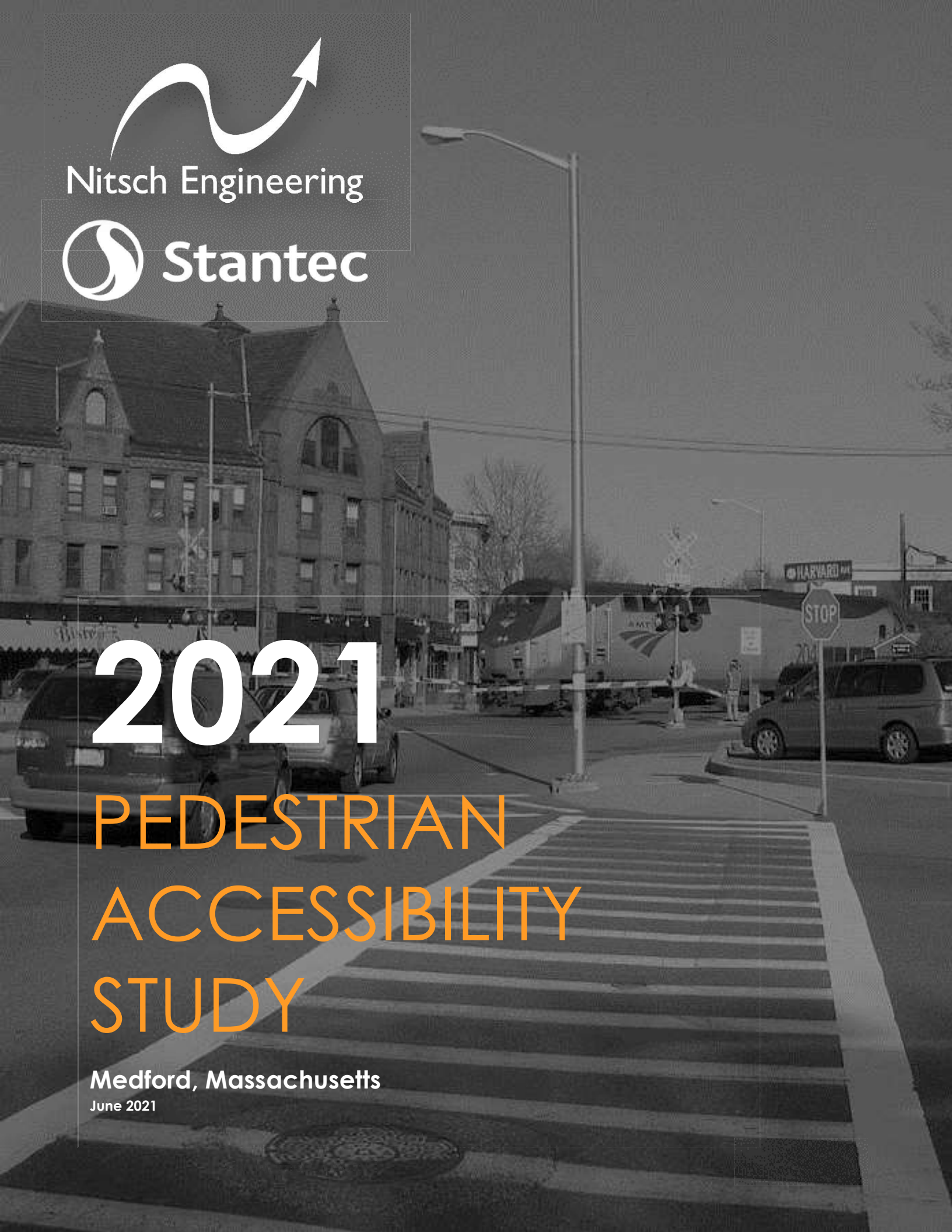
Nitsch Engineering

Stantec



2021 PEDESTRIAN ACCESSIBILITY STUDY

Medford, Massachusetts

June 2021

TABLES

FIGURES

1 INTRODUCTION

1 INTRODUCTION

BACKGROUND

The City of Medford is in Middlesex County, located approximately 6.7 miles northwest of downtown Boston, Massachusetts. Medford has a comprehensive pedestrian accessibility infrastructure consisting of over 190 miles of sidewalk and a little more than 2,800 pedestrian ramps which allow the population of over 57,000 people, as well as tourists, to enjoy the city.

The City of Medford, in June 2020, retained Nitsch Engineering and Stantec to create an inventory and assessment for both sidewalks and pedestrian ramps in an effort to make the City more accessible. From the first meeting with City Engineer, Tim McGiven and Assistant City Engineer, Mark Shea, it was clear that the City of Medford is committed to asset management, specifically addressing sidewalk condition, accessibility, and conformance with the Massachusetts Architectural Access Board (MAAB).

This inventory and assessment was undertaken in order to develop a comprehensive pedestrian sidewalk and ramp database describing ramp locations and conditions, and to better understand Medford's pedestrian accessibility infrastructure, so City-wide repair policies and priorities could be developed and established. The inventory was conducted utilizing geographic information systems (GIS) and web based data collection software in order to create a comprehensive database describing locations and conditions. This inventory includes detailed sidewalk and ramp measurements to be used to determine MAAB conformity and network-level information for systematic analyses to prioritize these assets for future construction programming, survey, and engineering. This inventory should be used in tandem with pavement network conditions to provide Medford with a more complete picture of overall conditions to assist with long-term capital improvement planning.

This report is designed to be a network level planning tool intended to provide a foundation for managing the City's pedestrian accessibility resources by combining technology, local knowledge, and professional engineering input. The following pages describe our approach.

INVENTORY APPROACH

Using iPads and iPhones with the ArcGIS Collector App, The Nitsch/Stantec Team conducted a City-wide (public-accepted streets) pedestrian sidewalk and ramp inventory and assessment with GIS integration to build a comprehensive database. Our Team provided a live web map track data collection progress.

Sidewalks Inventory

Beginning in August 2020, our team of engineers collected five (5) primary types of sidewalk field data:

1. Sidewalk material type: examples of materials include:
    - PC – Portland Cement Concrete
    - BR – Brick
    - BC – Bituminous Concrete
    - PCBA – Portland Cement Concrete w/ Brick Accent
    - SDGR – Stone Dust/Gravel
    - OT – Other

2. Sidewalk Visual Rating: a general condition category consisting of:
    - Excellent - Likely ADA compliant slopes, little to no surface distresses
    - Good - Likely ADA compliant, hairline cracks, 1 fault
    - Fair - Not ADA compliant, severe cracking, multiple faults, or missing brick
    - Poor – Not ADA compliant, extensive surface distresses, fractured panels and severe faulting, or missing bricks
    - Failure – Little to no accessibility

3. Sidewalk width: Average width of the sidewalk segment (excluding curb width). (Measured to the nearest half foot)

4. Curb reveal, type & condition: Curb type as well as average curb reveal along a given sidewalk segment with an overall condition per sidewalk segment. Sidewalk segments were broken out in the database on a street block-to-block basis.

5. Sidewalk slope: This measurement was based on a sidewalk cross-slope taken at a visually determined location where the slope appears to be the steepest, as a worst-case scenario within the segment.

    Additional data was gathered during field collection including a variety of types of trip hazards, pinch points (points at which the sidewalk width

Example of tree root and pinch point on Pleasant Street

is less than 36" due to obstructions such as trees, telephone poles, etc.), notes, comments or special considerations at observed at sidewalk locations, the initials of the inspector, photographs, and a timestamp with the date of the field inspection. See Appendix A for a full listing of sidewalk data collection attributes.

Ramps Inventory

Beginning in August 2020, field personnel also collected five (5) primary types of ramp field data:

1. Ramp material information: Examples of materials include:
   - PC – Portland Cement Concrete
   - BR – Brick
   - BC – Bituminous Concrete
   - PCBA – Portland Cement Concrete w/ Brick Accent

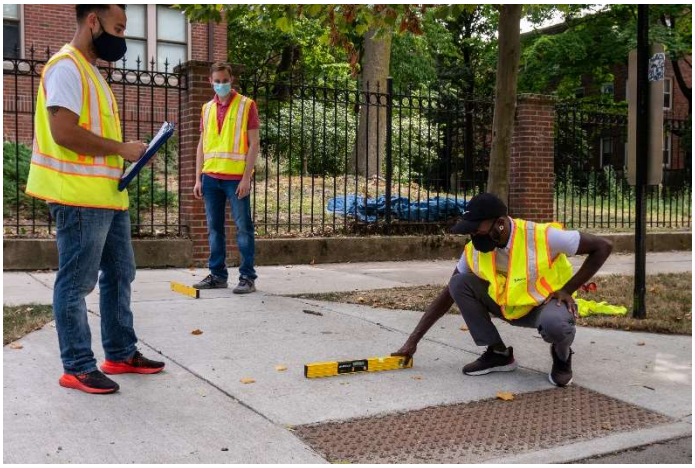
2. Ramp type: Based on a visual layout of the ramp:
   - Conventional
   - Directional
   - Narrow Sidewalk
   - Flat Corner
   - Pass-through
   - Combination

Missing ramp on Fulton St.

