2017 PEDESTRIAN ACCESSIBILITY STUDY

Natick, Massachusetts

Stantec

2017 PEDESTRIAN ACCESSIBILITY STUDY
NATICK, MASSACHUSETTS

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1 INTRODUCTION

BACKGROUND

The Town of Natick is located in Middlesex County, just outside of Boston, Massachusetts. Natick has a comprehensive pedestrian accessibility infrastructure consisting of over 140 miles of sidewalk and a little more than 1,500 ramps which allow the population of over 33,000 people, as well as tourists, to enjoy the town.

The Town of Natick, in June 2017, retained the firm Stantec to create an inventory and assessment for both sidewalks and ramps in an effort to make the Town more accessible. From the first meeting with Director of Public Works Jeremy Marsette, it was clear that the Town of Natick 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 Natick's pedestrian accessibility infrastructure, so Town-wide repair policies and priorities could be developed and established. The inventory was conducted utilizing geographic information systems (GIS) and a web based data collection software in order to create a comprehensive database describing locations and conditions. This inventory does not include detailed sidewalk and ramp measurements to be used to determine *absolute* MAAB conformity, but rather general network-level information so systematic analyzes could prioritize these assets for future construction programming, detailed MAAB compliant survey, and engineering. This inventory should be used in tandem with pavement network conditions to provide Natick with a more complete picture of the overall conditions to assist with long-term capital improvement planning.

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

INVENTORY APPROACH

Using field tablets with the ArcGIS Collector App, Stantec conducted a Town-wide pedestrian sidewalk and ramp inventory and assessment with GIS integration to build a comprehensive database. Stantec provided the Town a live link to track data collection progress.

Sidewalks Inventory

Beginning in July 2017, Stantec collected five (5) primary types of sidewalk field data:

1. Sidewalk material type: examples of materials include:
   CC – Cement Concrete
   BR – Brick
   BC – Bituminous Concrete
   CB – Cement Concrete w/ Brick
   OT – Other

2. Sidewalk distresses: Stantec identified and quantified damage areas included hairline cracking, lips at curb and back of sidewalk, missing bricks, empty tree pits, lifting concrete sidewalk panels, utility cuts, and tripping hazards. These distressed areas were measured and used to calculate a total damage area for each sidewalk segment using the following measurements:

   Length of Damage: The linear measure of damaged sidewalk in aggregate accurate to the nearest foot.

   Width of Damage: The average sidewalk damage width within the segment. (Measured to the nearest half foot) Occasionally, sidewalk damages did not extend the full width of the sidewalk and repairs would only require a small section to be replaced.

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

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

Example of trip hazard on Pitts St.

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 the total number of trip hazards, any sidewalk width pinch points (points at which the sidewalk width is less than 36" due to obstructions such as trees, telephone poles, etc., as well as less than 60" for snow plow obstructions), a notes field for any comments or special considerations at sidewalk location, the initials of the inspector, and a timestamp with the date of the field inspection. See Appendix A for a full listing of data collection attributes.

Ramps Inventory

Beginning in July 2017, field personnel also collected five (5) primary types of ramp field data:

1. Ramp material information: Examples of materials include:
   CC – Cement Concrete
   BR – Brick
   BC – Bituminous Concrete
   CB – Cement Concrete w/ Brick

   Ramp type: Based on a visual inspection of the ramp:
   Conventional
   Directional
   Narrow Sidewalk

2. Ramp deficiency:
   This is a simple visual assessment (no field measurements) as to whether a wheelchair could access and utilize the ramp. Attributes consisted of:
   Ramp is missing
   No level landing present
   Obstruction in path of travel
   No deficiency

Missing ramp on Union St.

3. Crosswalk Condition: Identified using the following convention:

   Crosswalk does not exist
   Crosswalk exists, not out of alignment with ramp
   Crosswalk exists and encloses the ramp threshold

4. Ramp and landing slopes:

   A 2-foot electronic smart level was used to record the slope(s) of the ramp and landing for each pedestrian ramp. MAAB maximum slope for a ramp is 8.3% and maximum landing slope for a landing is 2.0%. While the MAAB, under MCR 521 has many other requirements for pedestrian ramp components, these measurements were not taken during this phase of data collection. Only the running ramp and landing slope were collected. The intent of this survey was to gather the basic data required to prioritize ramps.

Recording ramp slope in field

Additional gathered data included whether there was a "lip" present based on transition from the street to the bottom of the pedestrian ramp; whether the ramp was recently constructed; 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; and finally a timestamp from when the survey was conducted. See Appendix A for a full listing of data collection attributes.

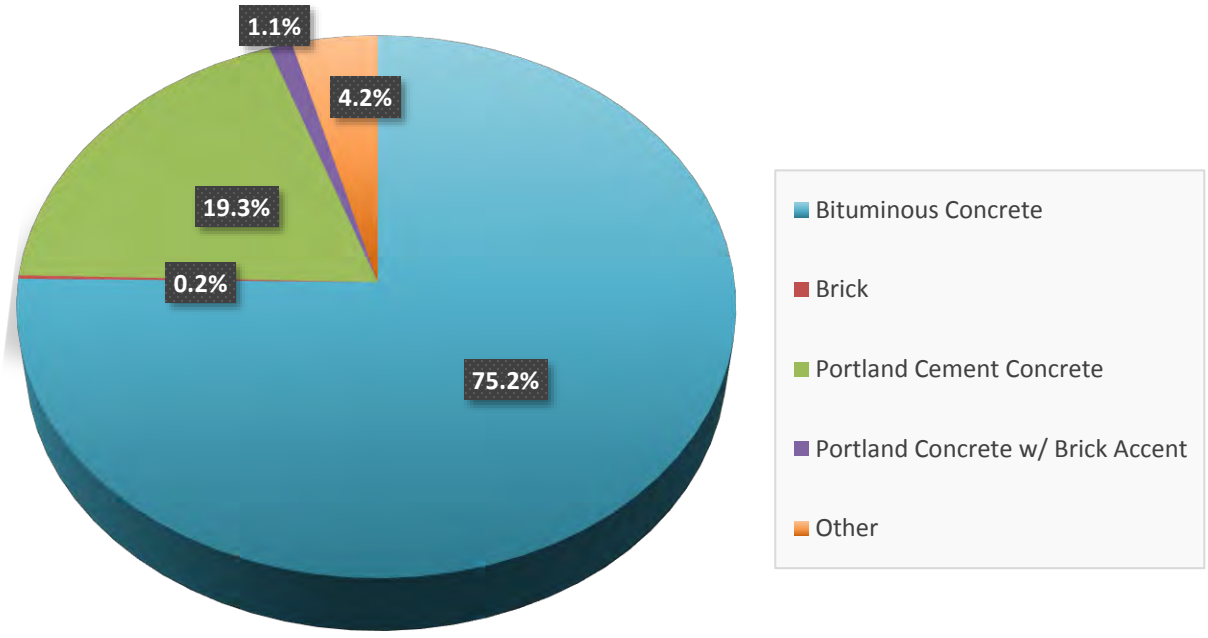
2 EXISTING CONDITIONS

2. EXISTING CONDITIONS

SIDEWALK INVENTORY

A total of 1816 sidewalk segments were inventoried throughout the Town of Natick, 1665 of which were Public Accepted segments and will be used for the analysis herein. The predominant material used for sidewalks in Natick is bituminous concrete (75%). Figure 1 below shows the Town-wide distribution of sidewalk area based on material type. It **should be noted that a majority of the 'Other' material** type comes from the Cochituate Rail Trail.

