BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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TECHNICAL MEMORANDUM

DATE: **January 19, 2017**
TO: **Boston Region Metropolitan Planning Organization**
FROM: **Ryan Hicks and Casey-Marie Claude**
RE: **Pedestrian Level-of-Service Memorandum**

Many commuters travel in the Boston region by walking at some point during their daily routine. However, not all walkways, sidewalks, and pedestrian facilities in the Boston region are in the best condition to accommodate pedestrians. At present there is no formal way to determine the pedestrian friendliness of transportation facilities in the region. The goal of this study—which was funded through the Unified Planning Work Program—was to create a performance monitoring tool for the pedestrian environment. This tool could potentially be used to monitor pedestrian mobility for the development of the Long-Range Transportation Plan (LRTP) or to evaluate projects in the Transportation Improvement Program (TIP), among other uses. In addition to the beneficial use for the Boston Region Metropolitan Planning Organization (MPO), this tool could be used by planners, engineers, and other professional staff to evaluate the suitability of pedestrian facilities.

Over the years, several organizations nationwide researched and implemented pedestrian monitoring programs. Typically, these programs assessed pedestrian level of service (PLOS) to monitor the pedestrian environment. MPO staff noted, however, that the term “level of service” (LOS) has been stigmatized recently for two reasons:

- First, it is believed that the quality of a roadway or intersection should be measured for multiple transportation modes, rather than a single mode of travel.
- Secondly, many pedestrian infrastructure advocates believe that pedestrian facilities should be scored on several categories, such as safety or system preservation, rather than given one cumulative rating.

Therefore, this project focused on developing a Pedestrian Report Card Assessment (PRCA) rather than PLOS. The PRCA tool will set a standard for measuring the pedestrian friendliness of intersections and roadway segments, which planners can use to grade any intersection or street.

The first section of this memorandum summarizes pertinent research, analyses, and applications of pedestrian environment performance monitoring by various organizations over the last 15 years. The memorandum then discusses the considerations that went into selecting performance measures for use in the Boston region that are best suited for gauging progress towards MPO goals, test runs that were conducted on the performance measures by examining real time situations at selected intersections and roadway segments, and the creation of scoring criteria for each measure. This document concludes by presenting the final PRCA, a potential tool for scoring the quality of the pedestrian travel environment at a specific location.

1 LITERATURE REVIEW AND PREVIOUS STUDIES

This section provides an overview of various tools for measuring LOS that were discovered during a literature search. The strengths and weaknesses of each tool are discussed.

1.1 Sprinkle Consulting LOS Model

The Sprinkle Consulting LOS model was sponsored by the Florida Department of Transportation and was created by Sprinkle Consulting in 2001.[1] The model was created to ascertain how comfortable pedestrians are when using pedestrian facilities. To develop the model, Sprinkle Consulting relied on two methods of feedback. First, they conducted scenario planning to evaluate how pedestrians react in different traffic situations. Secondly, they distributed surveys to pedestrians in order to identify what makes an environment comfortable for pedestrians. The Sprinkle Consulting model is based on several factors: personal safety, personal security, architectural interest, sidewalk shade, pedestrian lighting and amenities, presence of other pedestrians, and conditions at intersections. The LOS is graded from A to F, with heavy vehicular traffic considered as having a negative effect on pedestrian safety.

In 2010, the Florida Department of Transportation began transitioning from the Sprinkle Consulting model to Art Plan, which is a different method for determining PLOS.[2] The only difference between the two methodologies is that the Art Plan

[1] Bruce Landis, P.E, AICP, Venkat Vattikuti, MS, Russell Ottenberg, AICP, Douglas McLeod and Martin Guttenplan, "Modeling the Roadside Walking Environment: A Pedestrian Level of Service," accessed September 1, 2016, http://www.sprinkleconsulting.com/Images/UserSubmitted/Modeling%20the%20Roadside%20Environment_A%20Pedestrian%20Level%20of%20Service.pdf

[2] Florida Department of Transportation, *2009 Quality Level of Service Handbook,* http://www.dot.state.fl.us/planning/systems/programs/sm/los/pdfs/2009FDOTQLOS_Handbook.pdf

method excludes pedestrian behavior and infrastructure conditions on adjacent roadways. Additionally, pedestrian comfort and pedestrian crowding are not considered in the Art Plan analysis.

There are several interactive tools that are based on the Sprinkle model, which will allow a user to analyze the pedestrian LOS at a specific location. One example of an interactive tool is Ride Illinois' BLOS/PLOS calculator, an online tool that calculates a LOS for bicyclists and pedestrians for a roadway segment or intersection.[3] The calculator computes both the BLOS and PLOS simultaneously. Similar to the Sprinkle Consulting LOS model, the Ride Illinois calculator focuses mostly on the comfort level of the pedestrian, rather than pedestrian behavior.

Strengths

- The Sprinkle Consulting model puts an emphasis on measuring pedestrian comfort.
- The model uses surveys from pedestrians to determine standards by which to measure the comfort of the pedestrian environment.

Weaknesses

- Pedestrian behavior is not extensively factored into the model.
- This model uses a typical, single-grade method when calculating PLOS, which is not ideal for measuring the suitability of pedestrian infrastructure.

[3] Ride Illinois, "BLOS/PLOS Calculator Form," http://rideillinois.org/blos/blosform.htm

1.2 Bicycle and Pedestrian Connectivity Study

The Old Colony MPO, which serves an area south of Boston, developed models for both BLOS and PLOS as a result of its Bicycle and Pedestrian Connectivity study.[4] These models include elements from the Sprinkle Consulting model and the Pedestrian Infrastructure Index model, which was developed by the Federal Highway Administration (FHWA). In addition to using elements of these models, the Old Colony MPO added its own evaluation criteria to its model.

The Old Colony MPO used approximately 30 attributes to evaluate if the LOS is suitable in a certain area. It used a variety of sources, including geographic information system (GIS) maps, surveyed sources, and Google Street View. Similar to the Sprinkle Consulting model, the Old Colony MPO defines their PLOS as a walker's perception of comfort and safety. They created a standard to use for individual projects, but were not able to fully implement it for the entire region due to the lack of data. The standard was used, however, to create a PLOS map of a small neighborhood in connection with another transportation study.

In the Bicycle and Pedestrian Connectivity study, the Old Colony MPO recommended tying the performance measures used to determine PLOS to the MPO's goals and objectives and set a standard for all new roadways to have a BLOS and PLOS of C or better.

Strengths

- The Old Colony MPO uses a wide variety of performance measures to calculate PLOS.
- Their models add elements to the Sprinkle Consulting model and the Pedestrian Infrastructure Index model.

Weaknesses

- The model has not calculated BLOS and PLOS for the entire roadway network
- Pedestrian behavior is absent from this model.

[4] Old Colony Planning Council, "Bicycle and Pedestrian Connectivity Study" presentation, http://www.ocpcrpa.org/docs/projects/bikeped/Bicycle_and_Pedestrian_Connectivity_Study_Presentation.pdf

1.3 Walk Score

The Walk Score application, which was invented in 2007 by Jesse Kocher and Matt Lerner, helps apartment seekers determine the walkability of a neighborhood.[5] Walk Score rates a neighborhood between 0 and 100 based on a range of criteria, including proximity to amenities, such as grocery stores and restaurants. Points are awarded for amenities that are located within a 30-minute walk. Amenities must be within a quarter mile to receive the highest number of points. Walk Score also factors in conditions such as population density, intersection density, and roadway block length.

Strengths

- Walk Score is very effective at factoring the presence of nearby amenities such as grocery stores and restaurants into the score, which could be an indicator of how often pedestrians traverse through an area.

Weaknesses

- Walk Score does not factor in pedestrian infrastructure, such as sidewalk presence or pedestrian signals.
- Walk Score does not factor in pedestrian behavior, such as pedestrian volumes or pedestrian delay.

1.4 Highway Capacity Manual

The Highway Capacity Manual (HCM) pedestrian model, developed in 2010 by the Transportation Research Board, uses several criteria to determine PLOS.[6] This process includes a step-by-step method, which analyzes pedestrian movements and infrastructure, and an evaluation of performance measures. The pedestrian behavioral performance measures are focused on the pedestrians' ability to choose their desired travel speed or the ability to pass other pedestrians. The HCM also looks at environmental factors, with a focus on the infrastructure surrounding a walkway. Safety factors are also included in the HCM pedestrian model. The HCM model is influenced by the interaction of other modes, such as bicycles, transit, and automobiles.

Three components are needed for input into the model: LOS score, average speed of pedestrians, and circulation area. The HCM also has an evaluation criterion that analyzes off-street pedestrian facilities, such as trails. The HCM

[5] Walk score description available online at https://www.walkscore.com/how-it-works/

[6] Transportation Research Board, *Highway Capacity Manual* (2010 edition), http://hcm.trb.org/?qr=1

model is limited in that it cannot evaluate a facility's performance at all-way stop-sign-controlled intersections, roundabouts, or signalized ramps.

Strengths

- The HCM has very useful performance measures, which can be used as strong indicators of pedestrian friendliness.
- The HCM model allows users to calculate pedestrian scores for both intersections and roadway links.

Weaknesses

- Collecting data for the recommended measures may be difficult.
- Pedestrian scores derived from the HCM model are measured on a grade scale, which is currently not recommended by many planners and engineers in the United States.

1.5 Guidebook for Developing Pedestrian and Bicycle Performance Measures

The FHWA released the Guidebook for Developing Pedestrian and Bicycle Performance Measures in March 2016.[7] This guidebook includes suggestions about how an organization can start monitoring bicycle and pedestrian facility performance based on seven common community goals: Connectivity, Economy, Environment, Equity, Health, Livability, and Safety. Performance measures were determined based on how they evaluate six categories: Accessibility, Compliance, Demand, Reliability, Mobility, and Infrastructure. The FHWA recommends engaging the public and stakeholders by requesting that they submit performance monitoring input. The FHWA also recommends selecting performance measures for which the MPO can obtain measureable data.

Strengths

- This guidebook provides a thorough analysis of many possible performance measures that can be used to evaluate pedestrian facilities.

Weaknesses

- Some of the categories can be difficult to measure at times due to the lack of data.

[7] US Department of Transportation, Federal Highway Administration, *Guidebook for Developing Pedestrian and Bicycle Performance Measures*, https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/performance_measures_guidebook/

1.6 Local Access Score Tool

The Metropolitan Area Planning Council (MAPC) is a regional planning agency located in Boston. MAPC conducts planning for transportation, land use, public safety, economic development, social equity, and housing stock in the Boston region. In 2016, MAPC has created its Local Access Score Tool, which shows pedestrian and bicycle utility scores for roadway segments and shared-use paths.[8] The travel demand model is used for calculating the utility scores. The results are based on the nearby population, their destinations and the modes that they take during their commute.[9] This tool indicates how much each roadway segment would be used by bicyclists and pedestrians if there were adequate facilities for them to comfortably travel.

Strengths

- The Local Access Score Tool helps planners and engineers prioritize investments based on predicted pedestrian activities.

Weaknesses

- Local access score focuses exclusively on origin and destination movements to calculate the utility scores.

1.7 Other Pedestrian Studies and Models

Other pedestrian studies and models identified in the literature search include the following:

- Synchro is a modeling program that allows users to simulate improvements to an intersection, including pedestrian infrastructure improvements, such as the addition of actuated signal features.
- The Pedestrian and Bicyclist Level-of-Service on Roadway Segments study was sponsored by the Danish Road Directorate and used to determine the satisfaction of pedestrians who travel on roadway segments between intersections. This study relied strongly on surveys taken by pedestrians from various demographic backgrounds.
- The Multimodal Level-of-Service Analysis for Urban Streets: Users Guide (2009) is a study that was headed by Dowling Associates. The product of this study was intended to be used for evaluating urban roadways. In this

[8] Metropolitan Area Planning Council, “Local Access Score,” http://localaccess.mapc.org/

[9] Metropolitan Area Planning Council, “Planning Active Streets Tool: A New Resource for Massachusetts” presentation, http://masscptc.org/documents/conferencedocs/2016/Session%205%20%20Complete%20Streets/Planning%20Active%20Streets%20Tool.pdf

model, the automobile, pedestrian, bicycle, and transit modes each have their own LOS formula. However, each of the four LOS metrics affects one another (for example, automobile speeds will affect PLOS).[10]

1.8 SUMMARY

Many of these pedestrian tools focus on infrastructure rather than pedestrian behavior, partially because of the scarcity of data, such as pedestrian traffic volumes and pedestrian travel speeds. However, there is a distinct possibility that these data types will become more readily available in the coming years due to the improvement of technology. For example, global positioning system (GPS) monitoring is improving and will become more prevalent with the use of devices such as activity trackers. The expansion of GPS monitoring will allow better tracking of pedestrian volumes, travel speed, and delay. For the time being, there are both benefits and limitations to the existing models used to assess the quality of the pedestrian environment. The merits and disadvantages of the resources for use by the Boston Region MPO are listed below. Additionally, Table 1 lists some information about each model.

