Infrastructure Corridors: Leveraging Linear Systems for Public Life

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Keywords: transportation infrastructure, landscape architecture, urban design, open space, public space, corridors, infill, reuse, co-use, linear parks, practice-based research

The community benefits of public open space were made ever more apparent during lockdowns in U.S. cities during the COVID-19 pandemic. Parks and open streets became outdoor living rooms, birthday party venues, protest sites, meeting places, date spots, restaurants, and safe group gathering locations. Their function as necessary social infrastructure in the sense that sociologist Eric Klinenberg has defined it, became visible daily. At the same time a racial reckoning and climate emergency pressed for action while municipal budgets strained to meet basic needs. We know public space provision is key to democratic life for both dissent and community building. We also know we need to densify cities and make urban spaces livable and desirable if we want to reduce climate impacts and individual carbon footprints. Developing linear parks and open space systems that take advantage of existing infrastructure corridors is one promising option to meet these goals. These spaces utilize infill sites either by reuse or co-use of transportation infrastructure and due to their long form, have lots of edge which provides access to a greater number of people than a traditional parcel. And also, like all parks, they have the capacity to mitigate adverse urban impacts like heat, noise, and flooding. Our practice-based research group has studied four infrastructure types that were generated from the dominant transportation infrastructures of past waves of economic activity: port, river, rail, and road. Looking at over 400 precedent projects across the globe, we have distilled out five main strategies that inform the design, development, and use of these corridors and their associated storage areas. Contextualizing urban design and open space projects through the lens of their originating infrastructural footprint has not been attempted to date. This research paves the way for understanding the catalysts for infrastructure reuse or co-use, the unique benefits of linear systems, lessons learned from accompanying development patterns, exclusive funding streams, and political returns of investing in this type of open space. The research has been impactful in making the case for linear parks and systems as high-benefit, lower cost method of open space provision for American metro areas.

As was made ever more apparent during lockdowns in US cities during the COVID-19 pandemic, the community benefits of public open space are substantial. Parks and open streets became outdoor living rooms, birthday party venues, protest sites, meeting places, date spots, restaurants and safe group gathering locations. Their function as necessary social infrastructure, in the sense that sociologist Eric Kleinberg has defined it , became visible daily.

At the same time a racial reckoning and climate emergency pressed for action while municipal budgets strained to meet basic needs. We already know public space provision is key to democratic life for both dissent and community building. We also know we need to densify cities and make urban spaces both livable and desirable if we want to reduce climate impacts and individual carbon footprints. Open space is now not an amenity, but a necessary social and climate infrastructure, and a keystone of resilience

LINEAR PARKS

Linear parks are a promising option to meet these goals, but they've so far been deployed relatively sparingly. Linear parks and open space systems take advantage of existing infrastructure corridors like those for transportation or drainage (figure 1). As historically dominant modes of transportation become surpassed by new ones, the obsolescence of these networks can help grow public space systems. By utilizing infill sites—either by reuse or co-use—density is increased. And due to their long form, there is lots of edge, which provides access to a greater number of people than a traditional block parcel. Like a cell, more surface versus interior means more exchange for less size. And for a park, that means less area to maintain per user. And also, like all parks, linear parks have the capacity to mitigate adverse urban impacts like heat, noise, and flooding.

Linear parks are typically larger and more multi use than trails or greenways, but can incorporate those programs. Linear parks are not the same as linear development or linear urbanism. The focus is not on optimizing transportation corridors for speed and economic value in the sense that Arturo Soria y Mata envisioned with *La Ciudad Lineal* in Spain in the late 1800s, or Mohammad bin Salman's proposed development, The Line in Saudi Arabia.

Figure 1. Linear Parks: BARTD Linear Park and Station, SWA Group, landscape architects. Image credit: Gerry CAmpbell/SWA Group.

