

NEW YORK CITY PRIORITIZATION MODEL FRAMEWORK FOR PEDESTRIAN RAMP CONSTRUCTION

The Pedestrian Ramp Program at New York City Department of Transportation (NYCDOT) is dedicated to upgrading and installing pedestrian ramps and committed to providing accessibility throughout NYC. NYCDOT developed a GIS-based prioritization plan to analyze the survey data collected by Cyclomedia to aid in prioritizing construction of pedestrian ramps throughout the City of New York (City). Construction progress can be found on the program's website: <u>www.nycpedramps.info</u>.

NYCDOT has created a prioritization methodology that evaluates existing pedestrian ramps (and corners) using a weighted scoring system. The results of this prioritization provides the roadmap for performing work at locations which are outside of resurfaced stretches or complaint locations or are not within the scope of other alteration work.

This two-part weighted-scoring system comprises a <u>Condition Score</u> and <u>Geographic Score</u>. The <u>Condition</u> <u>Score</u> accounts for 13 physical characteristics of the existing ramp and how those characteristics affect the ramp's usability. The <u>Geographic Score</u> aids in the evaluation of 10 demographic and geographic properties of the area. Additional details for each scoring parameter are provided in separate sections below.

CONDITION SCORE

In October of 2019, NYCDOT completed the collection of detailed data of the City's pedestrian ramps using high- definition, street level imagery, and ground-based LiDAR technology. Using the data collected, measurements for ramp elements and obstacles were extracted. The Condition Score for each ramp was informed by assessing the measurements and obstacle inventory obtained during this survey utilizing weight and indicators that correspond to the condition of each element.

An illustration depicting the ramp elements is included in <u>Figure 1</u>. Obstacles were identified in three distinct zones: Landing (<u>Figure 2</u>), Ramp (<u>Figure 3</u>), or Other (<u>Figure 4</u>).





FIGURE 1 - PEDESTRIAN RAMP ELEMENTS





FIGURE 3 – RAMP ZONE





Included below are two tables (<u>Table 1</u> and <u>Table 2</u>) that show the ramp elements that were considered in the calculations of the condition score for typical (perpendicular) ramps and cut-throughs, respectively. These tables also include the assigned weights for each element.

	Category	Weight
1	Curb Reveal	10
2	Curb Ramp Running Slope	10
3	Detectable Warning Surface	10
4	Sidewalk Defects	5
5	Landing Length	5
6	Landing Cross Slope and Running Slope	10
7	Gutter Slope	10
8	Roadway Counter Slope and Ramp Running Slope Algebraic Difference	10
9	Flare Slope	5
10	Ramp Width	5
11	Ramp Cross Slope	5
12	Ramp Location relative to Marked Crosswalk	5
13	Obstacles	10
	TOTAL POTENTIAL SCORE	100

TABLE 1 - CONDITION SCORE (CS) ELEMENTS



	Category	Weight
1	Curb Reveal	15
2	Detectable Warning Surface	15
3	Sidewalk Defects	15
4	Landing Length (Clearance between DWS)	15
5	Ramp Width	15
6	Ramp Location relative to Marked Crosswalk	10
7	Obstacles	15
	TOTAL POTENTIAL SCORE	100

TABLE 2 - CONDITION SCORE (CS) ELEMENTS FOR CUT THROUGH

The score for each element is obtained by applying the respective weight to a rating value based on individual indicators. The indicators represent the evaluation of the measurement data extracted from the pedestrian ramp data collected, the respective rating value is multiplied by the weights to generate the quantitative score for each ramp element, and each ramp element is summed to obtain the total ramp condition score.

A low condition score represents ramps in better condition (lower priority) and a high condition score represents ramps in poor condition (higher priority). The corner condition score was assigned using the highest ramp condition score. Condition scores will be updated in accordance with our work programming schedules, utilizing new construction and inspection information when available.

Below is the criteria for each ramp element along with the weight and the corresponding rating value.

