NYC Information Technology & Telecommunications

LinkNYC
Link5G Design Proposal

Presented by
Department of Information Technology & Telecommunications, CityBridge, and ZenFi Networks

What's the Purpose of LinkNYC?

To provide free and equitable access to connectivity, information, and telecommunications services.

How Does LinkNYC Provide Free and Equitable Access?

- High-speed, free public Wi-Fi throughout NYC
- Free nationwide digital calling
  - 911 / 311 access
  - Access to all social services hotlines
  - Video-relay service for deaf and hard of hearing community
- Access to government and social services websites
- Advertising space for the City, community information, and local businesses
- USB port for free charging of mobile devices

People Use the Links!

- Since inception, there have been 10 million+ users of LinkNYC's Wi-Fi network!
    - The Aunt Bertha social services directory for jobs, housing, food, and other programs is accessed over 10,000 times per month.
    - The most searched for service during the pandemic has been people looking for food pantries.
- Since start of 2020, over 5 million calls!
    - The most dialed number is the EBT hotline.
- Free advertising for over 1,300 small and local businesses.
- The largest free public Wi-Fi network in the U.S.
- And these usage statistics are with a Link footprint primarily in Manhattan!

LinkNYC: Franchise Rebooted Redesigned

The original LinkNYC program, built primarily in Manhattan, relied solely on advertising revenue.

That financial model failed. The program did not grow throughout the outer boroughs, and by 2019, LinkNYC faced bankruptcy.

In 2021, the City amended the franchise and introduced a mixed financial model: advertising and 5G cellular services revenue. The mixed model came with realistic financial requirements so that the program would survive. The introduction of 5G meant that the franchise not only would provide its core services to the outer boroughs, it will bring next-gen cellular connectivity to underserved areas citywide.

Highlights of the LinkNYC 2021 Amendment:

2021 – the Year of 5G	The City is committed to having the most up-to-date, equitably distributed, highest quality telecommunications infrastructure of any major city in the world, and the reboot of the LinkNYC program means underserved areas citywide will have better access to and options for 5G.
Commitment to Equity	90% of new installations, which have free digital calling, free high-speed Wi-Fi AND are 5G enabled, will be built in the outer boroughs and above 96th Street in Manhattan.
Design Consistency	New Link5G design aims to maintain the aesthetic of both the existing LinkNYC footprint and the approved 5G shroud for pole tops.
Enhanced Services	Link5G design will enhance neighborhoods' cellular connections and provide businesses and pedestrians with improved high-speed Wi-Fi coverage.
Commitment to City Initiatives	25% free advertising space on LinkNYC for City and City programs.

The Case for LinkNYC: The Digital Divide in New York City

Figure 12: Households in New York City with Home Broadband or Mobile Broadband

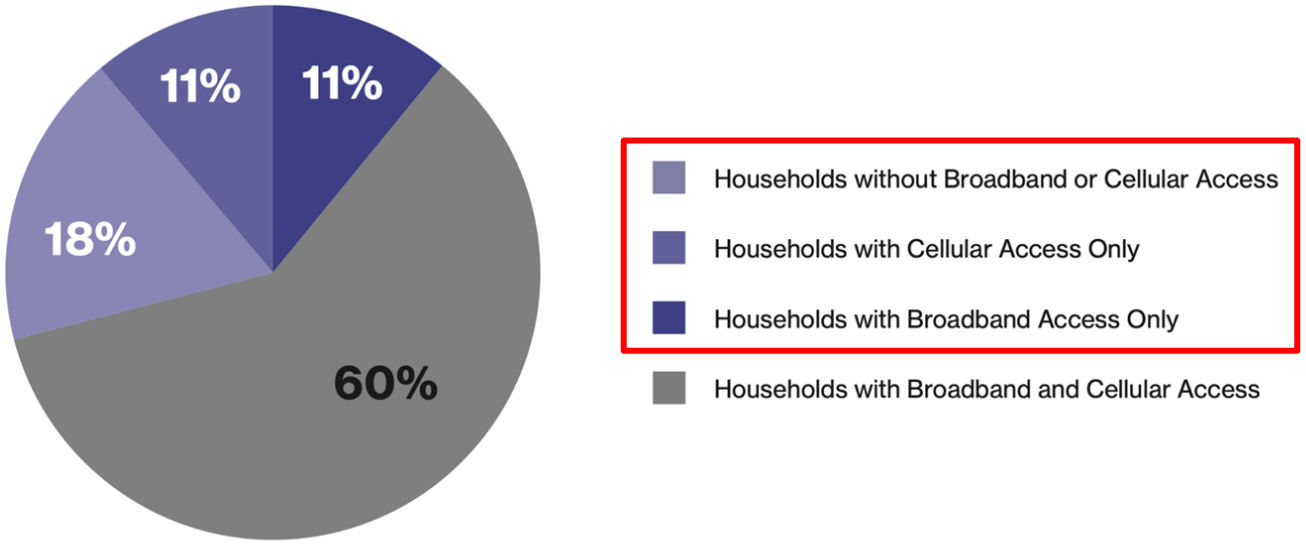
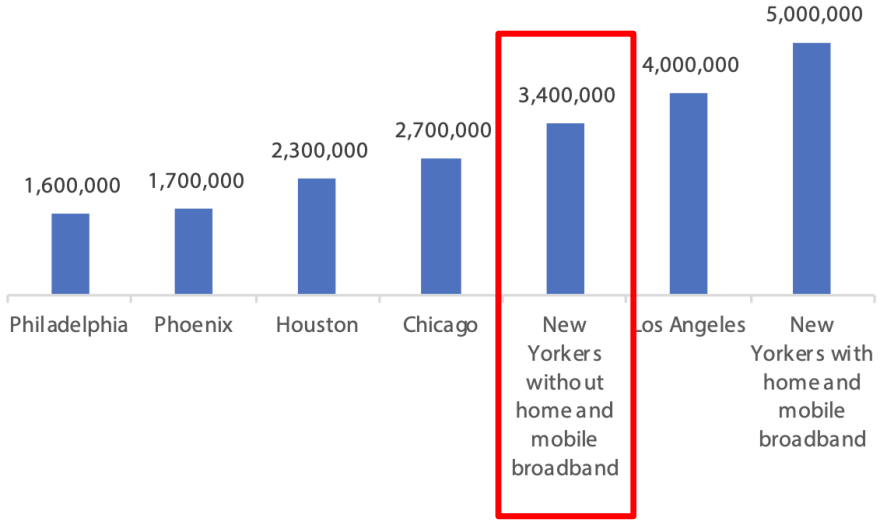


Figure 13: New York City's Digital Divide Relative to Other Cities' Total Populations

Source: HR&A Advisors

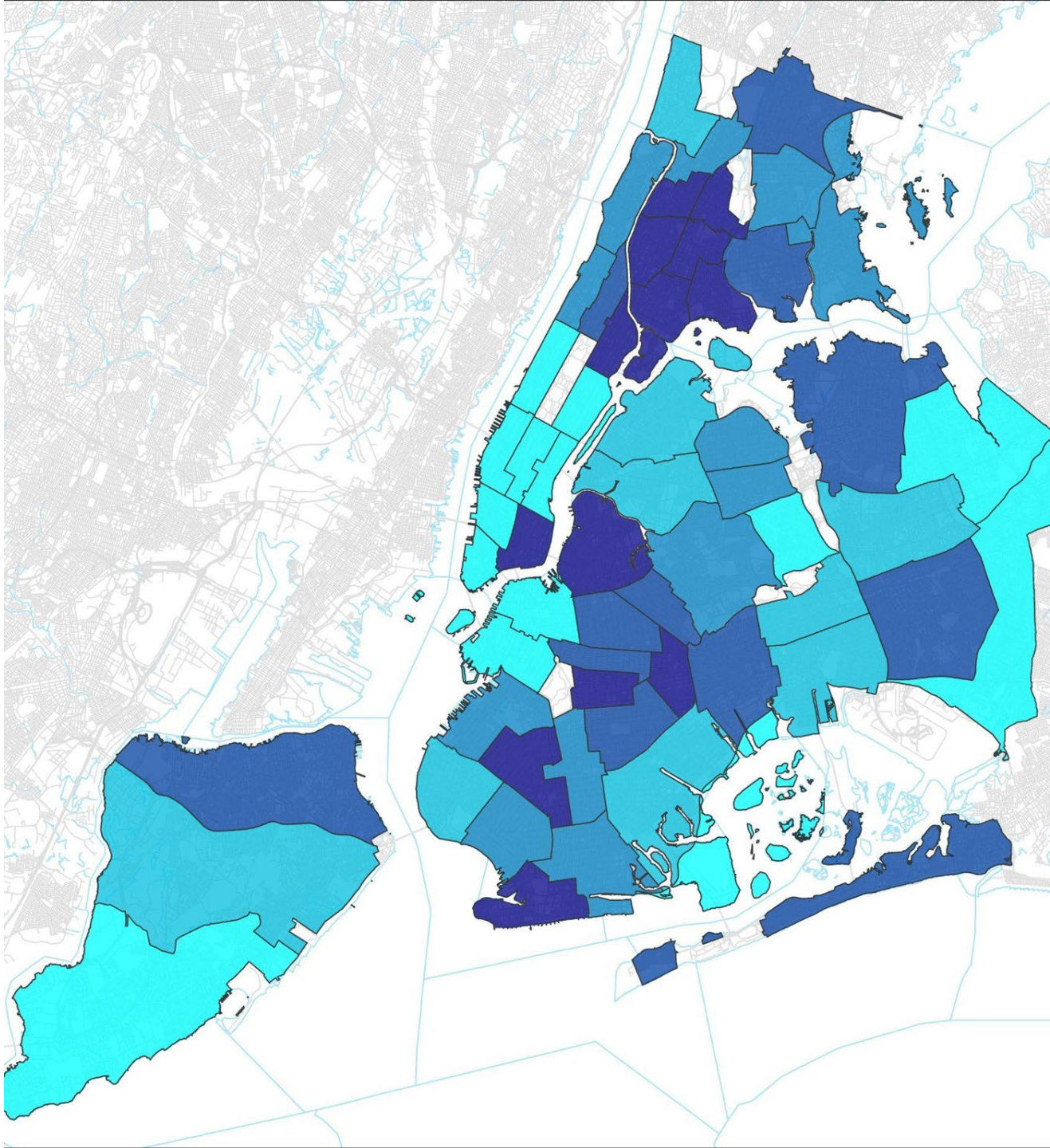


Source: The New York City Internet Master Plan - Jan 2020

Digital Divide: Internet Deserts

Households with No Internet Access
Percentage by Community District

- 22% to 32% (13)
- 21% to 22% (7)
- 16% to 21% (16)
- 13% to 16% (10)
- Below 13% (13)



