DEPARTMENT OF TRANSPORTATION

Mitigating Community Harms of Dense Highway Infrastructure – Spaghetti Junctions

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16. Abstract (Limit: 250 words) Spaghetti junctions, connecting multiple highways in one dense junction, have improved vehicular connectivity and promoted economic growth. However, their benefits are unevenly distributed, with communities located near the infrastructure often bearing a disproportionate share of costs. Documented impacts on these communities include community fragmentation, displacement, and isolation; reduced property values and local business decline; and increased air and noise pollution, soil and water contamination, and associated health risks. Over the past two decades, growing recognition of these harms has spurred local- and state-led initiatives, many of which aim to balance the community's well-being, equity, and environmental sustainability with transportation needs, while addressing historical injustices. This research analyzes strategies implemented across the U.S. to mitigate the adverse effects of dense highway infrastructure, offering insights to inform similar efforts in Minnesota. The study includes a literature review, a nationwide scan, eight case studies showcasing diverse approaches and contexts, and successful practices to mitigate the harms of dense highway infrastructure. Findings highlight that changes in practices are central to successful mitigation efforts, particularly those around stakeholder engagement that prioritize meaningful involvement of affected communities and cross-sector collaboration.			
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Final Report

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List of Abbreviations

Acronym	Description
ADA	Americans with Disabilities Act
ADID	Atlanta Downtown Improvement District
ARRA	American Recovery and Reinvestment Act
BC	Black carbon
BIPOC	Black, Indigenous, and People of Color
CAC	Community Advisory Committee
CEI	Design and Construction, Engineering, and Inspection
dB	Decibels
dBA	A-weighted decibels
DCR	Department of Conservation and Recreation
DDA	Downtown Development Authority
DOT	Department of Transportation
DREAM	Department of Real Estate & Asset Management
DWSD	Detroit Water and Sewerage Department
EGLE	Michigan Department of Environment, Great Lakes, and Energy
FDOT	Florida Department of Transportation
FEC	Florida East Coast
FHWA	Federal Highway Administration
GDOT	Georgia Department of Transportation
HOT	High Occupancy Toll
HUTDF	Highway User Tax Distribution Fund
ILE	Inner Loop East
ILN	Inner Loop North
MARTA	Metropolitan Atlanta Rapid Transit Authority
MDOT	Michigan Department of Transportation
MMSD	Milwaukee Metropolitan Sewerage District
MnDOT	Minnesota Department of Transportation
MOU	Memorandum of Understanding
MPH	miles per hour
NCTCOG	North Central Texas Council of Governments
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
NYSDOT	New York State Department of Transportation
ORC	Owner's Representative Consultant
PID	Public Improvement District
PM	Particulate Matter
PPP	Public Private Partnership

RAP	Recycled Asphalt Pavement
RCN	Reconnecting Communities and Neighborhoods
ROW	right-of-way
SANDAG	San Diego Association of Governments
SBE	Small Business Enterprise
TIF	Tax Increment Financing
TIGER	Transportation Investment Generating Economic Recovery
TREC	The Real State Council
TSNDC	Town Square Neighborhood Development Corporation
TxDOT	Texas Department of Transportation
WisDOT	Wisconsin Department of Transportation
WRPF	Woodall Rodgers Park Foundation

Executive Summary

Complex highway interchanges, often referred to as “spaghetti junctions,” have contributed to improved vehicular connectivity and increased economic activity in many metropolitan areas. Yet there is growing recognition that communities located near them experience a disproportionate share of the costs of dense highway infrastructure, such as community fragmentation, concentrated noise and air pollution, and decreased property values. This study investigates innovative approaches taken by states and localities to mitigate the adverse impacts of dense highway infrastructure, with the aim of identifying successful approaches to mitigating community harms and providing examples to the Minnesota Department of Transportation (MnDOT) for consideration of such approaches in Minnesota.

Research Methods

To investigate successful approaches to mitigating community harms of spaghetti junctions, the research team conducted a review of existing research, a national scan of projects, and case studies of eight projects reflecting diverse strategies for addressing the adverse impacts of dense highway infrastructure. Case studies incorporated interviews with key stakeholders; reviews of project websites and reports, newspaper articles, and presentations as well as articles and historical records relating to the impact of highway construction for communities located near spaghetti junctions; and an examination of land-use patterns and Census data on the demographic composition of populations living near each junction. The research team then connected findings from the literature review, national scan, and case studies to existing MnDOT policy and guidance to provide insights regarding the implementation of such approaches in Minnesota.

Case Study Findings

The study examines projects and impacted communities within one mile of spaghetti junctions and identifies strategies for addressing adverse community impacts, including freeway cap parks, highway underpass parks, and infrastructure removal and/or reconfiguration. Projects that involve one or more of these strategies typically aim for improvements in multiple aspects, including impacts on community (such as community fragmentation and displacement, isolation of communities, destruction of community and cultural landmarks, and both physical and mental health impacts); impacts on the environment (such as increased air pollution, noise pollution, soil degradation, heavy metal contamination, and water pollution); and impacts on the economy (such as declines in economic outputs such as business development, employment, and property values).

Analysis of case study data reveals a set of findings about the design and implementation of projects focused on addressing the community harms of spaghetti junctions (shown in ES Table 1).

ES Table 1: Findings from case studies

Subject Area	Key Findings
General	1. Projects are highly localized and contextual. While engineering factors help direct choices about design, ongoing and intentional involvement between stakeholders and communities, active communication, agility, and willingness to innovate are key factors in moving projects forward. 2. Changes in practice, rather than changes in policy, appear to facilitate project implementation and success. As such, the findings provide limited guidance regarding policies, regulations, or guidelines that MnDOT might adapt or change to mitigate harm for communities impacted by dense highway infrastructure.
Project Design and Funding	3. Most projects originate at the local level and are carried forward by local actors. In two cases, projects were initiated by the state DOT and adapted to accommodate local interests. 4. Project design choices are determined by multiple factors including characteristics of the transportation infrastructure and traffic volumes, availability of funding, alignment of interests across diverse stakeholders, and project history. In some cases, the strategy chosen to ameliorate community harms is determined decades prior to implementation. 5. Projects require coordination, but not always active collaboration, between the state DOT and local actors.
Project Governance and Stakeholder Engagement	6. The structure of project governance, ongoing operation, and maintenance varies across projects. 7. Projects bring together multiple actors across levels of government. Alignment of interests across actors and agility are necessary precursors to securing funding and project implementation. 8. Community engagement varies across cases and is shaped by the composition of the project area as well as the best practices at the time. In some cases, engagement undertaken by local actors is distinct from engagement that occurs as part of state or federal requirements.
Project Impacts and Use of Infrastructure	9. A primary aim of projects is to draw people into the space through amenities, recreational facilities, etc. Success in activating the area varies, determined by factors including surrounding land use and funding available. 10. Project benefits in terms of livability factors such as improved safety, health and environment, or sense of place accrue to the areas adjacent to the junction, but not necessarily the communities originally impacted by the construction of the junction.

Application of Case Study Findings to Minnesota

The case studies indicate that effective mitigation of adverse community impacts of spaghetti junctions begins with meaningful public engagement to understand the perspectives and needs of community members who live nearby this type of infrastructure. An analysis of current MnDOT policies and guidance reveals that current policies highlight many methods of public engagement adopted in successful projects. These methods extend beyond "traditional" forms of engagement, enabling meaningful forms of engagement with the public and other stakeholders. This finding is consistent with case study findings emphasizing changes in practice, rather than changes in policy, as necessary for facilitating project implementation and mitigation of community impacts.

To support MnDOT and project partners in their efforts to mitigate the impacts of dense highway infrastructure projects, the study concludes by developing a list of successful practices and strategies adopted across these case studies, focusing largely on practice changes that project managers might use to more effectively engage the public to identify community needs and potential solutions. Because community concerns often extend beyond transportation, researchers used the MnDOT Metro District´s Livability Framework to categorize the successful practices (shown in ES Table2). The pillars are equally important and are organized by their importance in mitigating community impacts. Finally, the study offers a set of metrics and qualitative indicators for assessing implementation and effectiveness.

ES Table 2: Successful practices by factors of the MnDOT Metro District's Livability Framework

Livability Framework Factor	Definition and Successful Practices
Trust	*"To create and maintain a livable transportation system, transportation authorities must build and retain stakeholders' trust through fostering long-term, good-faith relationships."* • Involve the general public, local stakeholders, and transportation partners in the process from the very beginning • Involve the general public, local stakeholders, and transportation partners throughout the project • Provide a single online source of project information • Respect local expertise on how and when to engage the public
Equity	*"Transportation investments that ensure the distribution of benefits and burdens of transportation systems and services are fair and just, which historically has not been fair. Transportation equity requires ensuring that underserved communities, especially Black, Indigenous, and people of color, share in the power of decision-making."* • Recognize inequities associated with previous transportation projects • Empowering the public by sharing some decision-making authority with them • Adopt design elements that minimize displacement of existing residents and businesses • Make commitments to distribute project benefits to more vulnerable members of surrounding communities

Livability Framework Factor	Definition and Successful Practices
Health and Environment	*"A livable transportation system bolsters the health and well-being of people who live, work, and play near system corridors. A livable transportation system requires investments that prioritize delivering benefits to Black, Indigenous, and people of color (BIPOC) and low-income communities who disproportionately endure the most severe health-related transportation burdens."* • Increase green spaces in public areas • Improve the aesthetics and environmental aspects of the area • Provide or improve activities available in the area (e.g., yoga classes, bike paths)
Economics	*"A livable transportation system connects people to jobs, boosts local economies, and creates wealth-building opportunities for communities, especially in under-resourced communities."* • Incorporate business programs (e.g., small business enterprise programs) • Adopt strategies to improve the economic vitality of the area
Sense of Place	*"A livable transportation system supports each neighborhood's unique sense of place. A strong sense of place makes people feel at home in their community and connected to their neighbors and culture."* • Adopt strategies that "activate" or draw people into the area, such as walking or biking paths, community gathering spaces, playgrounds, or space for commercial activities • Adopt strategies to center the perspectives of communities that have been harmed by dense highway infrastructure construction
Connections	**"***A livable transportation system gives people safe, efficient, and affordable multi-modal options to access places of social, economic, natural, and cultural significance."* • Adopt the Complete Streets approach
Safety	*"A livable transportation system ensures that everyone, regardless of their mode of transportation, can travel safely and without risk to their well-being. This goes beyond the prevention of physical accidents; it also includes the protection of personal security and the preservation of people's well-being, keeping them safe from danger, harm or threats while using the transportation system. A livable system invests in mitigating safety issues that disproportionately affect low-income and Black, Indigenous, people of color (BIPOC) communities."* • Create a safe environment for intended users that is designed to draw people in, such as installing lighting on a new walking path • Create safe alternatives for unintended users of such spaces, such as a connection to emergency housing for homeless individuals who might seek to use the area to sleep • Include ongoing maintenance and upkeep to ensure that the area remains safe for both intended and unintended users

Chapter 1: Introduction

Spaghetti junctions, or complex interchanges connecting multiple highways and interstates in one dense junction, have played a significant role in improving vehicular connectivity and promoting economic growth in many metropolitan areas. The benefits and burdens from this type of dense highway infrastructure, however, are not evenly distributed. Communities located near the infrastructure often bear a disproportionate share of costs. Documented impacts on such communities include community fragmentation and displacement, community isolation, and negative health outcomes. Research also documents environmental impacts such as increased air pollution, noise pollution, soil degradation, and water pollution, all tied to corresponding health concerns. Communities located near spaghetti junctions also face economic challenges related to the decline of property values, and local businesses may struggle to stay viable due to changes in traffic flow.

The past 20 years have witnessed a growing interest in projects and initiatives led by local stakeholders and state departments of transportation (DOTs) aimed at addressing the negative impacts of dense highway infrastructure. This shift has been driven in part by the recognition of the adverse effects on communities, particularly those located near spaghetti junctions or other complex highway interchanges. Many projects and initiatives aim to balance community well-being, equity, and environmental sustainability with transportation needs, while also addressing historical harms caused by previous planning decisions.

This research project analyzes strategies used across the United States to mitigate community harm caused by dense highway infrastructure, with the aim of identifying strategies, policies, and practices that can be adopted in Minnesota. Through a comprehensive review of existing literature, a national scan of strategies designed to lessen the impacts of dense infrastructure and spaghetti junctions for surrounding communities, in-depth case studies of projects representing diverse strategies, scope, and geography, and an analysis of Minnesota Department of Transportation (MnDOT) policy and guidance, the project identifies a set of recommendations for mitigating the negative community impacts of spaghetti junctions in Minnesota.

The report proceeds as follows. The second chapter reviews existing literature to inventory the community, environmental, and economic impacts of dense infrastructure projects, with a particular focus on spaghetti junctions. The third chapter presents the results from a nationwide scan of strategies used across the United States to mitigate the impacts of dense highway infrastructure projects. The fourth chapter presents findings from eight case studies that further investigate the efforts taken to address community harms using one or more of the strategies identified in the second chapter. The last catalogues successful practices used in other states that have contributed to mitigating the harms of dense highway infrastructure, using MnDOT's Metro District's Livability framework. The results of this analysis will be used by MnDOT to implement projects that advance equity and improve the quality of life for communities located near dense highway infrastructure in Minnesota.

Chapter 2: Literature Review

This chapter reviews literature on the impacts of dense highway infrastructure, with a particular emphasis on spaghetti junctions. *Spaghetti junction* is the common name for complex or massively intertwined road traffic interchanges. Typically, spaghetti junctions are interchanges in dense highway systems, connecting multiple major highways and interstates in one dense junction. The dense junction typically creates stack interchanges, in which the on and off-ramps for the various highways are stacked vertically rather than horizontally. These junctions are a safer but more costly and space-consuming alternative to traditional interchanges (Jovanović & Atelšek, 2020).

The literature regarding spaghetti junctions specifically is fairly limited and is sometimes contained within literature about broader highway systems. As a result, while this chapter includes literature focused specifically on spaghetti junctions when available, it also draws from research focusing on broader highway infrastructure as it offers valuable context on the impacts of dense highway infrastructure.

2.1 Impacts of Spaghetti Junctions

The literature identifies impacts relevant to areas located near spaghetti junctions or other dense highway infrastructure that generally fall into three categories: community impacts, environmental impacts, and economic impacts. This subsection discusses impacts in each of these areas.

2.1.1 Community Impacts

Community impacts are impacts for neighborhoods, local institutions, and residents living near spaghetti junctions and dense highway infrastructure. These impacts include community fragmentation and displacement, isolation of communities, destruction of community and cultural landmarks, and both physical and mental health impacts.

It is important to note that there are few studies that focus on the community impacts of spaghetti junctions specifically. Rather, impacts are identified in studies of highway construction more broadly. In some instances, the interchange itself was built after the construction of a highway, creating negative impacts for the surrounding communities. Research does highlight a cycle of disinvestment in areas adversely affected by highway development (Archer, 2021), which may have made such areas more likely to experience the subsequent development of dense highway infrastructure. More research is needed on the particular effects of spaghetti junctions on surrounding communities.

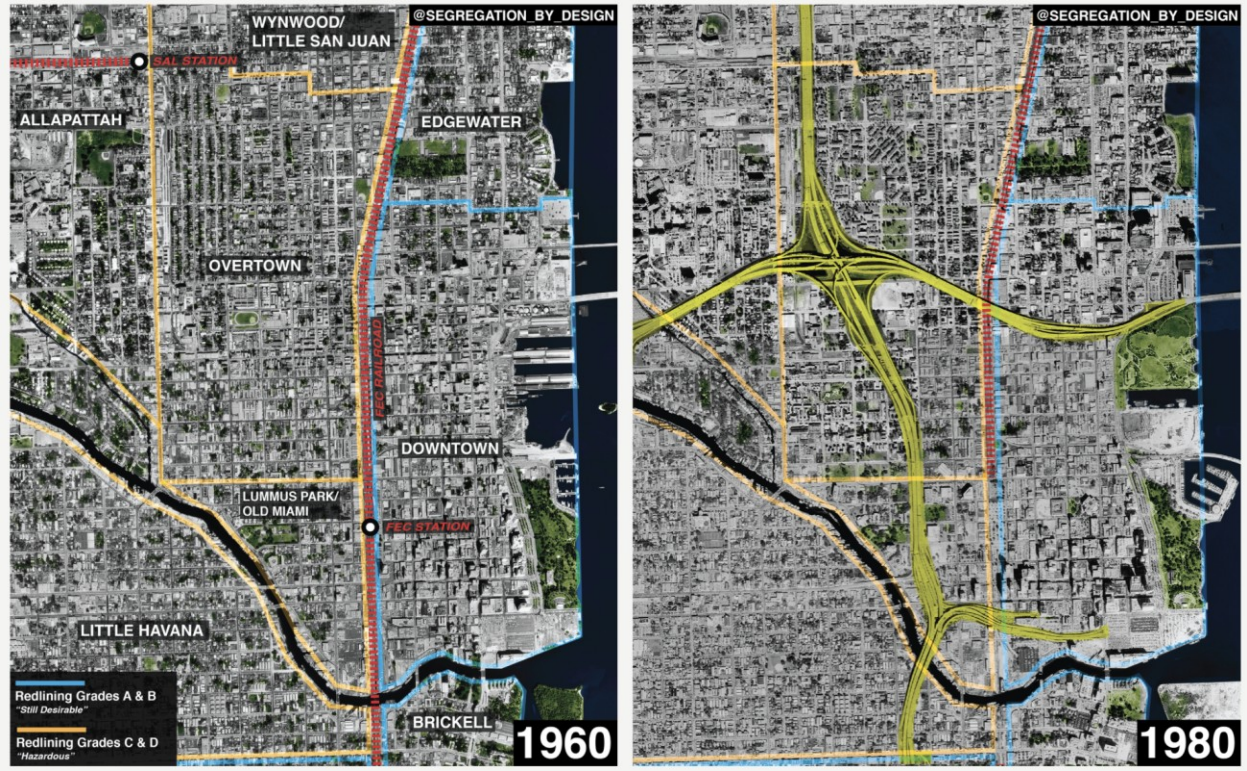
Community Fragmentation and Displacement: While the literature is limited, there are examples of the construction of spaghetti junctions, and highways more generally, bisecting communities and displacing residents. Historically, fragmentation and displacement occurred disproportionately in low-income and minority (primarily African American or Latino) communities. Factors including racial bias, lack of political representation, and the role of lower cost criteria in site selection was often tied to the

selection of less-advantaged and minority communities for dense highway infrastructure construction (Estrada, 2005; Loukaitou-Sideris et al., 2023).

Prior to the construction of the interstate highway system, segregation and discriminatory housing policies led to concentrated areas of African American residents and businesses in many cities across the United States. These neighborhoods were among the most impacted by highway construction. For example, the construction of I-40 in Nashville, Tennessee, in the 1950s led to the demolition of over 620 African American homes, 27 apartment complexes, and six African American churches, despite the efforts of a group of African American professionals who formed the I-40 Steering Committee to oppose the construction (Mohl, 2014). The infrastructure also separated three prominent African American community institutions (Fisk University, Meharry Medical College, and Tennessee A. & I. University) from each other and from the African American community. The construction of I-40 also created barriers between children and their playgrounds and schools, congregants and their churches, and businesses and their customers. Notably, the junction located near the segment of I-40 that displaced African American residents and businesses (the I-40 and I-65 interchange) opened several years after the initial construction of I-40.

This pattern of community fragmentation and displacement was replicated across the United States. For example, the construction of I-95 in Miami, Florida, in the 1960s, led to the fragmentation of African American neighborhoods (Kim, 2021; Mohl, 2014) – see Figure 2.1. The highway transformed the neighborhood of Overtown from a middle-class and cultural center of African American residents into a distressed inner-city area. The construction took 40 square blocks, displaced 12,000 people living in adjacent residential areas, reduced the African American of Overtown population from 45 to 24 percent, and led to a reduction of roughly 28 percent of local businesses from 1949 to 1966. In West Newton, Massachusetts, the Massachusetts Turnpike interchange ruptured the African American community that was organized around the Myrtle Baptist Church (Rubin, 2006).

Similarly, in St. Paul, Minnesota, the construction of I-94 displaced one-seventh of the African American residents of the Rondo Community (Archer, 2021). About 72 percent of homes demolished were homes to African Americans (Cavanaugh, 2006). The area also lost many black-owned businesses (such as barbershops and movie theaters) that were never replaced. The highway disrupted social cohesion, reduced residents' ability to walk and bike, and initiated a period of economic and social decline for the community (FHWA, 2024).



Source: *(Susaneck, 2024)*

Figure 2.1 Downtown Miami and Overtown before and after I-95 construction

Other minority communities were also affected by dense highway infrastructure construction (Loukaitou-Sideris et al., 2023). For instance, the construction of I-5 through Barrio Logan in San Diego, California, forced the displacement of Mexican American residents; the construction of I-980 in Oakland, California, isolated the Latino and African American community in the area; the Cross Bronx Expressway in New York City, New York, pulled apart the fabric of the local working-class Jewish community; and the Ford Freeway in Detroit, Michigan, cut through Jewish, German, and Italian immigrant neighborhoods, as well as African American communities.

There is also evidence that the effects of dense highway infrastructure construction persisted beyond the immediate community fragmentation and displacement caused by the construction and highway footprint. For instance, although owners of properties condemned for freeway construction were reimbursed according to “fair market values,” in many cases, property values were already depressed. Those who remained in the area often reported a loss in sense of community, and experienced rapid property depreciation due to proximity to highway and noise and air pollution problems. Some minority residents struggled in subsequent years to find housing in nearby areas due to the higher housing prices, higher rents, and continuous segregation, leading many to relocate (Loukaitou-Sideris et al., 2023).

Isolation of Communities: Some highway dense infrastructure was intended to separate African American neighborhoods from white neighborhoods. In Alabama, for instance, the state located interstate highways in African American neighborhoods with the aim of displacing current residents and

preventing African Americans from encroaching on white neighborhoods, punishing the leaders of the civil rights movement, and displacing registered voters (Retzlaff, 2020). The separation of communities from one another persists to this day. In Orlando, Florida, I-4 separates African American communities on west side of the city from white communities and the central business district on the east side. In Syracuse, New York, I-81 acts as a barrier between white and minority communities and separates high-income from low-income neighborhoods (Archer, 2021; Retzlaff, 2020).

The isolation of communities can create a cycle of disinvestment and isolation. For example, the construction of I-81 in the 1950s and 1960s cut through the urban center of Syracuse, New York, decimating the predominantly African American and Jewish 15th Ward (see Figure 2.2). When residents of this area moved to other city neighborhoods, middle- and upper-class residents moved to the suburbs. This contributed to lack of investment in public services in the area (such as transit) and perpetuated the disconnection of low-income residents who remained in the area from work, school, and opportunity. Housing for low-income families remains concentrated around the I-81's elevated overpass (Archer, 2021).

Panel A: Syracuse's 15th Ward neighborhood, before construction

Panel B: The interchange of I-81 and I-690 in Syracuse, after construction in 1969

Sources: (Arpey, 2022; The S.I. Newhouse School of Public Communications, 2021).

Figure 2.2 Before and after of the construction of I-81 in Syracuse

Destruction of Community and Cultural Landmarks: The construction of spaghetti junctions also contributed to the destruction of community and cultural landmarks, especially churches in racial minority areas and sacred places of Native nations. In California, the construction of the East Los Angeles

Interchange and 23-27 lanes traversing the interchange consumed 135 acres of land, displacing places of worship such as Saint Isabella and bisecting Hollenbeck Park in Boyle Heights, one of the most prominent Mexican American neighborhoods in Los Angeles. Similarly, the Pacoima neighborhood in Los Angeles, California, lost a 40-acre park to construction of I-5, which required 31 acres of land for a cloverleaf interchange. When the state purchased the area from the City of Los Angeles Recreation and Park Commissioners, the parties agreed to compensate the community by building another park - a promise that to this date remained unfulfilled (Loukaitou-Sideris et al., 2023).

As another example, the Macarthur Maze near the San Francisco–Oakland Bay Bridge in Oakland, California (see Figure 2.3) was constructed on Shellmounds - a sacred burial ground of the Ohlone, an indigenous tribe in California (Roosblad, 2019). This site was the largest of 435 burial sites around the Bay Area and was also used for sacred ceremonies by the Ohlone people. The continuous commercial and residential developments that occurred following construction of the interchange contributed to the further desecration of the Shellmounds.

Sources: *(Astaneh-Asl, 2011; Eric, 2020).*

Figure 2.3 MacArthur Maze aerial view 1950 and 2020

Health Impacts: Existing research documents both physical and mental health impacts of dense highway infrastructure on nearby communities. Health impacts are primarily related to the environmental impacts (discussed in the following subsection) and are more acute in vulnerable populations such as minority communities and economically disadvantaged neighborhoods, contributing to health disparities in urban areas (Fuller et al., 2013; Samuels & Freemark, 2022; Sanchez et al., 2004).

Respiratory impacts - Several studies demonstrate increased prevalence of respiratory impacts from exposure to elevated concentrations of traffic-related air pollutants which are concentrated near dense highway infrastructure (Bonner, 2022; Mortimer et al., 2002; Wjst et al., 1993). In Pacoima, California, for instance, asthma rates among residents increased about three percentage points between 2012 and 2017, leading to an rate of 20 percent in 2017 (Loukaitou-Sideris et al., 2023). Community leaders in the area attributed these increasing asthma rates to the environmental precedent set by freeways and

establishment of industrial facilities including an asphalt recycling center, refineries, landfills, and dumping sites in the neighborhood.

Research focusing on the general highway system also provide evidence of increased respiratory impacts near highway corridors. For instance, studies show that living within 1,000 feet of a freeway is associated with diminished lung function, increased lung cancer risk, elevated asthma hospitalizations heightened bronchitis risk, and a general rise in pediatric medical visits (Brugge et al., 2007; Hystad et al., 2013; Loukaitou-Sideris et al., 2023; Samuels & Freemark, 2022). Similarly, studies focusing on children find that children residing or attending school within 100 to 500 meters (about 300 to 1,600 feet) of highways exhibit more lung deficiencies and lifelong respiratory conditions, compared to those located further away (CEPA, 2017; Gauderman et al., 2007; Hauptman et al., 2020). Other studies have found that residents living close to freeways attest to the persistent dustiness and report a need to install air extractors in homes to mitigate respiratory impacts (Kopnina & Shoreman-Ouimet, 2011; Roosblad, 2019).

Psychophysiological responses to noise exposure – Finally, there is evidence that high levels of traffic noise, especially near busy highways, can contribute to permanent and temporary hearing loss and tinnitus, sleep disturbance, annoyance, cognitive disruption, and stress (Corbisier, 2003; Gilani & Mir, 2022; Stansfeld et al., 2000; Terry et al., 2021; Welch et al., 2023). For example, one study found evidence of an increased risk of damage in the auditory system with exposure to road traffic noise greater than 70 decibels (dB) (Wang et al., 2021).

2.1.2 Environmental Impacts

Dense highway infrastructure has wide-reaching environmental consequences. This section discusses air pollution, noise pollution, soil degradation, heavy metal contamination, and water pollution.

Of the three areas of impact, research on environmental impacts is perhaps the most extensive. As is the case with other areas, although some studies focus on spaghetti junctions, the literature tends to emphasize highways more broadly. While there is limited research pertaining to spaghetti junctions specifically, it is reasonable to suspect environmental impacts to be magnified in dense highway interchanges due to the increased traffic volume and speeds that such interchanges can accommodate.

Air pollution: Several studies have examined the impacts of spaghetti junctions and dense highway infrastructure on the emission of air pollutants (such as particulate matter [PM]10, PM2.5, nitrogen dioxide, and carbon monoxide) and diminished air quality, and associated escalation of health risks (discussed in the previous section). Studies date back to the introduction of dense highway interchanges as a transportation strategy. For example, one of the oldest spaghetti junctions, constructed in 1968 in Birmingham, United Kingdom, raised public awareness about the impacts of such infrastructure on air pollution, lead pollution, and noise, and its consequences for human health. A 1974 report revealed an 80 percent increase in lead levels in air from 1972 to 1974 (Central Unit On Environmental Pollution, 1974). In addition, a later study also provided evidence of the total particle number concentration,

which was significantly higher at the roadside of this intersection relative to other sites consider in the study (Shi et al., 1999).

Air pollution in spaghetti junctions is high given the amount of traffic that these accommodate. The East Los Angeles Interchange in California, designed for 450,000 vehicles per day, now accommodates around 1.7 million vehicles daily, creating one of the most concentrated air pollution pockets and has led to violations of state and federal air quality standards (Estrada, 2005).

General highway studies that use proximity models to determine exposure zones for traffic-related air pollution highlight the pronounced elevation of air pollution levels as a result of vehicle emissions in the vicinity of freeways and for those within vehicles in traffic and on roadsides (Bonner, 2022; Brugge et al., 2007; Downs, 2004; HEI, 2010; Houston et al., 2016; Patton et al., 2014; Schraufnagel, 2020).[1] However, the increase in air pollution levels (measured by the extent and slope of the distance-decay gradients) differs based on a variety of factors including neighborhood infrastructure (such as street canyons, roadside structure, noise barriers, elevated or sunken roadways, and tree and shrub buffers), pollutant type, the mix of light- and heavy-duty vehicles, vehicle speeds, meteorologic conditions, season, and time of day (HEI, 2010; Patton et al., 2014).

Pollutants consistently reported at heightened levels near highways include ultrafine particles, black carbon (also known as soot), nitrogen oxides, and carbon monoxide. One study of I-710 and I-405 in Los Angeles found a significant increase in measured pollutants closer to the freeway (Brugge et al., 2007).

Noise pollution: Noise pollution is another impact of dense highway infrastructure such as spaghetti junctions. Despite constituting a key concern for planners, regulatory bodies, and communities in the United States, there is limited research on noise levels in spaghetti junctions, and research is still emerging on topics including in-vehicle noise and consequences for public health (Lee et al., 2014). Studies have found increased levels of noise due to dense highway networks, for which low-speed truck traffic contributes the most. The increase, however, varies depending on the traffic flow, vehicle speed, vehicle type, characteristics of the road surface, and neighborhood characteristics, including the landscape and layout of buildings (Alesheikh & Omidvari, 2010; Awwal, 2021; Vij & Agrawal, 2013). High levels of noise are associated with psychological impacts, elevated heart rates, hearing loss, disruption of spoken communication, and disturbance of sleep cycles as described in the previous section.

There is evidence that spaghetti junctions, designed to accommodate higher volumes of vehicles at elevated speeds, contribute to increased noise pollution. Such environmental impacts were recognized early on, as seen in the case of the Gravelly Hill intersection in Birmingham, United Kingdom. A government study conducted in the 1970s near the M6 at Perry Bar found noise levels ranging from 74 to 67 A-weighted decibels (dBA), a unit of measurement that assesses levels of noise pollution (Shelton, 2010).

[1] Exposure zones for traffic-related air pollution vary from 50 to 1500 meters from highways, with meta-analyses suggesting a range of 300 to 500 meters (HEI, 2010).

In the United States, high levels of noise from dense highway infrastructure have been documented, but literature about the extent or levels of such noise is limited. Roosblad's (2019) documentation of the Macarthur Maze in California offers one anecdote from an older woman talking about the grumbling sound of the infrastructure in the background: "I have been hearing this sound for 73 years now. From the time I was born until today, that noise has been a part of me." Similarly, a study of the Massachusetts Turnpike in Boston, Massachusetts documents an increase in noise emissions during the COVID-19 pandemic, despite a general reduction in human activity. The increase in noise emissions was due to higher vehicle speeds and tire/road interactions. Commercial vehicles, prevalent on major freeways like US 93, were found to generate more noise and likely constituted a higher proportion of overall traffic volume during COVID compared to pre-pandemic times (Terry et al., 2021). Because such factors are likely to be magnified in areas of dense highway infrastructure, it is reasonable to suspect increased noise pollution in such areas as well.

High levels of noise also impact commuters. One study assessed the risk of hazardous noise exposure on State Highway 288 in Houston, Texas for 12 commuters and found that commuters were more likely to be exposed to noise levels between 75 dBA and 85 dBA, which exceeds the public health and welfare marginal safe level of 75 dBA (Li et al., 2016).

Soil degradation: The construction and functioning of dense highway infrastructure, including spaghetti junctions, cause alterations in the physical characteristics of the soil, referred to as soil degradation. Soil degradation includes changes in soil structure, texture, and elasticity and it is evidenced in diminished water stability of soil aggregates, elevated soil dispersion, increased rates of structural failure, reduced non-capillary pores, uneven pore distribution, heightened bulk density, and degraded soil texture. All of these alterations result in reduced fertility, corrosion resistance, and permeability (Zhang, 2020).

Heavy metal contamination: Studies have found that highway infrastructure in urban areas is associated with elevated concentrations of heavy metals in soil, which persist over time, and are challenging to remove. Heavy metals found around highways include zinc, cadmium, copper, and lead and result from higher traffic density, materials falling from vehicles (such as tire rubber, and metal platings on car parts), and poor condition of road surfaces. Their presence poses potential health hazards for communities and maintenance workers, as well as harm to living organisms along the highways (Turer & Maynard, 2003). Impacts are not limited to highway vicinities, as these heavy metals may be transferred from soil to runoff water, which can result in further impacts to downstream water quality and health conditions.

Heavy metal contamination along the highways is a long-term issue, with one study finding the presence of lead in northeast Los Angeles decades after leaded gasoline was phased out, with high concentrations in the area adjacent to an elementary school and an athletic field (Lejano & Ericson, 2005). Such findings highlight potential long-term public health and ecological risks associated with lead-soil contamination,

which are complicated by the challenges associated with soil remediation more generally (Estrada, 2005; Lejano & Ericson, 2005; Loukaitou-Sideris et al., 2023).[2]

Water pollution: Research on the influence of dense highway infrastructure's influence on water pollution focuses on the source of contamination and its impact on water quality across various water bodies. Pollutants on highways, accumulated during dry periods, lead to concentrated early runoff, negatively impacting water quality. This impact has been assessed through analyses of fine particles and toxicity, which is measured as microorganisms' mortality and reproduction inhibition (Kayhanian et al., 2012). Factors contributing to water pollution include high traffic volumes, pavement type, and the nature of pollutants (chemicals, heavy metals) from various sources such as vehicle emissions and atmospheric deposition (Opher & Friedler, 2010; Yannopoulos et al., 2019).

2.1.3 Economic Impacts

Dense highway infrastructure typically aims to maximize traffic flow and increase safety, which in turn results in enhanced vehicular mobility, boosted connectivity, and reduced costs (Brown et al., 2009; Chmielewski & Kempa, 2019). Scholars have examined the economic impacts of dense highway infrastructure in nearby areas by exploring changes in economic outputs such as business development, employment, and property values.

It is important to note that economic impacts are likely to vary based on the characteristics of the area surrounding spaghetti junctions. While some dense highway interchanges are located in industrial areas, others are surrounded by residential and commercial developments. In addition, as with other areas, more research is needed on the economic impacts of spaghetti junctions specifically.

Changes in business development: Scholars have found both positive and negative impacts on business development that depend on several factors such as the stages of the infrastructure project, infrastructure design, location-specific characteristics,[3] and new demands caused by the infrastructure (Funderburg et al., 2010; Wray et al., 2000).

Some studies have documented the displacement or destruction of businesses brought about by the construction of dense highway infrastructure. For example, one analysis of the interstate highway in Scotlandville, Louisiana, a rural area, documented a change in traffic flow away from the minority business district and displacement of 33 minority businesses. Displaced minority businesses also

[2] Soil remediation is challenging due to the persistence of contaminants and the complexity of soil ecosystems, which require targeted strategies for surface and subsurface pollution. Effective restoration efforts depend on understanding ecological processes, tailoring methods to specific contaminants and soil types, and navigating financial, logistical, and regulatory barriers. Additionally, community engagement and clear communication are essential for addressing concerns of affected populations (Baumhardt et al., 2015; Lejano & Ericson, 2005; Loukaitou-Sideris et al., 2023; Yannopoulos et al., 2019).

[3] This includes demographics of the community, topographic and environmental characteristics for the area, existing land use, planning and zoning policies, and urban vs exurban vs rural context among others.

experienced hardship in relocating and often ceased to operate, leading to a loss of jobs in the community (Steptoe & Thornton, 1986). Similar experiences have been documented for dense highway infrastructure in Sacramento, Pasadena, East Los Angeles, and Miami (Kim, 2021; Loukaitou-Sideris et al., 2023; Mohl, 2008).