CONDITION SCORE WEIGHT AND RATING CRITERIA

1. CURB REVEAL

Weight	Indicator	Rating Value
	≤ 0.25"	0%
10	> 0.25"- 0.5"	50%
	> 0.5"	100%

2. CURB RAMP RUNNING SLOPE

Weight	Indicator	Rating Value
10	≤ 8.33%	0%
	> 8.33% - 10%	50%
	> 10%	100%



3. DETECTABLE WARNING SURFACE (DWS)

Weight	Indicator	Rating Value
	Standard DWS	0%
10	Non-Standard	100%
	DWS	100%

4. SIDEWALK DEFECTS

Weight	Indicator	Rating Value
5	No	0%
	Yes	100%

5. LANDING LENGTH

Weight	Indicator	Rating Value
5	≥ 36"	0%
	< 36"	100%

6. LANDING CROSS SLOPE AND LANDING RUNNING SLOPE

Weight	Indicator	Rating Value
10	≤ 2%	0%
	> 2%	100%

7. GUTTER SLOPE

Weight	Indicator	Rating Value
10	≤ 2%	0%
	> 2%	100%



8. ROADWAY COUNTER SLOPE AND ROADWAY RUNNING SLOPE ALGEBRAIC DIFFERENCE

Weight	Indicator	Rating Value
10	≤ 11%	0%
	> 11%	100%

9. LEFT OR RIGHT FLARE SLOPE

Weight	Indicator	Rating Value
	≤ 10%	0%
5	> 10% - 12%	50%
	> 12%	100%

10. RAMP WIDTH

Weight	Indicator	Rating Value
5	≥ 36"	0%
	< 36"	100%

11. RAMP CROSS SLOPE

Weight	Indicator	Rating Value
	≤ 2%	0%
5	> 2 - 4%	50%
	> 4%	100%

12. LOCATION WITH RESPECT TO MARKINGS (CROSSWALK)

Weight	Indicator	Rating Value
	Aligned	0%
5	Unmarked	50%
	Not Aligned	100%



13. OBSTACLES

Weight	Indicator	Rating Value
10	No	0%
10	Yes	100%

CUT-THROUGH RAMP CONDITION SCORE WEIGHT AND RATING CRITERIA

1. CURB REVEAL

Weight	Indicator	Rating Value
	≤ 0.25"	0%
15	> 0.25"- 0.5"	50%
	> 0.5"	100%

2. DETECTABLE WARNING SURFACE (DWS)

Weight	Indicator	Rating Value
15	Standard DWS	0%
15	Non-Standard DWS	100%

3. SIDEWALK DEFECTS

Weight	Indicator	Rating Value
16	No	0%
15	Yes	100%

4. CUT-THROUGH LANDING LENGTH (CLEARANCE BETWEEN DWS)

Weight	Indicator	Rating Value
15	≥ 24"	0%
15	< 24"	100%



5. CUT-THROUGH RAMP WIDTH

Weight	Indicator	Rating Value
15	≥ 36"	0%
	< 36"	100%

6. LOCATION WITH RESPECT TO MARKINGS (CROSSWALK)

Weight	Indicator	Rating Value
	Aligned	0%
10	Unmarked	50%
	Not Aligned	100%

7. OBSTACLES

Weight	Indicator	Rating Value
15	No	0%
15	Yes	100%

Following initial scoring for ramps, quantitative condition scores are further grouped into Low, Medium, and High categories using the Natural Breaks¹ method, where data is grouped in an optimized manner based on the natural flow of data, and not equally split groups. Included is an illustration below (Figure 5) of Natural Breaks.

Based on this sample of data below, a Low score ranges from 0 to 37.5, a Medium score ranges from 37.6-57.0, and a High score ranges from 57.1-100. We applied this same methodology to the Geographic Score. Prioritization work will be informed by a combination of condition score and geographic scores and grouped into overall Low, Medium, and High values.