Source: The New York City Internet Master Plan - Jan 2020

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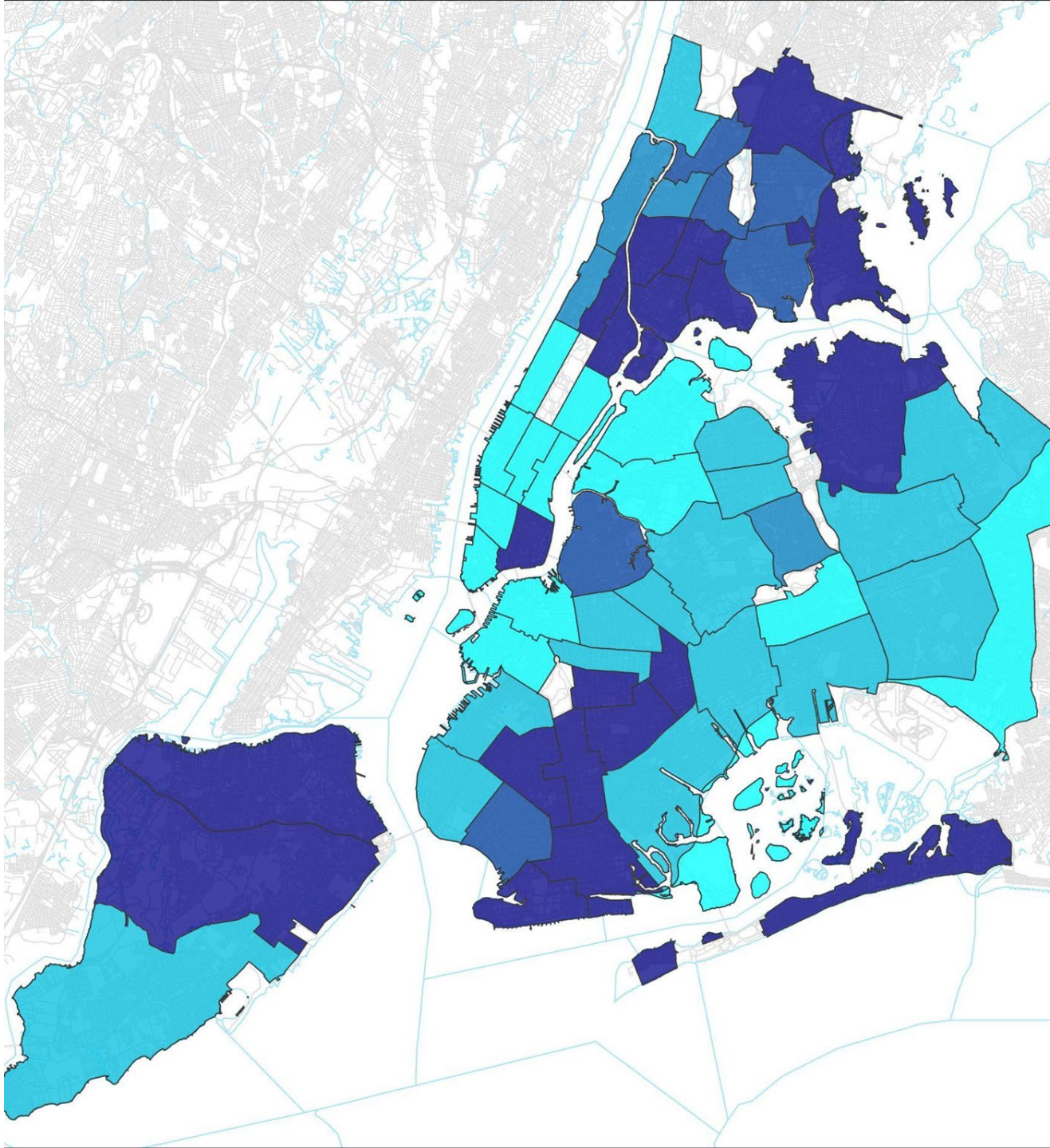
Digital Divide: Mobile Broadband Desert

Households with No Mobile Broadband Access
Percentage by Community District

- 27% to 40% (20)
- 25% to 27% (6)
- 24% to 25% (4)
- 21% to 24% (16)
- Below 21 % (13)



Source: The New York City Internet Master Plan - Jan 2020

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Link5G Addresses the Digital Divide

- 40% of New York City households lack the combination of home and mobile broadband, including 18% of residents — more than 1.5 million people — who lack both.
- In response to a survey of LinkNYC Wi-Fi users during the COVID pandemic, 30% reported no other access to broadband internet, even with most kiosks in Manhattan.
- Link5G will expand the free LinkNYC Wi-Fi network and bring mobile broadband and fiber infrastructure directly to underserved communities.

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Equitable Deployment Mandate

CityBridge must build a minimum of 739 new Links in thirteen equity community districts (outlined in red on the map).

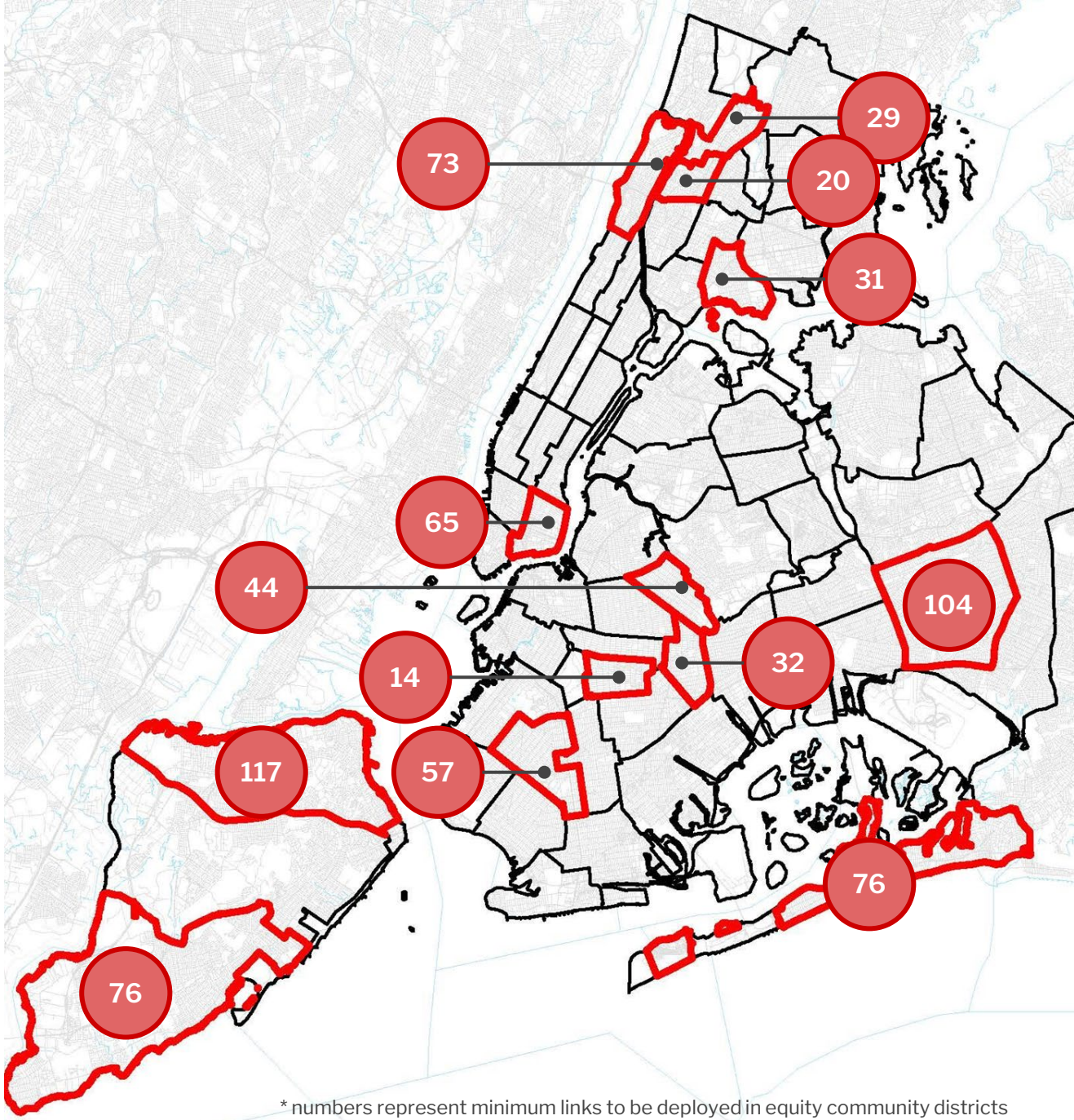
These were chosen by the City based on:

- Lack of broadband options
- Lower median annual income
- Lack of Links
- High levels of pedestrian / street traffic

These districts are in all 5 boroughs and include neighborhoods hit hard by the pandemic, such as:

Bronx:	Hunts Point and Longwood
Brooklyn:	Bushwick, Brownsville and Ocean Hill
Manhattan:	Inwood and Washington Heights
Queens:	Rockaway, Jamaica and Hollis
Staten Island:	Port Richmond, St. George, Stapleton