Certainly, there are documented drawbacks and failings of infrastructure reuse as parks—such as gentrification, attracting new development, and residential displacement. As a high profile and well used park, the High Line in New York has been a flash point and example of these failings.[4, 5] The non-profit, the High Line Network, and its partners are exploring alternative processes by which adverse impacts on existing communities can be eliminated or mitigated and parks can be drivers of local, community-led economic development. The non-profit works directly with organizations developing green spaces in the U.S., and thus is very much applying lessons learned from direct experience.

INFRASTRUCTURE CORRIDOR REUSE AND CO-USE

At XL Lab, the practice-based research and innovation lab at SWA Group, an international landscape architecture, urban design, and planning firm, we have a multi-part project on infrastructure corridors underway. The following will summarize the main findings of our initial study in which we reviewed and aggregated basic information from over 400 recent infrastructure reuse and infrastructure co-use projects from all over the world in order to understand this project type and how it can be used to leverage linear systems for public life.

Figure 2. Study data set (top) and select findings (bottom).

XL Lab studied four infrastructure types—those that were generated from the dominant transportation infrastructures of past waves of economic activity. This included port, river, rail, and road infrastructure systems. These were ordered roughly chronological. Our data set had 404 projects, and a quarter of those were projects designed or planned by SWA and the remainder were by other designers. In terms of location, the projects were about half domestic (in the US), and half elsewhere. For examples, see a subset of 60 of these projects, in figure 5.

For inclusion in the data set, there were four main criteria (figure 2). One, that the projects were built--they existed in real life and could be visited. Second, that they were occupiable—it provided public space for pedestrians, bicyclists, etc. Third, that the project was either formerly, or currently, transportation infrastructure. And the last criterion was that it was within a metro area. In the United States, this meant a Metropolitan Statistical Area (MSA), defined by the United States Office of Management and Budget, using US Census data. This does not mean a center city. An MSA is part of a wider economic network that can have multiple city centers, as well as both suburban and urban areas. There are far more recent infrastructure reuse and co-use projects around the world that meet these four criteria than our data set contains. However, after compiling around 500 projects from awards programs, media outlets, and prominent design firm portfolios, applying the criteria narrowed the sample size to 404 and we then started collecting data.

FINDINGS

Out of 404 projects we found that:

The average project length was 1.8 miles. The measure was taken along the longest edge, or water's edge, in the case of port and river projects. It was measured in Google Earth for all projects. 1.8 miles is rather long for landscape architecture projects, as it exceeds the typical boundary defined by an urban land parcel, which is a common constraint. However, it also shorter than large networks built out over long periods of time like Buffalo Bayou Greenways and The Atlanta Beltline. This average length may reflect the political and budgeting realities that lead to projects being multi-phased or built as pilots or "demonstration projects" for both speedier ribbon cuttings and alignment with political and budgeting cycles.

6% of projects were temporary projects. This means that they were either tactical urbanism interventions built to test buy-in or catalyze investment, intended to be removed after a set period of time, or mobile. The remaining 94% were fixed projects. Although the paradigm is shifting towards flexibility in the field of landscape architecture, these projects are the typical design standard aiming at a 20-50-year life span or so, and only able to be removed or substantially changed via demolition. This ratio of fixed to temporary could have been actively tipped in one direction or the other depending on initial project selection. At the time, the team was not aware of a suitable target ratio that