Figure 1
Distribution of Sidewalks by Material Type



SIDEWALK CONDITION INDEX

A sidewalk condition index or SCI value was established to quickly categorize sidewalk conditions into a repair strategy schema. This index is based on a 0 to 100 scale which is calculated by taking the damaged area and dividing it by the total sidewalk area, then multiplying by 100. The result is then subtracted by 100 to produce an SCI value.

$$SCI = 100 - (((damage\ area)/(sidewalk\ area)) * 100)$$

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

0-49 = Full Replacement/ Reconstruction
50-79 = Localized Repairs/ Panel Replacement
80-100 = Do Nothing

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

FULL REPLACEMENT/ RECONSTRUCTION

Morse Street

Stantec

LOCALIZED REPAIRS

Hayes Street

DO NOTHING

Pine Street

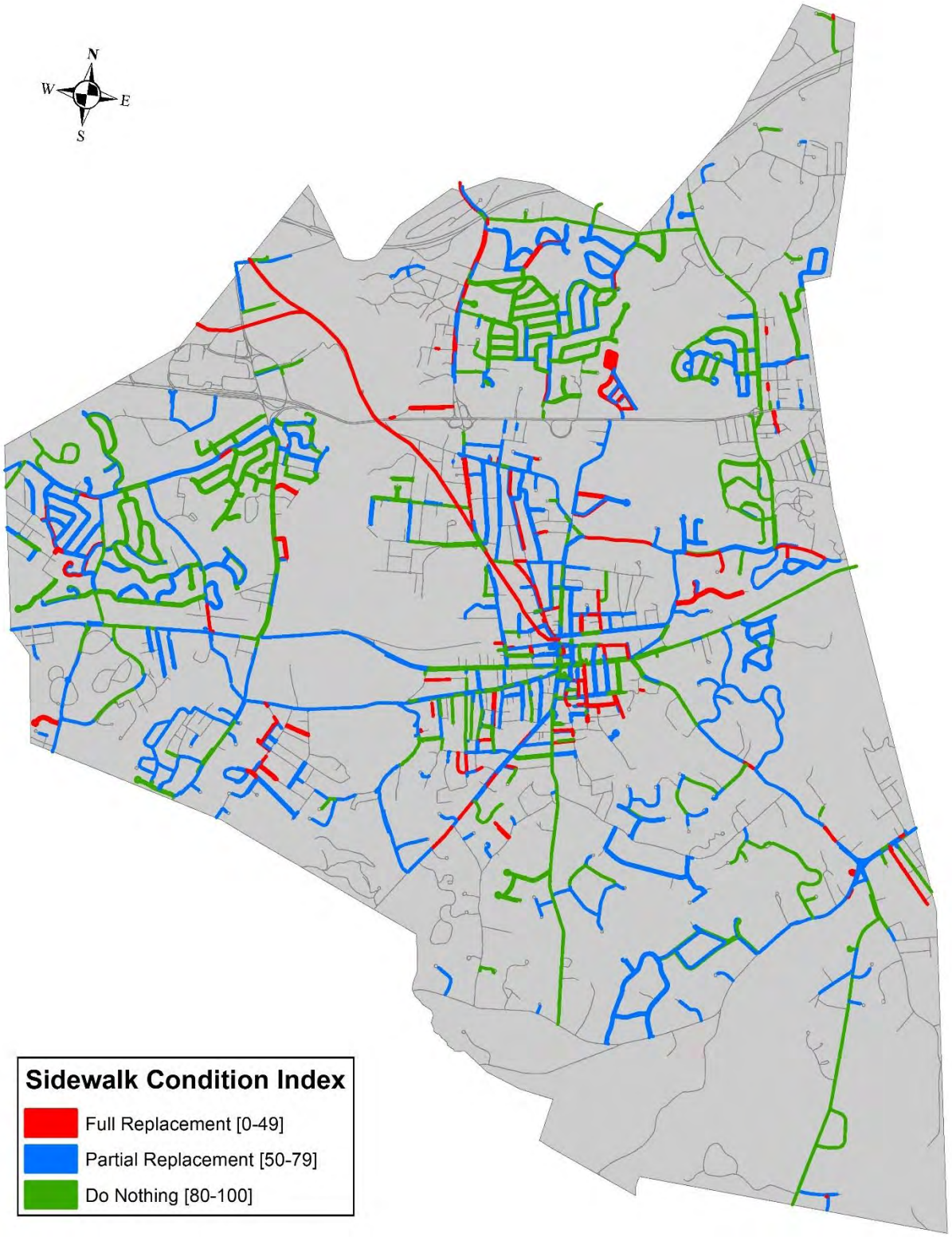
Table 1 below shows the distribution of these SCI treatment bands throughout the Town.

Table 1
SCI Treatment Band Distribution

SCI Treatment Band	Sidewalk Count	Sidewalk Miles	Sidewalk Area
Full Replacement/Reconstruction	200	18.1	511,872
Localized Repair/ Panel Replacement	862	74.6	1,802,410
Do Nothing	694	57.0	1,457,505

The average area based SCI in Natick is 70, which puts average conditions at the border of fair/good. With 39% of the sidewalk network in the 'Do Nothing' treatment band and 48% in the 'Localized Repair' treatment band, the Town of Natick is in relatively good shape. Figure 2 below shows the distribution of the different SCI treatment bands throughout the Town.

