Walking and Biking Into the Future: MassDOT's Next Gen Bike and Pedestrian Facilities Vision Map

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Project Goals

• This project will support MassDOT’s goal in expanding a high comfort network for pedestrians and bicyclists to all applicable MassDOT facilities statewide that are within the range of a short walking or biking trip.

Where We Are

• Task 1 – Project Management
• Task 2 – Collection and Review of Available Data Sets
• Task 3 – Project Identification and Vision Mapping
• **Task 4 – Project Prioritization Metrics**
Builds off

This project will support MassDOT's goal in expanding a high comfort network for pedestrians and bicyclists to all applicable MassDOT, NHS and Federal Aid eligible facilities statewide that are within the range of a short walking or biking trip.

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Collection and Review of Available Data Sets

- **GIS Data Compilation**
  - REJ+ (Compilation of Data Layers)
  - Ped/Bike Crashes
  - Roadway Inventory
  - HSIP Clusters
  - Traffic Volumes
  - Posted/Prevailing Speed Limit
  - Transit Stop Presence on Road Segment (50-ft horizontal buffer)
  - Public Services
  - Parks/Open Spaces / Recreational Facilities
  - Population Density
  - Employment Density
  - Commuters that Walk, Bike and Take Transit
  - Designated Truck Route
  - Resiliency
  - Parcel and Assessing Data
  - Impact II – Bike/Ped Risk Factor (Compilation)
  - Ped/Bike Volumes
  - Statewide Bike/Ped Plan Public Wiki Map Comments
  - Potential for Everyday Walking and Biking (Compilation)
Collection and Review of Available Data Sets (cont.)

- Planned Project Data Compilation
  - MBTA Bus Network Redesign
  - SRTS Projects
  - Miscellaneous Pedestrian and Bicycle Projects
  - General Projects w/Multimodal Elements
  - Statewide Pedestrian and Bicycle Transportation Plans
  - Beyond Mobility (Ongoing Coordination)
Collection and Review of Available Data Sets (cont.)

- Reviewing and Screening of Data Layers
  - Screened Out Roadways Not Relating to NHS, MassDOT Jurisdiction and Federal Aid Eligible
  - Screened Out Limited Access Roadways
  - Have Begun Manual Screening of Non-Applicable Roadway Segments
  - Performed General Review and Documentation of Data Layers to Address Identified Inconsistencies
Project Identification and Vision Mapping
Vision Map Overview

- Map where 100% of residents living or working along applicable roadway segments have access to high comfort pedestrian and bicycle facilities for short walking and biking trips
  - Should represent a road network that covers any potential short trip, populations may want to take:
    - Residence to residence
    - Residence to school/grocery store
    - School to park/library
Primary Components to Vision Map Development

- Establishing the ‘Recommended Infrastructure’ for pedestrians and bicycle on the study area road network
- Identifying gaps in existing bicycle and pedestrian infrastructure
- Identifying land uses that support travel via high comfort pedestrian and bicycle network
- Overlaying walk and bike-shed thresholds over identified land uses
Recommended Infrastructure Identification

- Identified High Comfort Facility Screening Criteria
  - Bikes – Utilized FHWA Bikeway Selection Guide
  - Pedestrians – Utilized 5-foot Sidewalk Width
Recommended Infrastructure Identification

- Land Use Context Zones (2020 Census)
Gap Analysis

- **Bicycle Gap Analysis**
  - Reviewed Land Use, Speed, Volume and Existing Bicycle Facility Data in Relation to FHWA Bikeway Selection Guide Criteria to Develop GIS Gap Viewer
  - Supplemented available speed data with INRIX speed probe data around the state
Gap Analysis

- **Bicycle Gap Analysis**
  - Infrastructure Gap – No Physical Bicycle Facility/Shoulder
  - Quality Gap – Existing Bicycle Facility Does Not Meet FHWA Recommended Bicycle Facility Type Based on Traffic Volume and Speed Conditions
  - No Physical Gap, Insufficient Data for Quality Gap – Bicycle Facility Exists, But Unable to Assess Compliance With FHWA Guidance Due to Insufficient Speed or Volume Data
Gap Analysis

- Pedestrian Gap Analysis
  - Infrastructure Gap - No Physical Sidewalk Facility
  - Quality Gap – Existing Sidewalk is Less Than 5 Feet Wide
    - Documented Whether Quality Gap is One Side or Both Sides
- Future Analysis Underway to Perform Statewide Lidar Assessment of Sidewalks To Provide Better Condition Assessment
Gap Analysis

- Pedestrian Gap Analysis
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- Future Analysis Underway to Perform Statewide Lidar Assessment of Sidewalks To Provide Better Condition Assessment
Vision Map Development
Considered Three Different Approaches to Vision Mapping

- Overlaying Gap Analysis with Potential for Everyday Walking and Biking
- Point of Interest Buffer Applied Walk (1/2 Mile) and Bike (3 Mile) – Shed to Gap Analysis Layer
- Land Use Based Analysis Applied to Gap Analysis Layer with (1/2 Mile) and Bike (3 Mile)
Builds off

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- **Task 4** – Project Prioritization Metrics

**Land Use Based Approach to Vision Mapping**

**MULTIPLE-USE PROPERTY**

**CODE 0**

Real property used or held for one or more than one purpose, including parcels with multiple detached or attached buildings, are considered multiple-use property for classification purposes. Any necessary related land on a multiple-use property must be allocated among the classes of property within the building.