- The Sprinkle Consulting model is effective at monitoring the comfort of pedestrian facilities, but fails to monitor pedestrian behavior.
- The MAPC project is intriguing, and it will be crucial for the Boston Region MPO and MAPC to work together on the projects that focus on bicycle and pedestrian movements.
- The Old Colony MPO's PLOS model is similar to what the Boston Region MPO wants to achieve with the pedestrian LOS project. Therefore, it would be advisable to create a tool that is similar to the one that the Old Colony MPO has developed.
- The HCM model is effective when applied to a small project area with a large amount of data available from field studies, but some of the performance measures would be difficult to apply on a regional or even a corridor level due to the lack of data. The PLOS tool, Art Plan, is embedded in the HCM. However, this tool does not consider conditions for adjacent roadways.
- The FHWA suggests some good performance measures. However, it is often difficult to obtain data.
- Walk Score does not factor in pedestrian comfort, pedestrian movement, connectivity of pedestrian facilities, sidewalks, or how many lanes of traffic a pedestrian must cross. It seems that the walk score is applied on over a particular area rather than a specific location.

[10] Richard Dowling, *Multimodal Level of Service Analysis for Urban Streets: Users Guide* (2009)

Table 1
Comparison of Pedestrian Monitoring Methods

PLOS method	Modes measured	Method of analyzing pedestrian behavior	Method of Measuring	Estimated number of factors/ performance measures	Measured network
Sprinkle Consulting Model	Pedestrian Bicycle	Vehicle annual average daily traffic (AADT)	Grade scale	12	Sidewalks Roadways
Old Colony MPO Model	Pedestrian Bicycle	Vehicle AADT	Grade scale	30+	Sidewalks Roadways
Walk Score	Pedestrian Bicycle Transit	None	Point scale between 0 and 100	12	General area
Highway Capacity Manual	Pedestrian Bicycle Highway	Average travel time Vehicle volumes Occupied street parking	Grade scale	10	Sidewalks Trails Roadways
FHWA Guidebook	Pedestrian Bicycle	Average travel time Crashes Delay Person throughput and volume	User determined	30	Sidewalks Trails Roadways
MAPC Local Access Score Tool	Pedestrian Bicycle	Trip origin and destination	Point scale between 0 and 100	8	Sidewalks Trails Roadways

2 MARKING PROGRESS TOWARD GOALS AND OBJECTIVES

In order to create a PRCA tool, MPO staff determined that it was best to assemble elements from all of the models listed above and add other measures that would be prioritized with consideration of data availability. As an end product, the performance measures selected for the PRCA must gauge the progress toward goals for improving the pedestrian environment on roadway segments and signalized intersections. The following sections describe types of performance measures, the MPO's goals, and objectives for a PRCA for the Boston region.

2.1 Performance Measurement

A robust PRCA monitors infrastructure that facilitates the movement of pedestrians in the transportation network, and analyzes the presence and behavior of travelers. A major purpose of the PRCA is to identify areas where people are expected to rely heavily on pedestrian facilities.

Types of PLOS Measures

Performance measures that are used for this tool are categorized as either infrastructure or mobility performance measures. Infrastructure performance

measures are used to analyze the existing transportation facilities or environment to determine if a location is suitable for pedestrian travel. These measures monitor the condition and presence of sidewalks, roadways, crosswalks, and signals. Data that are used to monitor infrastructure performance measures are usually static and do not change from day to day. Data for infrastructure performance measures usually come from roadway inventories or intersection surveys.

Examples of infrastructure performance measures include the following:

- Sidewalk presence
- Lighting presence
- Crossing opportunities

Mobility performance measures are used to analyze the presence and behavior of travelers. Mobility performance measures include pedestrian counts, pedestrian travel speed, and vehicle movements. Mobility performance measure statistics can often vary from day to day, whereas infrastructure performance measures are usually fixed unless the infrastructure is under construction. Data for mobility performance measures usually come from vehicle or pedestrian traffic monitoring efforts.

Examples of mobility performance measures include the following:

- Average vehicle travel speeds
- Pedestrian crashes
- Pedestrian volumes

Transportation Equity Factors

Even though monitoring transportation equity is not required for the PRCA, it is strongly recommended. Areas where residents are dependent on pedestrian facilities are places where it is especially important to provide high quality pedestrian environments. Locations where there are high percentages of households that do not own vehicles or where residents are less likely to own cars because of low incomes are examples of the types of places where one might expect high use of pedestrian facilities. Additionally, it is very important to provide high quality pedestrian environments near schools and locations where there are large elderly populations who may not be able to drive.

The PRCA provides the option to analyze four factors, referred to by MPO staff as transportation equity factors, to determine if a specific area is a place where one might expect high pedestrian use:

- Areas that are located in an environmental justice zone, as defined by the MPO
- Areas where more than 8.9 percent of the population is over 75 years of age
- Areas where more than 27.5 percent of households do not own a vehicle
- Traffic analysis zones (TAZs) that are located within a quarter mile of a school or college

These factors address aspects of transportation equity, which is a key goal of the Boston Region MPO's LRTP. For a detailed description of each transportation equity factor, refer to Appendix C.

Roadway segments and intersections are classified based on the number of transportation equity factors that apply to them. For example, a location with zero or one factor is classified as having low usage; a location with two factors has moderate usage; and a location with three or four factors has high usage. The higher the presence of transportation factors at a location, the more important it is that there is a high quality pedestrian environment along the roadway segment or at the intersection.

2.2 Goals and Objectives

The MPO has adopted six goals and associated objectives as part of its LRTP. The goal areas are as follows:

- Safety
- System Preservation
- Capacity Management and Mobility
- Economic Vitality
- Clean Air and Clean Communities
- Transportation Equity

To provide the optimum pedestrian network for the Boston region, it is important to move toward achieving these goals. The PRCA grades the quality of the walking environment under the following four goal areas:

1. Safety

   This goal area focuses on the overall safety of pedestrians. Progress toward safety goals is often evaluated by monitoring Highway Safety Improvement

Program (HSIP) pedestrian cluster locations.[11] Safety can also be assessed by determining if pedestrian travel facilities are properly separated from automobile travel facilities (considering, for example, the buffer space between a sidewalk and a roadway).

2. System Preservation

   The System Preservation goal area focuses on the condition of pedestrian infrastructure that is located along roadways and at intersections, including sidewalks and pedestrian signals.

3. Capacity Management and Mobility

   The Capacity Management and Mobility goal area focuses on how people and vehicles move throughout the transportation network and the connectivity of the transportation network. This goal area also emphasizes the need to ensure that transportation infrastructure meets the Americans with Disabilities Act (ADA) standards.

4. Economic Vitality

   The Economic Vitality goal area focuses on the vibrancy, or energy and liveliness, of the pedestrian network. Economic vitality is often measured using pedestrian counts.

The Clean Air and Clean Communities goal is monitored through the TIP selection process rather than the PRCA. The reason for this is because air quality standards are required to be met in order for a project to be included in the TIP and receive federal funding. Additionally, transportation equity is a recommended but not a requisite goal for the PRCA. Monitoring transportation equity in the PRCA is strongly encouraged as many people who live in areas that have a high presence of transportation equity factors often rely heavily on pedestrian facilities for their commute.

The objectives created to monitor progress towards achieving the goals are listed below:

[11] An HSIP cluster is a location which ranks in the top five percent of all crash clusters in the region based on Equivalent Property Damage Only (EPDO) scores. EPDO scoring is a method for assessing the frequency and severity of crashes at a given location over a period of time. This method assigns weighting factors to indicate the severity of a crash; a crash that causes a fatality is weighted by 10, a crash causing injury is weighted by 5, and a crash resulting in property damage is weighted by 1.

- Objective #1: Address pedestrian safety at areas with a high number of pedestrian crashes (Safety)

- Objective #2: Improve pedestrian safety in areas not at a HSIP pedestrian cluster location (Safety)

- Objective #3: Improve safety for school-related travel on regional and local arterials (Safety)

- Objective #4: Improve existing pedestrian and bicycling infrastructure (System Preservation)

- Objective #5: Use existing capacity of transportation facilities more efficiently and increase healthy transportation capacity (Capacity Management and Mobility)

- Objective #6: Increase walkability and support communities to promote walkability (Capacity Management and Mobility)

- Objective #7: Improve pedestrian access to rapid transit (especially north-side Orange Line stations and south-side Red Line stations) (Capacity Management and Mobility)

- Objective #8: Implement bicycle and pedestrian investments that encourage support of local businesses (Economic Vitality)

3 SELECTION OF PERFORMANCE MEASURES

The process the MPO staff used to evaluate performance measures is described in this section, along with a discussion of the measures and scoring criteria staff recommends using in the PRCA for the Boston region.

3.1 Process for Selecting Performance Measures

During the process of selecting performance measures for the PRCA Tool, MPO staff met internally to discuss the pros and cons of every performance measure under consideration. First, staff compiled a list of potential performance measures that could be used for the PRCA. Then they defined each performance measure using staff input and research from previous PLOS studies. Additionally, they distributed a survey to planners and engineers in the Boston region to poll them on the utility of each performance measure.

Two surveying efforts were conducted. The first was an internal poll, in which Boston Region MPO staff members were invited to comment on potential performance measures. The second polled planners and engineers from the Boston region with extensive knowledge about bicycle and pedestrian facilities.

The online survey was created on Google Forms and was distributed to a total of 19 participants. The survey was restricted to professionals in the field because the proposed performance measures were technical and detailed responses were requested. Some of the municipalities and organizations surveyed included the following:

- City of Boston
- City of Cambridge
- Massachusetts Department of Transportation (MassDOT)
- Livable Streets
- Northeastern University
- WalkBoston
- MAPC

The survey consisted of four sections. The first section asked questions about the respondents, such as the organizations that they represent and their commute to work. In the second section, the survey then asked if the performance measure definitions are clear, if the performance measures influence pedestrian level of comfort, and if the performance measures should be used for grading the PRCA. The third section focused on transportation equity and assessing the importance of ensuring good PLOS in areas where the population relies heavily on pedestrian infrastructure. The final section asked various questions in regards to how the respondents feel about the pedestrian

network in the Boston region. For full results and a copy of the survey, refer to Appendix F and G.

Staff considered the survey responses and the availability of data for monitoring system performance when selecting the final performance measures for use in the PRCA. Some performance measures were not selected due to the lack of data.

3.2 Selected Performance Measures

MPO staff recommends the use of 13 specific performance measures for grading PRCA. Each of the performance measures gauge one of four goals that were adopted in the PRCA. Table 2 lists each selected performance measure, the performance measure type, the network it measures, and the PRCA goal that it gauges. Additionally, the selected performance measures are described in the following subsection. For a full description of all performance measures, including those not selected, refer to Appendix A.

Table 2
Selected Performance Measures

Performance Measure	Performance Measure Type	Measure applies to roadway segment, intersection, or both	Boston Region MPO Goal
Sidewalk Presence	Infrastructure	Both	Capacity Management and Mobility
Crossing Opportunities	Infrastructure	Both	Capacity Management and Mobility
Walkway Width	Infrastructure	Roadway segments	Capacity Management and Mobility
Pedestrian Delay	Infrastructure	Intersections	Capacity Management and Mobility
Curb Ramps	Infrastructure	Intersections	Capacity Management and Mobility
Pedestrian Volumes	Mobility	Both	Economic Vitality
Adjacent Bicycle Right of Way	Infrastructure	Roadway segments	Economic Vitality
Pedestrian Crashes	Mobility	Both	Safety
Vehicle-Pedestrian Buffer	Infrastructure	Roadway segments	Safety
Average Vehicle Travel Speeds	Mobility	Both	Safety
Sufficient Crossing Time Index	Infrastructure	Intersections	Safety
Pedestrian Signal Presence	Infrastructure	Intersections	Safety
Sidewalk Condition	Infrastructure	Both	System Preservation

Infrastructure Performance Measures

Sidewalk Condition

The Sidewalk Condition performance measure documents the condition of sidewalks along roadway segments and intersections. Sidewalk condition directly impacts pedestrian safety, which is a major grading category in the PRCA.

Sidewalk Presence

The Sidewalk Presence performance measure indicates whether sidewalks are present along a street segment or at an intersection. The presence of a sidewalk along a street has a positive impact on the PRCA's Capacity Management and Mobility grade. The score for this performance measure is dependent on if there is a sidewalk present on either one or both sides of a roadway segment.

Pedestrian Signal Presence

The Pedestrian Signal Presence performance measure quantifies the characteristics of pedestrian signals. Pedestrian signal phases can either be exclusive or concurrent. Concurrent pedestrian signal phases accompanied by "no turn on red" signage receive the highest grades because they allow pedestrians to cross more frequently than exclusive pedestrian signals – which often require pedestrians to wait through the entire signal cycle before they are allowed to cross an intersection – and because the signs reduce the likelihood of pedestrian-vehicle collisions. Additionally, it is recommended that Leading Pedestrian Interval (LPI) is present at intersections, as LPI's allows pedestrians extra time to begin their way across an intersection before traffic lights for vehicles turn green.