Dense highway infrastructure, however, also impacts the area's access to nearby businesses, commercial markets, and regional markets, which may lead to increased business activity. McMillen & William Lester (2003) found that businesses tend to locate or have a higher demand for locations near dense highway infrastructure such as highway interchanges. According to Wray et al. (2000), after construction, industrial areas often remain industrialized, and the opportunities for warehousing and distribution increase. However, these may be re-developed for commercial and office use in cases in which there is a strong demand for space. The impacts on distressed areas are mixed, with some studies indicating economic growth and others showing economic decline. Interchange design also has important implications for the development of the area, particularly some areas suffered from aesthetic harm caused by large and unattractive structures that created shadows and an unpleasant environment (Wray et al., 2000).

Changes in employment: Scholars also examined the impacts on employment in areas near dense highway infrastructure. These impacts vary depending on the context of the infrastructure investment. Studying the impacts of dense highway infrastructure in three California counties[4] in the mid-1990s, Funderburg et al. (2010) found that surface transportation had a large impact on growth patterns. Of note, Orange County experienced a significant increase in new jobs after gaining highway access compared to no-build counterfactuals (between 13 to 9,410). However, Merced County (a rural area), experienced a significant negative impact (with a loss of 36 jobs per square kilometer). The authors did not find a significant effect on Santa Clara County (an urbanized area).

Analyzing infrastructure investments in Pacoima, Sacramento, Pasadena, and Los Angeles, California, Loukaitou-Sideris et al. (2023) found that highway development contributed to urban sprawl and the relocation of employment opportunities in suburban areas, making it difficult for low-income communities to access jobs far away from the city center. This coupled with the high cost of housing ownership in the suburbs and transportation costs further exacerbated the economic hardships of disadvantaged communities.

Changes in property values: Dense highway infrastructure impacts property values and the extent of it depends on various factors including the distance of the property to the infrastructure, land use in the area, and the infrastructure design. Carey & Semmens (2003) examined the effects of the development of Superstition Freeway (US-60), Arizona on land use and property values and found that, in the aggregate, property values tend to increase although some properties may experience adverse impacts. In addition, proximity to the infrastructure had a negative effect on the value of detached single-family

[4] The Guadalupe Freeway in Santa Clara County; Highway 99 bypass in Merced County; and the Eastern, Foothill, and San Joaquin Hills Transportation Corridors in Orange County.

homes but a positive effect on multifamily residential developments and commercial properties.[5] Lastly, according to the authors, the level of traffic in the area seems to be a factor determining the negative impact on property value.

Similarly, Cohen et al. (2022) studied the value of properties near I-84 in Hartford, Connecticut between 1940 and 1960. They found that properties located 0.5 mile or more away from the interstate experienced a 55 percent appreciation and that the appreciation decreased as the distance to the interstate increased (27 percent appreciation for houses within 1.25 miles). The authors acknowledge that although most houses in their sample experienced an increased value between the pre-announcement of I-84 and its construction, it may be possible that some properties that would have seen substantial depreciation and were close to the proposed highway ended up being demolished before the highway construction, and therefore not available in their dataset (the sample only included properties that had at least one sale in the 1960s, after construction).

In the case study of Pasadena, California, Loukaitou-Sideris et al. (2023) also found that properties located near the highway (within 150 meters of the freeway footprint – or about 500 feet) were adversely affected compared to properties beyond it. Although properties in the area, on average, experienced an increase in value, this was below the city average. Between 1960 and 1980, properties near the freeway experienced a 59 percent increase in value, while those beyond the freeway area experienced a 74 percent increase in value (with an average change in home value in the city of 66 percent). Findings from Loukaitou-Sideris et al. (2023) also show that rents in the study area in 1960 were lower than in Pasadena as a whole and the income difference was even greater, which suggest that residents in the study area paid a higher portion of their income for housing creating an additional barrier to homeownership and asset-building.

[5] The authors considered properties immediately adjacent to the highway, properties located within half mile of US-60, and properties located on a major mile street. According to their estimates, residential properties near the highway experienced a value reduction of $4,749 to $7,850 depending on their location, while properties in the broader impact area incurred a value reduction of $2,261 to $4,231 (in 2000 housing dollars). Contrarily, multifamily residential developments near the highway experienced a premium of $5,162, while those close to primary streets experienced a premium of $4,654.

Chapter 3: Nationwide Scan of Projects Mitigating Impacts of Dense Highway Infrastructure

3.1 Overview

This chapter provides an overview of strategies used across the United States and, to a limited extent, Canada to mitigate the negative impacts of spaghetti junctions on nearby communities. To identify strategies, the research team scanned projects in areas under or surrounding (within one mile of) spaghetti junctions. These projects are often found close to metropolitan areas where the neighborhoods around the junction existed prior to development of the highway system. While the impacts of highway infrastructure may be similar to the impacts of spaghetti junctions, the extent of the impacts is likely to be magnified in areas with complex interchanges or dense highway infrastructure. In addition, the complexity of the infrastructure may be a factor influencing the types of strategies and approaches used for mitigation purposes.

The research team reviewed research on transportation and urban planning and analyzed projects that received funding via federal programs to assist communities impacted by highway infrastructure. The team also relied on internet searches of specific spaghetti junctions to investigate efforts to reconfigure or otherwise adapt existing infrastructure to mitigate negative impacts for surrounding communities. Researchers documented projects that were implemented, are planned to be implemented, or receive funding for planning purposes. Appendix A provides a list of the projects identified in the scanning.

Strategies for mitigating harm include freeway cap parks, highway underpass parks, and infrastructure removal and/or reconfiguration. Embedded within these strategies are a variety of approaches that aim to address community, environmental, and economic impacts identified in the literature review. For example, several examples discussed in this chapter incorporate a Complete Streets approach, which is an approach to transportation planning that focuses on all kinds of transportation users, including pedestrians, bikers, and users of public transit in addition to drivers, and takes into account the full spectrum of ages and abilities. Design elements associated with a Complete Streets approach, such as dedicated transit lanes, bike lanes, and sidewalks can contribute to the reduction of air pollutants by reducing vehicle traffic and creating more space for airflow and pollutant dispersal (California EPA, 2017). Such elements may also aim to promote health benefits and enhance connectivity.

Some examples incorporate *greenification* approaches that aim to transform underutilized areas into green spaces (e.g., planting trees, and using plants in streets planters and walls). These approaches have a goal of generating positive health and environmental impacts. Still other examples include the adoption of an aesthetic or art-based approach. For example, in some of the identified projects, arts serve as a means to honor heritage, or are viewed as a form of resistance and reclamation for affected communities.

Across all projects identified, there is a variety of involved stakeholders. This variation includes different levels of government (federal, state, local) as well as public, private, and nonprofit sectors. Leadership

dynamics differ across projects: some are led by the government (state vs local) and others by community advocates or organizations. Overall, most of the projects identified in the scanning have a community involvement component. While most recent projects have an equity justice lens and rely heavily on community engagement, some projects, especially older ones, began in part due to community reactions to the negative impacts of highway construction.

There are additional strategies that address the environmental impacts of highway infrastructure that are not specific to spaghetti junctions. Such strategies include those designed to reduce or disperse the pollutants associated with highways with high traffic volumes. Strategies such as speed reductions, design elements that encourage airflow, sound barriers (sound walls, for example), and vegetation to disperse air and water pollutants have a robust base of research support for their impact on the environment (California EPA, 2017). While these strategies are shown to be effective in either reducing emissions and/or pollutants, or in reducing the impact of emissions and/or pollutants on local populations by dispersion; these strategies rarely focus on mitigating the impacts of spaghetti junctions or other dense highway interchanges specifically. Rather, such strategies aim to address the environmental impacts of roadways with high traffic volumes generally (California EPA, 2017). Indeed, some strategies are likely challenging to implement in spaghetti junctions, such as sound barriers and low-emission zones.

At the same time, some strategies that apply more broadly to highly dense infrastructure are featured in the projects identified, including new road reconfigurations that reduce top speed, tree planting or other forms of vegetation, and construction techniques or systems that are environmentally friendly (e.g., sylva cell systems, recycled asphalt pavement [RAP], warm-mix asphalt, etc.). Other strategies typically associated with high-traffic volume highways and used in some spaghetti junctions include high occupancy toll (HOT) lanes (e.g., I-85 Express Lanes in Atlanta, which includes the interchange of I-85 and I-285, and I-95 Express Lanes in northern Virginia, which run through the interchange connecting I-95, I-495, and I-395) and efforts to reduce the number of vehicles on the road (e.g., efforts to expand/connect public transit and support multi-modal transportation).

Lastly, several projects incorporate additional non-transportation-related strategies to address community impacts. Examples of this include updating land use/zoning policies as areas typically accommodating dense highway infrastructure are available or adapted for public use, fostering affordable housing developments, adopting anti-displacement strategies, and promoting economic development.

3.2 Project Strategies and Approaches

This section discusses strategies and approaches for mitigating the impacts of dense highway infrastructure. Strategies include freeway cap parks, highway underpass parks, and infrastructure removal and/or reconfiguration. Approaches, such as the Complete Street approach, are embedded within discussions of each strategy. For each strategy, we provide examples that illustrate variations in the scope and nature of the projects. While projects typically prioritize a set of goals (e.g., connecting communities), most projects seek to address multiple goals (e.g., community connections, economic development, and enhanced safety and mobility).

3.2.1 Freeway Cap Parks

Freeway cap parks are among the most common strategies for addressing the fragmentation and isolation experienced by communities located near spaghetti junctions and dense highway interchanges. Freeway cap parks are built in the air space above sections of highway that are below grade. Such parks are often initiated by local, non-governmental actors, and shift the focus from a vehicle-centric design toward a people-centric design (Brennan, 2022). A 2018 review of freeway lids and cap parks[6] identified 18 completed projects and 9 proposed projects across 24 U.S. cities (Houston & Zuñiga, 2019).

Freeway cap parks address community impacts by connecting neighborhoods and other prominent urban spaces, and vary in size and scope. For example, *downtown connectors* link isolated communities to downtown areas, and *neighborhood connectors* and *mobility bridges* focus on connecting neighborhoods on either side of a highway. *Waterfront or civic connectors* enhance connectivity between major civic locations and/or waterfront areas (Houston & Zuñiga, 2019). In Minnesota, Duluth's four I-35 cap parks provide a local example of freeway cap parks that serve to connect downtown Duluth to the waterfront (Slater, 2022).

There is some evidence to suggest that freeway cap parks help address the physical and mental health impacts of dense highway infrastructure. For example, one study evaluating the cost-effectiveness and potential public health benefits of the Cross-Bronx Project in New York, suggests long-term health benefits including improved cardiovascular health due to a reduction in noise pollution and increased levels of physical activity due to proximity to a park - benefits that would far exceed construction costs (Houston & Zuñiga, 2019).

Freeway cap parks are also motivated by economic considerations. For example, the proposal to build a lid on the Woodall Rodgers Highway in Dallas, Texas was initiated by developers and business leaders as a way to incentivize redevelopment and investment. Klyde Warren Park, which opened in 2012 and is discussed in greater detail in the next chapter, spans over 5 acres and contains amenities including a performance space, restaurant, dog park, plazas, and seating for up to 3,000 visitors. The area within half a mile of the park received over $1 billion in residential and commercial investment prior to the

[6] A lid is the infrastructure while the cap park is the park on top of the lid.

park's opening (Houston & Zuñiga, 2019). In addition, compared to similar cities, Dallas experienced faster office and multifamily construction growth after the beginning of the lid construction in 2012 (Cunningham, 2022). Dallas added nearly 5,300 individual multifamily units after starting the lid, more than twice as many units as the six years before.

It is important to note that there are examples of freeway cap parks located on major highways, but not within a mile of spaghetti junctions. For example, the freeway cap park proposed in the Reconnect Rondo project (Minnesota) is just over two miles from the dense highway interchange leading into St. Paul. While such projects aim to address some of the same impacts as the projects identified in this scan, the impacts are likely to be magnified in areas with complex interchanges or dense highway infrastructure. This chapter therefore focuses on projects located within a mile of a spaghetti junction.

Jim Ellis Freeway Park (Seattle, Washington)

Seattle's Jim Ellis Freeway Park, completed in 1976, was the first freeway cap park completed over an active freeway in the United States. Located near downtown Seattle, Freeway Park was built over a below-grade segment of I-5, a highway that is central to both the regional economy and Washington state. Around the time of the highway's opening, average daily traffic on I-5 near downtown Seattle was approximately 125,000 vehicles. In 2018, the average daily number of vehicles had increased to nearly 300,000 (City of Seattle, 2020).

A primary purpose of the 5.2-acre park was to reconnect the Downtown and First Hill neighborhoods, which had been separated by the construction of I-5 in 1965. The park was constructed with funds from a variety of sources, including a county bond resolution, federal and state highway funds to finance the lid construction, funding from the city of Seattle, and private developers and donors (Project for Public Spaces, Inc., 2005). Figure 3.1 shows an aerial view of I-5 before and after the construction of Freeway Park.

Panel A. Aerial of I-5 before the construction of Freeway Park

Panel B. Aerial of I-5 after the construction of Freeway Park in 1976

***Source**: (Lid I-5 Org, 2016)*

Figure 3.1 Freeway Park in I-5 Seattle before and after

Notably, the park was also designed to lessen the negative environmental impacts of the freeway. For example, in the park's Central Plaza, a large water feature that originally released 28,000 gallons of water per minute was designed to muffle the sound of the highway below. Vegetation in Freeway Park also aimed to reduce air pollution and minimize sound (TCLF, 2006). Figure 3.2 shows a view of the vegetation along one side of Freeway Park.

Sources: *(Freeway Park Association, 2022; Hinshaw, 2016; TCLF, 2006)*
Figure 3.2 Freeway Park in I-5 in Seattle

Although the park's early years were considered a success, design elements eroded over time, and the dense vegetation created an area which provided cover for drug use and criminal activity. Additional issues included lack of use, poor perception of the park, limited integration to neighboring buildings, and lack of a broad management strategy (Project for Public Spaces, Inc., 2005). The city of Seattle, in collaboration with the Freeway Park Association, is currently in the midst of a $10 million project to repair, restore, and enhance Freeway Park. This example highlights the importance of ongoing maintenance and upkeep of the new area.

Reconnecting San Diego (San Diego, California)

In 2024, the San Diego Association of Governments (SANDAG) received funding from the State of California's Reconnecting Communities: Highways to Boulevards Grant and the Federal Government's Reconnecting Communities Pilot to reconnect San Diego communities negatively impacted by highway

infrastructure (D. Garrick, 2024; SANDAG, 2024). While the larger project involves the revitalization of blocks adjacent to freeways, $1.3 million is allocated to analysis, outreach, and a feasibility study of the construction of freeway cap parks over portions of the I-5 in Barrio Logan - the community that is home to Chicano Park (described below). The freeway cap parks would be designed to increase community cohesion, provide new access options, and improve environmental conditions in the area (see Figure 3.3).

***Source**: (Lopez-Villafaña, 2021)*

Figure 3.3 Project area in San Diego

The Stitch (Atlanta, Georgia)

The Stitch is a project that aims to reconnect downtown Atlanta by placing a freeway cap park over a ¾ mile segment of the I-75/I-85 "Connector," a 14-lane highway running north-south through downtown Atlanta (see Figure 3.4). Complex interchanges are located at either end of the project site. Originally completed in 1964, construction of the highway destroyed several predominantly low-income African American neighborhoods and displaced over 7,000 African American residents, while placing a barrier between downtown (The Stitch, 2024b).

The highway was reconstructed and widened in the mid-1980s and today is one of the busiest segments of the highway in the state, traversed by approximately 350,000 vehicles per day (DaVinci Development Collaborative LLC, 2019). The project recently secured approximately $158 million from the federal Reconnecting Communities and Neighborhoods grant program to fund the construction of Phase 1 of the project, scheduled to begin in 2026 and end in 2030 (Kelley, 2024; The Stitch, 2024d).

***Source**: (City of Atlanta & Atlanta Downtown Improvement District, 2022)*

Figure 3.4 Map of the area of The Stitch project

The Stitch is a complex project involving multiple areas of planning and policy. Once completed, the project will create approximately 14 acres of urban greenspace on top of the cap, while converting

vehicle-centric side streets into Complete Streets designs (The Stitch, 2024d). The project also aims to increase residential and commercial activity in the area. The majority of new development is expected to be residential, with a goal of 20 percent or more affordable housing units for lower-income residents (The Stitch, 2024c). According to project stakeholders: “one goal is to get the surrounding property owners to either build affordable housing or fund affordable housing by paying some of their increased property value into a pool” (Chidi, 2023).

Additional economic and environmental benefits are expected from this project (Council for Quality Growth, 2021). The project will foster transit-oriented development at the Civic Center Metropolitan Atlanta Rapid Transit Authority (MARTA) rail station and introduce an off-street local and commuter bus facility for improved passenger connections, which will improve access to jobs. It will also contribute to the sustainability of the area by locally addressing flooding and mitigating noise and air pollution, increasing multimodal transportation, and incorporating climate change mitigation strategies. Figure 3.5 shows aerial views of the current and proposed areas of The Stitch.

Panel A. Aerial view of connector, current

Panel B. Aerial view of The Stitch, proposed

Source: *(Atlanta Downtown Improvement District, 2024a)*

Figure 3.5 Aerial view of The Stitch pre- and post-construction (proposed)

3.2.2 Highway Underpass Park

A second strategy is the creation of parks or other public spaces under or within a mile of dense highway infrastructure, with the aim of supporting connectivity, redevelopment, or urban aesthetics. Use of this strategy has grown in recent decades. Historically, areas under elevated highways, interchanges, and ramps have often been considered “lost spaces” (Trancik, 1986), defined as public areas in need of redesign that contribute little to surrounding areas or users. While research from the United States is limited, there is a growing body of international research investigating attitudes and activities related to the transformation of such “lost spaces” under elevated highways (Ramezani, 2021; Saouma, 2008).

Chicano Park (San Diego, California)

San Diego’s Chicano Park offers one example of a highway underpass park. In the 1960s, the construction of I-5 and the San Diego-Coronado Bay Bridge led to the bisection and isolation of Logan Heights, a center of Mexican American culture in southern California. Following community activism in response to the proposed siting of a California Highway Patrol station under the Coronado Bridge, the City of San Diego agreed to build a park and granted artists permission to paint on the walls and pillars beneath the bridge (see Figure 3.6).

Source: *(Department of Ethnic Studies, 2015)*

Figure 3.6 Chicano Park in San Diego's I-5

In 2016, Chicano Park was designated as a National Historic Landmark in recognition of the artistic and cultural significance of the park (Rosen & Fisher, 2001; San Diego Tourism Authority, 2022). The cultural significance arises in part from the role of murals and artistic expression as a form of resistance and reclamation for Latino communities. Approximately 40 murals were painted between 1973 and 1981, many of which were restored with federal funding in 2011 and 2012. Today, there are nearly 90 murals and sculptures in Chicano Park.

Lynch Family Skatepark (Cambridge, Massachusetts)

The Lynch Family Skatepark in Massachusetts provides another example of an underpass park (see Figure 3.7). The skatepark is located in a commercial district of East Cambridge, under ramps that connect I-93 to US Route 1 to the east and MA Route 28 to the west. The land under the ramps is among those sites that the state of Massachusetts promised would be returned to public use following Boston's "Big Dig," an extensive highway project that replaced an elevated highway with an underground highway, with the aim of reducing traffic and improving mobility throughout the Boston area (State of Massachusetts, 2024). The land was designated as a skate park in 2013 and transferred to the Massachusetts Department of Conservation and Recreation (DCR), which currently owns and maintains the park. Office buildings, railroad tracks, and a 14-acre state-owned park lie adjacent to the skatepark.

Source: *(Charles River Conservancy, 2017)*

Figure 3.7 Lynch Family Skatepark in Cambridge, Massachusetts

A confluence of factors led to the skatepark's creation. The idea for a skateboard park emerged after Nancy Schön, a sculptor known for her "Make Way for Ducklings" sculptures in the Boston Public Garden, became acquainted with the skateboarders who were using her sculptures for practice. She learned that there were few locations for skateboarding in the city and began scouting possible locations. At the same time, the Charles River Conservancy was similarly interested in creating a skatepark in the Boston area. The two joined forces to press for movement forward in building a skatepark (Schön, 2014). Construction of the park required considerable funding from a variety of sources, including the Lynch Family Foundation, for which the park is named, Vans, and the Massachusetts DCR.

I-10 Connect (El Paso, Texas)

El Paso's I-10 Connect Project also provides an example of efforts to connect communities following the construction of dense highway infrastructure. The I-10 Connect project aims to improve connectivity between two major highways and address congestion at the Bridge of the Americas Port of Entry. While the primary aim of the project is to improve mobility, the project also incorporates elements designed to promote community in an area heavily impacted by highway construction of earlier eras.

In the 1960s, the construction of the I-10 freeway displaced many residents of El Paso's multicultural Lincoln Park neighborhood (Juárez, 2019). The area is of cultural significance, as it is located near the site of the first Mexican American settlement north of the Rio Grande. The area is also home to Lincoln

Center (formerly, Lincoln Park School), the only local school that African American and Mexican American children were able to attend in the early 1900s (Betancourt, 2023; Juárez, 2014). Lincoln Center, now owned by the Texas Department of Transportation (TxDOT), is located at the interchange between several major highways - an area locally known as "Spaghetti Bowl" (see Figure 3.8).

Source: *(Valdez, 2015)*

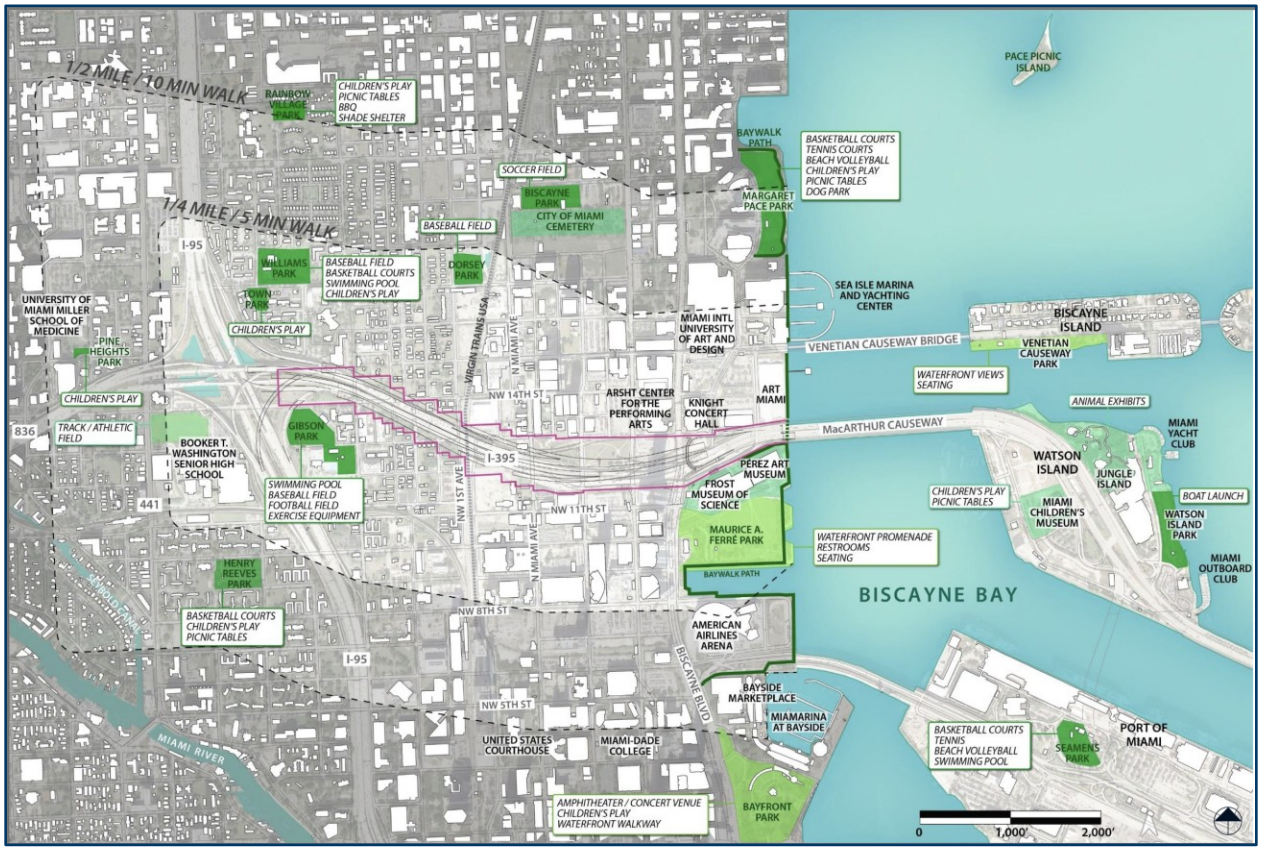
Figure 3.8 Location of Lincoln Center, El Paso, Texas

Lincoln Park, an open space area adjacent to the Lincoln Center, was created in 1973. Modeled after San Diego's Chicano Park, the park includes over 50 murals painted on highway pillars beneath the I-10 and US-54 interchange and on the walls of Lincoln Center (Bender, 2020). Early plans for I-10 Connect called for the demolition of Lincoln Center. In response to resistance from the local community, TxDOT altered its designs to preserve the building as well as five original bridge columns with murals. TxDOT also agreed to visually record 10 murals on columns requiring removal (Bender, 2020).

Underdeck (Miami, Florida)

Another project that recently received funding is The Underdeck Project in Miami, Florida, with completion expected by 2027 (The Underdeck, 2022a). The project will develop a 33-acre public open space under the reconstructed I-395, connecting the Overtown, Downtown, Omnia, and Edgewater neighborhoods, which were highly impacted by the construction of I-95 in the mid-1960s (Galli, 2023) (see Figure 3.9). The area will serve as a multi-purpose green space with zones, amenities, and artwork that celebrate the culture and heritage of the communities in the area (FDOT District 6, 2024). In addition, the infrastructure will accommodate pedestrian walkways, fountains, community gardens,

community plazas, and spaces for rent.



Source: *(HRA et al., 2019)*

Figure 3.9 The Underdeck in Miami, Florida

3.2.3 Infrastructure Removal or Reconfiguration

A final set of strategies involves the removal or reconfiguration of infrastructure to alleviate the negative impacts of dense highway infrastructure. Many projects in this category involve the removal of infrastructure that is underutilized or does not involve dense highway interchanges. There are, however, several projects that involve the removal of high-volume roadways or complex highway interchanges.

Embarcadero Freeway (San Francisco, California)

Perhaps the most prominent example of infrastructure removal is the demolition of San Francisco's Embarcadero Freeway (shown in Figure 3.10). The two-level highway was designed to connect the Bay Bridge to the east and the Golden Gate Bridge to the north (Chamings, 2021). The construction of the highway had significant community impacts. In addition to cutting the city off from the waterfront, the highway's long on/off ramps extended deep into neighboring communities.

Source: *(Chamings, 2021)*

Figure 3.10 San Francisco's Embarcadero Freeway

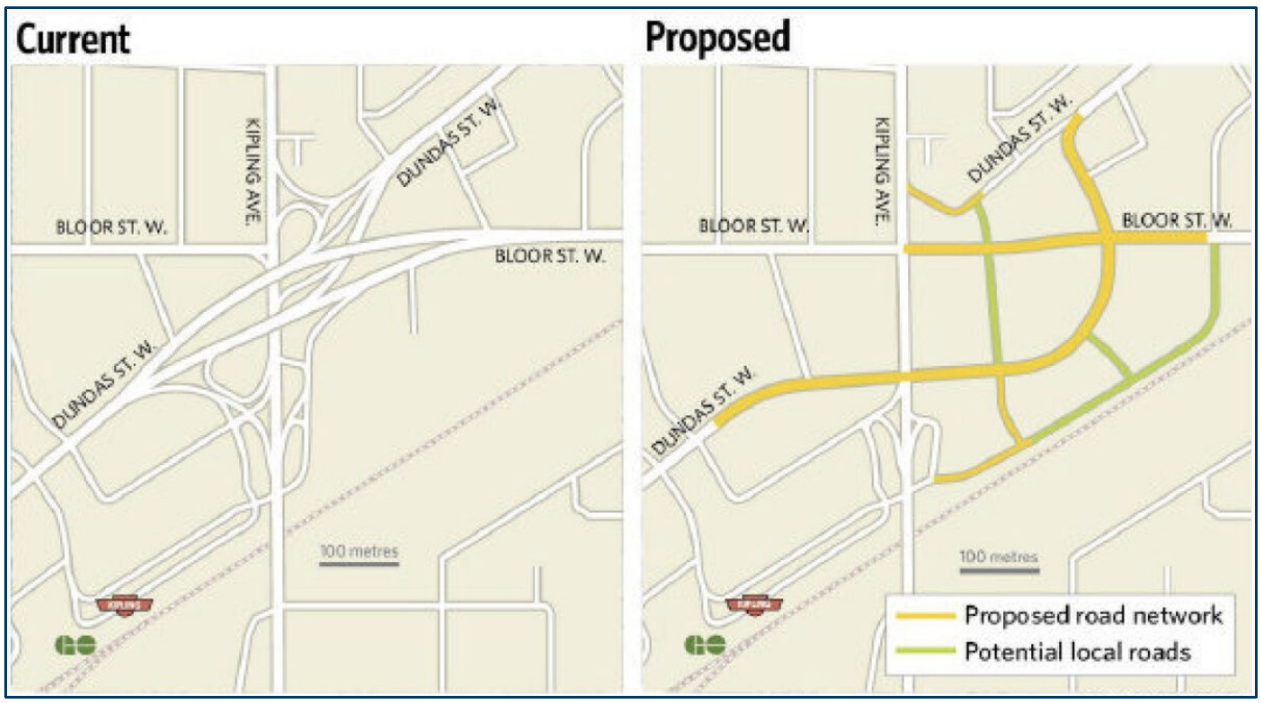
While calls to tear down the Embarcadero Freeway persisted through the 1970s and 1980s, it was not until the 1989 Loma Prieta earthquake damaged the highway that public opinion and political will shifted towards highway demolition. Neighboring streets absorbed much of the highway traffic and public transit saw notable increases. Engineering studies also showed that demolition would be more cost-effective than retrofitting the freeway. Highway demolition began in 1991 and Embarcadero Boulevard opened in 2000 (see Figure 3.11) (Cervero et al., 2009; CNU, 2015).

Source: *(CNU, 2017)*

Figure 3.11 Ferry Building in San Francisco along Embarcadero Boulevard

Etobicoke Interchange (Toronto, Canada)

Etobicoke's spaghetti junction in Toronto, Canada was transformed from a vehicle-centric, freeway-style interchange into a Complete Streets environment (see Figure 3.12) (Spurr, 2017). Construction to reconfigure the interchange began in March 2017 and reached substantial completion in October 2020 (City of Toronto, 2021). The transformation included the demolition of two bridges and replacement with three major at-grade intersections and a network of new streets. The project also included improved pedestrian facilities such as wider sidewalks, trees, street furniture; bicycle facilities with separated bike lanes (on Bloor and Dundas St.), and improved access to subway stations.



***Source**: (Spurr, 2017)*

Figure 3.12 Transformation of Six Points Interchange in Toronto (Canada)

The new road network provides safe movement and access for all road users including vehicles, pedestrians, and cyclists, while allowing for environmental remediations (Figure 3.13). The infrastructure's transformation freed up approximately 15.5 acres of city-owned land that was parceled into seven mixed-use redevelopments and blocks connected by streets (City of Toronto, 2024). An additional 1.75 acres were available for parks and public art. In addition, the change from the interchange provides lower speed limits and additional signalized intersections (City of Toronto, 2021). Lastly, the project embraced green infrastructure with more than 300 trees planted along the new roadways in conjunction with a system that provided uncompacted soil and helped treat stormwater on-site, removing pollutants from the runoff and serving as a short-term storage facility (Deeproot, 2024).

Panel A. Aerial of the area after construction

Panel B. Road configuration with bike lanes, planters, and street trees

***Sources**: (City of Toronto, 2021; Deeproot, 2024)*

Figure 3.13 Six Point Interchange after transformation

Chapter 4: Case Studies of Projects that offer Innovative Design Solutions to Mitigate Harm to Surrounding Communities

This chapter presents a series of case studies of projects that aim to mitigate the negative impacts of dense highway infrastructure. Each of the projects involve one or more of the strategies and approaches identified in the previous chapter, and seek to address community, environmental, and/or economic benefits for surrounding areas. The case studies examine factors leading to the identification of a particular strategy, factors hindering and facilitating project design and implementation, public and stakeholder engagement, and intended impacts.

The chapter begins by outlining the methodology used to identify and investigate projects, followed by an overview of key findings. The chapter then discusses each case study and concludes with a detailed discussion of findings across cases.

4.1 Methodology

The research team conducted eight case studies of projects that provide innovative design solutions to mitigate harm to surrounding communities from dense highway infrastructure and spaghetti junctions. Selection criteria included an explicit focus on mitigating the community harms of dense highway infrastructure, location within a radius of one mile of a spaghetti junction, and actual or expected livability benefits for surrounding communities. Selection criteria were adapted to include one project without an explicit focus on mitigating community harms, but with design elements intended to promote connectivity and incorporate community preferences.

The projects were also selected to ensure variation with respect to geography, project design, scope, and demographics of the community in areas adjacent to the project. Though not explicitly part of the selection criteria, projects also vary with respect to the breadth of involvement across public, private, and nonprofit sectors as well as areas and levels of government. Table 4-1 shows the list of projects selected as case studies.

Table 4-1. List of projects selected as case studies

Project Name	Type of Project	Project Status
Klyde Warren Park in Dallas, Texas - Phase 1	Freeway cap park	Completed
Klyde Warren Park in Dallas, Texas - Phase 2	Freeway cap park	In progress
Marquette Interchange in Milwaukee, Wisconsin	Enhancements to areas under the interchange	Completed
The Inner Loop in Rochester, New York - Inner Loop East (ILE)	Highway removal	Completed
The Inner Loop in Rochester, New York - Inner Loop North (ILN)	Highway removal	In progress

Project Name	Type of Project	Project Status
The Stitch in Atlanta, Georgia	Freeway cap park	In progress
The Underdeck in Miami, Florida	Enhancements to areas under the interchange	In progress
I-94 Modernization Project in Detroit, Michigan	Infrastructure and safety improvements	In progress

As shown in Table 4-1, the Klyde Warren Park and The Stitch involve freeway cap parks, Marquette Interchange and The Underdeck focus on enhancements to areas under an interchange, and the Inner Loop involves a highway removal all in areas within a mile of the dense highway interchange. Detroit's I-94 Modernization Project focuses on improvements to infrastructure and safety, but incorporates elements designed to promote community connectivity.

Klyde Warren Park Phase I, the Marquette Interchange, and the Inner Loop East projects are completed projects. Klyde Warren Park Phase II and Inner Loop North are in the design phase and adapt lessons learned from predecessor projects. The phases have been included as distinct projects because the phases differ considerably with respect to project design, funding sources, and community involvement. Lastly, the I-94 Modernization project is currently in construction and The Stitch and The Underdeck are in the design phase. For the latter two projects, construction is expected in 2025-2027.

Given the project's focus on mitigating negative community impacts, the research team prioritized investigating issues related to community impacts and engagement. The research team reviewed documentation from project websites, project reports, newspaper articles, and presentations, as well as articles and historical records relating to the impact of highway construction for communities located near spaghetti junctions. In addition, we examined land use patterns and Census data on the demographic composition of populations living near each junction.

The research team also reached out to key stakeholders involved on each project. For each project, the team contacted officials from state DOTs as well as local project leads, including city and county officials, staff from other local governmental entities, and a local foundation. The team also used a snowball sampling approach to identify other relevant stakeholders. In total, the research team interviewed 17 stakeholders. All interviews were anonymous to better engage with the representatives. Notably, some local and state officials were unresponsive to our requests, directing us either to the state level or (more frequently) to local officials. This lack of response may stem from officials' capacity to participate in interviews, lack of active engagement on the project, or other project or partnership dynamics beyond the scope of this study.

4.2 Overview of Key Findings

The analysis reveals a set of findings that are in some ways contrary to the expectations of the research team and Technical Advisory Panel (TAP) team. While our expectations were that the case studies would reveal state frameworks or policies that MnDOT might leverage or change to enable strategy

implementation, as well as engineering factors important in shaping the selection of strategies and project design, the analysis identified relationship- and trust-building, active and intentional community engagement, and willingness to "think outside the box" as critical factors in securing funding and facilitating project implementation and success. Key findings are discussed in greater detail throughout the case studies and in Section 4.3 . Findings are organized into four areas and are presented in Table 4-2.