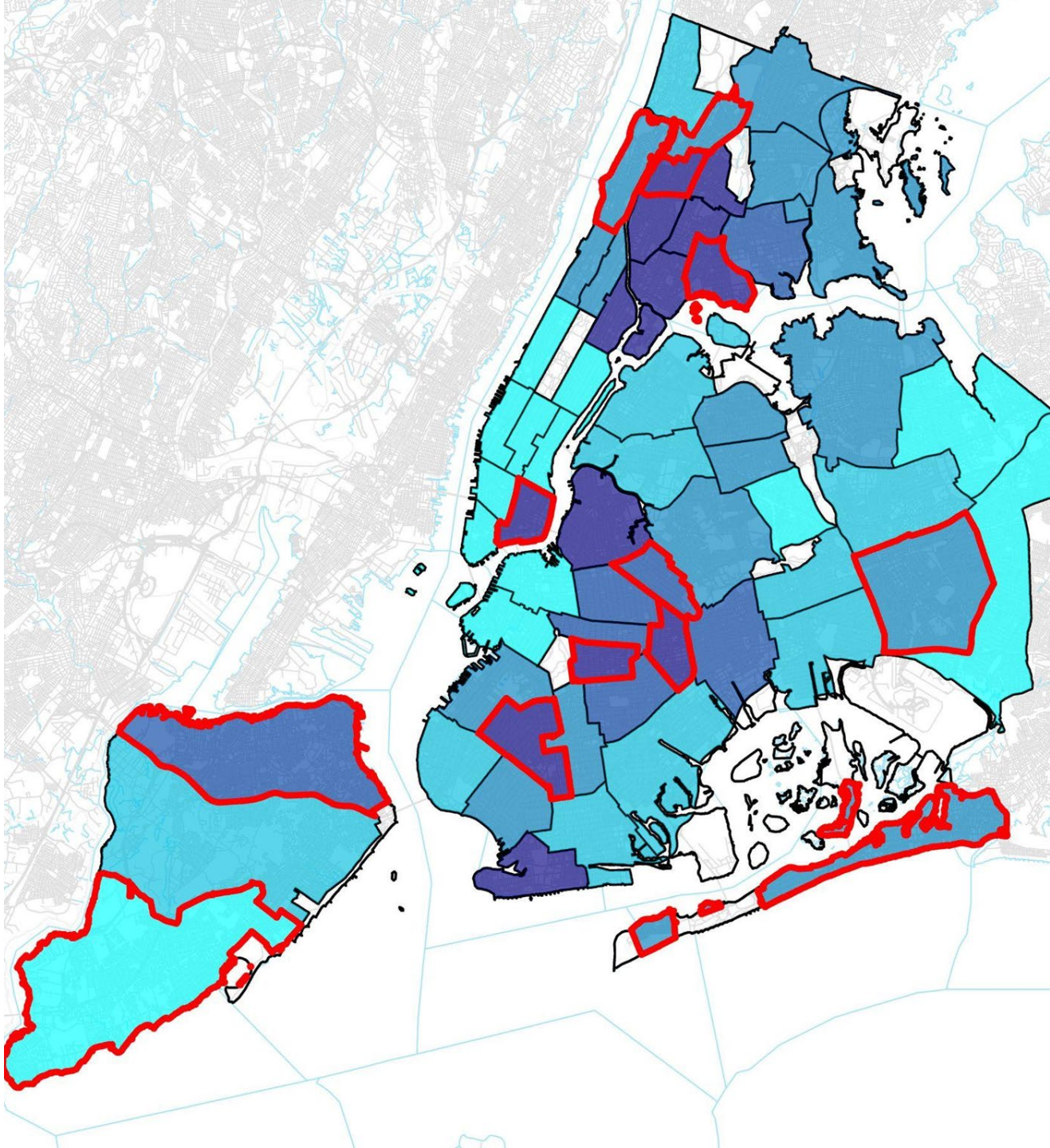
In addition, 90% of all new LinkNYC locations will be in outer boroughs and above 96th Street in Manhattan.



* numbers represent minimum links to be deployed in equity community districts

Equitable Deployment Mandate

Focus on Internet Deserts



Source: The New York City Internet Master Plan - Jan 2020

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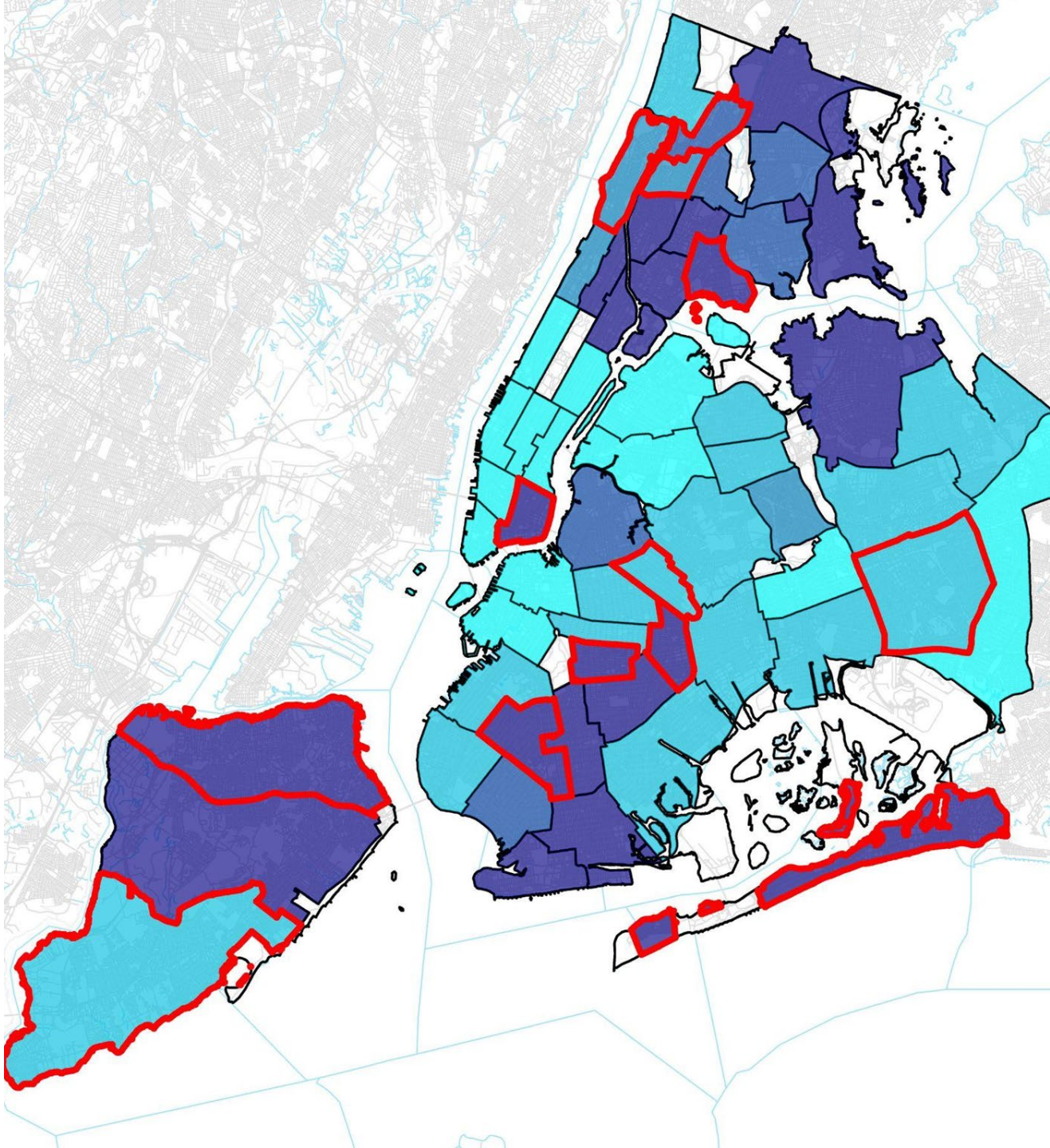
Equitable Deployment Mandate

Focus on Mobile Broadband Deserts



Source: The New York City Internet Master Plan - Jan 2020

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Design Requirements to Support the Reboot

- To incorporate 5G into Links, the new design must provide for:
  - Multi-tenant, multi-technology wireless services
  - Space for radio equipment below transmission bays
  - Space for cooling, cabling
  - Robust structural integrity
  - At least 5 transmission bays for multi-carrier and Wi-Fi services
  - Minimum height requirements as set by FCC safety regulations
- Must provide all existing Link services
- Must align with LinkNYC aesthetic
- Must be safely and sustainably maintainable
- Minimize disruption to pedestrians and streetscape

Introducing Link5G

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Introducing Link5G

Consistent look and feel with existing kiosk

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Link5G designed to the minimum height to support a viable LinkNYC program

- 19.5’ is minimum transmitter height permitted while complying with FCC safety regulations
- 29” minimum bay height required for transmitter separation
- 5” for ventilation
- 5 bays required for free Wi-Fi and sufficient space for 5G transmitters

19.5’ + (29” x 5) + 5” = 32’ total height

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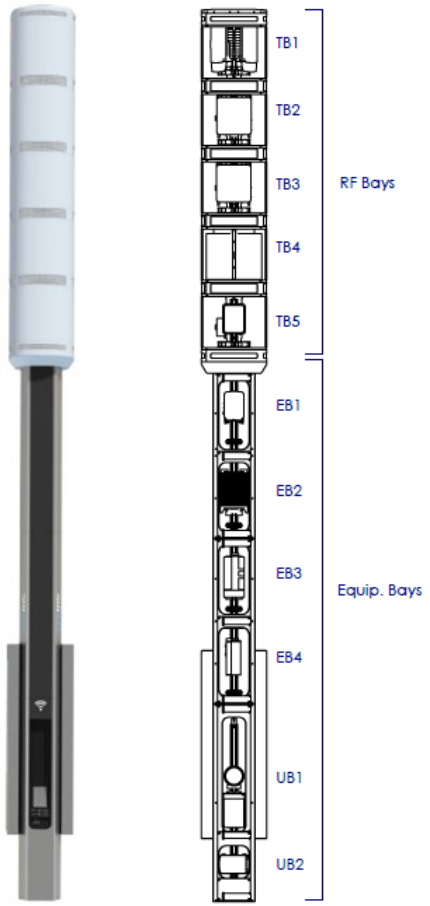
Link5G Design Expands Broadband Accessibility



FRONT VIEW
(SHROUDS HIDDEN
FOR CLARITY)

TB1	Millimeter Wave Bay for Operator 1 Ultra-Fast 5G Service	Ultra-Fast 5G Services from multiple providers, giving NYers freedom of choice and the fastest possible wireless services
TB2	Millimeter Wave Bay for Operator 2 Ultra-Fast 5G Service	
TB3 + TB4	Millimeter Wave Bay or Sub 6 GHz Shared Bay for 4G LTE + 5G for additional coverage and capacity for CBRS and/or IOT to support neutral host providers and technologies	Coverage and capacity at Sub 6GHz bands, while alternative technology offerings increase competitive landscape and open doors to alternative wireless providers for NYers
TB5	Optimized Wi-Fi structure and siting locations improve coverage and performance of free public gigabit Wi-Fi	Improved free public Wi-Fi Service
EB1 to EB4	Operator Equipment	Safe, secure, efficient use of space to house required radio equipment concealed from view
UB1 + UB2	LinkNYC Wireless Services Equipment, Pole controls and connection to fiber and power	Provides critical public City services

Below ground fiber infrastructure that can be used by other carriers to deliver connectivity throughout NYC

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Evolution of Link5G Design

5G Multi-tenant + Kiosk → **With technical modifications** → **Link5G**

Link5G requires a minimum of 5 bays for Wi-Fi, new technologies, and/or tenants to allow reduced deployment density, to support the higher cost to deploy and offset the cost of sites that have less commercial value.

