I-5 Lid Feasibility Study

Summary Report

September 2020

City of Seattle

Final I-5 Lid Feasibility Study Report

I-5 Lid Feasibility Study
Contract No. PCD19002

Task 7. I-5 Lid Feasibility Study Report

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Seattle Housing Authority (SHA)
Seattle Human Rights Commission
Seattle Immigrant and Refugee Commission
Seattle LGBTQ Commission
Seattle Office of Economic Development (SOED)
Seattle Public Schools (SPS)
Seattle Women's Commission
Washington State Convention Center (WSCC)

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A Guide to Using this Feasibility Study

This report summarizes the initial analysis to assess the feasibility of lidding I-5 through downtown Seattle. Further exploration of a long-term and complex project of this scale must consider the relationship between social, financial and economic benefits, along with improvements to the built environment, and whether they outweigh the risks and costs of lid development. Moreover, exploration would consider whether the value proposition of lidding I-5—and the potential benefits it could create—would align with the city's vision and goals for the Seattle of the future.

This report is the amalgamation of the body of work performed during the I-5 Lid Feasibility Study (LFS) process. The first part of the report provides the background, precedents and rationale behind the exploration of a lid. It also describes the overall approach to the study and defines the feasibility framework used.

The second part of the report focuses on addressing the engineering, economic, financial and urban design challenges of developing a lid in the heart of downtown, and summarizes the technical memorandums developed as part of this study. This section describes the multiscale and multidisciplinary context of the study, and other factors that informed the feasibility assessment. It also addresses the technical feasibility of lidding I-5, including the engineering feasibility, related technical considerations, and physical constraints of building over a complex urban freeway on sloped topography. The results of examining three development program test cases are described, each addressing a different guiding question and urban design considerations, to explore whether a lid can maximize public benefits. Analysis of the three test cases also explores the range of financial feasibility and economic opportunity of a lid, with considerations relative to project delivery, policy assumptions, governance models, and funding and financing mechanisms. Each analysis section in Part II concludes with a summary of key takeaways.

The third part presents a blueprint for lidding I-5, exploring important considerations and next steps to support future decisions about whether to advance the lid concept.

An overview of what you will find in each section of the report follows.

COVID-19 Context

Seattle will continue to grow and change in unforeseen ways, made less clear and further complicated by the COVID-19 pandemic. Employment opportunities and growth rates, existing displacement trends and lack of affordable housing, where people want to live and the transportation options they choose, and priorities for public funding will all be affected by COVID-19. Yet, the pandemic highlights the need for strategies to increase community resiliency and capacity to thrive. The lid would play a critical role in city and regional planning to ensure, even in a global health and economic crisis, equitable opportunity and outcomes. While this feasibility study was largely conducted in a pre-COVID reality, it recognizes the significant near-term economic, social and health impacts of the pandemic. The long-term results of COVID-19 cannot be predicted in the timeframe of this study but are addressed throughout the report and will be influential in future next steps in exploring a lid of I-5 in downtown Seattle.

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Acronyms and Abbreviations

ACS	American Community Survey
AMI	Area Median Income
B	Billion
BUILD	Better Utilizing Investments to Leverage Development Grant Program
CIP	Cast-In-Place
COVID	Coronavirus Disease
DON	Seattle Department of Neighborhoods
DSA	Downtown Seattle Association
FHWA	Federal Highway Administration
FLS	Fire and Life Safety
GIS	Geographic Information System
I-5	Interstate 5
LFS	I-5 Lid Feasibility Study
LGBTQIA+	Lesbian, Gay, Bisexual, Pansexual, Transgender, Genderqueer, Queer, Intersexed, Agender, Asexual, and Ally community
LID	Local Improvement District
M	Million
MHA	Mandatory Housing Affordability Requirement
NB	Northbound
NEPA	National Environmental Protection Agency
O&M	Operations and Maintenance
OPCD	Seattle Office of Planning and Community Development
PDA	Public Development Authority
PDA	Preservation and Development Authority
PFD	Public Facilities District
PSRC	Puget Sound Regional Council
R&R	Repair and Replacement
RLV	Residual Land Value
ROM	Rough-Order-of-Magnitude
SAB	Structural Assessment Boundary for the LFS
SB	Southbound
SF	Square Feet
SODO	South of Downtown
TAT	Technical Advisory Team of the LFS
TOD	Transit-Oriented Development
USD	United States Dollars
WSCC	Washington State Convention Center
WSDOT	Washington State Department of Transportation

A Message from the Technical Advisory Team:
What we learned from the I-5 Lid Feasibility Study

The I-5 Lid Feasibility Study was initiated in response to a citizen-led effort to secure study funding as part of the community benefits package from the Washington State Convention Center expansion project. Those funds were administered by Seattle's Office of Planning and Community Development, which also convened a Technical Advisory Team to guide the study process and provide input and review during development of the study. That team included representatives from Seattle's Department of Transportation, Seattle Parks and Recreation, the Seattle Office of Housing and Seattle Department of Neighborhoods as well as the Washington State Department of Transportation (WSDOT). Multiple colleagues in other departments and from within our respective agencies were also involved through the study process. We thank them for their engagement, time and expert review. We also thank the consultant team, organized and led by WSP, for their thorough work, technical expertise, professional judgement, partnership and high level of responsiveness to the Study Community's needs.

When we initiated the study in early 2019, we could never have imagined the world in which we would be releasing the final report: wracked by a global pandemic and related economic fallout as well as a local and national movement to reevaluate policing, injustice and inequity that have negatively affected Black, Indigenous, and people of color for too long.

While the chapters that follow summarize the many more pages of technical and financial analyses completed for this study, we thought it would help our colleagues and community if we provided our own condensed summary of what we learned as a result of this work, and what it may mean going forward:

This is a very preliminary study. The study helps us understand what's technically possible, key barriers and considerations for any future lid project, and the impact of alternative development programs (and different levels of "community benefit") on cost and financial performance over time. It provides a wealth of valuable data and analysis to inform potential next steps, but does not recommend a development program or take a position on whether this is an idea worth pursuing.

Lidding in this area is possible, but would be challenging. Lidding over I-5 in downtown Seattle, and highways in general, is not new. It's been done before, including in three previous projects within and adjacent to the study area. But this stretch of highway—including its topography, alignment, frequent on- and off-ramps and urban context—is particularly challenging even as it presents intriguing and meaningful potential benefits.

The more the lid has to hold up, the more expensive it is to build. The cost of the underlying lid structure is higher if you need it to support buildings and other structures. But even the simplest lid structure—to hold up green space—could be complicated and expensive. The (very preliminary) projected costs for developing a lid project from Madison Street to Denny Way range from about $966 million for the lowest cost "park lid" to about $2.5 billion for a lid that can support a development program that maximizes vertical development and private investment. Those costs do not include several factors that would need to be determined through future studies.

On- and off-ramps are particularly challenging. Working around existing on- and off-ramps adds to complexity and cost, and results in lid outcomes that are less than ideal (bordering on undesirable in some locations). But relocating, removing or reconfiguring ramps is not a simple proposition and has other implications—both good and bad. Although the frequency of highway interchanges in the study area is greater than highway design standards recommend, eliminating even a single ramp presents significant challenges. Any future lid project would need to analyze and address the long-term needs and operations of I-5 and the adjacent downtown street network. That work was beyond the scope of this project, but the results of this analysis can help inform future work and problem solving.

Vehicle parking and slope issues would require creative solutions. Any lid project would need to consider strategies to significantly reduce or nearly eliminate the need for parking options on the lid. Providing parking for buildings on a lid in a manner consistent with current standards and practices would make the project infeasible. Also, the area's considerable slope would be a challenge—but vertical development (buildings or pavilions) could mitigate this challenge while also contributing to activating open space areas.