Crossing Opportunities

The Crossing Opportunities performance measure reflects the number of crosswalks that are present. For roadway segments, the measure is reported as the number of crosswalks per linear mile. The greater the number of marked crosswalks, the more flexible pedestrian travel becomes, thereby increasing mobility. Additionally, the presence of a crosswalk alerts drivers that pedestrians may be crossing the roadway. Crossing opportunities are measured at intersections by analyzing the presence of crosswalks at each approach.

Curb Ramps

The Curb Ramp performance measure identifies the presence of curb ramps at intersections. Intersections with curb ramps at all pedestrian approaches facilitate pedestrian travel, thereby increasing mobility. Curb ramps should be perpendicular to the curb, positioned to guide pedestrians into the crosswalk. The position of curb ramps is especially important for mobility-impaired and vulnerable pedestrians.

Vehicle-Pedestrian Buffer

The Vehicle-Pedestrian Buffer measures the total distance between vehicular traffic and pedestrian traffic. A vehicle-pedestrian buffer should be at least five-feet wide. A buffer is good for reducing vehicle-pedestrian traffic incidents, which often result in bodily injuries or fatalities.

Walkway Width

The Walkway Width performance measure is an important calculation because the width of a walkway impacts its accessibility. An accessible sidewalk should be at least five-feet wide to allow two wheelchairs to pass one another while traveling along the pedestrian corridor. Mobility is greater in locations where there are a high percentage of sidewalks at least five-feet wide.

Sufficient Crossing Time Index

The Sufficient Crossing Time Index performance measure determines whether there is adequate time for pedestrians to complete a crossing of a signalized intersection at a speed of 3.5 feet per second during the combined duration of the pedestrian change and red clearance/buffer intervals of a traffic signal cycle. The FHWA recommends that all pedestrian crossing times be based on walking speeds no faster than 3.5 feet per second in order to accommodate all populations.

Adjacent Bicycle Right of Way

The Adjacent Bicycle Right of Way performance measure evaluates if there are adjacent bicycle facilities such as bike lanes, sharrows, and extra wide shoulders on roadway facilities. Roadways with bicycle facilities often correlate with the economic prosperity of an area. Additionally, providing bicyclists separate facilities will encourage them to ride in bicycle lanes or a roadway rather than sidewalks. Pedestrian comfort is often lower when bicyclists and pedestrians share the same right of way, mostly because of the difference in speed of travel between bicyclists and pedestrians.

Pedestrian Delay

The Pedestrian Delay performance measure tracks the amount of time a pedestrian must wait at an intersection for a walk signal. Long delays can encourage pedestrians to engage in dangerous behavior, such as dashing across an intersection ahead of oncoming vehicular traffic.

Mobility Performance Measures

Average Vehicle Travel Speeds

The Average Vehicle Travel Speeds performance measure represents the average speed at which vehicles travel along a roadway segment. Vehicle speeds are preferred over speed limits because they reflect the actual speed of vehicle traffic as opposed to the speed at which vehicles are expected to travel. High vehicle travel speeds increase pedestrian stress and decrease safety.

Pedestrian Crashes

The Pedestrian Crashes performance measure documents areas where pedestrian crashes are common. Due to a lack of pedestrian volume counts, this performance measure will be assessed by the location of HSIP Pedestrian Crash Clusters.

Pedestrian Volumes

The Pedestrian Volumes performance measure represents the number of pedestrians traveling through a location over a period of time. High pedestrian volumes can indicate high economic vitality in an area because large numbers of pedestrians indicate that a location is busy and vibrant. Such areas encourage people to congregate and conduct business. Therefore, locations that have high pedestrian volumes will typical score high in the economic vitality category.

3.3 Performance Measure Scoring and Weighting

After MPO staff selected performance measures for PRCA grading at intersections and along roadway segments, they created scoring criteria for every performance measure. A score of one is the worst score possible while a score of three is the best. Appendix D lists three possible conditions for each performance measure and the score that a grader should give for each performance measure condition.

Once MPO staff created the scoring criteria for the performance measures for PRCA grading at intersections and along roadway segments, they assigned a weight to each measure. The weighting allows performance measures with the greatest impact on the quality of pedestrian travel to affect PRCA scores more than other performance measures with less significant impacts. The weights MPO staff assigned to each performance measure reflect several considerations:

- Usefulness of the performance measure

- Relevance of the performance measure
- Area of application (intersection or roadway segment)
- Survey evaluation results

MPO staff found the performance measures that best reflect the pedestrian experience at intersections and along roadway segments to be the most important and therefore assigned those measures the most weight. Performance measures for pedestrian crashes, pedestrian delay, and crossing time index were all rated more highly, for example, than performance measures that document the physical environment, such as walkway width, pedestrian signal type, pedestrian-vehicle buffer width, and curb ramp presence. The tables below indicate the weights that MPO staff associated with each performance measure. Table 3 lists the performance measures used to grade the roadway segments and Table 4 lists the performance measures for intersections.

The weight assigned to each measure factors into PRCA grading when the weight of each performance measure is multiplied by the score assigned to a specific location. The weighted scores of the performance measures in each PRCA category are then added together and divided by the number of weights assigned for each category.

Table 3
Roadway Segment Performance Measure Weights

Performance Measure	Boston Region MPO Goal	Weight
Sidewalk Presence	Capacity Management and Mobility	3
Crossing Opportunities	Capacity Management and Mobility	2
Walkway Width	Capacity Management and Mobility	1
Pedestrian Volumes	Economic Vitality	1
Adjacent Bicycle Accommodations	Economic Vitality	1
Pedestrian Crashes	Safety	3
Pedestrian-Vehicle Buffer	Safety	1
Vehicle Travel Speed	Safety	1
Sidewalk Condition	System Preservation	1

Table 4
Intersection Performance Measure Weights

Performance Measure	Boston Region MPO Goal	Weight
Pedestrian Delay	Capacity Management and Mobility	3
Sidewalk Presence	Capacity Management and Mobility	2
Curb Ramps	Capacity Management and Mobility	1
Crossing Opportunities	Capacity Management and Mobility	1
Pedestrian Volumes	Economic Vitality	1
Sufficient Crossing Time (Index)	Safety	3
Pedestrian Crashes	Safety	3
Pedestrian Signal Presence	Safety	1
Vehicle Travel Speed	Safety	1
Sidewalk Condition	System Preservation	1

4 TEST RUNS

Each potential performance measure was tested on five roadway segments and five intersections that are located throughout the Boston region. MPO staff recorded their calculations for each performance measure at each location. The scores for every performance measure were based on the information MPO staff

collected for each intersection or roadway segment. The scoring criteria for the performance measures are specified in Appendix D.

The weighted scores of all the performance measures within the same category are averaged, as explained above, and given a grade of poor, fair, or good based on the average weighted category score. The average weighted scores are classified as follows:

- Good – Score is 2.3 or more (maximum 3.0)
- Fair– Score is between 1.7 and 2.3
- Poor – Score is 1.7 or less (minimum 0)

Table 5 and Table 6 list the PRCA grades MPO staff calculated for each category during test runs on selected intersections and roadway segments. For detailed information about every performance measure at each intersection or roadway segment, refer to Appendix E. Table 5 and Table 6 also indicate whether there are transportation equity issues at each location; this was determined using the transportation equity factors described in section 2.1. Transportation equity factors do not directly affect the score of the other PRCA categories. However, the higher the presence of transportation equity factors, the more important it is for the location to earn “good” scores in each category of the PRCA.

Table 5
Results from Test Run
Intersections

Intersection	Municipality	Capacity Management and Mobility	Economic Vitality	Safety	System Preservation	Transportation Equity Factor Presence
US 3 and Route 2A/Mystic Valley Parkway	Arlington	Fair	Fair	Good	Poor	Moderate
Lowell Street and East Street	Lexington	Poor	Poor	Fair	Poor	High
Route 129 and Route 1A	Lynn	Fair	Fair	Good	Good	High
Bolton Street and Lincoln Street	Marlborough	Fair	Poor	Good	Good	Moderate
Route 109 and Route 27	Medfield	Fair	Poor	Fair	Fair	Low

Table 6
Results from Test Run
Roadway Segments

Roadway Segment	Municipality	Capacity Management and Mobility	Economic Vitality	Safety	System Preservation	Transportation Equity Factor Presence
Route 9 from Francis Street/Tremont Street to Louis Prang Street/Ruggles Street	Boston	Good	Good	Good	Good	High
Route 62 from US 3 to Bedford Street	Bedford	Good	Poor	Good	Good	Moderate
Route 140 from Main Street to Chestnut Street	Franklin	Good	Fair	Good	Good	Low
Beacon Street from Washington Street to Harvard Avenue	Brookline	Good	Fair	Fair	Good	High
Dexter Street to Route 16	Everett	Good	Good	Good	Good	Moderate

5 RECOMMENDATIONS AND NEXT STEPS

5.1 Recommendations

MPO staff recommends adoption of the PRCA methodology for grading the quality of the pedestrian environment at intersections and along roadways in the Boston region. Municipal employees and the public can grade PRCAs for any intersection or roadway segment, as long as they have access to accurate data or are willing to conduct field work to collect the necessary information. The PRCA grades the quality of the pedestrian environment using multiple categories to give a score for several goals, rather than one cumulative score.

For the best interest of the Boston region and for the development of the next LRTP, it is recommended that the MPO pursue a follow up project which would create a PRCA monitoring program for the MPO. If the PRCA monitoring program project is approved, MPO staff will calculate the PRCA for select intersections and roadway segments throughout the Boston region. A dashboard can be developed for planners, engineers, and the general public to use for analyzing the pedestrian friendliness of intersections and roadway segments around the region.

5.2 Next steps

Outreach

The next step is to begin PRCA outreach efforts, which will inform planners and engineers from local communities about the PRCA tool. MPO staff will present

this methodology to the MPO board and at local conferences. This memorandum will be posted on the MPO's website, under the Livability section. Additionally, staff will work with the MPO's outreach coordinator and the MassDOT Director of Sustainability to determine other innovative ways to inform the public and professionals about this tool, as part of the Congestion Management Process (CMP), LRTP needs assessment, and Transportation Improvement Program (TIP) work.

Dashboard Project

This project focused on developing a methodology that outlines the proper way to monitor PRCA grades. The next step is to focus on the implementation of this project. In early 2017, MPO staff will compose a proposal for a follow up project for creating a dashboard that would monitor PRCA grading on roadways and at intersections in the Boston region. This new project will include collecting the raw data for the selected performance measures throughout the entire defined network. The information would be used to calculate performance measure scores, which will be used to evaluate the performance of roadways and intersections. Once developed, the dashboard will be available to the public on the MPO's website. This project will be proposed for federal fiscal years 2017-18.

RH/rh/cmc

APPENDICES

Appendix Section	Section Name
Appendix A:	Potential Performance Measures
Appendix B:	Data Sources for Selected Performance Measures
Appendix C:	Transportation Equity Factors
Appendix D:	Scoring Criteria for Selected Pedestrian Level-of-Service Performance Measures
Appendix E	Test Run Results
Appendix F:	Pedestrian Level-of-Service Survey
Appendix G	Pedestrian Level-of-Service Survey Results

APPENDIX A

POTENTIAL PERFORMANCE MEASURES

Table A.1
Potential Pedestrian Level-of-Service Performance Measures

Performance Measure	Type of Performance Measure	Definition/Description	Required Metrics	Application	How the performance measure will factor into LOS calculations	What type of pedestrian level-of-service goals does the performance measure assess?	How measure will be displayed	Measure applies to roadway segment, intersection, or both	Data Source
Average Vehicle Travel Speeds	Mobility	The Average Vehicle Travel Speeds performance measure represents the average speed at which vehicles travel along a roadway segment. Vehicle speeds are preferred over speed limits because they reflect the actual speed of vehicle traffic as opposed to the speed at which vehicles are expected to travel. High average vehicle travel speeds increase pedestrian stress, which lowers pedestrian level of service. *Average Vehicle Travel Speeds = average speed for roadway segment (the highest average speeds of either the AM or PM peak period is used for the purpose of calculating the pedestrian level of service)*	Average vehicle speed for each roadway segment	MPO staff will assign high pedestrian level-of-service scores to roadway segments and intersections with slower average speeds and low pedestrian level-of-service scores to those with faster average speeds.	MPO staff will assign a value of “high” if the average vehicle travel speeds are less than 25 miles-per-hour (MPH); a value of “medium” if average vehicle travel speed is between 25 MPH and 35 MPH; and a value of “low” if the average speed is 35 MPH or more.	Safety	Map illustrating average vehicle speeds (e.g. by color) along roadways	Both	INRIX data set
Curb Ramp Presence	Infrastructure	The Curb Ramp Presence performance measure identifies the presence of curb ramps at intersections. Intersections with curb ramps at all pedestrian approaches facilitate pedestrian travel, thereby increasing pedestrian level of service. Curb ramps should be perpendicular to the curb, positioned to guide pedestrians into the crosswalk. Curb ramps and their directions are especially important for mobility-impaired and vulnerable pedestrians.	Curb ramp locations; curb ramp types	MPO staff will assign high pedestrian level-of-service scores to intersections with ramps in good condition at all approaches, moderate pedestrian level-of-service scores to intersections with ramps at some approaches, and low pedestrian level-of-service scores to intersections without curb ramps.	MPO staff will assign a value of "high" if each intersection approach has a curb ramp in good condition for each crossing or one apex curb ramp that serves all crossings at the corner; "medium" if two or three approaches include either of the ramp conditions described above; and “low” if there are fewer than two approaches with ramps in good condition for all crossings.	Capacity Management and Mobility	Map illustrating curb ramp locations and types	Intersections	Field surveys; street imagery
Median Presence	Infrastructure	The Median Presence performance measure indicates whether there is a median separating the travel lanes of a roadway. Roadways with medians tend to be more pedestrian friendly than roadways without them because medians provide a refuge for pedestrians crossing the roadway. Medians should measure at least six-feet wide in order to accommodate wheelchairs, strollers, bicycles, etc.	Median presence (Y/N); median width	MPO staff will assign high pedestrian level-of-service scores to roadway segments and intersections with medians and low pedestrian level-of-service scores to those without medians.	MPO staff will assign a value of “high” if the median is more than six-feet wide; “medium” if the median is less than six-feet wide; and “low” if no median is present.	Safety	Map illustrating where roadways with medians are located	Both	Roadway inventory; street imagery