- A larger diameter shroud (34” vs. 22” for 5G multi-tenant) is required for:
  - Larger radios and azimuth control for mid-block deployment
  - Cable management
  - Thermal dissipation
  - Quiet and energy efficient operation

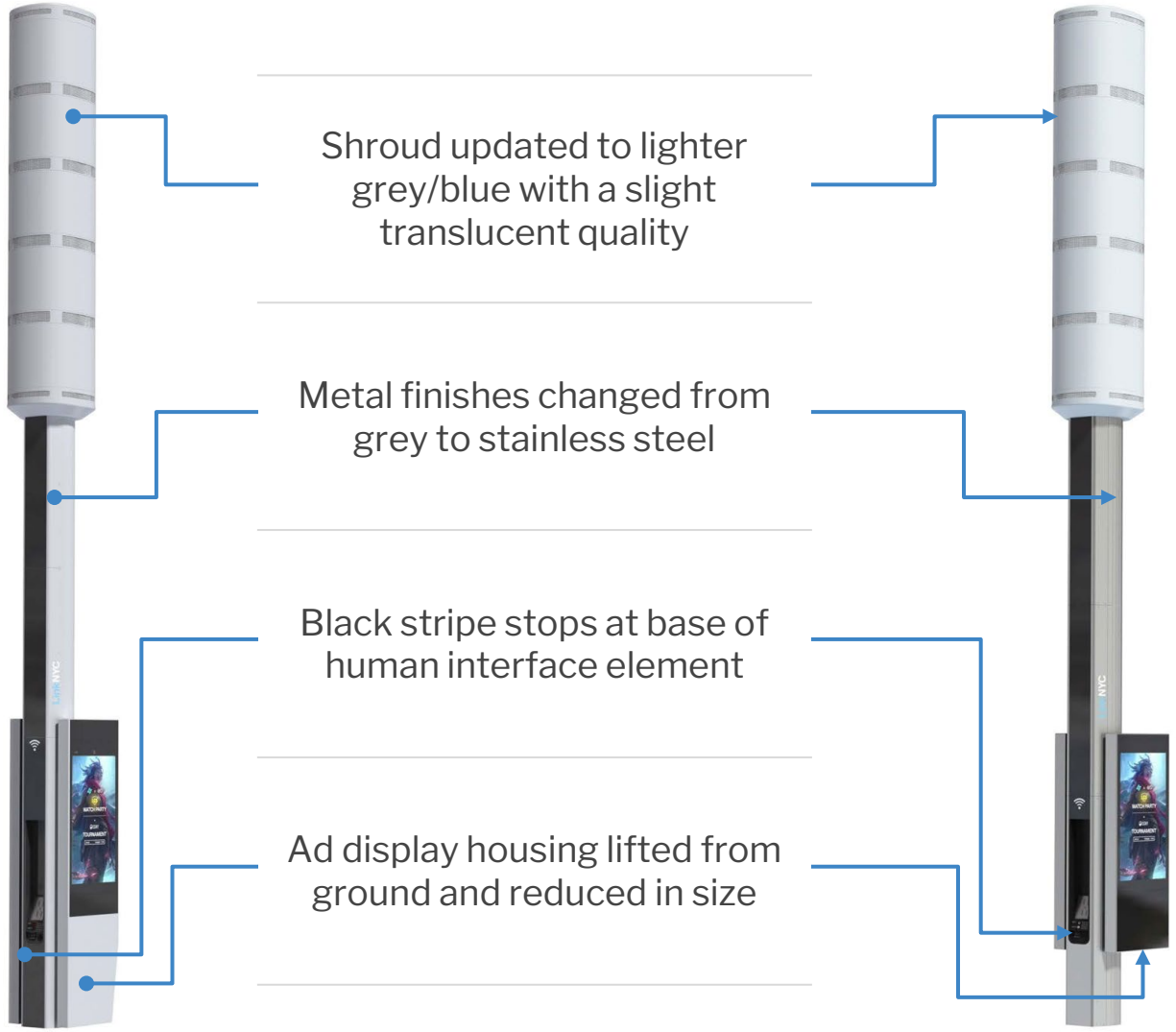
- A larger pole (18” vs 8”) is required for:
  - Structural stability
  - Internal radio installation
  - Internal cable management

Antenna, the design firm behind the original Link kiosk, helped refine the Link5G design:

- Unarticulated large volume makes for a bulkier presence. Using different color/finish/material for pole and shroud breaks up the overall volume, so it is seen as two separate smaller volumes:
  - Change color of shroud to lighter grey/blue w/ slight translucence to reduce the perceptual impact of the shroud
  - Make the structure and the display frame stainless steel finish (somewhat reflective) - reduces the apparent volume
- Stop the black front face at the bottom of the touchpad assembly:
  - articulate parts with interface functions to humanize the scale and make it appear lighter by not hitting the ground
  - create focus on the interface elements
- Reduce the size of the display housing and lift it off the ground to make it appear lighter

Evolution of Link5G

Updated design responsive to PDC feedback



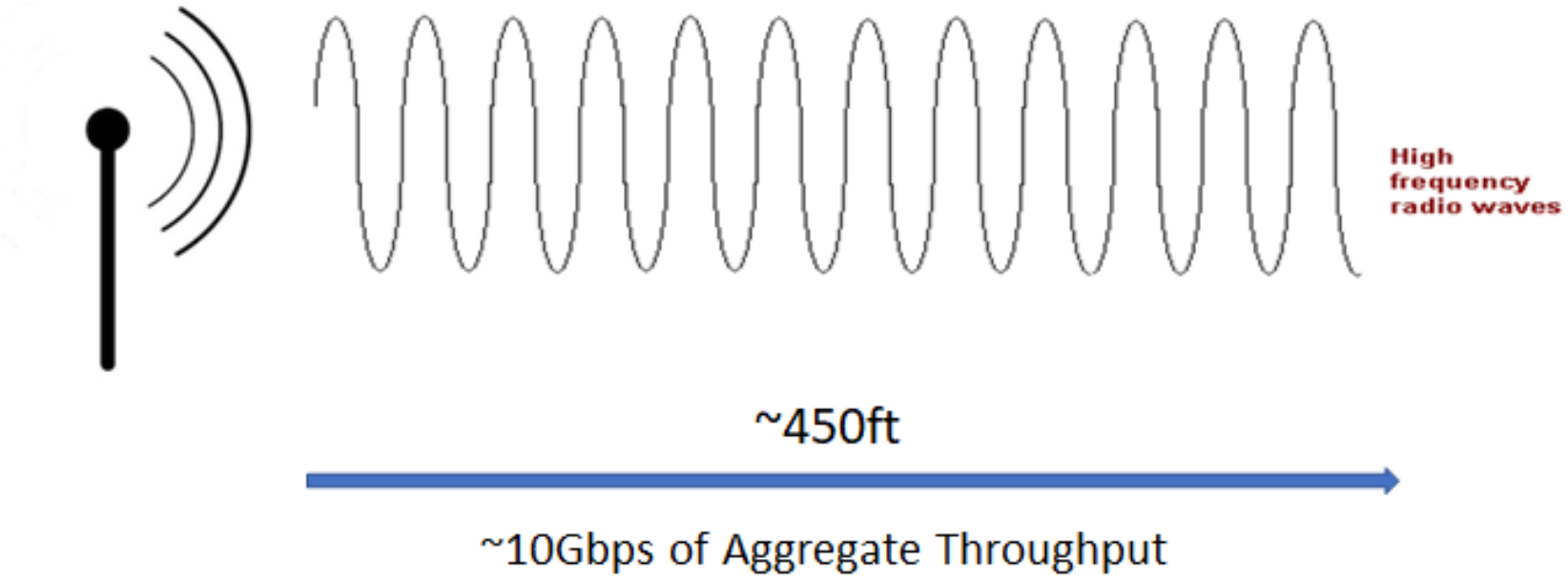
Link5G designed to provide complete connectivity

- Multi-Tenant, Multi-Service means New Yorkers have access to the most available wireless technologies
- More wireless access=better connectivity options for more people
- Wi-Fi, millimeter wave 5G, sub-6 GHz 5G and 4G LTE are all crucial building blocks in providing different layers of coverage
- Wi-Fi and 5G are complementary, not substitutes
    - overlapping coverage means connectivity is always available
    - Wi-Fi and 5G technologies are used for different purposes by different users
    - 5G provides different classes of service and continuity for users moving across the City

“A gigabyte is a gigabyte, no matter how it gets over the air. We need *both* Wi-Fi and our cellular network in New York to give our users consistent, reliable service." - Global Connection Management at a major carrier

Coverage Characteristics of 5G mmWave

Superior throughput over shorter distances requires dense deployment to achieve pervasive coverage.



Throughput is a maximum aggregate value tested under Lab conditions. This will vary in the field based on radio manufacturer specifications, signal strength, signal quality, number of simultaneous users, climate conditions, free space loss & external interferences

Need for dense deployment means NYC needs both poletops and Link5G to address growing demand

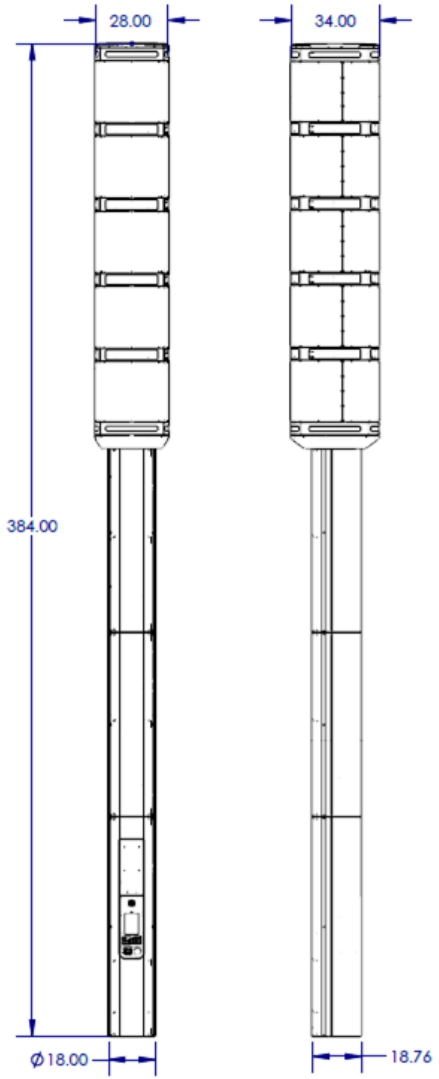
"**Why small cells?**

Small cells are low-powered radio access points that connect mobile devices to mobile networks over a small area. They typically reuse frequencies on an extremely dense basis to take full advantage of available spectrum.