This would be a large and expensive undertaking, requiring a variety of funding and financing sources. Financial analysis of the test cases demonstrates that while private development on the lid could help defray costs, it wouldn't cover them. It would likely require some combination of municipal, county, regional, state and federal funding, as well as philanthropic or private-sector contributions to make a lid project a reality. For the current analysis, we assumed that 100 percent of capital costs would be financed (i.e., no initial federal, state or local funding), resulting in annual debt servicing of anywhere from about $50 million to $130+ million.

How you do it will depend on what you're doing. There are different approaches to the design, financing, construction, maintenance and management of a lid project. The delivery, ownership and governance model that makes the most sense would be determined in part by what is being built and how it is being paid for. The report evaluates options based on the three test cases that were examined.

This area of the city has significant needs beyond re-linking neighborhoods and mitigating the environmental impacts of I-5. This is one of the densest parts of our city and region, and a critical part of our economy. It has seen significant growth in population, jobs and visitors in recent years but without a commensurate increase in open space and other amenities needed to support a healthy and vibrant urban neighborhood. There are many lower-income households that face the risk of displacement whether or not a lid project is implemented. To ensure equitable development and prevent housing displacement adjacent to a new freeway lid, additional strategies above and beyond the Mandatory Housing Affordability requirements would be needed. Future project evaluation would require a thorough racial equity analysis.

Significant benefits could flow from this investment. Projects of this scope and scale could create significant social and economic benefits. The test cases we examined would create from 621,000 to 4.7 million square feet of new housing; nearly 2 million to 5 million square feet of commercial and hotel space; and between 2.5 and 9.8 acres of new park space. A lid project could tentatively support 5,000 to 13,000 direct, indirect, and induced jobs over 10 years from construction alone and revitalize the economy with up to $3.1 billion in annual economic activity.

I-5 in this area requires attention and investment regardless; lidding could be part of a larger effort to address long-term resilience of this critical transportation spine. I-5 was built in the 1960s, with a designed lifespan of 75 years. While WSDOT has been investing in this stretch of I-5 and its many supports, bridges and retaining walls, getting it up to current seismic standards would demand significant commitment and investment. Collaborative analysis and planning between the City of Seattle and WSDOT would be needed to determine the best course of action for this critical infrastructure. This needs to happen regardless of any lid effort, but important next steps in exploring a lid could be incorporated in that work.

While we analyzed the full stretch of this study area as a single lid project, it could be approached differently. We looked at test cases, costs and other factors across the length of the study area, from Denny Way to Madison Street. Where possible, though, we reported cost data on an area-level basis (i.e., Madison Street to Freeway Park; Freeway Park/Convention Center; Pike/Pine; and Olive Way/Denny Way) and know that the cost, complexity and benefits of a lid vary across the study area. That information can inform next steps that might explore a more focused lid effort in one or two segments, or a "mix and match" analysis that focuses on park area in some segments and more building-focused programs in others.

This would require significant and ongoing partnership. A visionary undertaking of this scope and scale would be achieved only through strong and sustained partnership. The community-led Lid I-5 Committee has been effective in advancing this concept and securing the funds for this study. They would undoubtedly remain active in advocating for next steps. The City of Seattle, WSDOT, other agencies and elected leaders would need to decide the shape, focus and level of commitment to any next steps, incorporating a broader community engagement strategy. This study helps to inform, but does not determine, what those next steps could or should be.

The long-term economic and social impacts of the COVID-19 pandemic will be real, but how they might affect this, or other long-term planning and investment remains unclear. The COVID-19 pandemic hit Seattle and the rest of the world just as the final phases of this analysis were being completed. While it doesn't change the purpose or results of the analysis, it creates uncertainty about how to interpret or apply them. The community is facing severe impacts from the crisis that require attention and investment. Spending $1+ billion to build a lid over I -5 seems misaligned with other imminent priorities. However, as we phase into recovery, we also embrace the opportunity to re-engage our civic imagination about the future city we seek to create: one that is healthy, equitable, vibrant and resilient. Seattle's past, present and future have been shaped by bold ideas and big investments that have often emerged from the hardest times.

This is a first step. We approached this study with the idea that its results would need to have a long shelf-life, understanding that these types of infrastructure projects take multiple decades to conceptualize, analyze, design and complete. The recent closure of the West Seattle Bridge highlights the long-term nature of this effort. Improving the resiliency of this critical transportation infrastructure is a priority for the City of Seattle and would require significant investment that exacerbates near-term funding challenges for a lid. We hope the analysis and its results will serve the City of Seattle and its partners well, now and in the coming years, as we move from crisis into recovery, reconnection and resilience.

— Core Technical Advisory Team

PART I.
Feasibility Study
Background and Framework

Aerial view of study site; north-facing view of I-5 from Madison Street overpass.

1. Introduction

The Interstate 5 (I-5) Lid Feasibility Study (LFS) identifies key considerations to inform future planning and decision-making regarding the concept to lid I-5 through downtown Seattle, Washington. The study was designed to understand the technical and financial feasibilities of lidding the freeway and to look at opportunities for maximizing public benefits. The study site runs along a 0.8-mile sunken portion of I-5 from Madison Street (south end) to Denny Way (north end) (Figure 1-1). The technical aspect of the I-5 LFS identifies locations of the study site where the freeway could be spanned to support development that would range from open space to high-rise structures. Three theoretical development test cases were assessed to explore the range of costs, benefits and outcomes of various levels of development intensity, and a mix of public and/or private uses. The economic and financial assessment analyzes feasibility related to the benefits of lidding with considerations on the real estate market, operations and maintenance costs, construction and phasing, funding and financing options, as well as various governance models.

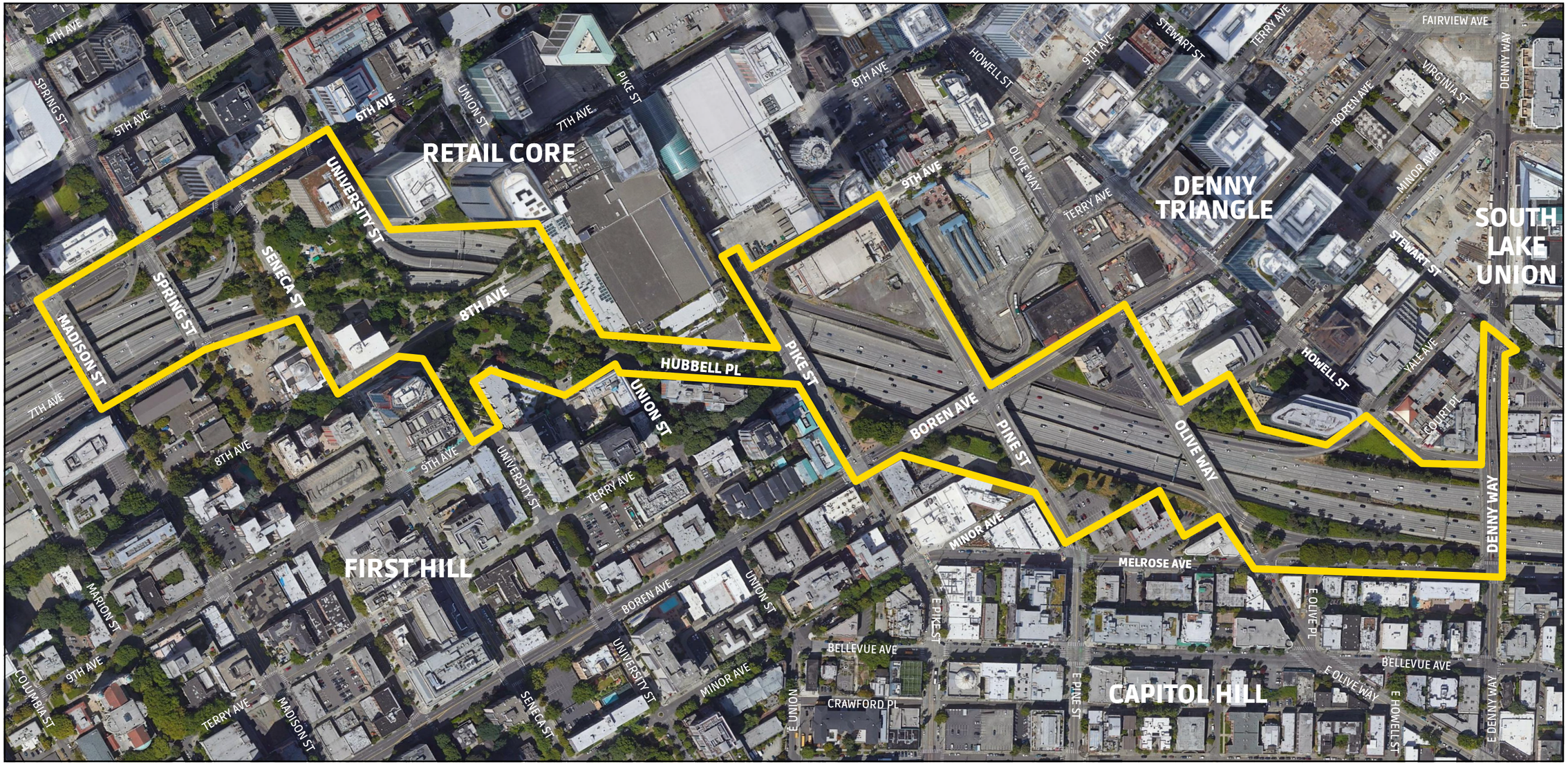
The I-5 LFS is preliminary and pre-dates any planning, program definition, broader public engagement, and design. The scope of this study did not include developing alternatives analysis; therefore, the study does not present any recommendations or preferred alternatives. The study provides the City of Seattle, partner agencies, and project stakeholders with credible technical information and resources to assess the technical and financial feasibility of the lid concept and to serve as a tool set that can be used to inform future phases of work. The I-5 LFS is an important milestone in exploring the long-range vision and priorities to shape downtown Seattle's future, as well as to inform how to plan and approach the preservation and upgrade of critical transportation infrastructure in the Puget Sound region and beyond.