The first digit of multiple-use property is always a zero (0). The second and third digits are the major classification of the property represented. The digits following zero (0) are used in the order of minor importance.

**Examples**

Since the guidelines for coding multiple-use property are unique, several specific examples of how to identify such property with these codes are listed below. These are only examples and do not represent all possible multiple-use codes. Note: The initial zero code is limited to three digits and can only describe three classes of property.

- **003** Multiple Use, primarily Residential
  - A building with a retail store on the first floor, apartments on the upper floors, and a major portion of the related land is reserved for current parking.
- **001** Multiple Use, primarily Commercial
  - A building with retail use on the first floor, office space on the second and third floors, apartments on the fourth floor and a major portion of the related land is allocated for commercial use.
- **007** Multiple Use, primarily Commercial with part of land designated under Chapter 61A of the Act
  - A farm property with land and buildings predominantly used for commercial farming with part of land (at least 5 acres) designated horticultural/agricultural under Chapter 61A.
- **021** Multiple Use, primarily Open Space
  - A single-family house with substantial sewage designated open space by the assessors.

**RESIDENTIAL**

**CODE 1**

MG.L. Chapter 59:2A: All real property used or held for human habitation containing one or more dwelling units including row housing with facilities assigned and used for living, sleeping, cooking and eating on a non-stationary basis, and including a bed and breakfast home with no more than three rooms for rent. Such property includes accessory land, buildings or improvements incidental to such habitation and used exclusively by the residents of the property or their guests. Such property shall include: (i) land that is situated in a residential zone and has been subdivided into residential lots, and (ii) land used for the purpose of a manufactured housing community, as defined in Chapter 140, §27F. Such property shall not include a hotel or motel.

- **100** Single Family
- **102** Condominium
- **103** Mobile Home (includes land used for purpose of a mobile home park)
- **104** Two Family
- **105** Three Family
- **106** Accessory Land with Improvement – garage, etc.
- **107** (Intentionally left blank)
- **108** (Intentionally left blank)
- **109** Multiple Houses on one parcel (for example, a single and a two-family on one parcel)

**11 Apartments**

- **111** Four to Eight Units
- **112** More than Eight Units
- **113** (Intentionally left blank)
- **114** Affordable Housing Units (Greater than 50% of the area median income, Category per MGL 140 §27F, §33 for definition of governmental body and affordable housing formula)
Pedestrian Short Trips—Vision Map Analysis

Statewide Statistics
- **Statewide Analysis - Pedestrian Vision Map**
  - Total Miles Captured: 4,380 mi, 99.5% of total roads
  - Total Miles Not Included: 20 mi
- **Statewide Analysis - Bicycle Vision Map**
  - Total Miles Captured: 4,400 mi, 100% of total roads

Gap Type Breakdown
- Sufficient Infrastructure: 1,194 mi, 27% of roads
- Quality Gap: 634 mi, 14% of roads
- Physical Gap: 2,552 mi, 58% of roads

Road Capture by MPO - Pedestrian Vision Map
- Berkshire: 407/414 mi, 98% of total MPO roads
- Boston Region: 1,203/1,203 mi, 100% of total roads
- Cape Cod: 254/254 mi, 100% of roads
- Central Massachusetts: 444/447 mi, 99% of roads
- Franklin: 278/284, 98% of roads
- Martha’s Vineyard: 54/55.4, 99% of roads
- Merrimack Valley: 169/169, 100% of roads
- Mountachusett: 319/319 mi, 100% of roads
- Nantucket: 10/10 mi, 100% of roads
- Northern Middlesex: 127/127 mi, 100% of roads
- Old Colony: 196/196 mi, 100% of roads
- Pioneer Valley: 573/576 mi, 99% of roads
- Southeastern Massachusetts: 346/346 mi, 100% of roads
Bicycle Short Trips—Vision Map Analysis

Statewide Statistics

Statewide Analysis - Pedestrian Vision Map
Total Miles Captured: 4,389 mi, 99.5% of total roads
Total Miles Not Included: 20 mi

Gap Type Breakdown
Sufficient Infrastructure: 1,194 mi, 27% of roads
Quality Gap: 634 mi, 14% of roads
Physical Gap: 2,552 mi, 58% of roads

Statewide Analysis - Bicycle Vision Map
Total Miles Captured: 4,400 mi, 100% of total roads

Gap Type Breakdown
Sufficient Infrastructure: 434 mi, 10% of roads
Quality Gap: 706 mi, 16% of roads
Physical Gap: 3,235 mi, 74% of roads