¹<u>https://support.esri.com/en/other-resources/gis-dictionary/term/94d8264d-0dab-43b6-90fd-113d88f0a0f9</u>





FIGURE 5 – EXAMPLE OF NATURAL BREAKS METHOD WHERE DATA IS GROUPED INTO OPTIMIZED SECTIONS BASED ON THE DISTRIBUTION OF SCORES.

GEOGRAPHIC SCORE

The Geographic Score utilizes geographical and demographical data to assign a quantitative value that most benefits the population in need of adequate pedestrian ramp access throughout NYC. A high geographic score represents areas where pedestrian activity, especially by persons with mobility challenges, is expected to be high. Ten categories were selected to best describe the likelihood of high pedestrian activity, with an emphasis on the population with disabilities or mobility difficulty. A weight was assigned to each of these categories to prioritize their importance. These categories along with their respective weights are presented in <u>Table 3</u>.

	Category	Weight
1	Facilities and Program Sites Specialized for People with Disabilities	15
2	Ambulatory Disability Population	15
3	Visual Disability Population	15
4	Senior Population	10
5	Facilities and Program Sites	10
6	Transit Facilities	10
7	Accessible Subway Facilities	10
8	Transit Volume	5
9	Parks and Open Spaces	5
10	Vision Zero Priority Locations for Pedestrians	5
	TOTAL POTENTIAL SCORE	100

TABLE 3 - GEOGRAPHIC SCORE (GS) CATEGORIES



The score for each category is obtained by applying the respective weight to a rating value based on individual indicators. The indicators represent the evaluation of parameters such as distance or natural breaks that correspond to each category. The respective rating value is multiplied by the weights to generate the quantitative score for each intersection. The summation of all the categories produces the Geographic Score for every street intersection point in NYC.

For visualization purposes, Thiessen polygons² are created to allocate space to the nearest intersection point. Each Thiessen polygon defines an area of influence around an intersection point, where any location inside the area is nearer to that point than to all the others. The geographic and demographic characteristics of the space within in polygon are assumed to best reflect the geographic score of the intersection point that it surrounds. The result, the Geographic Score Map, visualizes the polygons by grouping the geographic score in Low, Medium, and High categories using the Natural Breaks method. Furthermore, for borough equity, the Geographic Score is compared and viewed by borough. A sample of how the results may appear has been illustrated in Figure 6.



FIGURE 6 – EXAMPLE OF THIESSEN POLYGONS, FOR ILLUSTRATION PURPOSES ONLY

² <u>https://support.esri.com/en/other-resources/gis-dictionary/term/edebba87-b3f8-4af8-a07e-1548d1082802</u> <u>https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/create-thiessen-polygons.htm#S_GUID-</u> <u>D34D240D-D714-4E51-8F7A-59806DDC6D19</u>.



GEOGRAPHIC SCORE CATEGORY DESCRIPTIONS

1. Facilities and Program Sites (Specialized for People with Disabilities)

In accordance with Title II of the ADA, State and local governments are required to make their services, programs, and activities for the public accessible to individuals with disabilities.

Facilities and program sites owned, operated, funded, licensed or certified by City, State, or Federal agency in NYC that generally help to shape New Yorker's quality of life are considered in this geographic score category. This category includes schools, day cares, libraries, public safety services, youth programs, community centers, health clinics, work force development programs, and transitional housing (compiled by NYC Department of City Planning). Additionally, hurricane evacuation centers provided by Office of Emergency Management (OEM) are included in this category.

Facilities and program sites specialized for people with disabilities and accessible hurricane evacuation centers are weighted more than facilities and program sites used by the general public and non-accessible hurricane evacuation centers.

Intersections are scored according to their proximity to the facilities and program sites specialized for people with disabilities and accessible hurricane evacuation centers. The maximum distance (.25 miles) was broken into quartiles for the ratings below. Intersections are given a score based on how close they are from a facility/program site.

