Access and Circulation Studies

Financial District and Seaport Climate Resilience Master Plan

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1. Overview & Objectives

This appendix is intended to supplement *Chapter 5: A Resilient 21st Century Waterfront – Access and Circulation* and provides additional detail on the existing conditions, case studies, and design studies that informed the Master Plan. This appendix covers access point frequency, methods of accessing the waterfront, emergency vehicular access, and replacing and improving the esplanade and bike paths.

Protecting this area from flooding requires significantly raising the shoreline edge while also continuing to connect residents, commuters, and visitors of all ages and abilities with this waterfront. Today, the Financial District and Seaport waterfront is easily accessible. This area connects the Brooklyn Bridge and The Battery, links key transportation facilities, and hosts open space and recreational amenities. The Master Plan continues to connect people to the East River and supports lively, thriving neighborhoods. Further, the Master Plan ensures that emergency, operations, and maintenance vehicles can continue to make the waterfront safe and run smoothly. While the height of the flood defense system could represent a major barrier between the city and the water, the Master Plan avoids this by integrating the proposed flood defense into a new landscape. To overcome the height difference—nearly two stories in some locations—the Master Plan includes a multi-level waterfront with several ways to enter and get around this waterfront.

The access and circulation strategies for the Master Plan support the Master Plan's goal to "[i]ntegrate climate resilience infrastructure into the city by ensuring universal accessibility and emergency vehicular connections to the waterfront and along the shoreline, and a continuous bikeway." The Master Plan defines Universal Access as: "An environment designed to be usable by all people to the greatest extent possible; design that is focused on providing equitable access and experiences for people with disabilities." To ensure universal access to the waterfront and make movement as free and easy as possible, the Master Plan proposes pathways and slopes over which people are moving that are no steeper than 5% or 1:20 to keep movement as comfortable as possible. The Americans with Disabilities Acts stipulates that movement routes with slopes steeper than 1:20 (5%) are considered ramps and require handrails and railings.

1.1 Ground Transportation Hierarchy

The Project Team examined three modalities of ground movement - pedestrian, bike, and vehicles/automobiles - and access to and through the site for these modalities. To guide the design development and decisions, the Project Team defined a guiding hierarchy for modes of ground transportation.

1. **Pedestrians:** The pedestrian experience – including safety and access to public transportation such as ferries - should be prioritized above all other modes. Flood defense measures will likely necessitate alterations to current site access frequency and circulation. Priority access corridors should be identified based on relative to width of corridor, connectivity to the upland fabric, public transit proximity, and upland program proximity in addition to existing or potential new waterfront program. Universal access drives all considerations for pedestrian movement, with the intent to make movement to, from, and along the waterfront as easy as possible with as many routes as possible between destinations.
2. **Bikes and Transit:** Space for safe bicycle (including e-bikes and e-scooters) and transit connectivity should be a priority. Continuity of the Manhattan Greenway needs to be maintained. Access points should be driven by proximity to the existing and planned network. Conflicts with other modes should be minimized. When possible, bottlenecks should be eliminated. While the Master Plan does not propose changes to the current bus routes, the Select Bus Service (SBS) M15 (which runs on Water Street) and the M55 (which runs on Broadway) are upland of the Financial District and Seaport waterfront and circulate in the Peter Minuit Plaza area. Any future proposed surface street changes must account for the operation of these routes.

3. **Vehicles/Automobiles:** Flood defense measures will likely necessitate alterations to streets, roadways, and automobile site access. While specific automobile requirements will need to be determined by program and operations requirements, automobile and other vehicle access should be prioritized by proximity and connectivity to the existing roadway network. Spatial solutions that allow for more flexible operations and emergency access should be prioritized. All vehicles that can currently access the waterfront along South Street will continue to be able to do so, including vehicles for freight and deliveries, taxis and ride share vehicles, and paratransit ambulettes. The Master Plan does not include access for private automobiles to the waterfront but does include dedicated vehicle lanes for delivery and drop-off/pick-up where necessary adjacent to maritime transportation facilities.

1. Pedestrians

2. Bikes and Transit

3. Vehicles/Automobiles

Figure 1: Hierarchy within ground transportation within site access

1.2 Key Questions

Four key questions guided the Project Team's priorities and strategies for preserving universal access to the waterfront:

1. Where and how frequent do waterfront access points need to be?
2. What are the different ways the Master Plan can provide waterfront access?
3. How can this Master Plan preserve or enhance the esplanade or bike path?
4. How can this Master Plan ensure safe emergency and operations vehicle access?

2. Where and how frequent do waterfront access points need to be?

Between Whitehall Street and Wagner Place, thirteen (13) streets provide east-west connections between the Financial District and Seaport neighborhoods and the waterfront. Today, pedestrians can cross South Street at eight locations to reach the shoreline, as shown in Figure 4. Some access points are close together (just over 200 feet apart) while others are further apart due to existing infrastructure. For example, the Battery Park Underpass ramps up to the elevated FDR Drive viaduct between Whitehall Street and Old Slip, which blocks access to the water for over 1,000 feet – a distance longer than a typical avenue in Manhattan. North of Old Slip, a nearly continuous pedestrian connection along South Street provides universal access to the waterfront without restriction.

Planned waterfront access points along the line of flood defense must maintain strong connections to the adjacent neighborhoods and streets: the Master Plan provides waterfront access at points no more than 500 feet apart. The Project Team identified a series of key principles and a process to determine pedestrian site access recommendations.

2.1 Key Principles

- Given the height of the flood defense (15 to 18 feet above the shoreline today) and the desire to keep it as continuous as possible, flood defense measures will impact the frequency of waterfront access points.
- Priority access corridors should be identified based on many characteristics such as relative width of corridor, connectivity to the upland fabric, terrestrial public transit proximity, upland program proximity, maritime transit proximity (existing and proposed), and existing and potential new waterfront destinations and programming.
- A rhythm of access frequency that responds to the existing street pattern will be developed, tested, and refined as necessary.
- Specific opportunities for access improvements should be identified and advanced, where possible.

2.2 Process

A. Identify existing waterfront destinations and potential proposed waterfront destinations, adjacent open spaces, and existing waterfront access points.
B. Analyze east-west connections at each street corridor and evaluate upland connections as well as overall character and proximity to the waterfront.
C. Conduct an access point frequency analysis by collecting case studies and develop a rule of thumb acceptable access frequency.
D. Identify potential priority access points to be tested (and adjusted) within the context of each alternative.

The Project Team conducted extensive analysis of the existing east-west connections between the city fabric and the waterfront to determine priority corridors to site direct waterfront access. The Project Team also catalogued adjacent and waterfront open spaces and maritime facilities to understand pedestrian destinations.

2.2.1 Existing Waterfront Destinations, Adjacent Open Spaces, and Existing Waterfront Access Points

Early in the process, upland and waterfront open spaces were identified and existing waterfront access locations and South Street crossings were characterized. Developing an understanding of the study area as it exists today is a critical first step in determining the locations to maintain or add waterfront access connections. The set of figures below illustrate the existing built fabric of the study area and key waterfront destinations.

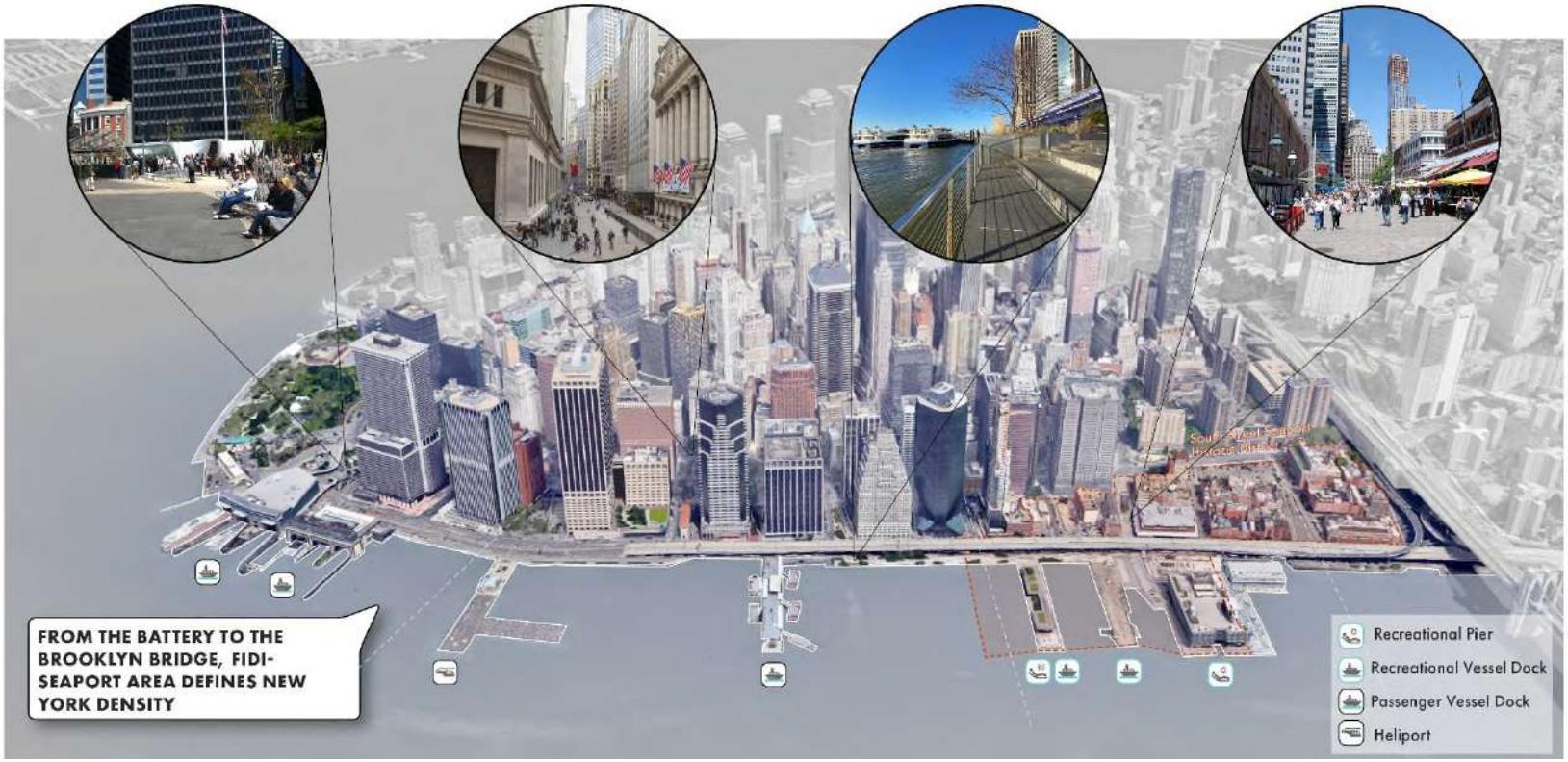

Figure 1: Built fabric context and maritime waterfront destinations (L to R: Peter Minuit Plaza, Wall Street, East River Esplanade get down, pedestrianized Fulton Street)

Figure 2: Upland open spaces

Figure 3: Waterfront open space destinations

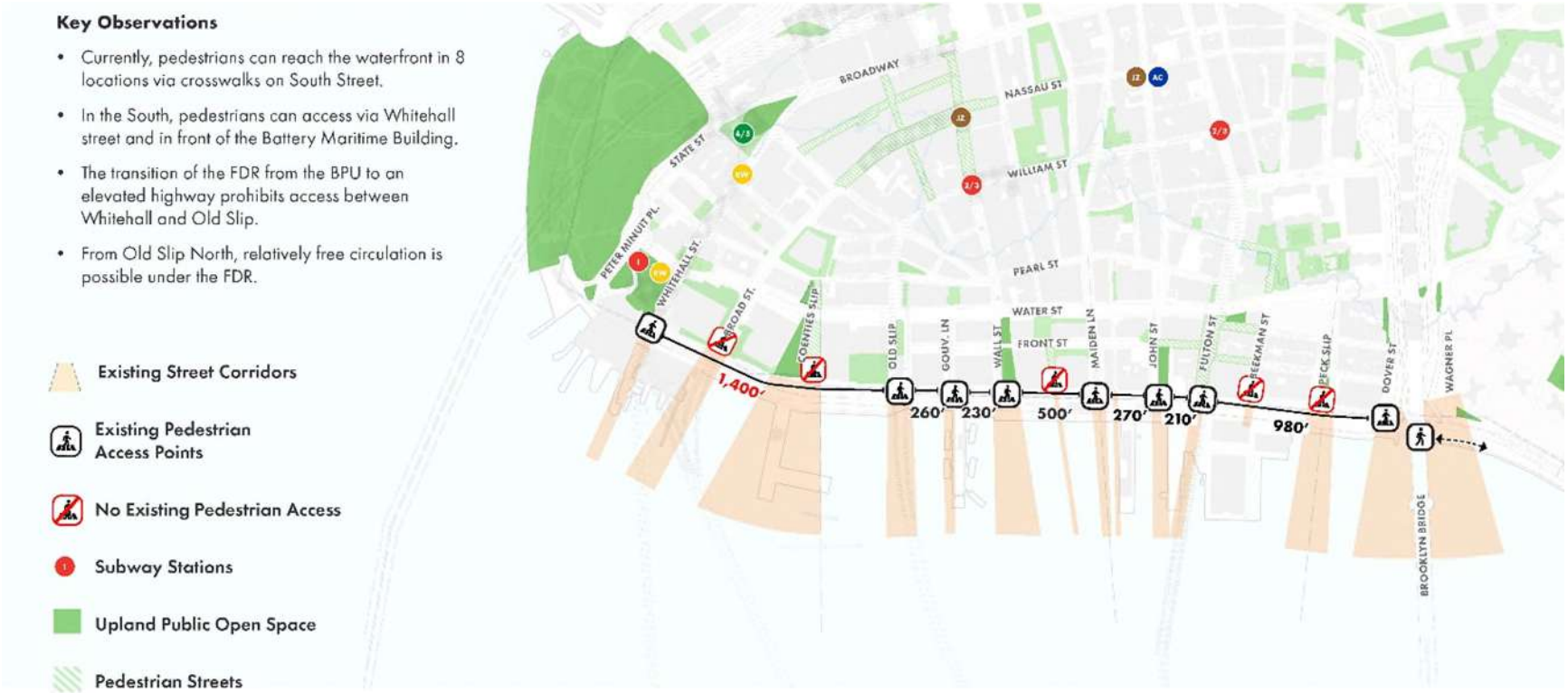

Figure 4: Existing waterfront pedestrian access points

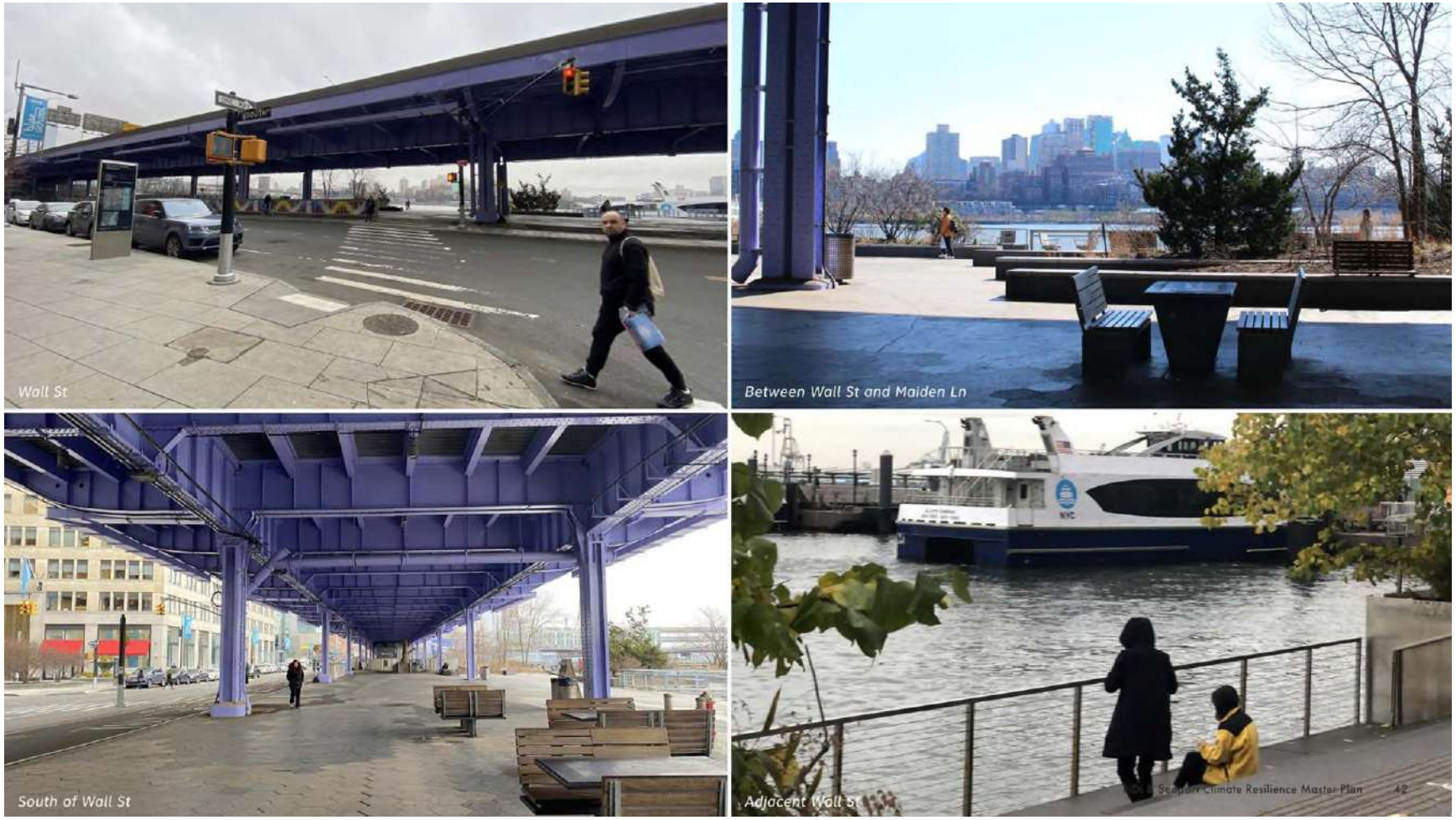

Figure 5: South Street Crossings and Waterfront Open Spaces. Where not encumbered by construction or parking lots, the river side of South Street is characterized by easy and free movement between street crossings and waterfront destinations.

2.2.2 East-West Connections between the Upland Neighborhoods and the Waterfront Analysis

The Project Team conducted an extensive street-by-street analysis of all the east-west connections from the Financial District and Seaport neighborhoods to the waterfront. The figure below characterizes the existing Lower Manhattan roadways. The east-west connections in the study area range from local streets/pedestrian plazas all the way to major through street/pedestrian plazas.

Figure 6: Lower Manhattan Roadways

The following set of figures summarize the east-west corridor analysis. The Project Team categorized the streets by physical characteristics, including width of right of ways, sidewalks, and vehicular areas, adjacent open spaces, adjacent transit (i.e., subway and bus), automobile connectivity, length (i.e., number of continuous blocks), connectivity to maritime assets, character and program, and typical street wall building type. The Project Team also analyzed each viewshed. This information provided critical context for where connectivity needed to be maintained and where there was an opportunity for connectivity to be improved.