Table A.1 (Cont.)
Potential Pedestrian Level-of-Service Performance Measures

Performance Measure	Type of Performance Measure	Definition/Description	Required Metrics	Application	How the performance measure will factor into LOS calculations	What type of pedestrian level-of-service goals does the performance measure assess?	How measure will be displayed	Measure applies to roadway segment, intersection, or both	Data Source
Number of Roadway Travel Lanes	Infrastructure	The Number of Roadway Travel Lanes performance measure indicates the total number of travel lanes along a roadway segment (the number of lanes in each direction). A roadway is better suited for pedestrians when it has fewer travel lanes, because there is less distance that pedestrians must travel from one side of the street to the other and there are fewer opportunities for conflict between pedestrians and vehicles.	Number of roadway lanes	MPO staff will assign higher pedestrian level-of-service scores to roadway segments and intersections with fewer travel lanes and lower pedestrian level-of-service scores to roadway segments and intersections with more travel lanes.	MPO staff will assign a value of "high" if a roadway has fewer than two lanes; "medium" if a roadway has two to four lanes; and "low" if there are more than four lanes.	Safety	Data stored in GIS database; Map displaying (by color) the number of travel lanes on roadways	Both	Roadway inventory
On-Street Parking Presence	Infrastructure	The On-Street Parking Presence performance measure identifies whether parking is present on a roadway segment. On-street parking increases pedestrian level of service because the street parking acts as a barrier between vehicular and pedestrian traffic. *Percent of Roadway Segment with On-Street Parking = Total Length of On-Street Parking Spaces / Total Length of Roadway Segment (if measuring parking space length on both sides of the roadway, double the roadway segment length)*	Length of total parking spaces along roadway segment; length of roadway segment	MPO staff will assign the highest pedestrian level-of-service scores to roadway segments with the largest percentages of on-street parking and the lowest pedestrian level-of-service scores to roadway segments with the smallest percentages of on-street parking.	MPO staff will assign a value of "high" if a roadway segment has parking on more than 50 percent of its length; "medium" if parking is present along 25 percent to 50 percent of its length; and "low" if parking is located along less than 25 percent of its length.	Safety	Map illustrating the percentage of roadway segments that include on-street parking (color for each percentage category)	Segments	Field surveys; street imagery
Pedestrian Buffer	Infrastructure	The Pedestrian Buffer performance measure identifies if there is a space present between a sidewalk or walkway and a roadway. The minimum buffer width recommended by the Federal Highway Administration (FHWA) is two feet (three feet when there is on-street parking). This buffer may take the form of a planting strip, with vegetation such as grass and trees, or the form of municipal infrastructure, such as lights and signs. Pedestrian buffers can be measured using aerial imagery.	Presence of space between the sidewalk and the street (Y/N); width of space between sidewalk and street	MPO staff will assign high pedestrian level-of-service scores to roadway segments with pedestrian buffers and low pedestrian level-of-service scores to roadway segments without pedestrian buffers.	MPO staff will assign a value of "high" if the pedestrian buffer is wider than eight feet; "medium" if the buffer measures between two and eight feet; and "low" if the buffer is narrower than two feet.	Safety	Map illustrating the location of roadway segments with two-foot wide pedestrian buffers (or three-foot wide buffers if there is on-street parking)	Segments	Aerial imagery

Table A.1 (Cont.)
Potential Pedestrian Level-of-Service Performance Measures

Performance Measure	Type of Performance Measure	Definition/Description	Required Metrics	Application	How the performance measure will factor into LOS calculations	What type of pedestrian level-of-service goals does the performance measure assess?	How measure will be displayed	Measure applies to roadway segment, intersection, or both	Data Source
Pedestrian Crashes	Mobility	The Pedestrian Crashes performance measure documents areas where pedestrian crashes are common. Due to a lack of pedestrian crash rate data, this performance measure will be assessed by the location of Highway Safety Improvement Program (HSIP) Pedestrian Crash Clusters.	Highway Safety Improvement Program (HSIP) Pedestrian Crash Clusters	MPO staff will assign high pedestrian level-of-service scores to roadway segments and intersections that do not contain HSIP Pedestrian Crash Clusters and low pedestrian level-of-service scores to roadway segments and intersections that include HSIP Pedestrian Crash Clusters.	MPO staff will assign a value of “low” if the segment or intersection is located in a Highway Safety Improvement Program (HSIP) Pedestrian Crash Cluster (the top five percent of pedestrian crash clusters for each Regional Planning Agency between the years of 2004-2013), and a value of “high” for segments and intersections that are not within an HSIP Pedestrian Crash Cluster.	Safety	Map illustrating where HSIP Pedestrian Crash Clusters are located	Both	MassDOT crash data
Pedestrian Signal Presence	Infrastructure	The Pedestrian Signal Presence performance measure quantifies the characteristics of pedestrian signals. Pedestrian signal phases can either be exclusive or concurrent. Additionally signs, such as "no turn on red," can alter both pedestrian and vehicular traffic behavior. Finally, a Leading Pedestrian Interval (LPI) allows pedestrians to begin their way across an intersection before traffic lights for vehicles turn green, which reduces conflict between pedestrians and turning vehicles as compared to pedestrian signals that illuminate concurrently with vehicular traffic signals.	Pedestrian signal characteristics (exclusive vs. concurrent, presence of “no turn on red” signage, and presence of LPI)	MPO staff will assign high pedestrian level-of-service scores to intersections with pedestrian signals that avoid conflicts between crossing pedestrians and turning vehicles.	MPO staff will assign a value of “high” if an intersection has concurrent pedestrian signals accompanied by "no right turn on red" signage or a LPI; “medium” if an intersection has an exclusive pedestrian signal; “low” if an intersection has concurrent pedestrian signals that do not include "no right turn on red" signage or a LPI.	Safety	Map illustrating the types of pedestrian signals at locations	Intersections	Field surveys; CTPS GIS signal data; street imagery; municipal documentation
Percent Sufficient Walkway Width	Infrastructure	The Percent Sufficient Walkway Width performance measure is an important calculation because the width of a walkway impacts its accessibility. An accessible sidewalk should be at least five-feet wide to allow two wheelchairs to pass one another while traveling along the pedestrian corridor. Pedestrian level of service is higher in locations where there are a high percentage of sidewalks at least five-feet wide. *Percent Sufficient Walkway Width = Length of Sidewalks 5+ Feet Wide / Total Sidewalk Length*	Width of sidewalks and walkways; length of sidewalks and walkways	MPO staff will assign high pedestrian level-of-service scores to roadway segments and intersections with sidewalks at least five-feet wide and low pedestrian level-of-service scores to roadway segments and intersections with sidewalks narrower than five-feet wide.	MPO staff will assign a value of "high" if all the sidewalks along both sides of a roadway segment measure at least five-feet wide; “medium” if there are sidewalks at least five-feet wide on one side of the roadway; and "low" if less than 50 percent of a roadway segment's sidewalks are five-feet wide, or if less than two of the roadway segment's approaches have sidewalks that are five-feet wide.	Capacity Management and Mobility	Map illustrating where sidewalks measure five feet or wider	Segments	Field surveys; aerial maps

Table A.1 (Cont.)
Potential Pedestrian Level-of-Service Performance Measures

Performance Measure	Type of Performance Measure	Definition/Description	Required Metrics	Application	How the performance measure will factor into LOS calculations	What type of pedestrian level-of-service goals does the performance measure assess?	How measure will be displayed	Measure applies to roadway segment, intersection, or both	Data Source
Roadway Curb Presence	Infrastructure	The Roadway Curb Presence performance measure indicates whether there is a curb that precludes automobile sidewalk access. The presence of a curb between sidewalks and roadway lanes helps improve safety by providing a small barrier between pedestrian traffic and automobile traffic.	Curb presence	MPO staff will assign high pedestrian level-of-service scores to intersections and roadway segments with curbs and low pedestrian level-of-service scores to intersections and roadway segments without curbs.	MPO staff will assign a value of "high" for intersections in which all approaches have a roadway curb and for roadway segments with curbs on both sides; "medium" for intersections that have curbs at one to three approaches and for roadway segments that have curbs on one side; and "low" for intersections that have no curbs at any approach, and roadway segments that have no curbs.	Capacity Management and Mobility	Map illustrating where roadways with curbs are located	Segments	Roadway inventory
Sidewalk Condition	Infrastructure	The Sidewalk Condition performance measure documents the conditions of sidewalks along roadway segments and intersections. Sidewalk condition directly impacts pedestrian safety, which in turn affects pedestrian level of service. The condition of sidewalks may be assessed by conducting field surveys or analyzing street imagery. *Percent of sidewalks in good condition = total length of sidewalks in good condition/total length of sidewalks*	Percent of sidewalks in good condition	MPO staff will assign high pedestrian level-of-service scores to roadway segments and intersections with large percentages of sidewalks in good condition and low pedestrian level-of-service scores to roadway segments and intersections with small percentages of sidewalks in good condition.	MPO staff will assign a value of "high" for intersections where sidewalks at all approaches are in good condition, and for roadway segments where sidewalks are in good condition on both sides of the street; "medium" for intersections where sidewalks are in good condition on one to three approaches, and roadway segments that have sidewalks in good condition on one side of the street; and "low" for intersections that have no approaches that have sidewalks in good condition, and roadway segments that have no sidewalks in good condition.	System Preservation	Map illustrating (by color) the condition of sidewalks	Both	Field surveys; street imagery

Table A.1 (Cont.)
Potential Pedestrian Level-of-Service Performance Measures

Performance Measure	Type of Performance Measure	Definition/Description	Required Metrics	Application	How the performance measure will factor into LOS calculations	What type of pedestrian level-of-service goals does the performance measure assess?	How measure will be displayed	Measure applies to roadway segment, intersection, or both	Data Source
Sidewalk Presence	Infrastructure	The Sidewalk Presence performance measure indicates whether sidewalks are present along a roadway segment or at an intersection. The MassDOT Roadway Inventory specifies whether a roadway includes a sidewalk on one or two sides of the street. The presence of a sidewalk along a street has a positive impact on pedestrian level of service. At locations where sidewalks on either side of the road are not continuous, MPO staff will calculate a percentage using the length of sidewalk present along the length of a roadway segment or intersection. *Sidewalk Presence = total length of sidewalks/total length of roadway (if measuring sidewalk length on both sides of the roadway, double the roadway length)*	Sidewalk presence along roadway segment/intersection; length of sidewalk; length of roadway	MPO staff will assign high pedestrian level-of-service scores to roadway segments and intersections with sidewalks on both sides of the road; medium pedestrian level-of-service scores to roadway segments and intersections with a sidewalk on one side of the road; and low pedestrian level-of-service scores to roadway segments and intersections with no sidewalks.	MPO staff will assign a value of “high” for intersections in which all approaches have sidewalks, and for roadway segments that have sidewalks on both sides on the street; “medium” for intersections with sidewalks on at least half of the approaches, and roadway segments that have sidewalks on one side of the street; and “low” for intersections that have sidewalks at less than 50 percent of all approaches, and for roadway segments with no sidewalks.	Capacity Management and Mobility	Map illustrating sidewalk presence along roadway segments and intersections (different colors for one side, two sides, and none)	Both	Roadway inventory
Sufficient Crossing Time Index	Infrastructure	The Sufficient Crossing Time performance measure determines whether a signalized intersection provides adequate time for pedestrians to complete a crossing at a speed of 3.5 feet per second or slower during the combined duration of the pedestrian change and red clearance/buffer intervals. The FHWA recommends that all pedestrian crossing times be based on walking speeds no faster than of 3.5 feet per second in order to accommodate all populations. *Sufficient Crossing Time Index=(Length of Crossing/3.5 feet per second)/Combined Duration of the Pedestrian Change and Red Clearance/Buffer Intervals*	Length of pedestrian crossing; duration of pedestrian change interval for crossing; duration of red clearance/buffer interval for crossing	MPO staff will assign high pedestrian level-of-service scores to intersections with crossing times that allow pedestrians to travel 3.5 feet per second or slower, and low pedestrian level-of-service scores to intersections with crossing times that do not allow pedestrians to travel 3.5 feet per second.	MPO staff will assign a value of “high” to intersections that have a sufficient crossing time index greater than 1.3; “medium” to intersections that have sufficient crossing time indices between one and 1.3; and “low” to intersections that have an index less than one.	Safety	Map illustrating crossings where pedestrian signals provide sufficient crossing time for pedestrians to travel 3.5 feet per second and crossings where pedestrian signals do not provide enough travel time	Intersections	Aerial maps