Weight	Range	Rating Value
	Distance within 660 feet radius (1/2 mile)	100%
	Distance within 1320 feet radius (¼	70%
15	mile)	
	Distance within 1980 feet radius (3/8	40%
	mile)	
	Distance within 2640 feet radius (½ mile)	10%
	Distance >2640 feet radius	0%

Below is a detailed description of the facility subgroups that were included in the evaluation of this category.

Facility Subgroup Included	Description
Special Ed and Schools for Students	Specialized schools and educational services for students
with Disabilities	with disabilities
Preschools for Students with	Contar specialized on proschool students with disabilities
Disabilities	Center specialized on preschool students with disabilities
Programs for People with	Specialized child care, caregiver support, and recreational
Disabilities	services



2. Ambulatory Disability Population

The Pedestrian Ramp Program prioritizes areas with populations of individuals with ambulatory disabilities³ where accessible pedestrian ramps are most in need. Ambulatory disability is defined by American Community Survey (ACS)⁴ as having serious difficulty walking or climbing stairs.

Census tracts are classified by the population of individuals with ambulatory disabilities using the Natural Breaks method. Each class is given a score based on the rating value and assigned a weight. Intersections are assigned the highest score of a census tract within 100 feet.

Weight	Range	Rating Value
	Natural Breaks Class 1 (Highest)	100%
15	Natural Breaks Class 2	70%
15	Natural Breaks Class 3	40%
	Natural Breaks Class 4 (Lowest)	10%
	No Ambulatory Disability Population	0%

3. Visual Disability Population

The Pedestrian Ramp Program prioritizes areas with populations of individuals with visual disabilities⁵ where accessible pedestrian ramps, specifically detectable warning surfaces, are most in need. Visual disability is defined by ACS as having serious difficulty seeing, even when wearing glasses.

Census tracts are classified by the population of visual disability using the Natural Breaks method. Each class is given a score based on the rating value and assigned a weight. Intersections are assigned the highest score of a census tract within 100 feet.

Weight	Range	Rating Value
	Natural Breaks Class 1 (Highest)	100%
15	Natural Breaks Class 2	70%
15	Natural Breaks Class 3	40%
	Natural Breaks Class 4 (Lowest)	10%
	No Visual Disability Population	0%

³ <u>https://adata.org/factsheet/understanding-disability-statistics</u>

⁴ <u>https://www.census.gov/programs-surveys/acs</u>

⁵ <u>https://adata.org/factsheet/understanding-disability-statistics</u>



4. Senior Population

Seniors (over 65 years old) confront higher rates of disability than the general population. Over a third of the senior population in NYC is living with a disability.⁶ With the growing senior population in NYC, it is important to consider the senior population in the geographic prioritization portion of the model.

Census tracts are classified by the population of visual disability using the Natural Breaks method. Each class is given a score based on the rating value and assigned a weight. Intersections are assigned the highest score of a census tract within 100 feet.

Weight	Range	Rating Value
	Natural Breaks Class 1 (Highest)	100%
10	Natural Breaks Class 2	70%
10	Natural Breaks Class 3	40%
	Natural Breaks Class 4 (Lowest)	10%
	No Senior Population	0%

5. Facilities and Program Sites (Non-Specialized)

In accordance with Title II of the ADA, State and local governments are required to make their services, programs, and activities for the public accessible to individuals with disabilities.

Facilities and program sites owned, operated, funded, licensed or certified by City, State, or Federal agency in NYC that generally help to shape New Yorker's quality of life are considered in this geographic score category. These facilities and programs include schools, day cares, libraries, public safety services, youth programs, community centers, health clinics, work force development programs, and transitional housing (compiled by NYC Department of City Planning). Additionally, hurricane evacuation centers provided by Office of Emergency Management (OEM) are included in this category.

Intersections are prioritized according to their proximity to non-specialized facilities and program sites and non-accessible Hurricane Evacuation Centers. Specialized facilities and program sites and accessible Hurricane Evacuation Centers are included as a separate category. Intersections are given a score based on how close they are from a facility/program site.