Figure 2
SCI of Sidewalk Network



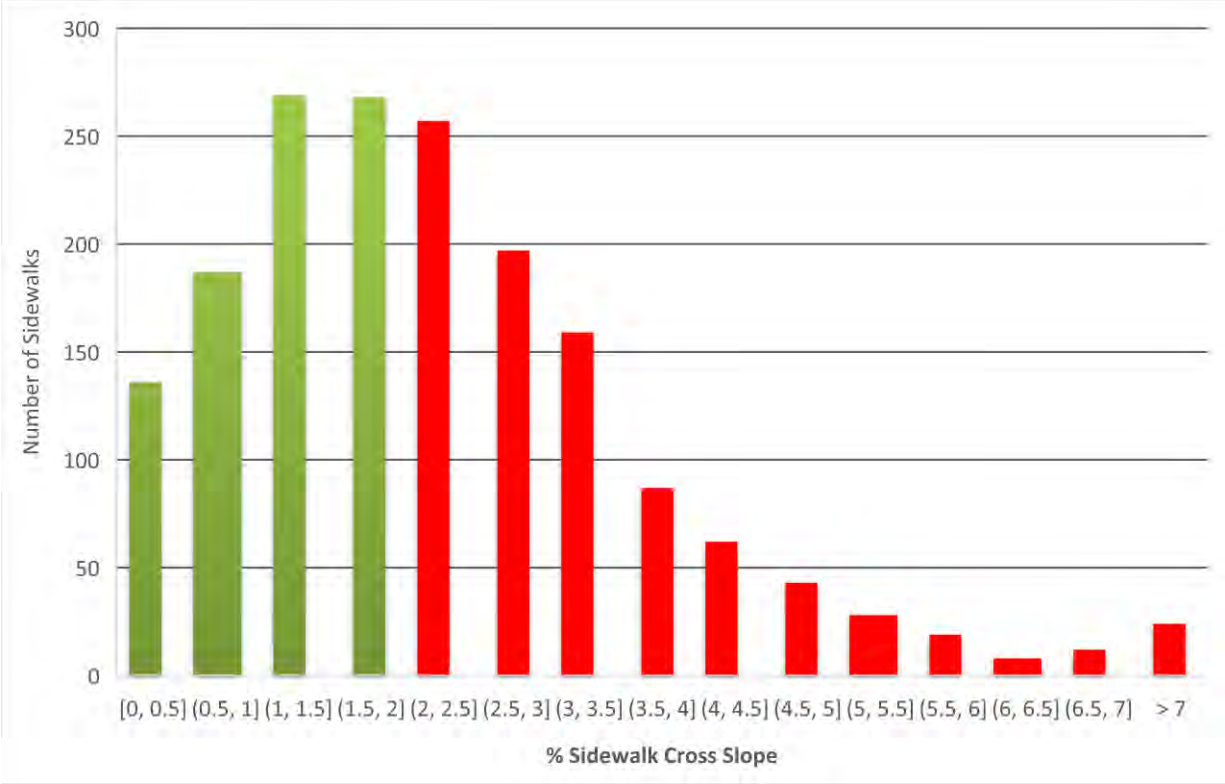
SIDEWALK SEGMENT ACCESSIBILITY

In order to determine the likelihood of meeting the minimum MAAB sidewalk standard, the 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 at least 3 feet.

The notes field was also evaluated to determine if street furniture, buildings, or other hardscape obstructions prevented passage along the sidewalk. Figures 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 Natick 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 likely to assume 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

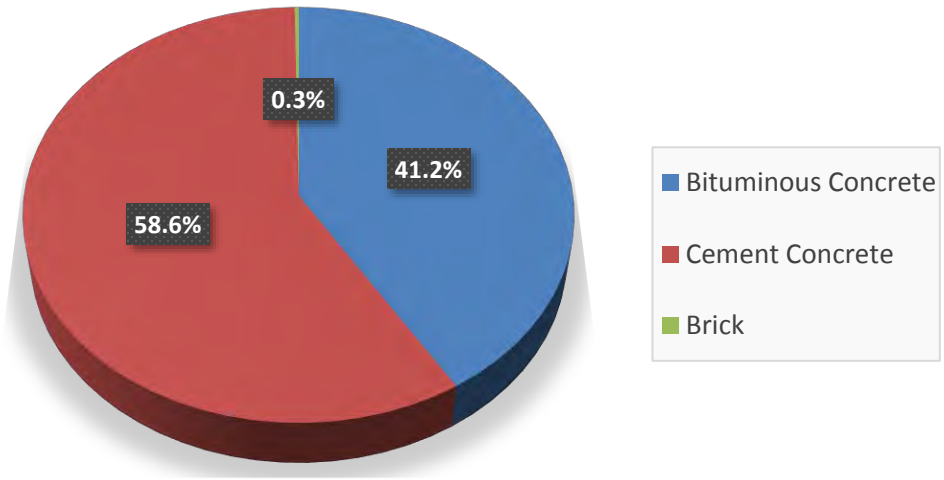


For this report, a sidewalk was considered likely compliant if the cross slope was less than 2%, width greater than 3 feet, and an SCI greater than 85. Within those thresholds, it was determined that only 21% of sidewalks in Natick are likely compliant.

RAMP INVENTORY:

1,551 public accepted pedestrian ramps were inventoried throughout the Town of Natick, including ramps that were classified as "missing" where existing crosswalk markings led to vertical curb face(s) with no curb cut to access sidewalk. A categorization of the inventoried pedestrian ramps, as seen in Figure 4, shows that they are predominately made from cement concrete (59%) and bituminous concrete (41%) with a handful of brick ramps as well (0.3%).

Figure 4
Distribution of Ramps by Material Type



RAMP CONDITIONS:

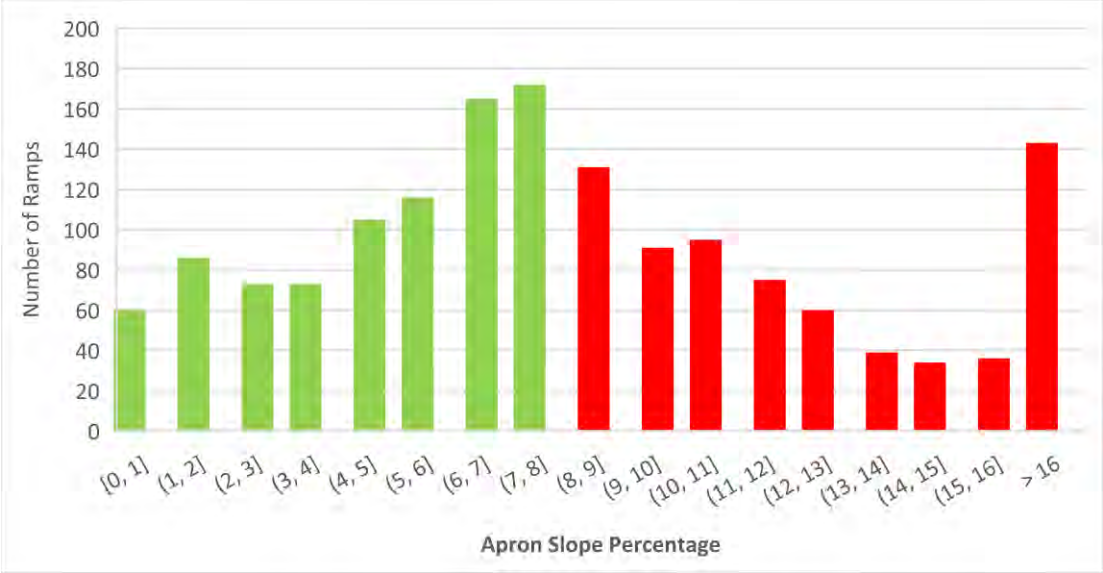
Table 2 below shows general ramp accessibility conditions. 82% of the ramps inventoried were considered to have a landing present with no obstruction. 229 ramps were found which had no level landings present, as well as 40 ramps which were missing and 13 ramps with obstructions in the path of travel.