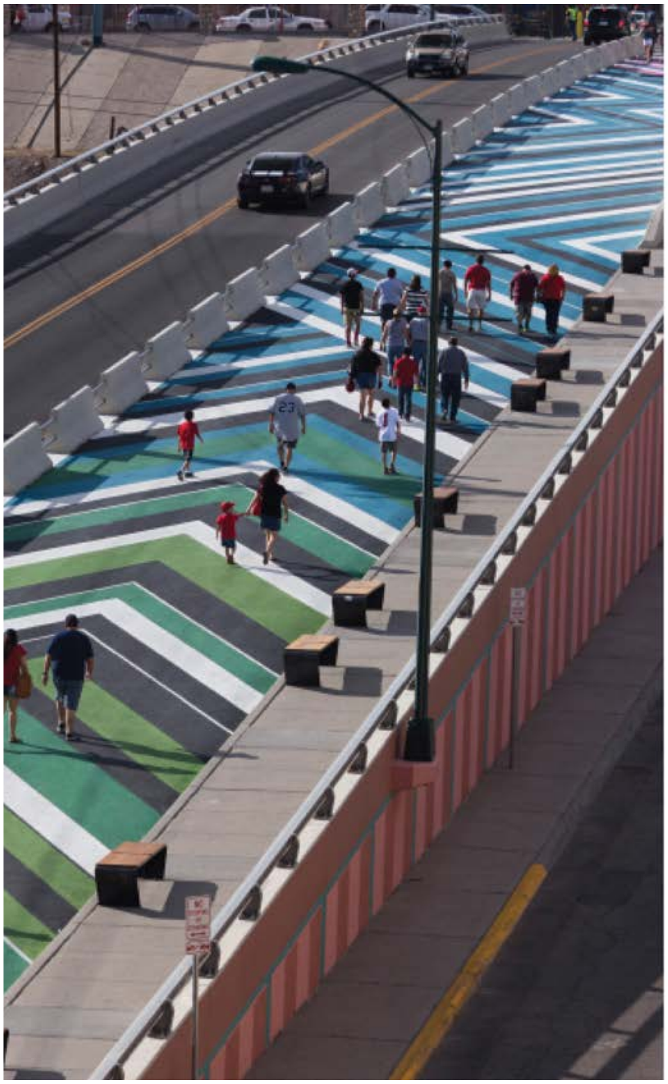

Figure 3. El Paso Pedestrian Pathways, SWA Group, landscape architect (left) is an infrastructure co-use project. Hunter's Point South Waterfront Park phase 2, SWA/Balsley, landscape architect (right) is an infrastructure reuse project. Image credit: Jonnu Singleton/SWA Group.

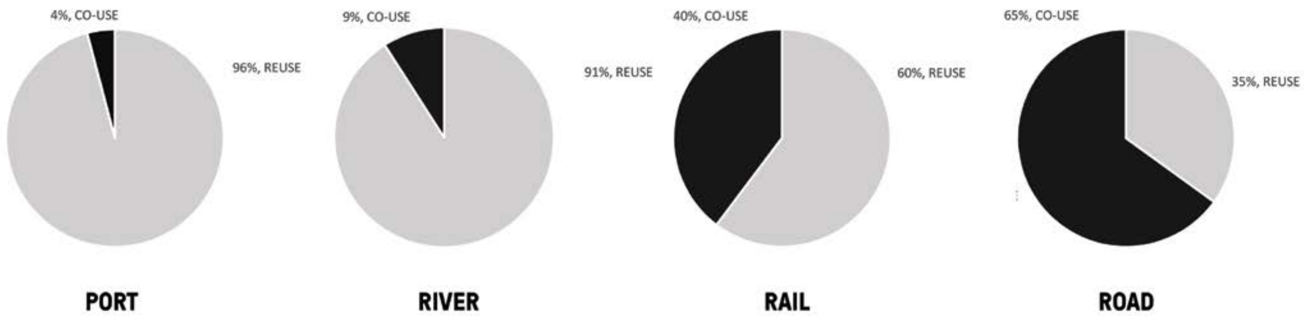

Figure 4. The ratio of co-use projects varied and increased the more recent the transportation technology. The project data set seems to reflect the gradual obsolescence of older transportation regimes. Port infrastructure has the least amount of co-use as it transitions away from its industrial uses. Road infrastructure has the highest ratio of co-use as the dominant transportation system at the current moment. Image credit: SWA Group/XL Lab.