Table 4-2. Key Findings from Case Studies

Subject Area	Key Findings
General	1. Projects are highly localized and contextual. While engineering factors help direct choices about design, ongoing and intentional involvement between stakeholders and communities, active communication, agility, and willingness to innovate are key factors in moving projects forward. 2. Changes in practice, rather than changes in policy, appear to facilitate project implementation and success. As such, the findings provide limited guidance regarding policies, regulations, or guidelines that MnDOT might adapt or change to mitigate harm for communities impacted by dense highway infrastructure.
Project Design and Funding	3. Most projects originate at the local level and are carried forward by local actors. In two cases, projects were initiated by the state DOT and adapted to accommodate local interests. 4. Project design choices are determined by multiple factors including characteristics of the transportation infrastructure and traffic volumes, availability of funding, alignment of interests across diverse stakeholders, and project history. In some cases, the strategy chosen to ameliorate community harms is determined decades prior to implementation. 5. Projects require coordination, but not always active collaboration, between the state DOT and local actors.
Project Governance and Stakeholder Engagement	6. The structure of project governance, ongoing operation, and maintenance varies across projects. 7. Projects bring together multiple actors across levels of government. Alignment of interests across actors and agility are necessary precursors to securing funding and project implementation. 8. Community engagement varies across cases and is shaped by the composition of the project area as well as the best practices of the time. In some cases, engagement undertaken by local actors is distinct from engagement that occurs as part of state or federal requirements.
Project Impacts and	9. A primary aim of projects is the activation of the area, with the goal of drawing people into the space through amenities, recreational facilities, etc. Success in activating the

Subject Area	Key Findings
Use of Infrastructure	area varies, determined by factors including surrounding land use and funding available. 10. Project benefits in terms of the livability framework accrue to the areas adjacent to the junction, but not necessarily the communities originally impacted by the construction of the junction.

4.3 Case Studies

This section details the projects selected as case studies. In collaboration with the TAP, the research team identified a set of topics to investigate in each case. These include:

- History of the highway, interchange, and communities impacted by the highway/interchange as well as the project. Race, historic underinvestment, lack of green space (amount of land that is covered with artificial materials), poverty (share of people in households where income is at or below 100% of federal poverty rate), traffic proximity and volume (count of vehicles at major roads within 500 meters – about 1,640 feet), and unemployment were included for the analysis of the current demographics of the area.
- Project overview, including non-transportation strategies integrated into the project
- Funding strategy
- Governance structure
- Stakeholder engagement, including engagement conducted by local stakeholders and the state DOT, across phases of project development
- Expected impacts and use of infrastructure

4.3.1 Klyde Warren Park – Dallas, Texas

History

Dallas is a city of approximately 1.3 million, located in the northeastern region of Texas. Numerous highways and interstates radiate out from the center of the city, connecting Dallas to Forth Worth to the west, Austin and Houston to the south, and Oklahoma City to the north. The Woodall Rodgers Freeway (also known as Spur 366) is a 1.7-mile stretch of highway that connects two major highways that run north-south on either side of downtown Dallas. Spaghetti junctions are located on both ends of the Woodall Rodgers Freeway, connecting I-35E on the west to US Highway 75/I-345 to the east (see Figure 4.1).

The highway was intended to act as a high-speed connector between I-35E and US Highway 75/I-345 on the east. Although planning for the highway began in 1952, challenges related to costs, design, and right-of-way (ROW) slowed the progress of construction. The highway officially opened in 1983, 31 years after it was initially proposed (Osborne, 2018).

Source: *Google Earth Pro*

Figure 4.1 Aerial view of Woodall Rodgers Freeway, connecting I-35E and US Highway 75/I-345

Highway construction in the Dallas metro led to the displacement of residents and businesses and contributed to economic decline in an historically African American area of the city. In the 1920s, the

area once known as North Dallas, located just north of the Woodall Rodgers Freeway, was home to a thriving African American commercial corridor as well as the only two high schools for African American students in Dallas. Construction of US Highway 75 in the 1940s divided North Dallas into eastern and western sections, contributing to a decline of commercial activity. Construction of the Woodall Rodgers Freeway compounded problems by isolating North Dallas from the central business district, located to the South. Highway constructions led to the displacement of many residents and businesses, forcing relocation to areas throughout South and West Dallas (Prior & Kemper, 2005; SMU, 2024).

Beginning in the late 1970s, the areas on either side of the Woodall Rodgers Freeway underwent considerable gentrification and demographic change, facilitated by the city government and encouraged by developers. Just north of the highway, the percent of residents living below the poverty line decreased from 31 percent in 1970 to 11 percent in 2000. From 1970 to 2000, the African American population residing north of the highway decreased from 89 percent to less than 7 percent (Prior & Kemper, 2005).

In 1979, the area just south of the highway was designated as an Arts District. North Dallas was renamed Uptown in the late 1990s to promote real estate development (Houston & Zuñiga, 2019). Today, Uptown is a highly affluent area of the city, with skyscraper apartment buildings and high-end restaurants and shopping (SMU, 2024).

Table 4-3 presents the demographics of the Census tract areas immediately adjacent to Klyde Warren Park (Uptown to the north and the Arts District to the south). This table indicates a lack of green space and high proximity to traffic on either side of the park. The tracts are relatively more advantaged than other tracts with respect to poverty and unemployment. Though Uptown (formerly, North Dallas) was once an area with high barriers to accessing home loans due to redlining, it has relatively low levels of poverty and unemployment. The population of Uptown is majority white, with considerably more racial diversity within the Arts District.

Table 4-3 Demographics in adjacent areas to Klyde Warren Park (2023)

Variable	Uptown	Art District
Race	81% White, 6% Asian, 6% Hispanic or Latino, 4% Black or African American, 3% other	49% White, 28% Black or African American, 10% Hispanic or Latino, 7% Asian, 1% American Indian, 5% other
Historic underinvestment	Yes - high barriers to accessing home loans	No
Lack of green space	96th percentile	97th percentile
Poverty	25th percentile	60th percentile
Traffic proximity and volume	95th percentile	94th percentile
Unemployment	25th percentile	44th percentile

Note: *Data for Uptown Art District consider Census tracts 48113001704 and 48113002100, respectively.* ***Source:*** *(Council on Environmental Quality, 2024).*

Klyde Warren Park Project Overview

The idea of building a deck park over the Woodall Rodgers Freeway originated in the 1960s but reappeared in 2002 within the real estate community (Klyde Warren Park, 2024c). In 2001, Dallas was one of three cities considered by Boeing for its corporate headquarters, along with the cities of Denver and Chicago. Boeing's decision to select Chicago due to its connectivity advantages motivated the real estate community in Dallas to work to improve the city's connectivity by connecting the Uptown neighborhood north of the freeway to the Arts District and Downtown areas to the south via a freeway cap park (WRPF representative, personal communication, August 2, 2024). The project had the goal of spurring economic development, enhancing redevelopment and investment, promoting connections, and attracting pedestrian foot traffic (Houston & Zuñiga, 2019; Mullenbach et al., 2021; USDOT, 2014).

The initial idea was to build the park at one time, but due to elevated costs, the park construction was divided into two phases. Phase I of the project involved the construction of a 5.4-acre deck park over the 8-lane freeway (already a lowered section of freeway) to connect Uptown and Dallas Arts District and bridge surrounding communities in the Dallas metropolitan area, expand green spaces, and increase the economic vitality of the area (see Figure 4.2). Phase I of the Klyde Warren Park initiated construction in October 2009 and was completed in October 2012 with a total cost of $112 million (Klyde Warren Park, 2024c).

Source: *(Klyde Warren Park, 2024c)*

Figure 4.2 Klyde Warren Park, phase 1

The Phase II of the project adds 1.5 acres of deck to the west of St. Paul Street. Of the total area, 0.81 acre are for a pavilion with a Visitor Experience Center and 0.84 acre for the West Lawn for markets, festivals, and events (Park & Recreation Board, 2019). This additional area allows for the expansion of the existing children's park and the relocation of the dog park. Construction of Phase II is expected to start in late 2025 and be completed in three years. The total cost of Phase II is estimated at around $155 million (Barnett, 2024).[7]

While there is limited evidence that existing laws or policies hindered project success, regulatory changes during the project's first phase did require securing additional funding for design changes. For example, a change in the highway's classification from an open expressway to tunnel required complying with National Fire Protection Association rules. A code change that occurred mid-project required $1.5 million in additional fireproofing measures to protect the tunnel and park in the event of fire due to an accident or crash (Nielsen, 2012a).

Funding Strategy

The park's development was initiated with seed funding in 2004. The Dallas-Forth Worth area Real Estate Council (TREC), an organization that represents 95 percent of commercial real estate business in North Texas and more than 2,000 commercial real estate professionals (TREC, 2021), provided a $1 million grant for feasibility studies and to provide staff support during early stages of the project. The Texas Capital Bank provided a $1 million donation for the park and its founder also joined with a personal donation of $1 million (Klyde Warren Park, 2024c).

Phase I of the project was funded through a public-private partnership (PPP) between the Woodall Rodgers Park Foundation (WRPF), the entity created to run and manage the park, and the City of Dallas Parks Department. Funding for the $112 million phase of the project came from $20 million in voter-approved bond funds from the City of Dallas in 2006 (Nielsen, 2012b), $20 million in highway funds from TxDOT, and $16.7 million in federal stimulus funds (American Recovery and Reinvestment Act - ARRA) (City of Dallas Parks and Recreation Board, 2019; Klyde Warren Park, 2024c). The remaining $55.3 million balance was provided by individual donors directly to the Woodall Rodgers Park Foundation. The North Central Texas Council of Governments (NCTCOG) also provided support to improve pedestrian and bicyclist access to the park (FHWA, 2016). Stakeholders note that having the WRPF as an independent management group helped accommodate the different needs from the multiple organizations that contributed to funding this project throughout the lifetime of the project (Ozdil et al., 2013; USDOT, 2014).

Phase II of the project will also be funded with public and private resources. The deck construction will be funded with $30 million from NCTCOG, which includes $20 million from the Neighborhood Access and Equity Grant Program to be used for an extension of an existing pedestrian cap/deck park to create

[7] Phase II was anticipated to start in 2019, but initial price estimates came high due to the COVID-19 pandemic and was postponed.

additional space between Pearl Street and west of Akard Street; $3 million that will be paid back via tax increment financing (TIF) funds; and $7 million to be paid back via other sources; and $10 million from the City of Dallas 2017 Bond Program, which require match funding from non-city sources. In addition, there will be private funding for the construction of all park amenities. This includes $20 million pledged from existing donors; $10 million from naming opportunity (in discussions);[8] and the remaining funding will come from a capital campaign (City of Dallas Parks and Recreation Board, 2019; NCTCOG, 2024).

It is worth noting that current TxDOT policies do not allow certain state funding categories to be used to construct decks, caps, or stitches, which are widened bridges over a highway. TxDOT alternatives allow for caps to be built, but partner agencies will have to secure funding from federal, local, or private sources for these types of projects (TTI, 2021).

The WRPF is responsible for the estimated $6.4 million annual operating budget, which is primarily funded through private funding (Klyde Warren Park, 2024c). Revenue streams include restaurant proceeds, corporate sponsorships, ongoing contributions from property owners within the adjacent Klyde Warren Park/Dallas Arts District Public Improvement District (PID),[9] and annual fundraising. In addition to this, TxDOT maintains the highway lanes and retaining walls, while the City of Dallas maintains the deck and life safety elements (City of Dallas Parks and Recreation Board, 2019; NCTCOG, 2024).

Governance Structure

Planning and construction of Klyde Warren Park necessitated coordination between the City of Dallas, the TxDOT, and the business community. Inspired by Bryant Park in New York, a small group of local business leaders[10] connected with the City's Mayor in 2002 to discuss capping the Woodall Rodgers Freeway to build a world class park. In 2004, these stakeholders formed the WRPF and gathered seed funding to research how the park would impact the area. A year later, the WRPF and the City of Dallas Parks Department formed a public-private partnership to secure funding for the park's design and construction (Klyde Warren Park, 2024c).

As the first freeway cap in Dallas, development and use agreements between stakeholders took some time to design (WRPF representative, personal communication, August 2, 2024). The City of Dallas

[8] As of 2019, WRPF had naming rights with City Manager's approval in the original Use Agreement. The proposed agreement is considering for the WRPF to have the right to name the Plaza area and individual elements under $500,000, and have the naming rights with consent by Park Director in excess of $500,000 (City of Dallas Parks and Recreation Board, 2019).

[9] The PID was established in 2014 and renewed in 2021 until 2031. It is managed by the Woodall Rodgers Foundation (City of Dallas, 2024). The PID's rate is $0.025 per $100 of appraised value property (City of Dallas, 2023). PID funds are used for maintaining amenities, not to build new ones (Dallas Arts District, 2021). In December 2023, it generated $1.7 million in income (Malnory, McNeal & Company, 2023).

[10] This group included Jodi Grant, the founder of the Texas Capital Bank; John Zoog, then a Dallas real estate professional, today president of Southwest Region Goldenrod Companies (2024); and Linda Owen, then president of the Real State Council (Klyde Warren Park, 2024c, 2024b).

granted TxDOT the ROW to build the project but maintains the rights (FHWA, 2016). During the construction phase, TxDOT managed construction of the deck and the City of Dallas managed construction of the park. TxDOT owns the tunnel and maintains the highway lanes and retaining walls, while the City of Dallas maintains the deck and life safety elements of the tunnel and owns the park (City of Dallas Parks and Recreation Board, 2019). In addition, the WRPF signed a 40-year lease with the city to operate, maintain, and manage the park for up to 99 years (Klyde Warren Park, 2024c).

The Klyde Warren Park is a programmed park, rather than a static park, which offers activities and events throughout the year (WRPF representative, personal communication, August 2, 2024). WRPF offers several events and programs that are free to the community such as yoga classes; music festivals; summer movie series; and Independence Day, Labor Day, and holiday celebrations (City of Dallas, 2023; City of Dallas Parks and Recreation Board, 2019).

Stakeholder Engagement

Relative to other cases, there is a notable lack of information on planning and public engagement during the park's development and construction (Phase 1 or Phase 2). No discussion of public engagement is evident on the park's website nor was it discussed during interviews with key stakeholders. The WRFP does have a Community Engagement Task Force (also referred to as the Diversity, Equity and Inclusion Task Force) which consists of Dallas business leaders who meet quarterly to share information and plan free programming activities for the park (Klyde Warren Park, 2024a). Stakeholders referenced in interviews largely consist of city and business leaders and philanthropists. In addition, it is important to note that the communities originally impacted by highway construction are no longer residing in the area. The current demographic composition of the residential areas abutting the park are largely affluent and white.

Impacts of the project and use of the infrastructure

There are several economic, social, and environmental impacts from Phase I of the project. The park's economic impacts, including real estate development and increased tax revenue, are significant and widely touted by stakeholders. The park generates about $312.7 million in economic benefit and $12.7 million in tax revenue (Ozdil et al., 2013). In addition, it is estimated that the park created more than $2 billion in economic impact from 2012 to 2018. The park has also contributed to increasing lease rates and rents in the Arts District and Uptown by a minimum of 32 percent (Perez, 2015).[11]

Phase II of the project is also expected to further bring development and growth into the area. There are already plans for redevelopment with an estimated value of $2.7 billion, which will result in annual tax revenues of $38 million for taxing entities - including $10.4 million for the City of Dallas (City of Dallas

[11] In the Arts District, lease rates at Trammel Crow Center -916,000-square-foot mixed-use complex- increased 32 percent (from $19 to $25 per square foot) and rents at 2100 Ross increased 46 percent (from $13 to $19 per square foot). In Uptown, at 2000 McKinney, lease rates increased 56 percent (from $25 to $37 per square foot) and rents 64 percent (from $22 to $36 per square foot).

Parks and Recreation Board, 2019). In addition, initial projections estimated an additional $850 million in stimulus to the region due to the expansion of the park (Perez, 2015). With the park's expansion, business owners also expect an opportunity for their businesses to grow due to the expected increase in visitors (Barnett, 2024).

In terms of community impacts, results from a survey with 224 park users show that the park improves the quality of life primarily through reduced mental stress, better perception of place, and providing a place to be outdoors (90.9 percent of survey respondents); promotes healthy living mainly by providing a place to relax, and enjoy a passive activity and vigorous walking (86.3 percent of survey respondents); promotes a safe and secure environment through the lighting design, open visibility, and presence of others (83.9 percent of survey respondents); and promotes art and artistic activities (79 percent of survey respondents) (Ozdil et al., 2013).

In addition, the park has improved the walkability of the city center due to its integration of pedestrian, streetcar, and bicycle accessibility (USDOT, 2014) and has increased attendance to the adjacent cultural institutions in the Arts District (ASLA, 2016). Trolley ridership has also increased by 61 percent with the opening of the park. Stakeholders note that these factors contribute to the sense of place that was lacking from the core of the city (ASLA, 2016).

There are also considerable environmental benefits. The park integrates native plantings and stormwater reclamation in its design, allowing environmental reparation. The park captures 18,500 lbs of carbon dioxide annually, intercepts a total of 654,214 gallons of stormwater annually, reduces stormwater runoff by 3.63 cubic feet per second,[12] adds a 53 percent permeable surface (which impacts the urban heat island),[13] and reduces the temperature in the park by 5.5 degrees Fahrenheit (compared to the average temperature in the zip code in which the park is located) (Ozdil et al., 2013).

An additional environmental benefit coming from native planting has been the ability to attract pollinators - about 50 percent of the planting is native to the North Texas area (ASLA, 2016; FHWA, 2016). In addition, the park's buildings use solar and geothermal energy, saving about 94,000 kilowatts of electricity annually (about $11,279 of annual savings).

Finally, park benefits related to community and environmental impacts is its capacity to absorb freeway noise. Acoustic levels at the part site measured between high 80s and low 90s before construction, but were expected to drop to 60 dB after construction (Nielsen, 2012a).

Despite these benefits, there are concerns regarding environmental gentrification,[14] housing affordability, and displacement of long-term residents and businesses in the area (Houston & Zuñiga,

[12] The stormwater runoff pre-development was 9.88 cu.ft/sec, while post-development it is 6.25 cu.ft/sec.
[13] The park - including lawns, plantings, and gravel surfaces- is more than 50 percent permeable, compared to the 100 percent impermeable freeway that it covers (Ozdil et al., 2013).
[14] Environmental gentrification, also referred to as green gentrification, is a process in which the implementation of an environmental planning agenda (cleaning up pollution or providing green amenities)

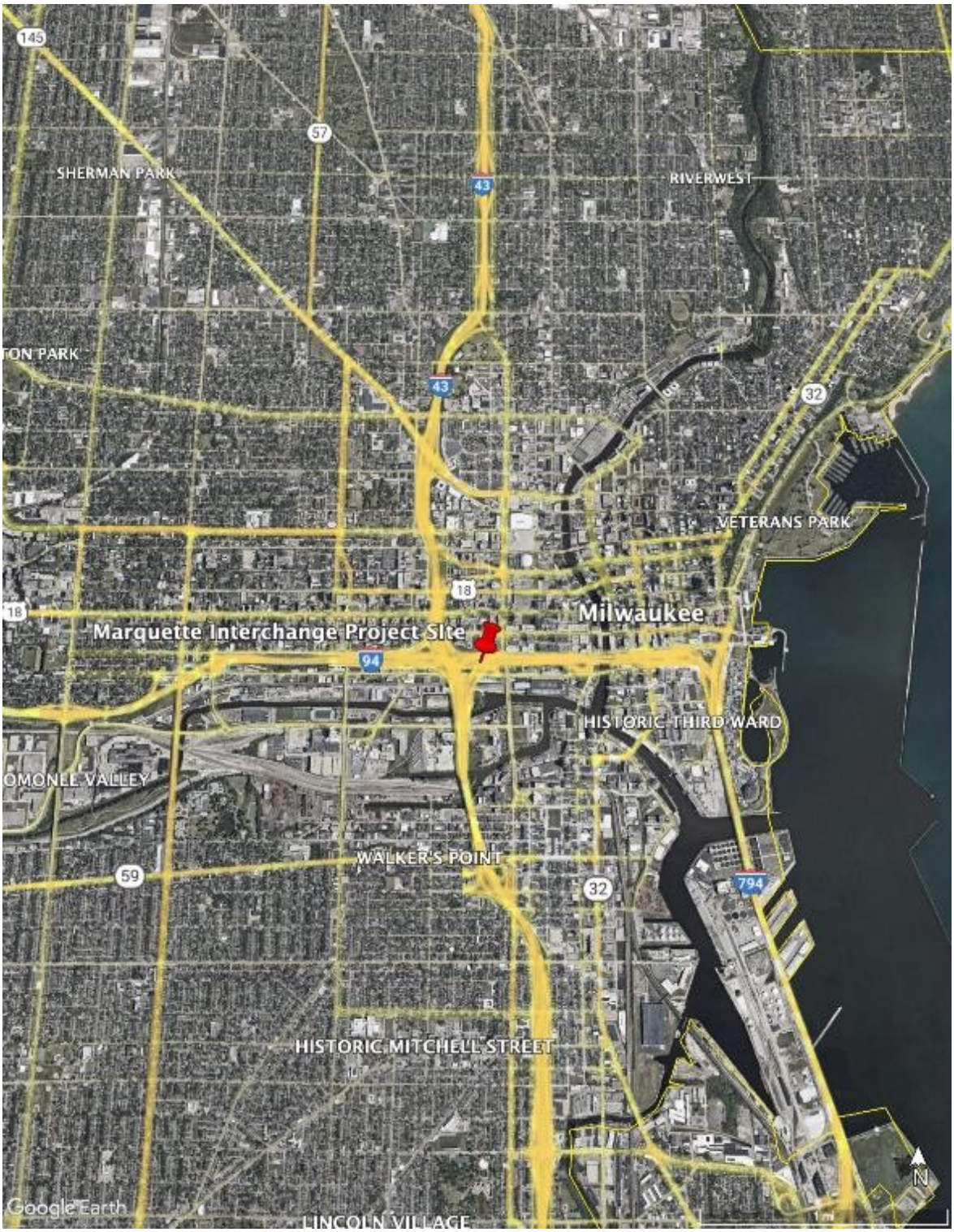
2019). While positive impacts extend across areas, economic impacts - particularly for development - tend to dominate discussions of the benefits of Klyde Warren Park. There is limited evidence of measures taken to involve or address the concerns of residents or businesses originally impacted by highway construction or displaced by construction of the park, beyond the ability to use the park. This serves as a contrast to other cases in the analysis, where addressing or remedying past harms are central to project planning and design.

4.3.2 Marquette Interchange, Milwaukee, Wisconsin

History

The City of Milwaukee, located on the western shore of Lake Michigan, is home to nearly 600,000 residents. Interstate highways run north-south and west of the city, connecting Milwaukee to Madison to the west, Green Bay to the north, and Chicago to the south. The Marquette Interchange in downtown Milwaukee lies at the intersection of three major highways: I-94, I-43, and I-794 (see Figure 4.3). Planning for the interchange began in 1957 as part of a larger effort to alleviate congestion, improve safety, and increase connectivity by building a network of highways through the city. At the onset of construction in 1964, a Milwaukee Sentinel headline noted that the planned junction "looks like a plate of spaghetti." The interchange opened to traffic in December 1968, representing the apex of highway building in Milwaukee (Foran, 2018).

lead to the exclusion and displacement of disenfranchised residents. These improvements increase local property values pricing out vulnerable residents (BCNUEJ, 2024).



***Source**: Google Earth Pro*

Figure 4.3 Marquette Interchange, Milwaukee, Wisconsin

Highway building in Milwaukee coincided with pronounced growth in the city's African American population. Between 1940 and 1960, Milwaukee's African American population grew from 12,158 to 74,546 - an increase of nearly 600 percent. Racial segregation and redlining led many Black migrants to settle just north of Milwaukee's downtown– an area that became known as Bronzeville. By the 1950s and 1960s, Milwaukee had become one of the most segregated cities in the US (Foltman & Jones, 2019; Wisconsin Historical Society, 2024).

Bronzeville was a thriving center of African American business and culture in Milwaukee (Harpole & Walzer, 2016). The construction of I-43 cut directly throughout the community, leading to the displacement of over 6,000 homes as well as businesses, clubs, and organizations (WHEDA, 2024). According to Census data, approximately 70 percent of residents displaced by the local construction were African American. A study of families displaced due to highway construction showed that 97 percent continued to reside in areas north of Milwaukee's downtown (House, 1970). Today, Milwaukee remains highly segregated, with African American residents concentrated north of downtown and on either side of I-43 (Foltman & Jones, 2019).

The Marquette Interchange was built in Milwaukee's downtown area, south of Bronzeville. In addition to the displacement caused by highway construction, construction of the interchange led to the removal and/or displacement of downtown businesses such as the Cutler Hammer plant and public spaces such as Red Arrow Park, as well as the destruction of Tory Hill, a historically Irish neighborhood (Foran, 2018).

Today, the area surrounding the Marquette Interchange is predominantly commercial, industrial, and institutional. Marquette University is located in the northwest quadrant of the interchange, with a small number of buildings to the south and east. Commercial areas and the downtown district are located in the northeast quadrant. Southern quadrants are largely industrial, with the Menomonee River running west-east along the southern side of the interchange.

Table 4-4 presents the demographics of the Census Tract Areas immediately adjacent to the Marquette Interchange project. Census data show that areas surrounding the interchange have limited green space and high proximity and volume of traffic. Though most land use is not residential, demographic characteristics indicate that the area is diverse racially, with relatively high levels of poverty and unemployment.

Table 4-4 Demographics in adjacent areas to the Marquette Interchange (2023)

Variable	North-East of the Interchange	South of the Interchange
Race	48% White, 36% Black or African American, 9% Hispanic or Latino, 7% other	42% Hispanic or Latino, 31% Black or African American, 18% White, 9% other
Historic underinvestment	No	No
Lack of green space	98th percentile	90th percentile
Poverty	88th percentile	96th percentile
Traffic proximity and volume	99th percentile	88th percentile
Unemployment	48th percentile	95th percentile

Note: *Data for the north-east and south areas of the interchange consider Census tracts 55079186300 and 55079186800, respectively.* ***Source:*** *(Council on Environmental Quality, 2024).*

Notably, the Marquette Interchange underwent a major reconstruction from 2004-2008 to modernize the infrastructure and reconfigure the interchange to mitigate congestion and improve safety. At the time of its completion, the $810 million project was the largest road project in Wisconsin's history. Led by WisDOT, the reconstruction involved considerable collaboration across levels of government and alongside local stakeholders such as Marquette University.

The project incorporated several elements designed to engage and benefit the local community, including a Community Sensitive Design Task Force and a Disadvantaged Business Enterprise (DBE) program, which required contractors to hire a certain percentage of local, disadvantaged Milwaukeeans and minority and female contractors on the larger interchange reconstruction project (Anthony & Rodriguez, 2021; Humphries, 2008). The reconstruction effort also involved significant outreach and engagement by WisDOT.

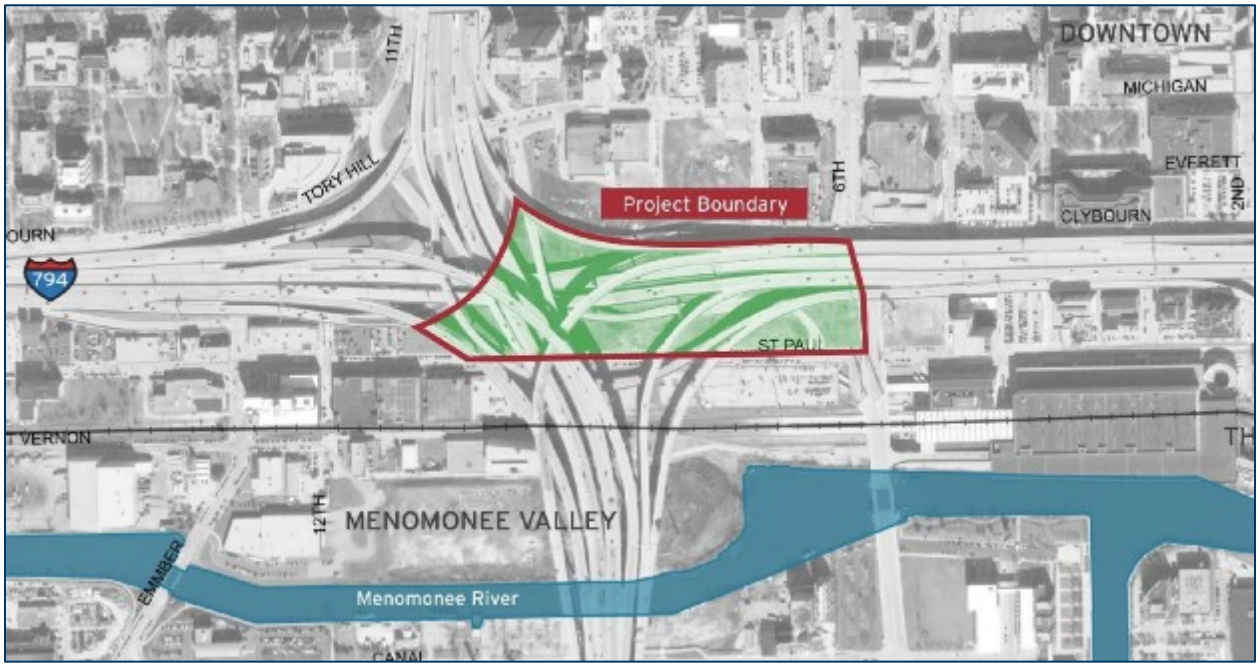
The Marquette Interchange Green Infrastructure Project Overview

The Marquette Interchange Green Infrastructure Project was a two-year project designed to capture and treat contaminated stormwater runoff from the Marquette Interchange before it runs into the city's sewer system or the Menomonee River, which flows east into Lake Michigan. Led by the Milwaukee Metropolitan Sewerage District (MMSD), it was the first project funded through the MMSD's "Green Highway" program, which uses green infrastructure to address highway stormwater runoff. Engineering design and public engagement began in Fall 2019 and the project was completed in winter 2020 (MMSD representative, personal communication, August 1, 2024).

WisDOT first became involved in the project due to reasons unrelated to infrastructure: a large homeless encampment had formed under the interchange, leading to numerous calls from the public for WisDOT to address (WisDOT representatives, personal communication, August 16, 2024). Both local and state actors were interested in finding housing for homeless individuals before the winter months. In

addition, actors including the City of Milwaukee were interested in clearing the highly visible encampment prior to the Democratic National Convention, scheduled for the following year (2020) (City of Milwaukee Representative, personal communication, August 9, 2024).

Around this time, WisDOT was approached by the MMSD, a regional public agency that provides water reclamation and flood management services, to initiate a green infrastructure project under the Marquette Interchange. This project would be the first project in MMSD's "Green Highway" program - which aims to address highway stormwater runoff through green infrastructure and is consistent with the city's plan to add 36 million gallons of stormwater storage through green infrastructure by 2030. Figure 4.4 presents the area of the green infrastructure project.



Source: *(Sunderland, 2021)*

Figure 4.4 Area for Marquette Interchange Green Infrastructure project

Because homelessness in Milwaukee is a county-level issue, WisDOT worked alongside Milwaukee County and local housing agencies to find shelter for the nearly 100 homeless individuals living under the interchange. MMSD led implementation of the green infrastructure, working alongside consultants, the City of Milwaukee, and WisDOT throughout the process.

With respect to the green infrastructure, design challenges included a need to protect existing highway infrastructure, contaminated soil, and low levels of sunlight and high salt levels. The final project design included three bioretention basins, four acres of native landscaping, 2,100 square feet of permeable pavers, and 1,700 feet of permeable path, as well as innovative devices designed to treat contaminated runoff. Although amenities other than the footpath and plaza were not fundable under MMSD's Green

Highways Program, future recreational opportunities were incorporated into the design (Sunderland, 2021).

Notably, the project did not require any significant changes to federal or state laws or local ordinances. The project did require approval from WisDOT's Bureau of Structures as well as from the Federal Highway Administration. MMSD also sought a ROW permit from the state and was required to identify any environmental impacts of the project.

Funding Strategy

The project was funded via MMSD's Green Solutions Funding, which provides municipalities including the City of Milwaukee annual grants to complete green infrastructure projects. Early in the process, MMSD and the City of Milwaukee decided that the city would use its annual allocation for the Marquette Interchange project. The total cost of the project was approximately $2.3 million. In addition, although MMSD funding could be used to construct the green infrastructure, it could not be used to design or construct other amenities or aesthetic features (City of Milwaukee Representative, personal communication, August 9, 2024).

Governance Structure

The project represented a collaborative effort between MMSD; WisDOT, which owns the 16 acres of land under the interchange and maintains the highway infrastructure; the City of Milwaukee, which maintains the land under the interchange; and Milwaukee County, which has the authority to address issues related to homelessness in the area. MMSD and WisDOT each had project leads who were in frequent communication to discuss implementation, align messaging, and serve as point people for the project.

While MMSD has longstanding partnerships and established trust with the City of Milwaukee and Milwaukee County, the collaboration with WisDOT to implement green infrastructure represented a new way of working together. In addition, the collaboration across departmental areas (for example, WisDOT engineers partnering with Milwaukee County Housing Division) represented an innovative type of partnership for WisDOT. Project partners highlighted the importance of active involvement of all parties; internal and external buy-in; and consistent communication and education:

> "During our initiative, the State, County, and City were heavily represented at the bi-weekly meetings but each one had to work towards acceptance within their respective governmental agency. Nonprofit and private sectors provided funds and highlighted the importance of addressing this issue to city and state decision-makers… The key to mitigating [diverse stances] is consistent communication and education among the work group and a unified approach on these issues (City of Milwaukee et al., 2021)."

Because the project was MMSD's first Green Highway project, early stages of the project involved negotiation between partners concerning responsibilities, funding, permitting, and maintenance. Partners agreed that post-construction, WisDOT would continue to own the land and

maintain the highway infrastructure, including the downspouts that bring stormwater from the highway to the ground. The City of Milwaukee would maintain the land under the highway, with WisDOT paying a certain percentage of the annual costs of maintaining the land.

The partnership was widely recognized as a success. The City of Milwaukee, Milwaukee County, and the State of Wisconsin submitted and were awarded a Wisconsin Policy Forum Salute to Local Government Awards in the category of Intergovernmental Cooperation (City of Milwaukee et al., 2021). In addition, the structure of the project partnership has been replicated in subsequent Green Highway projects.

Stakeholder Engagement

Public engagement activities were led by MMSD and the City of Milwaukee. Two public information meetings were held to showcase and discuss multiple concept designs for the space (Sunderland, 2021). The first informational meeting was well-attended, with attendees overwhelmingly supportive of the project. Many members of the public were particularly supportive of the amenities that might come alongside an activated space. Public engagement was largely responsible for a central plaza as well as a footpath running north-south under the interchange.

WisDOT officials noted that a key learning from the project was the importance of engaging local stakeholders on a semi-private or one-to-one basis well before the public information meeting. For this project, important stakeholders included Marquette University, local business improvement districts, as well as nearby businesses.

Impacts of the Project and Use of the Infrastructure

There are several environmental impacts from the project. The green infrastructure captures the first inch of rainfall, which equals over 290,000 gallons of runoff from approximately 6 acres of highway (MMSD, 2024). While the green infrastructure elements selected for this project are largely successful in filtering out sediment from the water, they are less successful in filtering out phosphates.

With respect to community impacts, the project transforms the area under the interchange into an appealing landscape with improved vegetation and lighting (see Figure 4.5). The footpath improves connectivity for pedestrians/cyclists, and the design offers the possibility for installation of future amenities. Stakeholders note that the area is somewhat underutilized, due to a lack of commercial or residential activity near the interchange. However, recent redevelopment in the area - including a new apartment complex located in the northeast corner - may lead to greater use in the future.

Source: *(MMSD, 2024)*
Figure 4.5 Green infrastructure under the Marquette Interchange

It is important to note that the communities that benefit from the improved aesthetics and connectivity differ somewhat from the communities originally impacted by construction of the highways. Community institutions such as Marquette University were impacted by the original construction and may benefit from activation of the space beneath the interchange. In addition, the benefits of increased stormwater capture and filtering of sediment likely impact the city as a whole.

However, African American communities that were displaced by the construction of I-43 (located north of the Marquette Interchange) are relatively unaffected by this green infrastructure project. At the same time, Milwaukee is working to address the needs of communities originally impacted by highway construction on other projects. For example, Milwaukee recently received a $36.6 million federal Reconnecting Communities grant to rebuild 2.6 miles of corridor through the historic Bronzeville Neighborhood (Gunn, 2024).