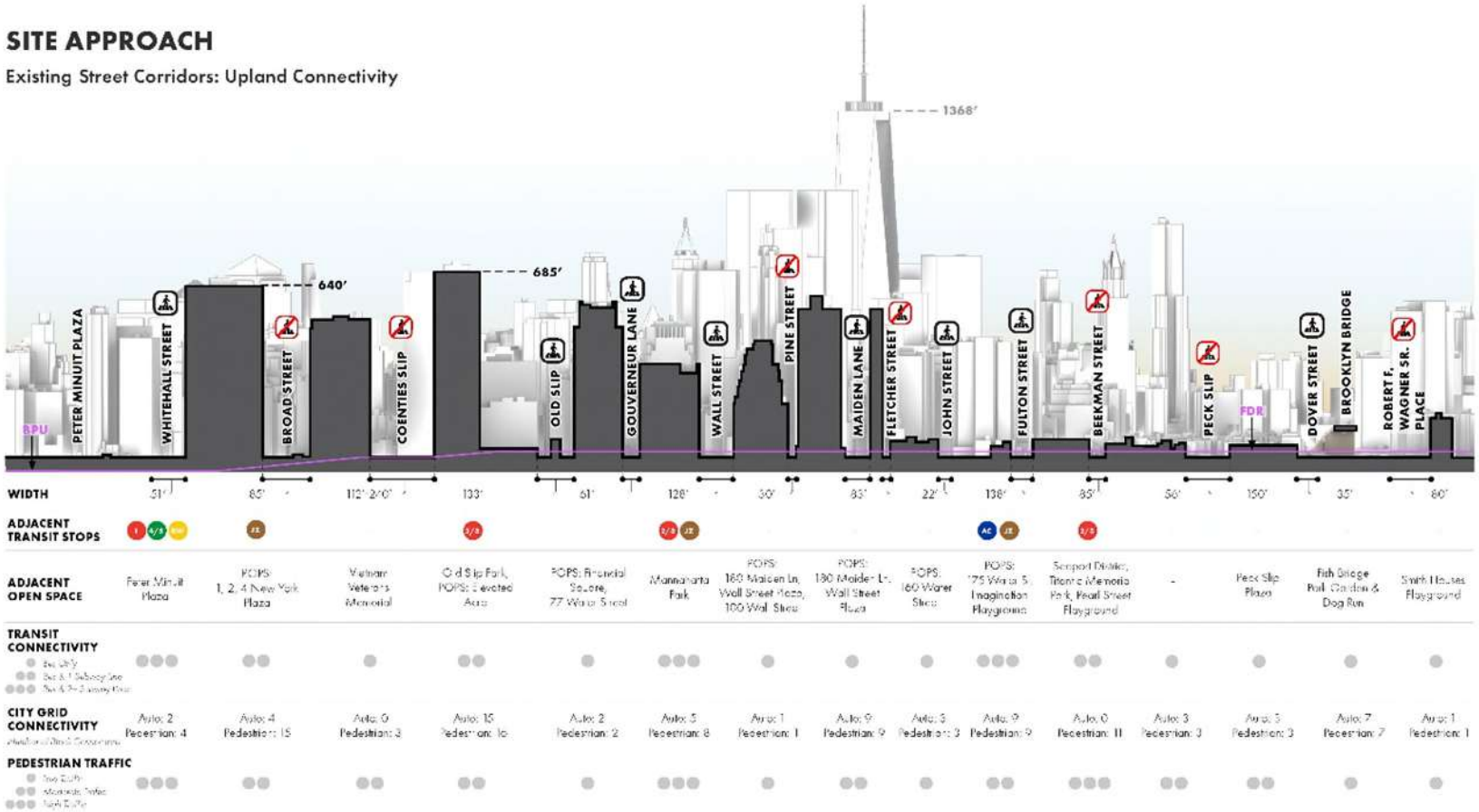

Figure 7: Existing Street Corridors: Upland Connectivity

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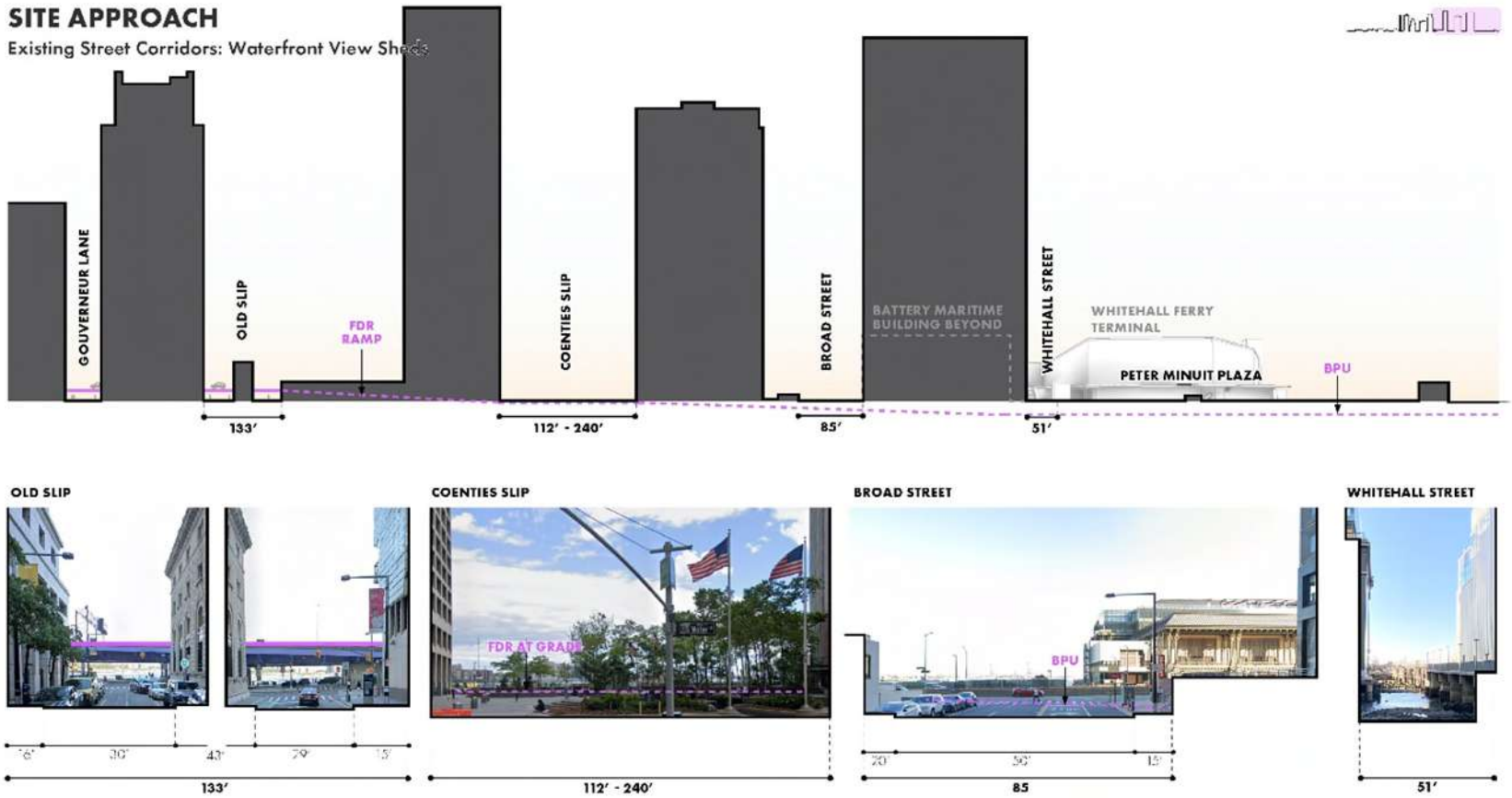


Figure 8: Existing Street Corridors - Waterfront View Sheds (Whitehall Street to Old Slip)

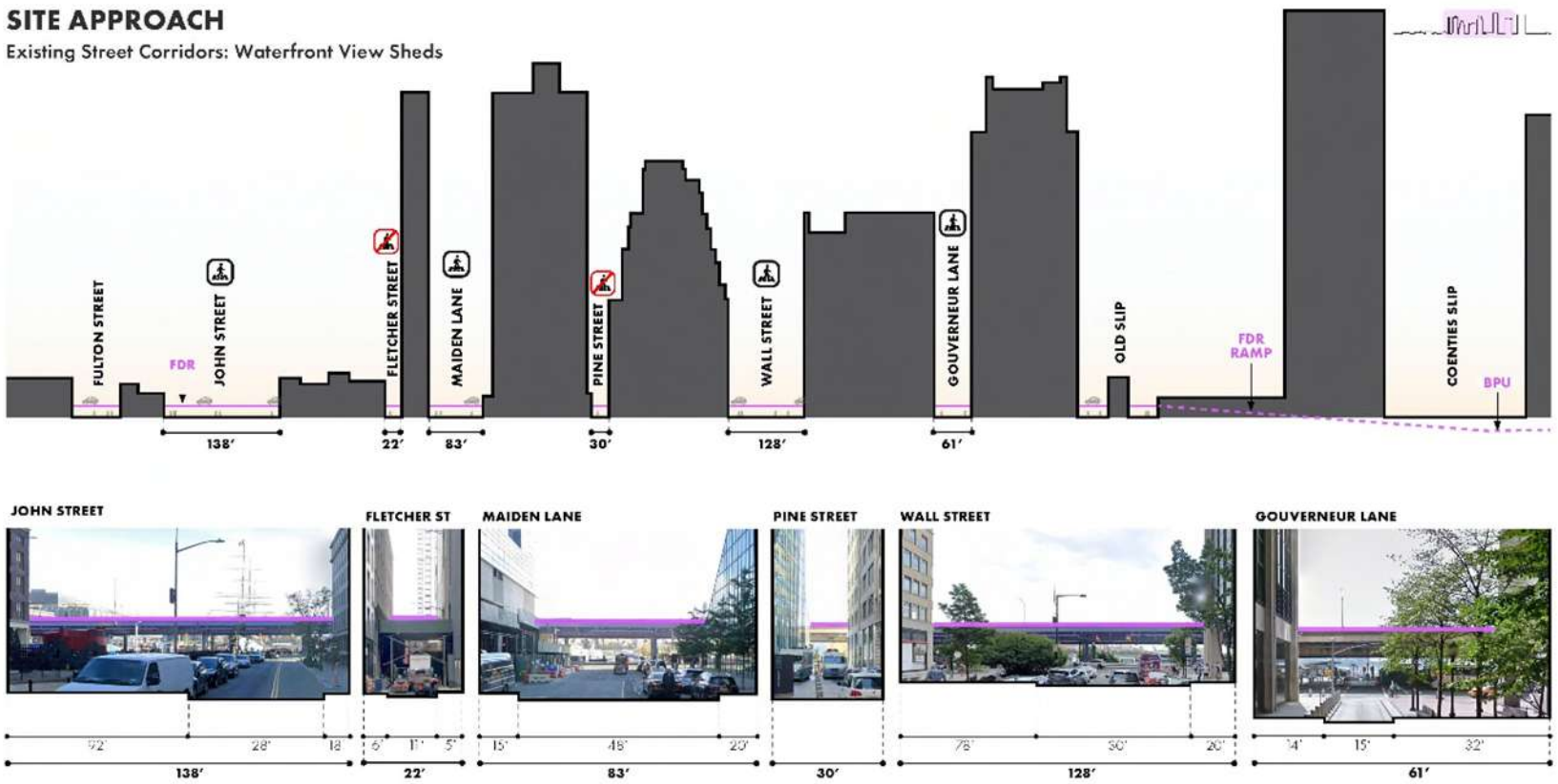


Figure 9: Existing Street Corridors - Waterfront View Sheds (Gouverneur Lane to John Street)

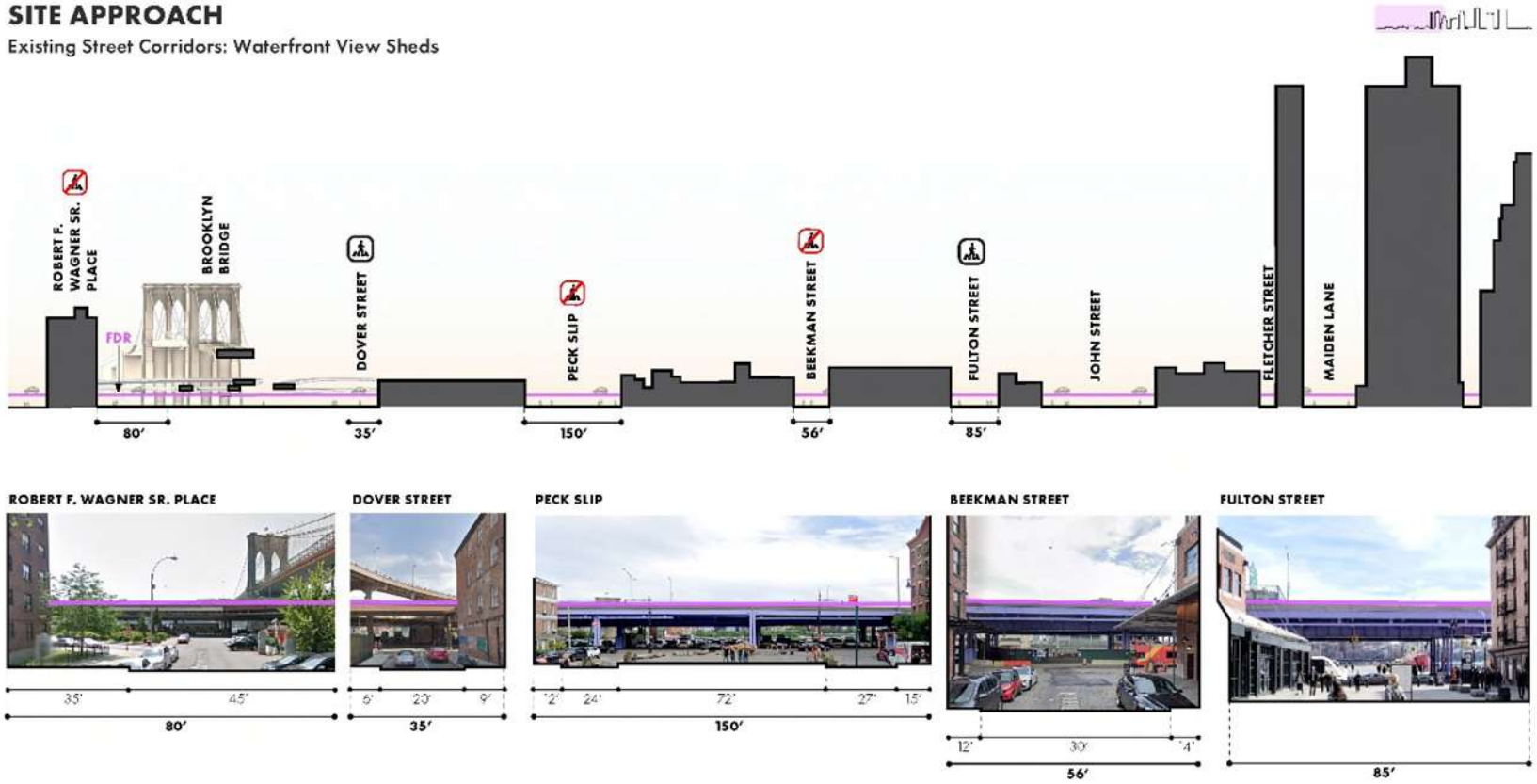


Figure 10: Existing Street Corridors - Waterfront View Sheds (Fulton Street to Robert F. Wagner Sr. Place)

The figure below highlights the streets in the study area with the strongest upland connectivity. These streets have good street grid continuity and connect transit corridors to the waterfront.

Figure 11: East-West Connections with Strong Connectivity Upland

2.2.3 Detailed East-West Street Corridor Analysis:

The following tables and figures provide a detailed analysis of each corridor, going into more depth including character/program, street type, view width, adjacent open spaces, adjacent transit stops, and more. These details provide a valuable foundational understanding of the site today and were considered wen considering any modifications to connectivity under the proposed plan.

Corridor	Character / Program	Street Type	Width (ft)	Adjacent Open Space	Waterfront Ped Access	Pedestrian Traffic[1]	Adjacent Transit Stops	Transit Connectivity[2]	Upland Auto. Connection	City Grid Connectivity (Blocks)		Maritime Access	Typical Building Type	View Corridor[3]
										Auto.	Ped.			
Whitehall Street	Maritime, Offices, Tourism	Local Street	51 (view) 68 (corridor)	Peter Minuit Plaza	Y	3	1, 4, 5, R, W | M15, M15SBS, M20, M55	3	1-way WB to Pearl St.	2	4	WFT, BMB (GI Ferry and Slip 5: City and Regional Ferry)	High-rise commercial	1
Broad Street	Offices, Plaza, Arcade	Local Street	85	POPS: 1, 2, and 4 New York Plaza	N	2	J, Z | M15, QM7, QM8, QM11, QM25, NYCTA emergency access structure	2	2-way to Stone St.; 1-way WB to Beaver St; then restricted/pedestrianized for NYSE	4	15	-	High-rise commercial	3
Coenties Slip	Park, Plaza	Pedestrian	112 - 240	Vietnam Veterans Memorial	N	2	BM1, BM2, BM3, BM4	1	Pedestrianized between South St. and South William St.	0	3	-	High-rise commercial, mid-rise mixed use	3
Old Slip	Historic Building, Offices	Local Street	133 (48+35+50)	Old Slip Park, POPS: Elevated Acre	Y	2	2, 3 | M15, SIM5, SIM15, SIM35	2	2-way via Hanover Sq. to Pearl St.; then 1-way NB via William to Beekman St.	15	16	Pier 6, Pier 11	High-rise commercial and mixed use	2
Gouverneur Lane	Offices	Local Street	61	POPS: Financial Square, 77 Water Street	Y	1	QM7, QM8, QM11, QM25	1	1-way EB from Water St., pedestrianized between Water and Pearl	2	2	Pier 11	High-rise commercial	1
Wall Street	Offices, Public Open Space, Tourism	Local Street	128	Mannahatta Park	Y	3	2, 3, J, Z | M15, M15SBS	3	1-way EB from William St., pedestrianized between William St. and Broadway	5	8	Pier 11	High-rise commercial, mixed use, and residential	2
Pine Street		Pedestrian	30	POPS: 180 Maiden Lane, Wall Street Plaza, 100 Wall Street	N	1	M15	1	Pedestrianized between South and Water St.	1	1	-	High-rise commercial	1
Maiden Lane	Offices, Residential	Through Street DOT Truck Route	83	POPS: 180 Maiden Lane, Wall Street Plaza	Y	2	M15, QM7, QM8, SIM5, SIM15, SIM35	1	2-way to Gold St., splitting into Liberty St. and Maiden Ln. before reaching Broadway	9	9	Pier 15	High-rise commercial, mixed use, and residential	2
Fletcher Street		Local Street	22	POPS: 160 Water Street	N	1	M15	1	1-way EB from Pearl St.	3	3	-	High-rise commercial and residential	1
John Street	Mixed commercial and residential	Local Street	138	Imagination Playground, POPS: 175 Water Street	Y	2	A, C, J, Z | M15, QM11, QM25	3	2-way to Pearl St.; then 1-way EB from Broadway	9	9	Pier 15, Pier 16, Pier 17	Mid-rise mixed use and commercial; high-rise mixed-use west of Front St	2
Fulton Street	Tourism, mixed commercial and residential	Pedestrian	85	Seaport District, Titanic Memorial Park, Pearl Street Playground	Y	3	2, 3 | M15, M15 SBS, SIM5, SIM15, SIM35	2	Pedestrianized between South and Pearl St.; 2-way to William Street; 1-way WB to Church St.	0	11	Pier 15, Pier 16, Pier 17	Mid-rise mixed use	2
Beekman Street	Tourism, mixed commercial and residential	Local Street	56	-	N	2	M15, M15 SBS, SIM5, SIM15, SIM35	1	1-way WB to Pearl St.	3	3	-	Mid-rise mixed use	0
Peck Slip	Mixed commercial and residential	Local Street	150	Peck Slip Park	N	2	M15, BM1, BM2, BM3, BM4, QM7, QM8, QM11, QM25	1	2-way to Water St.; 1-way WB to Pearl St.	3	3	-	Mid-rise mixed use	2
Dover Street	Mixed commercial and residential, Infrastructure	Local Street	35	Fish Bridge Park Garden and Dog Run	Y	1	M15, M22, QM7, QM8, QM11, QM25, SIM5, SIM15, SIM35	1	1-way EB from Pearl St; 1-way EB from Broadway via Park Row and Frankfurt St. to Pearl St.	7	7	-	Mid-rise mixed use	1
Wagner Place	Infrastructure, Residential	Local Street	80	Smith Houses Playground	N	1	M15, M22	1	1-way EB to Pearl St.	1	1	-	High-rise residential	2

[1] 1 = Low pedestrian traffic; 2 = Moderate; 3 = High

[2] 1 = Buses only; 2 = Buses and 1 subway line; 3 = Buses and more than 1 subway lines

[3] 0 = View obstructed; 1 = Narrow, partially obstructed; 2 = Wide, partially obstructed; 3 = Wide, unobstructed

Figure 12: Street Corridor Summary

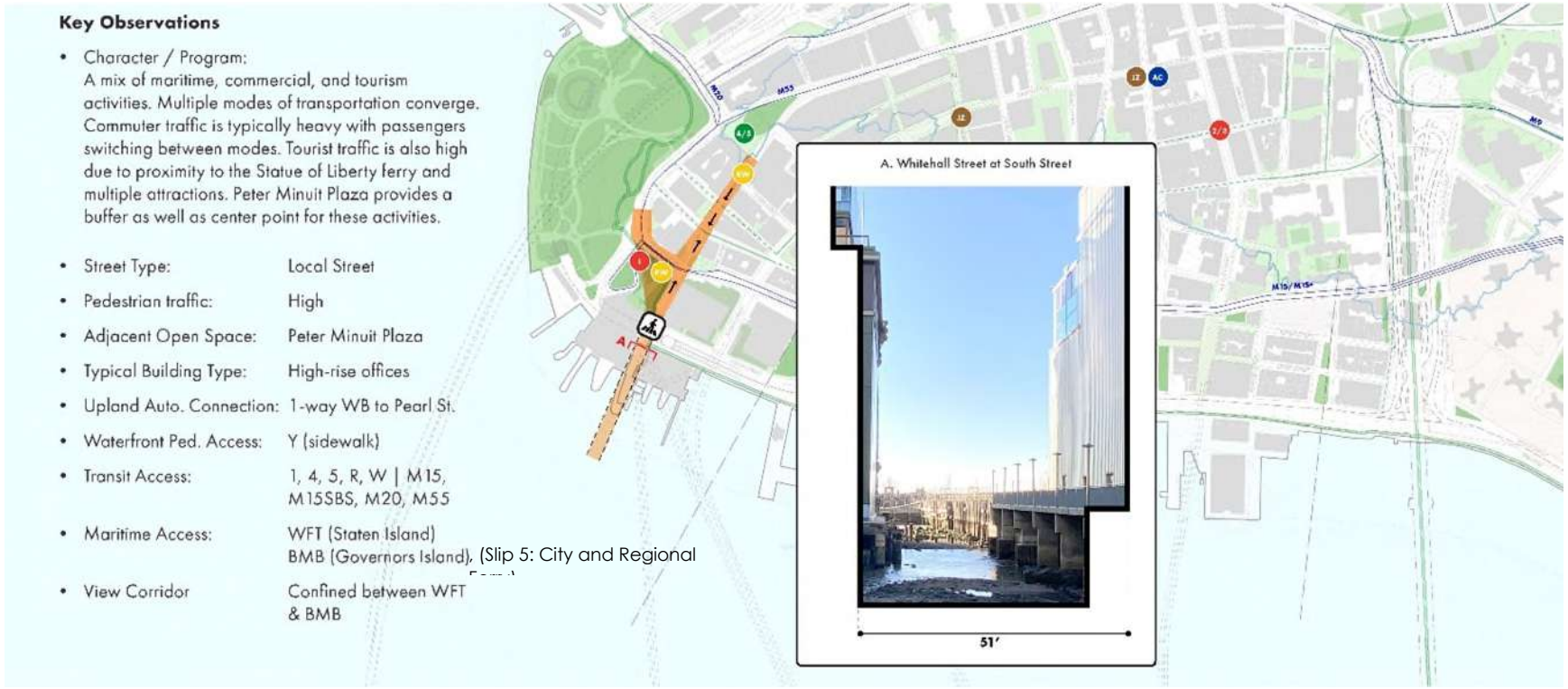


Figure 13: Whitehall Street

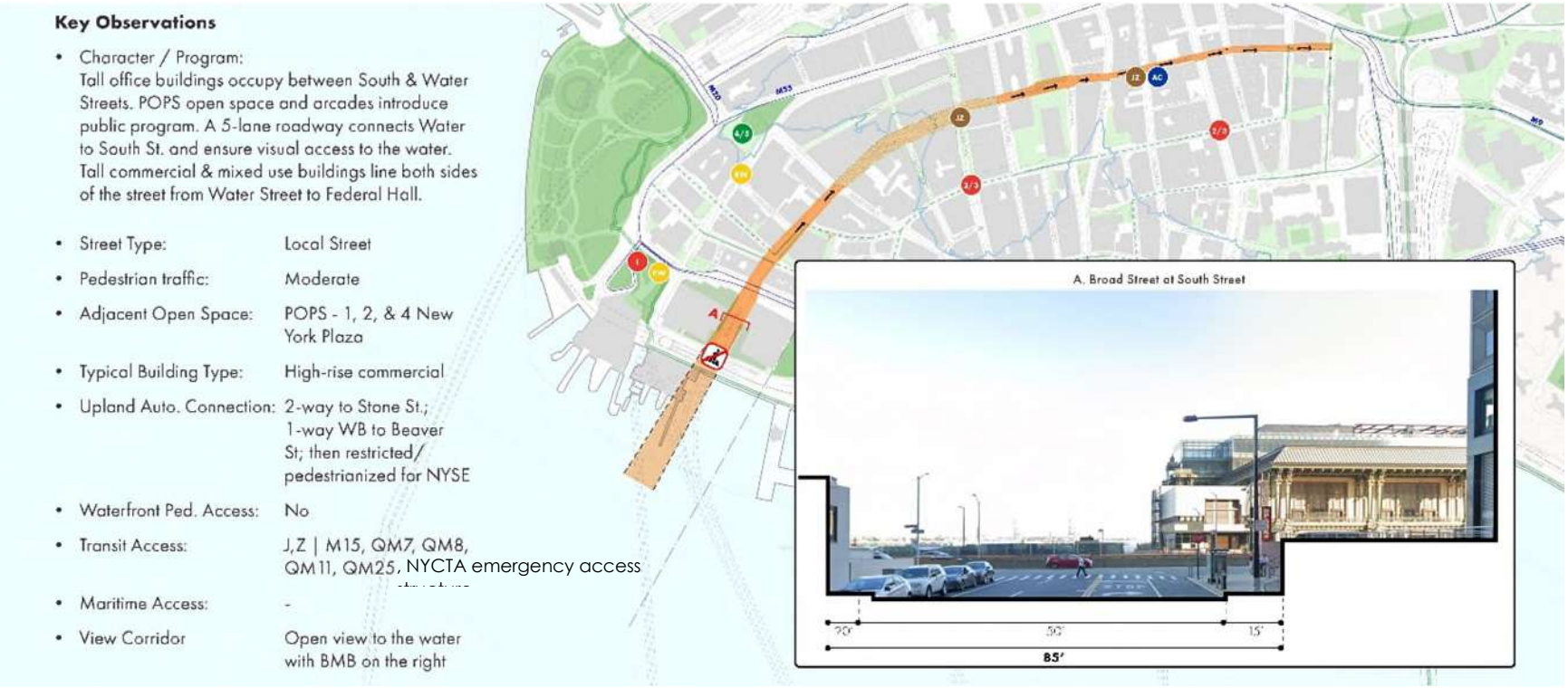


Figure 14: Broad Street

Figure 15: Vietnam Veterans Memorial Plaza (Coenties Slip)

Key Observations

- Character / Program:
  The historic 1st Precinct Station (NYC Police Museum) forms an anchor point at Old Slip & South Street. On the two sides are tall office buildings. Across Water Street, as Old Slip becomes Hanover Square & William Street, is an area of tall mixed-use and residential buildings.