Table A.1 (Cont.)
Potential Pedestrian Level-of-Service Performance Measures

Performance Measure	Type of Performance Measure	Definition/Description	Required Metrics	Application	How the performance measure will factor into LOS calculations	What type of pedestrian level-of-service goals does the performance measure assess?	How measure will be displayed	Measure applies to roadway segment, intersection, or both	Data Source
Transit Service Presence	Infrastructure	The Transit Service Presence performance measure indicates whether an area is served by public transportation. A roadway segment or intersection within a quarter mile of a train station or bus stop will be considered to be served by public transportation. *Transit Service Presence = Bus Stop or Train Station within a Quarter Mile of Roadway Segment or Intersection*	Location of bus stops, rapid transit, and commuter rail stations	MPO staff will assign high pedestrian level-of-service scores to roadway segments and intersections within a quarter mile of a bus stop, rapid transit station, or commuter rail station, and low pedestrian level-of-service scores to roadway segments and intersections farther than a quarter mile from a bus stop, rapid transit station, or commuter rail station.	MPO staff will assign a value of "high" for intersections and roadway segments that have frequent bus, rapid transit, or commuter rail service; "medium" for locations with limited bus service and/or commuter rail stations; and "low" for locations that have no transit service. Transit service must be within a quarter mile of the intersection or roadway segment.	Capacity Management and Mobility	Map illustrating roadway segments and intersections served by public transportation	Both	CTPS GIS layers
Annual Average Daily Traffic (AADT)	Mobility	The AADT performance measure assesses the average number of vehicles that travel along a roadway segment on a daily basis. A roadway that has a high AADT will typically have a lower pedestrian level of service due to increased pedestrian stress. *AADT = Massachusetts Department of Transportation (MassDOT) volume counts at a respective location*	Traffic volumes	MPO staff will assign a lower pedestrian level-of-service score to roadways that have a high AADT.	MPO staff will assign a value of "high" to intersections and roadway segments that have an AADT of less than 10,000; "medium" to those that have an AADT between 10,000 and 30,000; and "low" to those that have an AADT of more than 30,000.	Safety	Map illustrating AADT (e.g. by color) along roadways	Both	MassDOT database or Highway Performance Monitoring System (HPMS); roadway Inventory
Crossing Opportunities/ Crosswalks per Mile	Infrastructure	The Crossing Opportunities performance measure reflects the number of crosswalks that are present along roadway segments. The measure is reported as the number of crosswalks per linear mile. The greater the number of marked crosswalks along a roadway segment, the more flexible pedestrian travel becomes, thereby increasing pedestrian level of service. Additionally, the presence of a crosswalk alerts drivers that pedestrians may be crossing the roadway. Crossing opportunities are also measured at intersections by analyzing the presence of crosswalks at each approach. *Crossing Opportunities per Mile = Number of Crosswalks along a Roadway Segment / Length of Roadway Segment in Miles*	Crosswalk locations; roadway segment length	MPO staff will assign lower pedestrian level-of-service scores for roadway segments that have few crossing opportunities.	MPO staff will assign a value of "high" to intersections that have crosswalks at all approaches and to roadway segments that have at least 10 crosswalks per mile; "medium" to intersections that have crosswalks at two or three approaches and roadway segments that have seven to nine crosswalks per mile; and "low" for roadway segments that have crosswalks on less than two approaches and roadway segments that have less than seven crosswalks per mile.	Safety	Maps illustrating crosswalk frequency along roadway segments	Both	Aerial maps; municipal documentation

Table A.1 (Cont.)
Potential Pedestrian Level-of-Service Performance Measures

Performance Measure	Type of Performance Measure	Definition/Description	Required Metrics	Application	How the performance measure will factor into LOS calculations	What type of pedestrian level-of-service goals does the performance measure assess?	How measure will be displayed	Measure applies to roadway segment, intersection, or both	Data Source
Lighting Presence	Infrastructure	The Lighting Presence performance measure indicates whether street lighting is present along a roadway segment or at an intersection. The presence of lighting helps pedestrians feel safer, which lowers pedestrian stress and increases pedestrian level of service.	Street light locations	To be determined	To be determined (due to lack of data)	Safety	Data stored in GIS database; Map illustrating where lights are located	Both	Field surveys; municipal databases
Pedestrian Travel Speed	Mobility	The Pedestrian Travel Speed performance measure demonstrates the average amount of time it takes a pedestrian to travel along a specific segment of sidewalk or walkway. This data may be available in the near future from third party vendors. Federal guidance states that pedestrian signals should allow sufficient time for pedestrians to cross a roadway at a speed of 3.5 feet per second, so MPO staff would assume that 3.5 feet per second is a comfortable pedestrian walking speed. A low average pedestrian speed would indicate congestion at a location, and therefore a low pedestrian level of service. *Pedestrian Travel Speed = Average pedestrian travel speed at a specific time of day at a certain location*	Average pedestrian travel speed	MPO staff will assign lower pedestrian scores to walkways that have low pedestrian travel speeds.	To be determined (due to lack of data)	Capacity Management and Mobility	Map illustrating average pedestrian travel speeds (by color)	Segments	Third party vendors
Pedestrian Volumes	Mobility	The Pedestrian Volumes performance measure represents the number of pedestrians traveling through a location during a period of time. High pedestrian volumes can indicate a high pedestrian level of service in an area because pedestrians are comfortable walking in the location.	Number of pedestrians that crossed a screen line (imaginary line for counting) during a period of time	MPO staff will assign higher pedestrian scores to walkways that have high pedestrian volumes.	MPO staff will assign a value of “high” to intersections and roadway segments that are traversed by at least 60 pedestrians per hour; “medium” to those traversed by between five and 60 pedestrians per hour; and “low” to those traversed by less than five pedestrians per hour.	Economic Vitality	Map illustrating pedestrian volumes (color for each volume category)	Both	Field surveys; third party vendors; municipalities

Table A.1 (Cont.)
Potential Pedestrian Level-of-Service Performance Measures

Performance Measure	Type of Performance Measure	Definition/Description	Required Metrics	Application	How the performance measure will factor into LOS calculations	What type of pedestrian level-of-service goals does the performance measure assess?	How measure will be displayed	Measure applies to roadway segment, intersection, or both	Data Source
Pedestrian Delay	Infrastructure	Pedestrian delay is measured by tracking the amount of time a pedestrian will have to wait at an intersection for a walk signal. This performance measure is important because long pedestrian delays can encourage dangerous pedestrian behavior, such as dashing across an intersection ahead of oncoming vehicular traffic before the signal enters the pedestrian phase. *Pedestrian delay = (0 .5 (cycle length – green time for peds.)^2) / Cycle length*	Signal cycle length; pedestrian crossing time (walk interval, pedestrian change interval, and red clearance/buffer interval)	MPO staff will assign higher pedestrian scores to intersections that have low pedestrian delays.	MPO staff will assign a value of "high" to intersections that have less than a 20 second delay; "medium" to intersections that have between a 20 second and 40 second delay; "low" to intersections that have more than a 40 second delay.	Capacity Management and Mobility	Map illustrating pedestrian delay (color for each volume category)	Intersections	Municipalities
Vehicle-Traffic Buffer	Infrastructure	The Vehicle-Traffic Buffer performance measure represents the total distance between vehicular traffic and pedestrian traffic. A vehicle-traffic buffer should measure at least five-feet wide.	Distance between the pedestrian corridor (sidewalks/walkways) and vehicular traffic	MPO staff will assign higher pedestrian scores to roadway segments that have a wider vehicle-traffic buffer.	MPO staff will assign a value of "high" to roadway segments that have at least a 10-foot buffer; "medium" to roadway segments with a buffer of between five and 10 feet; and "low" to roadway segments that have less than a five-foot buffer.	Safety	Map illustrating buffers (color for each width category)	Segments	Imagery
Pedestrian Signal Compliance	Mobility	The Pedestrian Signal Compliance performance measure represents the percentage of crossings that occur during a walk signal phase (at signalized intersections). Crossings where an unusually large percentage of pedestrians do not wait for the walk signal could indicate a need to either increase the frequency and predictability of walk signals, or (in the case of low traffic volume roads) to convert the entire intersection from signal-controlled to STOP sign-controlled.	Pedestrian counts; percent of pedestrians that do not comply with walk signal	MPO staff will assign a high pedestrian score to intersections that have a high percentage of pedestrians who comply with walk signals.	To be determined	Mobility	To be determined	Intersections	Field surveys

Table A.1 (Cont.)
Potential Pedestrian Level-of-Service Performance Measures

Performance Measure	Type of Performance Measure	Definition/Description	Required Metrics	Application	How the performance measure will factor into LOS calculations	What type of pedestrian level-of-service goals does the performance measure assess?	How measure will be displayed	Measure applies to roadway segment, intersection, or both	Data Source
Direct Crossings to Transit Stops	Infrastructure	The Direct Crossings to Transit Stops performance measure represents the presence or absence of crosswalks leading directly to transit stops. This metric would indicate how quickly and safely pedestrians can reach transit. Areas where pedestrians have to walk a quarter of a mile or more just to cross the street to get to a transit stop would have lower LOS scores.	Presence of crosswalks near transit stops	MPO staff will assign a high pedestrian score to intersections and roadway segments that have direct crossings to transit stops.	To be determined	Mobility	To be determined	Both	Imagery
Pedestrian Queue Space	Mobility	The Pedestrian Queue Space performance measure would focus on pedestrian crowding at the corners of busy intersections. Sidewalks should have sufficient space to accommodate the queue of pedestrians typically present.	Sidewalk space at the corner of an intersection; pedestrian counts	MPO staff will assign a high pedestrian score to intersections that have adequate pedestrian queue space.	To be determined	Economic Vitality	To be determined	Intersections	Field surveys, imagery
Distance from Vehicle STOP Bar to Center of Crosswalk	Infrastructure	This performance measure would assess the safety buffer that exists between vehicles stopped at a red light and crossing pedestrians. Intersections where the STOP bar is set farther back from the crosswalk, where a bike box is installed between the STOP bar and the crosswalk, or where the crosswalk is wider than average would score higher.	Distance between vehicle STOP bar and the center of the crosswalk	MPO staff will assign a high pedestrian score to intersections that have a greater distance between the vehicle STOP bar and the center of the crosswalk.	To be determined	Safety	To be determined	Intersections	Imagery
Share of Pedestrians in Queue Completing Crossings at Signalized Intersections	Mobility	This performance measure would complement the Sufficient Crossing Time measure by identifying whether all pedestrians in queue can cross the street safely during the walk phase. Intersections where the volume of pedestrians is high and not all individuals can cross during a walk signal may require a longer walk phase than one timed for 3.5 feet per second.	Number of pedestrians that cross an intersection; number of pedestrians in the queue for crossing the intersection	MPO staff will assign a high pedestrian score to intersections that have a high share of pedestrians in queue completing crossings during signalized intersection pedestrian phases.	To be determined	Mobility	To be determined	Intersections	Field surveys

Table A.1 (Cont.)
Potential Pedestrian Level-of-Service Performance Measures

Performance Measure	Type of Performance Measure	Definition/Description	Required Metrics	Application	How the performance measure will factor into LOS calculations	What type of pedestrian level-of-service goals does the performance measure assess?	How measure will be displayed	Measure applies to roadway segment, intersection, or both	Data Source
Bus Stop Location	Infrastructure	Bus stops that are located immediately before a signalized intersection can pose a danger to pedestrians. When buses are stopped in them, crossing can be a challenge due to poor visibility of parallel traffic. When buses are absent, cars use the bus stop lane as a right turn or a bypass lane. It is recommended that bus stops are at locations that follow an intersection.	Location of bus stop	MPO staff will assign a high pedestrian score to intersections that do not have bus stops immediately before signalized intersections.	To be determined	Safety	To be determined	Intersections	Imagery
Adjacent Bicycle Accommodations	Infrastructure	The Adjacent Bicycle Accommodations performance measure evaluates if there are adjacent bicycle facilities such as bike lanes, sharrows, and extra wide shoulders on roadway facilities. Roadways with bicycle facilities often correlate with the economic prosperity of an area. Additionally, providing bicyclists separate facilities will encourage them to ride in bicycle lanes or a roadway rather than on sidewalks. Pedestrian comfort is often lower when bicyclists and pedestrians share the same right of way. This is mostly caused by the difference in speeds between bicyclists and pedestrians.	Presence of sharrows, extra wide shoulders or bicycle lanes	MPO staff will assign a high pedestrian score to roadway segments that have bike lanes, sharrows, and extra wide shoulders.	MPO staff will assign a value of “high” if bicycle lanes are present on a roadway; “medium” if there are sharrows or extra wide shoulders; “low” if there are no bicycle facilities present on a roadway	Economic vitality	Map that illustrates the location of bicycle facilities	Segments	Imagery; roadway inventory