2. Background

The City of Seattle commissioned the I-5 LFS in February 2019 as part of the "community benefit agreement" related to the expansion of the Washington State Convention Center (WSCC). The Seattle City Council approved the funds for the I-5 LFS as part of the benefit agreement to explore the feasibility of building a new lid or lids across I-5, expanding from the existing lids of Freeway Park and the WSCC. These funds were secured largely through the efforts of community members who have been exploring and advancing the proposal to lid (i.e., overbuild, deck or cap) I-5 through downtown Seattle, Washington. Seattle's Office of Planning and Community Development served as project manager and convener, with active participation throughout the process from key departmental partners (Seattle Department of Transportation, Seattle Parks and Recreation, Seattle Office of Housing and Seattle Department of Neighborhoods) as well as the asset owner, the Washington State Department of Transportation (WSDOT).

The study was designed to understand the technical and financial feasibility of lidding the freeway and to look at opportunities for maximizing public benefits.

Figure 1-1. Study Site



Legend

Structural Assessment Boundary (Study Site)

0 300 600 Feet

3. The Opportunity

Seattle has seen tremendous change over the last decade. Much of that change has come in the form of population, economic and job growth. But that growth, especially downtown, has outpaced the provision of housing, schools, transportation, parks and other public necessities to support thriving, equitable and resilient communities. Moreover, I-5 is a critical facility, but its construction has had lasting impacts on the communities directly adjoining its footprint. Investments to improve the resiliency of I-5 would open the opportunity to reconnect downtown neighborhoods that were divided when I-5 was built.

The I-5 LFS is a critical first step in a long-term exploration of whether creating new "land" via a lid over I-5 can help Seattle address some of its most pressing needs both current and future, known and unknown. Beginning this exploration now allows Seattle to capture the momentum from and align with several unique opportunities:

- $1.5 million in funding from the Washington State Convention Center Addition community benefit package.
- WSDOT's proposed I-5 System Master Plan to study strategic, comprehensive investments to improve 107 miles of I-5 from Tumwater to Marysville.
- The Imagine Greater Downtown partnership's vision, Seattle 2035 Comprehensive Plan and proposed Strategic Mobility Plan for the downtown street network, including potential reconfiguration of I-5 access points to reduce congestion, support transit operations and achieve long-term community goals.
- City of Seattle and King County efforts to improve regional housing affordability, through the Housing Affordability and Livability Agenda, Mayor Durkan's Affordable Middle Income Housing Advisory Committee, and the Regional Affordable Housing Task Force Five Year Action Plan.
- The need to address economic, public health and critical I-5 infrastructure resilience highlighted by the global impacts of the recent COVID-19 pandemic.

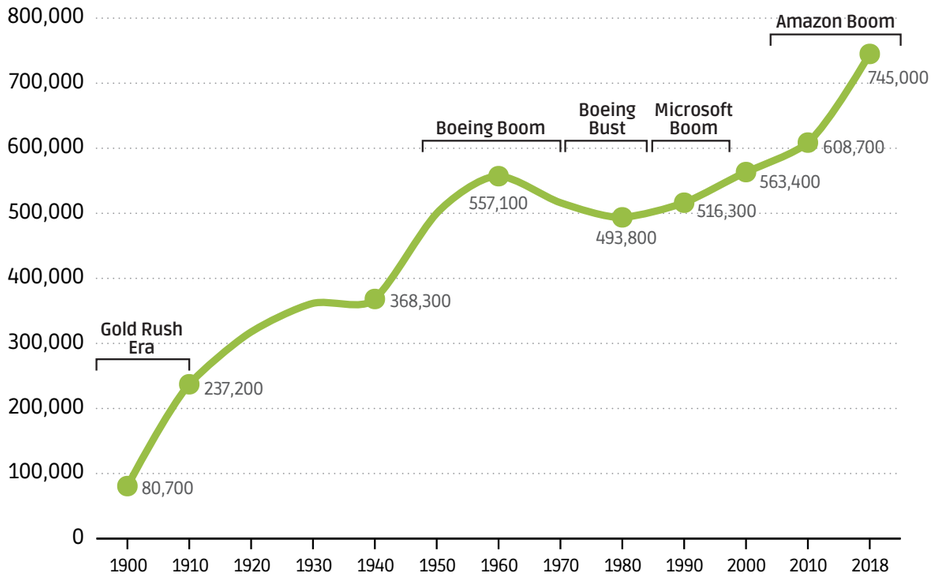
3.1 Challenges Turned into Opportunities

Seattle and the region have experienced rapid growth at a rate seen only during the Gold Rush, but this growth has not paralleled the provision of public amenities, particularly in downtown Seattle.

- Between 2010 and 2019, Seattle added over 138,000 residents, a 23 percent increase (United States Census Bureau, 2020), and an estimated 374,000 jobs for the metropolitan statistical area (Washington State Employment Security Department (ESD) , 2020). Over the same period, 59,000 housing units were added, a 19 percent increase (Washington State Office of Financial Management (OFM), 2020), with more than 21,500 units permitted and not yet built as of May 2020 (City of Seattle, 2020).
- Downtown Seattle and the urban neighborhoods surrounding the proposed lid were targeted for growth in housing and employment by regional and City of Seattle growth management policies, and that growth has arrived.
- The neighborhoods surrounding the study site are recognized as areas with the highest access to opportunity in terms of employment, transit, and services, and development regulations were crafted to encourage density in areas of high opportunity. These policies have worked: Downtown and First Hill/Capitol Hill took 40 percent of Seattle's recent new job growth and 29 percent of the population growth (City of Seattle Office of Planning and Community Development (OPCD), 2019b). However, this has been accompanied by increased and heightened risk of displacement, confirmed through a City of Seattle study in 2016[1] (City of Seattle Office of Planning & Community Development (OPCD), 2016), with modeled analysis updated through this study.
- The growth in density has not been accompanied by a concurrent increase in needed amenities such as parks, community spaces, affordable housing and schools, though these are goals aligned with several initiatives and planning instruments for the City of Seattle.