3. Crosswalk Presence, alignment, and condition: Identified using the following convention:
   - Alignment
     - Yes, misaligned
     - Yes, aligned
     - No Crosswalk
   - Condition
     - Good
     - Fair – Slight Fading
     - Poor – Needs Re-striping

4. Ramp, Landing, and Wing slopes:
   A 2-foot electronic smart level was used to record various slope components for each pedestrian ramp. MAAB, under Code of Massachusetts Regulations (CMR) 521 has many other requirements for pedestrian ramp components, these measurements were also taken during data collection.

Additional gathered data included whether there was a "lip" present based on transition from the street to the bottom of the pedestrian ramp; whether an Accessible Pedestrian Signal (APS) is present and accessible at signalized locations; a comments field containing any other information pertaining to the ramps not covered in the other data fields; the initials/identity of the data collector; photograph, and a timestamp from when the survey was conducted. See Appendix A for a full listing of ramp data collection attributes.



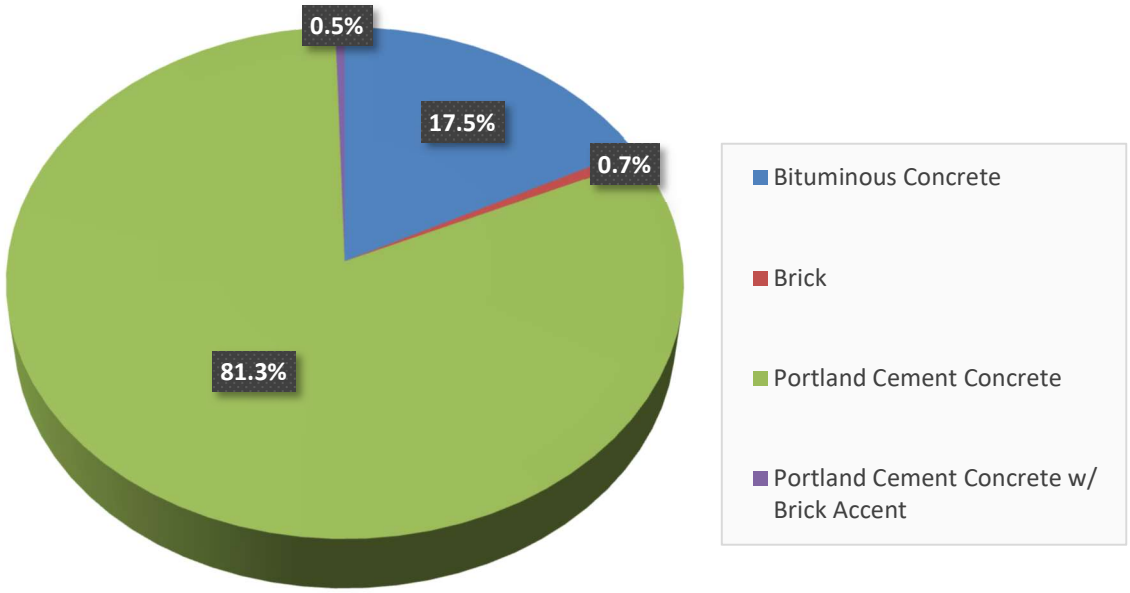
2 EXISTING CONDITIONS

2. EXISTING CONDITIONS

SIDEWALK INVENTORY

A total of 2,662 sidewalk block to block segments were inventoried throughout the City of Medford. The predominant material used for sidewalks in Medford is Portland Cement Concrete (81%). Figure 1 below shows the City-wide distribution of sidewalk area based on material type.

Figure 1
Distribution of Sidewalks by Material Type



Stantec

SIDEWALK CONDITION INDEX

A sidewalk condition index or SCI value was established to categorize sidewalk conditions into a repair strategy scheme. This index is based on a 0 to 100 scale which is calculated using the count of Hard Obstructions, Tree Roots, Curb conditions and Visual Sidewalk Observations. The result is then subtracted from 100 to produce an SCI value.

$$SCI = 100 - (\text{Hard Obstruction Score} + \text{Tree Root Score} + \text{Distress Store} + \text{Curb Condition Score} + \text{Visual SCI Score})/(\text{Highest Total Score})$$

SCI treatment bands were established and categorized to determined repair strategies accordingly:

0-50 = Full Replacement/ Reconstruction
50-89 = Localized Repairs/ Panel Replacement
89-100 = Do Nothing

The photos below show the visual difference between the three categories:

FULL REPLACEMENT/ RECONSTRUCTION

Sheridan Avenue

Stantec

LOCALIZED REPAIRS

Leyden Street

SCI: 73

DO NOTHING

Lawrence Road

SCI: 99

Stantec

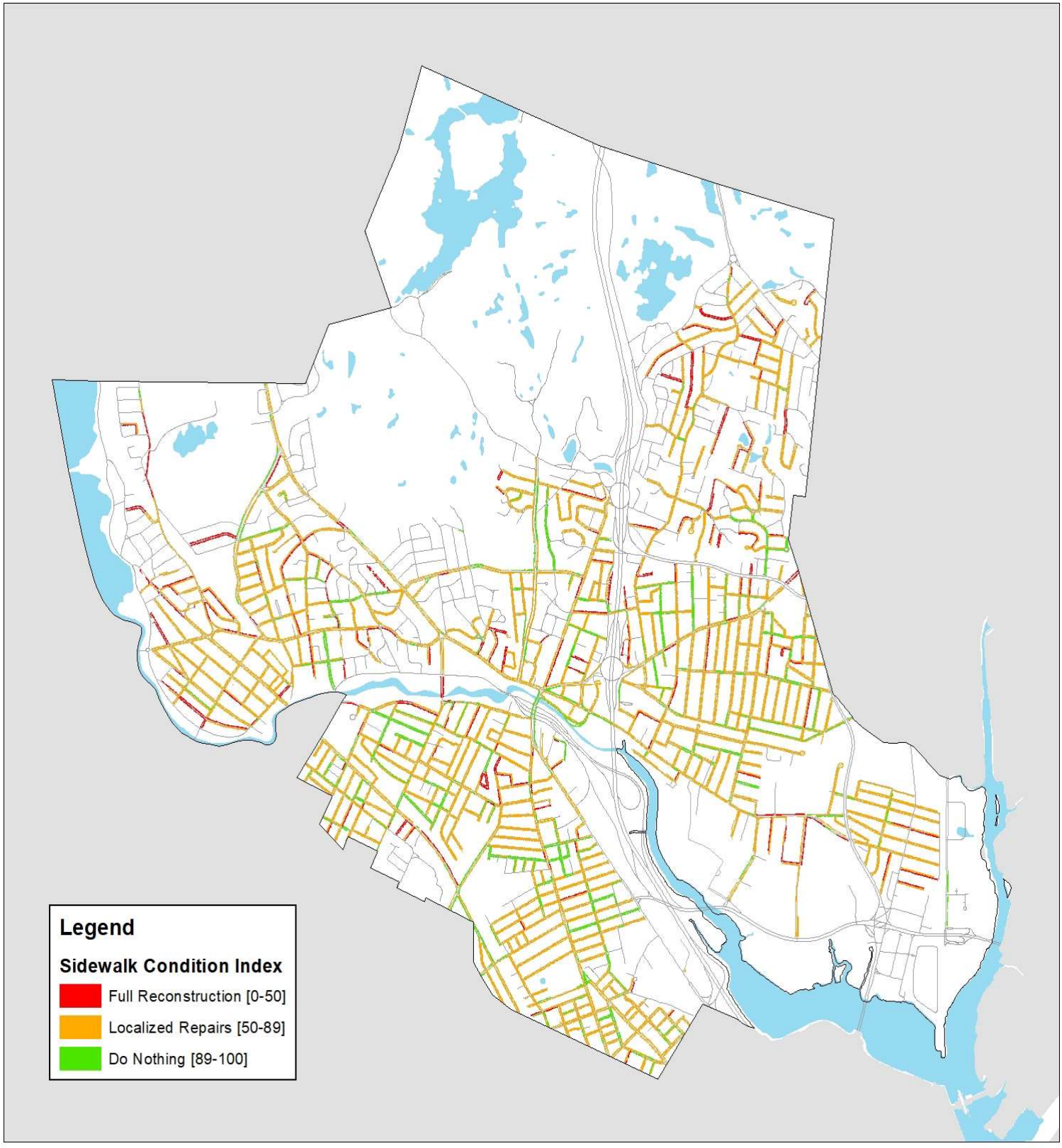
Table 1 below shows the distribution of single sided, block to block sidewalk segments, with respect to these SCI treatment bands throughout the City of Medford.