APPENDIX B

DATA SOURCES FOR SELECTED PERFORMANCE MEASURES

Table B.1
Data Sources for Selected Performance Measures

Performance Measures	Data needed	Data sources	Data availability frequency
Sidewalk Condition	Locations where sidewalks are in good condition	Sidewalk condition can be assessed by observing sidewalks through street imagery websites.	Every 3 years
Sidewalk Presence	Sidewalk presence along roadway segments and intersections	Sidewalk presence data is available from the MassDOT roadway inventory, which is updated every year.	Every 3 years
Average Vehicle Travel Speeds	Average vehicle speeds	Data for this performance measure will be provided internally. The Boston Region MPO staff has access to vehicle probe datasets that can provide the average travel speeds for a roadway segment.	Every 3-5 years
Pedestrian Crashes	Highway Safety Improvement Program (HSIP) Pedestrian Crash Clusters	This performance measure will be analyzed by looking at a MassDOT dashboard that visually displays the locations of HSIP crash clusters.	Every 3 years
Crossing Opportunities/ Crosswalks per mile	Crosswalk locations, roadway segment length	Data for this performance measure will be collected through aerial imagery.	Every 3 years
Pedestrian Volumes	Pedestrian counts	Pedestrian volumes can be obtained by several sources, including the MPOs bicycle/pedestrian count database, functional design reports and various traffic counts. Manual pedestrian counts can be also used to measure pedestrian volumes.	Varies

Table B.1
Data Sources for Selected Performance Measures (Cont.)

Performance Measures	Data needed	Data sources	Data availability frequency
Pedestrian Signal Presence and Type	Pedestrian signal characteristics (exclusive vs. concurrent, presence of no turn on red signs or leading pedestrian intervals)	Pedestrian signal type will be obtained from a signals database that was created by the Boston Region MPO staff. Signal type data is also available from various studies, entities, and municipalities.	Varies
Curb Ramp Presence	Curb ramp locations and conditions	Data for this performance measure will be obtained through street imagery. Also, an ADA ramp inventory for the entire state is available through MassDOT.	Every 3 years
Vehicle-pedestrian Buffer	Distance between vehicle travel facilities and pedestrian facilities	Data for this performance measure will be collected through aerial imagery.	Every 3 years
Percent Sufficient Walkway Width	Width of sidewalks and walkways	Data for this performance measure will be collected through aerial and street imagery.	Every 3 years
Sufficient Crossing Time Index	Length of pedestrian crossing and duration of pedestrian change interval for crossing	The length of the crossing will be measured using aerial imagery. The time that is allowed for pedestrians to cross will be provided by signal timing data. This data is available from various studies and functional design reports.	Varies
Pedestrian Delay	Signal cycle length and “green time” for pedestrians	“Green time” for pedestrians and signal cycle length will be provided by signal timing data. This data is available from various studies, municipalities, entities, and functional design reports.	Varies
Adjacent Bicycle Accommodations	Locations of bike lanes, sharrows and roadways with extra wide shoulder widths	Should width is available from the roadway inventory. The location of bike lanes and sharrows are available through street and aerial imagery.	Varies

APPENDIX C

TRANSPORTATION EQUITY FACTORS

Table C.1
Transportation Equity Factors

Transportation Equity Factors	Definition/Description	Required Metrics	Prioritization	Data Source
Proximity of schools	Pedestrian infrastructure is important in areas surrounding schools, so it is important to know their locations when prioritizing pedestrian infrastructure improvements. If a roadway or intersection is located within a quarter mile of a school, it is considered to be a vital area for pedestrian infrastructure. Quarter-mile buffers will be used to identify locations near schools.	Location of schools and colleges, by traffic analysis zone (TAZ)	Locations within a quarter mile of a school or college will be identified as high priority locations for pedestrian infrastructure.	MAPC, Municipalities
Percent of population with disabilities	The quality of pedestrian infrastructure often impacts the mobility of individuals with disabilities. This factor assesses the percentage of people with disabilities living in a specific area. MPO staff will consider the TAZs with the highest percentage of people with disabilities to be among the areas most in need of good pedestrian infrastructure.	Percent of a TAZ's population with a disability, by TAZ	Locations with higher percentages of people with disabilities will be identified as high priority locations for pedestrian infrastructure.	American Community Survey
Percent of population over 75 years of age	Seniors are a segment of the population who may be inordinately impacted by poor pedestrian infrastructure. MPO staff will consider the importance of good pedestrian infrastructure to be higher in locations where there are high percentages of people over the age of 75.	Percent of population over the age of 75, by TAZ	Locations where more than 8.9 percent of people are over age 75 will be identified as high priority locations for pedestrian infrastructure.	American Community Survey
Environmental justice areas	This measure identifies environmental justice areas that have a high percentage of minority or low income residents. As defined by the Boston Region MPO, environmental justice areas have a minority population of more than 27.8 percent and/or 60 percent of households have a median household income of less than $45,624.	Locations where the minority population is more than 27.8 percent and/or locations where 60 percent of households have a median household income of less than $45,624, by TAZ	Locations where the minority population is more than 27.8 percent and/or where 60 percent of households have a median household income of less than $45,624 will be identified as high priority locations for pedestrian infrastructure.	Internal data
Mode split	Mode split is the percentage of commuters who use a specific mode when traveling to work. These modes include driving, walking, biking, and public transportation. Good pedestrian infrastructure is important in areas where there are high percentages of commuters who walk, bicycle, or take transit. This measure is based on the combined percentage of people who commute by walking, bicycling, and using public transportation.	Mode split data from the American Community Survey, by TAZ	Locations where there are high percentages of people who commute by walking, bicycling, or using public transportation will be identified as high priority locations for pedestrian infrastructure.	American Community Survey
Percent of households that do not own any vehicles	This transportation equity factor shows the percentage of households in an area that do not own a car. It is important for areas that have a carless household rate of more that 27.5 percent to have good pedestrian infrastructure, because walking is usually an important travel mode for these areas.	Percent of households that do not own any vehicles, by TAZ	Locations that have more than a 27.5 percent household carless rate will be identified as a high priority location for pedestrian infrastructure.	American Community Survey

APPENDIX D

SCORING CRITERIA FOR SELECTED PEDESTRIAN LEVEL-OF-SERVICE PERFORMANCE MEASURES

Table D.1
Scoring Criteria for Selected Pedestrian Level-of-Service Performance Measures

Curb Ramp Presence	Score
ramps in good condition at all approaches	3
ramps in good condition at 2-3 approaches	2
ramps in good condition at 0 or 1 approach	1

Average Travel Speeds	Score
average speed less than 25 miles per hour (MPH)	3
average speed between 25 MPH and 35 MPH	2
average speed of 35 MPH or more	1

Pedestrian Crashes	Score
Not located in pedestrian cluster	3
Located in pedestrian cluster	1

Pedestrian Signal Type	Score
Concurrent, right turn on red prohibited or Leading Pedestrian Interval	3
Exclusive	2
Concurrent, right turn on red permitted	1

Walkway width (intersections)	Score
At least 5-foot sidewalk leading to all approaches	3
At least 5-foot sidewalk leading to 2 or 3 approaches	2
At least 5-foot sidewalk leading to 0 or 1 approaches	1

Walkway Width (roadway segments)	Score
All sidewalks are at least 5-feet wide on both sides of street	3
Sidewalks are at least 5-feet wide on one side of the street	2
No sidewalks are at least 5-feet wide	1

Sidewalk Condition (intersections)	Score
All approaches are in good condition	3
2-3 approaches are in good condition	2
0-1 approaches are in good condition	1

Table D.1
Scoring Criteria for Selected Pedestrian Level-of-Service Performance Measures (Cont.)

Sidewalk Condition (roadway segments)	Score
Sidewalks are in good condition on both sides of the street	3
Sidewalks are in good condition on one side of the street	2
Sidewalks are in bad condition on both sides of the street	1

Sidewalk Presence (intersections)	Score
All approaches	3
2-3 approaches	2
0 or 1 approaches	1

Sidewalk Presence (roadway segments)	Score
Sidewalks are present on both sides of street	3
Sidewalks are present on one side of the street	2
No sidewalks present	1

Sufficient Crossing Time Index	Score
More than 1.30	3
1.00-1.30	2
Less than 1.00	1

Crossing Opportunities (intersections)	Score
All approaches have crosswalks	3
2 or 3 approaches have crosswalks	2
0 or 1 approaches have crosswalks	1

Crossing Opportunities (segments)	Score
More than 10 crosswalks per mile	3
7 to 10 crosswalks per mile	2
Fewer than 7 crosswalks per mile	1

Pedestrian Volumes	Score
More than 60 per hour	3
5 to 60 per hour	2
Fewer than 5 per hour	1

Table D.1
Scoring Criteria for Selected Pedestrian Level-of-Service Performance Measures (Cont.)

Pedestrian Delay	Score
Less than 20 second delay	3
20 to 40 second delay	2
More than 40 second delay	1

Vehicle-pedestrian Buffer	Score
More than 10 feet	3
5 feet to 10 feet	2
Less than 5 feet	1
Adjacent Bicycle Accommodations	Score
Bicycle lanes present on street	3
Sharrows or extra wide shoulder present on street	2
No bicycle infrastructure present on street	1

APPENDIX E

TEST RUN RESULTS

Table E.1
Intersection Results
US 3 and Route 2A/Mystic Valley Parkway in Arlington

Performance Measure	Features	Goal	Weight	Unweighted Scores	Weighted Score
Pedestrian Delay	45 seconds	Capacity Management and Mobility	3	1	3
Sidewalk Presence	Sidewalks present on all approaches	Capacity Management and Mobility	2	3	6
Curb Ramp Presence	Ramps at all approaches are in poor condition	Capacity Management and Mobility	1	1	1
Crossing Opportunities	3 approaches have crosswalks	Capacity Management and Mobility	1	2	2
Pedestrian Volumes	13 per peak hour	Economic Vitality	1	2	2
Pedestrian Crashes	Not in HSIP cluster	Safety	3	3	9
Sufficient Crossing Time Index	26 seconds needed/27 seconds provided =1.03	Safety	3	2	6
Average Vehicle Travel Speeds	28 MPH	Safety	1	2	2
Pedestrian Signal Type	Semi-actuated with exclusive pedestrian phase	Safety	1	2	2
Sidewalk Condition	Good on 1 out of 4 approaches	System Preservation	1	1	1
Transportation Equity Factor	2 out of 4 factors	N/A	N/A	N/A	N/A

Table E.2
Intersection Results
Lowell Street and East Street in Lexington

Performance Measure	Features	Goal	Weight	Unweighted Scores	Weighted Score
Pedestrian Delay	42 seconds	Capacity Management and Mobility	3	1	3
Sidewalk Presence	Sidewalks present on 2 out of 4 approaches	Capacity Management and Mobility	2	2	4
Curb Ramp Presence	No ramps at any approaches	Capacity Management and Mobility	1	1	1
Crossing Opportunities	2 approaches have crosswalks	Capacity Management and Mobility	1	2	2
Pedestrian Volumes	0 per peak hour	Economic Vitality	1	1	1
Pedestrian Crashes	Not in HSIP cluster	Safety	3	3	9
Sufficient Crossing Time Index	24 seconds provided/30 needed =0.8	Safety	3	1	3
Average Vehicle Travel Speeds	34 MPH	Safety	1	2	2
Pedestrian Signal Type	Actuated exclusive pedestrian phase	Safety	1	2	2
Sidewalk Condition	Good on 1 out of 4 approaches	System Preservation	1	1	1
Transportation Equity Factor	3 out of 4 factors	N/A	N/A	N/A	N/A

Table E.3
Intersection Results
Route 129 and Route 1A in Lynn

Performance Measure	Features	Goal	Weight	Unweighted Scores	Weighted Score
Pedestrian Delay	45 seconds	Capacity Management and Mobility	3	1	3
Sidewalk Presence	Sidewalks present on all approaches	Capacity Management and Mobility	2	3	6
Curb Ramp Presence	Ramps are at all approaches	Capacity Management and Mobility	1	3	3
Crossing Opportunities	All approaches have crosswalks	Capacity Management and Mobility	1	3	3
Pedestrian Volumes	30 per peak hour	Economic Vitality	1	2	2
Pedestrian Crashes	Not in HSIP cluster	Safety	3	3	9
Sufficient Crossing Time Index	21 seconds provided/19 seconds needed=1.1	Safety	3	2	6
Average Vehicle Travel Speeds	23 MPH	Safety	1	3	3
Pedestrian Signal Type	Exclusive pedestrian phase	Safety	1	2	2
Sidewalk Condition	Good on all approaches	System Preservation	1	3	3
Transportation Equity Factor	3 out of 4 factors	N/A	N/A	N/A	N/A