Table 2
Ramp Accessibility

RAMP ACCESSIBILITY	COUNT OF INSTANCES
Existing Ramp w/landing and no obstruction	1311
Existing Ramp w/ no landing present	229
Ramp is missing	40
Existing Ramp w/obstruction within proximity to travel of path	13
TOTAL	1593

To get a more in depth analysis of MAAB compliance beyond visual inspection, pedestrian ramp and landing slopes were integrated. MAAB maximum slope for ramps 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 Ramp Slope Percentage

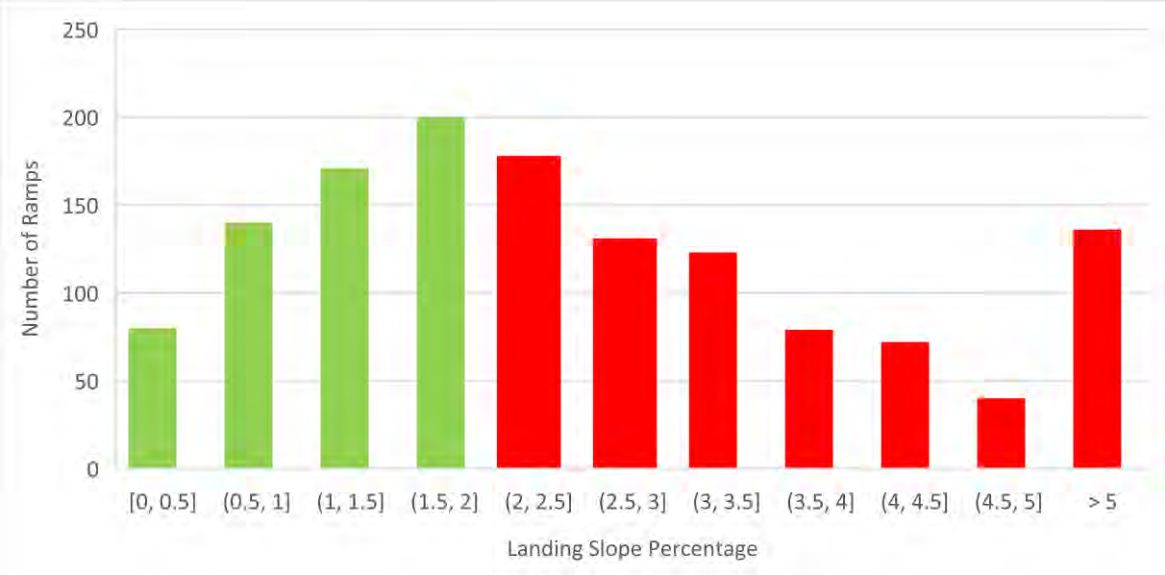


The distribution of apron slopes Town-wide are relatively good as they normalize around the acceptable MAAB slope of 8.3%. However, there are a significant number of ramps which have apron slopes exceeding 16% which is worrysome. A majority of these ramps come in neighborhoods with bituminous sidewalks with minimal efforts made towards creating accessible ramps. A few examples of these are shown below.

Liberty Street

Wellesley Road

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, five primary attributes were used: visual inspection, ramp slope, landing slope, crosswalk deficiences, and presence of a lip. In using these, it was determined that 74% of the existing ramps in Natick (excluding missing ramps) are likely not compliant with MAAB standards.

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. In order to effectively manage Natick'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 Natick'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 5 criteria that were scored separately and were key to the overall decision making process. The criterion is:

1. Proximity to Schools
2. Proximity to Commuter Rail Station
3. Proximity to parcels with high pedestrian traffic (Retail, Parks, Community Centers, Etc.)
4. Ramp Existence
5. Ramp Condition

Note: Figure 9 shows locations for Schools, Commuter Stations, and High Pedestrian Parcels

1. Proximity to Schools

The ramps locations were related spatially to the closest School parcels - both public and private. Three (3) different buffer zones were created to prioritize ramps in the proximity of a school. If the ramps fell within 500 feet of the school parcel 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.

2. Proximity to MBTA Commuter Rail Stations & MWRTA Buses

The ramps locations were related spatially to the closest MBTA Commuter Rail station & MWRTA Buses within a buffer of 300 feet. The NPR score for a ramp

was based on its distance from a commuter station or bus stop ranged from 0-300. 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, shown below.

$$NPR_{TRANSIT} = 300 - distance\ to\ commuter\ station\ or\ bus\ stop$$

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 will be.

3. Proximity to High Pedestrian Parcels (HPP)

The ramps locations were related spatially to High Pedestrian Parcels within a buffer of 200 feet. High Pedestrian Parcels include retail, parks, community centers, etc. The NPR score for a ramp was based on its distance from an HPP ranged from 0-200. 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 HPP, shown below.

$$NPR_{HPP} = 200 - distance\ to\ Parcel$$

4. Ramp Existence

Missing ramps significantly hinder pedestrian accessibility, which is why ramp existence played a key role in determining the NPR for ramps. If the ramp was missing, an NPR score of 450 was given. If no level landing was present, an NPR score of 400 was given. If a ramp was present regardless of material or damage present, a score of 0 was given.

5. Ramp Condition

The NPR value also includes information on the condition of the ramp. The NPR values were determined based on the ranges from the table below.