1 Refer to the I-5 LFS Economic and Financial Feasibility Memorandum.

Figure 3-1. City of Seattle Population, 1900–2018

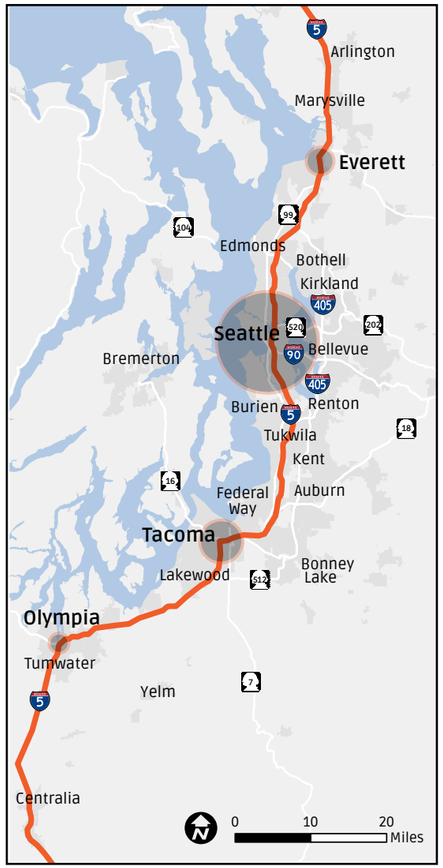


Source: Data Courtesy of U.S. Census Bureau; adapted from (Balk, Seattle's population boom approaching Gold Rush numbers, 2015)

Interstate 5 is a piece of critical infrastructure that faces huge preservation needs; while a strategic transportation corridor, it acts as an east-west barrier disconnecting and imposing environmental burden to surrounding communities.

- I-5 is the backbone of Washington state's transportation system and one of the state's most important transportation assets. I-5 is an economic lifeline for the region, yet is seismically vulnerable and in need of billions of dollars of investment and repair, including its downtown segment (Figure 3-2).
- This transportation spine is critical to daily life and—given that it is close to surpassing its design life—is susceptible to failure in the event of a major earthquake.
- I-5 is an environmental liability, with significant noise, air pollution, and visual impacts to thousands of people who live and work nearby and walk across it every day.
- A lid over I-5 could mitigate impacts that have affected the adjacent neighborhoods for over half a century, before I-5 gets rebuilt at the end of its design life. Neighborhoods and key urban centers could be reconnected—and continue the legacy of the first lids over I-5—and create new "land" in Seattle's most dense, opportunity-rich neighborhoods that could be made available for open space, affordable housing, and educational and community facilities.
- Seattle's 2035 Comprehensive Plan and Imagine Greater Downtown have set a vision to reconnect the downtown across I-5, articulating several policy outcomes to create a sustainable, equitable and livable Seattle for 2035.
- The WSDOT and City of Seattle, in partnership with private industry and community groups, have joined in a commitment to the efficient operations and long-term resilience of the I-5 system (see: USDOT BUILD Grant application) (WSDOT and City of Seattle, 2019). Taking steps to work toward a comprehensive I-5 System Master Plan sets the stage for the best, lasting solutions and coordinated action, including potential changes to the downtown Seattle street grid where it intersects with the I-5 system.

Figure 3-2. The Future of the I-5 System



Source: (WSDOT, 2019)

I-5 faces huge maintenance needs and traditional funding sources have been outpaced.

$2.5 billion needed for preservation through 2040.

$700 million to preserve 430 bridges through 2040.

$1.3 billion needed to repair pavement through 2040.

$550 million needed for seismic retrofits through Seattle.

I-5 System Partnership: A CALL TO ACTION

Legend

I-5 Regional Access | Cities | Major Cities on I-5

3.2 The Value Proposition

The I-5 lid could transform daily life in Seattle and help future generations thrive. Creating new "land" in the heart of downtown Seattle would open opportunities for equitable access to economic prosperity and jobs, parks and open space to support physical and mental wellbeing, affordable housing, and healthy, resilient communities. A lid can be a catalyst to repair communities that have been displaced and disconnected by I-5 while supporting regional movement of people and goods.

I-5 Lid Feasibility Study Guiding Principles

To keep the exploration of a lid aligned with the values and policy goals articulated in the Seattle 2035 Comprehensive Plan, Imagine Greater Downtown's vision and the City of Seattle's existing policy framework at the center of the study, guiding principles were created in partnership with the I-5 Lid Feasibility Study Committee. The guiding principles helped define opportunities and a vision for the kind of community Seattle aspires to be. Those principles and the values they represent include the following:

- Equity
- Health
- Affordability
- Sustainability and Resilience
- Connectivity
- Complete Community
- Identity

A description of the LFS Guiding Principles is available in the I-5 LFS Existing Conditions and Context Memorandum.

Equity: The lid could provide affordable space to marginalized communities in an area with the highest access to opportunities.

Equity is a major priority for Seattle, and with escalating rents, displacement is pushing out the most vulnerable people and businesses from urban neighborhoods. The lid could create physical space and catalyze investment in communities that have been disenfranchised to improve outcomes for populations that have been hardest hit by historical disinvestment, displacement and gentrification.

Health: The lid could create a healthier environment in the heart of the city.

A walkable urban core with reduced exposure to noise and pollution from I-5 would have positive health outcomes for people in downtown neighborhoods. A lid would contribute to a built environment that reduces stress conditions, promotes active transportation, and fosters social cohesion and mental health.

Affordability: The lid could accommodate affordable housing and affordable space for the uses that promote shared prosperity.

It is increasingly difficult for people to pay rent and to keep small businesses and cultural spaces possible. The lid could create access to affordable housing, small business opportunities and services, while encouraging cultural and economic diversity to create a vibrant street level.

Sustainability and Resilience: The lid could reduce ecological footprint of the freeway and improve seismic and community resilience.

A lid over I-5 could addresses the ecological footprint of the freeway and built environment, reduce the heat island effect downtown, promote healthy ecosystems, and increase the capacity of communities to survive, adapt, and grow in the face of chronic or acute stresses, including seismic and public-health risk events.

Connectivity: The lid could improve and re-establish pedestrian and bicycle connections.

The lid could improve the pedestrian network and experience, addressing the existing limited access, unsafe, unpleasant, noisy and polluted conditions. The lid could also reconnect the original street grid severed by I-5 and open up shorter, more pleasant and accessible ways to walk and cycle between First Hill/Capitol Hill and Denny Triangle/South Lake Union.

Complete Community: The lid is possibly the only way to provide space in a key location for needed amenities that include parks and open space, affordable housing, and commercial and civic spaces.

Land and space in the urban core are finite and in high demand. The lid could help respond to deficits in the surroundings for a desired large, flat open space in the heart of the city, as well as needed space to accommodate a variety of civic and public uses.