Table 1
SCI Treatment Band Distribution

SCI Treatment Band	Sidewalk Segment Count	Sidewalk Area (SF)
Full Reconstruction [0-50]	244	611,636
Localized Repair [50-89]	1,927	4,602,527
Do Nothing [89-100]	491	910,819

The average based SCI in Medford is **76.6**, which puts average conditions at the border of fair/good condition. With 75% of the sidewalk network in the 'Localized Repair' treatment band. Figure 2 below shows the distribution of the SCI treatment bands throughout the City.

Figure 2
SCI of Sidewalk Network



Stantec

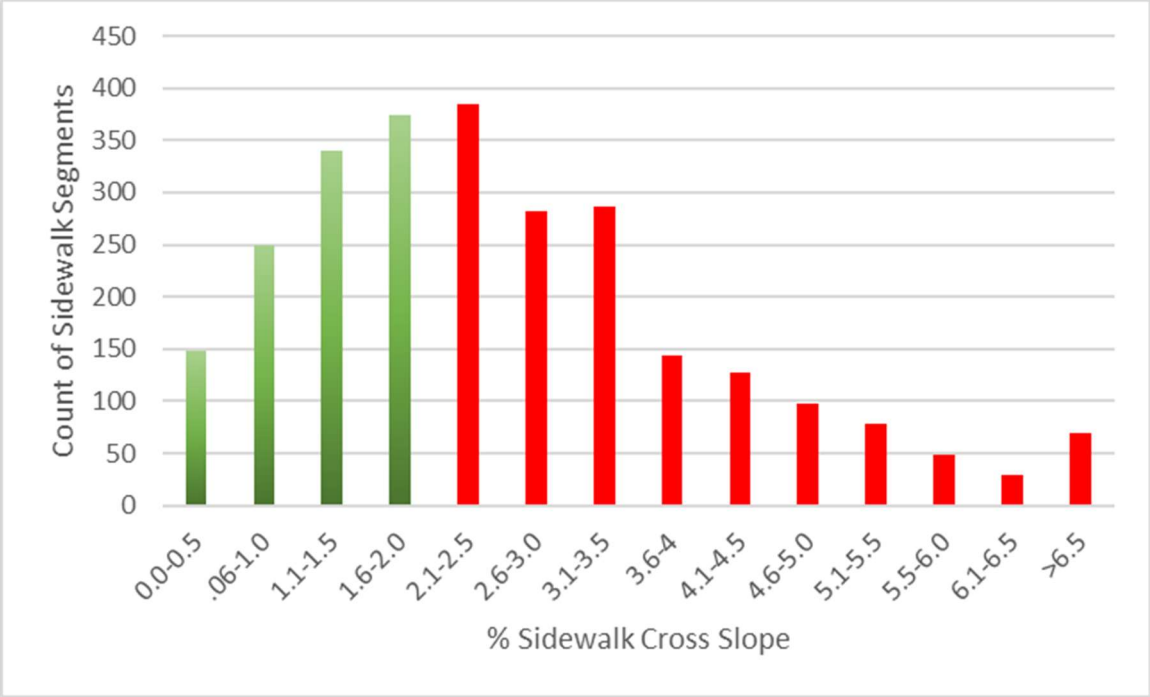
SIDEWALK SEGMENT ACCESSIBILITY

In order to determine the likelihood of meeting the minimum MAAB sidewalk standard, cross-slope and sidewalk width values were examined. In order to be a likely MAAB compliant sidewalk, a segment must have a cross-slope of less than 2% and a sidewalk width of at least 3 feet.

Street furniture, buildings, or other hardscape obstructions that prevented passage along the sidewalk was also located. Figure 3 displays the cross-slope measurements where green bars represent likely compliant slopes, and red bars represent likely non-compliant slopes. It can be seen from these that the primary reason for likely non-compliance in Medford is the sidewalk cross-slope since the majority of sidewalk widths surpass the 3 foot threshold.

If the sidewalk is considered likely compliant, it is assumed for the purposes of this assessment that the sidewalk is accessible. However, being "likely compliant" does not mean that the sidewalk is MAAB compliant and further verification is required to confirm complete compliance. An example requiring further verification would be a sidewalk segment that may include non-standard driveways, and/or overgrown tree roots.

Figure 3 Distribution of Sidewalk Cross-Slope



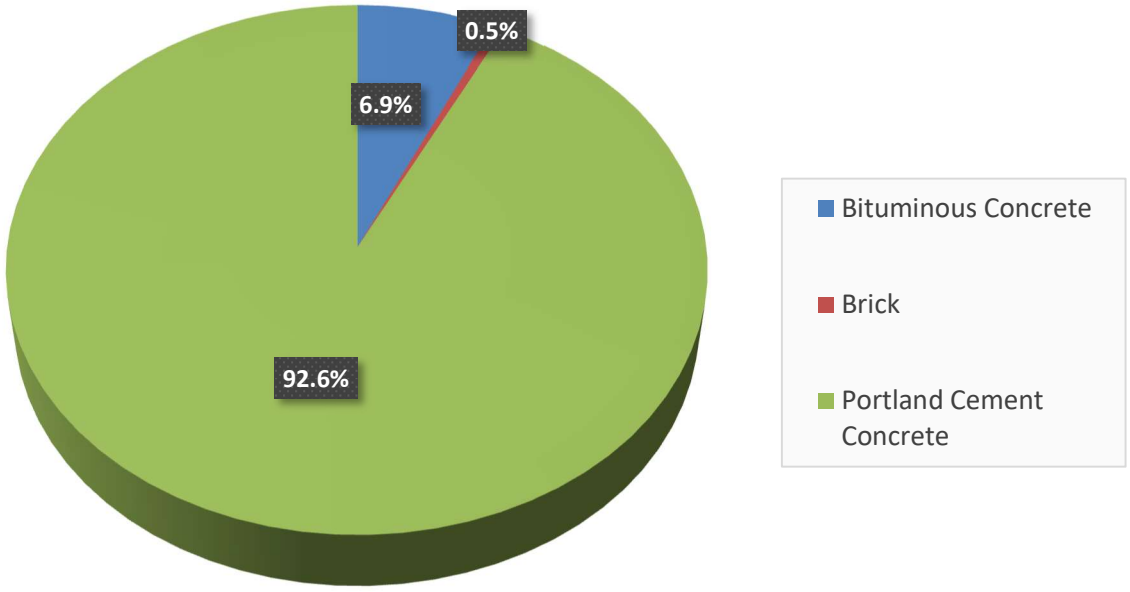
For this report, a sidewalk was considered likely compliant if the cross slope was less than 2%, width greater than 3 feet, and a overall condition that was not considered poor or failing for a likely compliant sidewalk. Within those

thresholds, it was determined that only 17% of sidewalks in Medford are likely compliant.

RAMP INVENTORY:

2,811 public accepted pedestrian ramps were inventoried throughout the City of Medford, including ramps that were classified as "missing" where existing crosswalk markings led to vertical curb face(s) with no curb cut to access the sidewalk. A categorization of the inventoried pedestrian ramps, as seen in Figure 4, shows that they are predominately made from cement concrete (92.6%).