- Street Type: Local Street
- Pedestrian traffic: Moderate
- Adjacent Open Space: Old Slip Park, POPS - Elevated Acre
- Typical Building Type: High-rise commercial & mixed use
- Upland Auto. Connection: 2-way via Hanover Sq. to Pearl St.; then 1-way NB via William to Beekman St.
- Waterfront Ped. Access: Yes
- Transit Access: 2, 3 | M15, SIM5, SIM15, SIM35
- Maritime Access: Pier 6 & Pier 11
- View Corridor: Wide view to the water with FDR

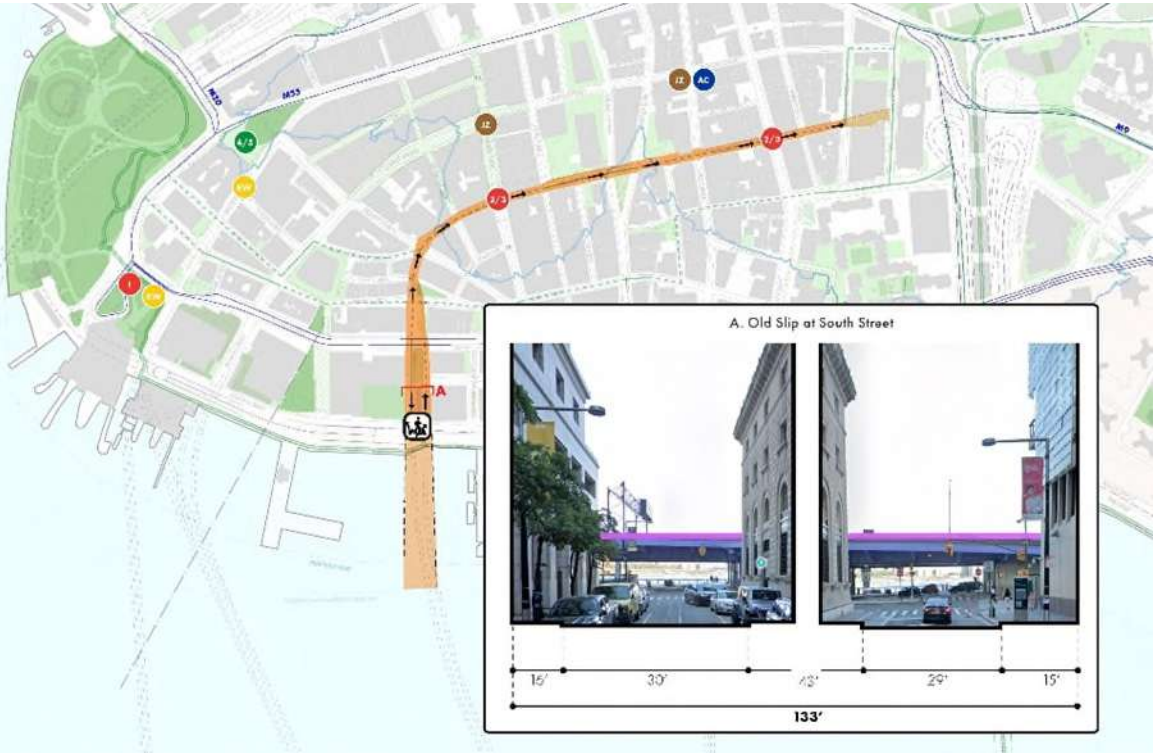


Figure 16: Old Slip

Key Observations

- Character / Program:
  A quiet one-lane, narrow street with tall commercial/office buildings on the two sides. POPS open space provides seating and slightly mitigate the canyon effect.

- Street Type: Local Street
- Pedestrian traffic: Low
- Adjacent Open Space: POPS - Financial Square, 77 Water Street
- Typical Building Type: High-rise commercial
- Upland Auto. Connection: 1-way EB from Water St., pedestrianized between Water & Pearl
- Waterfront Ped. Access: Yes
- Transit Access: QM7, QM8, QM11, QM25
- Maritime Access: Pier 11
- View Corridor Narrow, canyon like view with FDR

Figure 17: Gouverneur Lane

Key Observations

- Character / Program:
  Pier 11 brings in both commuter and tourist traffic. The number of tourists peaks at the historic core. The North side of the streets are mainly commercial buildings while the South side is a mix of mixed-use and residential buildings.

- Street Type: Local Street
- Pedestrian traffic: High
- Adjacent Open Space: Mannahatta Park
- Typical Building Type: High-rise commercial, mixed use, & residential
- Upland Auto. Connection: 1-way EB from William St., pedestrianized between William St. & Broadway
- Waterfront Ped. Access: Yes
- Transit Access: 2, 3, J, Z | M15, M15SBS
- Maritime Access: Pier 11
- View Corridor: Wide view to the water with FDR

Figure 18: Wall Street

Key Observations

- Character / Program:
  A narrow, pedestrianized street between tall commercial buildings. Both pedestrian and automobile traffic are light with occasional delivery/ utility access.

- Street Type: Pedestrian
- Pedestrian traffic: Low
- Adjacent Open Space: POPS - 180 Maiden Lane, Wall Street Plaza, 100 Wall Street
- Typical Building Type: High-rise commercial
- Upland Auto. Connection: Pedestrianized between South & Water St.
- Waterfront Ped. Access: No
- Transit Access: M15
- Maritime Access: -
- View Corridor Narrow, canyon like view with FDR

Figure 19: Pine Street

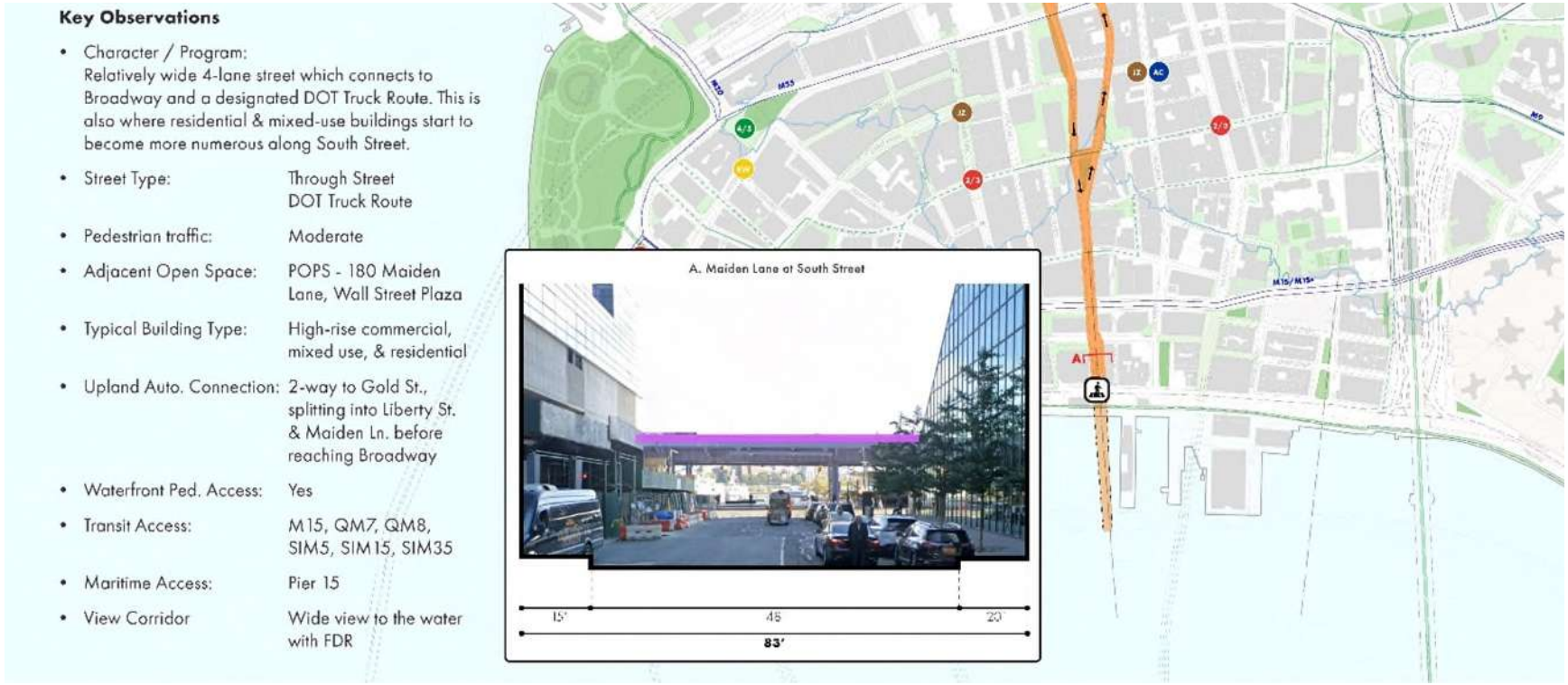


Figure 20: Maiden Lane

Figure 21: Fletcher Street

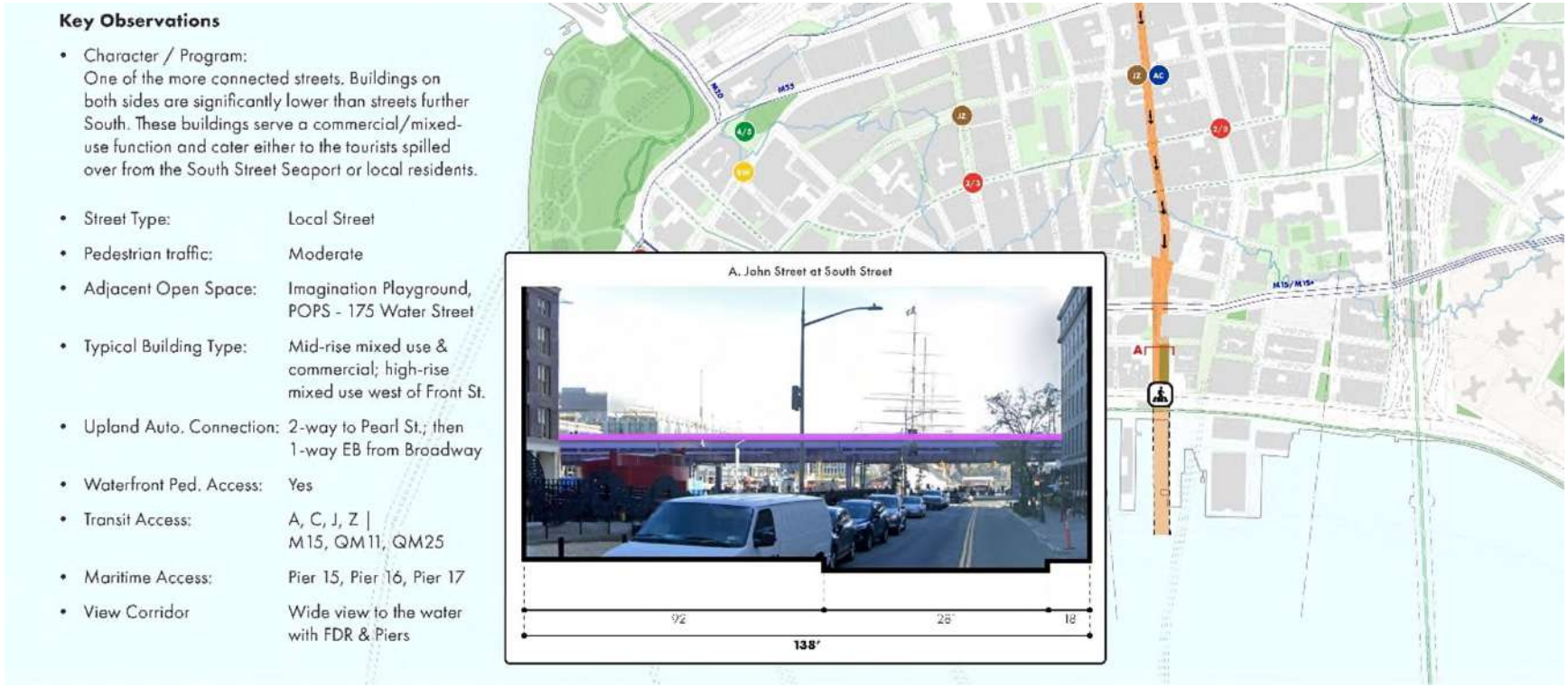


Figure 22: John Street

Figure 23: Fulton Street

Key Observations

- Character / Program:
  Cobblestone paved street which has more of a residential character than Fulton Street, but still has ample commercial activities on the ground floor, particularly where it meets Front Street.

- Street Type: Local
- Pedestrian traffic: Moderate
- Adjacent Open Space: -
- Typical Building Type: Mid-rise mixed use
- Upland Auto. Connection: 1-way WB to Pearl St.
- Waterfront Ped. Access: No
- Transit Access: M15, M15 SBS, SIM5, SIM15, SIM35
- Maritime Access: -
- View Corridor: Relatively narrow; FDR, Tin Building, & the Pier 17 building block view to the water

Figure 24: Beekman Street

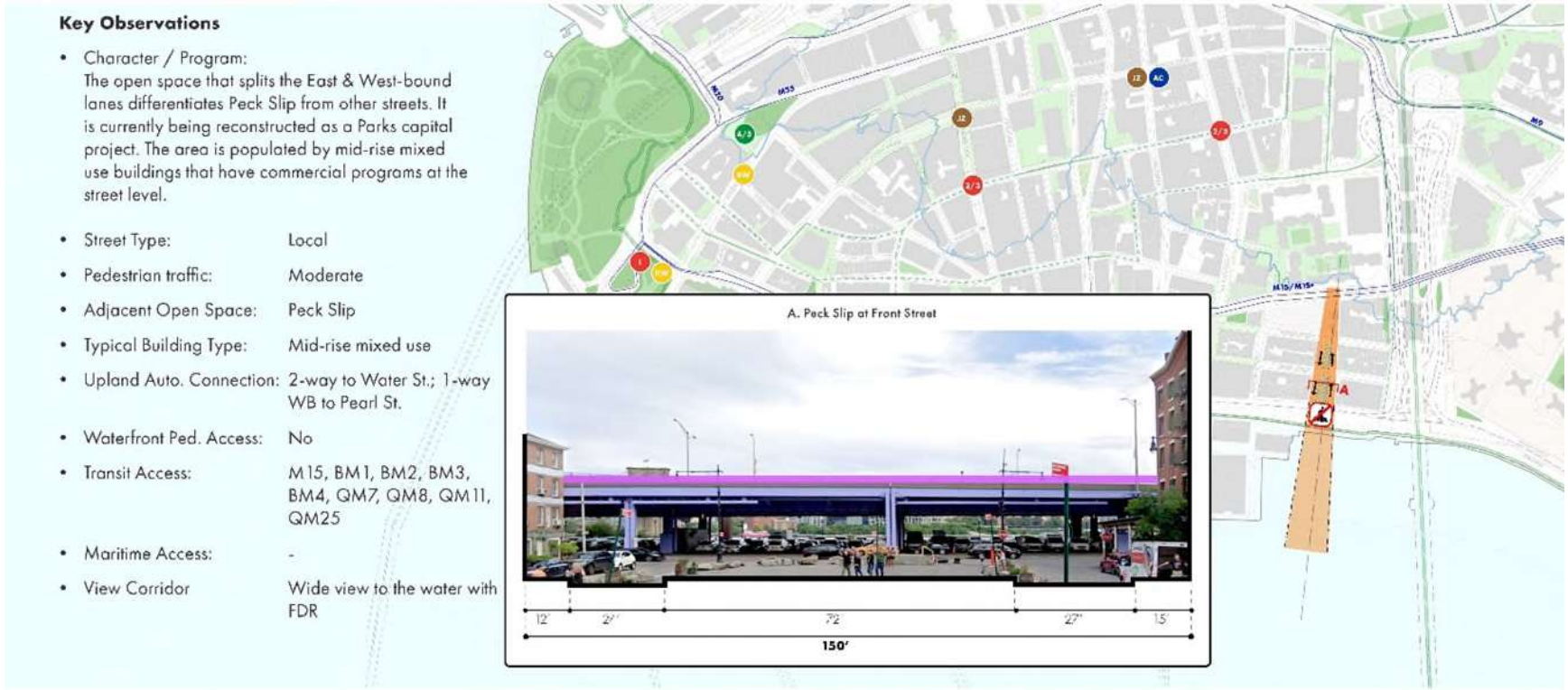


Figure 25: Peck Slip

Key Observations

- Character / Program:
  Relatively narrow street that runs along the Brooklyn Bridge, an FDR off-ramp, & a DOT maintenance yard. There is limited commercial activities at the street level but pedestrian traffic is not high.

- Street Type: Local Street
- Pedestrian traffic: Low
- Adjacent Open Space: Fish Bridge Park Garden & Dog Run
- Typical Building Type: Mid-rise mixed use
- Upland Auto. Connection: 1-way EB from Pearl St; 1-way EB from Broadway via Park Row & Frankfurt St. to Pearl St.
- Waterfront Ped. Access: Yes
- Transit Access: M15, M22, QM7, QM8, QM11, QM25, SIM5, SIM15, SIM35
- Maritime Access: -
- View Corridor Relatively narrow, FDR & Brooklyn Bridge ramps block views to the water

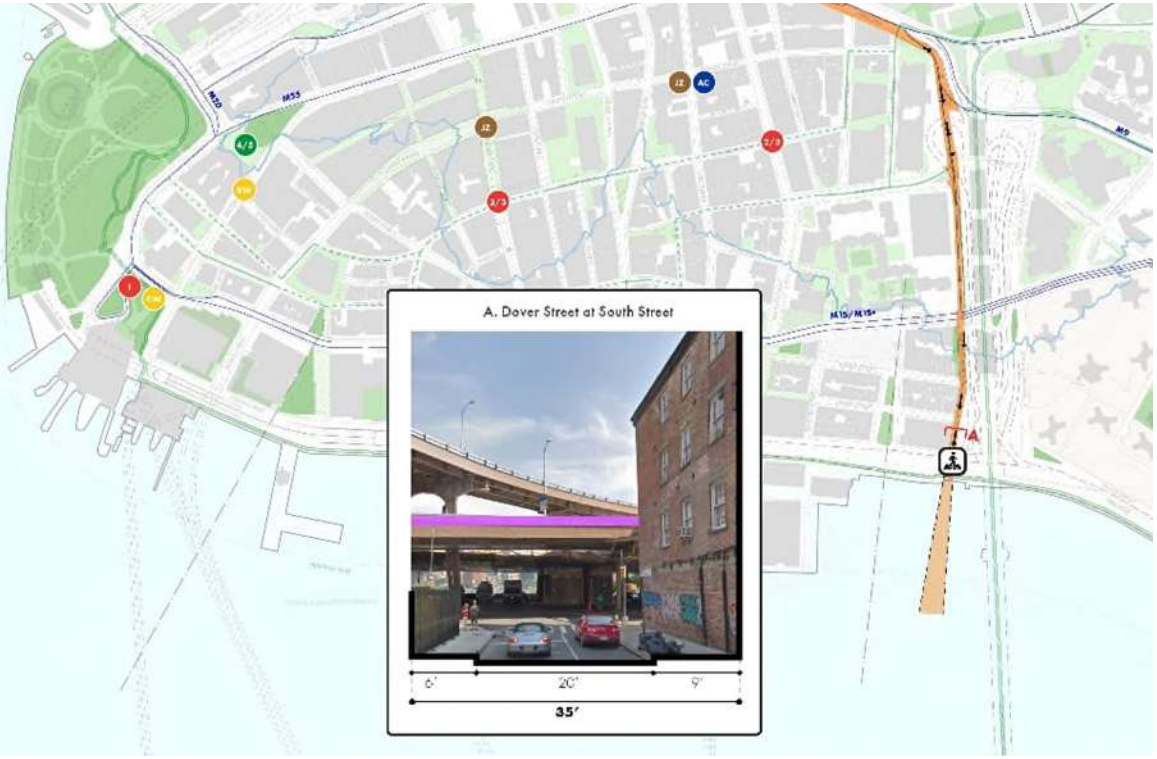


Figure 26: Dover Street

Figure 27: Robert F. Wagner Sr. Place

2.2.4 Access Point Frequency Analysis

While the Master Plan maintains all existing crosswalks and explores the possibility of adding new crosswalks where feasible, the height of the new multi-level waterfront needs its own access points up and over the flood defense. The Project Team looked to public parks and other waterfronts in the city to determine an appropriate frequency of access to the new waterfront. While access frequency recommendations provided by DCP for waterfront zoning do not apply here as it is a public site, not private development, the Project Team noted that in the case of shore public walkways, "upland connections give direct access to the shore public walkway at regular intervals (at least every 60 feet) from upland public streets." Based on the case study analysis, the Project Team recommended spacing waterfront access points no more than 500 feet apart.