Permanence	Project	Location	Designer
		PORT	
Fixed	Hunters Point South Waterfront Park	New York City, USA	SWA Group
Fixed	Shekou Coastal Promenade	Shenzhen, China	SWA Group
Fixed	Golden Gate National Recreation Area (GGNRA)	Marin County, USA	SWA Group
Fixed	Kalvebod Waves	Copenhagen, Denmark	JDS
Fixed	Tianjin Eco-city	Tianjin, China	SWA Group
Fixed	Pier 55/Little Island	New York City, USA	MNLA, Heatherwick
Fixed	Elliott Bay Seawall	Seattle, USA	JCFO
Fixed	Kobe Waterfront Arena Water Room	Kobe, Japan	SWA Group
Fixed	Vancouver Convention Centre	Vancouver, Canada	LMN
Fixed	Nelson Mandela Park	Rotterdam, The Netherlands	SWA Group
Fixed	Hafencity Public Spaces	Hamburg, Germany	EMBT
Fixed	Thames Barrier Park	London, England	Allain Provost, Alain Cousseran, Arup
Mobile	Water Taxi Beach	New York City, USA	Tom Fox and Mark Baker
Mobile	Den Flydende Kajakklub	Vejle, Denmark	Force4 Architects)
Mobile	1.26 Amsterdam	Amsterdam, The Netherlands	Janel Echelman
		RIVER	
Fixed	Bayou Greenways	Houston, USA	SWA Group
Fixed	Chicago Riverwalk	Chicago, USA	Sasaki
Fixed	Milton Street Park	Los Angeles, USA	SWA Group
Fixed	Medellín River Parks	Medellin, Columbia	Sebastian Monsalve Gomez & Juan David Hoyos Taborda
Fixed	Providence Pedestrian Bridge	Providence, USA	Inform Studio
Fixed	Pont Simone-Veil	Bordeaux, France	OMA, MDP
Fixed	Changsha Baxizhou	Changsha, China	SWA Group
Fixed	Meishe River Greenway and Fengxiang Park	Haikou, China	Turenscape
Fixed	Central Mississippi Riverfront Regional Park	Minneapolis, USA	SCAPE
Fixed	Washington Canal Park	Washington DC, USA	OLIN
Fixed	Bend Whitewater Park	Bend, USA	Greenworks, Otak
Fixed	Vera Katz Eastbank Esplanade	Portland, USA	Mayer/Reed
Mobile	Les Berges de Seine Floating Gardens	Paris, France	Jean-Christophe Choblet, APUR
Mobile	Spruce Street Harbor Park	Philadelphia, USA	Groundswell
Mobile	Open Border, Warming Hut	Winnipeg, Canada	Sputnik Architecture, Joyce de Grauw & Paul van den Berg
		RAIL	
Fixed	C-Square Plaza	Calgary, Canada	The Marc Boutin Architectural Collaborative
Fixed	Bicentennial Children's Park	Santiago, Chile	Elemental
Fixed	Crescent Park	New Orleans, USA	Hargreaves Associates
Fixed	Harvey Milk Plaza	San Francisco, USA	SWA Group
Fixed	Raised Gardens of Sants	Barcelona, Spain	Sergi Godia, Ana Molino
Fixed	Olympic Sculpture Park	Seattle, USA	Weiss Manfredi
Fixed	Circuit Trail	Dallas, USA	SWA Group
Fixed	SKY Highline Plaza	Philadelphia, USA	SWA Group
Fixed	Randall's Island Connector	New York City, USA	MNLA
Fixed	Sava Promenada	Belgrade, Serbia	SWA Group
Fixed	The Goods Line	Sydney, Australia	Aspect Studio
Fixed	Bloomingdale Trail/The 606	Chicago, USA	MVVA
Mobile	Klybeck Quai	Basel, Switzerland	Fontana Landshaftarkitektur
Mobile	Viaduct Rail Park	Philadelphia, USA	Hood Design
Mobile	Precollinear Park	Turin, Italy	Torino Stratosferica
		ROAD	
Fixed	Place des Festivals	Montreal, Canada	Daoust Lestage
Fixed	Ricardo Lara Linear Park	Lynwood, USA	SWA Group
Fixed	Girard Ave Interchange	Philadelphia, USA	AECOM
Fixed	Suzhou Center Bridge	Suzhou, China	SWA Group
Fixed	Southern Gateway Public Green	Dallas, USA	SWA Group
Fixed	Portsmouth Square	San Francisco, USA	SWA Group
Fixed	The Bentway	Toronto, Canada	Public Work
Fixed	Passerelle Pont Adolphe	Luxembourg, Luxembourg	CBA Architects
Fixed	Van der Donck Park	Yonkers, USA	Saratoga Associates
Fixed	Houston Bridges	Houston, USA	SWA Group
Fixed	Promenada	Velenje, Slovenia	Enota
Fixed	CityThread	Chattanooga, USA	SPORTS Collaborative
Mobile	El Paso Pedestrian Pathways	El Paso, USA	SWA Group
Mobile	Parkmobiles	San Francisco, USA	CMG
Mobile	Sunset Triangle Plaza	Los Angeles, USA	Rios Clementi Hale Studios