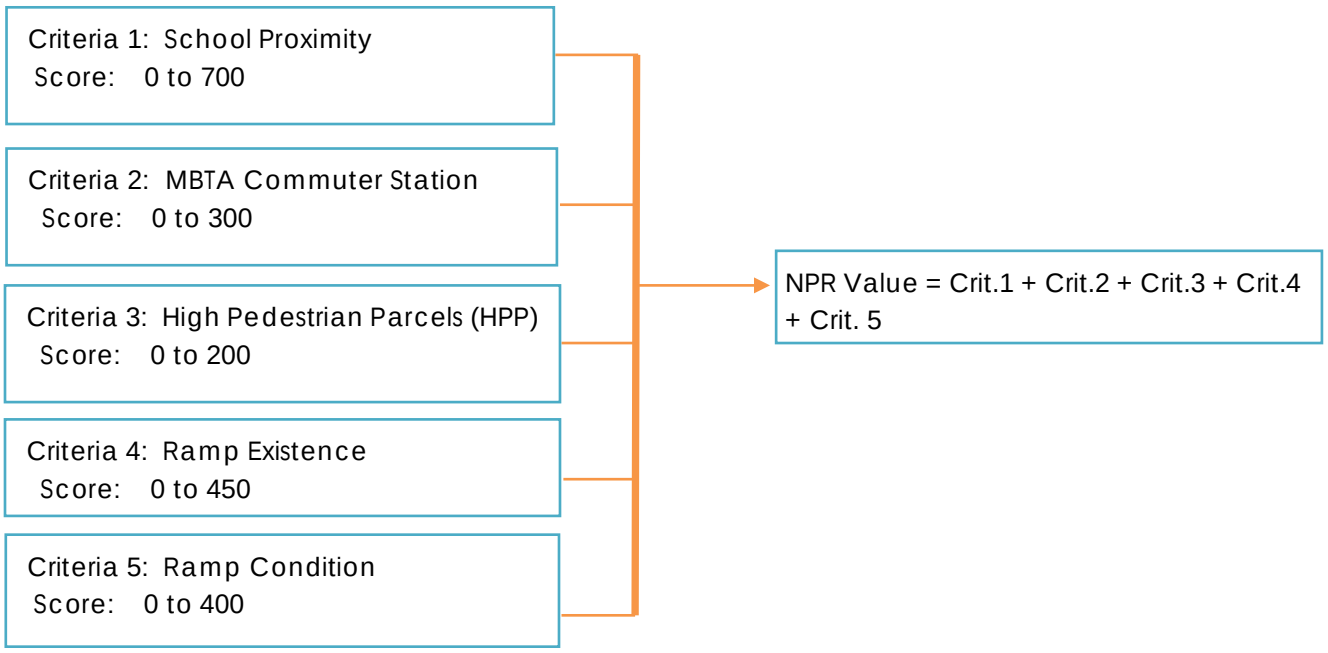
SLOPE TYPE	SLOPE RANGE	NPR SCORES
RAMP	8.3-12%	50
RAMP	12-15%	125
RAMP	15-25%	250
LANDING	2-5%	50
LANDING	5-15%	150

This strategy was established to increase points based on the level of severity in accessibility. The total NPR score a ramp could achieve based on ramp condition is 400.

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. If a ramp was considered 'newly constructed' and minimally non-compliant with minor deficiencies, it also received an NPR value of 0. These deficiencies could have been during construction or post construction due to frost action, heavy vehicles driving over ramps and impacting slopes. Even if the ramp is not compliant, since it is newly constructed, it has the lowest priority.

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 first (3) three elements in determining the NPR for sidewalks was the same used in the previous section for ramps. Only the last (2) two elements vary which will be discussed below:

1. Proximity to Schools
2. Proximity to MBTA station
3. Proximity to high pedestrian parcels
4. Sidewalk condition
5. Number of Trip Hazards

Sidewalk Condition

The condition of the sidewalk contributes into the overall NPR score. If the sidewalk segment has an SCI less than 25 it was assigned a score of 300, while if the SCI was between 25 and 50 it was assigned a value of 150. The cross slope was also factored into the NPR score based on the ranges in the table to the right.

Cross Slope % Range	NPR Scores
2-4%	50
4-6%	100
6-10%	200

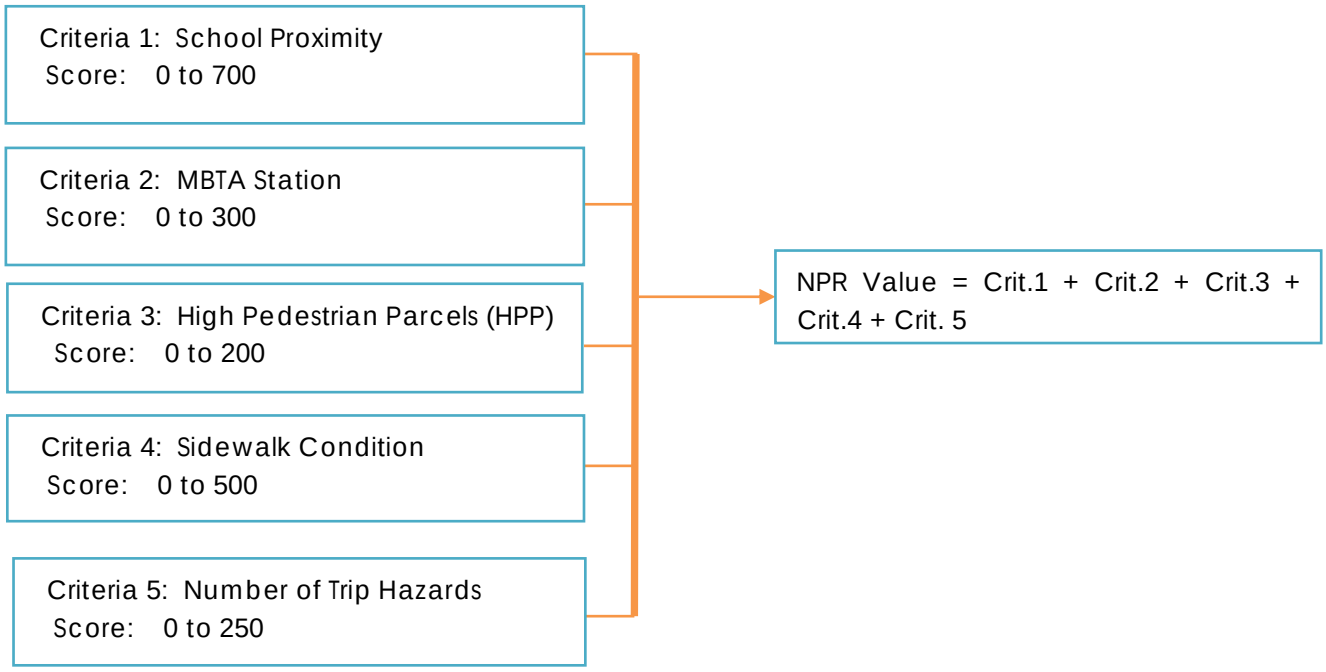
Number of Trip Hazards

The last criterion in the sidewalk NPR score is the number of trip hazards. If there were between 1 and 3 trip hazards detected a score of 50 was given. If there were between 3 and 6 trip hazards detected, a score of 150 was assigned. If there were more than 6 trip hazards, a score of 250 was given.

NPR Formula

The NPR formula adds the rankings for each criterion together to get a composite number ranking for each ramp 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 11 shows the NPR values for sidewalks throughout the Town. Sidewalks with a cross slope less than 2%, width greater than 4 feet, and SCI greater than 85 were considered compliant below and received an NPR value of 0.