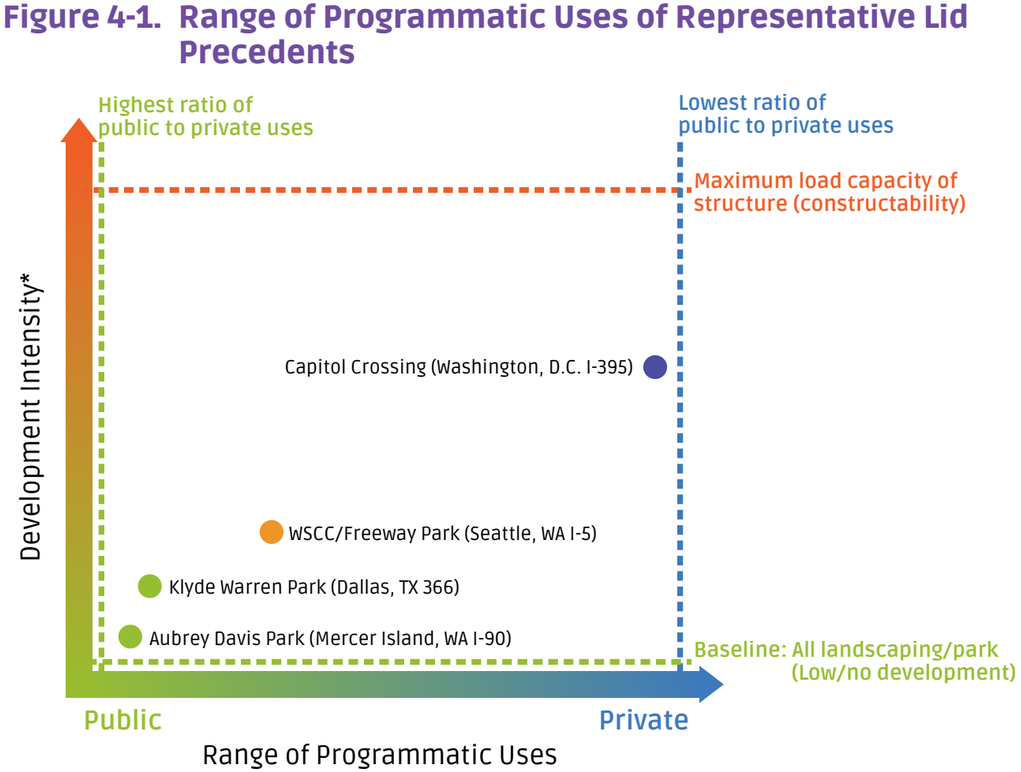
Identity: By covering the trenched freeway in its urban center, the City of Seattle could build on its Freeway Park legacy and its reputation in innovation and visionary thinking.

A lid is an opportunity to create a space that fosters a strong sense of place-based identity by creating memorable spaces that support daily life, community and culture. Freeway Park was the country's first lid over an urban highway and is now considered a historically significant asset. Now, over 40 years later, Seattle's identity as the "Emerald City" could be strengthened by expanding the idea of reconnection and regreening, redefining the approach to adaptive infrastructure.

4. National and Regional Precedents of Lids

Building lids over sunken urban freeways to reconnect communities and explore opportunities to address urban challenges has become a national trend, with several dozen completed projects, and another dozen proposed or in the planning and design stages (Figure 4-4). This idea is not new to Seattle, with examples such as the Freeway Park lid built in 1976 and the WSCC lid built in 1985 over I-5 in downtown Seattle, Mercer Island's Aubrey Davis Park over I-90 constructed in 1992 (Figure 4-3), and the recent SR 520's Montlake lid under construction (2019) in Seattle. The Seattle Municipal Tower, originally built as a commercial office tower, can also be regarded as a precedent of spanning over I-5, atop the express lane and on- and off-ramps.

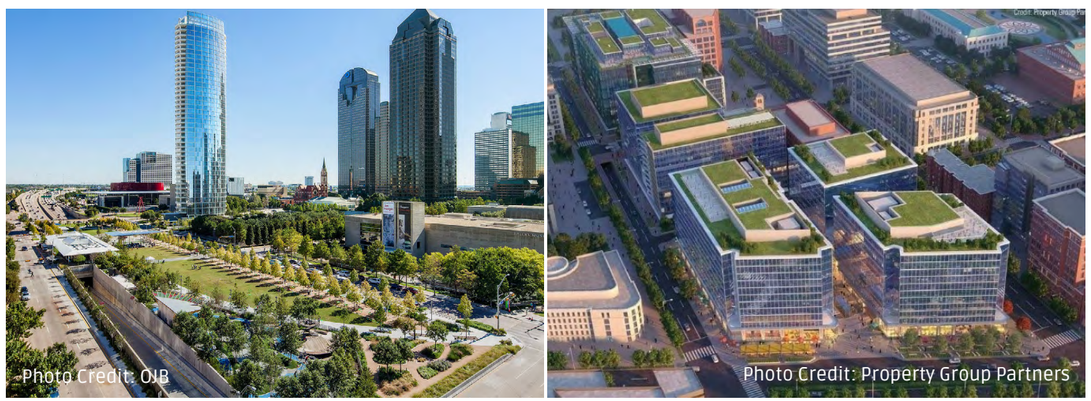
Figure 4-1. Range of Programmatic Uses of Representative Lid Precedents



*Development intensity related to square feet of development, stories, or Floor Area Ratio.

Although an overwhelming majority of freeway lid projects have created a wide array of parks, lids can also accommodate public, private and civic uses, including convention centers, government offices, housing, and commercial spaces (Figure 4-1). Though projects differ in size, vision, structural complexity, governance models, and project-delivery methods, the range of feasibility has been explored and showcased in various lid precedents across the country (Figure 4-2). Klyde Warren Park in Dallas, Texas, is a successful 5-acre public park lid over Woodall Rodgers Freeway (TX 366) constructed in 2009, with a mix of public (52 percent) and private (48 percent) funding. At the other end of the spectrum lies Capitol Crossing, a 6.5-acre privately funded (100 percent) lid that accommodates five new mixed-use buildings totaling over 2.2 million square feet of development atop I-395 in Washington, D.C.

Figure 4-2. Klyde Warren Park and Capitol Crossing as Representative Lid Precedents