Figure 5. Examples of 60 of the 404 infrastructure reuse and co-use projects surveyed. Image credit: SWA Group/XL Lab.

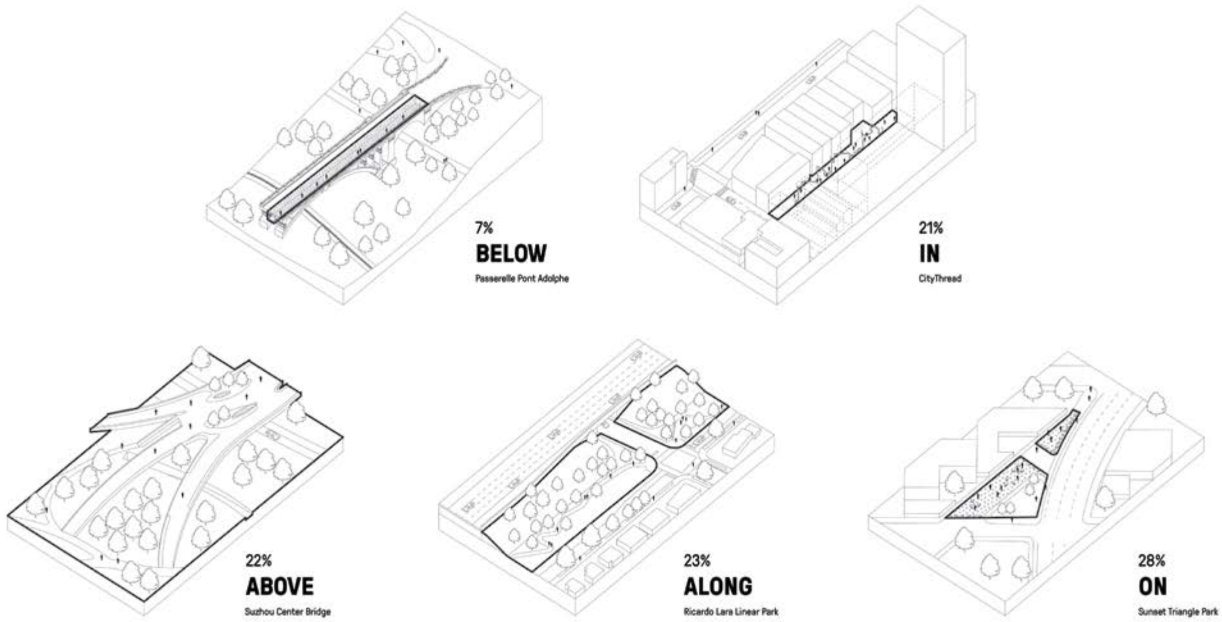

Figure 6. Five example infrastructure projects demonstrating positions and the ratios of each found in the 404-project data set. Image credit: SWA Group/XL Lab.