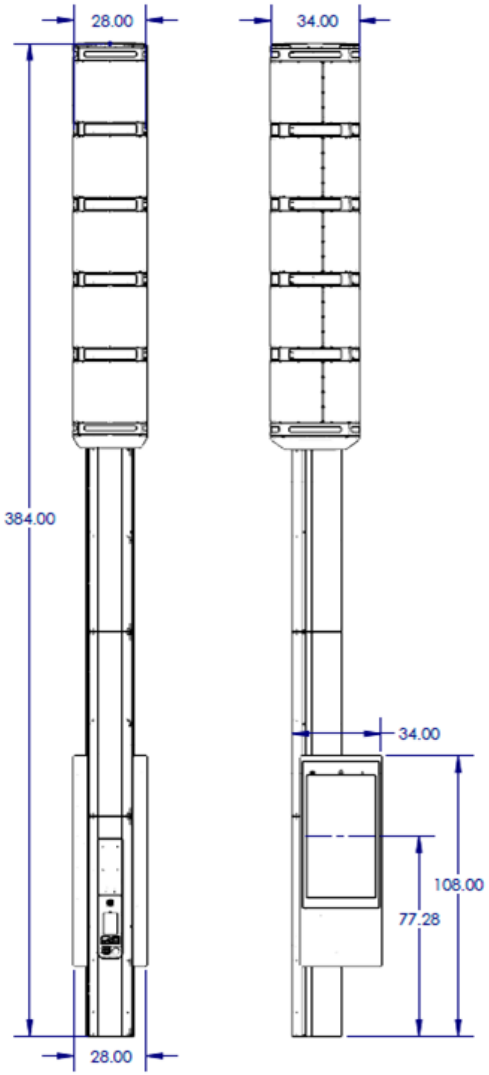
For 5G, network operators are planning to use not just the low- and mid- band spectrum that existing cellular networks mostly rely on. They will also need high-band spectrum, which carries over shorter distances than the lower frequencies that currently dominate wireless networks. Carriers will therefore **need a much larger number of access points, which cover smaller areas, to roll out 5G.**"

Source: PwC "Why 5G can't succeed without a small cell revolution"

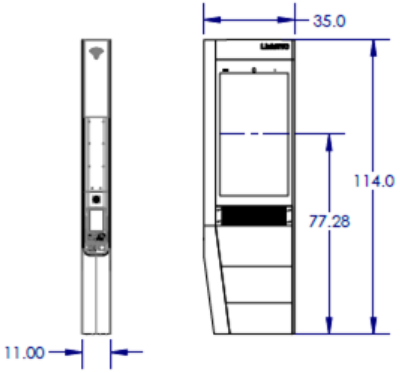
Link 5G vs Link Design



Link5G



Link5G (with screen)



Link

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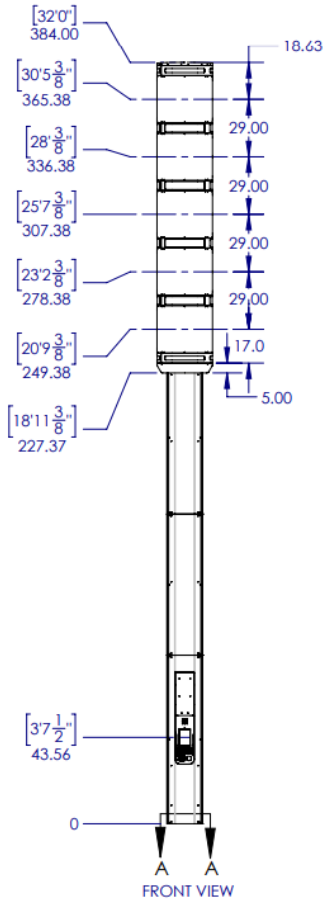
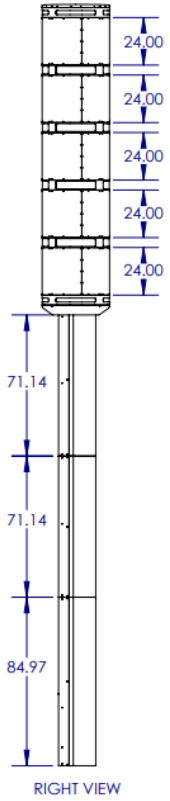
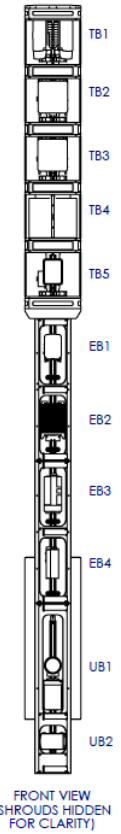
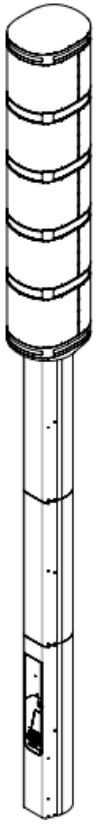
Link5G Design

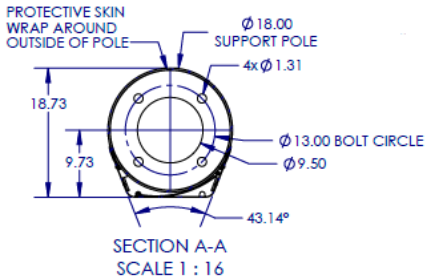
Pole Overview











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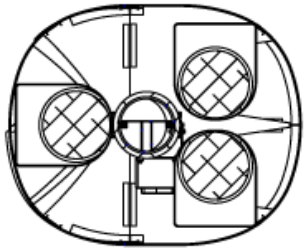
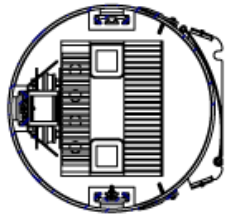
Link5G Design

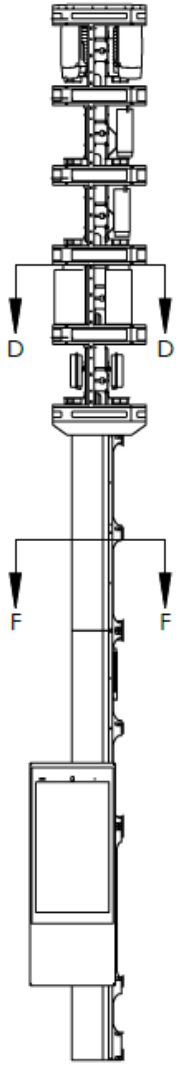
Equipment Bay Section Views

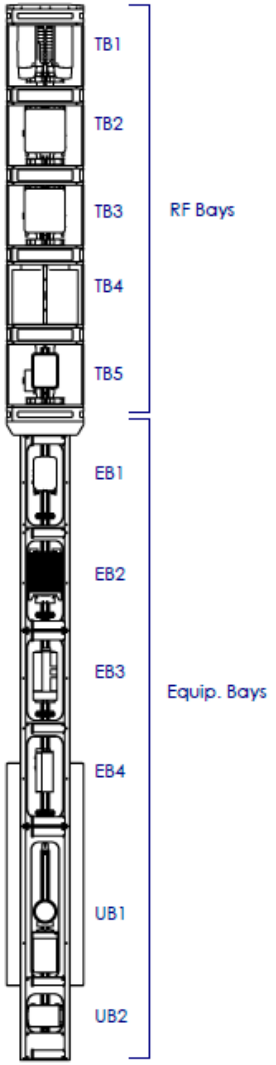


SECTION D-D
SCALE 1 : 16



SECTION F-F
SCALE 1 : 12





FRONT VIEW
(SHROUDS HIDDEN
FOR CLARITY)

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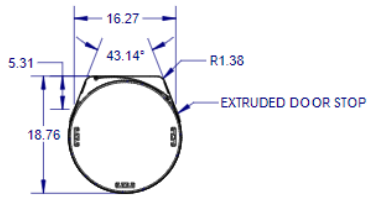
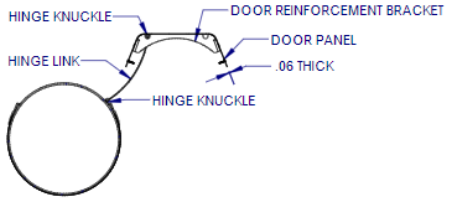
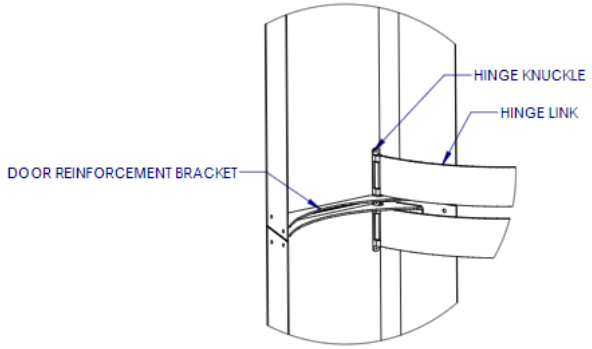
Link5G Design
Door Details