Figure 4
Distribution of Ramps by Material Type



RAMP CONDITIONS:

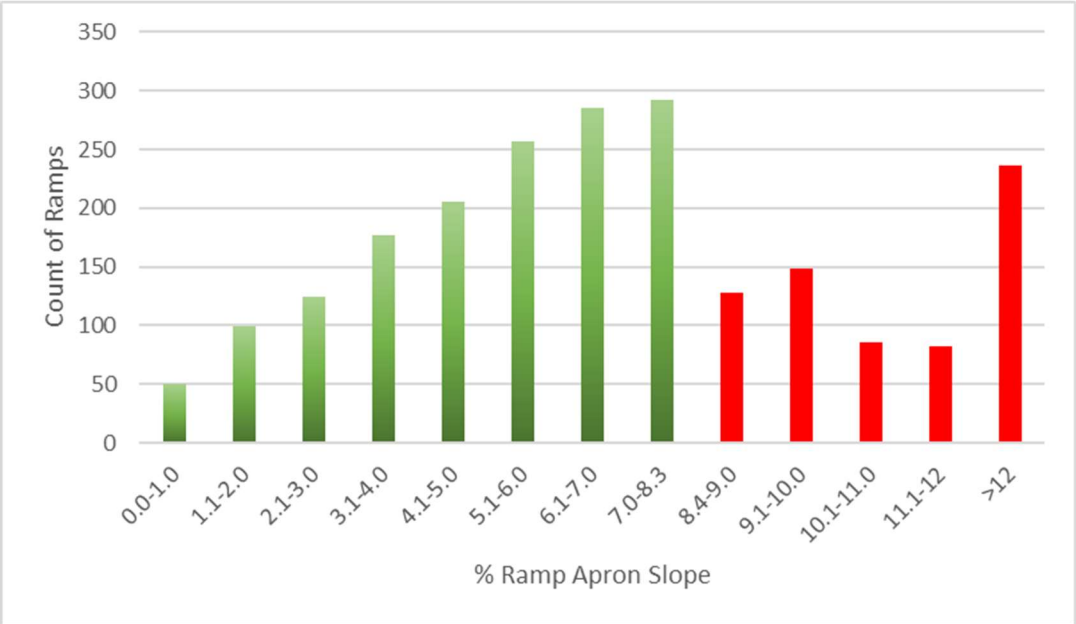
Table 2 below shows general ramp accessibility conditions. 44.4% (1,247) of the ramps inventoried were considered to have a landing present with no obstruction. 919 ramps were found which had no level landing present, as well as 622 ramps which were missing and 23 ramps with obstructions in the path of travel.

Table 2
Ramp Accessibility

Ramp Accessibility	Count of Instances
Existing Ramp w/ landing and no obstruction	1,247
Existing Ramp w/ no landing present	919
Ramp is missing	622
Existing Ramp w/ obstruction within proximity to travel of path	23
TOTAL	2,811

To get a more in depth analysis of MAAB compliance beyond visual inspection, pedestrian ramp apron and landing slopes were measured. The MAAB maximum slope for aprons and landings is 8.3% and 2.0% respectively. Figures 5 and 6 show distributions of both attributes with green bars showing compliant standards and red showing non-compliant standards.

Figure 5
Distribution of Apron Slope Percentage

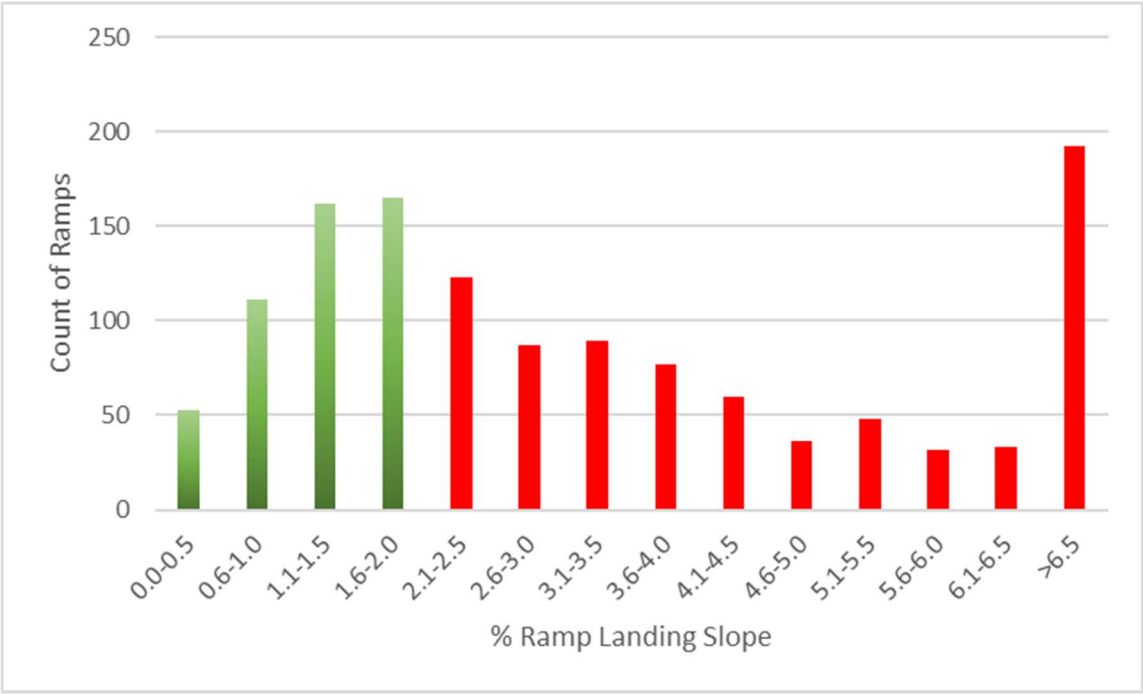


The distribution of apron slopes City-wide are relatively good as most ramps achieve an acceptable MAAB slope less than 8.3%. However, there are a significant number of ramps which have apron slopes exceeding 12% which significantly impedes accessibility. A majority of these ramps are made of portland concrete cement and are found through out the city. A few examples of these are shown below.

Clematis Road

Buzzells Lane

Figure 6
Distribution of Landing Slope Percentage



Note: Figure 6 excludes ramps in which no level landing was present. In determining likelihood of MAAB compliance, several inspection attributes were used:

1. If ramp is missing = <Null>
2. Threshold > 2.9'
3. Landing Existence = 'Yes'
4. Surface Landing Condition <> Poor
5. Surface Ramp Condition <> Poor
6. Landing Slope < 2.1%
7. Apron Slope < 8.4%
8. Right flare <10.1% unless
    a. > 10% and Obstruction in right flare = 'Yes'
9. Left flare <10.1%
    a. > 10% and Obstruction in left flare = 'Yes'
10. Obstruction of path with Ramp <> 'Yes'
11. Detectable warning panel = 'Yes' and either of the following:
    a. Condition of Warning Panel <> Poor
    b. Warning Panel Extend Width = 'Yes'
12. Counter gutter < 5.1%
13. Lip = 'No'
14. Condition of Pavement at bottom of Ramp <> Poor

Otherwise the ramp was determined to not be MAAB/ADA compliant. In using these, it was determined that **96%** of the existing ramps in Medford (excluding missing ramps) are likely not compliant with MAAB standards. In most cases, ramps failed because there was no adequate size landing, followed by landing slope >2%.

3 METHODOLOGY

3. Methodology

NETWORK PRIORITY RANKING (NPR):

The NPR number reflects the comparative merit of repairing one sidewalk/ramp over another, using variables other than simple observed deficiencies. To effectively manage Medford's pedestrian accessibility backlog, a systematic NPR was developed for each sidewalk/ramp. The database of sidewalk and ramp locations and ensuing methodology was tailored to reflect Medford's specific decision-making criteria for selecting ramps that would be most beneficial to repair first.

RAMPS NPR:

The NPR served as the means to prioritize ramp repair using seven (7) criteria that were scored separately and were key to the overall decision making process. The criterion is:

1. Ramp Existence
2. Proximity to Schools
3. Proximity to Bus & Train stops/stations
4. Proximity to Business Districts
5. Proximity to Parks and Recreational areas
6. Proximity to Medford 'High use Facilities'
7. Slope severity of Ramp apron & landing

1. Ramp Existence

Completely missing ramps significantly hinder pedestrian accessibility; thus, their mere existence or absence played a key role in determining the ranking.

- If a ramp was missing, regardless of a crosswalk being present, an NPR score of 450 was given.
- If the ramp was present, but missing a level landing, an NPR score of 250 was given.
- If a ramp was present regardless of material or extent of damage and included a level landing area, a score of 0 was given.

2. Proximity to Schools

The ramp locations were spatially related to public and private school parcels. Three (3) different sized buffer zones were created to prioritize ramps in the proximity of a school. If the ramps fell within 500 feet of a school, a score of 700 was given. If the ramp fell between 500 and 1000 feet away, a score of

300 was given. If the ramp fell between 1000 and 1500 feet away, a score of 150 was given.

3. Proximity to MBTA Commuter Rail Stations & Bus Stops

The ramp locations were related spatially to the closest MBTA commuter rail Station & Bus stops within a buffer of 500 feet. The NPR score for a ramp was based on its distance from a commuter station or bus stop and ranged from 0-500. If the ramp fell outside of the buffer, a score of 0 was given. However, if the ramp fell within the buffer, a score was given based on distance from the station, as shown below.

$$NPR_{MBTA} = 500 - distance\ to\ commuter\ station\ or\ bus\ stop$$

The rationale behind this calculation is that the closer a pedestrian ramp is to a commuter station, the higher the score will be for that ramp.