Table E.4
Intersection Results
Bolton Street and Lincoln Street in Marlborough

Performance Measure	Features	Goal	Weight	Unweighted Scores	Weighted Score
Pedestrian Delay	44 seconds	Capacity Management and Mobility	3	1	3
Sidewalk Presence	Sidewalks present on all approaches	Capacity Management and Mobility	2	3	6
Curb Ramp Presence	Ramps are at all approaches	Capacity Management and Mobility	1	3	3
Crossing Opportunities	All approaches have crosswalks	Capacity Management and Mobility	1	3	3
Pedestrian Volumes	4 per peak hour	Economic Vitality	1	1	1
Pedestrian Crashes	Not in HSIP cluster	Safety	3	3	9
Sufficient Crossing Time Index	14 seconds provided/12 seconds required =1.166	Safety	3	2	6
Average Vehicle Travel Speeds	28 MPH	Safety	1	2	2
Pedestrian Signal Type	Exclusive pedestrian phase, no turn on red	Safety	1	2	2
Sidewalk Condition	Good on all approaches	System Preservation	1	3	3
Transportation Equity Factor	2 out of 4 factors	N/A	N/A	N/A	N/A

Table E.5
Intersection Results
Route 109 and Route 27 in Medfield

Performance Measure	Features	Goal	Weight	Unweighted Scores	Weighted Score
Pedestrian Delay	65 seconds	Capacity Management and Mobility	3	1	3
Sidewalk Presence	Sidewalks present on all approaches	Capacity Management and Mobility	2	3	6
Curb Ramp Presence	ramps are at all approaches	Capacity Management and Mobility	1	3	3
Crossing Opportunities	All approaches have crosswalks	Capacity Management and Mobility	1	3	3
Pedestrian Volumes	1 per peak hour	Economic Vitality	1	1	1
Pedestrian Crashes	Not in HSIP cluster	Safety	3	3	9
Sufficient Crossing Time Index	21 sec provided/34 seconds required =0.62	Safety	3	1	3
Average Vehicle Travel Speeds	39 MPH	Safety	1	1	1
Pedestrian Signal Type	Exclusive pedestrian phase	Safety	1	2	2
Sidewalk Condition	Good on 2 approaches	System Preservation	1	2	2
Transportation Equity Factor	1 out of 4 factors	N/A	N/A	N/A	N/A

Table E.6
Roadway Segment Results
Route 9 from Francis St/Tremont Street to Louis Prang Street/Ruggles Street in Boston

Performance Measure	Features	Goal	Weight	Unweighted Scores	Weighted Score
Sidewalk Presence	Sidewalks are present on both sides	Capacity Management and Mobility	3	3	9
Crossing Opportunities	16 crosswalks per mile	Capacity Management and Mobility	2	3	6
Walkway Width	Sidewalks on both sides are more than 5-feet wide	Capacity Management and Mobility	1	3	3
Pedestrian Volumes	655 per peak hour	Economic Vitality	1	3	3
Adjacent Bicycle Accommodations	Sharrows are present in street	Economic Vitality	1	2	2
Pedestrian Crashes	Not in HSIP cluster	Safety	3	3	9
Average Vehicle Travel Speeds	21 MPH	Safety	1	3	3
Vehicle-Pedestrian Buffer	7.5 foot buffer	Safety	1	2	2
Sidewalk Condition	Sidewalks on both sides are in good condition	System Preservation	1	3	3
Transportation Equity Factor	3 out of 4 factors	N/A	N/A	N/A	N/A

Table E.7
Roadway Segment Results
Route 62 from US 3 to Bedford Street in Bedford

Performance Measure	Features	Goal	Weight	Unweighted Scores	Weighted Score
Sidewalk Presence	Sidewalks are present on both sides	Capacity Management and Mobility	3	3	9
Crossing Opportunities	6.72 crosswalks per mile	Capacity Management and Mobility	2	1	2
Walkway Width	Sidewalks on both sides are more than 5-feet wide	Capacity Management and Mobility	1	3	3
Pedestrian Volumes	0 per peak hour	Economic Vitality	1	1	1
Adjacent Bicycle Accommodations	No right of way	Economic Vitality	1	1	1
Pedestrian Crashes	Not in HSIP cluster	Safety	3	3	9
Average Vehicle Travel Speeds	29 MPH	Safety	1	2	2
Vehicle-Pedestrian Buffer	4 foot buffer	Safety	1	1	1
Sidewalk Condition	Sidewalks on both sides are in good condition	System Preservation	1	3	3
Transportation Equity Factor	2 out of 4 factors	N/A	N/A	N/A	N/A

Table E.8
Roadway Segment Results
Route 140 from Main Street to Chestnut Street in Franklin

Performance Measure	Features	Goal	Weight	Unweighted Scores	Weighted Score
Sidewalk Presence	Sidewalks are present on both sides	Capacity Management and Mobility	3	3	9
Crossing Opportunities	10.61 crosswalks per mile	Capacity Management and Mobility	2	3	6
Walkway Width	Sidewalks on both sides are more than 5-feet wide	Capacity Management and Mobility	1	3	3
Pedestrian Volumes	61 per peak hour	Economic Vitality	1	3	3
Adjacent Bicycle Accommodations	No right of way	Economic Vitality	1	1	1
Pedestrian Crashes	Not in HSIP cluster	Safety	3	3	9
Average Vehicle Travel Speeds	28 MPH	Safety	1	2	2
Vehicle-Pedestrian Buffer	1.75 foot buffer	Safety	1	1	1
Sidewalk Condition	Sidewalks on both sides are in good condition	System Preservation	1	3	3
Transportation Equity Factor	1 out of 4 factors	N/A	N/A	N/A	N/A

Table E.9
Roadway Segment Results
Beacon Street from Washington Street to Harvard Avenue in Brookline

Performance Measure	Features	Goal	weight	unweighted scores	weighted score
Sidewalk Presence	Sidewalks are present on both sides	Capacity Management and Mobility	3	3	9
Crossing Opportunities	14.5 crosswalks per mile	Capacity Management and Mobility	2	3	6
Walkway Width	Sidewalks on both sides are more than 5-feet wide	Capacity Management and Mobility	1	3	3
Pedestrian Volumes	1106 per peak hour	Economic Vitality	1	3	3
Adjacent Bicycle Accommodations	No right of way	Economic Vitality	1	1	1
Pedestrian Crashes	Located in a HSIP cluster	Safety	3	1	3
Average Vehicle Travel Speeds	25 MPH	Safety	1	3	3
Vehicle-Pedestrian Buffer	14 foot buffer	Safety	1	3	3
Sidewalk Condition	Sidewalks on both sides are in good condition	System Preservation	1	3	3
Transportation Equity Factor	4 out of 4 factors	N/A	N/A	N/A	N/A

Table E.10
Roadway Segment Results
Route 99 from Dexter Street to Route 16 in Everett

Performance Measure		Goal	Weight	Unweighted Scores	Weighted Score
Sidewalk Presence	Sidewalks are present on both sides	Capacity Management and Mobility	3	3	9
Crossing Opportunities	5.75 crosswalks per mile	Capacity Management and Mobility	2	1	2
Walkway Width	Sidewalks on both sides are more than 5-feet wide	Capacity Management and Mobility	1	3	3
Pedestrian Volumes	15 per peak hour	Economic Vitality	1	2	2
Adjacent Bicycle Accommodations	Street has bike lanes	Economic Vitality	1	3	3
Pedestrian Crashes	Not in HSIP cluster	Safety	3	3	9
Average Vehicle Travel Speeds	25 MPH	Safety	1	3	3
Vehicle-Pedestrian Buffer	5-foot buffer	Safety	1	2	2
Sidewalk Condition	Sidewalks on both sides are in good condition	System Preservation	1	3	3
Transportation Equity Factor	2 out of 4 factors	N/A	N/A	N/A	N/A

APPENDIX F

PEDESTRIAN LEVEL-OF-SERVICE SURVEY

Pedestrian Level of Service

Please help the Boston Region Metropolitan Planning Organization (MPO) to better evaluate the condition of the pedestrian network in the Boston region by providing input about performance measures that could be used to determine the quality—or level of service—of pedestrian infrastructure at specific locations. Please briefly read through the pedestrian level-of-service definition sheet before completing this survey.

Introductory Questions

Please tell us a little about yourself.

1. What type of organization do you represent?
   Mark only one oval.

   - ◯ City or town
   - ◯ MPO or other regional government organization
   - ◯ Transit service board
   - ◯ Travel demand management organization
   - ◯ Private transportation provider
   - ◯ Other

2. How do you commute to work?
   Check all that apply.

   - ☐ Drive alone
   - ☐ Carpool
   - ☐ Public transportation
   - ☐ Bike
   - ☐ Walk
   - Telecommute
   - ☐ Other

3. What is the duration of your average commute to work?
   Mark only one oval.

   - ◯ Less than 15 minutes
   - ◯ 15-30 minutes
   - ◯ 30-60 minutes
   - ◯ More than 60 minutes

Rating Potential Pedestrian Level-of-Service Measures

The MPO is considering adopting the following performance measures for use in pedestrian level-of-service analyses. Your input will help the MPO decide if the performance measures are well defined, if data are readily available for calculating level-of-service scores, and if the measures are influential in determining level of service.

4. Please look over the Performance Measure Definitions spreadsheet. What is your opinion of the definition provided for each performance measure listed below?

Mark only one oval per row.

	Understandable and Accurate	Understandable but Inaccurate	Unclear but Accurate	Unclear and Inaccurate
Average Vehicle Travel Speeds				
Curb Ramp Presence				
Median Presence				
Number of Roadway Travel Lanes				
On-Street Parking Presence				
Pedestrian Buffer				
Pedestrian Crashes				
Pedestrian Signal Presence				
Pedestrian Signal Type				
Percent Sufficient Walkway Width				
Roadway Curb Presence				
Sidewalk Condition				
Sidewalk Presence				
Sufficient Crossing Time				
Transit Service Presence				
Annual Average Daily Traffic (AADT)				
Crossing Opportunities				
Lighting Presence				
Pedestrian Travel Speed				
Pedestrian Volumes				

5. How much influence do you think each performance measure has over pedestrian level of service? Please assign each performance measure a weight between one and five, with five signifying your opinion that the performance measure has the most influence over pedestrian level of service, and one signifying that it has the least influence.

   Mark only one oval per row.

	1	2	3	4	5
Average Vehicle Travel Speeds					
Curb Ramp Presence					
Median Presence					
Number of Roadway Travel Lanes					
On-Street Parking Presence					
Pedestrian Buffer					
Pedestrian Crashes					
Pedestrian Signal Presence					
Pedestrian Signal Type					
Percent Sufficient Walkway Width					
Roadway Curb Presence					
Sidewalk Condition					
Sidewalk Presence					
Sufficient Crossing Time					
Transit Service Presence					
Annual Average Daily Traffic (AADT)					
Crossing Opportunities					
Lighting Presence					
Pedestrian Travel Speed					
Pedestrian Volumes					

6. How many performance measures do you think should be factored into pedestrian level-of-service calculations?

   Mark only one oval.

- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

7. Which of the following performance measures do you think should be factored into pedestrian level-of-service calculations?

Check all that apply.

- [ ] Average Vehicle Travel Speeds
- [ ] Curb Ramp Presence
- [ ] Median Presence
- [ ] Number of Roadway Travel Lanes
- [ ] On-Street Parking Presence
- [ ] Pedestrian Buffer
- [ ] Pedestrian Crashes
- [ ] Pedestrian Signal Presence
- [ ] Pedestrian Signal Type
- [ ] Percent Sufficient Walkway Width
- [ ] Roadway Curb Presence
- [ ] Sidewalk Condition
- [ ] Sidewalk Presence
- [ ] Sufficient Crossing Time
- [ ] Transit Service Presence
- [ ] Annual Average Daily Traffic (AADT)
- [ ] Crossing Opportunities
- [ ] Lighting Presence
- [ ] Pedestrian Travel Speed
- [ ] Pedestrian Volumes
- [ ] Other: .....

Transportation Equity Factors

The MPO will assess the quality—or level of service—of the pedestrian environment using the performance measures identified through responses to this survey, and develop pedestrian level-of-service scores for specific locations and transportation facilities. Locations where there are concentrations of vulnerable road users and populations who rely heavily on pedestrian infrastructure for daily travel will be prioritized as most in need of pedestrian infrastructure improvements.

8. How important do you think it is to ensure good pedestrian level of service in areas with the demographic characteristics listed below? Please assign a weight between one and five, with five signifying your opinion that the demographic group has the greatest need for good quality pedestrian infrastructure, and one signifying that it has the least need.