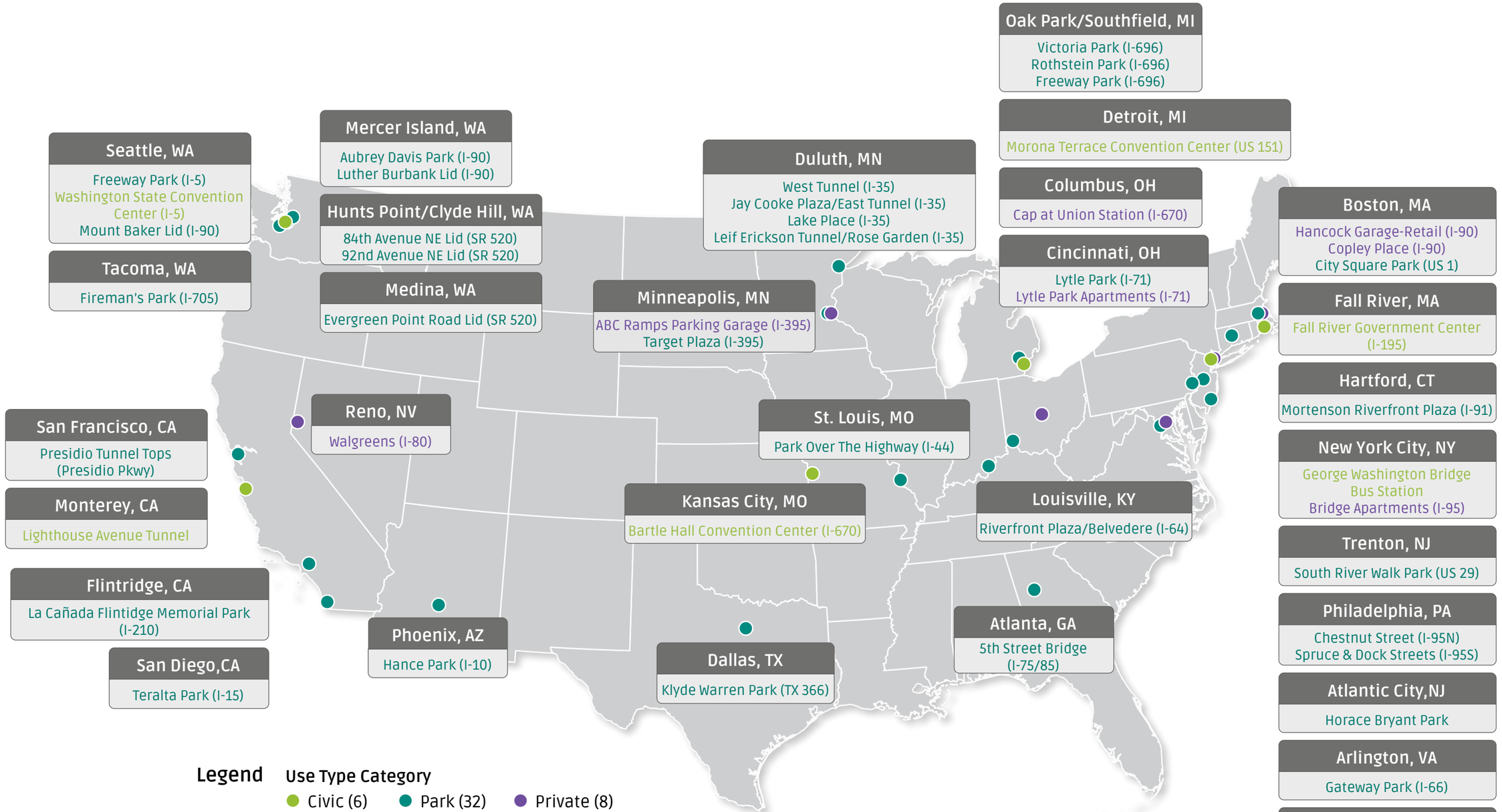


Klyde Warren Park (left) (OBJ, 2020) and Capitol Crossing (right) (Federal Highway Administration (FHWA), 2020b)

Figure 4-3. Aubrey Davis "Lid Park" on I-90 (Mercer Island, WA)

Photo Credit: Scott Bonjukian
(LID I-5 Steering Committee, 2019)

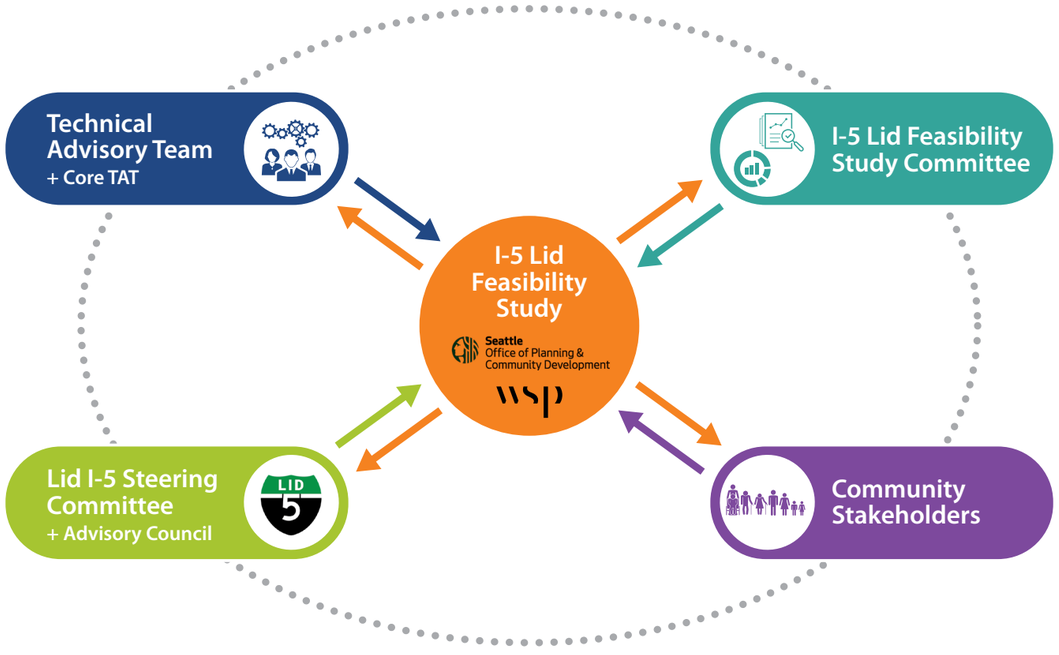
Figure 4-4. United States Freeway Lid Inventory (2019)



5. The Study Community

To support development of the I-5 LFS, the Seattle Office of Planning and Community Development (OPCD) and the consultant team engaged a network of community and agency partners, collectively creating the Study Community (Figure 5-1 and Figure 5-2). This network of partners included the Technical Advisory Team, I-5 Lid Feasibility Study Committee, Lid I-5 Steering Committee, and community stakeholders engaged through the Seattle Department of Neighborhoods.

Figure 5-1. Study Community and Coordination



Technical Advisory Teams

At the beginning of the feasibility study, OPCD formed a Technical Advisory Team (TAT) with members representing the WSDOT and several City of Seattle departments including transportation, housing, parks, neighborhoods, arts, utilities, economic development, and emergency services. The TAT met at key milestones throughout the study process to be kept apprised of study progress, share data and consult on key issues relevant to their expertise. The Core Technical Advisory Team, a subgroup of the larger TAT, met more frequently and played an important role in developing the feasibility study by sharing knowledge, expertise and information; building an understanding of relevant policy goals and priorities; identifying long-term opportunities and constraints related to the study area; and collaboratively testing ideas. The Core Technical Advisory Team included representatives from WSDOT, the City of Seattle's Department of Transportation, Department of Neighborhoods, Parks and Recreation, and Office of Housing. OPCD participated in both groups and played a lead role in communicating with the Mayor's Office to provide study updates and seek direction and guidance.

I-5 Lid Feasibility Study Committee

The OPCD formed the I-5 Lid Feasibility Study Committee early in the feasibility study process to provide guidance, expertise and advice to support development of the I-5 LFS. The committee met five times between March and December 2019. Its critical role was to help keep community stakeholders informed; bring forward community knowledge, expertise and information; foster an understanding of community goals and priorities related to the study area; and test and provide feedback on ideas. The committee comprised 16 community members representing more than a dozen organizations. A full list of members can be found in the acknowledgment section of this report.

Community Stakeholders

In support of the I-5 LFS the Seattle Department of Neighborhoods (DON) engaged in an outreach process to better understand community interest in the concept of lidding I-5 in downtown Seattle. DON's outreach to communities was guided by three key goals:

» Work with underrepresented community members to inform them of the feasibility study.

» Hear and document community members' visions, ideas and concerns for a lid over I-5.

» Give community members ways to keep informed and updated on the process.

With a focus on engaging people in underrepresented communities, DON conducted a five-month outreach process that included three focus groups with community liaisons representing immigrant communities, Blacks, Indigenous and People of Color, unhoused communities, people with disabilities; with representatives from the City of Seattle's Women's Commission, LGBTQ Commission, Commission for People with disAbilities, Human Rights Commission, and Immigrant and Refugee Commission; and with the Downtown Emergency Service Center. DON also met with residents of Horizon House and Olive Tower, the Equitable Development Initiative Advisory Board and the Central Area Collaborative. All in-person outreach was supported by an online survey available in Cantonese, Mandarin, Spanish, Somali, Vietnamese and English. Summaries of DON's outreach can be found in OPCD's I-5 Lid Feasibility Study Website.

The study consultant team and OPCD also hosted and participated in conversations and events with community stakeholders during the study. Activities included the following:

» Participation in a study area walking tour hosted by the Lid I-5 Steering Committee.

» Participation in events and panel discussions hosted by the Downtown Seattle Association.

» Briefings and learning sessions with the WSDOT, Lid I-5 Advisory Council, WSCC, Freeway Park Association, Seattle Office of Economic Development, Seattle School District and Seattle Housing Authority to understand each stakeholder's near- and long-term needs, policy goals and aspirations for a potential lid.