As an example, at Fort Greene Park, the distance between entrances is typically between 450 and 650 feet.

Figure 28: Fort Greene Park access point frequency analysis

Where Prospect Park meets the typical city grid, entrances are typically 700 feet apart.

Figure 29: Prospect Park access point frequency analysis

Access to Hudson River Park is spaced between 200 and 600 feet between 23rd and 26th Street.

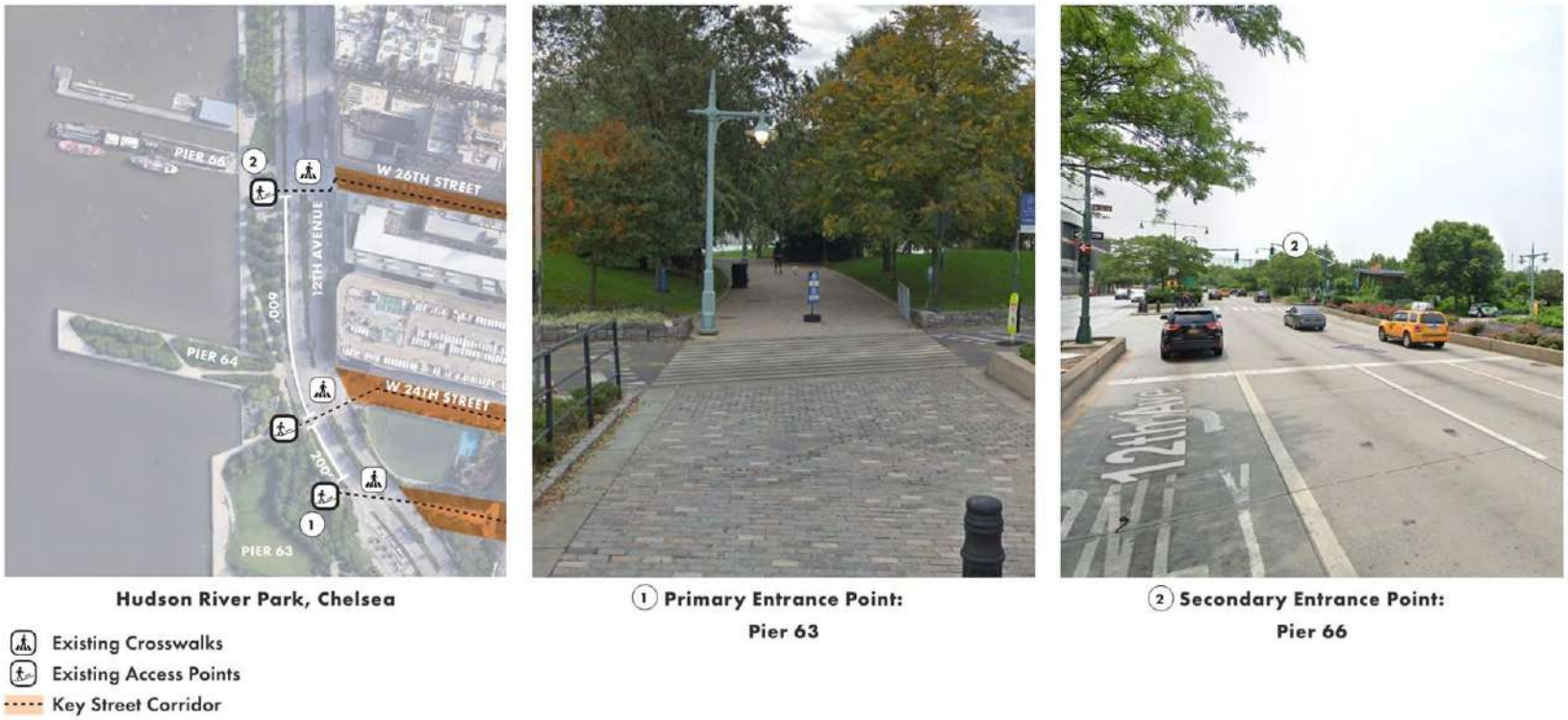


Figure 30: Hudson River Park access point frequency analysis

2.2.5 Design Recommendations

As a result of the analyses, the Project Team identified a series of opportunities to improve waterfront access:

- Access from Whitehall Street could be improved and serve as a gateway to the waterfront
- New connections could be created at Broad Street and/or Coenties Slip
- Wall Street is an excellent opportunity for a feature access point
- In the South Street Seaport area, easy pedestrian movement and connectivity could be improved, particularly at Peck Slip
- The Brooklyn Bridge corridor is an opportunity to better connect pedestrians and cyclists

The Master Plan presents Broad Street, Vietnam Veterans Memorial Plaza (Coenties Slip), Old Slip, Wall Street, Maiden Lane, Fulton Street, and Peck Slip as locations for waterfront access points. The Project Team also recommended the addition of new street crossings at Peck Slip and at Broad Street with the extension of the Battery Park Underpass cap upland of the Battery Maritime Building.

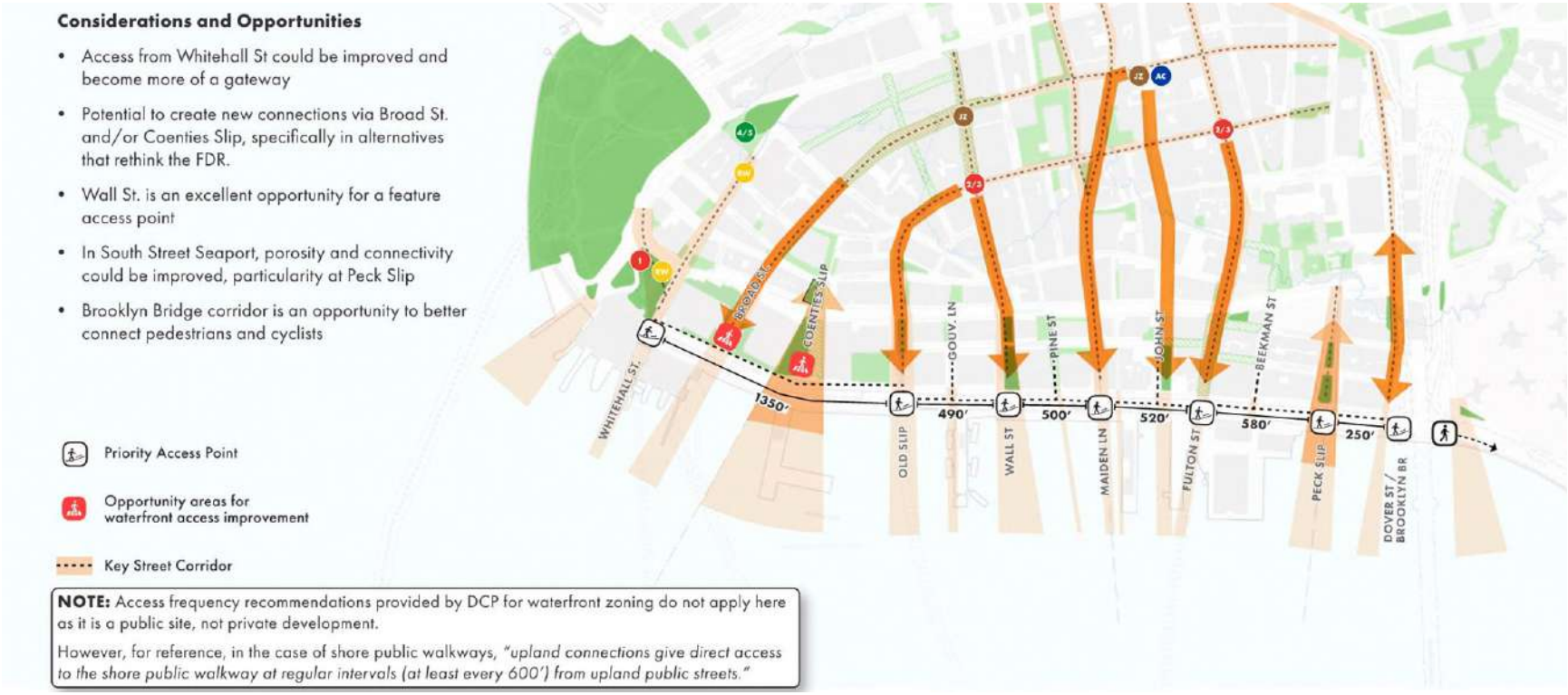


Figure 31: Considerations and opportunities for waterfront access

3. What are the different ways the Master Plan can provide waterfront access?

The Master Plan presents a universally accessible waterfront with as much direct access as possible. The Project Team studied strategies for direct access via up-and-over vertical access and via gateways. A path qualifies as universally accessible if sloped pathways are no steeper than 5% (1:20), which allows users of all ages and abilities to navigate them comfortably.

3.1 Up-and-Over Vertical Access

The Project Team studied a variety of up-and-over access strategies to bring people from current grade up to the upper level and back down to the waterfront. The Project Team looked at strategies with minimal footprints and strategies with larger footprints, all with the goal of providing universally accessible routes that are direct as possible.

3.1.1 Minimal Footprint Studies

Up-and-over access requires horizontal space. Understanding just how much space was needed to navigate up to the design flood elevation and back down to the waterfront was critical. Developing this understanding began by examining how narrowly up-and-over access could be achieved.

The Project Team found that minimal footprint access strategies did not meet the project goals, such as providing direct routes from starting point to destination along the waterfront. In addition, a wall-like condition at the water's edge would create an unsafe condition beneath the FDR Drive viaduct, with poorly lit corridors and unhealthy air quality. While the Master Plan does not present the minimal footprint strategies for primary access, some of the strategies presented herein provide important secondary access near primary access paths and co-located within buildings.

The graphic below presents the basic types of grade navigation with minimal footprints: vertical access (elevators and stairs), pathways parallel to vertical walls (the flood defense), and parallel pathways embedded in slopes.

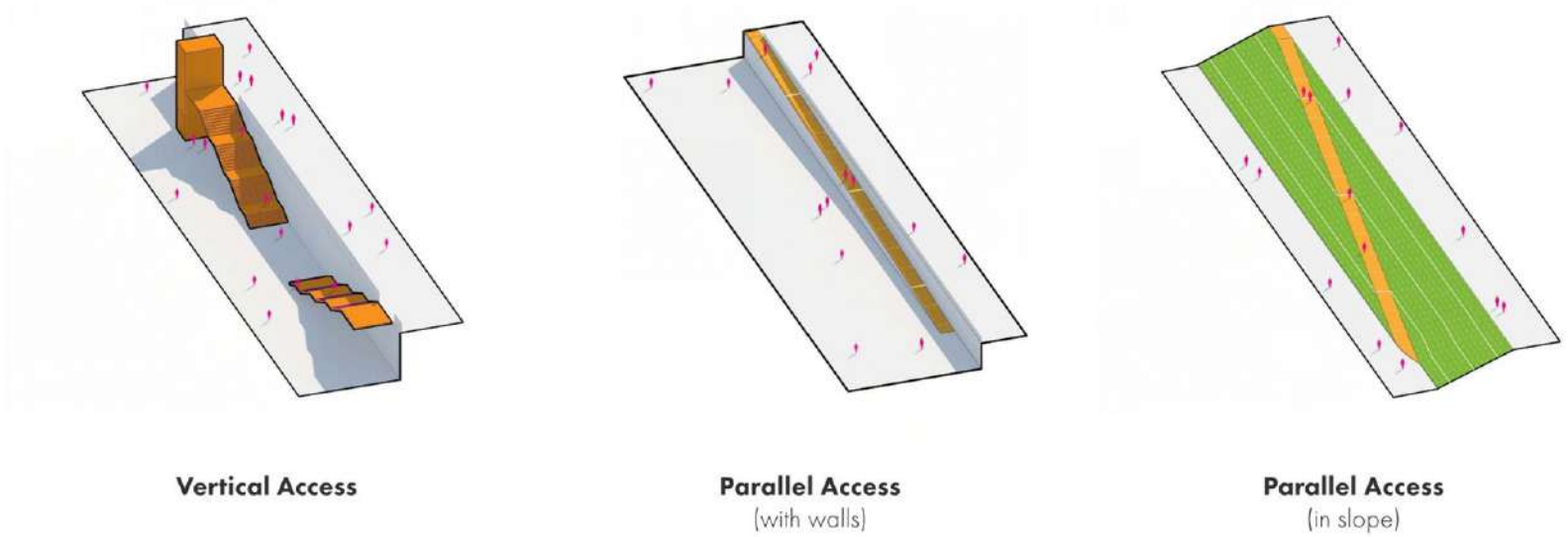
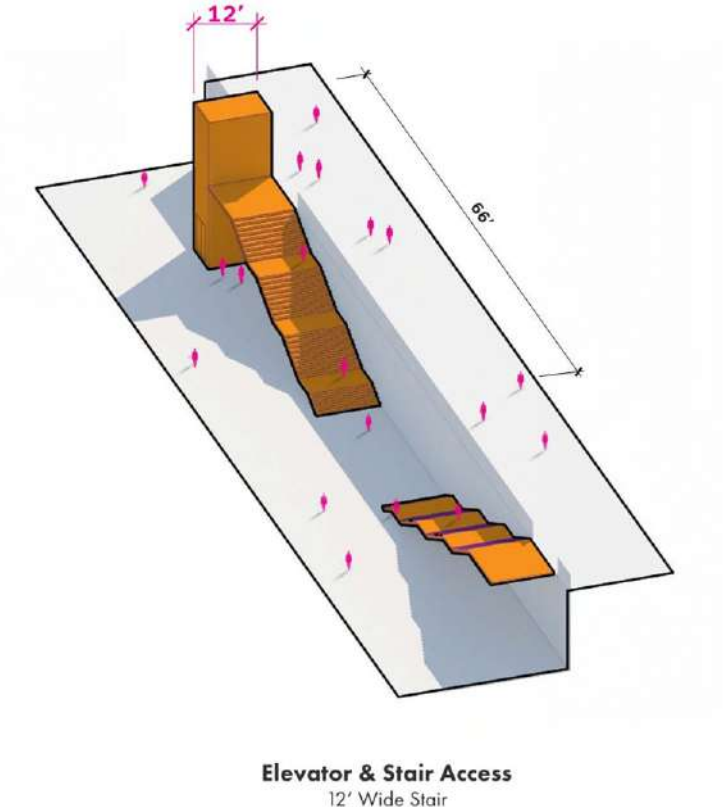


Figure 32: Summary of Minimal Footprint Access Strategies

Vertical access via elevators and stairs

The following figures provide greater detail on vertical access via elevators and stairs, including examples of the typology in existing public spaces and diagrammatic views of what the typology would look like in the study area.



- Stairs and ramps have a small footprint and provide the quickest way to get up and over flood protection
- However, the wall condition creates an undesirable experience
- Poses concerns from a maintenance perspective

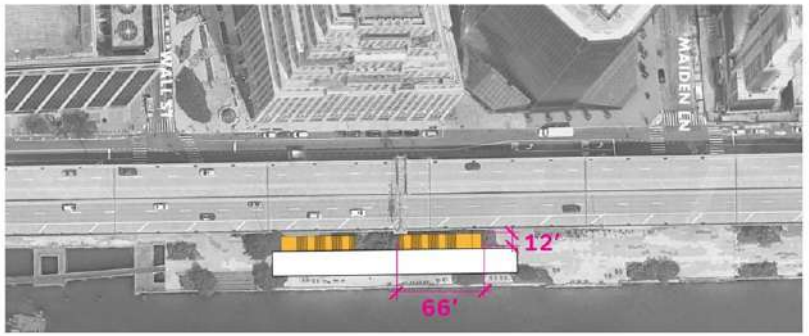


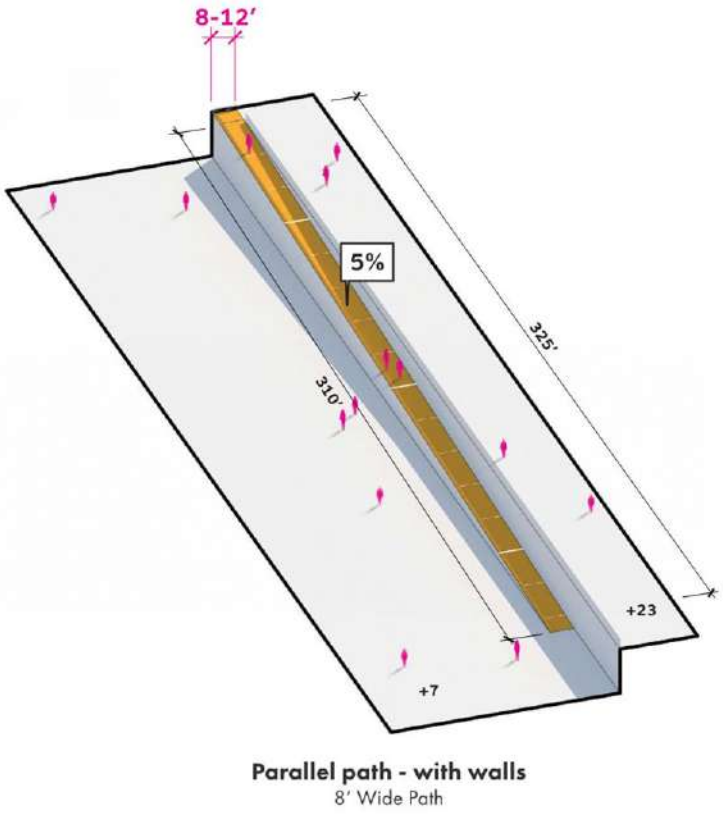
Figure 33: Elevator and Stair Access

Figure 34: Examples of Elevators and Stairs Embedded in Public Spaces

Figure 35: Diagrammatic Views of Elevators and Stairs Deployed on the Site

Parallel paths

The following figures provide greater detail on parallel paths, including examples of the typology in existing public spaces and diagrammatic views of what the typology would look like in the study area. The figures include information on paths parallel to walls and embedded into slopes.



- One continuous ramp can have the smallest footprint and is considered easier to navigate than stairs
- Although a continuous ramp would have landings and other opportunities for rest along its length, it is an undesirable condition because it poses problems for visibility and deposits a user too far from where they entered the ramp
- Undesirable wall condition remains present in this iteration