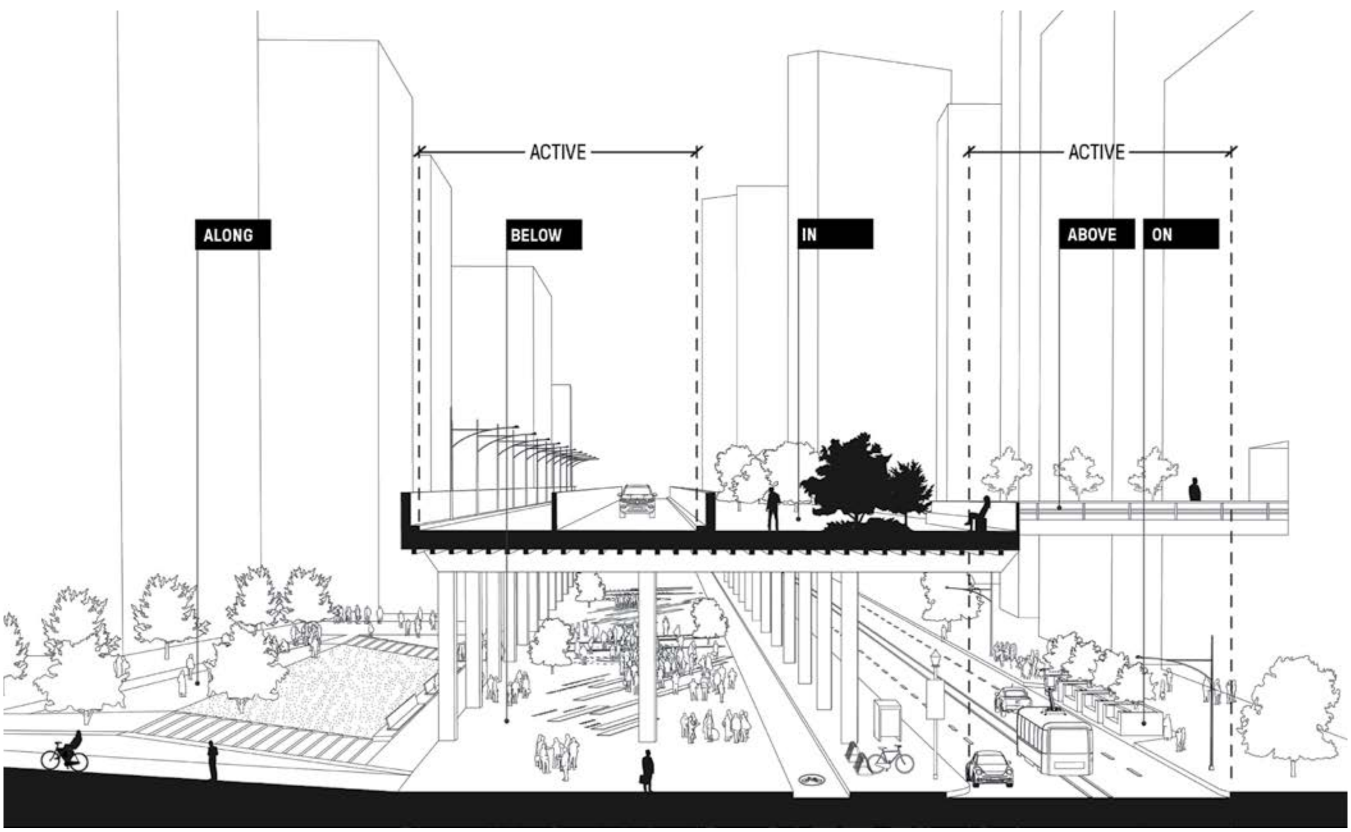

Figure 7. Road infrastructure section, composite view of five positions. Image credit: SWA Group/XL Lab.

would reflect a real-world relationship between the total of permanent vs. temporary design interventions.