Figure 9 NPR Proximity Elements

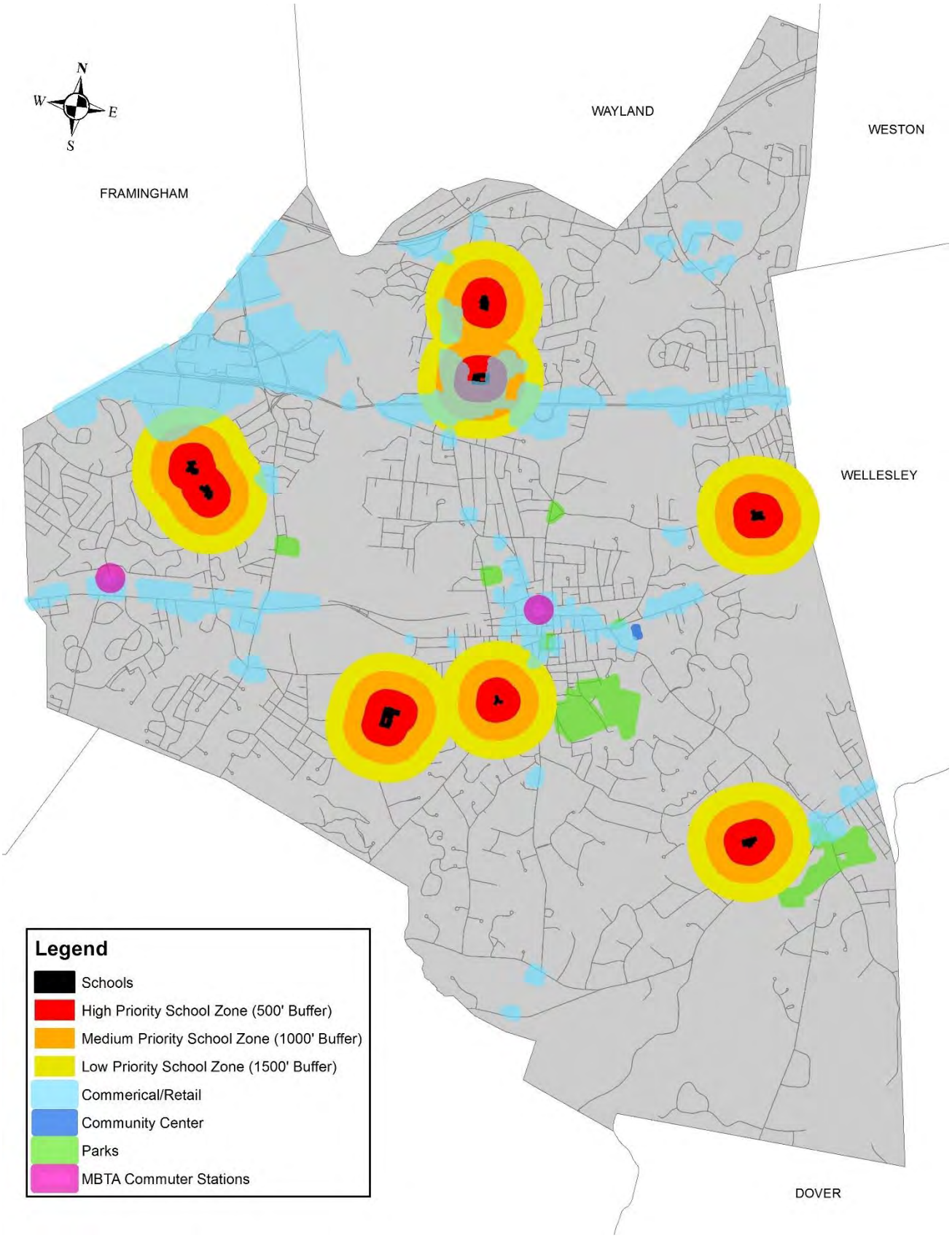


Figure 10 Network Ramp NPR