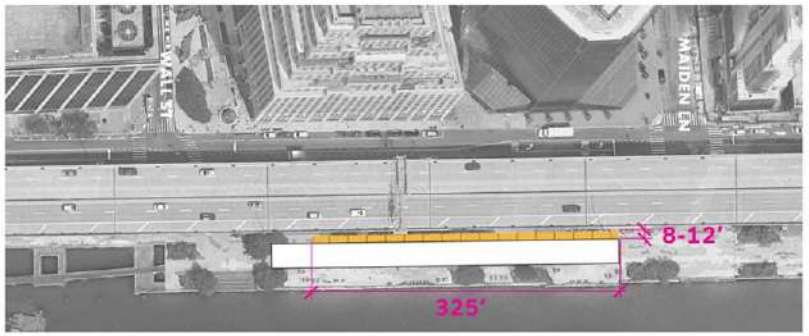


Figure 36: Pathways Parallel to Vertical Walls

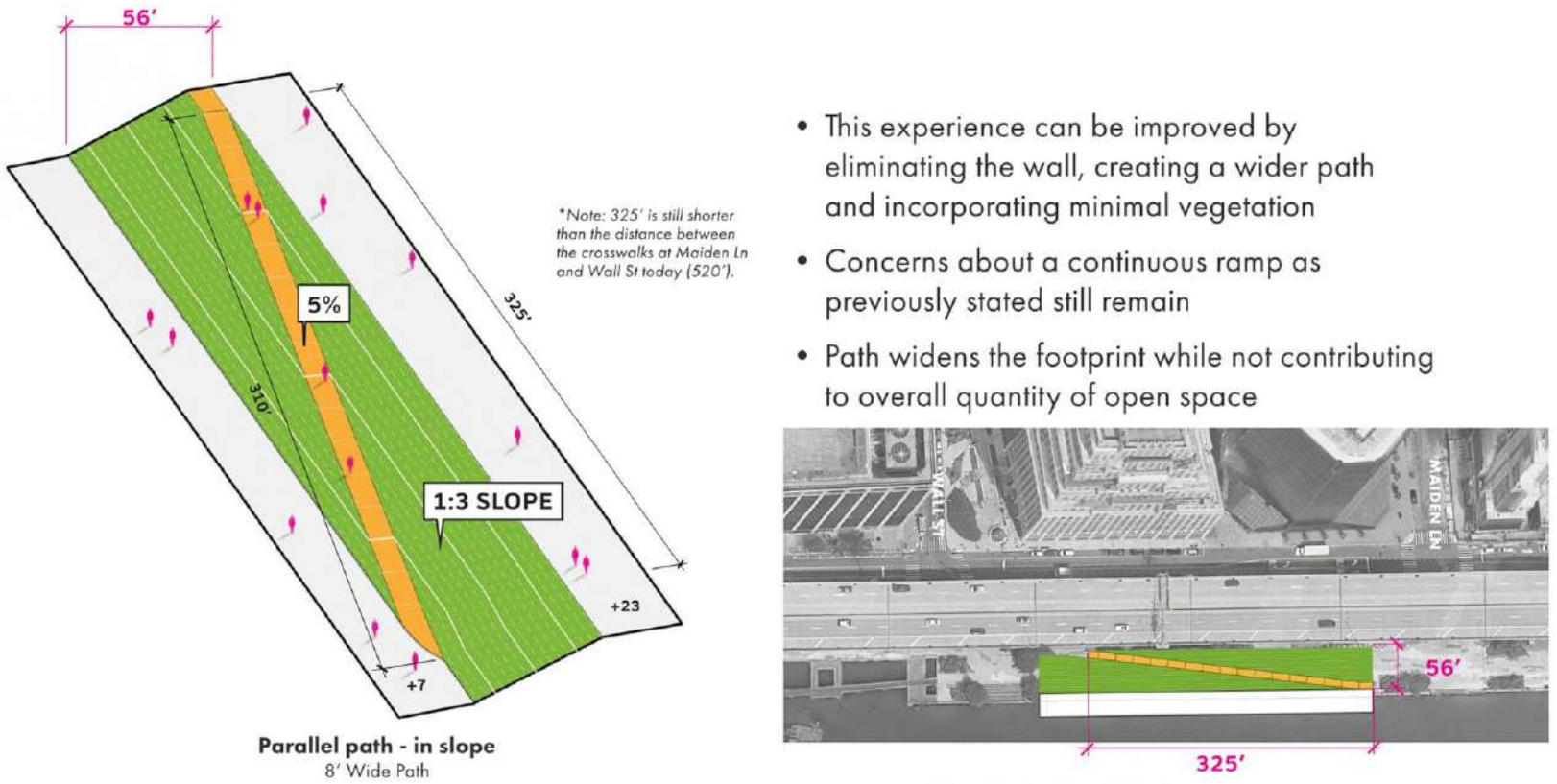


Figure 37: Parallel Pathways Embedded in Slopes

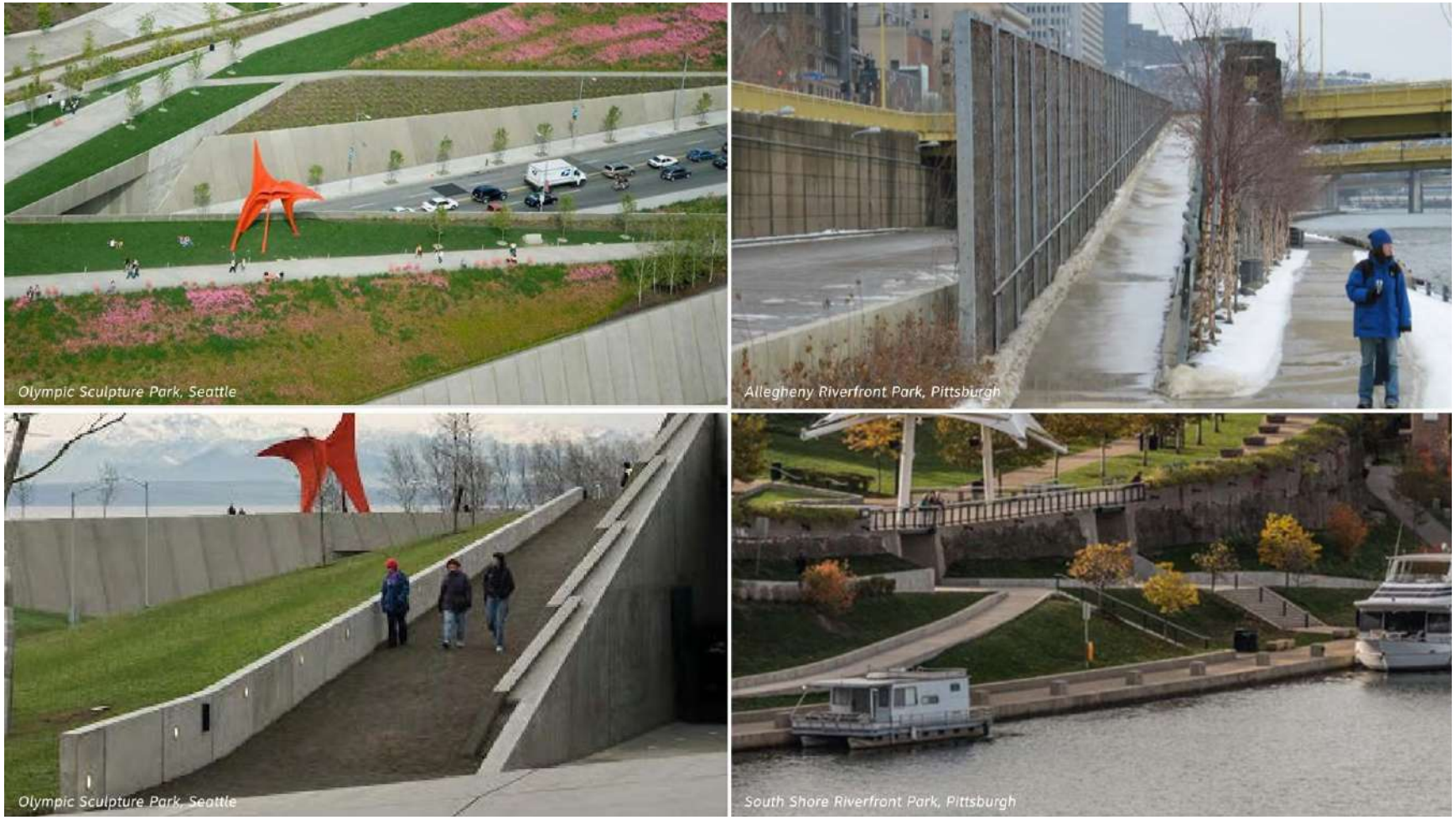


Figure 38: Examples of Parallel Pathways in Public Spaces

Figure 39: Diagrammatic Views of Parallel Pathways Deployed on the Site

3.1.2 Switchback Studies

The Project Team also studied the use of pathways that included switchbacks (i.e., back-and-forth ramps) to bring people from South Street to the upper level. This strategy creates more direct routes from starting point to destination while also providing opportunities to locate rest areas, planting, amenities, and other program along these ramps and otherwise integrate open space.

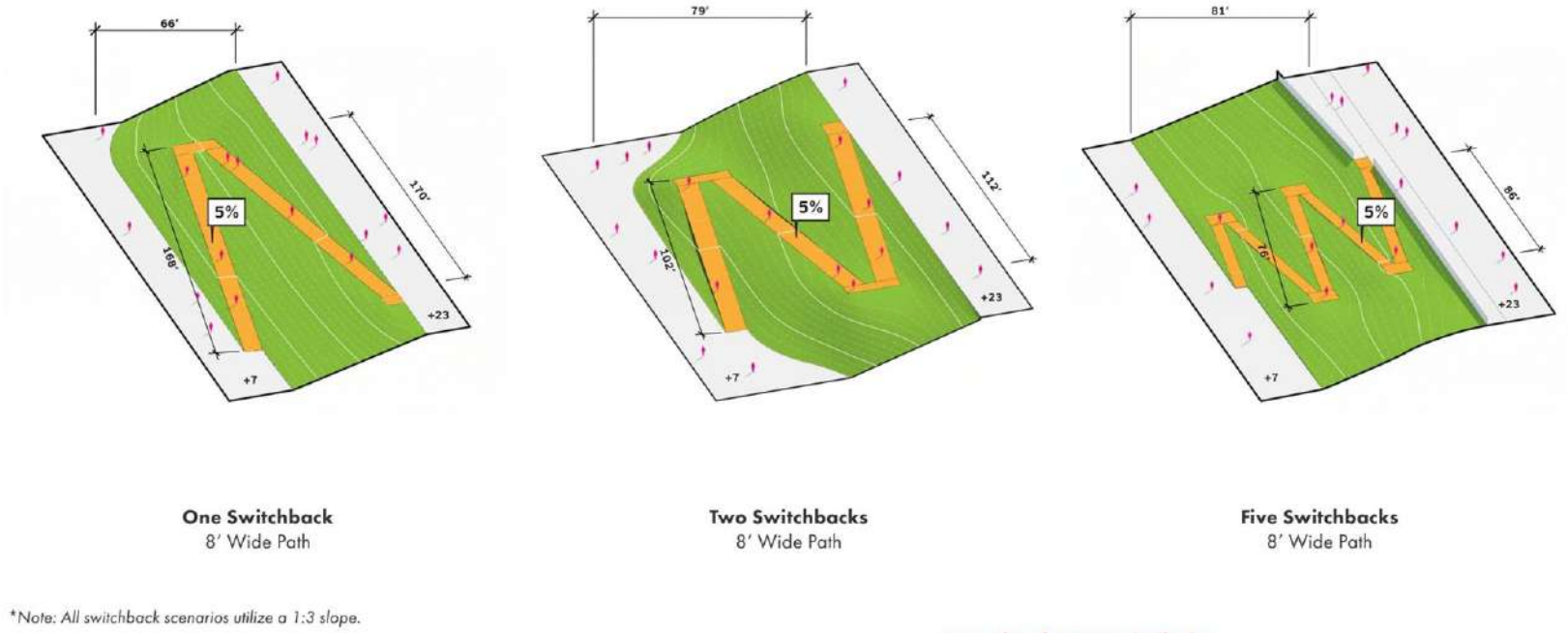
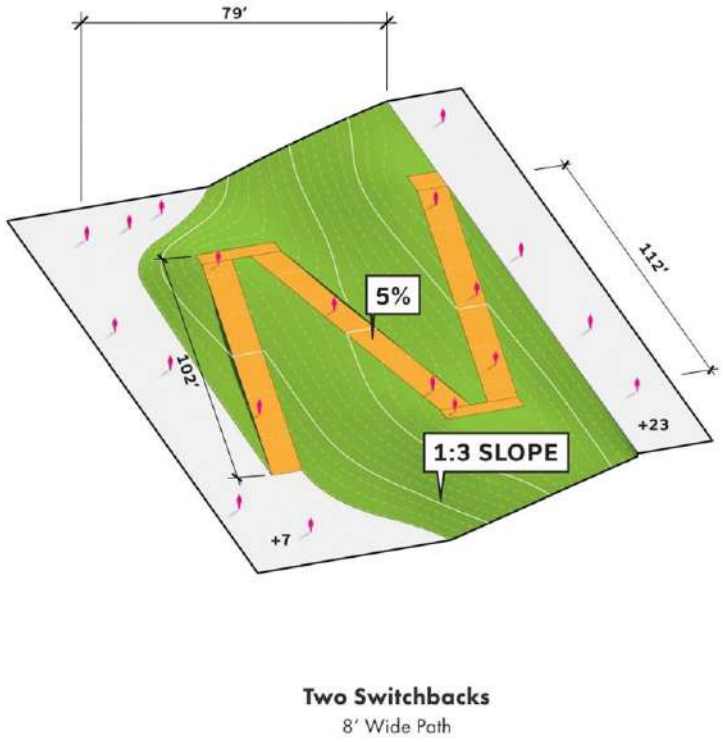


Figure 40: Summary of switchback option footprints and dimensions

The following figures provide greater detail on switchbacks, including examples of the typology in existing public spaces and diagrammatic views of what the typology would look like in the study area.



- While switchbacks have a deeper outboard footprint, their footprint along the shoreline is narrower, and can thus be accommodated more frequently
- Better for more frequent access, but must be used selectively, or modified to incorporate usable open space between pathways, to ensure that our open space targets are met

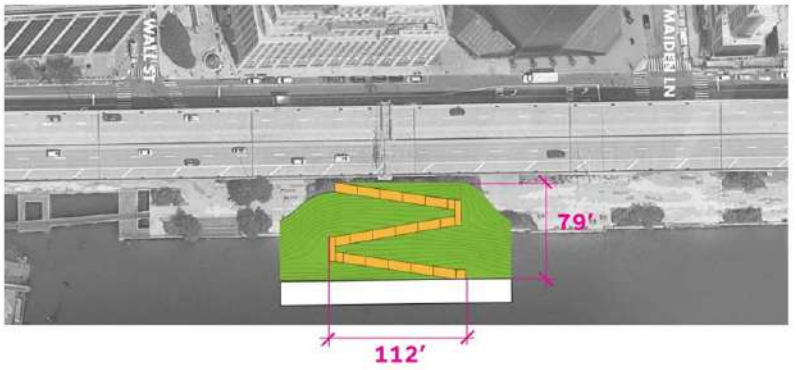


Figure 41: Switchback detail for two switchback scheme

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Figure 42: Examples of Other Waterfronts Utilizing Switchback Pathways

Figure 43: Diagrammatic Views of Switchback Pathways Deployed on the Site

3.1.3 Integrating Open Space

The Project Team looked for opportunities to integrate open space with access paths, especially when access paths are adjacent to upland open spaces (such as at the Vietnam Veterans Memorial Plaza, Wall Street, Fulton and John Street, and Peck Slip) to better connect existing and proposed open space. One such strategy included combining terraced open space with switchback pathways, which the Project Team found to be an efficient way to incorporate usable open space with access, ultimately minimizing the project's footprint. After the switchback configurations were initially explored, the grading was optimized to create usable open space that was integrated with the access points.

First, the Project Team defined what counted as usable open space. Precendent studies provided insight into a "minimally" usable slope, which, while still steep, can accommodate select uses. This minimally usable slope was determed to be 1:6, while the switch-back studies were done assuming a slope of 1:3. To achieve the multiple project goals, open space became integrated into access points in some project locations by fine-tuning the switchback scheme to allow for milder slopes that would better serve the community (for more information on open space studies, please see the Open Space and Program Appendix).

Figure 44: Usable open space definition

The Project Team worked through a variety of studies combining pathways and open space including terraced and multilevel open spaces. The figures below provide additional details on these studies.

Staggered Elevation Access

Staggered elevation access is the up-and-over vertical access type that integrates with open space. It maximizes usability while creating multi-level open space.

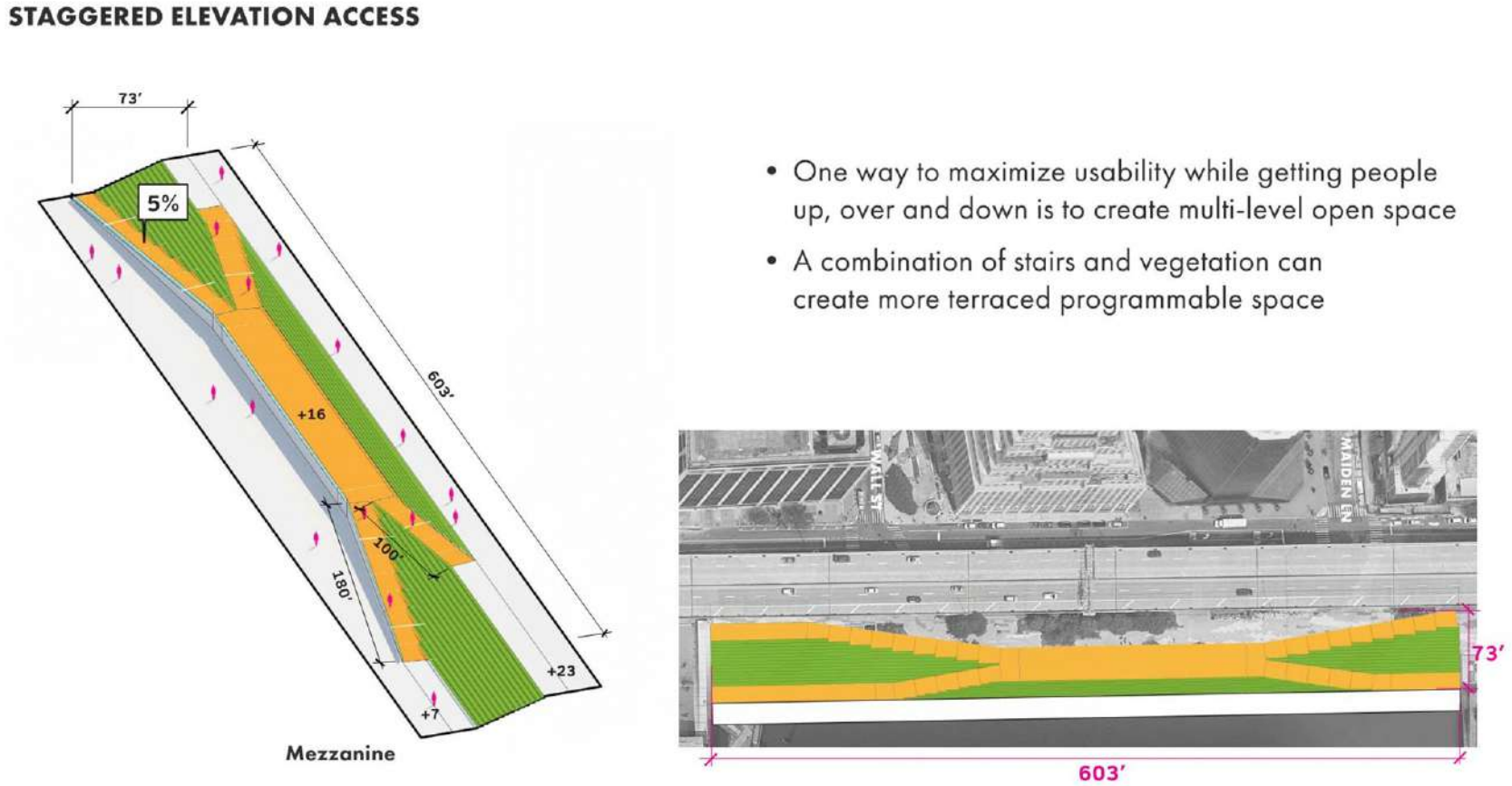


Figure 45: Staggered elevation access detail

Multi-Level Open Space

Different types of multi-level open space were studied, from a variety of landings to parallel terraces. Each type could be a part of a staggered elevation access point, as described above.

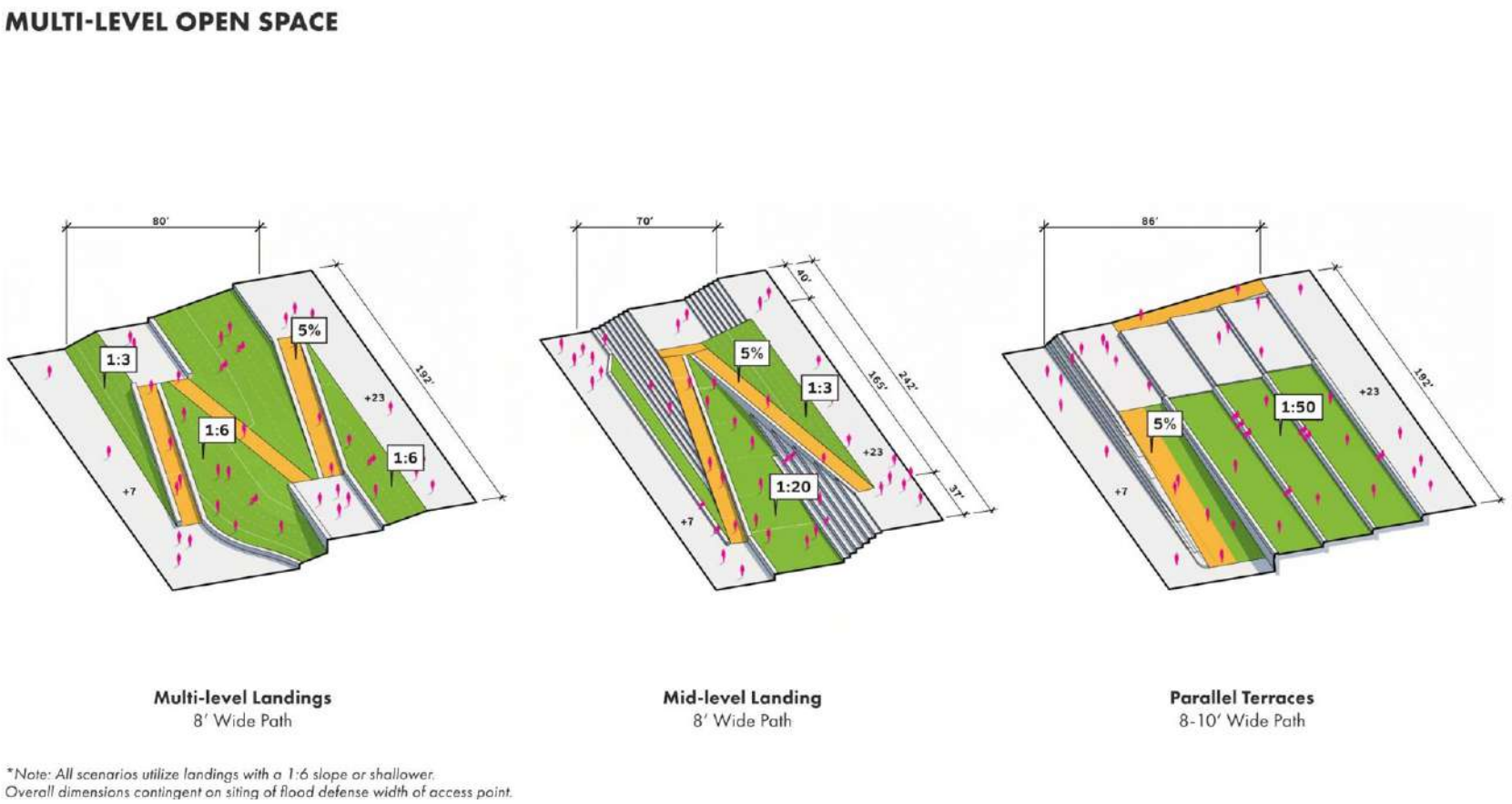
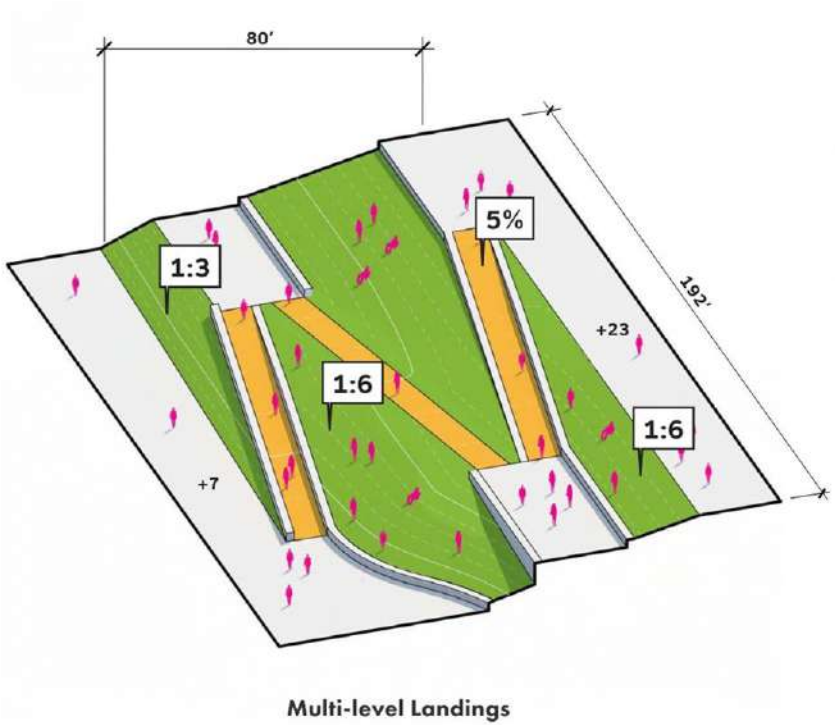


Figure 46: Multi-level open space summary

MULTI-LEVEL OPEN SPACE



- While multi-level spaces can have a larger footprint, they both provide a way for people to get up and over while simultaneously creating usable open space
- Multiple levels paired with multiple forms of access (stairs, ramps, lawns, etc.) provide a diverse experience and optionality for users
- Multi-level spaces can be integrated into an upper and lower esplanade and help provide a park-like feel across different waterfront zones

Figure 47: Multi-level landings detail

Figure 48: Examples of Open Space Integrated with Access Paths and Stairs in Public Spaces (Set 1)

Figure 49: Examples of Open Space Integrated with Access Paths and Stairs in Public Spaces (Set 2)

Figure 50: Examples of Open Space Integrated with Access Paths and Stairs in Public Spaces (Set 3)

3.1.4 Design Recommendations

The Master Plan presents switchback ramps and staggered elevation access as the primary strategy for access paths. These strategies connect the city side to the waterfront side in the most direct manner and can be spaced at the desired frequency while also minimizing the project's footprint. On the water side, the Master Plan presents parallel paths to move from the upper level to the lower level because the street grid has less of an influence and creates fewer constraints for the configuration. Additionally, staggered elevation access integrates multi-level open space into the access locations to achieve the Master Plan's multiple project goals.