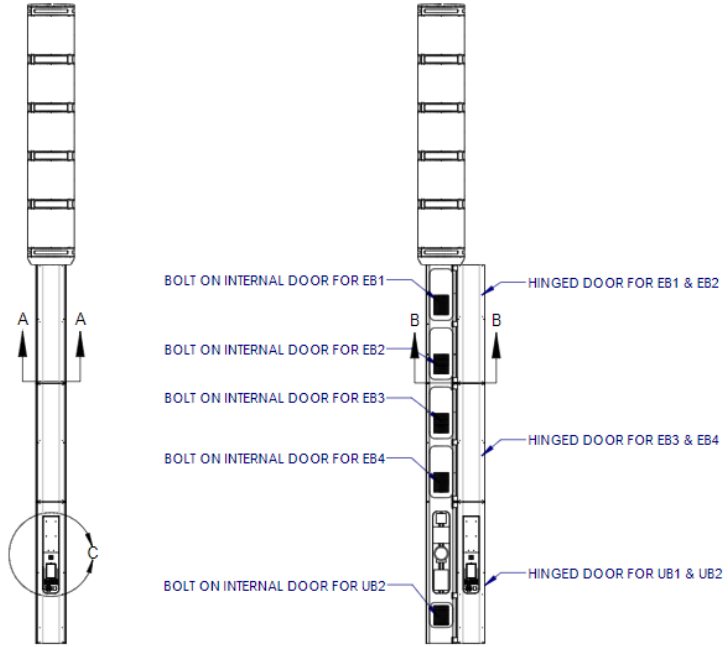
SECTION A-A
(HINGED DOORS CLOSED)
SCALE 1 : 16

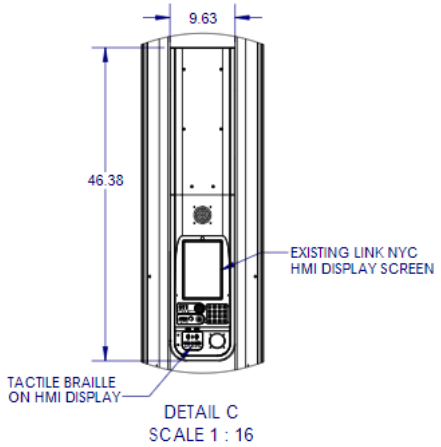


SECTION B-B
(HINGED DOORS OPEN)
SCALE 1 : 16



DOOR DETAIL
SCALE 1 : 8





DETAIL C
SCALE 1 : 16

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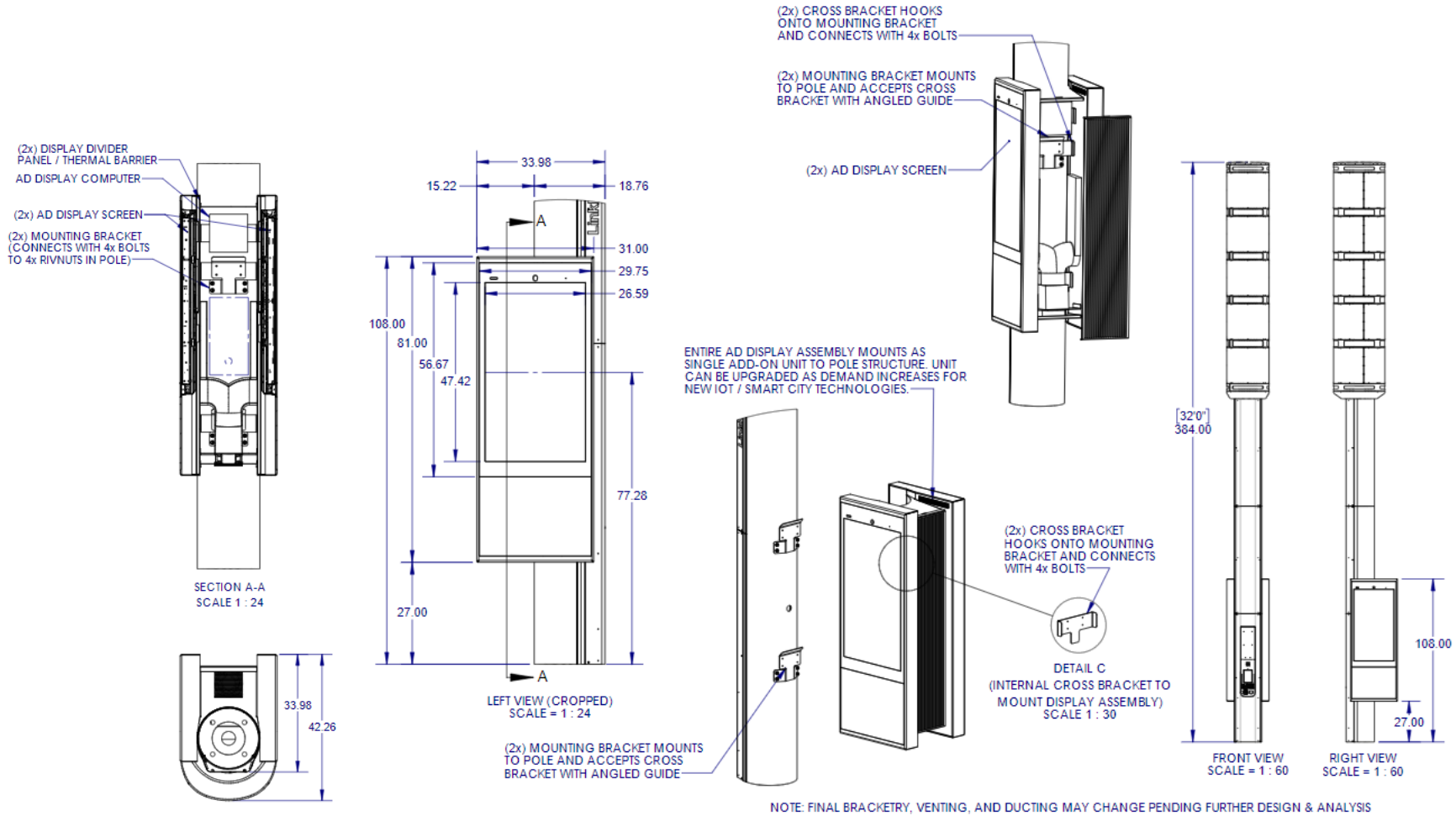
Link5G Design Screen Assembly



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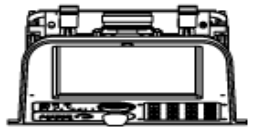
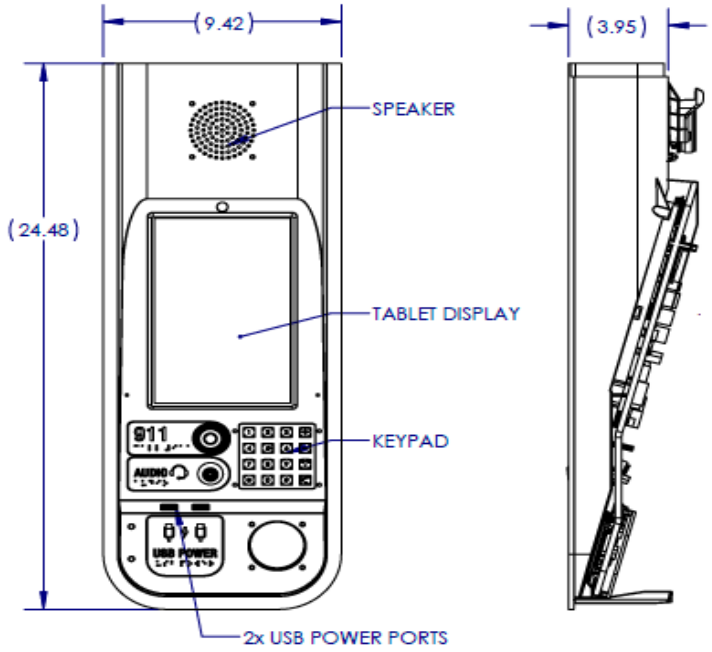
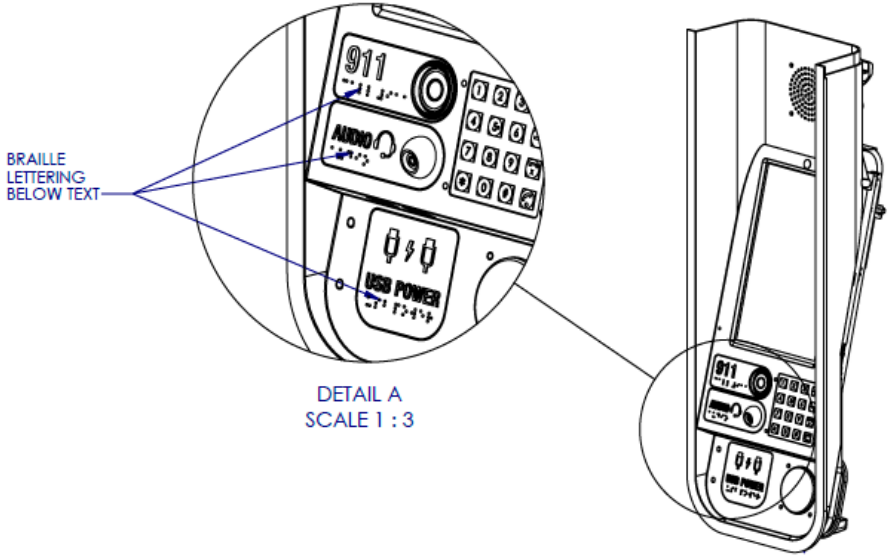
Link5G Design

Same UI used in Link and Link5G







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Link5G Design

Equipment & Transmission Bays Rendered Views

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Link5G
Expanding the Benefits of LinkNYC

	Free High Speed Wi-Fi Access	Internet Access Via Tablet	E911	Free Voice Calls	Multi-Tenant 5G Siting	Structure Designed for Long Range Wi-Fi	90% of new locations outside core of Manhattan
Existing Link	✓	✓	✓	✓			
Link5G	✓	✓	✓	✓	✓	✓	✓

