixed-use neighborhoods shows considerable VMT reduction stemming from an ability to walk, bike, or take transit to more destinations across several time periods (CAPCOA 2010). However, it is important to note that this research is limited to the neighborhood-level and not on a building-specific level. With Boston's diverse land use patterns and walkable neighborhoods, adding more residential and commercial options in a mixed-use environment may have negligible impacts on travel patterns.

The provision of a centralized parcel pick-up/drop-off location for residential projects is aimed at reducing off-site trips to mailboxes or post offices. Although not a strict VMT reduction feature, a primary benefit of a centralized parcel pick-up/drop-off location is reduced idling time for delivery vehicles on streets, preventing vehicle blockage of bicycle or general travel lanes.

## BUNDLING TRANSPORTATION OPTIONS (GOHUBS!)

<b>Points</b>	4
<b>Upfront Cost</b>	\$\$ of \$\$\$\$
<b>Ongoing Cost</b>	\$\$ of \$\$\$\$
<b>Difficulty Level</b>	Intermediate
<b>Definition</b>	Developer identifies publicly-accessible space around the development to collocate transportation options such as car share, bike share, bike parking, electric vehicle charging, passenger pick-up/drop, bike parking, and e-bike/e-scooter charging stations. This space may be adjacent to a public street that allows for transportation options to be located curbside.
<b>Land Use Applicability</b>	All
<b>Submission Requirements</b>	<p>The developer must design and install at the space elements of greening, placemaking, and seating, which could include WiFi, device charging, real time arrival information, community information, and other elements that support the intent of the <a href="#">GoHubs! Program</a>. The developer may locate other TDM strategies they are implementing, such as bike share, bike parking, and others at this location.</p> <p>Collocated transportation options should be coordinated with BTM during the development review process. If a development is near or adjacent to an MBTA transit station or key bus stop, the project proponent may, with MBTA approval, collocate transportation options on MBTA property.</p>
<b>Monitoring</b>	<p>Every Year - Confirm program status</p> <p>Every 3 Years - Demonstrate state of good repair</p>
<b>Reduction Impact</b>	Anticipated VMT reduction of approximately 5 percent. Research shows 4-5 percent trip reduction impact difference due to programmatic support of TDM strategies, of which transportation hubs mimic. The program is currently being piloted by the City and monitored.
<b>Sources</b>	CAPCOA (2010), TCRP (2010)

Bundling of transportation amenities is anticipated to achieve VMT reduction similar to those featured in the programmatic strategies, such as via provision of a TDM coordinator. By providing easier access to TDM resources, in this case by locating several options in one location, the visibility of and access to these resources is heightened.

Research from CAPCOA (2010) and TCRP (2010) found programmatic support for TDM strategies result in between one and six percent commute VMT reduction. These numbers trended higher for urban areas, where more non-drive alone options are available. A four percent difference between “low support” and “high support” TDM programs were cited by TCRP in a sample of 82 programs, with high support defined as employers providing most of the possible strategies available.

As many of these strategies are reflected elsewhere in the TDM Point System, this strategy is meant to provide an extra incentive for adoption of transportation options.

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To view this report online, go to [boston.gov/tdmpointsystem](http://boston.gov/tdmpointsystem).

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