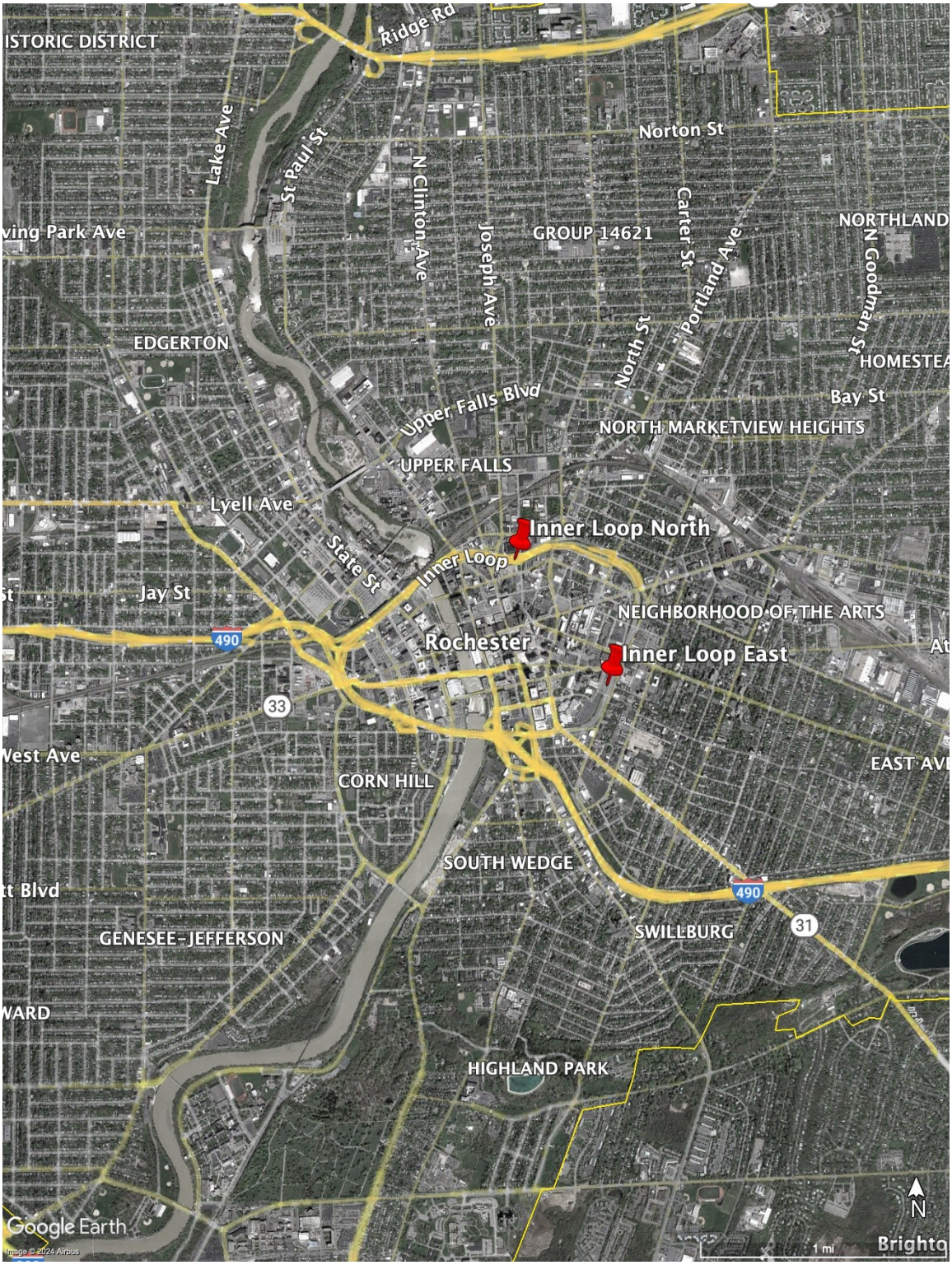
Finally, although stormwater capture was the primary aim of the project, there is evidence that green infrastructure investment may have fiscal impacts. A study of the impact of green infrastructure on property values within MMSD's planning area indicates that green infrastructure improvements had positive and significant impacts on surrounding property values, including in the Menomonee Valley neighborhood - located just south the Marquette Interchange. In addition, the authors note that the impact on property values is in addition to likely cost-savings arising from offsetting additional costs that would have been needed to address runoff and potential flooding (Madison, 2013).

4.3.3 The Inner Loop – Rochester, New York

History

The Inner Loop is a 2.68-mile sunken highway that encircles the central business district in Rochester, New York (see Figure 4.6). Planning for the highway began in the 1940s during a time of rapid population growth, rising automobile use, and suburbanization. The Inner Loop was designed to alleviate growing congestion in the city's downtown area by providing commuters with quick access to the city and through-traffic with an alternative to navigating downtown city streets (Petti, 2017).

Complex interchanges exist at two points, where the beltway connects to I-490, which runs east-west along the Inner Loop's southern portion.



Source: *Google Earth Pro*

Figure 4.6 Aerial view of Inner Loop in Rochester, New York (2024)

Construction of the Inner Loop began in 1952. During this time, the area surrounding downtown was largely developed, and large areas of land had to be acquired to accommodate construction of the freeway. Approximately 1,300 homes and businesses were destroyed in this process, forcing hundreds of residents and business owners to seek out other locations (Chhibber & McDermott, 2021). Construction of the Inner Loop also dismantled the existing street network and broke up many tightly knit neighborhoods (Petti, 2017).

By the time construction of the Inner Loop ended in 1965, Rochester's population had begun declining from its peak of 332,000 in 1950. The population fell to just over 296,000 by 1970 and roughly 232,000 by 1990 (Lahman, 2015). Population decline alongside job loss in the central city resulted in underutilization of the Inner Loop, particularly on its eastern side. In addition, while it provided commuters with easy access to the city, the sunken highway acted as a barrier to pedestrian or vehicular traffic from adjacent communities. The Inner Loop became known, colloquially, as the "Inner Noose" (Petti, 2017).

The highway's construction also had implications for Rochester's growing African American population. The number of African Americans living in Rochester increased dramatically after the second world war. In 1945, approximately 5,000 African Americans lived in Rochester; by 1964, this number had increased to 32,000 (Southwest Tribune, 2023). As in other cities, a combination of racism, restrictive covenants, and redlining led to a concentration of African American businesses and families in specific areas of the city. The earliest African American families settled in the Third Ward, located just south of what would become I-490. This area was also home to Clarissa Street, a thriving commercial area for African American businesses. Later migrants settled in the Seventh Ward, located north of the central city (Clarissa Uprooted, 2022).

Construction of the Inner Loop effectively created a barrier between residents of the Third and Seventh Wards and the central city, limiting access to job opportunities and limiting upward mobility and wealth creation (Petti, 2017). Just prior to the first Inner Loop project, areas north of the Inner Loop (the location of the historic Seventh Ward) had poverty rates nearly double the city's average and minority populations of over 60 percent (City of Rochester, 2024b).

Table 4-5 presents the demographics of the Census Tract Areas immediately adjacent to the Inner Loop East (ILE) and North (ILN) projects. As shown in the table, both project areas experience a lack of green space and close proximity to high-volume traffic. Areas to the east and inside the ILE project area have historically had high barriers to accessing home loans, while areas adjacent to the ILN have rates of poverty and unemployment relative to other areas of the city.

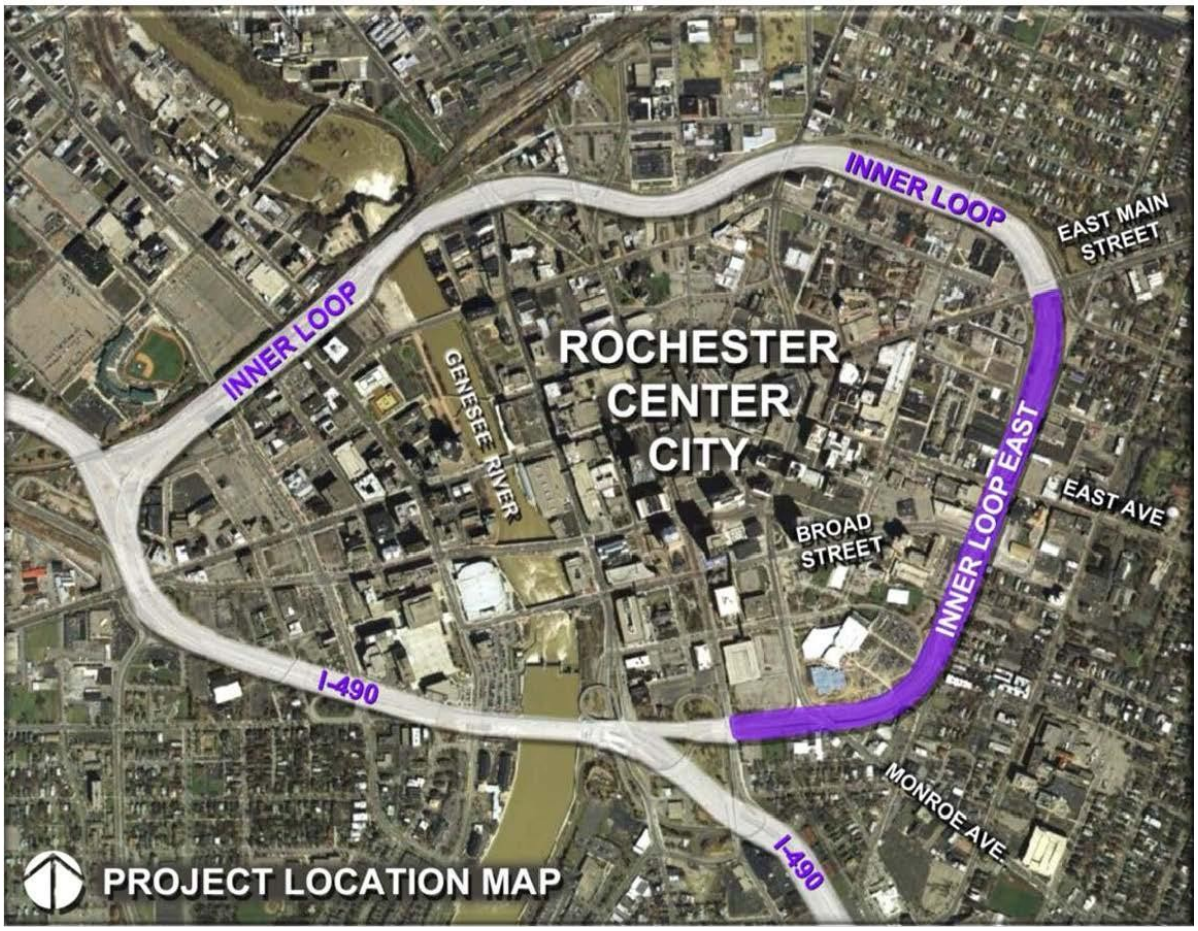
Table 4-5 Demographics in adjacent areas to the Inner Loop East and North projects (2023)

Variable	ILE (area to the east of the loop)	Inner Loop (area inside the loop)	ILN (area to the north-west)
Race	66% White, 15% Black or African American, 11% Hispanic or Latino, 1% other	48% White, 34% Black or African American, 12% Hispanic or Latino, 6 other	31% Black or African American, 30% Hispanic or Latino, 26% White, 10% American Indian and Alaska Native, 3% other
Historic underinvestment	Yes - high barriers to accessing home loans	Yes - high barriers to accessing home loans	No
Lack of green space	95th percentile	97th percentile	90th percentile
Poverty	87th percentile	91st percentile	98th percentile
Traffic proximity and volume	89th percentile	93rd percentile	74th percentile
Unemployment	72nd percentile	39th percentile	97th percentile

Note: *Census tracts consider for the area on the east to the loop: 36055009302; area inside the loop: 36055009400; area to the north-west of the loop: 36055000200.* ***Source:*** *(Council on Environmental Quality, 2024).*

Inner Loop East (ILE) Transformation Project

Completed in 2017, the Inner Loop East (ILE) Transformation Project was a city-led project that removed two-third of a mile of the Inner Loop's eastern portion (see Figure 4.7). This portion of the highway was underutilized, carrying only 10,500 vehicles per day. The project converted approximately 4,400 feet of below-grade highway into an at-grade, two-lane boulevard with on-street parking, bicycle lanes on both sides of the street, green space, and land for redevelopment. In total, the project eliminated 12 lanes of highway and three bridges, while creating 5.7 acres for mixed-use development along a walkable boulevard (Center for Innovative Finance Support, n.d.). The project broke ground in 2014 and was completed in 2017.



Source: *(City of Rochester, Dept. of Environmental Services, 2014)*
Figure 4.7 Inner Loop East transformation project map

Planning related to the project began several decades prior to its completion. In 1991, Rochester's *Vision 2000 Plan: A Plan for Downtown* recommended removing the eastern portion of the Inner Loop to connect downtown with surrounding areas. Rochester's *Rochester 2010: The Renaissance Plan* similarly advocated for converting the eastern portion of the Inner Loop into a boulevard (CNU Congress for the New Urbanism, n.d.). The 2003 Center City Master Plan affirmed community interest in reducing the "barrier effect" of the Inner Loop as a tool for downtown revitalization (FHWA, n.d.).

The New York State Department of Transportation (NYSDOT) provided funding to the City of Rochester to complete a scoping study. Additional planning efforts, including Rochester's Neighbors Building Neighborhoods program, Rochester Regional Community Design Center Charrette (2007), and Long-Range Transportation Plan for Genesee-Finger Lakes Region, similarly prioritized removal and/or reconstruction of the Inner Loop (City of Rochester, Dept. of Environmental Services, 2014).

In interviews, one stakeholder noted that it took time to move from concept to planning to design in part because the area lacked an identifiable neighborhood or community of residents or constituency of

highway users. As a result, there "wasn't a lot of opposition, but there also weren't many champions" (City of Rochester representatives, personal communication, September 13, 2024).

The long history of planning efforts resulted in the elimination of multiple scenarios for reconstructing the highway well before the project received funding to move forward. With respect to alternatives considered for the project, the 2011 Draft Scoping Report notes:

> "Normally, there are several alternative scenarios that are considered when assessing the needs of a highway in a built environment including: reconstruct, remove, elevate, bury, depress or relocate the highway. In the case of the Inner Loop, past studies have eliminated alternatives to elevate, bury or relocate the expressway based on the underutilization of the existing expressway along with community needs. The feasible options at this time are to either reconstruct/rehabilitate or remove the expressway. The reconstruction alternative will be considered the traditional "no-build" scenario and will primarily include maintenance and rehabilitation of the existing highway, as needed" (Stantec Consulting Services, Inc., 2011).

The project alternative analyzed in the Final Design Report (City of Rochester, 2014) highlights numerous community and economic benefits to highway removal, including improved community cohesion, increased multi-modal transit options, increased development and employment opportunities, and long-term employment gain. In addition, the project was not expected to result in long-term adverse health impacts or have negative environmental consequences. In other analyses, the city detailed mitigation measures designed to address noise, air quality, and hazardous waste and contaminated materials resulting from construction on surrounding communities.[15]

Funding Strategy

In 2000, the city used a small grant to complete the Inner Loop Improvement Study, which examined the feasibility and offered possible alternatives for reconstructing the eastern portion of the Inner Loop (Sear Brown & Icon Architecture, 2001). Several years later, Congresswoman Louise Slaughter helped secure a $2.4 million grant, which was used for a preliminary design of the project. A 2011 Draft Project Scoping Report built on previous planning efforts to further refine alternatives for replacing the highway infrastructure (N. Garrick, 2016).

Stakeholders noted that the project was ultimately able to move forward due to the availability and award of Transportation Investment Generating Economic Recovery (TIGER) funds under the Obama administration, stating that there was limited regional or state support at the time for using transportation dollars for a project of this type. As a result, the project was classified as a community development project (City of Rochester representatives, personal communication, September 13, 2024).

[15] The Final Design Report (City of Rochester, 2014) identifies and provides support for a classification of Class II action (Class II Categorical Exclusion with documentation) under the USDOT National Environmental Policy Act (NEPA). As a Class II action, a NEPA checklist and supporting documentation is necessary, but neither an Environmental Impact Statement nor an Environmental Assessment are required (USDOT, 2024).

In 2013, the City of Rochester received a $17.8 million TIGER grant from the USDOT, enabling it to begin construction on the highway's removal. The remaining funding for the $22 million project came from matching contributions from New York State ($3.8 million) and the City of Rochester ($414,000) (City of Rochester, Dept. of Environmental Services, 2014). Notably, constructing and maintaining the eastern portion of the Inner Loop was projected to be considerably less costly than maintaining it over a 30-year period. As one analysis of the project noted: "Maintaining the reconfigured urban boulevard created by the removal of the Inner Loop is estimated to be significantly less expensive in the long run than continuing to maintain and repair the current infrastructure" (HR&A Advisors, Inc., 2013).

Governance Structure

The ILE Transformation Project was led by the City of Rochester and required coordination with the NYSDOT, US Department of Transportation, Federal Highway Administration, and Monroe County, as well as contractors (City of Rochester, Dept. of Environmental Services, 2014). Both the NYSDOT and Monroe County Department of Transportation had been active participants on the Technical Advisory Committee for ten years preceding the project's implementation (City of Rochester, 2013).

The project involved back and forth negotiations between the City of Rochester and NYSDOT to reach an agreement. In interviews, stakeholders noted that while there was a financial incentive for the NYSDOT to remove the highway, the project was atypical in that NYSDOT approval processes were not designed for projects that aim to take away functional highway assets (City of Rochester representatives, personal communication, September 13, 2024).

Prior to the project, the NYSDOT owned and maintained the Inner Loop and I-490, as well as the superstructure and substructure of bridges crossing the Inner Loop. The ILE Transformation Project absolved the NYSDOT of responsibility for this segment of the Inner Loop and transferred ownership and maintenance responsibilities to the city and county. NYSDOT owns and maintains on-ramps to the interstate segment on the southwest portion of the Inner Loop (City of Rochester, 2013).

Stakeholder Engagement

The ILE Transformation Project held four public engagement events including two public information meetings in August 2013 and February 2014, one public open house in November 2013, and one public hearing in February 2014. City staff also met individually with business and neighborhood associations and hosted additional public meetings for specific groups (downtown workers, residents, etc.) (FHWA, 2018). It is important to note that the city provided opportunities for engagement in previous steps in the project, including as part of the Inner Loop Improvement Study (2000-2001) and scoping phase (2008-2013). Removal of the Inner Loop was also prioritized in planning related to the 2003 Center City Master Plan and 2007 Downtown Charrette Report (City of Rochester, Dept. of Environmental Services, 2014).

The Rochester Downtown Development Corporation and Southeast Area Coalition, consisting of nonprofit community groups representing residents and businesses in the project area, participated in a Project Advisory Committee. The City of Rochester was also active in soliciting endorsements from a

wide range of stakeholders, including elected officials, developers, project area stakeholders, regional organizations, and other interested businesses (City of Rochester, 2013).

City leaders note the importance of flexibility and transparency in engaging the public. During the 25 years that it took for the ILE Transformation Project to come to fruition, continuous feedback helped stakeholders maintain alignment and move forward as plans evolved (Abramson, 2023). In addition, leaders referenced the importance of a project website for disseminating information quickly and transparently in order to keep local stakeholders updated on progress and changes (FHWA, 2018).

Impacts of the Project and Use of the Infrastructure

The final design report for the ILE Transformation Project outlines four key objectives of the project (City of Rochester, Dept. of Environmental Services, 2014):

1. Support or enhance community quality of life by increasing connectivity, reconnecting the street grid system, improving the visual built environment, and encouraging sustainable land use patterns;

2. Enhance economic opportunities by addressing multimodal access, creating opportunity for new and infill development, and supporting local community land use plans;

3. Enhance the center city's transportation network via improved connectivity, utilizing complete street designs, improving geometric design, maintaining peak period mobility, and eliminating structural deficiencies; and

4. Preserve or enhance environmental health by minimizing or maintaining air quality and noise impacts, minimizing impacts on landmarks and historic resources, minimizing stormwater impacts, and supporting environmental initiatives.

The ILE Transformation Project was successful in meeting many of these objectives.

Figure 4.8 shows an area prior to and following the ILE Transformation Project. With respect to supporting and enhancing community quality of life, the project converted 12 lanes of high-speedway roadway into complete boulevard with wide sidewalks and bicycle lanes (FHWA, 2018). The boulevard includes features such as landscaping, colorful bike racks and benches, and set design guidelines for new development in the area (Pugh, 2024). In addition, the project restored parts of the preexisting street grid and connected Rochester's central business district with residential neighborhoods to the east (FHWA, 2018). Between 2014 and 2019, counts of cyclists increased by 67 percent and pedestrians by 49 percent (Pugh, 2024).

Panel A. Inner Loop before the removal of the highway

Panel B. Inner Loop after the removal of the highway

Source: *(Abramson, 2023)*

Figure 4.8 Inner Loop before and after highway removal

In removing the sunken highway, the project made 5.7 acres of land available for mixed-use development. One analysis reports that the project raised $229 million in economic development and created 170 permanent jobs and 2,000 construction jobs (FHWA, n.d.). As of 2024, 10 new multifamily projects and nearly 700 units had been developed on newly available land. Of these, 75 percent are considered to be affordable housing and units increase 20 percent for extremely low-income families

(supportive housing and project-based Section 8) (Pugh, 2024). The area also saw the emergence of restaurants and retail establishments (Horbovetz, 2023).

Despite the presence of affordable housing, concerns about gentrification persist. In the years following the ILE Transformation project, median per capita income increased from $23,198 in 2013 to $59,188 in 2021 - an increase of 155 percent. During the same period, median per capita income increased by 27 percent for the city as a whole. Educational attainment also increased from 63 percent with some college education to 85 percent in 2021. In addition, the percentage of African Americans in the project area decreased from 30 percent to 8 percent, while the percentage of whites increased from 59 percent to 77 percent (Pugh, 2024).[16]

Inner Loop North (ILN) Transformation Project

The Inner Loop North (ILN) Transformation Project is the second phase of the Inner Loop highway removal project. The project is currently in a project scoping and design phase, with construction tentatively expected to begin in 2027 (City of Rochester, 2024d).

The ILN Transformation Project differs significantly from the ILE Transformation Project in its scope, context, and approach. The project will reconfigure the remaining 1.5-mile Inner Loop segment by removing portions of elevated highway, infilling below grade portions, realigning street segments to the original street grid, and installing pedestrian and cycling facilities. The project is expected to reclaim 22 acres of land, of which 14 would be designated for redevelopment and eight for green space (City of Rochester, 2024a, 2024b).

The ILN Transformation Project is considerably more complex than the ILE Transformation Project, involving a greater number and type of highway-related structures, as well as a railroad corridor that runs adjacent to the highway (City of Rochester, 2024b). Six concepts were considered, ranging from a no-build concept to partially or completely removing the highway with various degrees of reconfiguring the corridor to promote connectivity, urban restoration, multimodal transit, and traffic flow and congestion. Several concepts were eliminated due to a failure to meet screening criteria related to operations of the transportation network (most notably, a connection to I-490 that runs along the south part of the Inner Loop), inability to establish the previous street grid, and the reclamation of acreage ill-suited for future economic and community development opportunities due to their likely size and shape (City of Rochester, 2024c).[17]

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[16] The areas included in this estimate include three Census block groups located adjacent to the ILE project: Block group 1, Census Tract 94.01; Block group 1, Census Tract 94.02; Block group 1, Census Tract 93.02 (Pugh, 2024).

[17] Project documentation identifies ILN as a likely Class II action (Categorical Exclusion) under the USDOT National Environmental Policy Act (NEPA) Regulations, meaning that the actions are not expected to have a significant effect on the human environment and thus do not require an environmental assessment (City of Rochester, 2024c; USDOT, 2024).

Notably, both interviews and project documentation attest to a scope that extends beyond transportation. For example, the project has involved considerations about neighborhood and land use planning to address community goals related to diverse housing, ownership opportunities, and expanded green space. Interviews also attest to messaging of the project as "not a transportation project," but rather an economic and community development project.

Funding Strategy

The total estimated cost of the project is $223 million, which includes $160 million for the street grid, $21 million related to county "pure waters" tunnel, $27 million in improvements to I-490, and $15 million for signature bridge elements to the Genesee River Bridge Crossing. New York State has allocated $100 million from the NYSDOT's five-year capital plan to support implementation of the project (Costanza, 2023). Project partners have also applied for approximately $125 million in federal dollars through the USDOT's Reconnecting Communities Pilot Program (Moule, 2024).

Stakeholder Engagement

The context of ILN differs considerably from ILE, as this segment of the Inner Loop carries more traffic than the segments removed during the ILE Transformation Project. Perhaps most significantly, the project cuts through residential areas with active community groups. Neighborhoods north of the remaining Inner Loop segments have poverty rates far above rates for the city as a whole, and more than 60 percent of residents in these neighborhoods identify as something other than white (City of Rochester, 2024b).

The broader national context is also different. As one city stakeholder notes: "The whole conversation nationally has changed on a whole host of issues… nobody was talking 10, 11, 12 years ago, when we were in the throes of design and grants and things, about racial equity, about displacement…the conversation is very different." Rather, the focus during the ILE Transformation Project was on development, investment, job creation, and cost-benefit analysis (Pugh, 2024).

The changed context has implications for the goals of the ILN Transformation Project as well as its approach. Goals for the ILN Transformation project include: (1) connectivity and accessibility, (2) neighborhood restoration, and (3) equitable outcomes. Public engagement is also considerably more robust relative to the previous project.

Project documentation as well as interviews with local stakeholders detail a greater number of meetings with the general public and key stakeholders (City of Rochester, 2024b). As of October 2024, engagement efforts have included 10 public meetings, some of which were presented in a design or workshop format, direct meetings with neighborhood groups, pop-up events, a community survey, and the involvement of an engaged Community Advisory Committee of over 50 representatives of local nonprofits, major property owners, business leaders, and political officials. Another key group includes the committee's Racial Equity Subcommittee, which exists to maintain a focus on equitable outcomes and future redevelopment (Pugh, 2024).

In interviews, local project leads noted the importance of transparency and intentionality in engaging the public. As one project lead noted: “[Engagement is] not about the meetings you provide - but how meaningful are they? How genuine are you?” Interviews also attest to the importance of iterative engagement, with project leads incorporating feedback and refining what is presented to the public at each engagement. As one individual stated: “You can’t ever really pull back.” While this requires more time and effort by project stakeholders, it also provides more opportunities to make the case for the project and design choices (City of Rochester representatives, personal communication, September 13, 2024).

Impacts of the Project and Use of the Infrastructure

The ILN project identifies three primary goal areas, including connectivity and accessibility, neighborhood restoration, and equitable outcomes. While some objectives of the ILN project align with those of ILE (including increased connectivity via reconnecting the street grid; promotion of multi-model accessibility; and enhanced opportunities for new investment and employment opportunities), the objectives of the ILN project differ in focusing on equitable outcomes for existing and future businesses and residents. Criteria used to assess concepts with respect to equitable outcomes include opportunities to expand green space; safety for all modes of transportation; minimized displacement of existing residents; and maximized opportunities for diverse housing. In addition, several criteria used to evaluate proposed design alternatives were developed by community members during the project’s planning phase.

4.3.4 The Stitch – Atlanta, Georgia

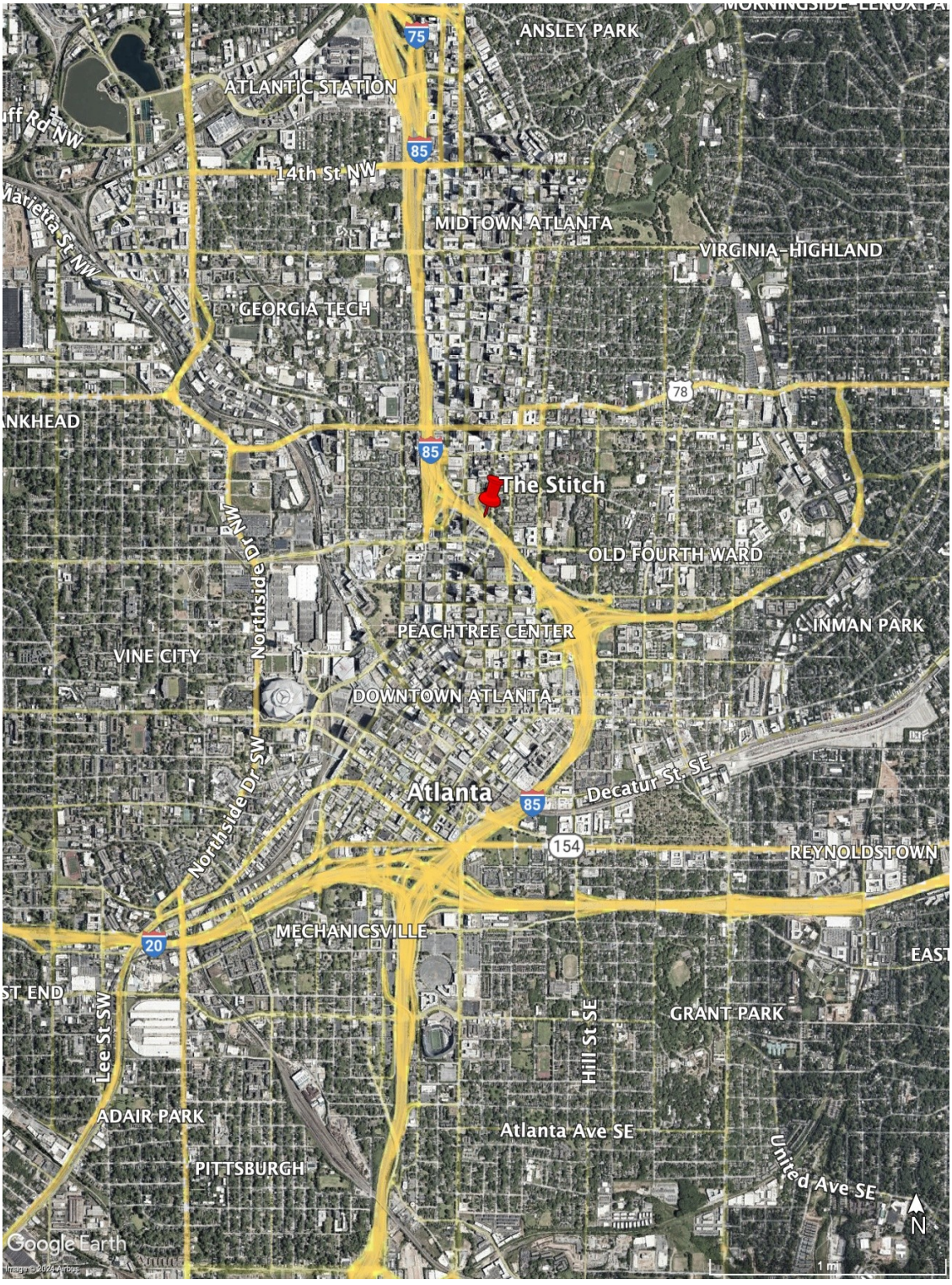
History

Atlanta is a city of approximately half a million residents located in the northwestern region of Georgia. The city of Atlanta experienced rapid economic growth and suburbanization in the 1940s and 1950s. In 1948, construction began on a series of highways designed in part to alleviate traffic congestion and connect the expanding suburban areas to the central business district. The highways were designed as a series of "arteries" extending from Atlanta to other urban areas in the state and were connected via a below-grade "Downtown Connector" (Connector), which would run north-south through the center of the city (H. W. Lochner & Company & De Leuw, Cather & Company, 1948; Lichtenstein Consulting Engineers, 2007).

A clear intent of highway design was to divide white from Black communities (DaVinci Development Collaborative LLC, 2019; Kruse, 2019). The Connector, for example, was intended to act as a barrier "between the central business district and the East Side African American Community" (H. W. Lochner & Company & De Leuw, Cather & Company, 1948; The Stitch, 2024b). The Connector cut through the Sweet Auburn neighborhood; a relatively prosperous African American commercial area located east of downtown Atlanta. Although African American voters were able to win concessions to move construction of the Connector slightly to the east, "highway construction … fundamentally destroyed [Sweet Auburn's] warm spirit of enterprise, conviviality, and respectability and fostered instead an atmosphere of fear, lawlessness, and decay" (Wiggins, 2021).

Land clearing began in 1948, and the Connector was opened to the public in 1964. Construction of the Connector displaced over 7,000 Black residents and contributed to the decline of other predominantly African American neighborhoods. In total, highway development displaced approximately 24,000 people and disconnected historically Black neighborhoods such as Buttermilk Bottom and Butler Street from economic opportunities in Downtown Atlanta (City of Atlanta & Atlanta Downtown Improvement District, 2022).

Currently a 14-lane highway, the Connector was reconstructed and widened in the mid-1980s (The Stitch, 2024b). Complex interchanges exist just south of The Stitch project area, where the Connector joins the John Lewis Freedom Parkway, as well as further south where the highway connects with I-20. Today, The Stitch is located in a federally-defined Area of Persistent Poverty, in which 23-31 percent of residents live below the poverty line. Between 46 and 68 percent of residents identify as people of color, and a large minority of residents lack vehicles in their households (City of Atlanta & Atlanta Downtown Improvement District, 2022). Figure 4.9 presents the area of the project.



Source: *Google Earth Pro*

Figure 4.9 Aerial view of The Stitch in Atlanta, Georgia

Table 4-6 presents the demographics of the Census Tract Area immediately adjacent to The Stitch project and other areas recognized by the DOT to be impacted by the project. This table shows that all areas surrounding The Stitch project area experience high poverty, lack of green space, and close proximity to high-volume traffic. Three areas also experience historically high barriers to accessing home loans based on redlining maps, and all are diverse racially.

Table 4-6 Demographics in adjacent areas to The Stitch project (2023)

Variable	Immediately Adjacent	East	Southeast	South	West
Race	39% White, 33% Black or African American, 18% Asian, 5% Hispanic or Latino, 5% other	48% White, 37% Black or African American, 7% Asian, 5% Hispanic or Latino, 3% other	56% Black or African American, 30% White, 5% Asian, 5% Hispanic or Latino, 4% other	59% Black or African American, 32% White, 5% Hispanic or Latino, 2% Asian, 2% other	56% Black or African American, 32% White, 8% Asian, 5% Hispanic or Latino
Historic underinvestment	No	Yes - high barriers to accessing home loans	Yes - high barriers to accessing home loans	No	Yes - high barriers to accessing home loans
Lack of green space	98th percentile	85th percentile	96th percentile	97th percentile	95th percentile
Poverty	86th percentile	79th percentile	89th percentile	93rd percentile	95th percentile
Traffic proximity and volume	99th percentile	98th percentile	99th percentile	99th percentile	98th percentile
Unemployment	82nd percentile	19th percentile	65th percentile	81st percentile	96th percentile

Note: *Data for the immediately adjacent area considers Census tract 13121001900; other areas include 13121001800 (east), 13121002800 (southeast), 13121011900 (south), 13121002100 (west).* ***Source:*** *(Council on Environmental Quality, 2024)*.

The Stitch Project Overview

The Stitch is a project that aims to "Cap the Connector" by placing a freeway cap over a ¾ mile segment of the Connector (see Figure 4.9). It is one of the busiest segments of the highway, traversed by approximately 350,000 vehicles per day (DaVinci Development Collaborative LLC, 2019). The project originated in the early 2000s following a proposal to expand and connect Mayors' Park in downtown Atlanta following the deaths of two prominent former Atlanta mayors. The idea resurfaced roughly a

decade later, when the Atlanta Downtown Improvement District commissioned a study to revisit the idea of a cap. Following the release of The Stitch Vision Plan in 2015, the project went through various iterations and stages of predevelopment work, including technical feasibility studies and implementation recommendations. The Stitch received federal funding to begin advanced planning in the early 2020s (The Stitch, 2024d).

***Source**: (City of Atlanta & Atlanta Downtown Improvement District, 2022)*

Figure 4.10 Map of The Stitch project area

Modeled after Klyde Warren Park in Dallas, Texas, The Stitch will be a programmed, rather than a static park. The park will include a 17-acre park with multi-use plazas and lawns, an interactive water feature, buildings for food and beverages, public art, and event and shade pavilions, to name just a few design elements. The scope of the Stitch also expands to multiple other areas.

Goals for The Stitch are organized around four pillars, including community, transportation, economy and wealth building, and health and resilience. Within each of these pillars are a set of goals, followed

by Stitch-led and partner-led objectives. The pillars and goals are shown below (for more information on specific objectives, see Atlanta Downtown Improvement District, 2024a).