4. Proximity to Business Districts

The ramp locations were related spatially to the Business Districts within a buffer of 500 feet. Business districts were identified and provided by the City. The NPR score for a ramp was based on its distance from a Business District and ranged from 0-500. If the ramp fell outside of the buffer, a score of 0 was given. However, if the ramp fell within the buffer, a score was given based on distance from the Business District, as shown below.

$$NPR_{HPP} = 500 - distance\ to\ Business\ District$$

5. Proximity to Parks and Recreational Areas

The ramp locations were related spatially to Park and Recreational Areas within a buffer of 500 feet. The NPR score for a ramp was based on its distance from an Open Space and ranged from 0-500. If the ramp fell outside of the buffer, a score of 0 was given. However, if the ramp fell within the buffer, a score was given based on distance from Park and Rec Areas, as shown below.

$$NPR_{OS} = 500 - distance\ to\ Open\ Spaces$$

6. Proximity to High Use Facilities

The ramp locations were related spatially to High Use Facilities within a buffer of 500 feet. High Use Facilities, which include churches, public buildings, and emergency response stations, were identified and provided by the City. The NPR score for a ramp was based on its distance from High Use Facilities ranged from 0-500. If the ramp fell outside of the buffer, a score of 0 was given. However, if the ramp fell within the buffer, a score was given based on distance from High Use Facilities, as shown below.

$$NPR_{HUF} = 500 - distance\ to\ High\ Use\ Facility$$

7. Slope Severity of Ramp

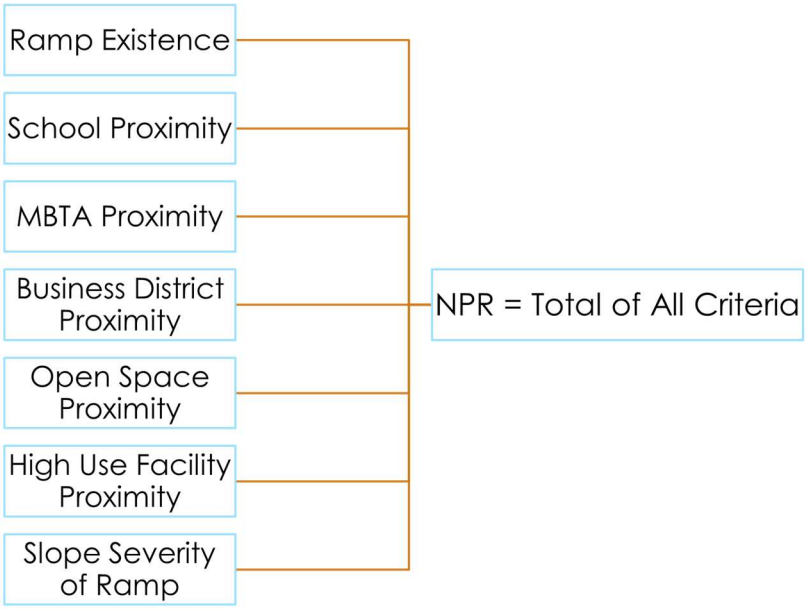
The NPR number also includes information on the measured percent slope of the ramp and landing. Higher percent slopes would require higher priority for repair.

- Apron Slope
  - If slope is greater than 11.9, and less than 15.0, then an NPR score of 150 was given
  - If the slope was greater than 15.0, then an NPR score of 300 was given.
- Landing Slope
  - If slope is greater than 4.5, and less than 6.5, then an NPR score of 100 was given
  - If the slope was greater than 6.5, then an NPR score of 200 was given.
- Otherwise a 0 NPR was given

NPR Formula

The NPR formula adds the rankings for each NPR criterion together to get a composite NPR ranking for each ramp in the data set. Figure 7 below shows a flowchart of the method:

Figure 7
Ramps NPR Calculation Flowchart



Note: if a ramp was likely-compliant, it received an NPR value of 0.

Once the final NPR values were summed for ramps, they were distributed into three categories based on the distribution of the values. Figure 10 shows all the likely-compliant ramps, as well as the priority levels on all non-compliant ramps.

SIDEWALKS NPR:

The NPR served as the means to prioritize sidewalk segment repair using Six (6) criteria that were scored separately and were key to the overall decision making process. The criterion is:

1. Sidewalk Condition (SCI)
2. Proximity to Schools
3. Proximity to Bus & Train stops/stations
4. Proximity to – Business Districts
5. Proximity to Parks and Recreational Areas
6. Proximity to Medford 'High use Facilities'

1. Sidewalk Condition

Presence of trip hazards and the physical condition of the sidewalk segments played a key role in determining the overall Sidewalk Condition Index Score (SCI Score) from 0-100; 100 being the best, 0 being the worst.
If SCI is:

- Greater than 85, an NPR score of 0 was given.
- Greater than 70 and less than 85, an NPR score of 150 was given.
- Greater than 50 and less than 70, an NPR score of 300 was given.
- Less than 50, an NPR score of 600 was given.

2. Proximity to Schools

The sidewalk segments were related spatially to the closest school parcels - both public and private. Three (3) different buffer zones were created to prioritize sidewalk segments in the proximity of a school. If the sidewalk segment fell within 500 feet of the school parcel, a score of 700 was given. If the sidewalk segment fell between 500 and 1000 feet away, a score of 300 was given. If the sidewalk segment fell between 1000 and 1500 feet away, a score of 150 was given.

3. Proximity to MBTA Commuter Rail Stations & Bus Stops

The sidewalk segments were related spatially to the closest MBTA commuter rail stations & bus stops within a buffer of 500 feet. The NPR score for a segment was based on its distance from a commuter station or bus stop and ranged from 0-500. If the sidewalk segment fell outside of the buffer, a score of 0 was

given. However, if the sidewalk segment fell within the buffer, a score was given based on distance from the station, as shown below.

$$NPR_{MBTA} = 500 - distance\ to\ commuter\ station\ or\ bus\ stop$$

The rationale behind this calculation is that the closer a pedestrian sidewalk segment is to a commuter station, the higher the score will be for that sidewalk segment.

4. Proximity to Business Districts

The sidewalk segment locations were related spatially to Business districts within a buffer of 500 feet. Business districts were identified and provided by the City. The NPR score for a sidewalk segment was based on its distance from a Business District ranged from 0-500. If the sidewalk segment fell outside of the buffer, a score of 0 was given. However, if the sidewalk segment fell within the buffer, a score was given based on distance from the Business District, as shown below.

$$NPR_{HPP} = 500 - distance\ to\ Business\ District$$

5. Proximity to Parks and Recreational Areas

The sidewalk segment locations were related spatially to Open Spaces within a buffer of 500 feet. The NPR score for a sidewalk segment was based on its distance from an Open Space and ranged from 0-500. If the sidewalk segment fell outside of the buffer, a score of 0 was given. However, if the sidewalk segment fell within the buffer, a score was given based on distance from the Open Space, as shown below.

$$NPR_{OS} = 500 - distance\ to\ Open\ Spaces$$

6. Proximity to High Use Facilities (HUF)

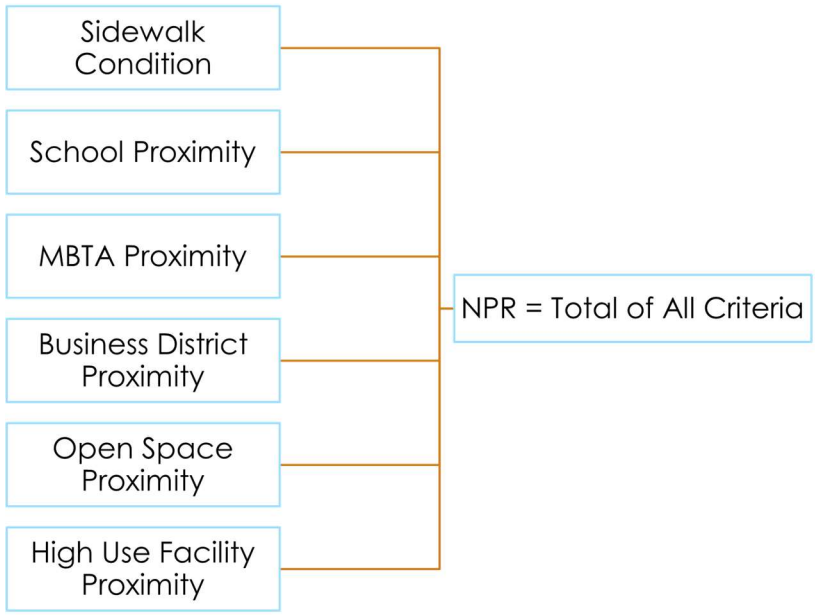
The sidewalk segment locations were related spatially to High Use Facilities (HUF) within a buffer of 500 feet. High Use Facilities, which include churches, public buildings, and emergency response personnel stations, were identified and provided by the City. The NPR score for a sidewalk segment was based on its distance from a HUF and ranged from 0-500. If the sidewalk segment fell outside of the buffer, a score of 0 was given. However, if the sidewalk segment fell within the buffer, a score was given based on distance from the HUF, as shown below.