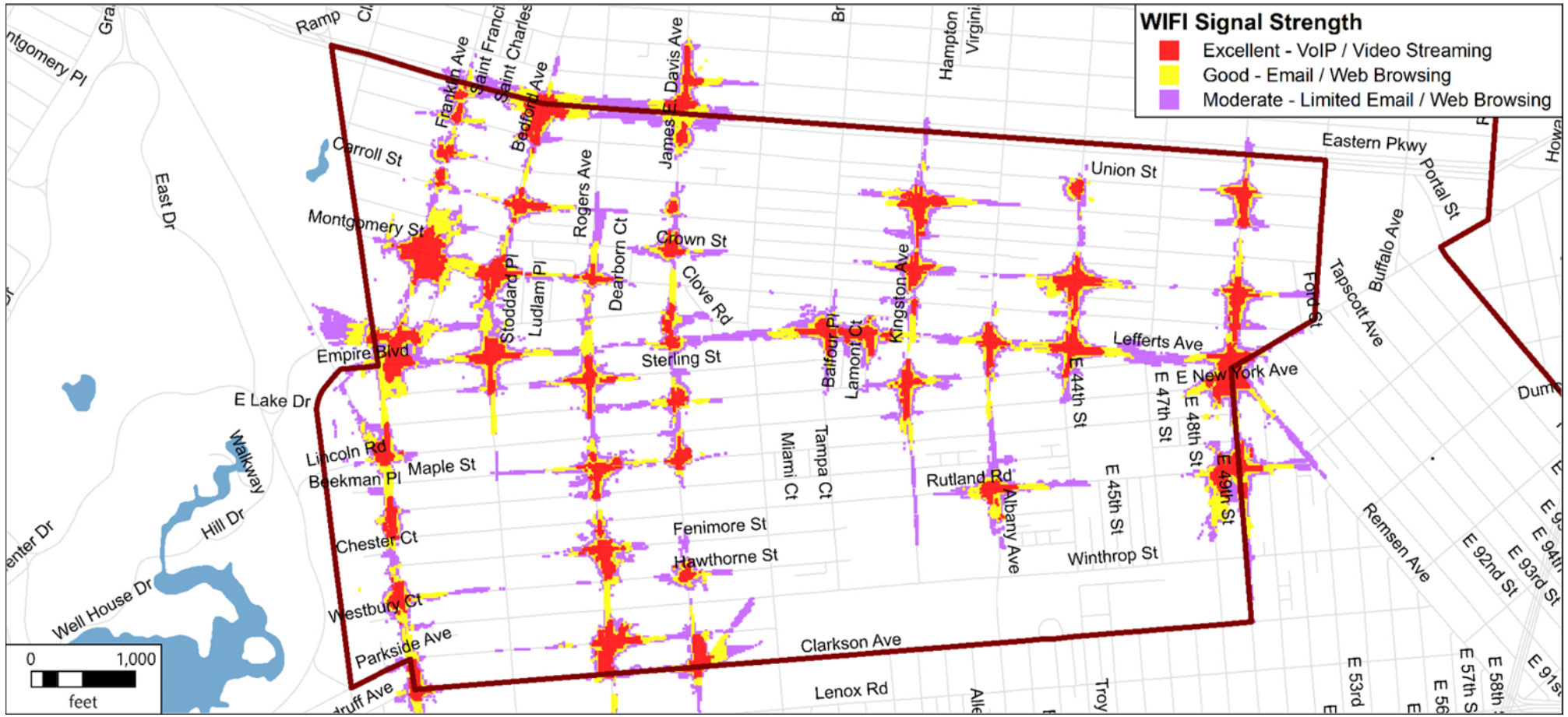
Current Wi-Fi Coverage

Brooklyn CD9 / Existing Links

Crown Heights South, Prospect Lefferts Gardens

Projected Wi-Fi Coverage

Brooklyn CD9 / Existing Links + Link5G



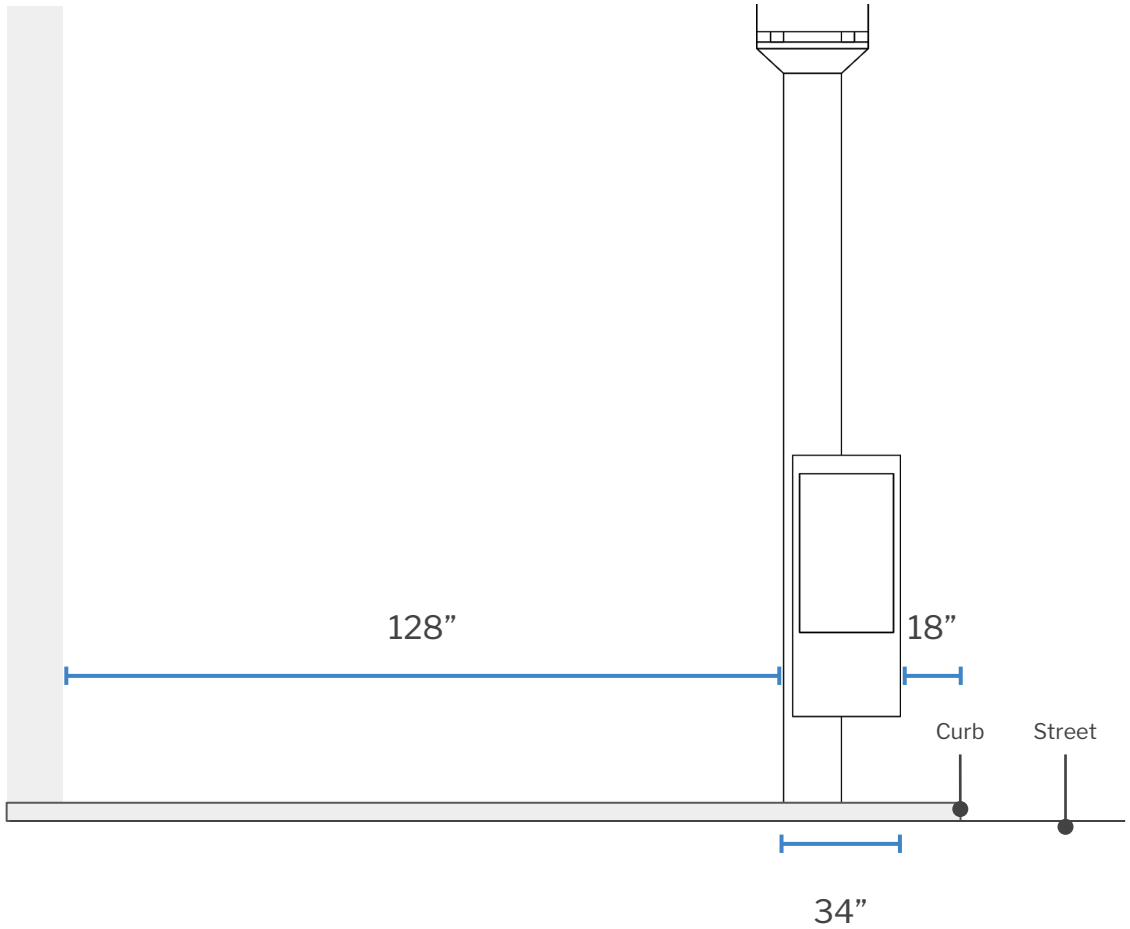
Crown Heights South, Prospect Lefferts Gardens

Siting

- The Link buildout follows the footprint of NYC's payphones.
    - All payphones that were on the street in the City as of 2014 are potential new Link locations.
- New siting restriction: may not have more than 1 Link5G per block and must only be on one side of the street per block.
- Locations for new Links that were NOT previously payphones must be proposed to the relevant Community Board, Council Member, Borough President, and BID for a 60-day comment period before it is built.
    - While the role of external stakeholders is advisory, DoITT is committed to a robust public process and has been proactively working with Borough President's offices to secure feedback from community boards on all proposed link locations.
- All proposed locations are made available online via Open Data.
- Links with ads may only be in Commercial and Manufacturing districts.
- Links must be spaced at least 50 feet away from each other.
- The Landmarks Preservation Commission must review any site in an historic district and no new Franchise Structure shall be erected parallel to a landmark site.
- Limitations on siting are subject to waiver by the Commissioner in their sole discretion.

Link5G

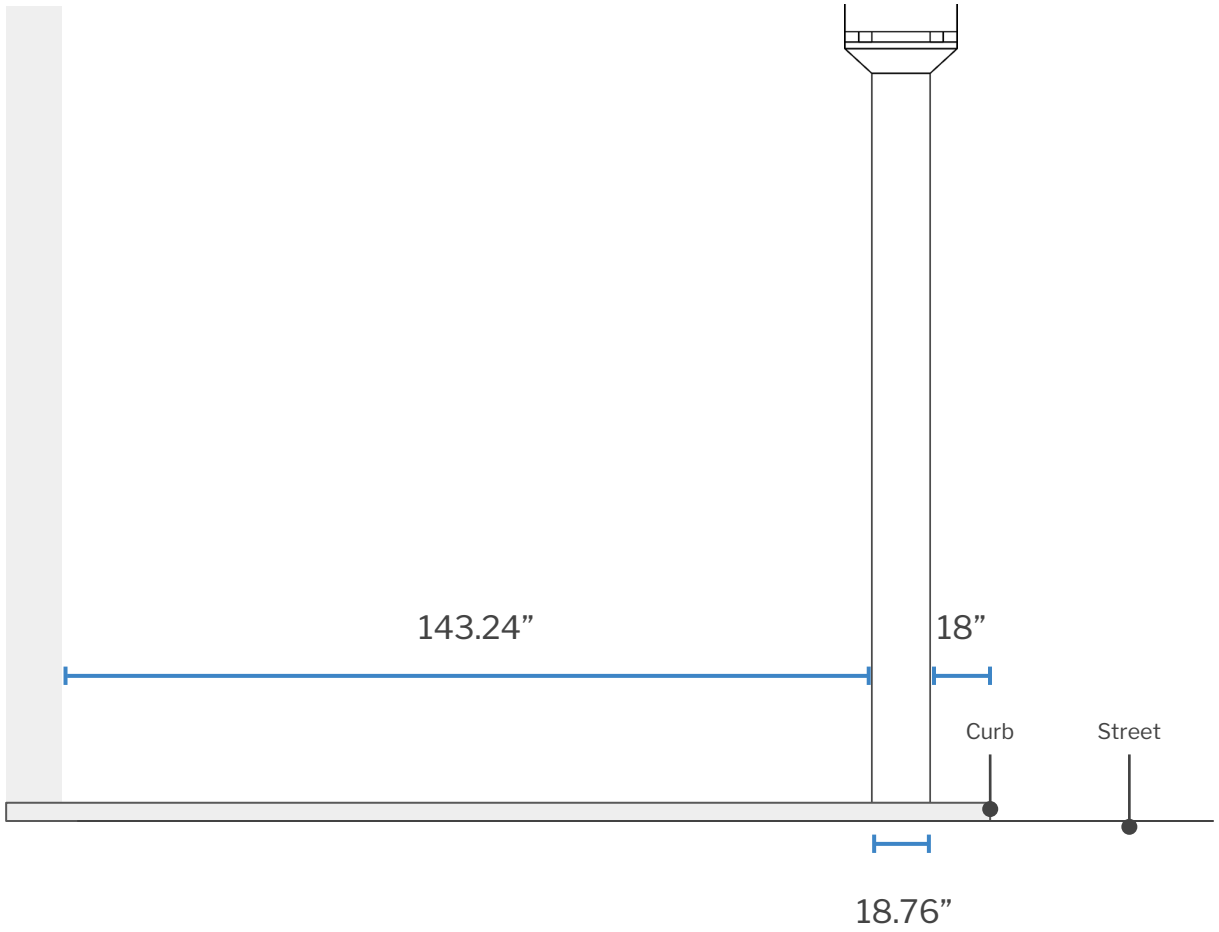
15’ Sidewalk Measurement



*Not drawn to scale

NYC Information Technology & Telecommunications

Link5G (Non-Screen)
15’ Sidewalk Measurement



*Not drawn to scale

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Link5G in NYC

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Link5G in NYC

NYC Information Technology & Telecommunications

Link5G in NYC

5G Poletop Shroud Comparison (approved single tenant)