Weight	Range	Rating Value
	Distance within 660 feet radius (1/2 mile)	100%
10	Distance within 1320 feet radius (¼ mile)	70%
	Distance within 1980 feet radius (¾ mile)	40%

⁶ https://comptroller.nyc.gov/reports/aging-with-dignity-a-blueprint-for-serving-nycs-growing-senior- population/



Distance within 2640 feet radius (1/2	10%
mile)	
Distance >2640 feet radius	0%

Below is a table of the different facilities that were included in the evaluation of this category.

Facility Group Included	Description	
Schools (K 12)	K-12 and alternative equivalency programs overseen by	
	NYC Dept. of Education and NYS Education Department	
	Childcare centers overseen by NYC Administration for	
Child Care and Pre-Kindergarten	Children's Services and NYC Dept. of Mental Health and	
	Hygiene	
	Services overseen by NYC Administration for Children's	
Child Services and Welfare	Services and NYS Education Department and NYC	
	Department of Education	
Vouth Comisso	Services overseen by NYC Dept. of Youth and Community	
Youth Services	Development	
Comme	Camps overseen by NYC Dept. of Mental Health and	
Camps	Hygiene	
Llichon Education	Public and privately operated 2 and 4 year colleges and	
Higher Education	universities	
Vocational and Proprietary Schools	ESL schools and trade colleges	
Libraries	Libraries operated by New York Public Libraries, Queens	
	Public Libraries, and Brooklyn Public Libraries and	
	academic institutions	
Cultural Institutions	Institutions licensed or funded by the NYC Dept. of Cultural	
	Affairs	
Public Safety	Services provided by New York Police Dept. and New York	
	Housing Authority Police	
Justice and Corrections	Courts and correctional facilities operated by NYC. Dept. of	
	Correction, NYS Unified Court System, NYS Dept. of	
	Corrections and Community Supervision, US Courts, and	
	Federal Bureau of Prisons	
Health Care	Health facilities overseen by NYC Health and Hospitals	
	Corporation, NYC Health and Human Services, NYS Dept. of	
	Health, NYS Office of Mental Health, and NYS Office of	
	Alcoholism and Substance Abuse Services	
Human Services	Services overseen by NYC Dept. of Homeless Services, NYC	
	Dept. of Human Resources, NYC Mayoralty, and others	
Health Care	Health facilities overseen by NYC Health and Hospitals	
	Corporation, NYC Health and Human Services, NYS Dept. of	
	Health, NYS Office of Mental Health, and NYS Office of	
	Alcoholism and Substance Abuse Services	



Human Services	Services overseen by NYC Dept. of Homeless Services, NYC
	Dept. of Human Resources, NYC Mayoralty, and others

6. Transit Facilities

Public transportation is the primary means of commuting in NYC. Therefore, adequate pedestrian access to and around transit facilities is critical. Transit facilities in NYC include the Metropolitan Transportation Authority (MTA) bus stops, express bus stops, subways stops, Long Island Railroad (LIRR) stops, Metro North stops, Port Authority Trans-Hudson (PATH) train stops, and ferry landings in NYC.

The areas of influence for this category were derived from the American Public Transportation Association's (APTA) *Recommended Practice for Defining Transit Areas of Influence* (2009).⁷ Transit areas of influence by transit facilities are defined to be generally concentric areas around transit stops or stations where pedestrian access will generate significant portion of transit trips to and from the stops or stations. Intersections are assigned a score if they are within a range of a particular transit mode as defined below.