$$NPR_{HUF} = 500 - distance\ to\ High\ Use\ Facility$$

NPR Formula

The NPR formula adds the rankings for each criterion together to get a composite number ranking for each sidewalk segment in the data set. Figure 8 shows a flowchart of the method:

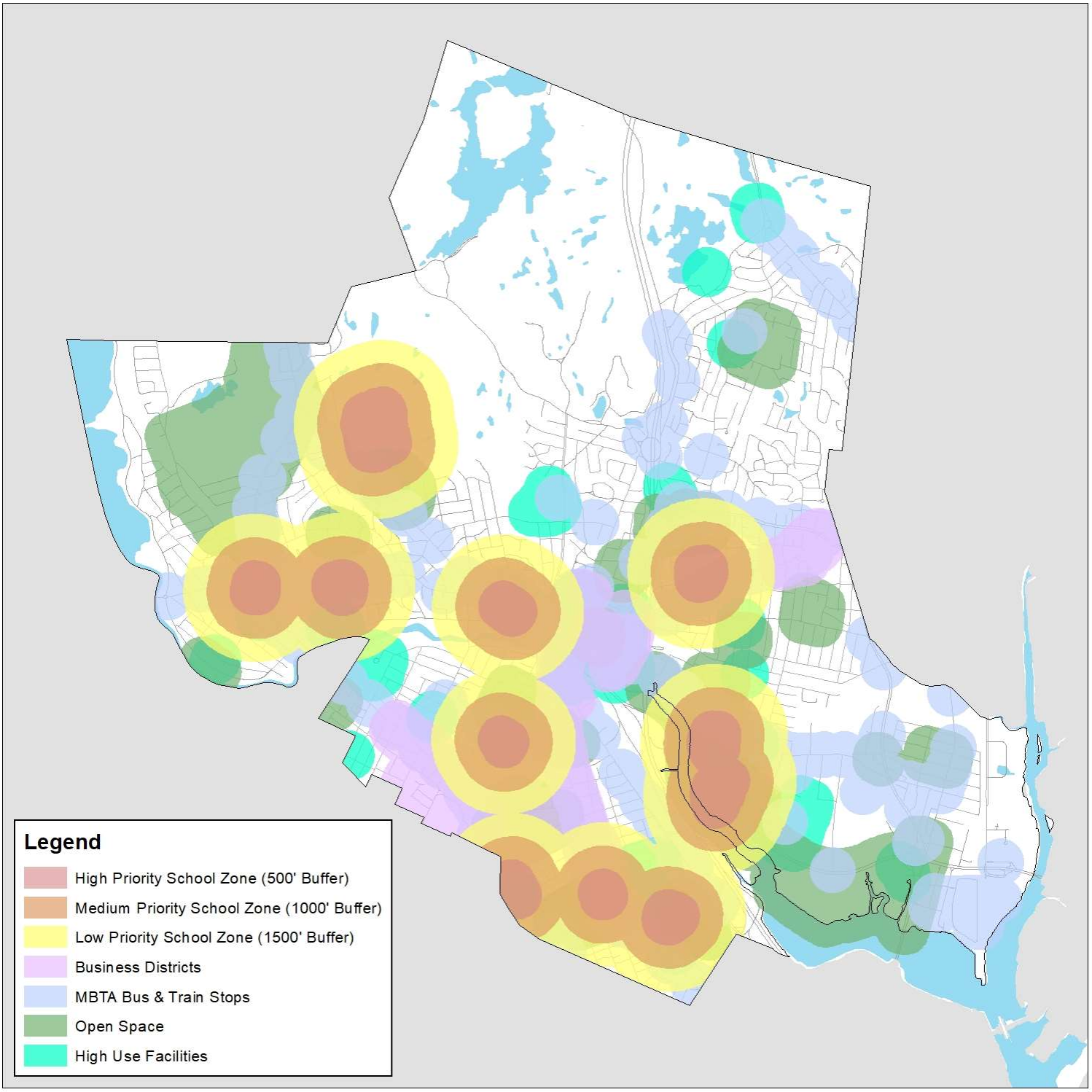
Figure 8
Sidewalks NPR Calculation Flowchart



Once the final NPR values were summed for sidewalks, they were distributed into three categories based on geometric split. Figure 10 shows the NPR values for sidewalks throughout the City of Medford. Sidewalks with a cross slope less than 2%, width greater than 3 feet, and SCI greater than 85 were considered compliant and received an NPR value of 0.

Figure 9 depicts the spatial related NPR criterion overlay results, while Figures 10 and 11 show a the resulting sidewalk and ramp repair prioritization distribution based on the NPR components.

Figure 9 NPR Proximity Elements



Stantec

Figure 10 Network Ramp NPR

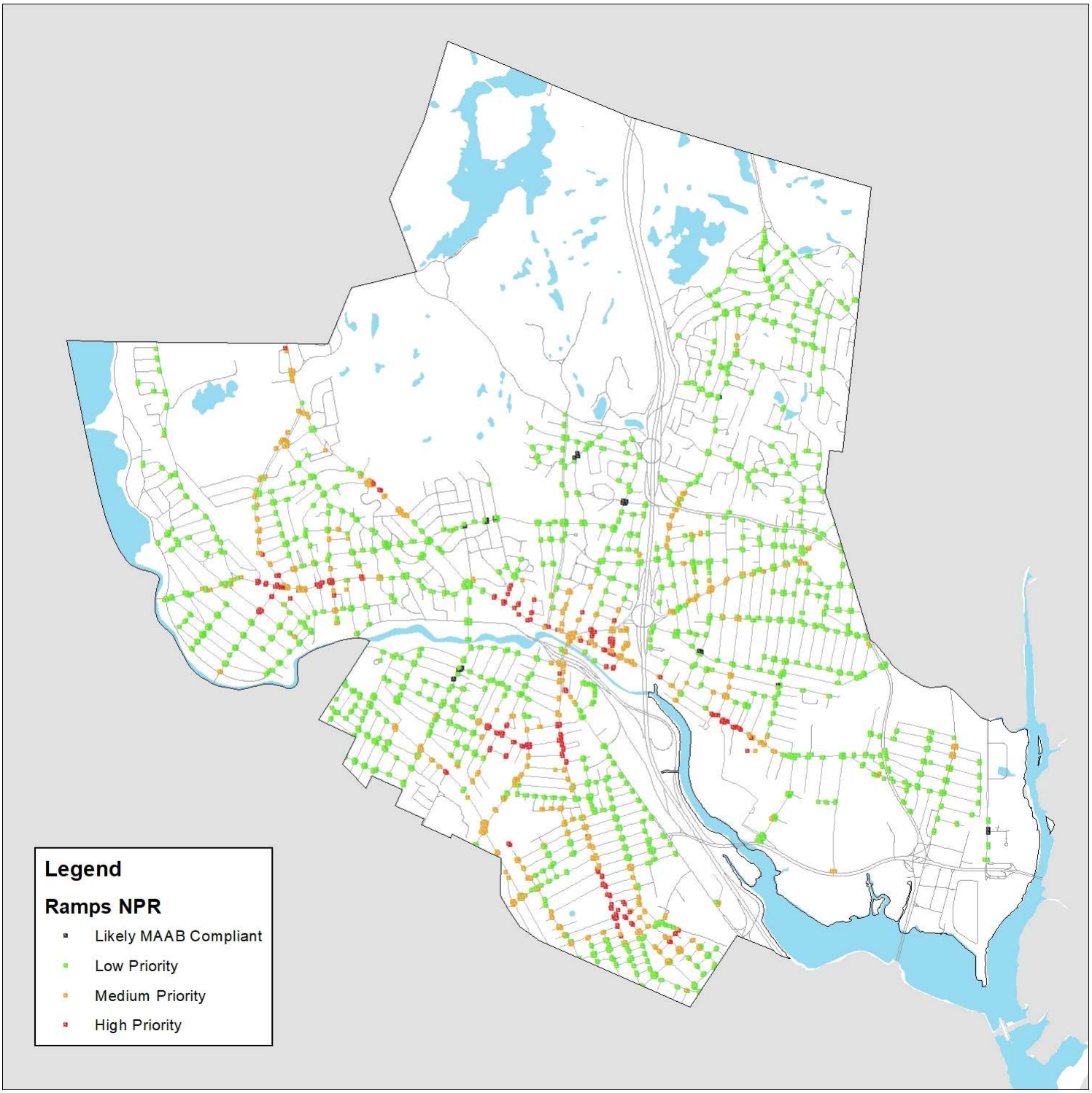
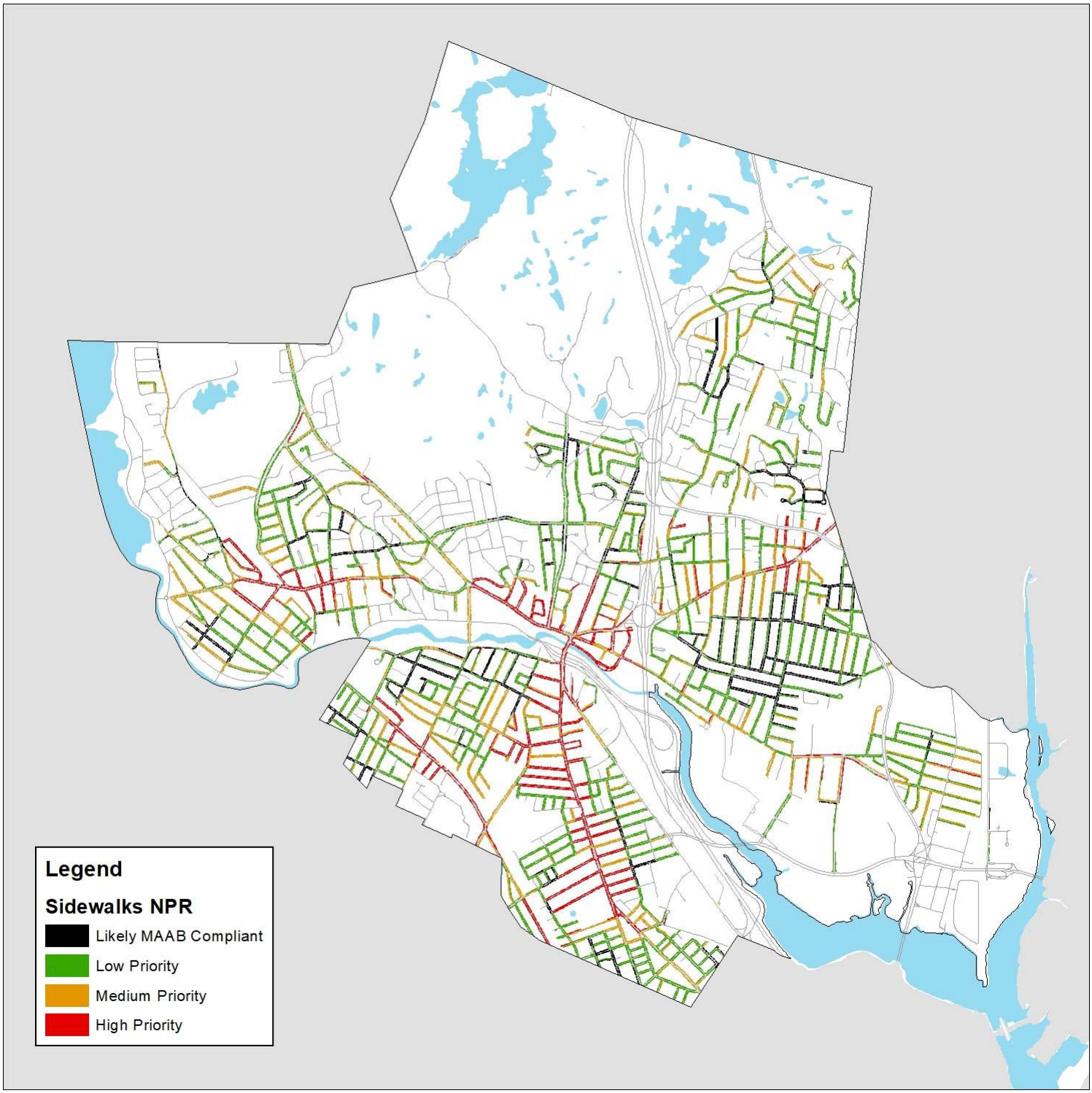