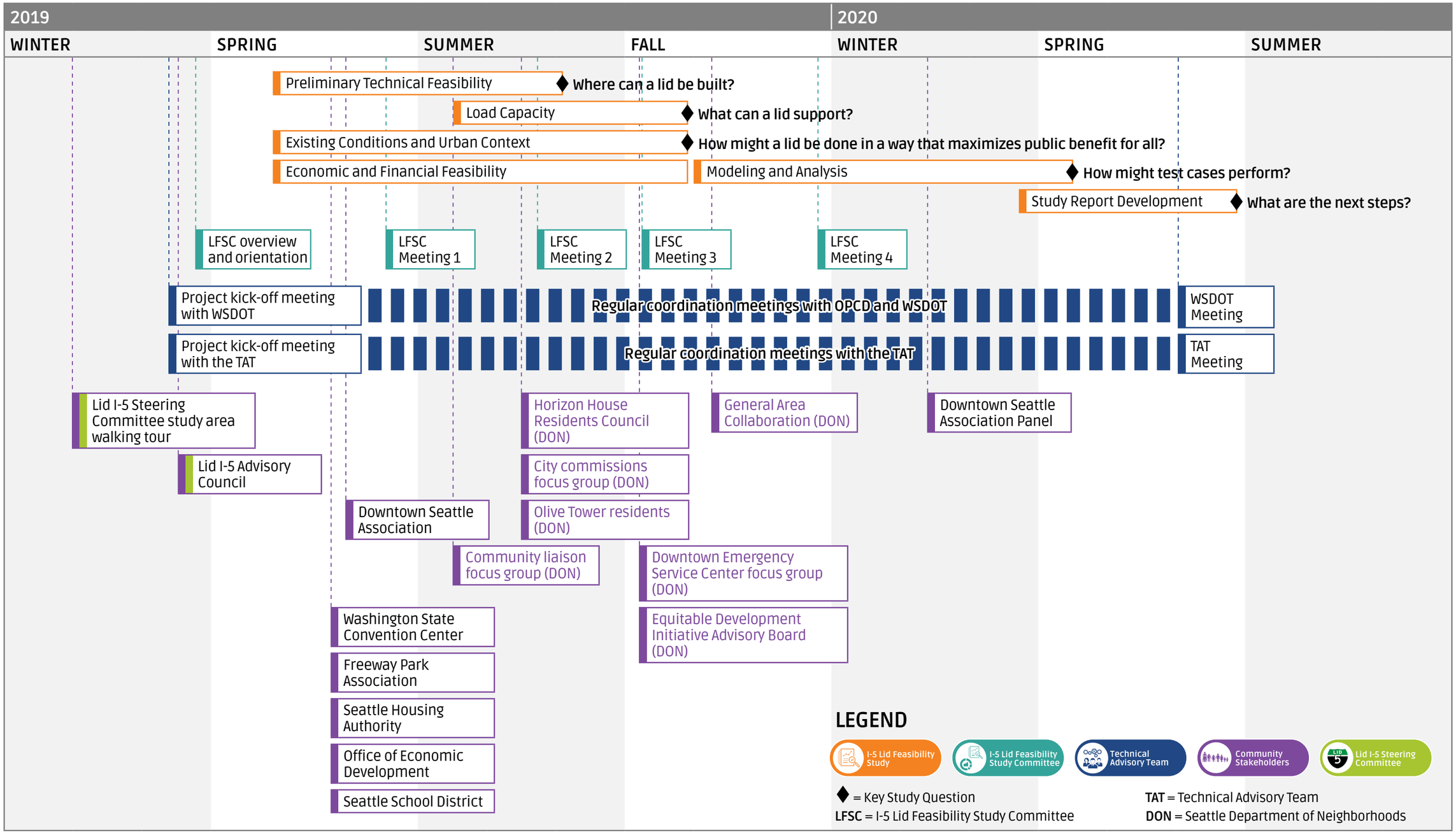
Lid I-5 Steering Committee

The Lid I-5 Steering Committee is a community organization made up of residents and volunteers advancing the concept of lidding I-5 for parks, schools, affordable housing and other public uses. In October 2018, the Lid I-5 Steering Committee helped secure $1.5 million to fund the feasibility study as part of the Washington State Convention Center Addition community benefit agreement. During the course of the I-5 LFS the Lid I-5 Steering Committee partnered with OPCD and the consultant team to share information about the study with stakeholders through briefings, community events and panel discussions.

Photo Credit: John Feit (LID I-5 Steering Committee, 2019)

Photo Credit: WSP

Figure 5-2. Study Community Timeline



6. Study Overview

The I-5 LFS identifies key engineering, economic, urban design and public policy considerations—integrated into a single systematic assessment—to inform future decision-making regarding the concept of lidding I-5 through downtown Seattle.

The I-5 LFS has two overarching goals:

1. Explore the range of feasibility, both technically and financially.
2. Develop a framework to maximize benefits for all.

Following the analysis to understand the technical feasibility of lidding I-5, three test cases were developed to explore not only urban design considerations, but also primarily the financial and economic feasibility of different hypothetical development programs on the lid. Although complex constraints narrow the range of options, the three test cases presented in this study are by no means the only potential scenarios. It is important to note that the study did not perform a detailed alternatives analysis or a broad-based public outreach and engagement process, so a preferred alternative was not identified as part of the scope of work. All test cases were guided by key assumptions and parameters established by the City of Seattle and informed by the Study Community through an iterative process. The objective was to test the creation of a lid that could integrate with the surrounding urban context and generate a range of public and economic benefits for Seattle, while preserving operations and capacity of one of the region's most critical transportation corridors—I-5. The analysis and resulting assessment provide a resource to inform future planning and decision-making.

Several factors that are in flux influence the feasibility of lidding I-5. The expectation of an I-5 System Master Plan, along with other regional and local planning efforts and updates, requires consideration of a potential lid over I-5 to preserve project feasibility. This study's findings can aid the initial coordination necessary between multiple, related entities for a future lid over I-5 through downtown Seattle.

6.1 Defining Feasibility

A goal of this study was to identify a set of criteria to frame feasible development of a lid from the perspectives of engineering, economics, and urban design. For the purposes of this study, feasibility was defined as follows:

» **Engineering — Constructability over I-5 and structural considerations:** a conceptual structural system for lids capable of supporting various load levels of development above a complex, active freeway, that do not reduce capacity on I-5 and minimize the impact on freeway operations.

» **Economics — Market demand and real estate development parameters:** economic and financial performance of a lid that creates value from various approaches to public and private development, as well as maintenance of the lid assets. Consideration of the balance of lid development strategies that minimize costs, and maximize economic and public benefits for surrounding downtown neighborhoods, the City of Seattle and the greater state and regional economy.

» **Urban Design — Place-based considerations of surrounding communities:** a framework that complements the existing adjacent neighborhoods, creates important connections and allows a range of uses from open space to mixed-use development. Development is compatible with the urban context and advances policy goals, as defined by the study's Guiding Principles and Value Proposition.

It is important to note that the I-5 lid, if implemented, would be the largest and most complex lid project in the Pacific Northwest, in terms of scale, site complexity (topography, the surrounding dense urban setting, and freeway operations), and the ambitious mix of public and private uses explored in this study. For the purpose of this study, feasibility is agnostic of any sociopolitical valuations. Such definitions would require further detailed study beyond the level performed as part of this exercise.

6.2 Study Approach

The I-5 LFS was designed to answer the following questions, through an iterative engineering, urban, and economic analysis, informed by input from the Study Community:

» Where can a lid be built and what can it support?

» How might a lid be done in a way that maximizes public benefit for all?

» How might test cases perform?

» What are the next steps and future considerations?

To answer these questions, the study followed an approach using three key steps.

The first key step explored the range of engineering feasibility to determine the constructability and cost estimates of the lid, block by block. This key step answered the question "where can a lid be built and what can it support?" and surfaced key considerations to factor in program constructability, phasing and rough-order-of-magnitude cost ranges.