Re-use projects made up 71% and co-use projects 29% of infrastructure projects. Reuse projects could also be called post-industrial for the most part; the original infrastructure is disused, decayed, out of use, or discarded, then revived for public space provision. Co-use projects happen when a section of the port, river, rail, or road infrastructure is being actively used at the same time for the original transportation purpose, in addition to public space. This could mean a sidewalk widening that takes over one lane of an active road, but continues to accommodate car and truck traffic alongside new pedestrian uses, as in El Paso Pedestrian Pathways in figure 3.

Depending on the transportation type, the ratio of co-use projects varied and increased the more recent the transportation technology (figure 4). The project data set seems to reflect the gradual obsolescence of older transportation regimes. Port infrastructure has the least amount of co-use as it transitions away from its industrial uses. Road infrastructure has the highest ratio of co-use as the dominant transportation system at the current moment. This may seem expected—as time marches on older systems and technologies fall into decay—however when one considers the current primacy of global shipping by container vessels, the suggested obsolescence in port infrastructure presents a problem. There may be something else at work here where current operations in port infrastructure are less compatible with co-use, or less overt than other infrastructure types, such as the completely man-made systems of rail and road.

Most projects were positioned in section one of four ways—*along*, *above*, *in*, or *on* the active transportation surface. These four positions showed up each about 20-30% of the time. More rarely, the project was positioned *below* the infrastructural surface, at 7% of the time. This is more common in rail and road infrastructures that can be elevated versus river and port infrastructure, where projects classified as *below* would be submerged. As as a design firm, these positional strategies were of great interest as they often relate closely to the design strategies employed. Projects positioned *in* were within the transportation corridor or storage space of the infrastructural zone. Those *above*, bridged over the corridor space. Projects that were *along* were parallel to the transportation corridor. Lastly, projects were classified as *on*, these were temporary or movable interventions that usually sit on top of the surface.

FURTHER WORK

XL Lab is in the process of doing 28 detailed case studies which look at a select subset of these 404 projects and look in more detail at the network, design layout, details, funding, effects, and the originators of each project.

This review of 404 projects is a section of a larger project, provisionally called Middleweights: The Vanguard of American Urbanism. There is certainly more to do in this vein of research. This part of the project paves the way for understanding the catalysts for infrastructure reuse or co-use, the unique benefits of linear systems, lessons learned from failures, exclusive funding streams, and the political returns of investing in this type of open space. Our group is going forward with answering these further research questions, as well as applying the research to practice.

ENDNOTES

1. Eric Klinenberg, *Palaces for the People: How Social Infrastructure Can Help Fight Inequality, Polarization, and the Decline of Civic Life,* Reprint edition (New York: Crown, 2019).
2. Pomponi, Francesco, Ruth Saint, Jay H. Arehart, Niaz Gharavi, and Bernardino D'Amico. "Decoupling Density from Tallness in Analysing the Life Cycle Greenhouse Gas Emissions of Cities." Npj Urban Sustainability 1, no. 1 (July 5, 2021): 1–10. https://doi.org/10.1038/s42949-021-00034-w.
3. Maddox, David. "Justice and Geometry in the Form of Linear Parks." The Nature of Cities (blog), April 18, 2016. https://www.thenatureofcities.com/2016/04/18/justice-and-geometry-in-the-form-of-linear-parks/.
4. Jo Black, Katie, and Mallory Richards. "Eco-Gentrification and Who Benefits from Urban Green Amenities: NYC's High Line." Landscape and Urban Planning 204 (December 1, 2020): 103900. https://doi.org/10.1016/j.landurbplan.2020.103900.
5. Lang, Steven, and Julia Rothenberg. "Neoliberal Urbanism, Public Space, and the Greening of the Growth Machine: New York City's High Line Park." Environment and Planning A: Economy and Space 49, no. 8 (August 1, 2017): 1743–61. https://doi.org/10.1177/0308518X16677969.