1. Community – Cultivate a thriving, diverse, and inviting community that reflects Atlanta's rich culture
    a. Create a park: Create a park to reinvigorate Downtown Atlanta that meets the unique needs of existing and future community members.
    b. Prioritize equity: Be intentional about prioritizing equity and inclusivity to make The Stitch accessible to people of all identities and backgrounds.
    c. Infuse history and culture: Infuse the history, culture, and aspirations of the community throughout projects, programs, and partnerships.
2. Transportation – Repair the long-standing barrier created by the interstate system and restore human-scaled connectivity options
    a. Reconnect communities: Reconnect north, south, east, and west Atlanta neighborhoods and community assets.
    b. Safe and equitable transit: Provide safe, comfortable, and resilient multimodal transportation options for all modes regardless of age, race, ability, and socioeconomic factors.
    c. Prioritize alternative transportation: Reorient infrastructure and land uses to prioritize pedestrians, bicyclists, and transit.
    d. Streets as public space: Maximize the use of streets as public gathering spaces.
    e. Transit improvements: Facilitate an increase in transit use through improvements to Civic Center MARTA Station and other nearby transit facilities.
3. Economy and Wealth Building – Build equitable access and expand opportunities and resources
    a. Transportation options: Expand low- and no-cost transportation options, such as transit, bicycling, and walking, and reduce reliance on car ownership.
    b. Economic development and affordable housing: Catalyze the thoughtful redevelopment of underutilized public and private spaces and maximize the creation of housing that meets Atlanta's affordable housing needs.
    c. Job opportunities: Improve equitable access to diverse and good-paying job opportunities to combat gentrification.
    d. Community services: Advance location-efficient and equitable access to healthy food, healthcare, childcare, and other services.
    e. Partnerships: Build committed partners between the public and private sectors to optimize investments
4. Health and Resilience: Enhance health, safety, and sustainability
    a. Healthy urban environment: Create an urban environment that promotes healthy lifestyles, including of both physical and mental health
    b. Resilient infrastructure: Make investments in resilient infrastructure and plan for the environmental impact of the entire project life cycle.
    c. Prioritize safety: Prioritize personal safety in the design of the public realm.

For the purposes of this analysis, two points are worth highlighting. First, it is clear the development and selection of alternatives and successful implementation of the plan will require active and intentional partnerships with stakeholders across areas and levels of government. This is particularly true for goals involving transit and economy and wealth-building, which will require the involvement of transit authorities as well as local government and nonprofit organizations.

Second, an equity lens is infused throughout pillars, goals, and objectives. The Stitch Master Plan has an entire chapter dedicated to analyzing the history and current conditions through an equity lens and drawing out equity goals for The Stitch across key areas such as land use and zoning and economic development (Atlanta Downtown Improvement District, 2024a). Project leads noted that while previous rounds of visioning and planning have been more office-centric, the more recent plans prioritize equity and designs to facilitate the reimagining of downtown Atlanta (ADID representative, personal communication, November 30, 2024).

Concept design and National Environmental Policy Act (NEPA) review (required due to the use of federal funds) are currently underway, with expected completion in mid-2025 (The Stitch, 2024a). The timeline for The Stitch is 2023 - 2037. Phase I will construct a bridge over the Connector between Peachtree Street and Courtland Street and build a park and streetscape improvements on existing adjacent streets and bridges. It also includes a number of multimodal transportation projects and transit station enhancements. Construction of Phase I is estimated to begin in 2026 and conclude in 2029. The design period for Phase II will begin in 2028, with construction beginning in 2030 and concluding in 2033. Phase III will begin design work in 2031, with an estimated completion of construction in 2036 (The Stitch, 2024a).

Funding Strategy

With an estimated cost of $713 million, The Stitch is one of the most expensive projects analyzed in this report. The Stitch has received a variety of grants to support study, design, and planning for the project. Federal funding includes a $1.16 million Community Project Funding Grant in 2022, $1.1 million from the US Department of Transportation's Reconnecting Communities Pilot, and $5 million to support preliminary engineering in 2023 (Kelley, 2024). In addition, The Stitch recently secured approximately $158 million from the federal Reconnecting Communities and Neighborhoods grant program to fund the construction of Phase 1 of the project (Kelley, 2024; The Stitch, 2024d).

The Stitch Master Plan identifies a variety of funding sources to fund the construction and ongoing maintenance and management of the park, including city budgetary allocations and earmarked funds; federal and state grants; real estate value capture, including through Tax Allocation Districts, Special Service Districts, and Community Improvement Districts; philanthropic and other private contributions and membership; and earned income (Atlanta Downtown Improvement District, 2024b).

Governance structure

The Stitch is led by the Atlanta Downtown Improvement District (ADID), a 501(c)(3) public-private partnership, governed by a Board of Directors and funded via a community improvement district. The

proposed governance structure for The Stitch is a new 501(c)(3) organization to spearhead the design, development, programming, operation, and management of the park. Once completed, the expectation is that the Georgia Department of Transportation (GDOT) will own the tunnel, cap, and bridge structure; the City of Atlanta will have an air rights easement to build and operate the park above the cap; and the 501(c)(3) will have a licensing agreement operate and maintain the park, including the tunnel system (Atlanta Downtown Improvement District, 2024a).

The development and implementation of The Stitch has required coordination and collaboration with GDOT, as well as local stakeholders such as the City of Atlanta, the Metropolitan Atlanta Regional Transit Authority, and the philanthropic and nonprofit communities. Alignment of interests - for example, The Stitch's incorporation of affordable housing development and the Mayor of Atlanta's commitment to delivering 20,000 units of affordable housing – has helped facilitate collaborative work. Stakeholders note that a history of successful collaboration - specifically, on Atlanta's Beltline - provides a level of comfort across stakeholders and has contributed to public support for The Stitch project (ADID representative, personal communication, November 30, 2024).

The evidence indicates that several factors facilitated the partnership between ADID, the City of Atlanta, and GDOT. There is a history of collaborative work between GDOT and local entities, contributing to an awareness of needs within the agency and trust between partners. As one project lead notes: "There is a good level of trust there that we've built up over the years" (ADID representative, personal communication, November 30, 2024). An awareness of needs helped Stitch stakeholders proactively address issues that would likely be of concern to GDOT. For example, The Stitch does not require a financial commitment from GDOT to operate or maintain either the tunnel or the park. Despite the fact that The Stitch is not solely within GDOT's mission, one project lead noted that the agency has been a committed partner on the project for many years, understanding that The Stitch will have widespread benefits for the region and state as a whole (ADID representative, personal communication, November 30, 2024).

Stakeholder engagement

There is a robust community engagement component of The Stitch. The most recent round of engagement activities began in November 2023 and has included 2 community workshops, 2 digital feedback portals, 3 student workshops, 14 community pop-up events, 22 stakeholder interviews, 5 focus groups, 4 steering committee meetings, and multiple presentations at community meetings. During this period, more than 6,000 individuals were engaged (2,000 in person) and over 20 engagement events were held (City of Atlanta, 2024). Engagement activities conducted as part of the Master Plan also included targeted outreach to environmental justice communities to ensure a representative sample of residents who live in and around the project area.

While the public response has generally been positive, the project lead notes that there has been some criticism that The Stitch does not do enough to support those who were originally displaced by the construction of the Connector. In response, a historian and community engagement specialist were hired to identify previous residents of the neighborhoods surrounding The Stitch and capture the stories

of former residents. This work will be followed by a series of listening sessions with previous residents and their descendants to better understand their needs and hopes concerning The Stitch. The Master Plan includes a chapter dedicated to the history of communities that were broken apart due to highway development and urban revitalization efforts, as well as a goal centered on infusing history and culture (Atlanta Downtown Improvement District, 2024a). Notably, the engagement described above is led at the local level, with project leads describing it as distinct from NEPA engagement in which GDOT will take a more active role (ADID representative, personal communication, November 30, 2024).

Impacts of the project and use of the infrastructure

The Stitch is a complex project involving multiple areas of planning and policy, including housing. As such, it is difficult to synthesize all the impacts of the project and intended uses of the infrastructure. Impacts highlighted on The Stitch website include (The Stitch, 2024c):

- Economic development: 3,000-3,4000 new affordable housing units; and 30 percent of new or existing housing units in the available affordable to individuals and families with 80 percent or less of area median income
- Parks and greenspace: 17 acres of new parks in Downtown
- Transportation: a 35 to 54 percent reduction in drive alone trips by 2040
- Sustainability and environment reintroduction of permeable surfaces and additional capture and filtration of 19 million gallons of rainfall per year
- Economic development: spur $2-3 billion in private investment; generating $21-$58 million in new annual property tax revenue (The Stitch, 2024c); 800 construction jobs; 12,230 estimated permanent jobs in new developments

Additional economic and environmental benefits are expected from this project (Council for Quality Growth, 2021). The project will foster transit-oriented development at the Civic Center MARTA rail station and introduce an off-street local and commuter bus facility for improved passenger connections, which will improve access to jobs. It will also contribute to the sustainability of the area by locally addressing flooding and mitigating noise and air pollution, increasing multimodal transportation, and incorporating climate change mitigation strategies. Figure 4.11 presents the current and the proposed view of the project.

Panel A. Aerial view of connector, current

Panel B. Aerial view of The Stitch, proposed

Source: *(Atlanta Downtown Improvement District, 2024a)*

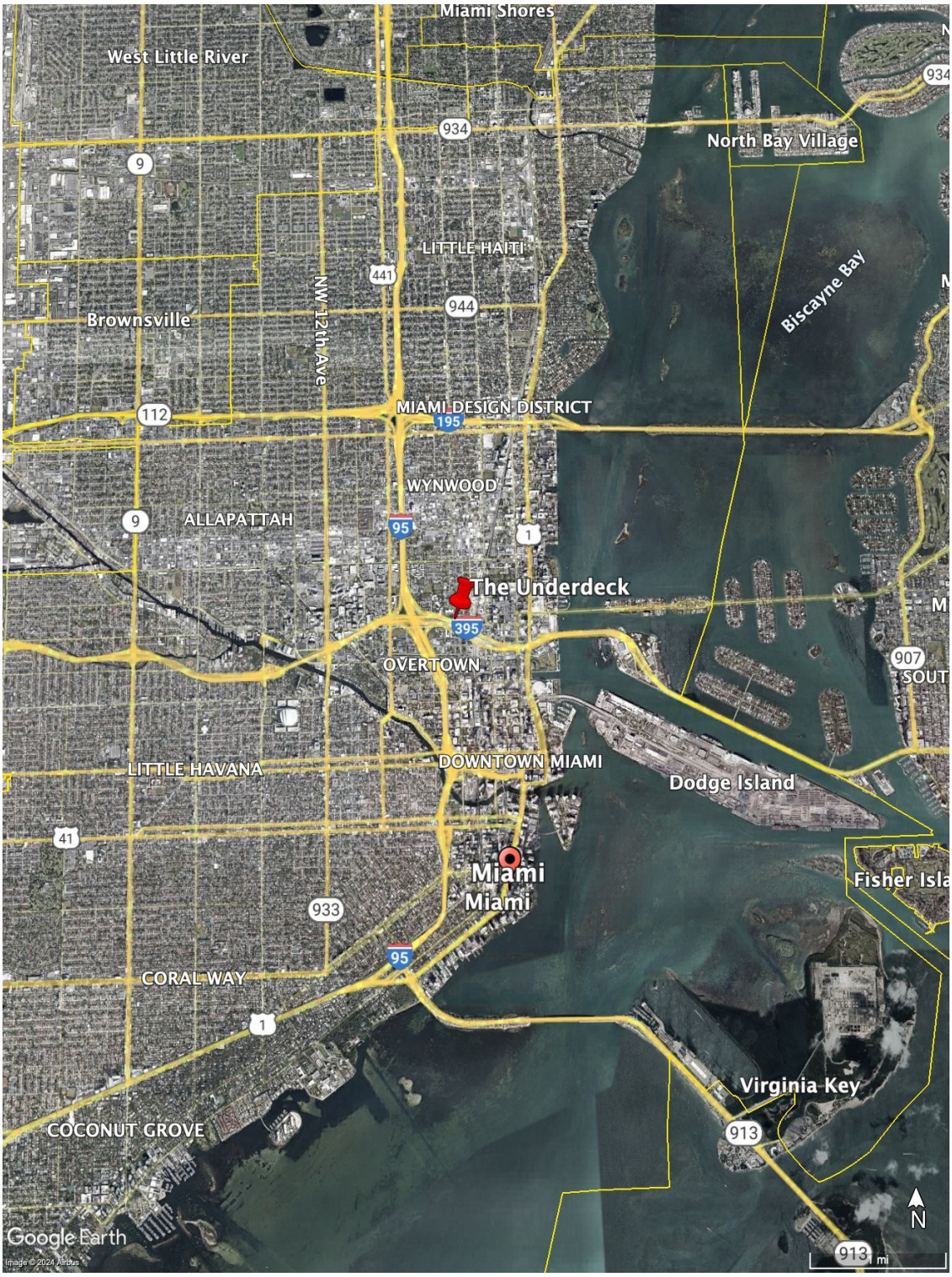
Figure 4.11 Aerial view of The Stitch pre- and post-construction (proposed)

4.3.5 The Underdeck – Miami, Florida

History

Miami is a city of approximately 455,000 people, located on the southeastern tip of Florida. In the 1960s, the construction of I-95 and I-395 and the spaghetti junction that connects them cut through the heart of the Overtown neighborhood in Miami, Florida. In the early 1900s, Overtown was a port entry for Black immigrants and drew in migrants from the American southern states, becoming a cultural home for the city's African American community. Before highway construction, Overtown was a thriving hub of black economic and cultural life. The population was primarily African American (75% of Miami Black residents lived in Overtown), composed of Black middle-class residents, entrepreneurs, and professionals owning businesses (although residents were concentrated in low-paying jobs).

While other areas of Miami benefited from highway construction, Overtown experienced many negative impacts (Dluhy et al., 2002; Foltman & Jones, 2019; Galli, 2023; Merritt, 2022; Mohl, 2001; Smith-Cavros & Eisenhauer, 2014). The highway construction displaced 12,000 people - approximately 40 percent of the population. It also forced the closure of numerous local businesses. Between 1949 and 1966, business establishments in the three-street commercial area declined by 28 percent. In addition, the project also resulted in the demolition of 40 blocks of housing and a portion of Miami's African American entertainment district. All of these weakened the social fabric and eroded the sense of community. After highway construction, the Overtown neighborhood experienced considerable demographic turnover (Dluhy et al., 2002; Merritt, 2022; Smith-Cavros & Eisenhauer, 2014). Figure 4.12 presents the area impacted by the project.



Source: *Google Earth Pro*

Figure 4.12 Aerial view of location of The Underdeck in Miami, Florida

Overtown continues to have a diverse population (Miami-Dade MPO, 2021). Based on 2015 ACS data, the population is primarily African American and Hispanic or Latino. The average per capita income is $11,578 (compared to an average per capita income of $28,823 in Miami-Dade County).

Table 4-7 presents the demographics of the Census Tract Areas immediately surrounding The Underdeck project. This table shows that the areas abutting the project lack green space and are located in close proximity to high-volume traffic. While the area to the east of The Underdeck project is relatively disadvantaged with respect to poverty, areas to the west of the project are considerably more disadvantaged with respect to poverty, unemployment, and historic barriers to home loans. Demographic data also show that areas to the west of The Underdeck are almost entirely non-white.

Table 4-7 Demographics in adjacent areas to The Underdeck project (2023)

Variable	North-West	South-West	East
Race	70% Black or African American, 25% Hispanic or Latino, 5% Other	52% Black or African American, 44% Hispanic or Latino, 4% other	53% Hispanic or Latino, 42% White, 7% Black or African American
Historic underinvestment	Yes - high barriers to accessing home loans	Yes - high barriers to accessing home loans	No
Lack of green space	86th percentile	89th percentile	94th percentile
Poverty	97th percentile	87th percentile	61st percentile
Traffic proximity and volume	99th percentile	99th percentile	97th percentile
Unemployment	98th percentile	93rd percentile	35th percentile

Note: *Census tracts considered for the area on the north-west of the project: 12086003100; area on the south-west of the project: 12086003400; area to the east of the project: 12086003702.* ***Source:*** *(Council on Environmental Quality, 2024).*

The Underdeck Project Overview

The Underdeck is part of a larger project involving the rebuilding of I-395 and construction of a signature bridge. Rebuilding I-395 has been a complex issue due to conflicting objectives (Miami Urban Watch, 2002). On the one hand, the City of Miami revitalization goals of improving socio-economic conditions, improving the city's image and attracting businesses, creating a residential/mixed-use community, and creating a pedestrian friendly environment with a strong identity and sense of place require certain changes in the I-395. On the other hand, the Florida Department of Transportation (FDOT) efforts to correct existing operational deficiencies, accommodate new traffic demands, and provide access to the

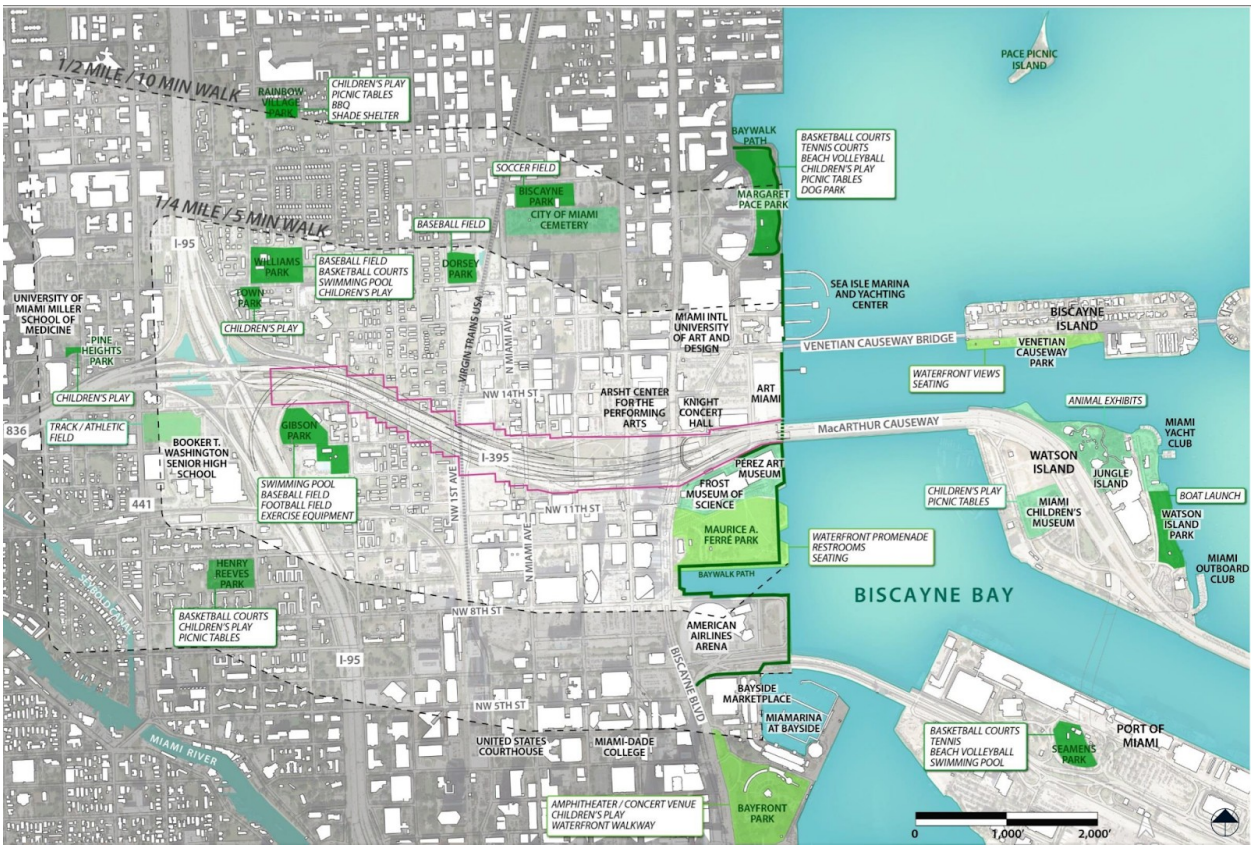
Port of Miami require other changes in I-395.[18] These two opposing forces, in addition to the lack of funding, considerable opposition by communities (such as Overtown), and corruption allegations[19] put on hold rebuilding plans for I-395. Moving the project forward and accommodating the needs of all relevant parties required realigning objectives and integrating efforts toward a common goal.

In 2019, FDOT, as the owner of I-395/State Road 836, approached the City of Miami to establish a partnership (City of Miami, 2024), in which the city would assist in the design of The Underdeck and thereafter operate and maintain The Underdeck under a master lease agreement. Both parties entered into a series of Memorandums of Understanding (MOUs)[20] that collectively set the parties' expectations as to their respective roles and responsibilities regarding the design, maintenance, and operation of The Underdeck. The City Commission also directed the administration to collaborate with community stakeholders to review the FDOT design and make recommendations. Between late 2021 and early 2022, FDOT and the City worked collaboratively to refine the plan (the Consensus Plan).

In 2021, the City of Miami Commission approved an MOU with the Town Square Neighborhood Development Corporation (TSNDC)/Underdeck Committee (Underdeck Executive Committee, 2022). This committee was formed to empower a diverse group of community stakeholders to galvanize community voices and engagement to inform the development of the project, elevating residents from bystanders to active participants. The committee, which consists of civic, business and philanthropic leaders, adjacent landowners, small business owners, nonprofits, and residents whose actions inform the design, governance, operations and maintenance, and funding of the project, issued a recommendations report that built on its community engagement efforts in 2022.

As of October 2024, The Underdeck Project is a community-centered municipal project that aims to alleviate some of the community isolation brought by I-95 and I-395. The project design is a 1-mile (33 acres) scenic gathering spot and pedestrian corridor under the path of I-395 (Figure 4.13) (Hanks, 2024). The estimated total cost for the project is $82.65 million (City of Miami, 2023) and cannot start construction until Florida finishes the "Signature Bridge" project that elevates I-395, which has an estimated completion of 2027.

[18] For FDOT, The Underdeck is part of a major project that involves the reconstruction of I-395 that was fully funded as part of the FDOT's 2014-2015 fiscal year budget (Viglucci, 2017).
[19] The City of Miami sued FDOT in 2013 for improper venue over I-395 bridge. Between 2013 and 2017, FDOT and the City organized a committee, as provided in the joint motion, to evaluate and recommend various bridge concepts proposed. In May 2017, FDOT announced its intention to award the project and the City filed a motion to re-open the 2013 case, which was denied by trial court (Florida Department of Transportation v. Sarnoff, 2018). Allegations reflected on the excessive costs of the project, lack of transparency in projects' assessment (aesthetic scoring), and lack of community input considered in the process.
[20] The first MOU dated April 4, 2019. The second MOU dated August 14, 2020 ("MOU 2", R-20-0147), with a first amendment on September 23, 2021 (R-21-0386) and a second amendment on July 1, 2022. The third MOU dated October 20, 2023 ("MOU 3").

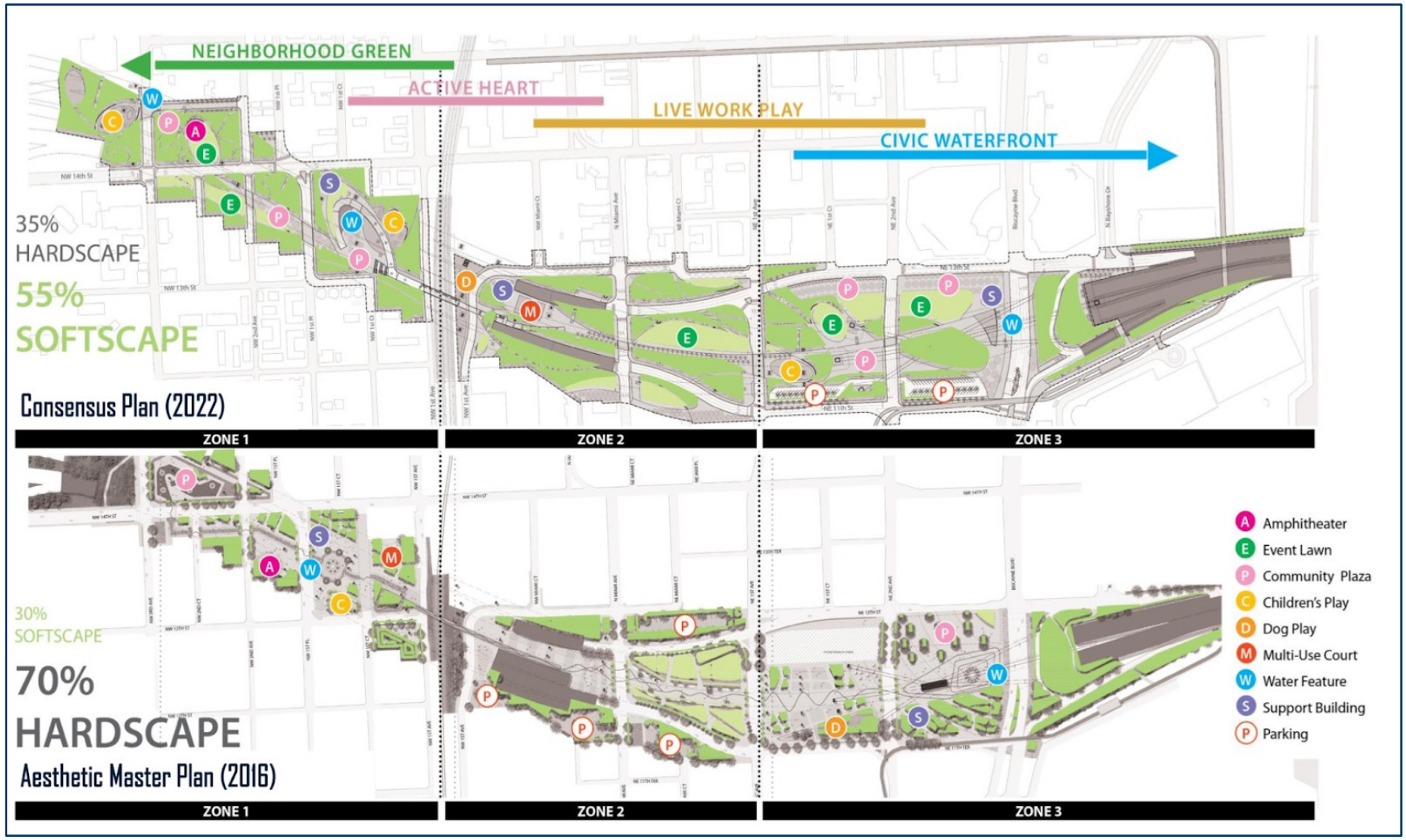


Source: *(HRA et al., 2019)*

Figure 4.13 The Underdeck in Miami

The Underdeck is designed to reconnect the urban fabric of Overtown, transforming the division brought by the infrastructure into an area that unifies the city (City of Miami, 2023). The project promotes equity and environmental justice through the creation of green space with opportunities for recreation as well as integrated pedestrian and bike routes, currently lacking at this location (see Figure 4.14).[21] The project aims to reclaim marginalized infrastructure space for active public use, enhance connection to cultural institutions, and revitalize adjacent neighborhoods (The Underdeck, 2022b).

[21] The open space is due to the elevated facility and the efforts to mitigate the visual impact of it. The design offers a reduced number of columns, taller columns (from 18-20 to 45-60 feet), and reduced fill plug (Archer Western-de Moya Joint Venture, 2017; HDR, 2022).



Source: *(Trina, 2023)*

Figure 4.14 Areas of The Underdeck 2016 plan vs 2022 plan

The Underdeck involves three unique characteristics that require attention and the development of thoughtful strategies (Trina, 2023). First, the project borders the I-95/I-395 interchange (a spaghetti junction) on the west, which needs to be addressed to create an accessible and human-scaled place. Ecological improvements and nature trails were identified as opportunities to mitigate the challenges brought by the interchange. Second, the middle of the project includes a Florida East Coast (FEC) rail crossing that needs to be overcome (as a physical barrier) with an accessible crossing for east-west continuity. Third, toward the east there is a need for a pedestrian focus to overcome the significant vehicle traffic and to create connections with cultural institutions. Figure 4.15 shows major areas and features of The Underdeck's design.

Source: *(City of Miami, 2024)*

Figure 4.15 Proposed design of The Underdeck

Funding Strategy

The total estimated cost of the project is $83 million (City of Miami, 2024), which is largely supported through federal funding. In March 2024, the City of Miami received $60.35 million from the Reconnecting Communities and Neighborhoods (RCN) federal grant program. FDOT has committed approximately $10 million, leaving another $10 million for the City of Miami (Hanks, 2024).

In addition to construction costs, operation and maintenance costs were estimated at $5.7 million annually in 2022 (Underdeck Executive Committee, 2022). These included maintenance, programming

and marketing, administrative costs, security, and liability coverage. The Committee recommendations include several funding considerations to cover those costs including fundraising contributions and endowment (2 percent), earned revenue such as from events and concessions (22 percent); community redevelopment agencies (CRAs) or business improvement districts (21 percent); government allocations from the FDOT, City of Miami, and Miami-Dade County (17 percent); grants (10 percent); and in-kind contributions from the public and private sectors (6 percent).

Several authorities also contributed funds for The Underdeck's design (Lackner, 2019). The Miami's Downtown Development Authority (DDA) voted in December 2019 to commit $50,000. Similarly, the Miami Parking Authority also committed $50,000. The Omni CRA agreed to contribute $150,000, and the Southeast Overtown/Park West CRA considered contributing.

Governance Structure

Currently, the City of Miami will operate and maintain The Underdeck under a master lease agreement with FDOT. The project is housed in the Department of Real Estate & Asset Management (DREAM) at the City of Miami. The governance structure recommended by the Committee for The Underdeck is a PPP with a conservancy model (Underdeck Executive Committee, 2022). The conservancy will not have membership but a board of directors that includes members from city, county, and state leadership and community representatives.

Stakeholder engagement

Although the project was originally funded in the 1990s, it stalled in part due to opposition from the community. FDOT officials note that the most recent round of work on the project has involved more active collaboration with local actors such as the City of Miami as well as more extensive public engagement, often facilitated by local stakeholders (FDOT Representatives, personal communication, November 23, 2024).

The Underdeck Committee has conducted a variety of efforts to ensure the community is informed and has opportunities to provide insights and feedback. These efforts include surveys, focus groups, virtual meetings and in-person meetings in various locations in Overtown and Downtown, and working group meetings related to stakeholder awareness; design, construction, and operation and maintenance; funding development; traffic, utilities, mobility, and parking; and name and branding. These efforts have brought more than 350 attendees to community meetings, 2,000 survey respondents, 135 focus group members, and 124 members of working groups; and involved representation of 31 organizations (Friends of the Underdeck, 2024; Trina, 2023).

Four main themes that inspired the current design of The Underdeck emerged from the ongoing outreach and engagement activities (The Underdeck, 2022b). The first theme is a desire for an active place; that is, a place for kids, families, young adults, and senior adults; a place to walk, jog, and run; and a place with a dynamic programming that adjusts to needs. Second, there is a desire for a connecting place; that is, a place that not only connects the east with the west and the north with the south, but also brings people together everyday through events, markets, and festivals. Third is the hope for an

authentic place that celebrates the diverse community and heritage. Lastly, engagement identified a need for a green place that counterbalances the concrete.

However, there have been concerns related to the planning process and the community engagement efforts (Merchant, 2022). First, a local newspaper reported the existence of a previous plan for The Underdeck project made for the city by a team of local Black architects in 2017, whom felt pushed out of the planning process (Morell, 2022).[22] Second, community members have also drawn concerns about the largely white and affluent composition of The Underdeck Committee, which raises concerns about the community-oriented approach that the project could involve.[23] Lastly, there is a suggestion that important voices of the Overtown community may be missing from the conversation.[24]

Strategies considered for implementation

Stakeholders note that to promote equitable economic impact, there are a variety of strategies and initiatives that can be considered with the community to ensure that the project is culturally sensitive (Underdeck Executive Committee, 2022). Some of the strategies include supporting local employment and programming opportunities, such as direct-hire opportunities, contracting with local businesses, promoting opportunities for local artists and vendors, and developing internship programs and seasonal opportunities for youth. For a larger impact, stakeholders recommend coordination with other initiatives such as housing and development policies, local development opportunities, and city/county workforce and training programs.

Representatives of local small businesses who participated in an interest group meeting also provided ideas for the development of an economic development strategy focused on strengthening local business opportunities (Underdeck Executive Committee, 2022) and involve having Overtown business and community members be part of the employment and revenue-generating opportunities. This could be achieved, for instance, by having a portion of parking meter fees directed to local organizations,

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[22] The plan was proposed as part of a joint venture between engineering groups (currently leading the ongoing construction of the I-395/SR836/I-5 project) and was chosen by the FDOT. After highway construction began in 2019 and the city took over some of the planning power, the team of Black architects stopped receiving updates: "*There were at least three years in which we didn't hear anything from anybody, and all of a sudden we saw that the city was moving ahead with someone to create a new plan, so we were left out in the dark in terms of that*" (Morell, 2022). Later, the Committee released a design plan finalized by another architectural firm which compared to the original plan, does not reference the legacies of Caribbean and Native American cultures and the historical component of it.

[23] Sources note that the majority of the committee was made up of the "crème de la crème" of Miami realtors and developers (Merchant, 2022). In addition, only four of the 17 members of the Executive Committee are Black and only one member designated as chair of a working group is Black (see Friends of the Underdeck, 2024 for the committee's makeup).

[24] Merchant (2022) reports that the Committee has not directly reached out to representatives of the business community. In particular, a representative of an important Black-owned business in Overtown has not been directly invited to open meetings, however, they knew of the existence of these meetings and attended.

nonprofits, or scholarship funds; marketing Overtown businesses through signage; allowing stands/kiosks for concession for revenue generation; and considering incorporating Overtown restaurants in areas designed as business space or considering the delivery of their food through delivery apps in designated areas if physical restaurant spaces are not feasible. Other ideas include promoting the hiring of Overtown residents, for example, by instituting training programs specific to the needs of local residents; providing transition support; marketing job opportunities in the Overtown area; and removing obstacles for hiring.

Lastly, representatives of local small businesses shared concerns about the current cost of living, low wages, and lack of affordability, which has resulted in many families from Overtown having to move to other areas of the county. With the construction, the likelihood of increased property values and taxes poses additional constraints. To mitigate this, stakeholders have also proposed the creation of a "Legacy Families Fund" that provides scholarships and support to residents, and developing a foundation for Overtown such as the Miami Bayside Foundation (Underdeck Executive Committee, 2022).

4.3.6 I-94 Modernization Project – Detroit, Michigan

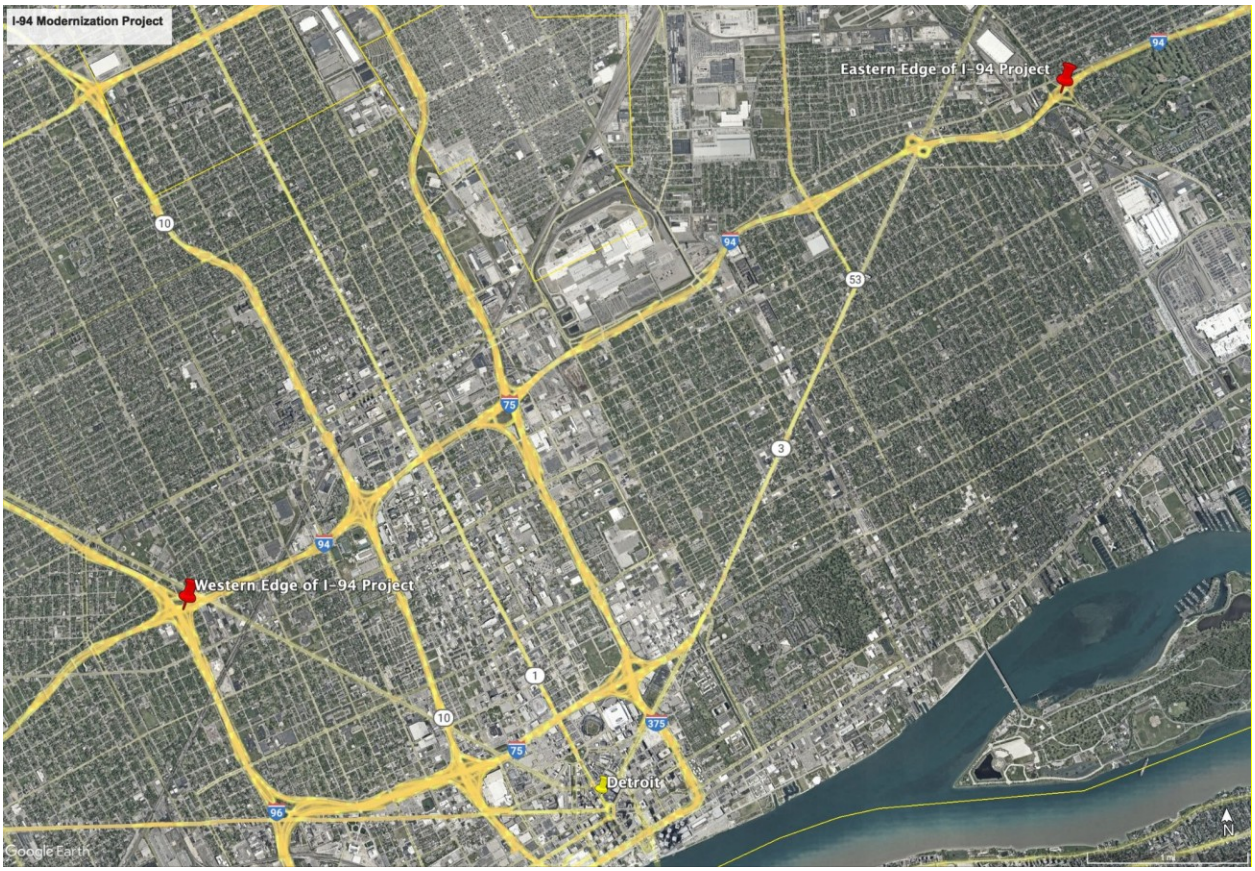
History

Interstate 94 (I-94) is a 275-mile highway that runs across the southern region of Michigan's Lower Peninsula from Lake Michigan on the western side of the state to the southern point of Lake Huron on the east. The highway began as a series of expressways intended to improve automobile transportation into Detroit and facilitate the movement of workers to the Willow Run Bomber Plant during the Second World War.[25] Segments of the highway were completed as early as 1941 and the intersection of I-94 and M-10, completed in 1953, was the first complete interchange to be built between two highways in the United States (Detroit Historical Society, 2024). Although construction of the expressways began many years earlier, construction accelerated as more funds became available following the passage of federal highway bills in the 1950s (Biles, 2014).