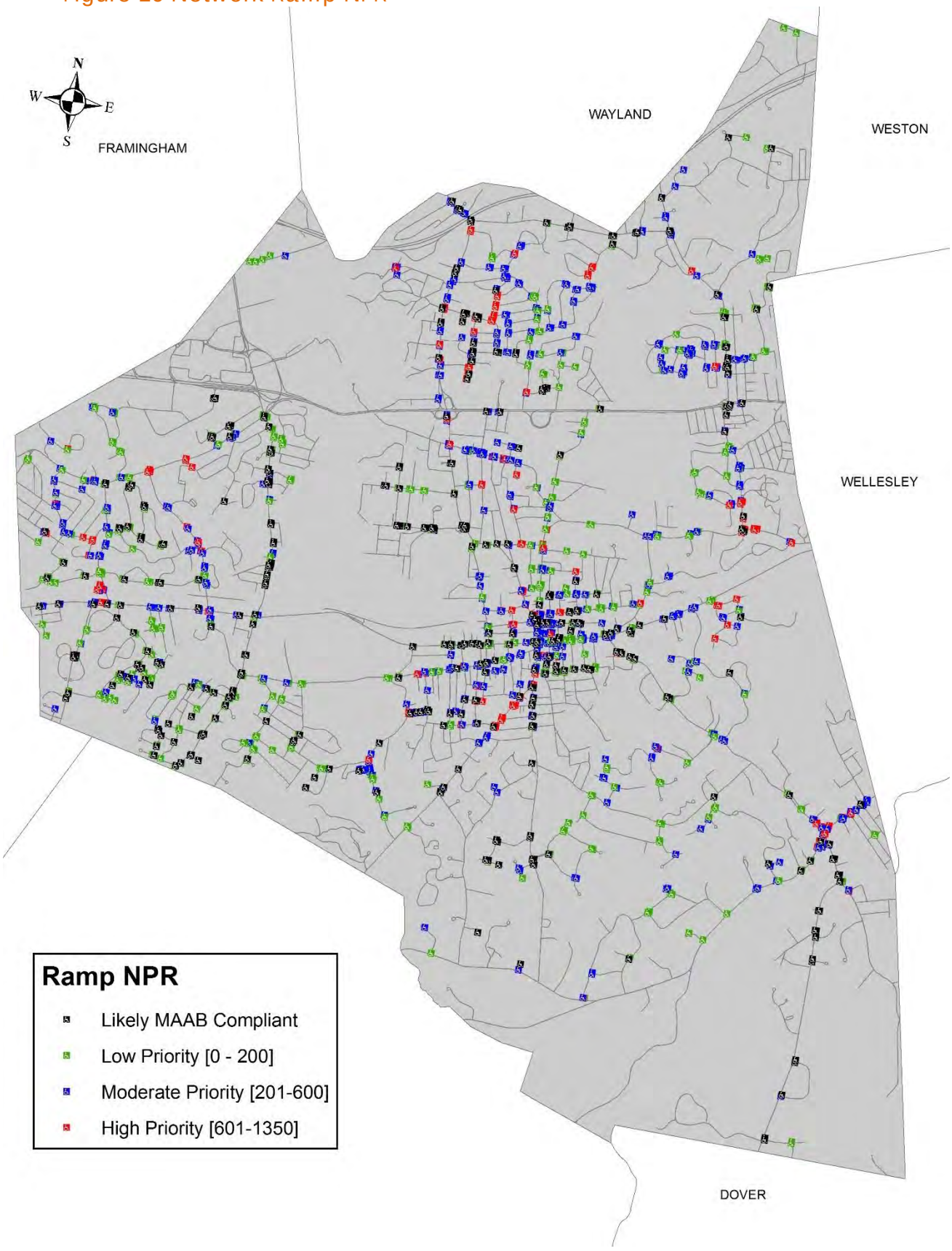
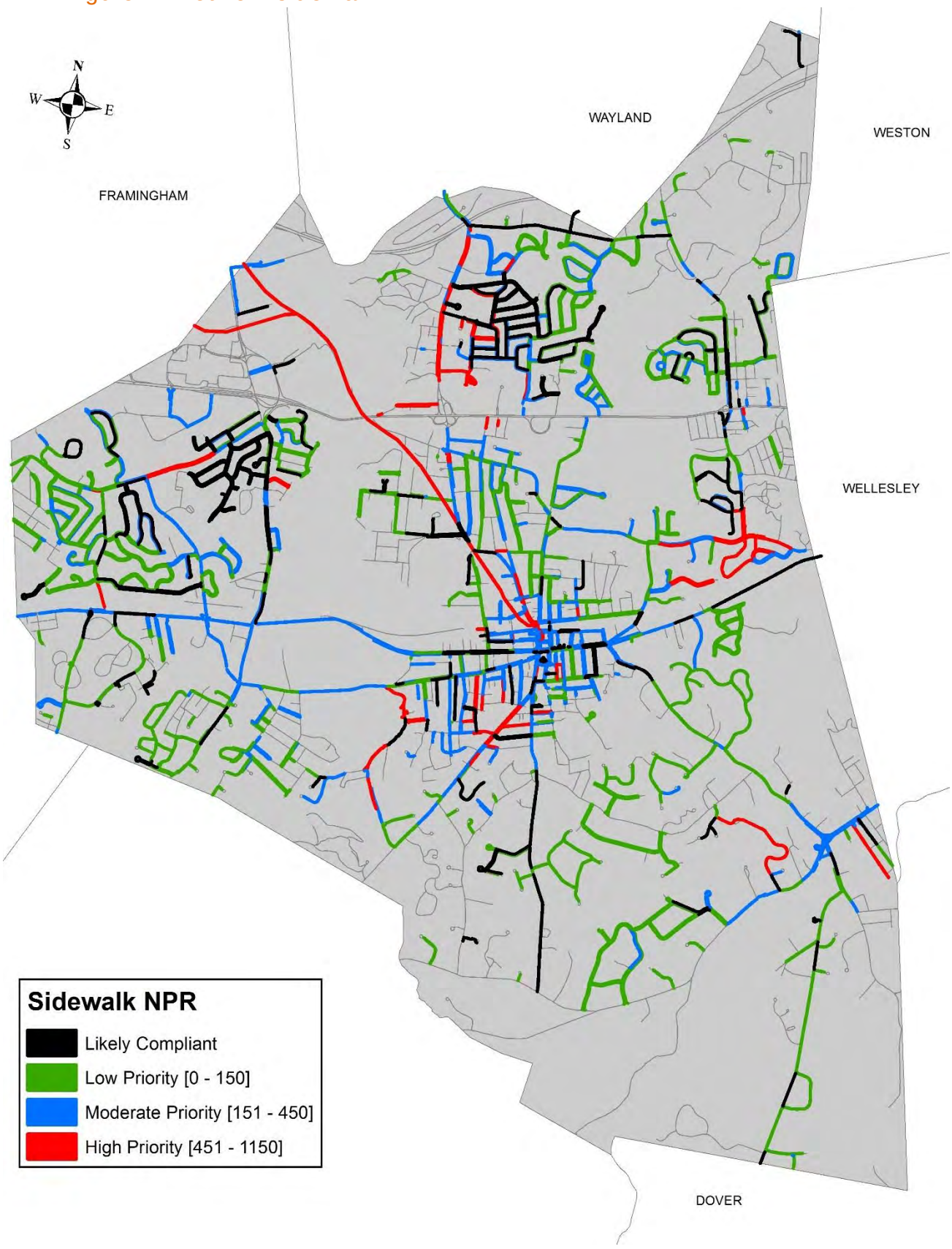
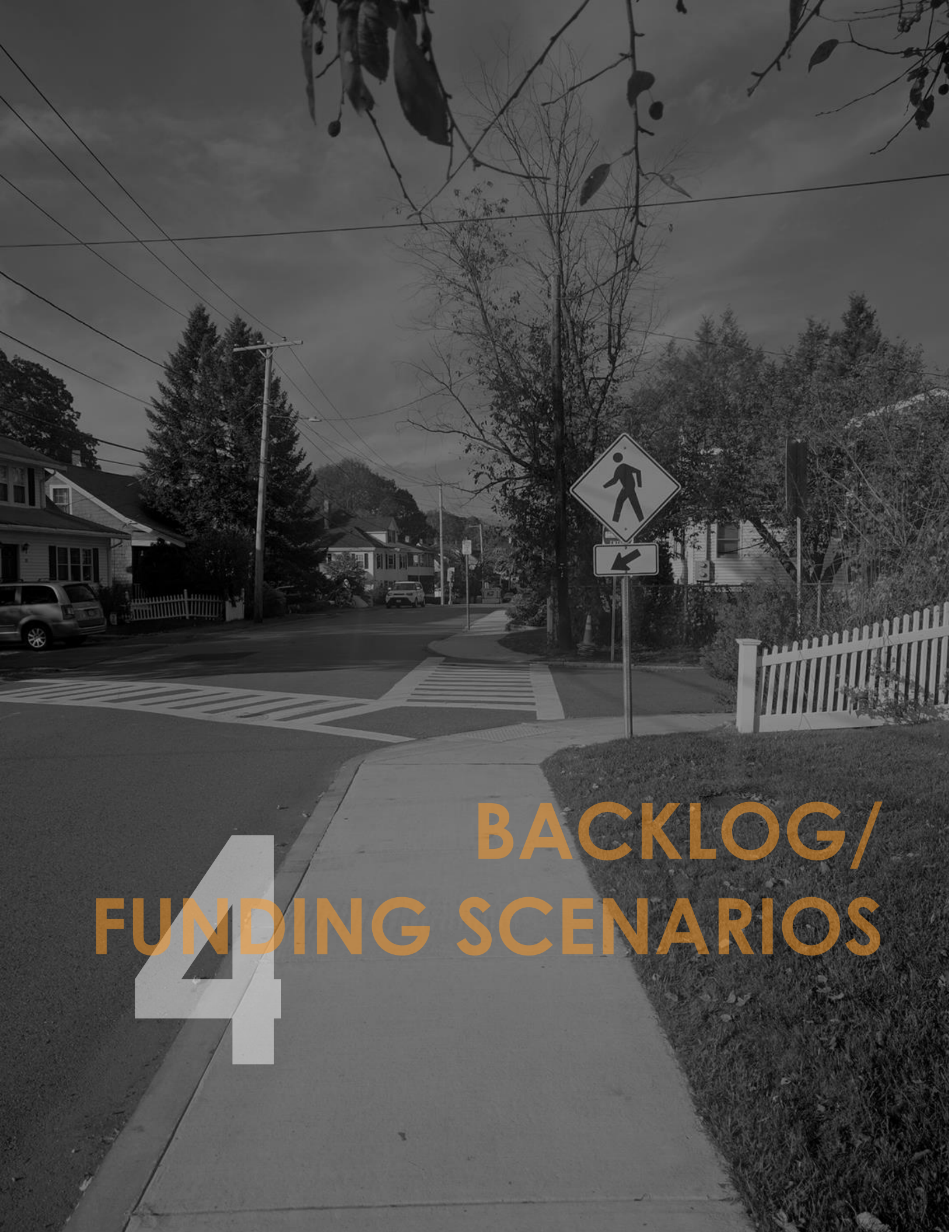