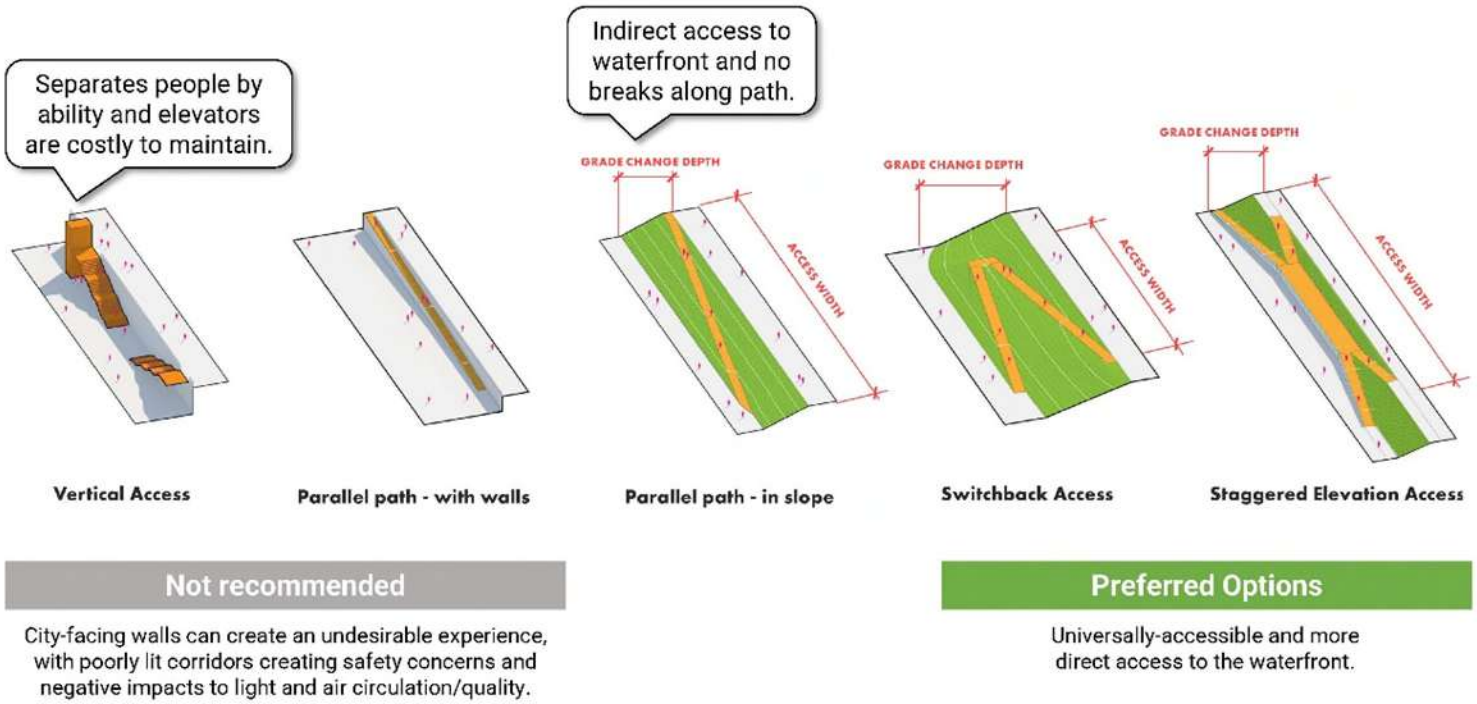
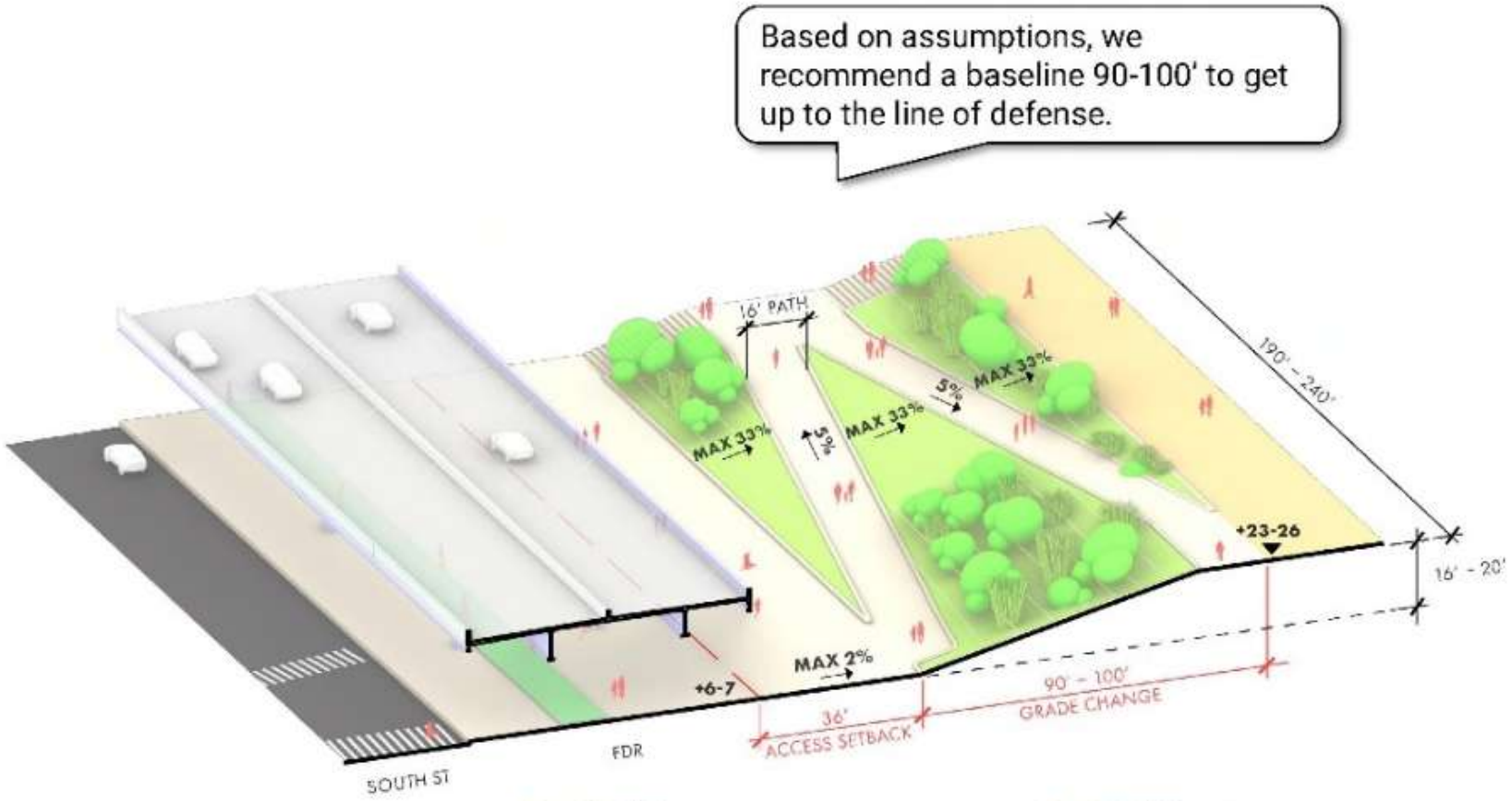
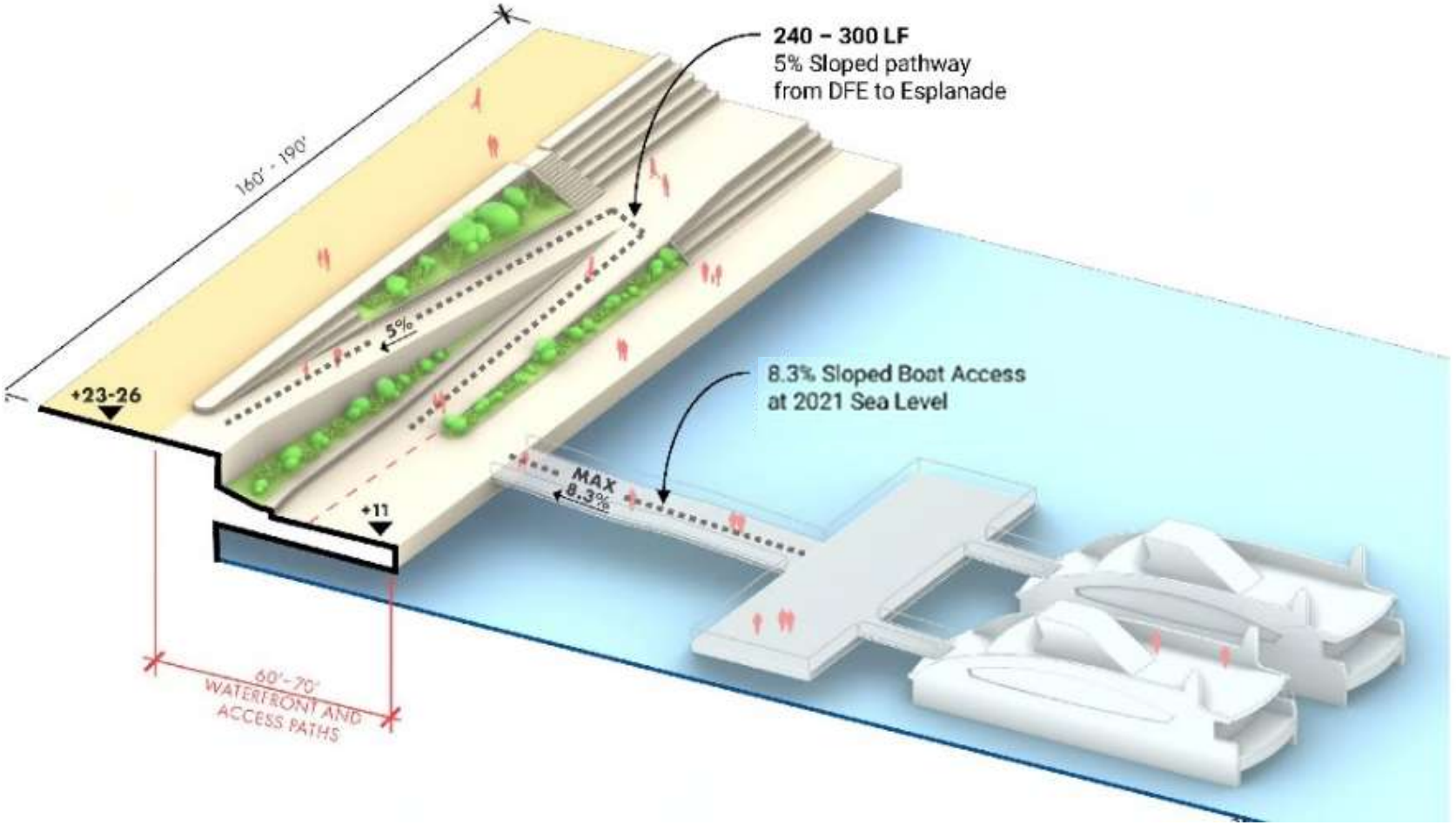


Figure 51: Recommendations for up-and-over vertical access strategies

At the up-and-over vertical access points, space is needed to allow for the appropriate slopes and grade changes to ensure access for all getting up to the design flood elevation.



Space is also needed to accommodate universal access from the neighborhood back down to the design flood elevation at the water's edge.



Gateway Access

The Master Plan presents gateway entrances at Broad Street, Old Slip, Fulton Street, and Peck Slip. At gateway entrances, gently sloped paths (i.e., maximum five percent slope) perpendicular to the shoreline provide direct waterfront access for pedestrians and emergency, operations, and maintenance vehicles. The area is vulnerable to future daily tidal flooding. Therefore, a constant, passive level of protection must still be present at the gateway locations. Reaching the passive elevation via a universally accessible slope is what drives the extent of the shoreline at the gateway locations. On top of the raised ground level, floodgates aligned with upland street corridors provide direct physical access and visual connections to key waterfront facilities during normal weather conditions.

4. How can this Master Plan preserve or enhance the esplanade or bike path?

4.1 Waterfront Esplanade

The Master Plan presents a waterfront esplanade which maintains or improves the quality and quantity of esplanade. The Project Team examined the existing conditions and studied waterfront esplanade precedents to provide esplanade width recommendations.

4.1.1 Existing Conditions

The East River Waterfront Esplanade provides important north-south connections for pedestrians and bicyclists between The Battery and Montgomery Street. Today, the Esplanade's width is between 14 and 55 feet wide. The Project Team analyzed the existing esplanade to understand its varied dimensions:

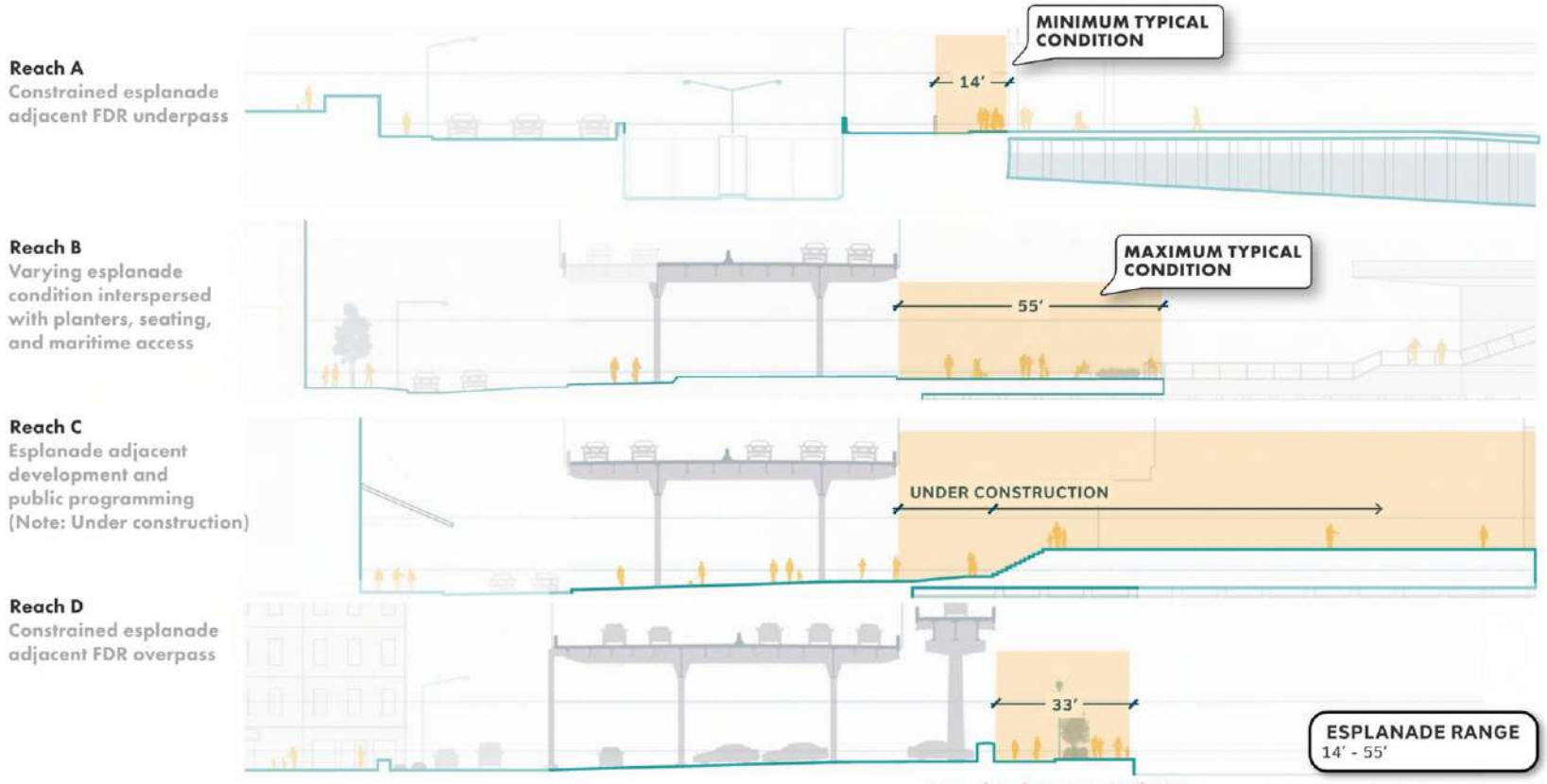


Figure 52: Existing waterfront esplanade conditions

4.1.2 Waterfront Esplanade Precedents

The Project Team analyzed precedent esplanades in New York City and throughout the world, accounting for adjacencies such as adjacencies to maritime facilities, ferry stops, and proximity to water. From these precedent studies, the Project Team found that:

- Waterfront esplanade widths vary across New York City.
- Widths depend on density of neighborhood, adjacent programming, and site needs.
- Minimum widths can be as narrow as 12-14 feet, but these are in low density and lightly trafficked areas.
- Precedents in Lower Manhattan which are adjacent to ferries are important comparisons for the Master Plan.
- Esplanades adjacent to ferries must respond to inland conditions, multi-modal transit connections, emergency vehicle access, and the density and ridership of the site.

The figures below present the precedent esplanade studies, including widths, adjacency to ferries and infrastructure, and international examples.

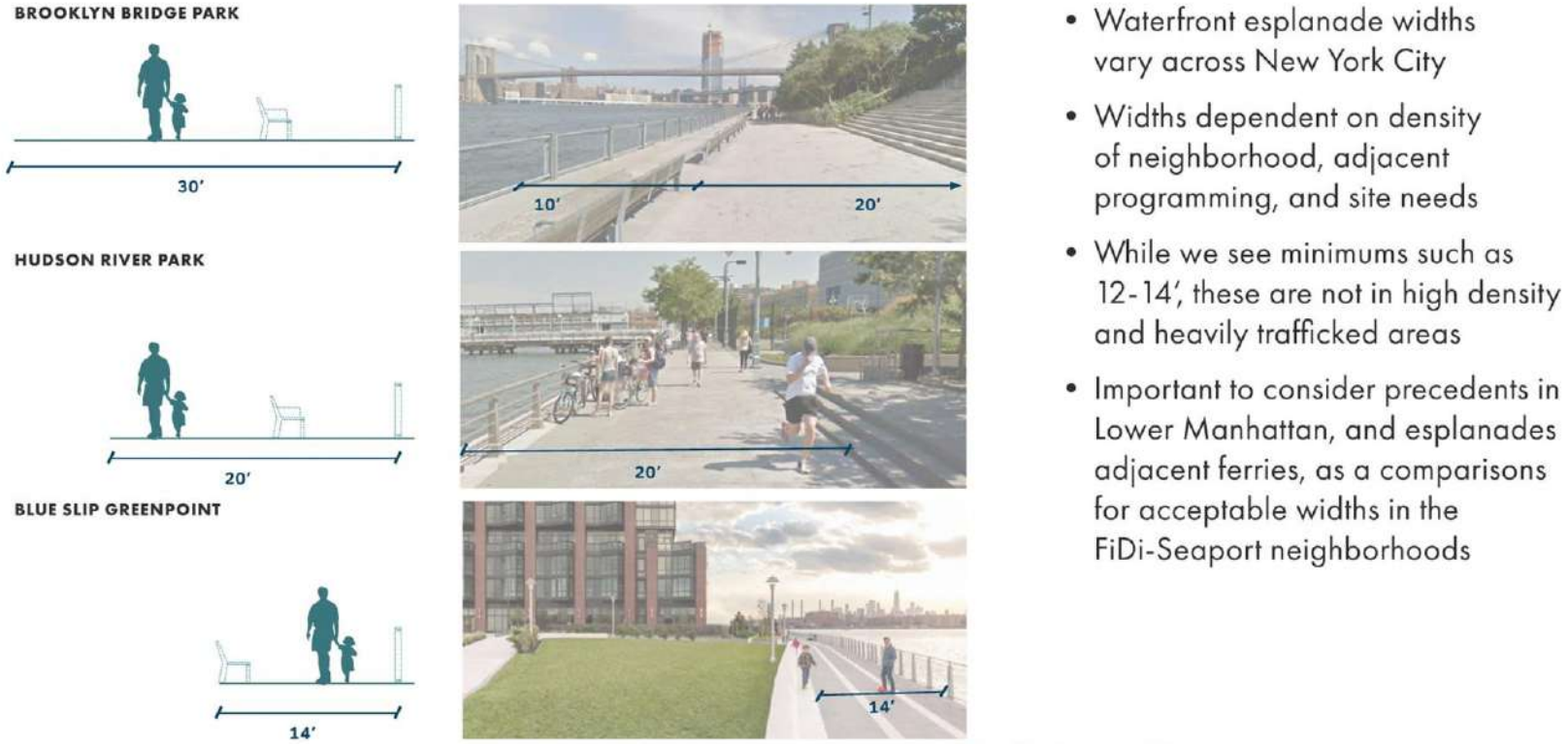


Figure 53: New York City Waterfront Esplanade Width Precedents Summary

Figure 54: New York City Waterfront Esplanade Width Precedents (Set 1)