Detroit's expressways were disproportionately routed through African American and less affluent communities, many of which were located in densely populated areas on the western edge of the city. Construction of the John C. Lodge Freeway (currently, M-10) resulted in the destruction of approximately 2,200 buildings in Detroit's Lower West Side, while construction of the Edsel B. Ford Expressway (currently, I-94), led to the razing of roughly 2,800 buildings on the West Side (Biles, 2014).[26]

[25] The Willow Run Bomber Plant opened in 1941 and at the time was the largest factory in the world. At its peak, the number of daily airplane workers assembling B-24 Liberty bombers was 42,000 (1943).
[26] Notably, highway construction and urban renewal efforts in Detroit also led to the demise of African American commercial and residential communities on the eastern side of the city, such as the Black Bottom and Paradise Valley communities. In 2023, MDOT and the City of Detroit received a $105 million grant from the federal Reconnecting Communities grant to reconstruct the I-375 freeway into a multi-lane boulevard supporting multimodal transportation.

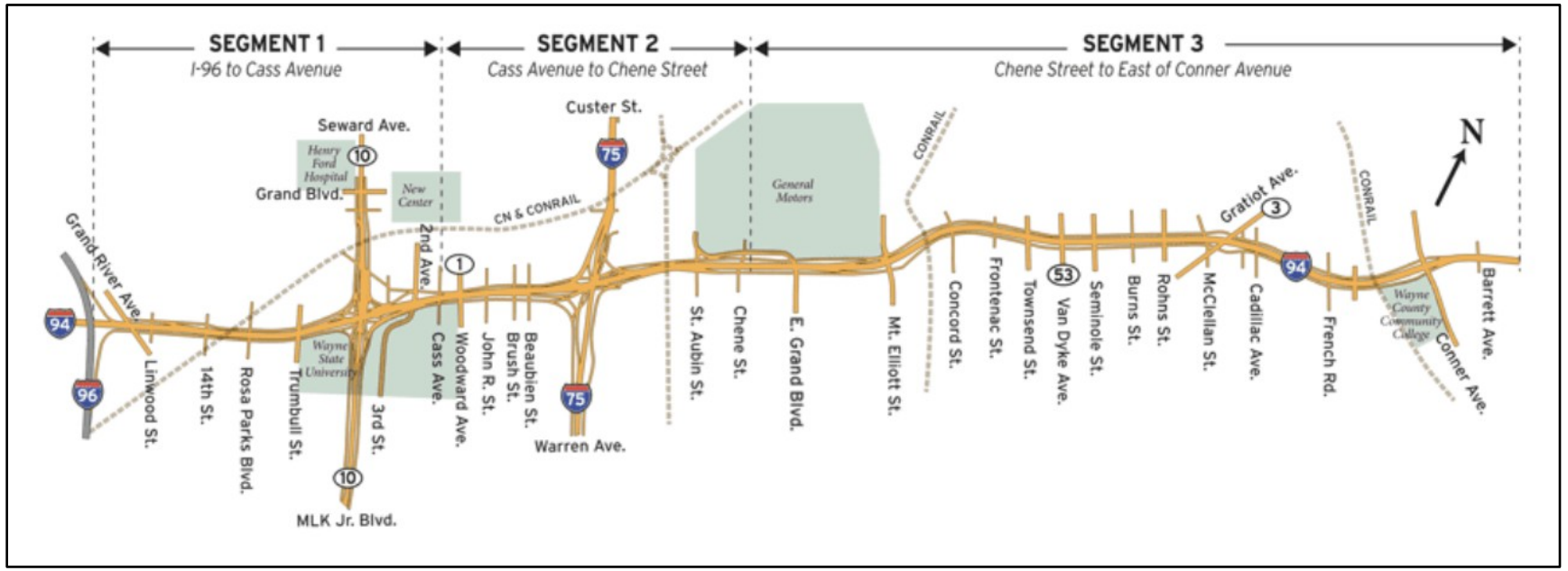
Led by the Michigan Department of Transportation (MDOT), the I-94 Modernization Project is a large project that aims to improve safety, capacity, local connectivity, and the condition of I-94 and its service drives, bridges, and interchanges and address operational deficiencies on I-94 in Detroit (MDOT, 2019a). The project is located east of the I-94/I-96 interchange to east of Conner Avenue, along with M-10 (from Martin Luther King, Jr. Boulevard to Seward Avenue), and along I-75 (from Warren Avenue to Custer Street in Wayne County) (see Figure 4.16).



***Source**: Google Earth Pro*

Figure 4.16 Aerial view of the I-94 Modernization project

Two spaghetti junctions are part of the modernization project (MDOT, 2019a). The I-94/M-10 interchange was the first freeway-to-freeway in the Midwest and is historic because of its association with the Port-World War II freeway and its unique design. Because of this, it is National Register of Historic Places (NRHP)-eligible under Criterion A and Criterion C. The interchange is currently surrounded by multi-family residential areas and governmental and institutional areas (see Figure 4.17). The other junction is the I-94/I-75 interchange. The interchange area is currently surrounded by industrial and transportation/utility uses. Both interchanges are areas of high traffic volumes and crash rates (MDOT, 2019a).



Source: *(MDOT, 2022a)*

Figure 4.17 I-94 Modernization project map

Table 4-8 presents the demographics of the Census Tract Areas immediately adjacent to the I-94/M-10 and I-94/I-75 interchanges. This table shows that while there is variation across the tracts surrounding the interchanges, all but one are majority non-White, with relatively high poverty and unemployment (with the exception of the NE tract adjacent to the I-94/I-75 interchange), lack of green space, and high proximity to traffic.

Table 4-8 Demographics in adjacent areas to I-94/M-10 and I-94/I-75 interchanges (2023)

Variable	I-94/M-10 Interchange				I-94/I-75 Interchange			
	NW	NE	SW	SE	NW	NE	SW	SE
Race	87% Black or African American, 7% White, 1% Asian, 1% Hispanic or Latino, 4% other	63% Black or African American, 31% White, 3% Asian, 3% Hispanic or Latino, 0% other	56% Black or African American, 34% White, 2% Asian, 1% Hispanic or Latino, 7% other	53% White, 19% Asian, 18% Black or African American, 3% Hispanic or Latino, 7% other	92% Black or African American, 6% White, 2% other	77% Black or African American, 18% White, 4% Hispanic or Latino, 1% other	54% Black or African American, 328% White, 10% Asian, 2% Hispanic or Latino, 6% other	Not available
Historic underinvestment	Yes - high barriers to accessing home loans	No	No	Yes - high barriers to accessing home loans	Yes - high barriers to accessing home loans	Yes - high barriers to accessing home loans	Yes - high barriers to accessing home loans	Yes - high barriers to accessing home loans
Lack of green space	94th percentile	97th percentile	87th percentile	96th percentile	91st percentile	96th percentile	92nd percentile	99th percentile
Poverty	99th percentile	88th percentile	98th percentile	97th percentile	98th percentile	26th percentile	77th percentile	Not available
Traffic proximity/volume	99th percentile	98th percentile	96th percentile	98th percentile	96th percentile	98th percentile	99th percentile	Not available
Unemployment	99th percentile	81st percentile	67th percentile	55th percentile	85th percentile	0th percentile	66th percentile	Not available

Note: *Data for I-94/M10 consider Census tracts 26163522400 (NW), 26163533900 (NE), 26163521900 (SW), 26163520200 (SE); and for I-94/I-75 considers 26163511200 (NW), 26163985100 (NE), 26163518000 (SW), 26163985900 (SE).* ***Source:*** *(Council on Environmental Quality, 2024).*

Project Overview

Although MDOT initiated its first environmental impact statement of the I-94 Modernization project in 1994, it was in 2004 that the final environmental impact statement was approved by the FHWA (MDOT, 2024b). The initial proposal had a regional approach, as it focused on adding capacity to improve transportation and access across the region (MDOT representatives, personal communication, December 11, 2024).[27] However, the proposal received community pushback as it would widen the I-94 footprint, which brought safety concerns and would have resulted in many building relocations and the elimination of pedestrian bridges (Scott, 2015). In addition, expanding the highway would have made Detroit's economic recovery more difficult by further separating Midtown and New Center, two neighborhoods that have been leading the City's revitalization. The public widely objected to the project and called for a local approach, improved local connectivity and mobility, and better pedestrian and bicycle infrastructure.

Starting in 2010, MDOT undertook a community engagement process to re-evaluate the project, with the aim of making project improvements context sensitive, supporting all mobility needs (local, regional, and interstate commerce as well as national and civil defense in a way that integrates all modes of travel), matching Detroit's development needs, and involving new reconstruction approaches (Complete Streets) to incorporate the city's policies for promoting non-motorized means of transportation in the design (MDOT, 2019a; MDOT representatives, personal communication, December 11, 2024).

MDOT worked together with the Detroit Department of Planning and Development, and the Detroit Department of Engineering to develop a revised project design that accommodated all needs (MDOT, 2022b). The proposed modifications did not expand the footprint of the freeway; made better use of existing roadway networks; modified local access to and from I-94, M-10, and I-75; and added Complete Streets to bridges to provide multi-modal access (MDOT, 2019a; Scott, 2019). The project also used retaining walls, which contribute to accommodating improvements within the existing I-94 footprint. Adding Complete Street bridges provides direct access across the freeway for all users (vehicles, bicycles, and pedestrians), which reduces travel distance and time for non-motorized users. In addition, these bridges do not require large ramps to be constructed, which avoids additional property impacts.[28]

[27] The section of I-94 in this project and the spaghetti junctions are crucial for international trade between the United States and Canada and the Atlantic Trade providing connection to the Detroit / Windsor border crossing facilities.

[28] Initial design proposed replacing the existing pedestrian bridges over the freeway with upgraded bridges but these needed to meet design requirements of the Americans with Disabilities Act (ADA) which require additional property impacts and result in increased travel for non-motorized users to get across the freeway. Complete streets bridges avoid these impacts but there is potential to reintroduce conflicts between vehicles and pedestrians across the service drives.

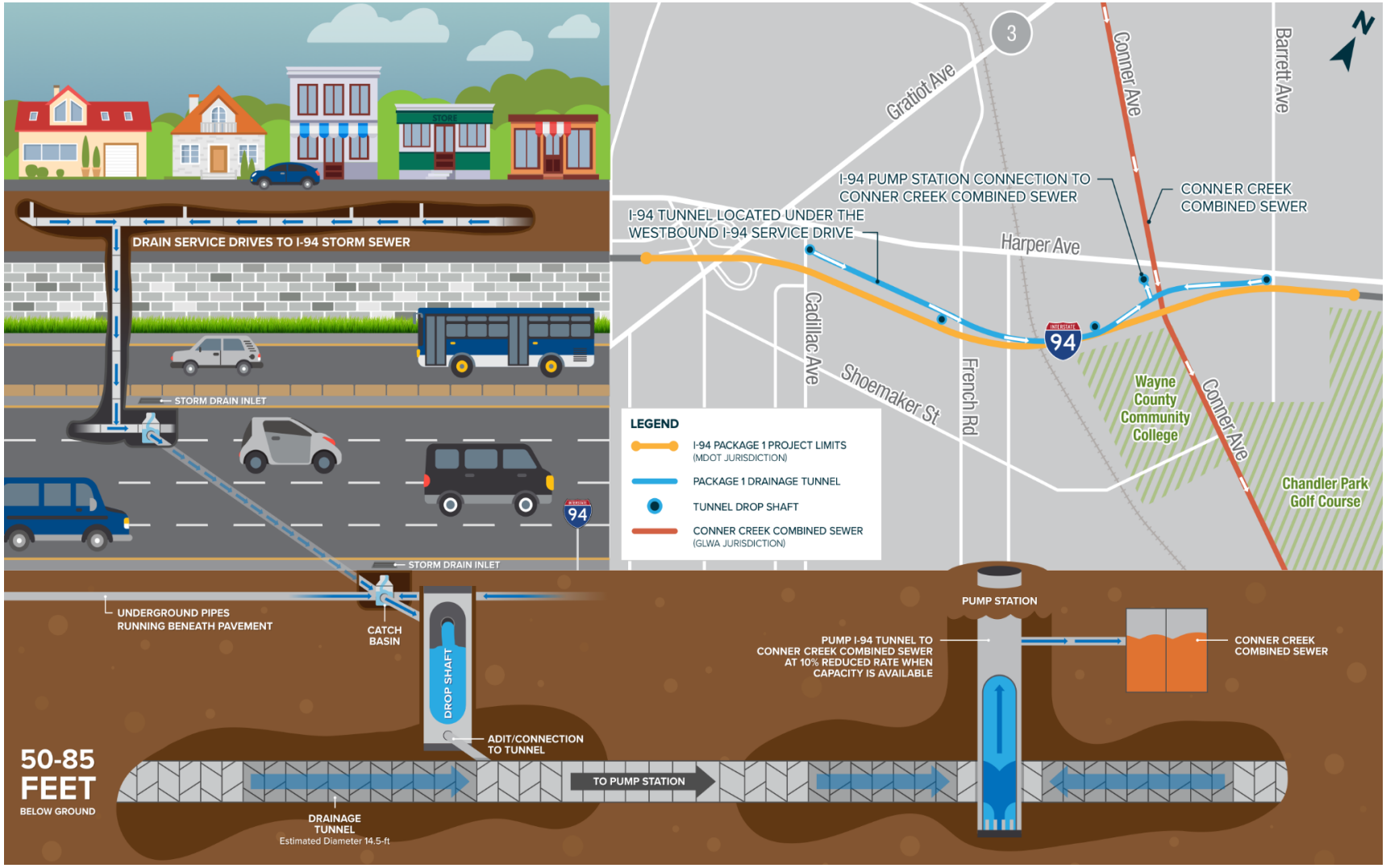
Proposed changes for interchanges include the following:

- I-94/I-75 interchange: Lengthening acceleration and deceleration lanes to correct deficient weaving movements, entrances and exits (east of I-75) will be redesigned to provide sufficient distance between them to meet current design standards, and full auxiliary lanes will be added between on- and off-ramps for vehicle merging, acceleration, and deceleration (MDOT, 2019a).
- I-94/M-10 interchange: Reconstructed and reconfigured to provide right-handed on- and off-ramps, provide access to the New Center area and Wayne State University, and provide street-level bridge crossings over M-10 at Holden Avenue and Merrick Street, which requires M-10 to be lowered and I-94 will bridge over M-10. The I-94 ramps to southbound M-10 will be redesigned to minimize impacts to the Wayne State University athletic fields. In addition, the project will be adjusting the freeway elevation to provide local street and community connections and keeping the northbound M-10 exit to the New Center area. The project will also eliminate a crossing over this interchange, moving traffic to a contiguous crossing, which was identified as a community connector bridge (in the public participation process), and as such its reconstruction will include wider sidewalks, buffered bike lanes, vehicular lanes, and more enhanced landscaping and aesthetics (MDOT, 2019a). Other features responding to public input include removing continuous service drives by repurposing the existing service drive network to two-way local street connectors and retaining and adding bridge connections across the freeway. Residents of Trumbull Crossing Apartment also opted to minimize ROW impacts by keeping the current alignment (a cul-de-sac of the service drive at the M-10 interchange).

Similarly, MDOT has identified potential stormwater management and landscaping opportunities in both spaghetti junctions.

In addition to addressing public concerns, the project had to adapt to an updated ordinance of the City of Detroit in 2018 (City of Detroit, 2024; MDOT representatives, personal communication, December 11, 2024). The updated Post-Construction Stormwater Ordinance requires management practices to mitigate infrastructure and water quality impacts of hard, impervious surfaces. Similarly, it requires projects to install controls to manage the amount of stormwater that is discharged into the city's system.

To separate the freeway and service drive stormwater from the community combined sanitary and stormwater system, and to comply with the local ordinance, the project added the construction of a drainage tunnel (see Figure 4.18) (MDOT, 2024a, 2024d). The tunnel will have capacity to store millions of gallons of water, which will allow the municipal system to drain first into treatment facilities before stormwater from the tunnel is discharged, which in turn will prevent the local system from being overburdened. The tunnel is scheduled for to be constructed in 2026-2028 and MDOT will coordinate with Detroit Water and Sewerage Department (DWSD); the Michigan Department of Environment, Great Lakes, and Energy (EGLE), or/and other regulatory agencies.



Source: *(MDOT, 2024d)*

Figure 4.18 Drainage tunnel

Funding Strategy

The construction of the project is projected to span 20 years (2013-2033) with an estimated cost of over $3 billion as of December of 2019 (MDOT, 2019b, 2022a). The project is divided into five phases, the first two related to the construction and reconstruction of bridges providing connectivity over I-94 (started in 2013) and the following three related to three segments of the project along I-94 (segments as shown in Figure 4.17).

Table 4-9 presents the schedule and project costs per phase in 2019. The most significant costs of Segments 1 and 2 are the reconstruction and reconfiguration of the I-94/M-10 freeway-to-freeway interchange and the reconstruction of the I-94/I-75 freeway-to-freeway interchange, respectively.

Table 4-9 Schedule and Financial Plan Annual Update (2019) for the I-94 Modernization project

Phase	Schedule	2019 Cost (in million)
Advanced Bridges Phase 1	2010-2023	$223.40
Advanced Bridges Phase 2	2017-2023	$215.60
Segment 3	2018-2027	$956.60
Segment 2	2018-2029	$503.50
Segment 1	2018-2033	$1,374.30

Note: *Schedule includes times for design, ROW, and construction. For the segments it also includes the time for pre-design (NEPA).* ***Source:*** *(MDOT, 2019b)*

The current funding plan involves funding from federal and state sources (MDOT, 2019b). Of the estimated costs of $3.3 billion, 90.4 percent are expected to be covered with federal funds, 9.4 with state funds, and 0.2 with local funds. The City of Detroit is not required to provide local matching funds for capital construction or reconstruction costs on portions of the project that are on the limited access highway (Michigan Public Act 51 of 1951, amended by Public Act 459 of 2016).

Governance Structure

The I-94 Modernization Project is led by MDOT, which manages and oversees all activities from the early engineering and environmental phases to the end of the project. Sponsors of the project include the FHWA, MDOT, and the City of Detroit (MDOT, 2022a). In addition, MDOT will also seek agreements with the City of Detroit to maintain planters, median plantings, street trees, and landscaping.

MDOT representatives note that the organization hires consultants for parts of the work that are necessary, but not extensive enough to warrant full-time staff. For example, as part of this project MDOT hired a consultant to work as the Owner's Representative Consultant (ORC) to assist with project design, management, cost, schedule, and quality, and work with the senior project manager serving as an extension of it (MDOT representatives, personal communication, December 11, 2024).

Stakeholder Engagement

Due its scope, the I-94 project engages a large number of stakeholders at the local, state, and federal levels, including the FHWA, City of Detroit, as well as local city council members, neighborhood groups, and other local stakeholders (MDOT representatives, personal communication, December 11, 2024).

Officials note that MDOT's approach to engagement on the I-94 project differs in important ways from the agency's traditional approach to public engagement, which prioritizes large public meetings to provide information on upcoming projects. For the I-94 project, engagement is highly localized and personal, consisting of individual or small groups of interested stakeholders in venues that are familiar (such as district council meetings or neighborhood block meetings). On this project, MDOT hosted open houses to gather feedback from the public on local neighborhood connectivity and requested assistance from the city's Planning and Development Department to develop local connectivity concepts, which included hosting neighborhood mobility and visioning workshops.

Input from the city and the public was then used to improve proposed modifications. In addition, MDOT conducted nine "Resident Roundtable" meetings in neighborhoods around the project to present proposed modifications, as well as targeted meetings with community organization groups. Overall, the MDOT team maintains frequent contact with local community leaders and organizations to help share information, get feedback on project design, and identify and mitigate potential project impacts (MDOT, 2019a).

In addition, the MDOT team has participated in locally run community outreach events as a *guest* to share project information and receive feedback on its design. According to MDOT officials, local leaders and organizations have the expertise into their neighborhoods that MDOT does not have (MDOT representatives, personal communication, December 11, 2024). One official notes that given the impact of highway construction on communities, there are certain elements of resistance and distrust, necessitating perseverance and consistency in addressing community concerns (MDOT representatives, personal communication, December 11, 2024).

MDOT officials note such an approach has the advantage of creating an environment in which participants feel more comfortable communicating their preferences and concerns about a project (MDOT representatives, personal communication, December 11, 2024). Engaging local constituencies in local settings also has the advantage of providing a space to report back on project developments, as well as engage participants who may not have otherwise attended an MDOT engagement (such as individuals who are attending a city council meeting on another topic).

Impacts of the Project and Use of the Infrastructure

The primary set of impacts of the projects revolve around updating highway infrastructure and improving safety. The current design of the I-94 Modernization project will increase the impervious area by 28 percent (78.55 acres) (MDOT, 2019a). To address this impact, MDOT will continue working to identify opportunities to incorporate green infrastructure.

Along with the I-94 Modernization project, the I-94 Modernization Project Small Business Enterprise (SBE) Training Program has the aim of maximizing small business participation in the areas of design and construction, engineering, and inspection (CEI) of the project (MDOT, 2024c).[29] Through this program more than 30 small businesses have obtained prime contracts and subcontracts with MDOT and the ORC valued at a total of $12.7 million. Overall, the SBE contracted work amounts to $22 million since 2016.

While the primary impacts center on updating infrastructure and improving safety, the project will also maintain community connections across the highway through updated bridges with Complete Street elements.

4.4 Findings

The goal of this analysis was to identify strategies, lessons, and insights for mitigating harm and improving livability standards for communities surrounding dense highway infrastructure through an analysis of existing cases with the same aim. While we expected that state-level framework and policies, as well as factors related to the likely impact of strategies and design elements, would shape project implementation and success, the data reveal relationship- and trust-building, active and intentional community engagement, and willingness to "think outside the box" as critical factors in securing funding and facilitating project implementation and success. This section elaborates on findings about the design, implementation, and impacts of projects that aim to mitigate the adverse impacts of spaghetti junctions.

4.4.1 The Role of State Frameworks, Guidelines, Statutes, and Regulations

Across cases, changes in practice, rather than changes in policy, appear to facilitate project implementation and success. As such, there is no roadmap of state frameworks, guidelines, statutes, or regulations that MnDOT might leverage or change to mitigate harm and improve livability standards for communities impacted by dense highway infrastructure. The research team asked all interviewees to identify state-level policy factors that facilitated project implementation or need to be changed to facilitate project implementation. Across cases, project partners stated that there were few formal policies that were leveraged or needed to be changed to move a project forward.

By contrast, project partners highlighted different ways of working as foundational to project implementation and success. Such changes include collaboration between areas of government (engineering, planning/zoning, housing, etc.), different ways of engaging the public (see discussion below), and a willingness to innovate as underlying project implementation and success. Different ways of working appear related in part to *who* is in charge – local stakeholders in more than one case identity leadership in the state DOT are particularly receptive to project goals. Federal grants that prioritize

[29] The goal is that small businesses meet or exceed 20 percent of I-94 Modernization Project participation in areas of design and CEI professional services.

collaboration and partnerships (especially partnerships that generate impacts in non-transportation areas) also appear to facilitate changes in practice.

While state policy changes do not appear necessary for mitigating the negative impacts of dense highway infrastructure, they offer tools for partners interested in such projects. For example, several stakeholders mentioned state-level Complete Streets policies as a tool for addressing community concerns regarding connectivity. Stakeholders also highlight trends in the DOT's receptivity to participate in projects traditionally outside the agency's scope.

When state policies restrict the DOT's ability to fund projects like freeway caps (as in Texas), the data suggest that they can hinder but do not necessarily eliminate strategy from consideration, as alternate funding mechanisms are available. It is worth noting that stakeholders in Miami and Milwaukee highlighted the FHWA's reluctance to approve a "park" under dense highway infrastructure, as the term "park" denotes a protected status and level of activity that is not encouraged under highway infrastructure. However, although the federal-level policy required modifying the design, it did not eliminate the strategy from consideration.

Finally, state and local policies appear to play a role in facilitating collaboration if and when policies align across stakeholders. For example, efforts to mitigate the negative impacts of dense highway infrastructure often go hand in hand with efforts to revitalize downtown areas. As one of Atlanta's Stitch representatives noted, GDOT officials support The Stitch in part because they view it as good for the city and good for the state, although it is technically beyond their scope.

4.4.2 Project Origins

It is clear from the case studies that projects are highly localized and contextual. In six of eight cases, efforts to mitigate the negative impacts of dense highway infrastructure begin at the local level, often originating years (and at times, decades) prior to implementation. Cases vary with respect to which local actor(s) initiates the project: in this study, those carrying the project forward at the local level include a municipal sewage district, business leaders, local developers, and downtown development districts. In some cases, community groups are also active in initiating and/or collaborating to move the project forward. In two cases, projects begin at the state level as part of a larger infrastructure project (a bridge project and highway modernization project).

At the same time, the DOT's willingness to support the project by participating in public engagement events, developing consistent messaging, and helping local actors navigate legal and policy hurdles, was seen as one of the factors contributing to project success. Project stakeholders also referenced the receptiveness of the state DOT to innovate as helping projects move forward.

4.4.3 Project Design

Across cases in this analysis, project design choices are determined by multiple factors including characteristics of the transportation infrastructure and traffic volumes, availability of funding, alignment of interests across diverse stakeholders, and project history. In some cases, the strategy chosen to ameliorate community harms is determined decades prior to implementation. For instance, in the cases of Rochester ILE and ILN, Atlanta's Stitch, and Miami's Underdeck, the general project design (highway removal, freeway cap, and activation of area beneath a highway) emerged several decades before the projects were funded. Early feasibility studies can provide impetus for a project idea to continue moving forward, or can eliminate a strategy from consideration.

Characteristics of the infrastructure and traffic help shape strategy selection and design choices, but they are not determinative. For example, the Marquette Interchange was selected as a site to implement MMSD's first green infrastructure project due to the volume of storm runoff captured and piped to the ground level at this location. Similarly, highway removal was seen as a viable strategy in Rochester due to the low volume of traffic on the Inner Loop's eastern side. However, many other factors shaped the overall design and particular design elements, including funding availability, public input, and shared interests. For example, in Milwaukee, funding was available to develop green infrastructure but not to fund amenities, public input was responsible for the creation of the footpath across the area, and a shared desire to activate the area under the interchange but discourage unwanted activity shaped decisions involving lighting and location of plantings.

4.4.4 Coordination and Collaboration with State DOT

The case studies reveal that projects require coordination, but not always active collaboration, between the state DOT and local actors. Because state DOTs own the ROW and maintain the dense highway infrastructure, they are engaged across projects. However, their formal involvement across cases varies from coordination (for example, negotiating MOU or seeking approval from the FHWA on behalf of local actors) to active collaboration (for example, co-leading projects with local stakeholders, regular participation in local engagement efforts, or leading formal engagement efforts conducted as part of federal approval processes). It is important to note that in cases when the DOT is leading the project and/or an active partner, state officials reported relying on local partners to facilitate engagement with local stakeholders and community groups.

In some projects led by local partners, stakeholders note that the state DOT perceives the project as a local project that the DOT is supporting. In one case, local stakeholders described proactively addressing issues of importance to the state DOT to help eliminate "reasons for them to say no." This is not meant to suggest that DOTs are against locally-led projects to mitigate the community harms of dense highway infrastructure. Rather, it reflects a recognition by local actors that such projects can be out of scope for the DOT and at times involve new approaches to using highway infrastructure and/or the area surrounding the infrastructure.

4.4.5 Governance during and post-construction

The formal structure of project governance and ongoing operation and maintenance varies across projects. In four cases (Klyde Warren Park Phases 1 and 2, The Stitch, and potentially, The Underdeck) stakeholders developed (or intend to develop) a public-private partnership to secure funding and guide the design and development of the project. In three cases, projects are led by local governmental entities (Marquette Interchange, ILE, and ILN), and in one case the state DOT is leading the project (I-94 Modernization Project). After the project is completed, governance structures also vary. Table 4-10 shows the respective role of different governmental actors and stakeholders across cases.

Table 4-10 Role of government actors and stakeholders

Case Study	State DOT	Locality	Other stakeholders
Klyde Warren Park Phases 1 and 2	TxDOT owns the freeway cap under the park	City of Dallas owns the park	WRPF operates and maintains the park
Marquette Interchange	WisDOT owns the land under the Marquette Interchange and pays a portion of maintenance costs.	City of Milwaukee maintains the land under the interchange.	Milwaukee Metropolitan Sewerage District (MMSD) has a Memo of Understanding with the City of Milwaukee to maintain the green infrastructure beneath the interchange
The Inner Loop East and North	NYSDOT absolved of responsibility for the ILE segment (transferred to City and County). NYSDOT owns and maintains on-ramps to the interstate segment on the southwest portion.	City of Rochester and to a limited extent, Monroe County, own and maintain the infrastructure	Not applicable
The Stitch (1)	GDOT will own the tunnel and bridge infrastructure as well as the air rights above the highway	The City of Atlanta will have an air rights easement to build the park and will own the park.	A newly-created 501c3 will operate and maintain the park and the tunnel system through a licensing agreement
The Underdeck (1)	FDOT will own the infrastructure and the land under the highway.	The City of Miami will operate and maintain The Underdeck under a master lease agreement with FDOT.	Not applicable
I-94 Modernization Project	MDOT owns and maintains the infrastructure	Not applicable	Not applicable

Notes: *(1) Expected as of October 2024.*

In this analysis, with the exception of the ILE and ILN cases, the state DOT does not give up the ROW but rather grants local stakeholders permission to maintain and/or operate spaces above or beneath the dense highway infrastructure. Governance arrangements appear dictated by the aims of the project. For example, Klyde Warren Park and The Stitch are both programmed parks that raise funds for ongoing operations and maintenance through activities and events as well as private or philanthropic dollars. For these projects, it is beneficial to have a nonprofit entity responsible for operating and maintaining the park. In the case of the Marquette Interchange, WisDOT retains ownership but the City of Milwaukee and MMSD maintain the land and green infrastructure, respectively, given their proximity to the land and expertise.

Across cases, coordination ensures that necessary approvals are granted, permits are filed, and technical or legal issues are resolved. However, we found few instances of federal or state laws or local ordinances that needed to change to enable implementation of the project.

4.4.6 Interest Alignment and Flexibility

All projects involve multiple levels of government and include the city government and the state DOT. Additional partners vary across projects but typically include representatives from the business community and county governments. Projects require some degree of coordination with the FHWA and projects that are large in scope tend to involve additional federal partners, such as members of Congress, typically in the role of providing or securing funding. Several projects include additional stakeholders, such as community groups, other areas of local government (such as housing or economic development, metropolitan planning councils, watershed districts, etc.), and civic leaders or philanthropists (who may donate to initiate project studies or to help fund specific aspects of the project).

Alignment of interests across diverse stakeholders is a necessary precursor to project implementation. Having a clear and common goal enables stakeholders to work together and co-create a balance between what each party desires and what is feasible within the stakeholders' capabilities and budget constraints. The data suggest that when partners mutually agree on the goals, they can more successfully navigate technical decisions associated with project implementation.

Conversely, the difficulty of aligning interests across diverse stakeholders can act as a barrier to securing funding and implementation of the project. Most cases in our study underwent multiple rounds of pursuing funding, often starting with small grants that enable a local government to study an issue or potential design. In addition, several stakeholders drew attention to the importance of flexibility, as projects typically span different political leaders, economic and political conditions, and funding possibilities.

In some cases, project stakeholders came together through an unforeseen series of events. For example, in Milwaukee, a homeless encampment, upcoming winter season, upcoming Democratic National Convention, and project proposal from an innovative sewerage district brought city, county, and state actors together to implement a green infrastructure project. In Dallas, the loss of Boeing's headquarters inspired civic leaders to bring public and private stakeholders together around the idea of a freeway cap

park. In other cases, project stakeholders align through years of researching a project, building trust, and pursuing funding, as is the case in both Rochester and Atlanta.

Successful implementation of a project can also act as a catalyst for future projects, in part because it provides evidence of shared goals and successful collaboration across diverse actors. For example, Milwaukee has implemented four additional green infrastructure projects on highways, and both Dallas and Rochester are in the second phase of their freeway cap and highway removal projects, respectively.

4.4.7 Community Engagement

Community engagement varies across cases and is shaped by the composition of the project area as well as the best practices of the time. While all projects identify community engagement as an important and necessary part of the project, there is variation in both the extent and transparency of public engagement efforts. For example, the research team found few instances of public engagement in Klyde Warren Park's first or second phases, but extensive outreach taking place as a part of Rochester's ILN project and Atlanta's Stitch.

Community engagement activities appear related to project aims and well as best practices of the time. In Dallas, goals related to economic development were central to the development of Klyde Warren Park, whereas in Rochester and Atlanta, goals related to reconnecting communities impacted by highway infrastructure are as important as economic goals. Stakeholders also noted changing expectations and norms surrounding community engagement, with an increasing emphasis on equity and intentional engagement with a wide array of groups at the local level.

In several cases, stakeholders distinguished between local engagement and "traditional" public engagement efforts or engagement conducted by state DOTs as part of federal approval processes. State DOT representatives in Florida and Michigan discussed "new" ways of engaging the public to facilitate more meaningful conversations and gain insights that would be unlikely to surface in more traditional public information sessions. Stakeholders in Atlanta and Rochester noted the importance of intentional and iterative engagement with groups of local constituencies and stakeholders, both as a venue for soliciting input and providing information as well as a mechanism for building trust. As one MDOT representative noted, the state DOT regards itself not as leading but rather as a "guest" in such instances.

Tools for engaging communities in this way include semi-private or one-on-one conversations with local stakeholders, presentations at city council or neighborhood block meetings, public websites with detailed information on the motivation for the project, project documentation, intended impacts, and community engagement opportunities, pop-up events, and provision of information in multiple formats and languages. Regardless of tools used, stakeholders noted the importance of early engagement, transparency, and ongoing involvement throughout the course of the project.

4.4.8 Activating Public Space

Across cases, a primary aim is the activation of a neglected, underutilized, or previously nonexistent space. Activating the space takes a variety of forms and can include aesthetic improvements such as landscaping, improved lighting, and public art; installation of amenities such as educational displays, recreational areas (pickleball or basketball courts, bicycle pump tracks,[30] or dog parks), or programmed activities (concerts, restaurants, etc.); and efforts to enhance connectivity with public paths or improved access to transit facilities. In several projects, stakeholders referenced the activation of space as underlying public support and contributing to a lack of opposition.

Efforts to activate the space are designed not only to improve the space, but also to draw people in from areas close to the junction and beyond. In doing so, projects can change the distribution of benefits. In Dallas, for example, a primary aim was to create a "world class park" that would draw visitors from Dallas, as well as tourists from outside of the city. In addition, prior to the ILE project, those benefiting from the area primarily consisted of commuters, local drivers, and freight drivers. Following the ILE project, benefits extended to local residents, developers, businesses, and the city. The cases in this study vary in how successful they are in drawing in visitors. Success appears to depend in part on the project's design features as well as the land use surrounding the junction. Projects with considerable amenities located near residential and commercial areas, for example, are more likely to draw in visitors than projects with few amenities located in industrial or non-residential areas.