Figure 11 Network Sidewalk NPR





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 analysis:

Table 3
Sidewalk Reconstruction Costs

SIDEWALK MATERIAL	COST
CC- Cement Concrete	$ 16.50/ft^2
BR- Brick	$ 25/ft^2
BC- Bituminous Concrete w/Grass Strip	$ 8/ft^2
BC- Bituminous Concrete w/Cape Cod Berm, Monolithic, or Type A Curb	$10/ft^2
BC- Bituminous Concrete w/Vertical Granite Curb	$13.50/ft^2

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

1. Reconstruction: SCI = 0-49 – Entire sidewalk area is budgeted to be reconstructed
2. Localized Repair: SCI = 50-79 – Only damage area is budgeted to be reconstructed
3. Do Nothing: SCI = 80-100 – Nothing budgeted for repair

Note: The costs in Table 4 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:

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 Natick 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 Town 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.

As of November 2017, Natick's backlog of sidewalk repair work totaled $11,952,796

FUNDING SCENARIOS:

In order to determine the necessary funding to keep the network in good conditions, (3) three future funding scenarios were run for (3) three years. In these scenarios, a lifetime of 20 years, 30 years and 40 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. For the funding analysis, 90% of the budget was dedicated to full replacement while 10% was used for partial repair. An inflation rate of 3.5% was used on a yearly basis.

The first scenario run was to have no funding contributed to the sidewalk network. This scenario is used to gauge the deterioration levels of the network in a worst case scenario where there is no funding available. Table 4 below shows the results of this scenario. As expected, the sidewalk network deteriorates to an SCI of 61 in just three years, while the backlog jumps to over $17.4M.

Table 4
$0 Funding Scenario

YEAR	FUNDING	BACKLOG	NETWORK SCI
11/2017		$ 11,952,796	70
FY2019	$0	$ 13,885,067	67
FY2020	$0	$ 15,169,895	64
FY2021	$0	$ 17,441,801	61

Next, a scenario was run to spend $675k on the sidewalk network per year. In this scenario, the network SCI is losing approximately a point a year while the backlog increases approximately $2.4M in three years. While these levels aren't necessarily skyrocketing, they are still increasing enough to be considered unsustainable in the future.

Table 5
$675k Funding Scenario

YEAR	FUNDING	BACKLOG	NETWORK SCI
11/2017		$ 11,952,796	70
FY2019	$675k	$ 13,172,123	68
FY2020	$675k	$ 13,749,169	67
FY2021	$675k	$ 14,387,594	66

Lastly, a scenario was run to try to keep the backlog at sustainable levels while keeping the network in good conditions. It was observed that spending $1.25M a year keeps both the network conditions and backlog at current levels. This is a good baseline for the Town to establish when budgeting for their existing sidewalk network. Any additional new sidewalk infrastructure would require additional funding for maintenance and replacement.

Table 6
$1.25M Funding Scenario

YEAR	FUNDING	BACKLOG	NETWORK SCI
11/2017		$11,952,796	70
FY2019	$1.25M	$12,304,658	70
FY2020	$1.25M	$12,306,754	70
FY2021	$1.25M	$12,560,815	71

5 RECOMMENDATION

5. RECOMMENDATION

RECOMMENDED PLAN OF ACTION

The overall pedestrian sidewalk network in the Town of Natick is currently in good to fair condition. With an average SCI of around 70, the Town has a good overall network condition level with the average sidewalk requiring localized repair. However, only 21% of the sidewalks are likely MAAB compliant based on existing condition, cross slope, and width of the sidewalks. If cross slope of the sidewalk exceeds 2% the sidewalk is considered non-compliant. With predominantly bituminous concrete sidewalks which are constructed with little to no control grades and tend to be flexible and distort (due to structural weakness in base, tree roots, etc.) more than cement concrete sidewalks, attaining this cross slope can be challenging. Based on the sidewalk condition index, it was determined that the current backlog of Natick's **sidewalk network** is $11,952,796.

New ramp on Peterson Rd. with a landing slope of 4.5%

The data gathered from this study shows with a "high-probability" that 26% of Natick'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 Town-wide ramp conditions.

Given the current condition of the network, it is likely that Natick has been funding the needs of the sidewalk and ramp network throughout the years. Based on the analysis from this study, a baseline of $1.25M should be spent to maintain current conditions. Stantec observed some 'newly constructed' ramps in the field which were minimally non-compliant due to workmanship which can be improved with better field layout and inspection. By putting a little more effort to build it right the first time, the Town can get more benefit from its asset investment of the network. The image to the left shows a new ramp built on Peterson Road which failed the landing slope compliance by 2.5%.

The Town should consider funding two (2) sidewalk repair programs, one maintenance program to address localized repairs primarily on

neighborhood sidewalks consisting of significant tree root distortions, trip hazards, etc., and a second capital improvement program using the NPR strategy as outlined in this study to address priority ramp locations and large reconstruction critical areas around schools and other high pedestrian traffic locations.

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

The Town's ADA Task Force should maintain and expand upon the database assembled by Stantec. Asset management is a systematic process that needs the long-term commitment and support of Natick'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-placed ramp construction.
2. Identify a single individual who will act as a custodian of the maintenance and upkeep of the sidewalk GIS layer/database.
3. 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.
4. Post all annual pedestrian ramp and sidewalk improvements into the GIS database. Both the pedestrian ramp condition ratings and the repair history information should be entered. Track MAAB ramp variance requests in a geo-database environment.
5. Add any new pedestrian ramps and sidewalks to the database as soon as the Town accepts them. Pavement and sidewalk data can be added/modified as it becomes available.
6. Re-inspect 20% of sidewalks/ramps annually.

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