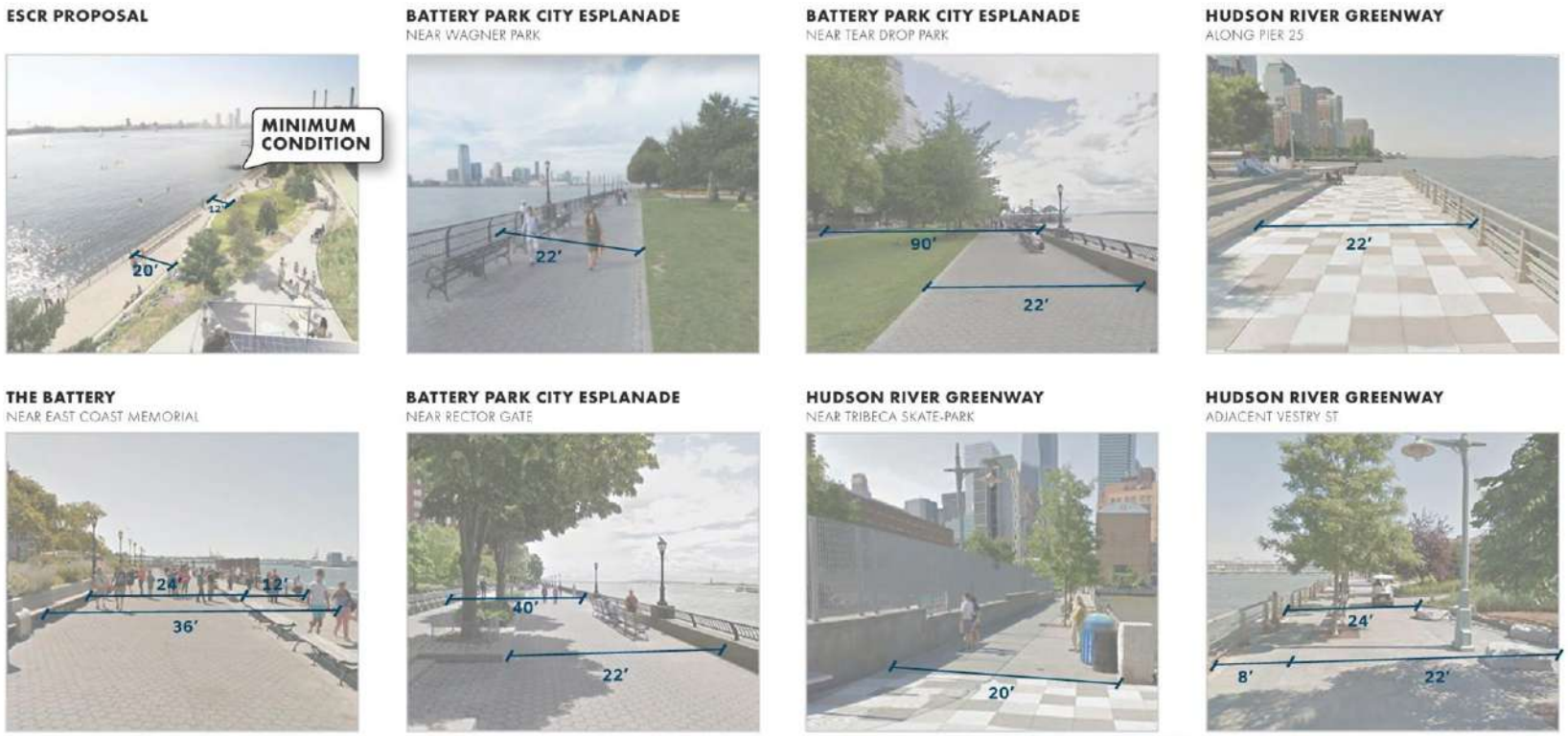


Figure 55: New York City Waterfront Esplanade Width Precedents (Set 2)

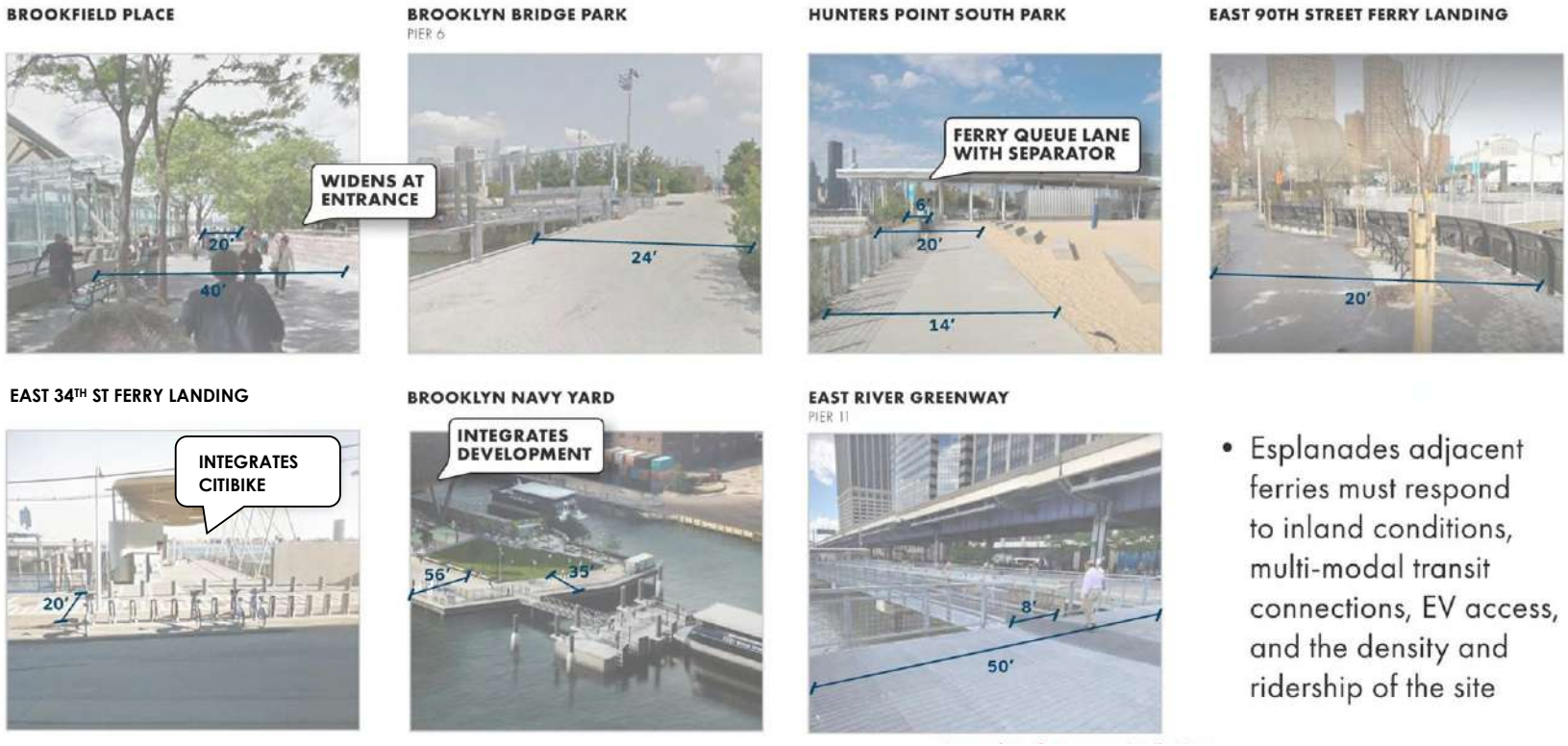


Figure 56: Esplanade widths adjacent ferry stops, New York City

NIEDERHAFEN RIVER PROMENADE
HAMBURG

RIVERSIDE PARK

BROOKLYN BRIDGE PARK
PIER 5 UPLAND

CHICAGO 606

XIAMEN BIKE SKYWAY
CHINA

MORTENSEN RIVERFRONT PLAZA
CONNECTICUT

Figure 57: Esplanades Adjacent Infrastructure, Global

Following precedent analysis, the Project Team defined esplanade width principles to guide the Master Plan design.

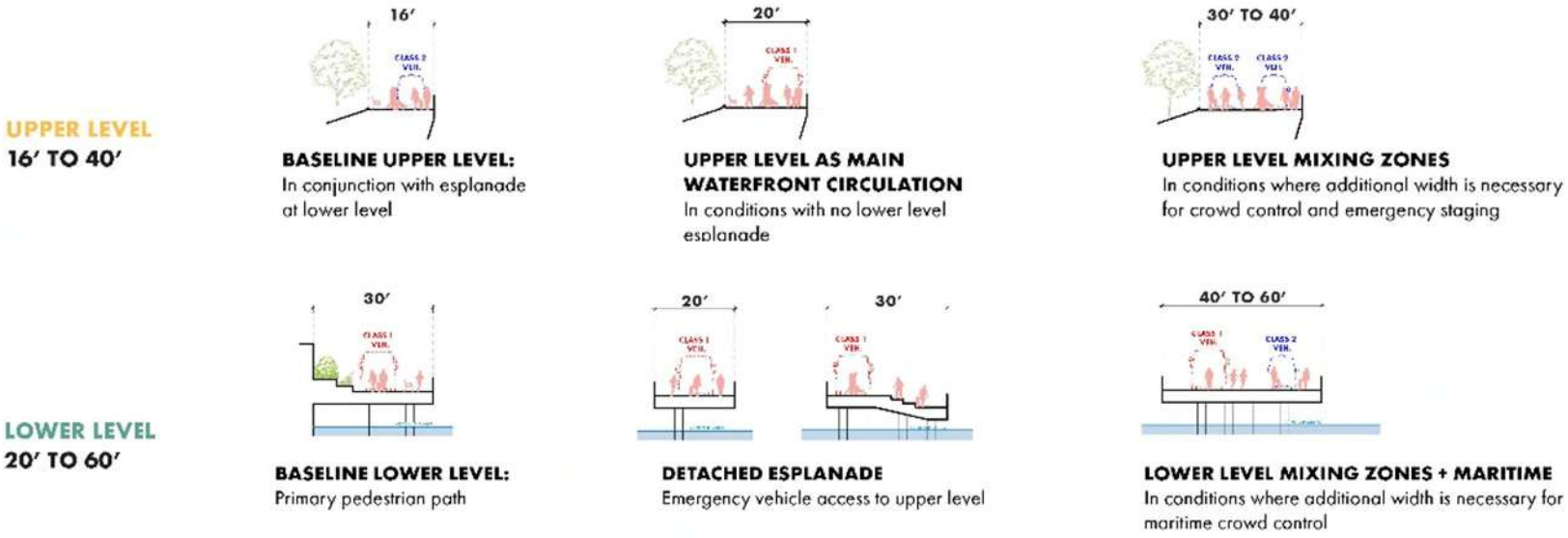


Figure 58: Esplanade widths

4.1.3 Multi-Level Waterfront Precedents

Given that the new waterfront will be higher than the existing waterfront, the Project Team also looked at multi-level waterfronts in New York City and throughout the world to analyze successful and unsuccessful precedents. The following lessons and principles emerged from the precedent studies:

- While an elevated esplanade well above the water works in some areas, it cannot be overbearing or monotonous across the entirety of the site.
- Minimizing uniform edge treatments and pushing and pulling in selective locations can break up the verticality of the upper esplanade while minimizing fill.
- Providing accessible spaces at multiple levels can bring people closer to the water at select locations and help to mediate the feeling of being significantly above the river.
- Long stretches of elevated space exaggerate the verticality of the esplanade.
- Uniform edge conditions provide little visual interest and further distance people from spaces below.
- When opportunities to get down to the water are not frequent nor visually apparent, one feels even more distant from the water.

- Many worldwide riverfronts employ a multi-level esplanade to bring people closer to the water where wall conditions are present.
- Successful multi-level waterfronts include lower-level esplanades that integrate programmatic variety including passive recreation, vegetation, and art installations.
- Program helps to create a diverse and engaging experience and supplement what would otherwise be a stark walled condition.

The figures below present the precedent studies of the multi-level waterfronts.

Figure 59: Successful New York City Precedents

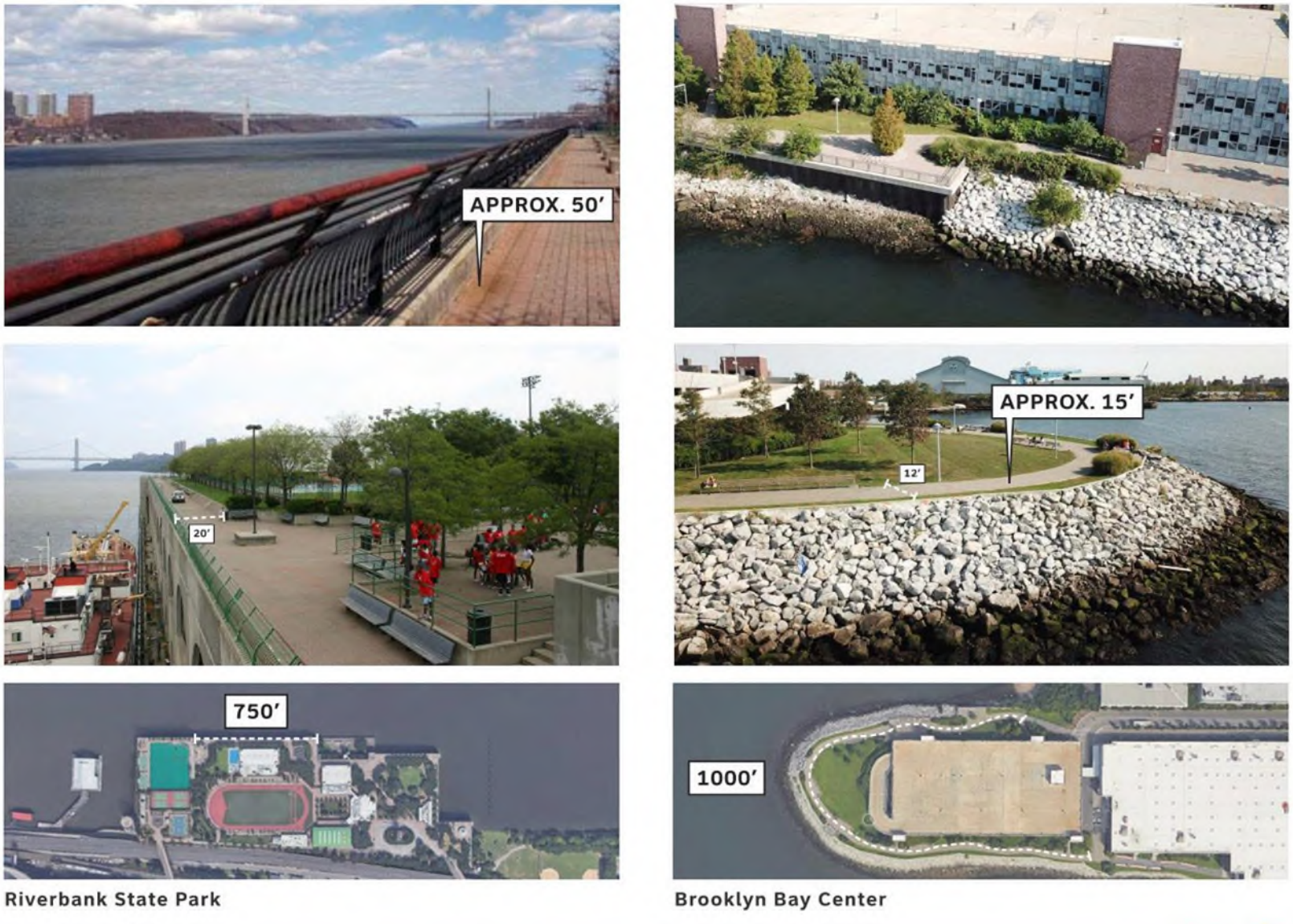


Figure 60: Unsuccessful New York City Precedents

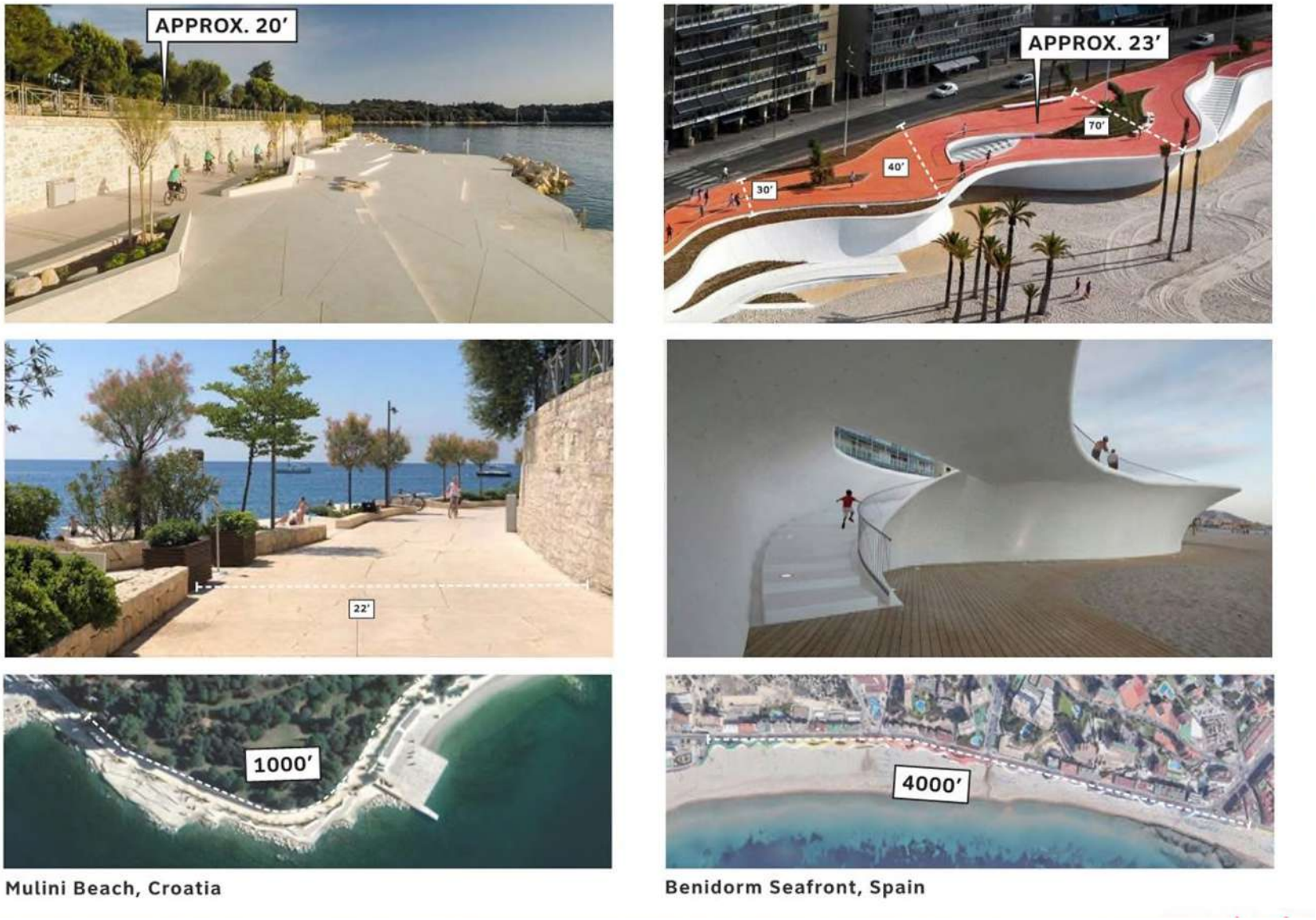


Figure 61: Precedents outside of New York City (Set 1)

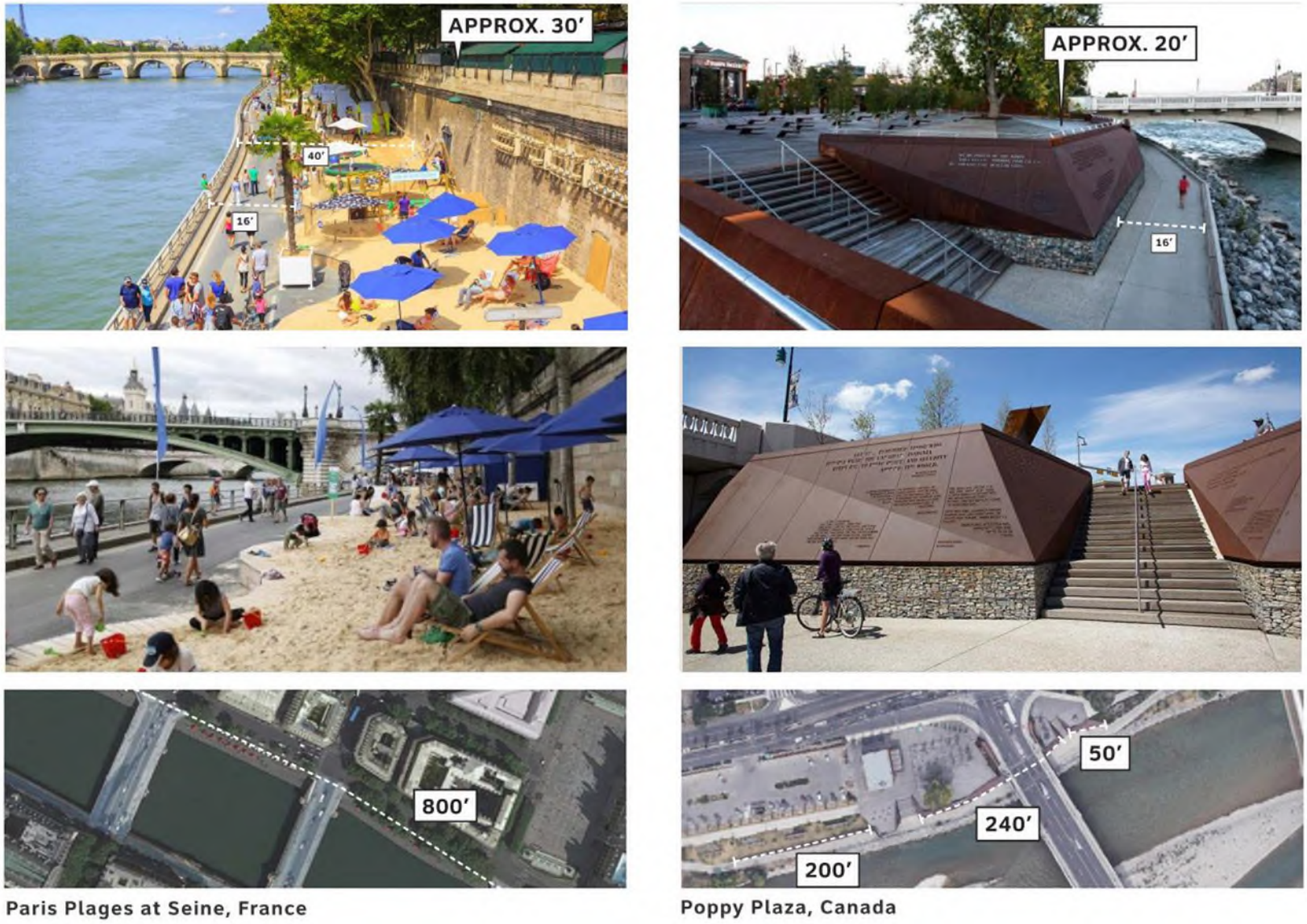


Figure 62 : Precedents outside of New York City (Set 2)

4.1.4 Design Recommendations

The Master Plan presents an esplanade width between 20 and 40 feet, with wider widths reserved for areas with higher anticipated pedestrian activity and additional space for emergency vehicle staging.