NYC Information Technology & Telecommunications

Link5G in NYC

5G Poletop Shroud Comparison (approved single tenant)

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Link5G in NYC

5G Poletop Shroud Comparison (approved single tenant)

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Link5G in NYC

Note: 5G pole top solution cannot be used on Flatbush poles due to structural issues

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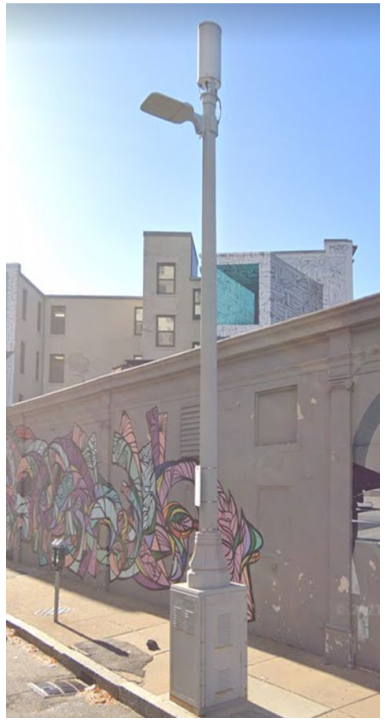
Link5G vs. Other 5G Street Furniture

Proposed CityBridge Structure

Comparisons in Other US Cities



New York City	Location	Phoenix**	Phoenix**	Boston**	Boston**
2,000+	Est. Deployments*	>50	>50	>50	>50
4 + Wi-Fi	5G mm radios supported *	1	1	0	0

* Deployments and technology estimates are based upon publicly available data
** Exposed radios means that each carrier site has different visual presentation

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Link5G vs. Other 5G Street Furniture

Proposed CityBridge Structure

Comparisons in Other US Cities

New York City	Location	Las Vegas**	Las Vegas**	San Jose	San Jose
2,000+	Est. Deployments*	>80	>80	>50	>50
4 + Wi-Fi	5G mm radios supported *	1	1	0	0

* Deployments and technology estimates are based upon publicly available data
** Exposed radios means that each carrier site has different visual presentation

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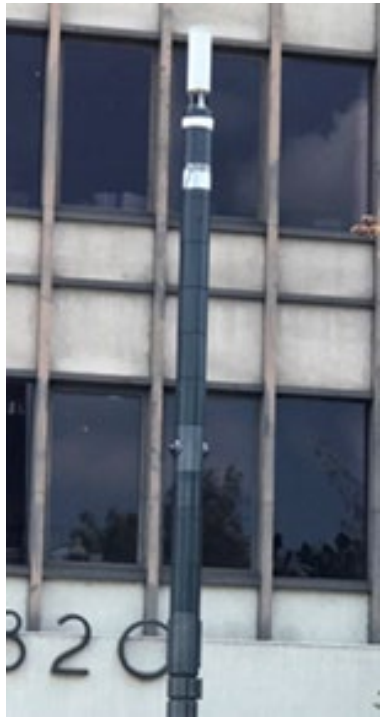
Link5G vs. Other 5G Street Furniture

Proposed CityBridge Structure

Comparisons in Other US Cities



New York City	Location	New Jersey***	Las Vegas	Houston**	Houston**
2,000+	Est. Deployments*	>100	>100	>50	>50
4 + Wi-Fi	5G mm radios supported *	3	0	1	1

* Deployments and technology estimates are based upon publicly available data
** Exposed radios means that each carrier site has different visual presentation

*** Note this structure is 60 - 80' tall

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Link5G

The Path Forward for LinkNYC

- The pandemic has made clear that we do not have the luxury of time to bridge the digital divide. We must act NOW.
- Link5G is the only path forward to sustain the LinkNYC program and expand into neighborhoods that will most benefit from free, high-speed internet, mobile broadband, and fiber infrastructure.
- After extensive consultation with engineers, designers and technical experts, we are confident that Link5G is the right design for New York City.
- Digital equity is necessary to fully participate and access opportunities in society. Approval of this design is all that stands between in the way of fulfilling our purpose — to provide digital connectivity to all residents of New York City.

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Without Link5G...

- No further expansion of LinkNYC program beyond Manhattan and limited outer borough neighborhoods — leaving most vulnerable New Yorkers without critical access to broadband connectivity.
- Loss of street furniture advertising used by local small businesses and communities.
- No publicly accessible option for 911/311.
- Loss of revenue stream from a marquee franchise program.
- Loss of 25% advertising space for City to promote its initiatives and public service announcements.
- Risk of Link kiosks going dark across the five boroughs.

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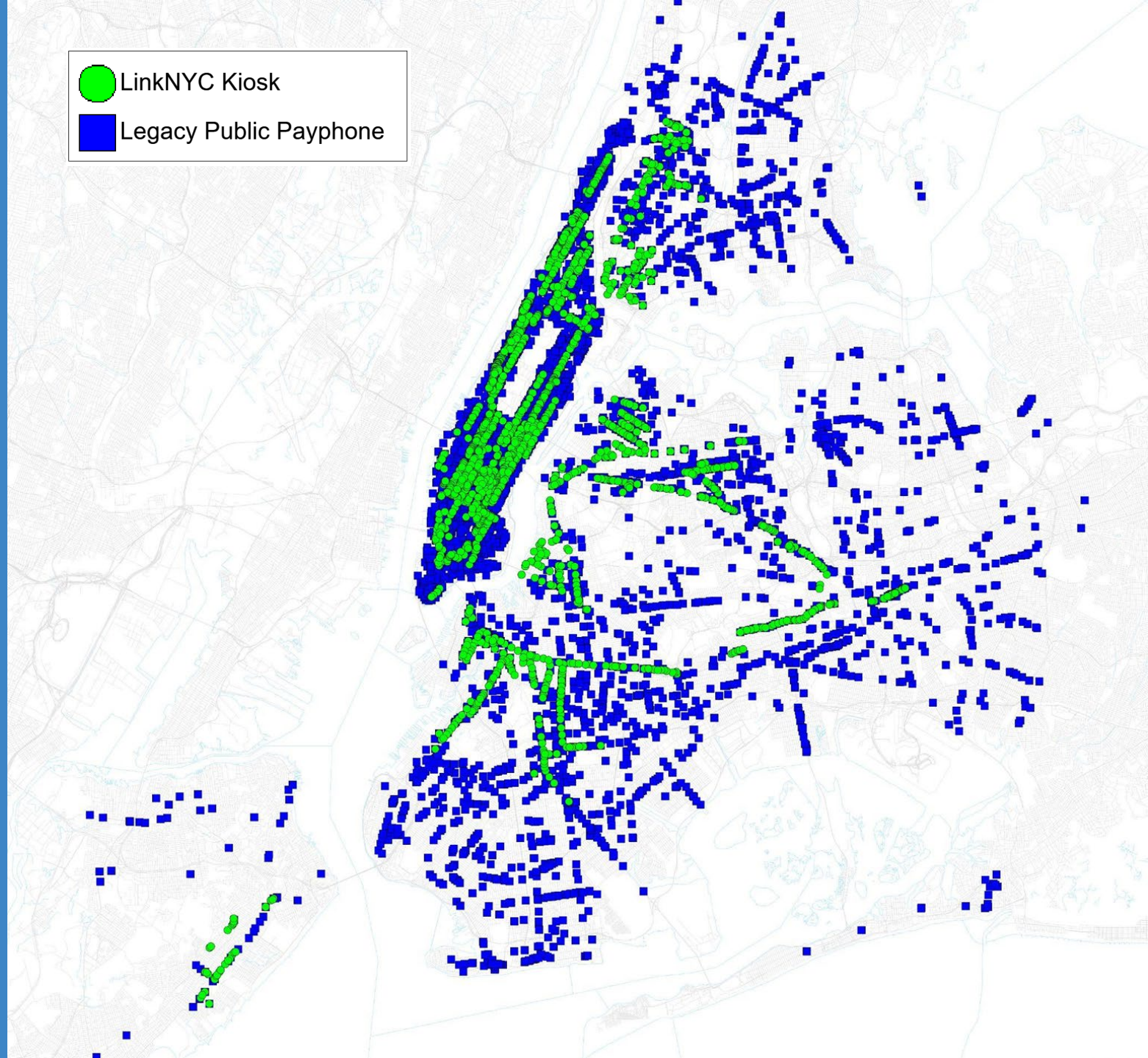
Appendix

Payphones vs LinkNYC

Without Link5G approval, communities that have lost payphones and don't have Links will not have access to public phone service including 911, 311, or other governmental emergency and information hotlines.



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Link5G in NYC

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Link5G in NYC

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2021 Amendment Deployment Schedule

Build Year (July to July)	Equity CD	Other CD	Cumulative Total Required by July build-year end
BY5	n/a	n/a	1,816
BY6 July 2020 - 2021	50	50	1,916
BY7 July 2021 - 2022	260	50	2,226
BY8 July 2022 - 2023	225	310	2,761
BY9 July 2023 - 2024	145	535	3,441
BY10 July 2025 - 2026	59	500	4,000
Total	**739**	**1,445**	

Pole Manufacturer Biography

Comptek

- National Wireless Infrastructure Engineering and Manufacturing
- Design and Fabrication of over 3,500 concealment poles for 5G wireless equipment
- Product supplier to affiliate Aero Solutions, LLC – over 4,000 monopole and tower modifications
- Concealment shrouds of 4G, 5G, CBRS, LAA radios and antennas – installed throughout US
- Established as Comptek Structural Composites in 1998
- Major customers - Verizon, AT&T, ExteNet, Crown Castle, ZenFi Networks, Cox Comm., Xcel Energy, Florida Power & Light, Zayo
- All major national markets
- ISO 9001:2015 Certified

Information Technology & Telecommunications

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