4.4.9 Distribution of Project Benefits

In the cases analyzed in this report, benefits accrue to the areas adjacent to the junction, but not necessarily the communities originally impacted by the construction of the junction. In all cases, decades have elapsed since construction of the original highway infrastructure, and the demographic composition of many communities has changed. Environmental, community, and economic benefits of projects are concentrated in areas adjacent to the projects. If populations originally impacted by the dense highway infrastructure no longer live near the highway, then they are less likely to experience the direct benefits of the project.

For example, African American communities in Dallas were largely displaced in the 1970s and 1980s by a combination of highway construction, development, and city-facilitated gentrification of North Dallas and the central business district. African American residential and commercial neighborhoods were replaced with other cultural amenities including an Arts District and high-rise apartments and condos. The population changed from predominantly African American and mixed income to predominantly White and affluent. Though Klyde Warren Park is open to the public, the benefits of connectivity between the Uptown and Downtown neighborhoods, green space, and economic activity are higher for

[30] A purpose-built track for cycling that has a circuit of rollers and banked turns.

those who live near the park - a population that is largely unrepresentative of the population originally impacted by highway construction.

In two cases (Klyde Warren Park and The Underdeck), stakeholders highlighted concerns regarding the role of highway mitigation projects in exacerbating gentrification and redistributing benefits to residents and businesses who have not been disproportionately impacted by the dense highway infrastructure. To address the potential for gentrification, other projects (The Stitch and ILN) have taken explicit steps to increase the likelihood that benefits accrue to individuals and businesses located near the projects, such as requiring a certain amount of new development to be affordable housing and ensuring that new land is broken up into smaller parcels to encourage home ownership.

Populations originally impacted by the highway construction are more likely to benefit if they continue to reside near the projection location. In Rochester, for example, the positive impacts of the ILN project will benefit communities of the historic Seventh Ward - an area that has experienced isolation and disinvestment due to the highway infrastructure and continues to be lower income and predominantly non-white.

Chapter 5: Successful Practices in Designing Solutions to Mitigate Community Harms of Dense Highway Infrastructure

In the previous chapter, the research team analyzed eight projects that focused on mitigating the negative community impacts of dense highway infrastructure. The analysis identified a set of factors associated with the successful design and implementation of such projects, including:

- Changes in practice, rather than changes in policy
- Local involvement and orientation to local context
- Coordinated project direction and administration across levels of government using a variety of governance structures
- Intentional and iterative engagement with local stakeholders and the general public
- Project designs based on community priorities as well as technical aspects of the transportation infrastructure

This chapter connects findings from the case study analysis to Minnesota policies and practices, with the aim of providing MnDOT with guidance about the factors that can help the agency develop and implement strategies to mitigate the adverse community impacts of dense highway infrastructure. The chapter emphasizes non-technical guidance, or guidance that is not based in engineering decisions. This is because individuals interviewed as part of the case studies did not emphasize technical decisions as the most important factors driving projects forward. While engineering factors are important and can certainly eliminate strategies from consideration, the case studies suggest that such factors alone do not explain successful strategy implementation.

Individuals interviewed in this project overwhelmingly pointed to changes in practice rather than changes in policy as helping to move projects forward. Practice changes include new ways of working across stakeholders, as well as innovative models for engaging the general public and key constituency groups, emphasizing communities that have traditionally been underserved, excluded, or harmed by past transportation projects.

The remaining sections of this chapter are organized as follows. First, because effective public engagement is critical to identifying community needs, uncovering impacts from existing and planned dense highway infrastructure, and understanding community concerns, we begin by discussing policy and practice related to public engagement. Second, we identify specific practices, outcomes, and associated metrics used across case studies to mitigate the current and past harms of dense highway infrastructure. Because case studies emphasized impacts associated with livability, the second section is organized by MnDOT Metro District's Livability Framework. Third, we discuss existing MnDOT policies and practices and their relationship to the practices used across case studies and identify

recommendations for effectively addressing the adverse impacts of dense highway infrastructure in Minnesota.

5.1 Policy and Practice Changes related to Public Engagement

"We could look at this from an engineering perspective, from an economic perspective. There is a local perspective that you do not really understand fully until you engage."
Interview with Detroit stakeholder

Effective mitigation of adverse community impacts of spaghetti junctions begins with effective public engagement to understand the perspectives and needs of community members. This section discusses policies, practices, and activities related to community engagement preceding, during, and following a transportation project.

Transportation engagement projects in Minnesota are often referenced in best practice reviews and guidelines, suggesting that the policy structures that enable meaningful engagement already exist. MnDOT's Public Engagement Policy outlines MnDOT's commitment to providing opportunities for the public to provide "meaningful input and to advance equity" in transportation decision-making, while its Public Engagement Guidance provides technical guidance to employees on how to engage the public, recognizing the importance of public engagement and relationship-building throughout the course of the project, as well as outside the project life cycle (MnDOT, 2021b, 2023).

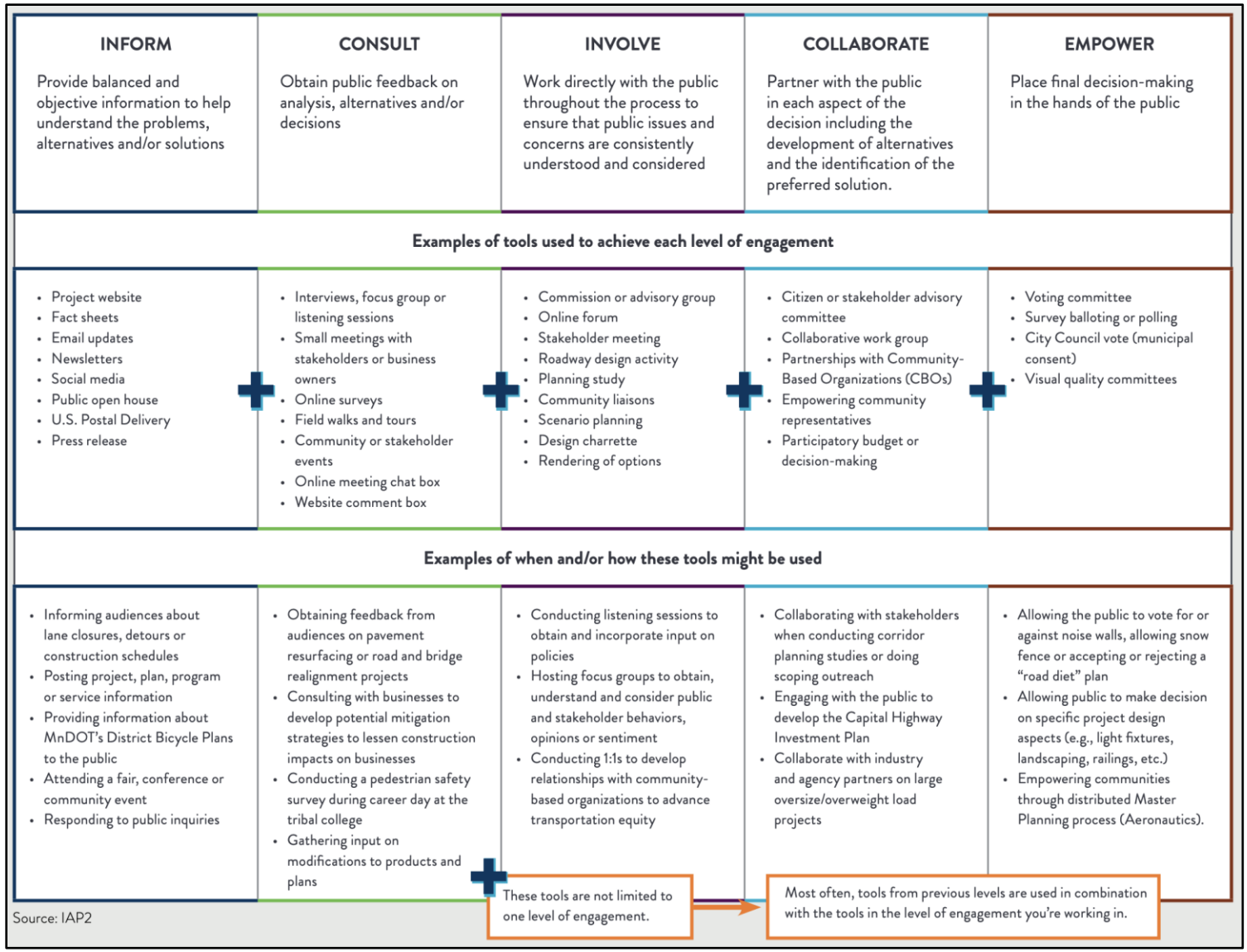
MnDOT's Public Engagement Policy defines "public" broadly, as:

- **General public**: any individual or group not necessarily associated with decision-making power or special interests but *may* have an interest in the outcome of a decision.
- **Stakeholder**: any individual or group that has, or perceives they have, a real and particular stake in the outcome of a decision.
- **Transportation partners**: Governmental or nongovernmental entities that work in partnership with MnDOT to facilitate transportation-related efficiencies, effectiveness, and cooperation, and to promote and encourage economic and technological development in transportation.

MnDOT's Strategic Framework for Public Engagement recommends establishing the level of engagement at which to engage the public based on International Association for Public Participation's (IAP2) Spectrum of Public Engagement, which serves as the foundation for MnDOT's engagement activities (shown in Figure 5.1) (MnDOT, 2017, 2021a). The IAP2 framework describes five levels of engagement that the public can expect from MnDOT, ranging from informing the public on the low end, to empowering the public on the high end.

What MnDOT refers to as "traditional public involvement" activities such as email blasts, project websites, and public meetings, cluster on the lighter end of the IAP2 framework - informing and consulting the public rather than working collaboratively with the public (MnDOT, 2025f). Other activities, such as forming an advisory committee or participatory budget or decision making, involve

groups of stakeholders collaborating or being empowered to make decisions in transportation projects, and are concentrated on the high end of the public engagement spectrum.



Source: *(MnDOT, 2021a)*

Figure 5.1 IAP2´s spectrum of public engagement

While MnDOT policy advocates for engagements that extend beyond informing or consulting when appropriate, in practice the level of engagement varies across transportation projects. In some cases, the level of engagement is limited to those activities required by law (MnDOT, 2025c). Federal legislation such as the NEPA of 1969 and the Federal-Aid Highway Act of 1970 establishes the importance of providing an opportunity for the public to engage and mandate public involvement for certain projects that are funded with federal dollars.

However, the requirements embedded within existing law do not always result in meaningful involvement for residents and community stakeholders - especially those who represent traditionally underserved populations. Barriers to such involvement include an historical focus within state DOTs on technical solutions that correspond to an engineering perspective, leadership's desire to stay firm to predetermined solutions, budgetary or staffing constraints to engage in collaborative approaches, and cultural differences (demographic as well as professional) between transportation stakeholders and the public (Aimen & Morris, 2012).

Research on public participation in transportation decision-making distinguishes between *public involvemen*t and *meaningful involvement*. Public involvement is characterized as an event rather than a process, a management versus collaborative approach, and top-down style of communicating information (Aimen & Morris, 2012). By contrast, meaningful involvement is defined as:

> "as a process that proactively seeks full representation from the community, considers public comments and feedback, and incorporates that feedback into a project, program, or plan when possible. The impact of community contributions encourages early and continuous public involvement and brings diverse viewpoints and values into the transportation decision-making process. This process enables the community and agencies to make better-informed decisions through collaborative efforts and improves the decision-making process" (Aimen & Morris, 2012; USDOT, 2022).

There are numerous guidebooks and articles offering techniques for enhancing meaningful involvement in transportation decision-making (Karner et al., 2018; Bilotto et al., 2020; USDOT, 2022). Consistent with findings from this analysis, many of these techniques emphasize changes in practice rather than changes in policy. Examples include establishing a shared agenda for what constitutes success across stakeholders, opening the decision making process to include non-agency individuals, and combining participation in formal structures with community organizing and advocacy approaches (Marcantonio & Tepperman-Gelfant, 2015). Other examples point to the importance of accessible events, engaging interactions, and outcome-oriented processes (Wagner, 2013). To the extent that policy changes are necessary, they are likely to be in the form of allocating resources or staff to diverse forms of engagement through the life of a project.

In this analysis, transportation stakeholders discuss working "differently" with respect to public engagement as being crucial for the success of the project, echoing findings from research on successful practices. Furthermore, interviewees often describe such engagement as distinct from NEPA

engagement. Rather than solely soliciting feedback via large public input sessions, stakeholders describe a complementary process that emphasizes intentionality, repeated interactions, and agility - qualities that move from left to right on the IAP2 spectrum. For example, several case studies in this analysis, including Rochester's ILE and ILN, Atlanta's Stitch, and Miami's Underdeck, undertook activities on the far-right end of the spectrum (Collaborate and Empower) in order to solicit meaningful public participation. In addition, all cases in this analysis had at least one activity that reached the level of Involve on the spectrum.

Across case studies, stakeholders also highlight practices that contribute to enhancing meaningful involvement. The practices often address the barriers that community members face to join and participate in the conversation. Some examples include providing round-trip transit tickets and parking passes to participants, sharing meeting materials online and providing a space to receive online public feedback, DOT having project personnel joining community meetings and events as guests (even in cases when a consultant was hired), and hosting direct meetings with neighborhood groups and in culturally relevant places such as churches and YMCA neighborhood centers. Currently, MnDOT's public engagement policy limit some practices to address community's barriers as it does not allow to provide childcare, transportation expenses, or incentives to participate (MnDOT, 2021b).

5.2 Successful Practices and Metrics

To provide guidance to MnDOT regarding the implementation of strategies to mitigate the adverse impacts of dense highway infrastructure, researchers developed a list of successful practices and strategies used across case studies in this analysis. Because stakeholders emphasized changes in practices, such as different ways of engaging the public, innovative project governance structures, and unique partnerships, this section focuses largely on practice changes that project managers might adopt to more effectively engage the public in identifying community needs and potential solutions. The section also includes several strategies, such as Complete Streets approaches, used across cases to better address community needs.

In addition, researchers compiled a comprehensive list of quantitative and qualitative metrics that can be incorporated into the review and assessment of dense highway infrastructure projects and monitored over time for evaluation purposes. The list, although comprehensive it is not exhaustive (these metrics complement those found in Maze et al., 2024). While these metrics listed serve as examples, the final list of metrics should be different across projects, reflecting the needs and concerns of the communities directly impacted by the project and tailored to the specific needs and concerns of the communities directly impacted by the project and tailored to the specific context of each project area.

The metrics listed in this report complement the technical metrics traditionally used in the review and assessment of dense highway infrastructure projects. While these traditional metrics are not included in this report, they remain important to project evaluation and include, for example, traffic counts and travel demand in dense highway infrastructure and local roads, as well as road conditions.

The metrics listed in this chapter reflect emerging practices adopted across reviewed case studies. In many of these projects, metrics were developed in response to community concerns. As a result, formal targets or benchmarks are not yet identified. Over time, as these metrics are more widely adopted, these may be refined and evolve into more structured indicators with defined targets always remaining responsive to the specific needs, priorities, and concerns of the communities in which projects are developed.

Because community concerns in case studies often extended beyond transportation, researchers used the Livability Framework to categorize the successful practices and metrics. MnDOT Metro District's Livability Initiative recognizes that transportation impacts the daily lives of community members beyond getting from one place to another. Transportation projects have the potential to fix infrastructure needs while also addressing community needs linked to transportation (MnDOT, 2025e). Overall, the Livability Initiative emphasizes a transportation system in which investments prioritize delivering benefits to Black, Indigenous, and people of color (BIPOC) and low-income communities who historically and disproportionately endure the most severe transportation burdens. The framework associated with the Livability Initiative includes seven pillars: (i) health and environment, (ii) economics, (iii) sense of place, (iv) safety, (v) connections, (vi) equity, and (vii) trust. The definition MnDOT Metro District provides to each pillar is included in each subsection.

The trust pillar is elevated as case studies suggest that it is a precursor to success in other livability domains. Research attests to the importance of trust in facilitating cooperation and improving outcomes in an increasingly complex and interconnected society (Edelenbos & Klijn, 2007). Trust between the DOT and local stakeholders can allow for the identification of needs across pillars and promote coordination and collaboration as projects are designed and implemented. In case studies, stakeholders repeatedly referenced trust between the DOT and the general public, local stakeholders, and transportation partners, as well as between local actors and the general public, as an important ingredient for success. This section therefore elevates trust in the discussion of livability domains.

In addition, while equity is one of the seven pillars of the livability framework and outcome measures are identified, equity can also be viewed as a process. The case studies suggest that discussions of equity can be integrated into the planning, designing, and construction of dense highway infrastructure to most effectively mitigate the impacts on communities. Much like trust, equity considerations can also be integrated into other pillars, requiring the disaggregation of data as much as possible to enable the assessment of outcome distribution among population groups, including BIPOC and low-income communities.[31]

[31] Although the livability framework emphasizes on BIPOC and low-income communities, data could also be disaggregated based on age (emphasizing young people and the elderly), disability, gender, and people who cannot drive among others.

5.2.1 Trust

"To create and maintain a livable transportation system, transportation authorities must build and retain stakeholders' trust through fostering long-term, good-faith relationships."

Trust in complex decision-making refers to "a more-or-less stable perception of actors about the intentions of other actors, that is, that they refrain from opportunistic behavior" (Edelenbos & Klijn, 2007). Trust can be distinguished from actions, though trusting relationships can also evolve from repeated positive interactions, and actions can be the result of trust between actors.

In case studies, stakeholders pointed to trust as a key factor facilitating success. Trust is influential in part because it helps stakeholders understand the unique needs of each actor. For example, a Milwaukee stakeholder noted that the trust level that had already been established between the partners gave project leads some knowledge of what would be needed to collaborate. Similarly, a stakeholder in Atlanta discussed trust between the state DOT, local business community, and city government: "There is a good level of trust there that we've built up over the years. We understood what [the DOT] needed," allowing local actors to proactively address the DOT's concerns. In addition, local actors' past success in delivering major projects also built trust between local stakeholders, the general public, and DOT.

While trust is difficult to measure, case studies attest to repeated successful collaboration and engagement as contributing to building trust between partners. The importance of building trust through repeated interactions is highlighted in MnDOT's Public Engagement Guidance, which states:

> "MnDOT recognizes that building trust and sustained relationships with communities and stakeholders is critical to ongoing, meaningful engagement. MnDOT builds trust by being present and connected to communities, and builds long-term relationships by having regular, reoccurring meetings with local partners and business groups and by regularly participating in community conversations, events and activities – even when there is no immediate present role for MnDOT."

Strategies related to trust-building include the following:

Involving the general public, local stakeholders, and transportation partners in the process from the very beginning: Across case studies, project leads considered early involvement as critical not only for the project to advance but also for identifying and addressing the adverse impacts of transportation projects. MnDOT's Public Engagement Guidance similarly notes the importance of early community involvement when planning engagement: "Involving communities early in the process contributes to identifying transportation and non-transportation needs and concerns, and thus, to better plan projects that consider and address them."

Involving the general public, local stakeholders, and transportation partners throughout the project: Case studies also attest to the importance of iterative engagement throughout the project. Two successful practices to engage community members throughout the project include: (i) having semi-

private or one-to-one engagement opportunities with local stakeholders well before formal public information meetings; and (ii) having continued engagement opportunities for the general public to voice concerns and propose solutions, and for the project team to disseminate information, collect feedback, and present project updates that address public concerns and incorporate community input.

These continuous and more personal engagement opportunities were crucial to advance projects in Detroit and Miami, for example, which initially received community pushback. In both cases, the exchange of information led to design modifications that better aligned and accommodated community needs. In Detroit, for example, the initial proposal would have widened the highway footprint and resulted in many building relocations and the removal of pedestrian bridges. By contrast, the final project did not expand the highway footprint and accommodated Complete Streets bridges to provide multi-modal access. Similarly, in Miami, the revised project design included a bridge to cross the railroad tracks that the community perceived as an obstacle to the area's integration and revitalization as well as a barrier to east-west connectivity (although it was important for port operations).

Provide a single online source of project information: Successful practices for building trust with local constituents involve active and intentional communication. As a Detroit stakeholder noted: "[The DOT] needs to be really upfront about what to expect and that helps build that trust." Providing a single source of project information contributes to transparency and accountability from all project partners.

In several cases, DOTs and project partners created a website that provided a standardized system of record in a single source. The information displayed on the website included project timelines (e.g., project milestones, community meeting dates), project documentation (e.g., goals and objectives, designs - including alternatives, construction phases, environmental analysis, impact assessments, records of decision, community meeting notes), project progress and real-time updates, and complementary project initiatives (e.g., training programs).

The single online source of project information was easily accessible, user friendly, and outward facing for the general public. In addition, the information provided was available in a language that was less technical and understandable to non-experts in the community.

Respect local expertise on how and when to engage the public. Although DOTs and local agencies have guidelines in place for community engagement, across case studies, local stakeholders and transportation partners led community engagement, as they were closest to the community and best positioned to identify important stakeholders and effective methods of community engagement. As noted above, DOT officials discussed attending local gatherings as a "guest" of local stakeholders. Deferring to local expertise regarding how and when to engage the public helped the DOT gather more reliable information on community perspectives and concerns, while identifying venues in which DOT officials could engage the public at multiple points throughout a project.

Table 5.1 presents trust outcome metrics identified across case studies. Most of the metrics identified relate to effective communication between parties, which is essential to building trust. Researchers

categorized metrics into those reflecting trust for community members and transportation partners. Trust for community members was discussed in terms of having meaningful public engagement and perceiving input is taken into consideration for project design and development. Trust for transportation partners was usually discussed in terms of future collaborative efforts that relied on trust generated in previous successful collaborative projects.

Table 5.1 Trust outcome metrics

Quantitative Metrics	Qualitative Metrics
Community	
*Community satisfaction on project website *Project website hits (count)	*Community perceptions on project website
*Voting rates - related to project-related decisions (e.g., adoption of tax increment financing) [locality] *Community attendance to engagement activities (count) *Trust in government/trust in DOT	*Community perceptions on meaningful engagement
(quantitative metrics not identified)	*Community perceptions about their input being valued in the process
(quantitative metrics not identified)	*Tracking how the community's input was used
Transportation Partners	
*Collaboration in future projects	*Partners' perceptions of collaboration
(quantitative metrics not identified)	*Partners' perceptions about their input being valued in the process

5.2.2 Equity

"Transportation investments that ensure the distribution of benefits and burdens of transportation systems and services are fair and just, which historically has not been fair. Transportation equity requires ensuring that underserved communities, especially Black, Indigenous, and people of color (BIPOC), share in the power of decision-making."

Like trust, equity is an important commitment for MnDOT. The importance of equity is evident in MNDOT's acknowledgement of the past harms of the transportation system, as well as its stated commitment to creating an equitable transportation system. MnDOT defines transportation equity as follows: "Transportation equity means the benefits and burdens of transportation systems, services and spending are fair and just, which historically has not been the case. Transportation equity requires ensuring underserved communities, especially Black, Indigenous and People of Color, share in the power of decision making (MnDOT, 2025a)." Case studies prioritize equity through the following strategies.

Recognizing inequities associated with previous transportation projects: Most dense highway infrastructure projects analyzed as case studies occurred during a time of formalized segregation and discrimination against minority populations. As a result, in addition to understanding the current transportation and non-transportation-related needs of the community, DOTs and local agencies of several projects allocated resources to understanding the history of communities living close to dense

highway infrastructure and the disruptions caused by previous transportation projects. For example, The Stitch project team hired a historian and a community engagement specialist to identify previous residents of the neighborhoods surrounding highway projects in Atlanta. Understanding the history of the community contributes to identifying communities harmed by past projects as well as their needs and hopes for new projects, and avoiding repeating the mistakes of previous projects while mitigating the effects they caused.

Empowering the public by sharing some decision-making authority with them: Across case studies, DOTS and local agencies incorporated project governance structures that included community members to inform and decide on project design and development. This contributes to having diverse voices at the table in the decision-making process. Examples of this include (i) creating channels for community input and feedback on project planning as well as incorporating the community's input on the project and following up with community members to communicate changes; (ii) establishing a Community Advisory Committee, whose composition reflects the community's makeup, or a Public-Private Partnerships with community members as board members.

Miami's Underdeck and Rochester's Inner Loop North projects provide examples of project structures that grant community members additional authority. For example, a PPP was recommended for The Underdeck project with a conservancy model (a board of directors with members from city, county, and state leadership and community representatives). Similarly, Rochester's Inner Loop North project involves a Community Advisory Committee (CAC) which plays a key role in shaping the project's design and planning. The CAC includes more than 50 representatives of local nonprofits, major property owners, business leaders, and political officials.

Adopting design elements that minimize displacement of existing residents and businesses: In several projects, DOTs adopted construction alternatives that minimized the displacement of existing communities and businesses. For instance, the project team in Detroit incorporated retaining walls within the design of the project, which allowed the addition of lanes into the dense highway infrastructure without changing the existing footprint and minimized the number of properties that needed to be displaced for the improvements. As another example, Rochester's Inner Loop North identifies "minimizes displacement of existing residents" as a screening criterion for alternative approaches to the project.

Making commitments to distribute project benefits to more vulnerable members of surrounding communities: As mentioned earlier, local agencies in several case studies partnered with local stakeholders to promote real estate development in areas adjacent to dense highway infrastructure. In some of these cases, project leads have made public commitments to ensure that housing opportunities are accessible for residents through affordable housing and supportive housing options. For example, about 75 percent of new projects in Rochester's Inner Loop North are intended for residents earning less than the area median income, veterans, and seniors. Similarly, Atlanta's Stitch project has committed to creating between 3,000 and 3,400 affordable housing units within a half mile of the project.

In addition to affordable housing efforts, some projects incorporate strategies to support homeownership. For example, Rochester's Inner Loop North involves changes in land use planning to ensure that new land is broken up into smaller parcels and thus address community goals related to diverse housing and homeownership opportunities.

Table 5.2 provides outcome metrics related to equity. It is important to note that equity also applies to all other metrics included in this report and, therefore, requires disaggregating data by population groups, including BIPOC and low-income communities.

Table 5.2 Equity outcome metrics

Quantitative Metrics	Qualitative Metrics
(quantitative metrics not identified)	*Explicit recognition of the history of communities with previous transportation projects/ past harms (written acknowledgement and design features)
(quantitative metrics not identified)	*Community Task Force composition (representativeness)
(quantitative metrics not identified)	*Community perceptions about their input being valued in the process
(quantitative metrics not identified)	*Tracking how the community's input was used
*Minimized displacement of existing residents (affected units instead of parcels) *Minimized displacement of businesses *Affordable housing [localities] (count, pct) *Housing ownership/renting rates [localities]	*Community perceptions on displacement
*Maximized opportunities for diverse housing [locality]	*Community perceptions on housing in the area

5.2.3 Health and Environment

"A livable transportation system bolsters the health and well-being of people who live, work, and play near system corridors. A livable transportation system requires investments that prioritize delivering benefits to Black, Indigenous, and people of color (BIPOC) and low-income communities who disproportionately endure the most severe health-related transportation burdens."

Across case studies, DOTs in collaboration with local or regional transportation partners implemented strategies or included design elements to enhance the sustainability of the area and boost motorized and non-motorized transportation.

Increasing green spaces in public areas: Green spaces are typically lacking in areas adjacent to dense highway infrastructure. In the projects analyzed, DOTs and local agencies incorporated design elements to increase green spaces in the area either by (i) incorporating green spaces underneath a section of the spaghetti junction (such as in Milwaukee) or under a highway section contiguous to the spaghetti junction (such as in Miami); (ii) building parks on top of highway caps placed contiguous to the spaghetti junction (as in Dallas and Atlanta); and (iii) adding green spaces from the highway-to-boulevard

conversion (as in Rochester). Although other projects did not increase green spaces in the area, they committed to accommodate improvements within the existing highway footprint, that is, without expanding the ROW (as in Detroit).

In conversations with interviewees, some highlighted the challenges they face when considering design elements that increase green spaces as part of the project. For instance, although there is some reluctance from the FHWA to approve a "park" under dense highway infrastructure (as there are concerns related to air quality and noise pollution along with structural complexities), project partners included elements that mimic park amenities in the final project design.

Improving aesthetics and environmental aspects of the area: Although not all projects can accommodate adding large green spaces, DOTs and local agencies incorporated green infrastructure in the design of many dense highway infrastructure projects. Examples include green walls, street trees, and native planting, or stormwater reclamation to improve air quality, lower temperatures, manage stormwater runoff, and enhance ecological benefits in the project area.

Incorporating green infrastructure also has economic impacts on areas surrounding the project. In Milwaukee, for instance, studies suggest evidence of increased property values and cost-savings arising from offsetting additional costs that would have been needed to address runoff and potential flooding.

Providing or improving activities available in the area: Local and regional agencies and private partners contributed to improving activities available in the area by (i) providing funding for parts of the project related to non-motorized transportation such as expanding or upgrading sidewalks and bicycle infrastructure, which the DOTs typically do not fund; and (ii) offering or improving activities available in the area for the community by incorporating programmed activities in public spaces.

Table 5.3 presents health and environment outcome metrics identified across case studies. While most metrics listed are directly related to environmental outcomes, some may also serve as proxies for health outcomes (such as air quality). Overall, there are a few metrics directly related to health, which mainly stem from the investments localities made in their communities. Two types of local investments are highlighted across case studies: (i) investments made to improve walkability and bicycle accessibility, which are typically funded with regional or local agencies' funds, and (ii) investments made in their local healthcare system with the additional revenue generated from added real estate development.

Table 5.3 Health and environment outcome metrics

Quantitative Metrics	Qualitative Metrics
*Repurposed area **Area designated for green space	*Community perceptions of improved quality of life **Reduced mental stress **Providing a place to be outdoors
*Restoration of existing green space	*Community perceptions of existing green space
*Number of trees planted	*Integration of native plants *Perceptions of presence (increase) of pollinators
*Air quality *Carbon dioxide captured (lb, pct)	*Community perceptions of air quality in the area
*Stormwater intercepted (gal, pct) *Stormwater runoff (cfs, pct) *Reduced impervious surfaces (acres, sqft, pct)	(qualitative metrics not identified)
*Temperature in the area (compared to the average temperature in the zip code in which the mitigation strategy is located)	*Community perceptions of temperature in the area
*Annual savings in electricity (kWh and dollar amount)	(qualitative metrics not identified)
*Acoustic levels/Noise absorbed (dB)	*Community perceptions of noise in the area
*Community participation in programmed outdoor activities (count, pct)	*Community perceptions of programmed outdoor activities
*Investments in health [localities] (proportion of tax revenue generated through new development allocated to health/hospitals)	*Community perceptions of healthy living **Providing a place to relax and enjoy a passive activity and vigorous walking **Improved walkability and bicycle accessibility

Notes: *Pounds (lb), gallons (gal), cubit feet per second (cfs), kilowatts per hour (kWh).*

5.2.4 Economics

"A livable transportation system connects people to jobs, boosts local economies, and creates wealth-building opportunities for communities, especially in under-resourced communities."

Across the dense highway infrastructure projects analyzed, DOTs and local agencies adopted strategies to boost employment and increase the economic vitality of adjacent areas.

Incorporating business programs: In some projects, DOTs adopted strategies to increase opportunities to the community that lives close to the project area and to obtain contracts for the design and execution of the project, thus boosting employment for the local community and businesses, emphasizing those that are disadvantaged. For example, stakeholders created a Small Business Enterprise (SBE) program to increase the participation of SBE in the design, construction, and inspection of Detroit's project.

Adopting strategies to improve the economic vitality of the area: Local agencies have jurisdiction to authorize commercial and residential real estate development in the area, which has the potential to boost the economic vitality of the area. Across case studies, local stakeholders worked to incentivize development to promote economic vitality, which was reflected not only in additional investment

brought to the area but also in additional tax revenue generated for local governments. For example, Rochester's ILE project made 5.7 acres of land available for mixed-use development, bringing the development of new multifamily projects, restaurants, and retail establishments. In Miami, strategies such as incorporating direct-hire opportunities, contracting with local businesses, promoting opportunities for local artists and vendors, and developing internship programs and seasonal opportunities for youth have also been considered with the development of The Underdeck.

In some projects, the emphasis was strongly placed on economic vitality, so much that projects were considered economic and community development projects rather than transportation projects. This emphasis also played a key role in identifying and securing non-transportation funding sources for project execution.

Other strategies to improve the economic vitality focus on creating opportunities for local businesses near the project area. For example, in some case studies, project partners worked along local agencies to incorporate spaces for food businesses within the design of new green spaces. Klyde Warren Park, for example, includes a Food Truck Friday event in their programming. Similarly, local businesses in Miami have recommended (i) establishing designated areas within The Underdeck for local restaurants to deliver their products to Underdeck visitors and (ii) using signage to promote and market local businesses (although these options are under consideration).

Table 5.4 presents economic outcome metrics identified across case studies. The economic outcomes identified reflect the economic activity resulting from new development drawn into the area due to the project.

Table 5.4 Economic outcome metrics

Quantitative Metrics	Qualitative Metrics
*Real estate development [localities] (count, dollar amount) *Commercial and housing permits [localities] (count) *Opportunities for community-based development *Property value (gentrification potential)	*Community perceptions of real estate development
*Repurposed area **Area designated for redevelopment	*Community perceptions of redevelopment
*Additional tax revenue collected [localities] (dollar amount, pct)	(qualitative metric not identified)
*Lease rates (pct) and rents (dollar amount)	(qualitative metric not identified)
*Household income	*Community reported household income
*Jobs created (count; temporary and permanent)	*Community perceptions of jobs in the area
*Business activity (small and big enterprises) **Businesses (count, income) (e.g., small businesses, freight: dollar amount, tons; billboards) **Employees (count)	*Having local businesses and community members be part of the employment and revenue-generating opportunities
*Small Businesses obtaining prime contracts and subcontracts (count, dollar amount of contracts) *Community members participating in training programs	*Perceptions of SBE/DBE obtaining prime contracts and subcontracts *Perceptions of community members participating in training programs

5.2.5 Sense of Place

"A livable transportation system supports each neighborhood's unique sense of place. A strong sense of place makes people feel at home in their community and connected to their neighbors and culture."

Across case studies, efforts to promote a sense of place are evident in design features intended to activate the area, as well as aesthetic elements that in some cases connected the current project area to areas or communities originally impacted by the construction of dense highway infrastructure.

Adopting strategies that "activate" or draw people into the area: As noted in the previous chapter, a primary aim across projects is the activation of the area under, above, or surrounding the spaghetti junction or dense highway infrastructure. Activation of the area is achieved by centering areas as destinations and by offering public spaces with dynamic programming, which creates spaces for community members to come together and connect. Projects incorporate a variety of design features, installations, and aesthetic elements to create areas reflecting the interests of surrounding communities or designed to attract certain populations to the area. Examples include: enhancing landscaping; improving lighting and public art; installation of amenities such as educational displays or recreational areas (such as pickleball, basketball courts, bicycle pump tracks, or dog parks); offering programmed activities (like concerts, restaurants, etc.); and enhancing connectivity with public paths or improved access to transit facilities

For example, Klyde Warren Park in Dallas includes elements to attract many different groups. The park contains a dedicated children's area as well as a reading room for families and hosts free family-related events such as weekly movies in the park. For adults, there are venues for performances as well as dining options. The park is also located next to the Dallas Arts District and contains artistic elements and creative programming such as a signature water feature, creative performance center, and hosts musical and theater performances throughout the year. As another example, the Marquette Interchange Green Infrastructure Project includes a pavilion as well as areas that can be transformed into amenities in the future.

Projects also include related strategies to activate areas adjacent to project areas. For example, Rochester's ILE and Atlanta's Stitch both involve collaborative efforts with local governmental entities to support the economic development of surrounding areas by creating new residential and commercial spaces. These efforts are discussed in greater depth in sections above.

Adopting strategies to center the perspectives of communities that have been harmed by dense highway infrastructure construction: In several cases, projects worked to center the perspectives of communities or populations that were originally harmed or displaced by the construction of dense highway infrastructure. As one example, discussed in greater detail above, a community engagement specialist and historian was hired to interview past residents and document a community history of Buttermilk Bottom and Butler Street, once thriving commercial and residential areas for Black residents of Atlanta. Notably, such efforts were funded and implemented by local actors rather than the state DOT.

Table 5.5 presents outcome metrics for sense of place identified in the case studies.