   Mark only one oval per row.

	1	2	3	4	5
Disabled population					
Population over 75 years of age					
Population under 18 years of age					
Commuters who exclusively walk, bike, or take public transit					
Population without access to vehicles					
Residents of environmental justice areas					
Residents within a quarter mile of a school or college					

9. Do you believe that there is adequate financial investment for pedestrian facilities in neighborhoods with the following demographic characteristics? *

   Mark only one oval per row.

	Yes	No	Unsure
Disabled population			
Population over 75 years of age			
Population under 18 years of age			
Commuters who exclusively walk, bike, or take public transit			
Population without access to vehicles			
Residents of environmental justice areas			
Residents within a quarter mile of a school or college			

Final Questions

Answer a few more questions, and you'll be finished! Thank you very much for your help!

10. Are there any performance measures not on the list that should be added? Please elaborate.

11. Are there any performance measure definitions that you would change? Please elaborate.

12. Please think of municipalities where you are familiar with the pedestrian facilities (e.g. where you live, where you work, where you commute). Please list the municipality/municipalities and answer the next four questions with their pedestrian facilities in mind.

(Long Answer Response)

13. How would you rate the pedestrian facilities in your municipality/municipalities? Please assign a weight between one and five, with five signifying your opinion that they are great, and one signifying that they are awful.
Mark only one oval.

1 2 3 4 5

Awful Great

14. Do you feel safe using pedestrian facilities in your municipality/municipalities?

Mark only one oval.

Yes

No

15. How connected is the pedestrian network in your municipality/municipalities? Please assign a weight between one and five, with five signifying your opinion that the network is continuous, and one signifying that it is fragmented.

Mark only one oval.

1 2 3 4 5

Fragmented Continuous

16. Do you believe that the pedestrian network in your municipality/municipalities meets accessibility standards?

Mark only one oval.

Yes

No

17. Please provide below any feedback you would like to share regarding the performance measures. Feel free to elaborate on any of the survey questions.

APPENDIX G

PEDESTRIAN LEVEL-OF-SERVICE SURVEY RESULTS

Table G.1
Number of responses in favor of each performance measure

Performance Measures	Total in Favor	Total Participants	Percent in Favor
Sidewalk Presence	15	19	79
Pedestrian Signal Presence	14	19	74
Sidewalk Condition	14	19	74
Lighting Presence	14	19	74
Average Vehicle Travel Speeds	13	19	68
Crossing Opportunities/Crosswalks per Mile	12	19	63
Pedestrian Crashes	11	19	58
Sufficient Crossing Time Index	10	19	53
Curb Ramp Presence	9	19	47
Number of Roadway Travel Lanes	9	19	47
Percent Sufficient Walkway Width	9	19	47
Pedestrian Type	8	19	42
Pedestrian Volumes	7	19	37
Pedestrian Buffer	5	19	26
Annual Average Daily Traffic (AADT)	5	19	26
Median Presence	4	19	21
Transit Service Presence	4	19	21
Roadway Curb Presence	3	19	16
On-Street Parking Presence	1	19	5
Pedestrian Travel Speed	0	19	0

Table G.2
What type of organization do you represent?

Organization	Responses	Percent
MPO or other regional government organization	12	63
Other	4	21
City or town	2	11
MassDOT	1	5

Table G.3
How do you commute to work? (Please check all that apply)

Mode	Responses
Public transportation	12
Walk	9
Bike	5
Telecommute	2
Drive alone	1
Paratransit	1

Table G.4
What is the duration of your average commute to work?

Duration	Responses
Less than 15 minutes	3
15-30 minutes	6
30-60 minutes	7
More than 60 minutes	3

Table G.5
What is your opinion of the definition provided for each performance measure listed below?

Performance Measures	Understandable and Accurate	Understandable but Inaccurate	Unclear but Accurate	Unclear and Inaccurate
Average Vehicle Travel Speeds	14	3	2	0
Curb Ramp Presence	18	0	1	0
Median Presence	18	1	0	0
Number of Roadway Travel Lanes	17	1	1	0
On-Street Parking Presence	17	0	2	0
Pedestrian Buffer	12	1	5	1
Pedestrian Crashes	12	3	3	1
Pedestrian Signal Presence and Type	15	0	3	1
Percent Sufficient Walkway Width	15	2	1	1
Roadway Curb Presence	15	2	2	0
Sidewalk Condition	14	1	3	1
Sidewalk Presence	17	0	1	1
Sufficient Crossing Time Index	16	1	0	2
Transit Service Presence	14	4	1	0
Annual Average Daily Traffic (AADT)	16	3	0	0
Crossing Opportunities/Crosswalks Per Mile	16	1	1	1
Lighting Presence	18	0	1	0
Pedestrian Travel Speed	12	4	3	0

Table G.6

How much influence do you think each performance measure has over pedestrian level of service? Please assign each performance measure a weight between one and five, with five signifying your opinion that the performance measure has the most influence over pedestrian level of service, and one signifying that it has the least influence.

Performance Measure	Average Score
Sidewalk Presence	4.8
Average Vehicle Travel Speeds	4.2
Crossing Opportunities/Crosswalks Per Mile	4.2
Sufficient Crossing Time Index	4.2
Lighting Presence	4.2
Sidewalk Condition	4.1
Number of Roadway Travel Lanes	4.0
Pedestrian Crashes	4.0
Pedestrian Signal Presence and Type	4.0
Curb Ramp Presence	3.8
Percent Sufficient Walkway Width	3.7
Roadway Curb Presence	3.7
Median Presence	3.5
Annual Average Daily Traffic (AADT)	3.5
Pedestrian Buffer	3.4
Transit Service Presence	3.3
Pedestrian Volumes	3.3
Pedestrian Travel Speed	3.2
On-Street Parking Presence	3.1

Table G.7
How many performance measures do you think should be factored into pedestrian level-of-service calculations?

Number of Performance Measures	Responses
10 performance measures	9
9 performance measures	2
7 performance measures	3
6 performance measures	3
5 performance measures	1
no answer	1

Table G.8
How important are the following Transportation Equity factors?

Factor	Average Importance Score
Disabled population	4.5
Population over 75 years of age	4.6
Population under 18 years of age	4.4
Commuters who exclusively walk, bike, or take public transit	4.6
Population without access to vehicles	4.4
Residents in environmental justice areas	4.3
Residents within a quarter mile of a school or college	4.4

Table G.9
Do you believe that there is adequate financial investment for pedestrian facilities in neighborhoods with the following demographic characteristics?

Factor	Yes	No	Unsure
Disabled population	3	12	4
Population over 75 years of age	4	11	4
Population under 18 years of age	2	9	7
Commuters who exclusively walk, bike, or take public transit	2	12	5
Population without access to vehicles	2	12	5
Residents in environmental justice areas	2	13	4
Residents within a quarter mile of a school or college	4	9	6

Table G.10
What municipalities are you most familiar with?

Municipality	Responses
Everett	1
Dedham	1
Boston	2
Cambridge	1
Undisclosed	14

Table G.11
How would you rate the pedestrian facilities in your municipality/municipalities?

Average Score	3.3 out of 5.0

Table G.12
Do you feel safe using pedestrian facilities in your municipality/municipalities?

	Responses
Yes	16
No	3

Table G.13
How connected is the pedestrian network in your municipality/municipalities?

Average Score	3.6 out of 5

Table G.14
Do you believe that the pedestrian network in your municipality meets accessibility standards?

	Responses
Yes	9
No	9
no answer	1

Table G.15
Are there any performance measures not on the list that should be added? Please elaborate.

Comments
Urban design; active building fronts; active first three+ stories (eyes on the street - will be against those that have garages without wrapper), frequency of cross-streets, trees/shade
distance between crosswalks---or does this come under crossing opportunity; shade; sidewalk snow and ice clearance; eyes on the street (not too many bank walls); the scale of signage
1) Crossing wait time (seconds between walk phases); 2) Number of crossing segments (that can't be crossed in a single walk phase) -- or, whether the crossing can be made in a single phase; 3) corner turn radius; 4) automatic or user-initiated (button) walk phase; 5) connectivity of walking network
Pedestrian average wait time at cross-walks (esp. at exclusive signals)
Presence of Preferred Paths (Safe-Routes-to-School; Arterial Walking Path); Percentage of Sidewalks on All Arterial Streets (Urban & Suburban)
There may be insufficient locations where this is a factor, but in some places pedestrian volumes are such that there is actually pedestrian congestion. This certainly happens at crossings near the commuter rail hubs and busiest T stations. Even the corner of Tremont and Boylston can become congested with pedestrians waiting for the walk signal, which increases crossing time. Other factors influence this, of course, including sidewalk width.
How are shading, trees, micro-climate taken into account?

Table G.16
Are there any performance measure definitions that you would change? Please elaborate.

Comments
Average Vehicle Travel Speed - Typically 85th Percentile Number of Roadway Travel Lanes - Needs to be clear (roadway intersection vs roadway segment) Pedestrian Buffer - How will intermittent buffers (tree pits) be calculated? Recommend using Vehicle-Traffic Buffer category instead Sidewalk Condition - How is "good" sidewalk condition defined? ADA Compliant? Sidewalk Presence - Presence and Walkway width appear to duplicate. Transit Service Presence - Recommend using 1/2 mile radius (train stations). Pedestrian Travel Speed - Recommend removing; Seems very manual Vehicle-Traffic Buffer - Specify Distance from middle of sidewalk to shoulder Pedestrian Signal Compliant - Seems very manual intensive
Overall, there are different kinds of roads that need different treatments. There are roads with high AADT and many lanes that can be great ped streets, but those need very wide sidewalks and buffers and medians. There are those that are basically alleys, that don't even need sidewalks. So the approach should be to first qualitatively classify the road based on lanes and AADT, and then analyze based on that, with potentially different measures and bases. - Average speed: what about 80% speed? - Medians - how about medians with fences? - Ped buffer: what about eg Boylston Street, where there is no buffer, but there is a ~35' sidewalk? Are furniture zones buffers? What about where there is no furniture zone, but a very wide sidewalk? - Transit service is so variable that this shouldn't be a yes/no. A twice a day bus, or even an every half-hour bus, is very different than Park Street. - Mode Split analysis: you need to highly weight not just areas that have home-work origins that are high transit mode split, but also those destinations. So ACS won't be enough. Need to look at places that have high work-based transit mode splits. - ped speed: Thinking about downtown at morning rush: people are moving relatively quickly, but with lots of congestion - people would be moving even quicker if they could. So just whether they are going over 3.5ft/s won't tell you whether a place is congested. Also, who are these third-party vendors? I want to know more.
Scores should be higher for signals that are concurrent vs. exclusive

Table G.17

Please provide below any feedback you would like to share regarding the performance measures. Feel free to elaborate on any of the survey questions.

Comments
Recommend reducing the number of items and combining, where appropriate. Need to be mindful of what is a quick calculation, and what is more labor-intensive that needs on-site evaluation. Dislike the idea of using parking lanes as a criteria. Many of our projects are trying to reduce parking lanes to provide bike accommodation. The width from middle of sidewalk to outside shoulder seems like a great way to capture the level of stress.
Sidewalks are cracked, cobblestones are dangerous for the elderly, pedestrians are confused about how to cross (some lights require buttons to be pushed while others do not). Exclusive walk signals have pedestrians waiting a long time to cross the street.
Rating pedestrian facilities region-wide is difficult. From my experience, which is exclusively Downtown/Back Bay/Fenway/Mission Hill Boston, I rate the pedestrian experience as "Very Good", but I am highly concerned with the many suburban towns and the availability of sidewalks and paths.
Not everyone lives in Boston, or even in the Boston region. I am not sure who your audience is for this survey, but if it will not exclusively be people living in Boston or the Boston region (however that is defined) the survey questions/metrics could be tailored a little better to be more encompassing.
Some of the questions in this section is difficult to answer because of limited information about pedestrian network in the Boston Region. See me if you would like further feedback
curbs preclude access by cars! (rather than "grade separation")
It might be worth exploring applying different PLOS to different types of roads. Roads in downtown Boston serve different purposes than, say, Route 1, or rural roads in the western portion of the region. If you apply the same standards to different road types you may end up with a disproportionate number of small town/rural roads with a low PLOS even though they have a very low ped and/or car use. That's not to say that they don't need sidewalks or other ped facilities, but that they may need fewer than those in downtown Boston. Alternatively, if, to avoid this problem, you exclude some of the performance measures, it may then exclude some of those that are important to Boston and other urban areas because of the high pedestrian use and diversity of users.
A couple things to consider adding - 1) with crossing signals, some come automatically and others don't change to walk unless a pedestrian pushes the button, this could be an interesting aspect to keep track of. 2) It's not clear to me what no-curb sidewalks are (maybe I've just never seen them), but could you consider adding more of a description, or is there any way to add small illustrations to help show what some of the performance measures mean? 3) Someone may not know what vehicle probe data means - could you add a definition? 4) I may have just missed this, but is there anything that helps differentiate between mid-block crosswalks and crosswalks at intersections?