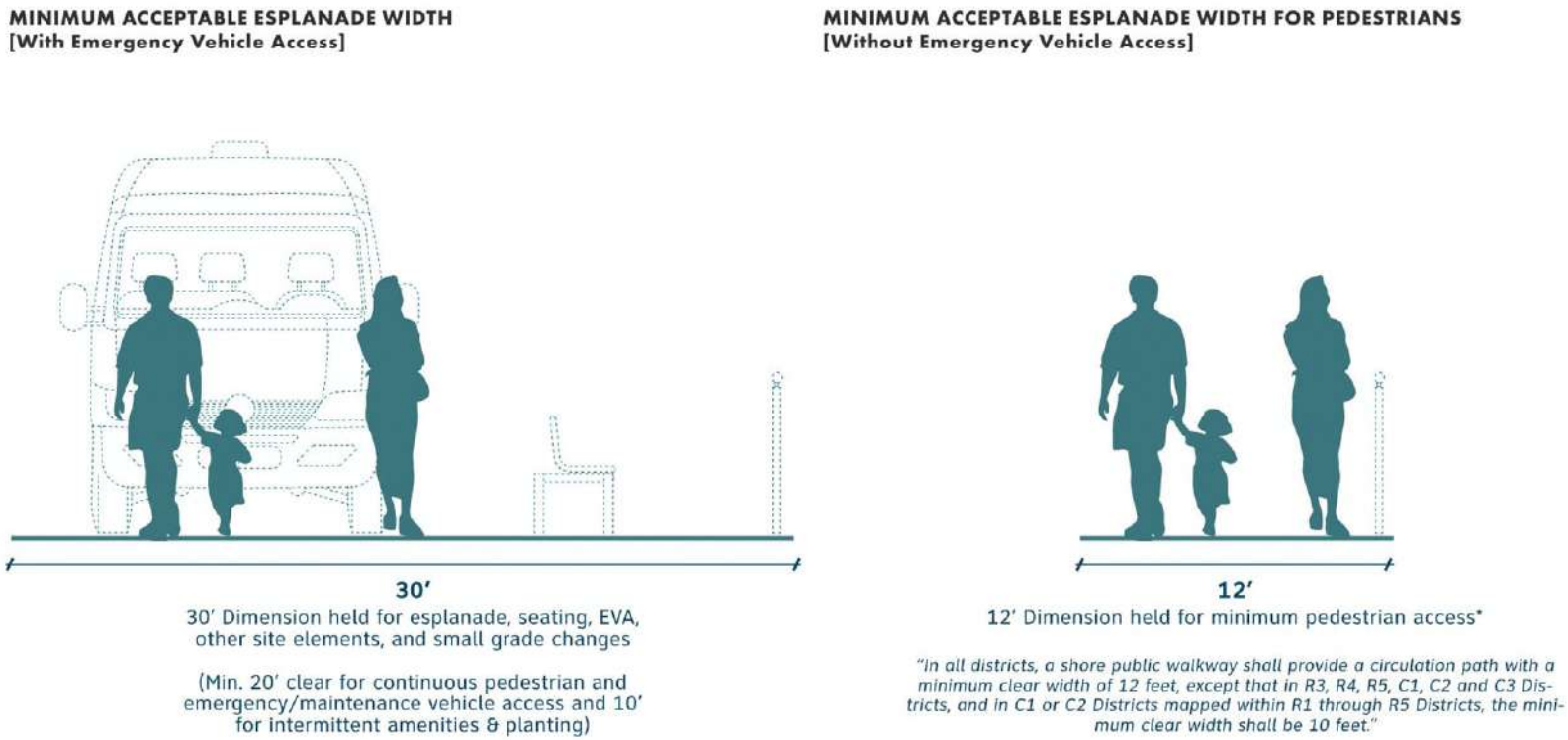


Figure 63: Esplanade recommendation

4.2 Bike Path and the Manhattan Greenway

The Manhattan Waterfront Greenway is a network of bike paths and green spaces that will soon connect all of Manhattan's waterfront neighborhoods. In the Financial District and Seaport, the bike path connects to The Battery in the south and the Brooklyn Bridge Esplanade in the north. The path is about 11 feet wide with one lane of travel in each direction. Conditions vary along the study area.

As part of the Master Plan, the City is committed to reincorporating the bike path to preserve this important connection for cyclists. Recently completed bike paths along the Hudson River and Brooklyn Bridge Park Greenways are 14 to 16 feet wide with one lane of travel in each direction. A similar path design would be appropriate along the Financial District and Seaport waterfront.

The Project Team established a series of principles for bicycle and micro transit circulation:

- Address bicycle and pedestrian choke points and minimize crossing conflicts
- Improve upland connectivity
- Prioritize the waterfront edge as a pedestrian zone separate from bicycle through route

4.2.1 Existing Conditions

The Project Team identified gaps and opportunities in the existing Lower Manhattan and Waterfront bicycle circulation, including:

- A critical bicycle and pedestrian choke point in front of the Battery Maritime Building because of the Battery Park Underpass trench
- Opportunity to connect to a planned bicycle connection between City Hall and the Whitehall Ferry Terminal via Broadway
- Confusing and potentially dangerous greenway mixing zones in the South Street Seaport area
- A lack of protected (Class I) or buffered/painted (Class II) bike lane from the Brooklyn Bridge to the Manhattan Waterfront Greenway

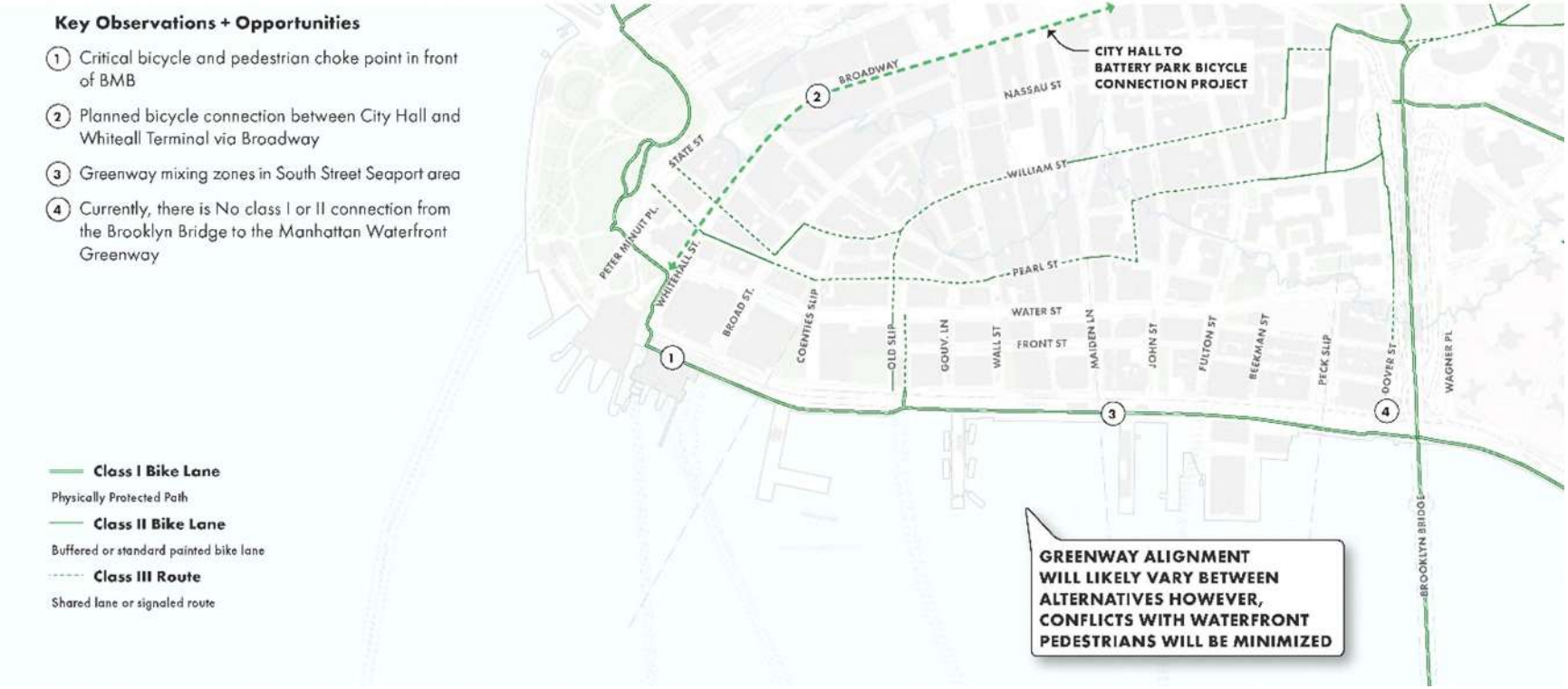


Figure 64: Bike route key observations and opportunities

Above: Mixing zone in South Street Seaport
Below: Dover Street at South Street

Congestion point at the Battery
Maritime Building

Figure 65: Bike Route Existing Conditions

4.2.2 Design Recommendations

The Master Plan reincorporates the bike path in a similar location – on the waterside of South Street upland up the flood defense infrastructure – with a similar design to recently completed bike paths along the Hudson River or in Brooklyn Bridge Park (with widths of 14-16 feet). The Master Plan also extends the Battery Park Underpass to Broad Street to improve pedestrian circulation to the waterfront and deconflict the space in front of the Battery Maritime Building, where pedestrians, cyclists, and drivers are currently competing for space in a very narrow footprint.

5. How can this Master Plan ensure safe emergency and operations vehicle access?

The Master Plan proposes emergency, maintenance, and operations vehicles use gateway entryways at Broad Street, Old Slip, Fulton Street, and Peck Slip to enter and exit the waterfront. Fire engines, the largest vehicle to be accommodated, must access all parts of the proposed waterfront esplanade, which includes a wide path to allow ease of movement. Mid-size vehicles, such as ambulances and operational vehicles, must also have access to the waterfront esplanade, as well as the upper-level flood defense. Mid-size vehicles can use proposed ramps from the Old Slip and Fulton gateways to access the upper level. Small vehicles, such as gators for trash collection, can maneuver all pedestrian pathways across the study area.

The Project Team established a series of principles for vehicular circulation:

- Flood defense measures will likely necessitate alterations to streets, roadways, and automobile site access
- Specific automobile requirements should be determined by program and operations needs for each alternative
- Automobile access should be prioritized by proximity and connectivity to the roadway network
- Solutions that allow flexible operations and emergency access should be prioritized

5.1 Existing Conditions

The waterfront is characterized by relatively free circulation for operations vehicles and a newly constructed access loop and fire lane at Pier 17.

Trailer temporarily parked near Pier 15

Access loop at Pier 17

The Project Team observed the following about existing vehicular circulation:

- South Street provides access to the FDR North and Pier 6 Heliport
- Vehicular access to a reconstructed heliport in a similar location would need to be maintained
- FDR viaduct allows relatively flexible vehicular access to the waterfront underneath elevated structure
- Loop street provides delivery and emergency access to Pier 17
- Maiden Lane provides a key two-way, direct E-W connection from South Street to the West Side

Figure 66: Existing Vehicular Access and Connectivity

5.2 Design Recommendations

The Project Team categorized vehicles by size and use into three classifications:

1. Class I – large emergency vehicles such as fire engines and large operations and maintenance vehicles
2. Class II – Ambulances and vehicles of a similar size, such as operations and maintenance vehicles for the flood defense system, construction vehicles, and garbage trucks
3. Class III – Micro operations, maintenance, and waste collection vehicles such as mini trucks and gators

Each vehicle class needs to reach certain locations throughout the study area and requires a different amount of space to safely navigate. These access needs shaped the location and width of access and circulation paths throughout the study area. The Project Team then established circulation principles for each, as described in greater detail in the Design Proposal of Access and Circulation. As the Master Plan design advances in future phases, vehicle access requirements to specific facilities and programs will be assessed.

Figure 67: Vehicle Classifications

Class 1 Vehicles:

- Full curb frontage access along the South Street/FDR corridor
- Provide access loops so large vehicular turnarounds will not be required
- Four vehicular flood gates provide three access loops
- Full access to the waterfront esplanade

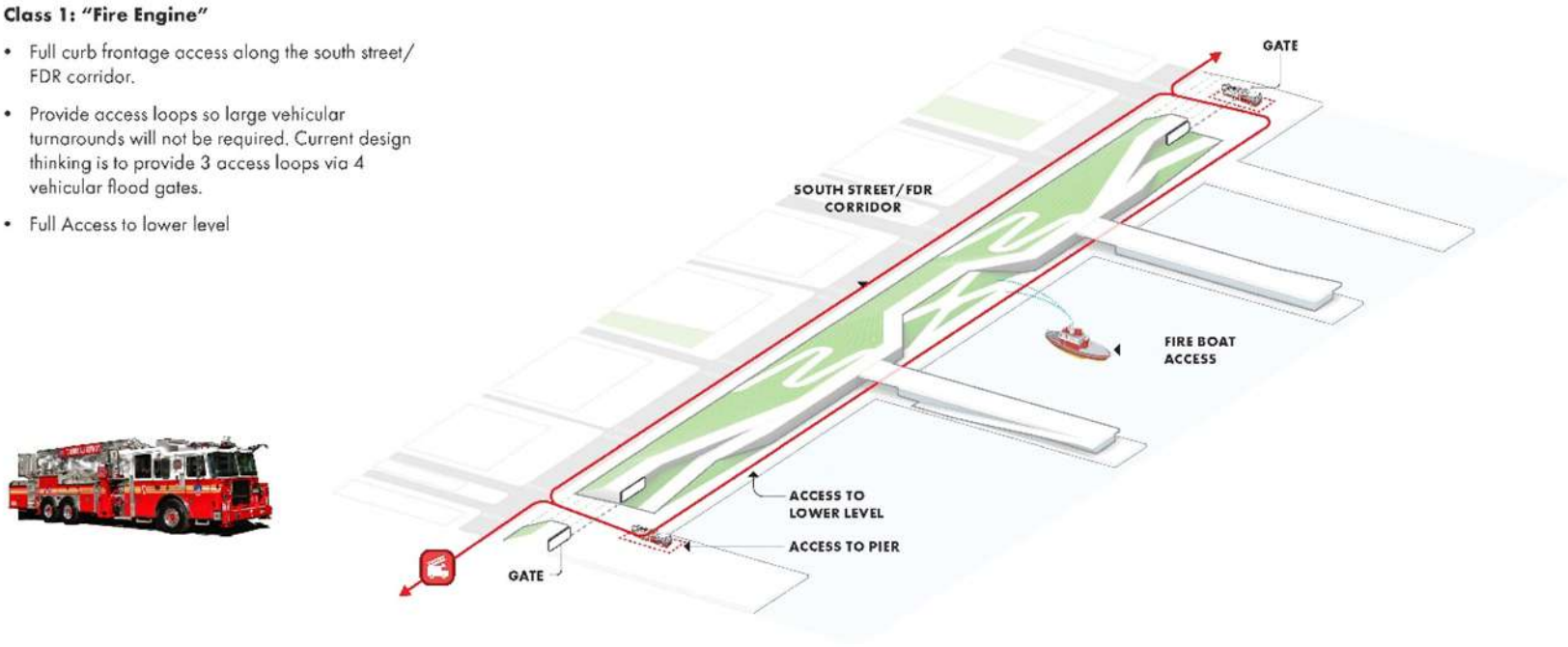


Figure 68: Class I Vehicle Conceptual Diagram

Class 2 Vehicles:

- Class 2 vehicles can go anywhere class 1 vehicles can with the same access points
- Full access to both the waterfront esplanade and the upper level
- Full access to flood defense for deployment of flood gates and maintenance

Class 2: "Ambulance + Large O+M"

- Anywhere a class 1 vehicle can go, with same access points
- Full access to both lower and upper levels of the waterfront
- Full access to flood protection for deployment and maintenance

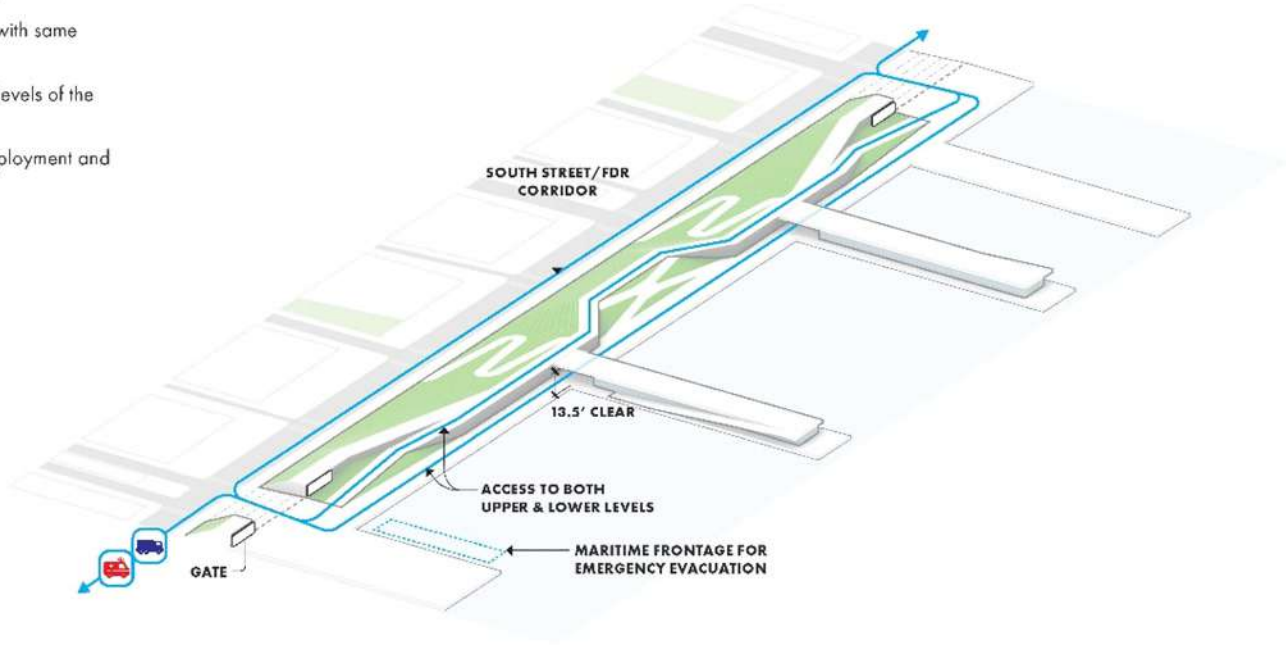


Figure 69: Class 2 Vehicle Conceptual Diagram

Class 3 Vehicles:

- Can go anywhere class 1 and 2 vehicles can go
- Class 3 vehicles will be able to use all pedestrian access points for circulation

Class 3:"Peds and Micro Vehicles"

- Anywhere class 1 and 2 vehicles can go
- Greenway shall be provided along the FDR/ South Street corridor. Bikes will be allowed on the waterfront but will not the primary route (like Battery Park City)
- Pedestrian access shall be prioritized at the following locations/street corridors: Whitehall, Broad/Coenties Slip (if FDR is rethought), Old Slip, Wall Street, Maiden Ln, Fulton Street, Peck Slip, Dover Street.
- All pedestrian access points shall meet universal access guidelines and allow small O+M vehicles (gators etc.).

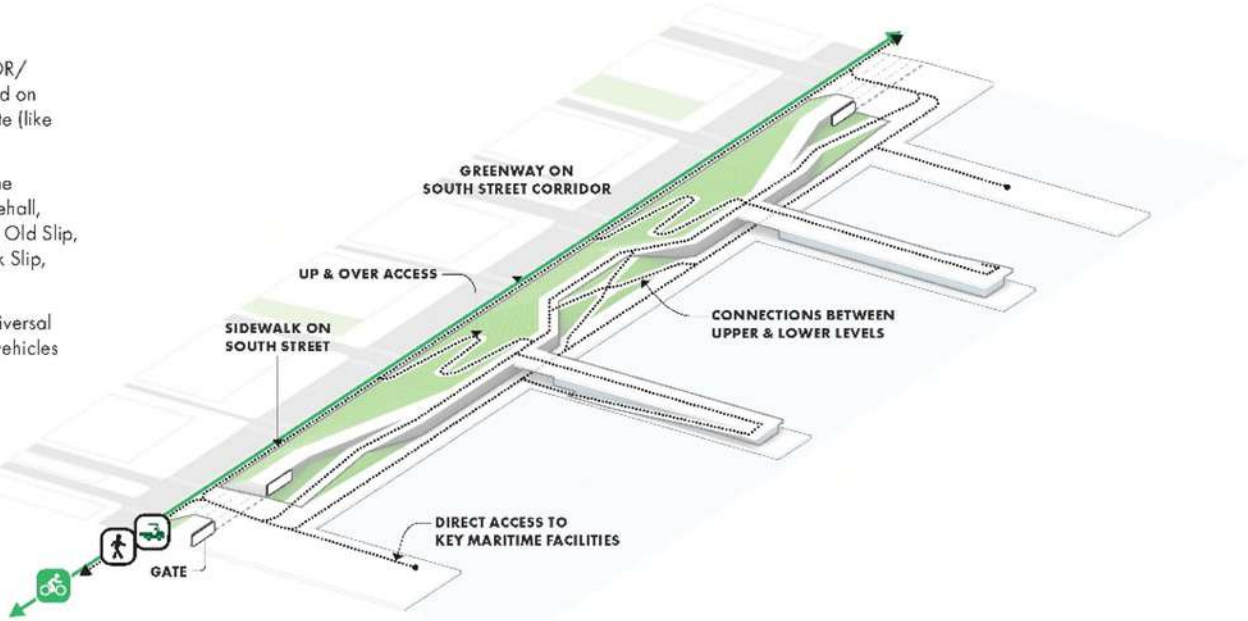


Figure 70: Class 3 Vehicle Conceptual Diagram