Figure 11 Network Sidewalk NPR



4 BACKLOG & FUNDING SCENARIOS

4.BACKLOG/FUNDING SCENARIOS

SIDEWALK REPAIR COSTS:

Having established a detailed inventory for existing sidewalks, financial costs were needed for future budget planning. Consideration was given based on historical pedestrian sidewalk repair costs, material classification, and sidewalk damage area. The following sidewalk budgetary reconstruction costs were used for this analysis:

Table 3
Sidewalk Reconstruction Costs

Sidewalk Material	Cost
PC- Portland Cement Concrete	$ 15/ft^2
PCBR – Portland Cement w/ Brick Accent	$ 25/ft^2
BR- Brick	$ 30/ft^2
BC- Bituminous Concrete	$ 15/ft^2
SDGR – Stone Dust/Gravel	$15/ft^2

The above costs were applied to the City-wide sidewalk network based on damage area based on the following categories:

1. Reconstruction: SCI = 0-50 – Entire sidewalk area is budgeted to be reconstructed
2. Localized Repair: SCI = 50-89 – Only damaged area is budgeted to be reconstructed
3. Do Nothing: SCI = 89-100 – Nothing budgeted for repair

Note: The costs in Table 3 include the full replacement of ramps on the sidewalk segment. Separate analysis was done on the ramps for accessibility and NPR to show the compliance and priority of repair, but the budget analysis herein include the ramps within the sidewalk segments.

CURRENT SIDEWALK BACKLOG:

Today's full replacement cost for Medford's sidewalks is $91.8M. Backlog is defined as the cost of repairing all sidewalks, partial panel replacement, and full replacement sidewalk reconstruction within one year bringing sidewalks to a near perfect condition. Backlog is a "snapshot" or relative measure of outstanding repair work. The backlog not only represents how far behind the Medford sidewalk network is in terms of its condition, but it also offers a basis for comparison for future and/or past year's backlog(s) to determine if the City is catching up, or falling behind. Backlog dollars represent the cost to repair sidewalks and curbing only. It does not include related repair costs for relocation and installation of utilities, lighting, signal/APS apparatus, or landscaping.

Utilizing SCI Treatment band distribution as found in Table 1 and Sidewalk reconstruction costs, in Table 3, we determined, Medford's backlog of sidewalk repair work is **$30,817,570** as of April 2021.

FUNDING SCENARIOS:

In order to determine the necessary funding to keep the network in good condition, a future funding scenario was evaluated for (3) three years. In the scenario, a lifetime of 25 years, 35 years and 50 years were used for Brick, Bituminous and Cement Concrete sidewalks respectively. The unit prices used include the repair of ramps, if applicable to the sidewalk segment.

An equilibrium scenario utlizing $2.5M annually for the sidewalk network was evaluated. This scenario maintains the SCI while lowering the backlog. Table 4 below shows the results of this scenario. The sidewalk network maintains an SCI around 76.6, while the backlog decreases to $26.4M over a 3-year period.

Table 4
$2.5M Funding Scenario

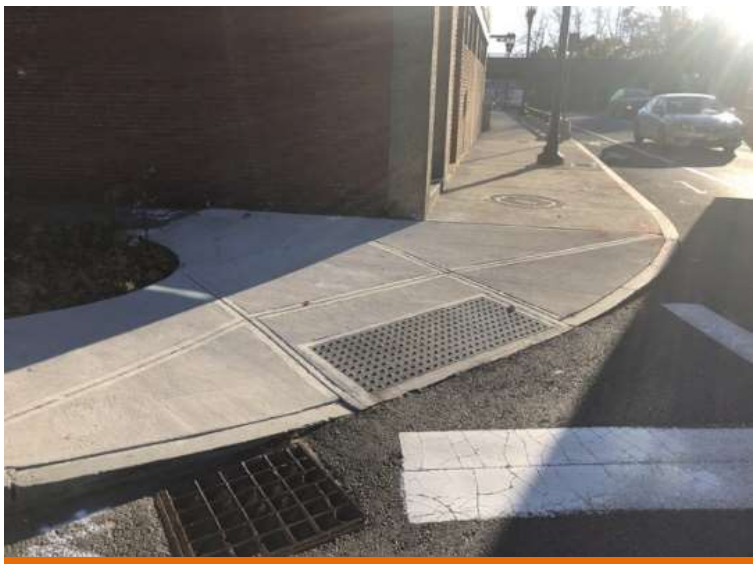
YEAR	FUNDING	BACKLOG	NETWORK SCI
03/2021		$30,817,570	76.6
FY2022	$2.5M	$29,387,139	76.2
FY2023	$2.5M	$27,905,177	76.3
FY2024	$2.5M	$26,387,328	76.4

5 RECOMMENDATION

5. RECOMMENDATION

RECOMMENDED PLAN OF ACTION

The overall pedestrian sidewalk network in the City of Medford is currently in good to fair condition. With an average SCI of around 76.6, the City has a good overall network condition level with most sidewalks only requiring localized repair. However, only 17% of the sidewalks are likely MAAB compliant based on existing condition, cross slope, and width of the sidewalks. If the cross slope of the sidewalk exceeds 2%, the sidewalk is considered non-compliant. With predominantly Portland cement concrete sidewalks, the sidewalks are in overall good physical condition but lack the required slopes to be considered ADA compliant. Based on the sidewalk condition index, it was determined that the current backlog of Medford's sidewalk network is $30,817,570.