Road Capture by MPO - Pedestrian Vision Map
Berkshire: 407/414 mi, 97.3% of total MPO roads
Boston Region: 1,203/1,203 mi, 100% of total roads
Cape Cod: 252/254 mi, 100% of roads
Central Massachusetts: 444/447 mi, 99% of roads
Franklin: 278/284, 97.8% of roads
Martha’s Vineyard: 56.9/55.4, 99% of roads
Merrimack Valley: 169/169, 100% of roads
Montachusett: 319/319 mi, 100% of roads
Nantucket: 10/10 mi, 100% of roads
Northern Middlesex: 127/127 mi, 100% of roads
Old Colony: 196/196 mi, 100% of roads
Pioneer Valley: 573/576 mi, 99% of roads
Southeastern Massachusetts: 346/346 mi, 100% of roads
Project Prioritization and Identification
Project Prioritization and Identification

- Consistency with Beyond Mobility Project Prioritization
  - Rural vs Urban Weighting
  - Focus on Equity, Safety, Transit Connectivity, % of People Walking and Biking
  - Grouping of Projects By Regional Planning Agency Boundary

- Draft Data Layer Weighting
  - Analysis Was Run Both With and Without Weighting Applied

- Will Be Using Following Data Layers for Reality Check
  - Impact II Safety Risk Tool
  - Bike Volumes (where available)
  - Statewide Bike/Ped Transportation Plan - Public Wiki Map Comments
  - Potential for Everyday Walking and Biking

<table>
<thead>
<tr>
<th>Analysis Topic</th>
<th>Priority (Weighting) (1-5)*</th>
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<tbody>
<tr>
<td></td>
<td>Urban</td>
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<tr>
<td>REJ+</td>
<td>5</td>
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<tr>
<td>Ped/Bike Crashes (50-ft horizontal buffer)</td>
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<tr>
<td>HSIP Clusters</td>
<td>5</td>
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<td>Transit Stop Presence on Road Segment (Urban - 0.5 Mile Walk &amp; 1.5 Mile Bike Buffer) (Rural - 1 Mile Walk &amp; 3 Bike Buffer)</td>
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<tr>
<td>Supermarket/Access to Food</td>
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<td>Population Density</td>
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<td>Proximity to Parks / Open Spaces / Recreational Facilities</td>
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* 1-5 weighting with 5 being more important
Technology Integrations: ArcGIS Notebooks

- Integrating Python into GIS Analysis
- Entire GIS Analysis contained in one place that can be easily repeated
- All NextGen GIS analyses were conducted using Notebooks
- Allowed for interactive edits with weighting/prioritization process
- Benefits:
  - Automating analysis
  - Increasing processing speed
  - Integrates into GIS map – live results
  - Organized, streamlined code
Bicycle Project Prioritization—Weighted by MPO

Legend

Bicycle Gap Corridors - Weighted by MPO

MPO_Rank_Combined

- > 95 - 100
- > 90 - 95
- > 85 - 90
- > 75 - 85
- > 65 - 75
- > 55 - 65
- > 40 - 55
- > 25 - 40
- > 15 - 25
- 0.394 - 15
Pedestrian Project Prioritization—Unweighted
Pedestrian Project Prioritization—Weighted
Bicycle Project Prioritization—Unweighted
Bicycle Project Prioritization—Weighted
Next Steps/Deliverables

- Refining project prioritization methodology
- Refining final project identification output
- Generating static maps and summary diagrams for each MPO
- Finalizing prioritization documentation (executive summary and technical memo)
- Final Project Wrap: Summer 2024
- Update pedestrian layers from the ongoing Sidewalk Condition Assessment—Anticipated Fall 2024
Use Case Studies—How Will MassDOT Utilize This Data?

- **Bike and Pedestrian Network Planning**
  - Project identification that is data driven
  - Identify priority corridors
  - Coordination with Municipalities / Districts / MPOs

- **Funding**
  - Level of funding needed at an annual / 5-year CIP
  - How much do regions need to meet specific thresholds?
  - Equitable funding allocation

- **Annual reporting and performance metrics**
  - How many gap miles were closed
  - Amount of investment and population served
    - Urban/rural
    - REJ+
    - District/MPO/State level
  - Were State / MPO level goals achieved?

- **District / MPO initiated projects**
  - Analyze where locations fall within the priority map

- **Complete Streets**
  - Assist in coordination of municipal planning for redundancy or collaboration

- **Complement road inventory facilities**
  - Support prioritization of sidewalk inventory Currently being assessed as a separate study
  - Support creation and prioritization of Massachusetts ADA Compliance Plan
Future Dashboard

- Policy Implementation
- Investment Allocation
  - Urban/rural
  - REJ+
- District/MPO/State level comparison
- Updated Network
  - Sufficient – Quality – Physical gap
- Comparative Illustration
  - MPOs / State
- Success metrics
  - Miles built
  - Millions spent
  - % improvements