Weight	Transit Mode	Range	Rating Value
	Local Street Transit	Distance within 660 feet radius (1/2 mile)	100%
		Distance > 660 feet radius	0%
10		Distance within 1320 feet radius (¼ mile)	100%
10		Distance > 1320 feet radius	0%
Rapid Transit		Distance within 1980 feet radius (¾ mile)	100%
	Distance > 1980 feet radius	0%	

Local Street Transit

Operates in mixed-flow with automobile traffic

- Metropolitan Transportation Authority (MTA) Bus Stops
- Ferry Landings

Rapid Street Transit

Operates in mixed-flow with automobile traffic, sometimes with partially dedicated or shared lanes

- MTA Express Bus Stops
- Metro North Bronx Bus Stops

⁷ www.apta.com/resources/standards



Rapid Transit

Operates in dedicated right-of-way with grade separation

- MTA Subway Stations
- Long Island Railroad (LIRR) Stations
- Metro North Stations
- Port Authority Trans-Hudson (PATH) Stations in NYC

7. Accessible Subway Facilities

Fully accessible MTA subway stations are given extra weight because these stations are expected to be more frequented by individuals with disabilities.

Fully accessible MTA subway stations have been identified in the MTA Subway dataset. Intersections within range (transit area of influence for rapid transit mode as described in Transit Facilities section) of an accessible MTA subway station are given additional weight.

Weight	Range	Rating Value
10	Distance within 1980 feet radius (³ mile)	100%
10	Distance > 1980 feet radius	0%

8. Transit Volume

The Pedestrian Ramp Program prioritizes areas with high pedestrian volume and activity. Since MTA pedestrian volume data are incomplete, MTA proprietary bus ridership and subway ridership data are used as proxies for pedestrian volume and activity.

Bus stop and subway station ridership volumes are classified into four classes using the Natural Breaks method. Each class is given a score based on the rating value and assigned weight. Intersections are assigned the highest ridership volume score of a bus stop, express bus, or subway that is within 660 feet, 1320 feet, and 1980 feet, respectively (distances adopted from APTA's transit area of influence by transit mode).

Weight	Range	Rating Value
	Natural Breaks Class 1 (Highest)	100%
5	Natural Breaks Class 2	70%
	Natural Breaks Class 3	40%
	Natural Breaks Class 4 (Lowest)	10%



9. Parks and Open Spaces

Parks and recreation play an important part in the life of a community and its members. Intersections are prioritized according to their proximity to parks and open spaces. Intersections are given a score based on how close they are from parks and open spaces.

Weight	Range	Rating Value
	Distance within 660 feet radius (1/2 mile)	100%
	Distance within 1320 feet radius (¼	70%
5	mile)	
	Distance within 1980 feet radius (3/8	40%
	mile)	
	Distance within 2640 feet radius (1/2 mile)	10%
	Distance > 2640 feet	0%

10. Vision Zero Priority Area for Pedestrians

Vision Zero is NYC's initiative to reduce traffic fatalities and injuries. In support of the Vision Zero initiative, the Pedestrian Ramp Program prioritizes intersections, corridors, and areas with high level of pedestrian fatalities and severe injuries. These are priority areas where improved safety and accessibility for all pedestrians is emphasized.

Intersections that are within priority areas, at priority intersections, or along priority corridors are assigned a score.

Weight	Range	Rating Value
5	Within priority area, at priority intersections, or along priority corridors	100%
	Not within priority area, at priority intersections, and along priority corridors	0%



COMBINED PRIORITIZATION MODEL

Quantitative condition scores and geographic scores were respectively grouped into Low, Medium, and High categories using the Natural Breaks method. The respective Low, Medium, and High groups correlate with priority and therefore a high geographic score and high condition score represent the highest priority.



FIGURE 7 – CONDITION SCORE AND GEOGRAPHIC SCORE NATURAL BREAK GROUPS

Pedestrian ramp construction prioritization will be informed by a combination of condition score and geographic score Low, Medium, and High values.



FIGURE 8 – CONDITION SCORE AND GEOGRAPHIC SCORE RELATIONSHIP MODEL



The results of this prioritization provides the roadmap for the program execution outside of the work that is performed as part of an alteration (including resurfacing and complaint work).

Locations will be programmed in accordance with the below ordered priority list of score combinations. Scores will be updated in accordance with our work programming schedules, utilizing new construction and inspection information when available.



FIGURE 9 – PRIORITIZATION ORDER