New ramp on Main Street with a landing slope over 5%

The data gathered from this study shows with a "high-probability" that 6% of Medford's existing pedestrian ramps (excluding missing ramps) are in compliance with MAAB standards. This study shows that future diligence with respect to MAAB standards will be necessary to improve City-wide ramp conditions.

Given the current condition of the network, it is likely that Medford has been funding the needs of the sidewalk and ramp network throughout the years. Based on the analysis from this study, a baseline of $2.5M should be spent to maintain current conditions. The Nitsch/Stantec Team observed some 'newly constructed' ramps which were minimally non-compliant due to workmanship, which can be improved in the future with better field layout and inspection. By putting a little more effort to build it right the first time, the City can get more benefit from its asset investment in the network. The image to the left shows a new ramp built on Main Street that failed the landing slope compliance.

The City should consider a capital improvement program using the NPR strategy as outlined in this study to address priority ramp locations and large

reconstruction of critical areas around schools, business districts, transit stop locations and high use facilities.

Medford should assemble an ADA Task Force including members from different City departments, as well as members from the physically challenged and disabled communities. Review and feedback from the accessibility community can vastly benefit Medford's efforts for improving pedestrian accessibility.

The City's ADA Task Force should maintain and expand upon the database assembled as part of the Sidewalk Inventory prepared by the Nitsch/Stantec Team. Asset management is a systematic process that needs the long-term commitment and support of Medford's practitioners and decision-makers to maintain the asset management database system. The following are general recommendations and standard management and upkeep practices for ramps and sidewalks:

Ramps and Sidewalks:

1. Implement a sound departmental quality control/assurance program, with particular focus on MAAB construction standards. Offer incentive/disincentive(s) based on new, in-place ramp construction. Consider paying separate item for poured landings and DWPs. During the winter months hold a education series with respective City contractors to go over ramp constrcution and layout for success to meeting MAAB standards.
2. Inspect newly constructed sidewalks and ramps within a month of completion to confirm that all was constructed to MAAB standards.
3. Identify a single individual who will act as a custodian of the maintenance and upkeep of the sidewalk GIS layer/database.
4. Update sidewalk segment information where past reconstruction dates are known. The ADA standards for accessible design changed January 26, 1992, having these dates could assist in avoiding MAAB violations.
5. Post all annual pedestrian ramp and sidewalk improvements into the GIS database/Cartegraph. Both the pedestrian ramp condition ratings and the repair history information should be entered. Track MAAB ramp variance requests in a geo-database environment.
6. Add any new pedestrian ramps and sidewalks to the database as soon as the City accepts them. Pavement and sidewalk data can be added/modified as it becomes available.
7. Re-inspect 20% of sidewalks/ramps annually.
8. Consider updating sidewalk NPR and joining with new Pavement/AssetManagement Plan data.

In summary, the pedestrian accessibility inventory should serve as a valuable tool to the City of Medford and to Medford decision-makers in their pro-active approach to managing Medford's sidewalk assets.

APPENDIX A

GIS Data Dictionary

SIDEWALKS

Attribute	Description
UniqueRdID	Unique Block to Block section of roadway
RoadName	Road Name
RoadStatus	Roadway Jurisdiction
SideofRoad	Compass direction of sidewalk relative to road
INSP_WHO	Inspector
INSP_DATE	Inspection Date
SWK_MATL	Surface material of sidewalk
SWK_WIDTH	Average width of sidewalk (ft)
SCI_RATING	Visual sidewalk rating
SWK_SLOPE	Average Cross-slope of sidewalk segment
RUN_SLOPE	Average Running slope of sidewalk segment
ESPLAN_TYP	Surface material of esplanade, material between sidewalk and curb, if present
ESPLAN_WID	Average width of esplanade (ft)
CURB_TYPE	Material of Curb
CURB_COND	Condition of Curb
CURB_REV	Average Curb Reveal (in)
NPR_SCHOOL	NPR Score based on School distance
NPR_MBTA	NPR Score based on MBTA distance
NPR_HPP	NPR Score based on Business District distance
NPR_HUF	NPR Score based on High Use Facilities distance
NPR_OS	NPR Score based on Parks and Recreational distance
NPR_COND	NPR Score based on condition of sidewalk
NPR_TOTAL	Sum of all NPR Criteron for sidewalk segment
FROM_	Cross-street which sidewalk segment begins at
TO_	Cross-street which sidewalk segment ends at
SHAPE_Leng	Spatial Line Length
SHAPE_Area	Spatial Polygon Area
Compliance	Whether or not sidewalk segment is likely AAB compliant
Backlog	2021 Cost of Repair
HardObstru	Count of Hard Obstructions along sidewalk
SoftObstru	Count of Soft Obstructions along sidewalk
AlligatorC	Count of HMA alligator cracking along sidewalk
Faulting	Count of Faulting along sidewalk
FracturedP	Count of Fractured PCC panels along sidewalk
MissingBri	Count of Missing bricks along sidewalk
Distortion	Count of Distortions along sidewalk
Hazards	Sum of Hazards and Obstructions along sidewalk
TreeRoot	Count of Tree root lifts along sidewalk
CurbFault	Count of Fault curb along sidewalk
SCI_Score	Sidewalk Condition Index score (0-100) based on count of obstructions and hazards

GIS Data Dictionary

RAMPS

Attribute	Description
OBJECTID	Unique ID of the ramp point
INSP_WHO	Inspector
INSP_DATE	Inspection Date
RAMP_TYPE	Type of ramp
RAMP_MATL	Surface material of ramp
MISSING_RA	If ramp is missing
RAMP_POS	Position of ramp
THR_WIDTH	Threshold width of ramp
LAND_EXIST	Ramp Width' x4' Landing Existence
RAMP_COND	Surface condition of entire ramp
LANDING_SL	Landing running or cross slope percent of ramp (worst case)
APRON_SL	Apron running slope percent of ramp
APRON_CS	Apron cross slope percent of ramp
RFLARE_SL	Slope of right flare (N/A if no flare exists)
LFLARE_SL	Slope of left flare (N/A if no flare exists)
DWP_MATL	Detectable Warning Panel material
DWP_COND	Condition of Detectable Warning Panel
DWP_WIDTH	Detectable Warning Panel extends entire width of ramp
GUTTER_SL	Gutter slope at bottom of ramp
GUTTER_CS	Gutter counter-slope extending into the street
LIP	Whether or not the ramp has a lip or not
CROSS_EXIS	Crosswalk existence & alignment
PAVE_COND	Condition of pavement in 4' x 4' area preceding ramp
OBSTR_RAMP	Obstruction of path with ramp
OBSTR_PATH	Obstructions of path within flares
VARIANCE	Whether ramp may require variance
APS_EXIST	APS Existence
CROSS_COND	Crosswalk condition
NOTES	Open text field for any notes/comments
NPR_SCHOOL	NPR Score based on school distance
NPR_MBTA	NPR Score based on MBTA distance
NPR_HPP	NPR Score based on Business District distance
NPR_RAMP_C	NPR Score based on condition of ramp
NPR_TOTAL	Sum of all NPR Criteron for sidewalk segment
RepairType	Type of ramp repair
ADA_MAABCo	Whether or not ramp is likely AAB compliant
Backlog	2021 Cost of Repair based on Repair Type
NPR_OS	NPR Score based on Parks and Recreational distance
NPR_HUF	NPR Score based on High Use Facilities distance
NPR_RAMP_E	NPR Score based on existence of ramp

GIS Data Dictionary

HAZARDS & OBSTRUCTIONS

Attribute	Description
INSP_WHO	Inspector
INSP_DATE	Inspection Date
ISSUE_TYPE	Type of Hazard or Obstruction

APPENDIX B

Stantec

N
W E
S

Legend

Ramps NPR

- Likely MAAB Compliant
- Low Priority
- Medium Priority
- High Priority

Sidewalks NPR

- Likely MAAB Compliant
- Low Priority
- Medium Priority
- High Priority

Priority Buffers

- High Priority School Zone (500' Buffer)
- Medium Priority School Zone (1000' Buffer)
- Low Priority School Zone (1500' Buffer)
- Business Districts
- MBTA Bus & Train Stops
- Open Space
- High Use Facilities