Table 5.5 Sense of place outcome metrics

Quantitative Metrics	Qualitative Metrics
*Programmed activities [project partners] **Community participation in programmed activities	*Community perceptions on sense of place **Improved perception of place **Presence of others **Promotion of activities for the community **Community cohesion
*Crime rates [localities]	*Community perceptions on improved safety
*Demographic composition	*Community perceptions on demographic composition
(quantitative metrics not identified)	*Assessment of impact on the visual environment, through Visual Impact Assessment

5.2.6 Connections

"A livable transportation system gives people safe, efficient, and affordable multi-modal options to access places of social, economic, natural, and cultural significance."

Across case studies, there is evidence that alternative transportation (pedestrians, bicyclists, and transit) is receiving higher priority in areas surrounding dense highway infrastructure projects than in the past. This represents a shift in practice as previous projects mostly focused on enhancing vehicular mobility, particularly long-distance travel, regardless of the negative consequences on surrounding areas.

Adopting a Complete Streets approach: DOTs and partnering local agencies adopt a Complete Streets approach across most projects analyzed. This approach to planning, designing, and constructing an interconnected network of facilities accommodates the needs of all users, that is, pedestrians, cyclists, transit riders, and motorists. The use of this approach encourages incorporating multi-modal options that address the needs of all users of the transportation system and creating or improving connectivity for community members to access places of social, economic, natural, and cultural significance (like museums).

Projects in Rochester and Detroit included Complete Streets in their design. Detroit, for instance, adopted the Complete Street approach in the reconstruction of existing bridges near spaghetti junctions. These provide direct access across the freeway for all users (vehicles, bicycles, and pedestrians), reducing travel distance and time for non-motorized users and avoiding additional property impacts because these bridges do not require large ramps to be constructed.

Table 5.6 provides examples of outcome metrics for the connections criterion.

Table 5.6 Connections outcome metrics

Quantitative Metrics	Qualitative Metrics
*Connections created (SP) **Distance/time to reach places of significance *Transit stops within walking distance	*Community perceptions of improved connectivity (SP) *Business perceptions of improved connectivity (small and big enterprises) (SP)
*Visual and physical barriers eliminated between neighborhoods (SP)	
*Added transit ridership *Added transit stations	*Community perceptions of improved transit services in the area
*Active transportation **Pedestrian activity (counts, pct) (H&E) **Bike activity (counts, pct) (H&E) * Resources used for active transportation (dollar amount, pct)	*Community perceptions of safe and comfortable walkability and bikeability (H&E)
*Drive-alone trips (counts, pct)	(qualitative metric not identified)
*Retains and ensures adequate capacity/operation of the spaghetti junction (interchange)	(qualitative metric not identified)

Note: *In parenthesis, other pillars supported by the metric: sense of place (SP) and health and environment (H&E).*

5.2.7 Safety

"A livable transportation system ensures that everyone, regardless of their mode of transportation, can travel safely and without risk to their well-being. This goes beyond the prevention of physical accidents; it also includes the protection of personal security and the preservation of people's well-being, keeping them safe from danger, harm or threats while using the transportation system. A livable system invests in mitigating safety issues that disproportionately affect low-income and Black, Indigenous, people of color (BIPOC) communities."

Safety is a key measure across any transportation project and many successful practices to enhance safety and metrics to measure safety have been documented in previous research. Yet while traditional measures of safety tend to emphasize vehicular accidents, the measure of safety included in the Livability Framework expands upon traditional conceptions to include physical safety regardless of mode of transportation as well as protecting security and wellbeing while using the transportation system.

The concept of safety is emphasized across the dense highway infrastructure projects analyzed as case studies and project documentation includes typical analyses of safety impacts for motorized users (such as crash analysis). Yet projects also include safety impacts for non-motorized users of the transportation system, as well as those using the system for non-transportation-related reasons.

Some of the approaches to improving safety are addressed in other sections, such as adopting a Complete Streets approach**.** As noted above, Complete Streets approaches aim to safely accommodate multiple types of users of the transportation system, including pedestrians, cyclists, and transit users.

For example, in Rochester, “safe and comfortable walkability and bikability” and “safety for all modes of transportation, inclusive of non-motorized users” are two criteria used to assess alternative designs.

Creating a safe environment for intended users of activated spaces: Several cases analyzed in this study aim to activate the area under or adjacent to a spaghetti junction for use by non-motorized travelers as well as those using the area for non-transportation-related reasons. In such cases, project leads attest to a need to create a safe environment for users of the space. For example, the foundation that manages Klyde Warren Park in Dallas employs its own full-time public safety officers to monitor safety in the park (Klyde Warren Park, 2025; WRPF representative, personal communication, August 2, 2024). In Milwaukee, stakeholders identified the importance of lighting and design features to minimize the presence of hidden areas under the interchange.

Creating safe alternatives for unintended users of the space: While unintended uses of activated spaces were not frequently discussed by stakeholders, the case of Milwaukee provides an example of an innovative approach for addressing the safety of unintended users. In this case, the DOT worked collaboratively with county and city governments to ensure the safety of nearly 100 homeless individuals who were living underneath the Marquette Interchange. The DOT’s actions to remove homeless individuals were conducted alongside the county’s activity to find housing, creating a situation in which unintended users were not simply evicted from the area but were assisted in securing a safe place to live.

Include ongoing maintenance and upkeep to ensure that area remains safe for both intended and unintended users: Several project stakeholders noted the importance of ongoing maintenance and upkeep of the newly designed areas to ensure safety and usability. Projects developed different structures for maintenance activities.

Table 5.7 presents safety metrics.

Table 5.7 Safety outcome metrics

Quantitative Metrics	Qualitative Metrics
*Crash rates (for all transportation modes; motorized and non-motorized users) *Fatality rates (for all transportation modes; motorized and non-motorized users) *Posted speeds / Traffic speeds	*Community perceptions on improved safety (for all transportation modes; motorized and non-motorized users)
*Presence of design features that support safety (e.g., lighting) *Reported complaints related to area maintenance or safety (count) [localities] *Injury types and rates in and around area *Crime rate or violent crime rate in and around area	*Community perceptions on feeling safe in area
(quantitative metrics not identified)	*Creating safe alternatives for unintended uses/users of the area (e.g., housing opportunities created for the homeless) [localities]

5.3 Policy and Practice Changes

The practices and strategies used to mitigate the adverse impacts of dense highway infrastructure vary widely based on the overall project design, intended use of the area, and characteristics of the infrastructure and surrounding communities. Across case studies, many of these activities extend beyond transportation infrastructure and to the extent that funding is needed, are funded by transportation partners or other stakeholders rather than the state DOT.

The MnDOT policies that most closely relate to the strategies and outcomes highlighted in the previous section include the Public Engagement Policy and Public Engagement Guidance discussed in the first section, MnDOT's Cost Participation and Maintenance Responsibility with Local Units of Government, and policies related to the funding of aesthetic features or design elements that promote multi-modal transportation (MnDOT, 2016). While not exhaustive, these policies and guidelines are most closely tied to the practices and strategies identified in the case studies.

MnDOT's Public Engagement Policy and Public Engagement Guidance discuss policy and recommendations related to effective public engagement. The Public Engagement Policy outlines federal and state laws that govern when MnDOT must engage the public as part of the implementation of transportation projects.[32] The Public Engagement Guidance offers recommendations and guidelines for operationalizing the policy across transportation projects.

Recommendations regarding public engagement include many of the ideas identified in the case studies and described above, including the importance of early and ongoing engagement throughout and outside of a project's lifecycle; intentional and flexible planning for engagement activities; and the contextual nature of engagement across projects. The guidelines also outline a set of recommended steps for public engagement planning, including:

1. Clearly defining the project and MnDOT's expectations and commitment
2. Identify stakeholders, issues, and needs
3. Determine the level of engagement
4. Clarify the public role in decision making
5. Create a public engagement plan
6. Evaluate engagement efforts

[32] MnDOT's Public Engagement Policy describes MnDOT's approach to environmental justice and details the federal legislation and requirements related to engaging environmental justice communities. While federal guidelines have changed with the onset of the second Trump administration, it is not clear at this point which changes will be sustained. This section assumes that MnDOT will maintain its commitment to environmental justice and desire to identify successful practices related to mitigating the adverse community impacts of dense highway infrastructure for communities disproportionately impacted, including low-income communities and communities of color.

The Public Engagement Guidance also provides guidance on applying an equity lens and removing barriers to participation to engage diverse audiences, including offering language services, hosting engagement events in accessible locations, and creating multiple alternative mechanisms for providing feedback. Both the policy and guidance are broad enough to accommodate engagement efforts that go beyond that typically required by federal and state law. The breadth of the policy and guidance, as well as MnDOT's orientation towards environmental justice, suggest that variation in engagement planning and activities stem in part from differences in project scope and design, as well as preferences of MnDOT project leads.

In addition, while MnDOT policy does not prohibit more extensive engagement efforts, such efforts require staff time and resources, and necessitate a flexible and collaborative approach to project design. It is likely that available resources and willingness or ability to adjust project designs to incorporate community feedback vary across projects, shaping engagement planning and activities across projects.

MnDOT is required by statute to follow a Complete Streets approach in all phases of project development and implementation (MnDOT, 2025b). This approach calls for consideration of multimodal options across transportation projects. If implemented, Complete Street designs can facilitate connections between communities impacted by dense highway infrastructure.

While Complete Streets design elements can be incorporated into MnDOT project designs and funded by MnDOT, there are exceptions and restrictions in cases involving dense highway infrastructure. For instance, MnDOT is not required to follow a Complete Streets approach on projects where non-motorized transportation is prohibited on highway infrastructure, as is typically the case for spaghetti junctions (MnDOT, 2022). In addition, there are limitations on funding that can be used for Complete Streets design elements. As of 2025, funds from the Highway User Tax Distribution Fund (HUTDF) cannot pay for expenses of the Office of Transit and Active Transportation within the Department of Transportation (MN S 161.045), which, among others, advances walking and bicycling in the state (MnDOT, 2025d).

To the extent that Complete Streets elements are incorporated into cases in this analysis, they are present under, over, or adjacent to dense highway infrastructure (for example, as part of a freeway cap park or underpass). Funding for the construction and maintenance of such elements typically comes from non-DOT sources. This suggests that strategies that promote connections within dense highway infrastructure projects may require collaboration and funding from transportation partners.

MnDOT's Cost Participation for Cooperative Construction Projects and Maintenance Responsibilities between MnDOT and Local Units of Government policy describes the responsibilities and cost participation of MnDOT on collaborative projects with local units of government (MnDOT, 2016). MnDOT participation in cooperative construction projects and subsequent maintenance with local governments is limited to trunk highway purposes. Cooperative construction projects may be initiated

by MnDOT requesting local participation in a trunk highway project, or by a local unit of government either:

- Requesting improvements or otherwise indicating its willingness to share the cost of a MnDOT project; or
- Requesting MnDOT cost participation in a locally initiated project.

Consistent with cases in this analysis, design elements that aim to promote livability factors such as economic vitality, community connections, and sense of place are outside the scope of MnDOT's authority and thus require collaboration and funding from transportation partners.

For example, MnDOT's Cost Participation and Maintenance Responsibility with Local Units of Government describes the conditions under which MnDOT will allow and fund aesthetic features such as design elements of the trunk highway to minimize impacts on the surrounding community, aesthetic treatments such as surface finishes or pavement coloration, enhancements to structural elements, decorative landscaping, and lighting units. The manual details the MnDOT funding allowed for aesthetic features based on the level of (aesthetic) impact of a project, project type category, and specific item under consideration (bridges, retaining walls, noise walls) (MnDOT, 2016). In addition, MnDOT's Art on Trunk Highway Right of Way Policy allows for donations of art for placement on trunk highway right-of-way that does not directly serve a transportation purpose (MnDOT, 2020). Consistent with the case studies, the art proposal applicant (required to be a state agency, political subdivision of the state, or tribal government) is responsible for the full cost of the art project.

MnDOT's participation in funding aesthetic elements is determined on a project-by-project basis. When impacts of a highway project on visual quality are expected to be significant, MnDOT's policy calls for a Visual Impact Assessment (VIA), typically conducted as part of the larger environmental review/NEPA process, with the final choice of mitigation measures decided after a preferred alternative is selected (MnDOT, 2025g). The VIA process focuses on documentation and description of efforts to mitigate negative impacts or enhance the surrounding environment, rather than metrics.

It is important to note that the FHWA also offers guidelines for mitigating adverse impacts for the environment surrounding the highway infrastructure, including avoiding the harm to the existing visual resources, minimizing the impact on existing visual resources, and replacing an adversely affected resource with the same type of resource or a substitute resource (FHWA, 2015). Thus, while such efforts were not discussed at length by case study interviewees, it is likely that there were efforts to minimize the impact on visual resources through use of forms, materials, and finishes that reflected the surrounding environment and/or use of the mitigation measures discussed above.

Chapter 6: Conclusions

There has been growing recognition that communities located near dense highway interchanges, or spaghetti junctions, experience a disproportionate share of negative impacts, including concentrated noise and air pollution, community fragmentation, reduced mobility, stress, mental health impacts, and increased traffic injuries and fatalities. The goal of this study was to identify strategies across the United States and, to a limited extent, Canada, to mitigate community harms of dense highway infrastructure and provide guidance to the Minnesota Department of Transportation (MnDOT) regarding the implementation of such strategies in Minnesota.

The research team used a multi-stage approach for identifying and analyzing successful strategies and practices used in other states. First, the research team reviewed existing literature to inventory and better understand the community (including health impacts), environmental, and economic impacts of dense highway infrastructure. Second, the research team performed a nationwide scan of harm mitigation projects to examine the range of strategies implemented to mitigate such impacts. Third, building on this scan and with input from the project's Technical Advisory Panel, the team conducted case studies to further investigate the efforts taken to address community harms. Case studies were selected to ensure diversity in geography, project design, scope, and demographics of the communities adjacent to the project, and to represent a range of approaches in terms of cross-sector collaboration, including public, private, and nonprofit sectors, and engagement across different levels of government. Finally, the research team analyzed MnDOT policies and guidelines to provide guidance regarding local implementation of successful strategies and practices.

The comprehensive review of research on the impacts of dense highway infrastructure projects on the community, the environment, and the economy contributes to the early identification of potential problems with current or proposed project designs. Understanding how diverse communities have been affected by previous transportation projects helps inform more equitable and proactive strategies to mitigate the impacts of current and future projects. The review also reveals that there is limited research on the community impacts of spaghetti junctions, highlighting an important area for future research.

This research project also identified dense highway infrastructure projects that adopt a range of strategies and innovative practices to reduce the negative impacts on communities. The strategies adopted depend on the context of the area and the goals for the infrastructure established by the community and project partners. Innovative practices that support the implementation of strategies that mitigate community harms include cross-sector collaboration, alignment of interest, and meaningful community engagement and involvement. Overall, findings from the case studies point to changes in practice, rather than policy changes, as facilitating the implementation of projects aimed at mitigating community harms. Key practice changes involve the way in which DOT staff approach collaboration with other areas of government, the DOT's receptivity to participate in projects traditionally outside the agency's scope, and innovative approaches to engage the public.

The research study also provides an analysis of MnDOT policy and guidance to implement successful practices identified in the research. This analysis indicates the existence of a few legal or administrative barriers. For instance, the current MnDOT's public engagement policy limits some practices to address the community's barriers as it does not allow for providing childcare, transportation expenses, or incentives to participate. Some of these are currently under revision. In addition to this, future analysis is needed to understand what are the organizational practices or internal cultures that may limit the implementation practices identified in this research.

The study concludes with a set of metrics that state DOTs, metropolitan planning organizations (MPOs), local municipalities, and partners can use to assess and monitor the impacts of dense highway infrastructure projects. The list of metrics, although comprehensive, is not exhaustive. The metrics presented serve as examples, as the data indicate that lists of metrics should reflect the needs and concerns of the communities directly impacted by the project and be tailored to the specific context of each project area.

Finally, the institutional and legislative landscape for Minnesota and the United States has changed significantly since the advent of this project. For the next several years, projects that prioritize equity, addressing community harms, or significant public engagement may be disadvantaged in federal funding processes due to shifting federal priorities as well as the rescinding of policies designed to promote environmental justice. As MnDOT remains committed to advancing transportation equity despite the changes at the federal level, this study identifies a set of strategies and practices that the agency can work toward implementing in future projects. In addition, the fact that the project identifies practice changes as critical may present an advantage in an environment that does not favor statutory changes in support of equity.

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Appendix A List of Projects

Finalized Projects

Project	Project Status	City	State/ Province	Description of highway infrastructure	Description of community	Project description	Goals of project	Stakeholders	Funding	Sources
Freeway Park	1976 (opening)	Seattle	WA	I-5 -- Widest part has 13 lanes. "Since I-5 was completed in 1969, average daily traffic on I-5 near downtown Seattle has doubled, from nearly 125,000 average daily vehicles to approximately 250,000 in 2017. In 2018, I-5 carried 288,000 vehicles daily through downtown Seattle, and traffic volumes are expected to increase by 12% to 22% by 2035."	First Hill: 50.9% White; 22.4% Asian; 9.6% Hispanic/Latino; 9.1% African American. Median household income: $89,947.	*Park built over a freeway *The park would restore pedestrian access between Seattle's Downton, Capitol Hill and First Hill neighborhood *Includes unique architectural forms, fountains, plazas and pathways. *The Park's 2010 landscape renovation brought attention back to the diverse canopy of mature trees, the series of bright grassy plazas and the array of seasonal blooms throughout the year.	*Bridging Seattle's Downtown and First Hill neighborhoods after they were severed by the construction of I-5.	Freeway Park is a City of Seattle public park, managed by Seattle Parks and Recreation.	**Cost:** $9.5 million total cost ($40 million in 2016 dollars) **Funding:** Funding from Forward Thrust bond money, as well as county, state and federal funding	https://www.freewayparkassociation.org/about-park/ https://www.tclf.org/sites/default/files/microsites/halprinlegacy/freeway-park.html https://lidi5.org/history/ https://www.seattle.gov/documents/Departments/Neighborhoods/Shared/NeighborhoodSnapshots/FIRST_HILL_2023.pdf https://www.seattle.gov/documents/Departments/OPCD/OngoingInitiatives/LidI5FeasibilityStudy/lfs-existing-conditions-and-context-
Chicano Park	1971 (signed into law) 1973 (first murals painted)	San Diego	CA	Park located below the junction connecting I-5 and San Diego - Coronado bridge (SR 75). I-5 constructed in 1963, bisecting Logan Heights. Coronado bridge cut through Barrio Logan in 1969.	Barrio Logan: Over 80% of the residents are of Hispanic descent. Younger population, median age is 28 (2007).	*Park established in 1971 following community activism in response to proposed siting of police station. *Characterized by murals - many celebrating Aztec and Mexican-American culture, painted on 24 pillars. "Its facilities include children's playgrounds, restrooms, a Kiosk or dance pavilion, picnic areas, multi-purpose courts, open play lawns, a raised plaza, community gardens, sculptures, fountain, and two small parking areas."	*The construction of the Coronado Bay Bridge demolished part of the neighborhood. From 1967 to 1970, residents had discussions with political officials about turning the area under the ramps into a public park. On 1970, community members learned that grading had already begun to construct a California Highway Patrol station. Community members arrived at the site to disrupt work and over the days community members and students arrived to occupy the site and began planting trees with the intention to build the envisioned park. *The occupation led to negotiations between activists and the City of San Diego, resulting in state land being leased to the City for the purpose of establishing the park.	*Barrio Logan community *CalTrans *City of San Diego *Artist/academic community (pushed for historical registration)	Not available	https://www.sandiego.gov/sites/default/files/legacy/planning/community/cpu/barriologan/documents/pdf/barriologanmarketanalysis1208.pdf https://npshistory.com/publications/srs/chicano-park-rs.pdf

Lynch Family Skatepark	2015 (opening)	Cambridge	MA	Skatepark is located under ramps to I-93, at interchange with US Route 1 and MA Route 28. Also connects to neighborhoods of East Cambridge, Bunker Hill, Downtown Boston.	Located in the NorthPoint Commercial district of East Cambridge. Ramps were constructed during the Big Dig (late 1990s/early 2000s - an extensive highway project that replaced an elevated highway with an underground highway, with the aim of reducing traffic and improving mobility throughout the Boston area). Surrounding land is both industrial, commercial, and public use. Railroad tracks to the northeast, office buildings to the west, and 14-acre state park to the south (connecting to waterfront).	*40,000-square-foot facility *Skate park that hosts a vibrant community of skate park athletes, creatives, and recreational visitors. *Embarking on a public art process at the skatepark.	*Began as an idea when sculptor Nancy Schön (“Make Way for Ducklings” fame) noticed skaters were using her sculptures in Copley Square for practice. She learned the skaters had few skating options and decided to look into getting a skate park built. *Obtaining a piece of land was a major hurdle. The site of the park was among parcels of land used during the "Big Dig". That land was formally designated for the skate park in 2013, but the site was also a former brownfield (industrial site) and had to be cleaned up before construction could begin	*Department of Conservation and Recreation (DCR) *Cambridge Hip-Hop Collective *Community Art Center, Cambridge *Lynch Foundation *Vans	**Funding:** $4.5 million total, w/$3 million to construction; significant private funds; $800k from Lynch Family Foundation, $1.5 million from Vans + $25k per year to DCR for maintenance	https://thecharles.org/our-work/lynch-family-skatepark/ https://www.cambridgema.gov/cdd/planud/neighplan/neighs/1
Klyde Warren Park	Phase I: (2012) Phase II: (Ongoing)	Dallas	TX	The park was built over eight lanes of a state freeway (366). One overpass was closed to make a larger continuous open space. The park is located in between two spaghetti junctions: One mile away from junction connecting I-345, SH 366, US 75; and 1.1 miles away from the junction connecting I-35E, SH 366.	Uptown Dallas: Median household income: $95,907 per year, median age of 31.9. Downtown Dallas: Primarily, young professionals ages 25-36. 35% make over $100K	*Phase I: Located above Woodall Rogers Freeway (St. Paul on the south, Pearl to the north, and the Woodall Rogers Frontage Roads to the east and west). *Phase II: Will provide additional open space, event space, retail, and parking on two separate deck structures over the freeway. The pavilion will offer space for a single ground-floor tenant and will serve as a gateway into the city. Additional plans for the pavilion include a 36,000-square foot multi-use green space for markets, festivals, and recreation.	*To connect Uptown neighborhood and Arts District.		**Costs:** Phase I. $110 million *City of Dallas: $20M (bond funds) *Texas DOT: $20M (highway funds) *USDOT: $16.7M (stimulus funds) *Private donations: $50M Phase II. Estimated cost: $60M **Funding:** *Bond funds from the City of Dallas *Highways funding from the State of Texas *Stimulus funding *Individual donors directly to the Woodall Rodgers Park Foundation *Real Estate Council	https://www.fhwa.dot.gov/ipd/project_profiles/tx_klyde_warren_park.aspx https://lidi5.org/case-studies/ https://www.point2homes.com/US/Neighborhood/TX/Uptown-Dallas-Demographics.html https://downtowndallas.com/wp-content/uploads/2019/04/2019-Residential-Fact-Sheet-FINAL.pdf

Transformation of Six Points Interchange	October 2020 (Completed)	Toronto	ON	Bloor St; Dundas St; Kipling Ave	Etobicoke: Median age of 40; median total income (2020) $47,600 (CAD)	*Transformation from a car-centric, freeway-style interchange into a Complete Streets environment. *It includes the demolition of two bridges, replacing them with three major at-grade intersections and a network of new streets. *It also includes improved pedestrian facilities such as wider sidewalks, trees, street furniture; bicycle facilities with separated bike lanes (on Bloor and Dundas St.), and improved access to subway stations. *The infrastructure's transformation is set to free up about 15.5 acres of City-owned land that was parceled into seven for mixed-use redevelopment and blocks connected by streets. An additional 1.75 acres could be used for parks and public art. *A primary requirement for project was to comply with the Toronto Green Standard — the city's sustainable design requirements for new private and city-owned developments. This addresses Toronto's environmental priorities including improving air quality, minimizing the urban heat island effect, and reducing stormwater runoff while improving the quality of water draining into Lake Ontario. For this, the project used a Silva Cell system.	*The reconfiguration supports the development of Etobicoke Centre as a vibrant mixed-use transit-oriented community.	City of Toronto	**Costs:** $60 million (CAD)	https://www.thestar.com/news/gta/etobicoke-s-spaghetti-junction-to-be-transformed-to-make-room-for-all-road-users/article_a0b9bd0a-0275-5597-90c6-cd416bddc586.html https://www.toronto.ca/news/city-of-toronto-celebrates-start-of-construction-of-the-new-state-of-the-art-etobicoke-civic-centre/ https://www.toronto.ca/community-people/get-involved/public-consultations/infrastructure-projects/six-points-interchange-reconfiguration/#:~:text=The%20new%20road%20network%20is,limits%20and%20additional%20signalized%20intersections. https://svn-ap.com/projects/six-points-interchange/ https://www.deeproot.com/case-studies/silva-cell/etobicoke-six-points-interchange-retrofit-in-toronto/#:~:text=Overview,2020%20(with%20numerous%20awards). https://www12.statcan.gc.ca/cens

I-10 Connect Project	2021 (Completed)	El Paso	TX	Adds connectors to the series of highway interchanges along the I-10 (the southernmost cross-country highway in the American Interstate Highway System), I-110 (shortest interstate highway in Texas), US 54, and Loop 375 (Cesar Chavez Border Highway) Corridors.	Lincoln Park, El Paso: 82.9% Hispanic; 28.7% White; 3% African American. Median household income is $41,382.	*The project expands US 54, I-10, I-110, and US 62 (Paisano), and includes eight bridge replacements, one railroad overpass, five bridge widenings, and two new direct connectors. *The project widens I-110, provides separate truck lanes for Southbound traffic going to Mexico, and provides multi-modal improvements along US 62 which experiences more than 1 million pedestrian crossings per year. *Presented challenging community concerns including addressing Lincoln Park (area with rich culture and building history) that included murals painted on the bridge columns under I-10, which the team worked to protect and preserve.	*To provide improved access from I-10 to Loop 375 *To improve mobility in the study area *It also providse additional improvements to minimize congestion leading to the Port of Entry	Texas Department of Transportation (TXDOT)		https://www.texasce.org/tce-news/i-10-connect-project-texas-department-of-transportation-el-paso-district/ https://www.txdot.gov/projects/projects-studies/el-paso/i10-connect.html https://cbs4local.com/newsletter-daily/san-xavier-community-accuses-i-10-connect-of-exacerbating-health-traffic-issues-federal-highway-administration-paisano-drive-north-copia-street-loop-375-us-54 https://www.point2homes.com/US/Neighborhood/TX/El-Paso-County/El-Paso/Lincoln-Park-Demographics.html https://firstandsold.com/places-to-live/lincoln-park-neighborhood-el-paso-tx/ https://acppubs.com/TXC/article/FAEABB21-el-paso-s-i-10-connect-

Projects in Construction										
Project	**Project Status**	**City**	**State/ Province**	**Description of highway infrastructure**	**Description of community**	**Project description**	**Goals of project**	**Stakeholders**	**Funding**	**Sources**
Underdeck Greenway // Overtown Miami Greenway // Heritage Trail	To start (Received funding for construction FY 2023; anticipated completion: 2027)	Miami	FL	The Underdeck is located under I-395, 0.5 miles from the junction of I-395 and SR 836 (about 8 lanes) / I-95	Overtown neighborhood: 27% Hispanic and 73% non-Hispanic. 17.5% White (including white Hispanic); 77% African American; and 5.5% multi-racial. 62% with ages between 18-64. Average per capita income: $11,578	*33-acre public open space under a reconstructed stretch of I-395 *Bridges would be broken up with higher overhead clearance allowing for more light *Shrinking the number of columns below the highway from 800 to 94. *Greenway will accommodate full-size trees *Pedestrian walkway. With a 24-foot-wide bridge that will have enough room for activities *Spaces for community plazas, cafés, concession areas, active recreation and spaces for rents	*Will serve as a multi-purpose green space connecting the neighborhoods of Overtown in the West to Biscayne Bay in the East *Supporting local employment and programming opportunities *Designed to alleviate some of the isolation brought by construction of I-95 and I-395	*Florida Department of Transportation (FDOT) *City of Miami *Downtown Development Authority *Miami Parking Authority *Omni Community Redevelopment Agency *Southeast Overtown/ Park West Community Redevelopment Agency	**Costs:** $82,653,730 Annual operation and maintenance costs are estimated at $5.7 million annually. **Funding:** *Reconnecting Communities and Neighborhoods (RCN) Grant: $60,353,730 *State of Florida: $10,000,000 *Miami: $10,000,000 **Part of a larger project that will cost $840 million.	https://www.miamitodaynews.com/2021/11/16/underdeck-miami-heritage-trail-designs-march-ahead/ https://underdeckmiami.com/about-the-project-draft/ https://www.dropbox.com/s/zb73d1nc8koqwdy/The-Underdeck-Year-In-Review-2022.pdf?dl=0 PAGE 50: https://www.transportation.gov/sites/dot.gov/files/2024-03/RCN%20FY23%20Awardees%20Factsheet_3_13_24.pdf https://www.fdotmiamidade.com/userfiles/files/Volume%202%20Aesthetics%20Manual_AWdMJV.pdf https://i395-miami.com/the-project/ https://www.i395-miami.com/Factsheet-i395-English.pdf http://maps.fiu.edu/mpotop/sites/default/files/community_reports/O

The Stitch, Midtown Connector	Ongoing	Atlanta	GA	The Stitch is located in between two junctions: 0.2 miles from the junction connecting I-75, Spring Street, William Street; and 0.9 miles from the junction connecting I-85, John Lewis Freedom Parkway, Ellis Street, Ascent Peachtree, Irwin Street. I-75/I-85 Connector (14 lanes)	Midtown Atlanta: 65% White; 12% African American; 9% Asian. Median household income of $111,765	*Will run for three quarters of a mile on top of the I-75/I-85 Connector, from the Civic Center Metropolitan Atlanta Rapid Transit Authority (MARTA) station on west Peachtree Street to past Piedmont Avenue *25 acres of park, greenspace, tree canopy *Stormwater capture, filtration, and reuse system *CO2 reduction through landscape absorption and storage *Tunnel filtration system *Noise reduction *Highway shoulder updates, exit reconfiguration and new collector distributor system *New bicycle and pedestrian connections *Connector crossing street network expanded, local area street network increased *Affordable housing *The Stitch will provide multi-modal connections over the interstate via multi-use paths, an improved surface transportation network, and enhanced transit amenities.	*Reconnect the east and west sides of Midtown, improve traffic and safety, provide increased access for walkers and bicyclists. *Improve stormwater retention and air quality	*MCP Foundation *City of Atlanta	**Total Costs:** $1.2 billion approx. **Funding:** Exploring a special service tax district in the area **Phase 1 costs:** $200 mill **Phase 1 funding:** NAE $157.6 mill The project also received a 2021 RAISE Planning Grant, which is supporting the development of site-specific criteria, guidelines, and housing policy needed to meet such an ambitious, but necessary, goal and that builds on the 2019 City of Atlanta Housing Affordability.	https://atlantaregional.org/whats-next-atl/articles/midtown-connector-aims-to-cap-downtown-atl-highway-with-green-space/ https://thestitchatl.com/project https://www.niche.com/places-to-live/n/midtown-atlanta-ga/residents/

Planning Projects										
Project	**Project Status**	**City**	**State/ Province**	**Description of highway infrastructure**	**Description of community**	**Project description**	**Goals of project**	**Stakeholders**	**Funding**	**Sources**
Reconnecting Southeastern San Diego and National City	Received funding for planning	San Diego	CA	I-5 bisects the Barrio Logan and Logan Heights communities, and the I-5/SR 75 interchange and Coronado Bridge further dissect Barrio Logan on the west side of I-5. There are few roads that cross I-5 to connect Barrio Logan and Logan Heights, and auto and pedestrian traffic is forced to funnel through the few cross-freeway connectors. The relative scarcity of these connections coupled with freeway on- and off-ramps at key crossing points create a hostile landscape for people walking and biking. Large parcels, industrial uses, and inadequate sidewalks on high-traffic streets further deteriorate pedestrian conditions. There are no bike lanes on any of the roads traversing I-5, despite Barrio Logan's proximity to the Bayshore Bikeway. The park is planned to be located 0.3 mile from the junction connecting I-5, SR 163	Barrio Logan: Over 80% of the residents are of Hispanic descent. Younger population, median age is 28 (2007).	*Barrio Logan Freeway Lid Parks project: Initiative planning two new parks covering I-5 in Barrio Logan. The new freeway lid parks will increase community cohesion, provide new access options, and safeguard the environmentally burdened community from harmful particulate emissions.	*Effort to make amends for some of the injustices of the past related to bulldozing communities and replacing those communities with highways *To convert underused highways that divide underserved communities into multimodal corridors and vibrant public spaces *To restore community connectivity, improve travel options, and provide opportunities for community-led solutions related to housing and transportation.	*Caltrans *City of San Diego *National City *San Diego Association of Governments (SANDAG) *Community-based partners (Mundo Gardens, Groundwork San Diego - Chollas Creek, and Urban Collaborative Project)	**Costs:** N/A - Planning Stage **Funding:** Grant from Reconnecting Communities: Highways to boulevards	https://www.sandiegouniontribune.com/news/politics/story/2024-03-12/freeways-split-san-diegos-communities-of-color-this-new-caltrans-project-aims-to-reconnect-them https://www.kpbs.org/news/local/2024/03/12/san-diego-national-city-receive-grant-to-reconnect-communities-divided-by-freeways https://www.sandag.org/news/SANDAG-awarded-federal-and-state-funds-to-transform-underserved-communities https://www.sandiego.gov/sites/default/files/legacy/planning/community/cpu/barriologan/documents/pdf/barriologanmarketanalysis1208.pdf
Pleasant Hill Reconnection and Commercial Planning	Received funding for planning	Macon-Bibb County	GA	I-75 and 540 (about 11 lanes)	Macon-Bibb County's Pleasant Hill Neighborhood: Median age of 28.8. 93% African American, 4% White, and 3% Hispanic. Median household income: $14,388. 63.1% people below poverty line.	*The planning study would focus on engagement, public infrastructure, zoning changes, and anti-displacement strategies. *The grant will be used to begin mitigating the impact of I-75 by creating an urban design plan for sidewalks, streetlights, transportation, transit, and a new commercial district.	*The project is a planning study to reconnect the community to itself and the downtown business district. *The project will rectify the exclusion of the Pleasant Hill neighborhood.	*Pleasant Hill Neighborhood Organization (PHNO) *Macon-Bibb County	**Costs:** N/A - Planning Stage **Funding:** Grant from Reconnecting Communities: Highways to boulevards	https://www.gacities.com/News/GMA-Updates/Five-Georgia-Projects-Receive-$210-Million.aspx https://apps.maconbibb.us/apps/countynews/detail.php?id=69142 https://censusreporter.org/profiles/14000US13021010100-census-tract-101-bibb-ga/

I-16 Ramp Removal	Received funding for planning	Savannah	GA	I-16 Corridor: The I-16 flyover ramp has been a physical and socioeconomic obstruction, hindering pedestrian safety and mobility, corridor revitalization, and community cohesion.	South Historic District: 73.2% White; 16.2% African American; 7.3% Hispanic. Median Household income $40,400.	*The I-16 Ramp Removal Project plans to remove the flyover exit ramp over Martin Luther King, Jr. Boulevard to Montgomery Street and associated adjacent ramps. *It aims to reconnect the historic grid street network, and provide access to Downtown, the Canal District, and the new arena. *It will create small sized neighborhood blocks, providing a safer pedestrian friendly environment by reducing vehicular speeds and adding public green spaces for the community. *When the I-16 interchange was constructed it caused historic injustices to the neighborhoods of Frogtown and Currietown, a Jewish neighborhood established in the 1830s, and has remained a barrier to development and economic vitality. This has become a physical and psychological barrier to economic development, pedestrian activity, and neighborhood revitalization. The area to the north and east of the site has been able to develop and thrive, while the area to the south and west has languished. The removal of this barrier would rectify decades of harm. *The project would restore eight acres of developable land on multiple city blocks and create a site for a new square and civic	*The removal is intended to spur neighborhood revitalization and equitable redevelopment opportunities.	*Metropolitan Planning Commission *Georgia Department of Transportation *Chatham County *The City of Savannah *Coastal Region (CORE) MPO	**Costs:** N/A - Planning Stage **Funding:** Grant from Reconnecting Communities: Highways to boulevards	https://www.gacities.com/News/GMA-Updates/Five-Georgia-Projects-Receive-$210-Million.aspx // https://reclaimingoldwestbroad.org/ https://www.cnu.org/publicsquare/2022/11/22/historic-opportunity-remove-barrier-reconnect-community https://statisticalatlas.com/neighborhood/Georgia/Savannah/South-Historic-District