» A technical evaluation was performed within the Structural Assessment Boundary (i.e., the study site, Figure 1-1) in order to determine build zones, lid geometric layouts and area, site constraints, and structural assessment and requirements.

- This evaluation was performed with consideration of the lid's load capacity per subsection for four load levels of development (open space, low-rise, mid-rise, high-rise).

» Technical design decisions were based on engineering judgement supported by limited analysis and asset-owner (WSDOT) constraints and requirements.

» The analysis was comprehensive of preliminary technical interdisciplinary considerations for any large-scale infrastructure project, including utility impacts, life safety requirements, staging and phasing, roadway civil engineering considerations, geotechnical and environmental studies.

The second key step established the foundation for scenario planning and the exploration of the lid as a neighborhood extension. This key step laid the groundwork to answer the question "how might a lid be done in a way that maximizes public benefit for all?" and surfaced key considerations relative to the development capacity, value creation potential, and urban character of the lid.

» This analysis integrates the technical findings with a comprehensive urban context analysis at different scales, urban design considerations, and a real-estate market scan to understand the potential for value creation.

» Characterization of existing conditions and urban context analysis of the study area and site were developed, along with a review of regional and City of Seattle policies and plans. The review of policies and plans was done in order to understand how a lid could contribute to goals at neighborhood, citywide and regional planning levels.

» Three test cases were established by the City of Seattle and informed by the Study Community, to characterize and test a range of the lid's development intensity, urban form, mix of public to private uses, and policy assumptions.

- None of the test cases represent an actual or recommended site design or development proposal and are intended to examine only the range of feasibility.
- Test cases explore the urban character of this neighborhood extension and provide the foundation to assess policy outcomes of the hypothetical development programs.

» As part of the test case development, building typologies and siting were assessed relative to load capacity, access (pedestrian and vehicular), and parcel ownership. This analysis considered infrastructure impacts on ramps, overpasses, existing structures and their historic designation. This examination was performed to yield proof of concept of viable development scenarios.

- These development scenarios served as input to real estate pro formas[2], based on a real estate development market scan, to appraise revenue generation potential in the next key step.
- Removal of existing buildings or placement of new structures on private parcels was not considered as part of the analysis.

The third key step explored the range of economic opportunity and the financial feasibility of the identified lid test cases. This key step answered the question "how might test cases perform?" and surfaced key considerations relative to project delivery, policy assumptions, governance models, and funding and financing mechanisms for the lid concept.

» The capital and operating costs assumed in the analysis were developed through a combination of assessing the capital investment costs attributed to each of the test case options and input from various owners and operators of similar assets in downtown Seattle on the cost of building and maintaining assets in an urban environment.

- Initial lid structural bookends (maximum and minimum lid areas) were defined for both the most robust and the leanest lid projects (high-load lid maximizing lid area vs. low-load lid with lid area framed around existing ramps) to determine the magnitude of potential capital costs and to provide preliminary indications whether the lid could leverage value from a mix of public and private development, minimize costs, and generate economic and public benefits.

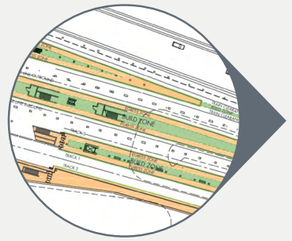
2 A pro forma is a Latin term that means "for the sake of form" or "as a matter of form", refers in a financial analysis context to a method of calculating future financial results using certain projections and/or assumptions.

Figure 6-1. I-5 Lid Feasibility Study Approach

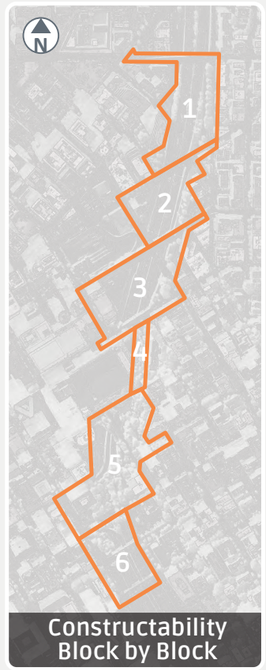
KEY STEP 1: Engineering Feasibility Assessment

WSDOT

Build Zone Assessment



- Asset-owner constraints
- Requirements
- Capital O&M cost assessment



Constructability Block by Block

KEY STEP 2: Scenario Planning

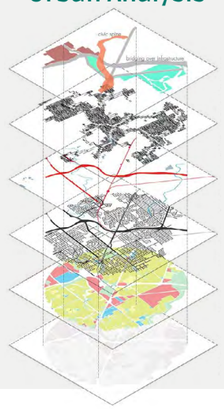
Community and Stakeholders

Needs & Wants

Partner Agencies

City of Seattle
WSDOT
SoundTransit
King County
Other state and local authorities

Layered Urban Analysis



Real Estate and Development Market Analysis

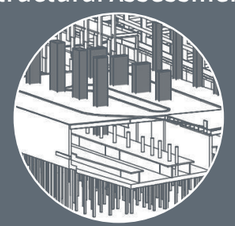
KEY STEP 3: Test Case Analysis

Financial Modeling

Test Case Analysis

	Test Case 1 All Ramps Remain	Test Case 2 All Ramps Remain	Test Case 2 Removal of Olive Way Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
ANNUAL REVENUE					
Vertical Development Revenue*	$0M	$19.8M	$25.5M	$3.7M	$3.3M
ANNUAL OPERATING CASH FLOW					
Lid Infrastructure O&M	($2.9M)	($2.9M)	($2.4M)	($2.9M)	($2.4M)
Lid Infrastructure R&R	($1.3M)	($3.0M)	($3.3M)	($2.0M)	($2.2M)
Public Park O&M	($0.07M)	($0.006M)	($0.006M)	($0.006M)	($0.006M)
ANNUAL NET OPERATING REVENUE (EXCLUDING DEBT)	**($4.2M)**	**$14.0M**	**$19.8M**	**($1.2M)**	**($1.4M)**
ANNUAL NET CASH FLOW					
Air Rights Lease Payment	(TBD)	(TBD)	(TBD)	(TBD)	(TBD)
Debt Service	($51M)	($121M)	($132M)	($79M)	($89M)
TOTAL ANNUAL FUNDING GAP	**($55M)**	**($107M)**	**($112M)**	**($80M)**	**($91M)**

Build Zone and Structural Assessment



+ Cost Range

Sample Feasibility Matrix

	Lid	Type	Cost	Use
1	✔	A–D	$$	1–4
2	✔	A, B	$	2–4
3		A	$	1, 2
4	✔	C, D	$$$	1–4
5	✔	B–D	$$	3, 4
6		B	$$	3
7	✔	A–D	$	1–4

Next Steps

Inclusive Communication and Engagement Process

Iterative Technical, Urban, Social and Economic Analysis

  - Through further refinement and the development of test cases through the second key step, the economic and financial performance of the project was analyzed for the full lid development along the study site based on phased construction of the four identified lid areas (Figure 6-2).
- The economic and fiscal impacts of the project were estimated for each of the test cases, derived from lid construction, real estate development on the lid, and the assumed ongoing infrastructure activity (i.e., maintenance).
- The revenue generation potential for each test case was determined by modeling the residual land value—or a developer's willingness to pay for "land"—expressed as annual private-sector contributions for the rights to develop over I-5.
- Net cash flow calculations—including ongoing operating costs and potential debt service for financing the capital improvements—estimate the projected financial gap between revenue generation from development on the lid, and the lid's capital and operational costs. An air rights lease payment to the State Motor Vehicle Fund, which would be paid annually for use of the lid, was not estimated as part of this analysis nor were other potential sources of funding beyond the private-sector contribution described above.
- The analysis also tested the sensitivity to several variables, including capital cost contingency and risk ranges, interest rates affecting the cost of capital, ramp removal, development capacity, and policy assumptions around affordable housing, civic space and parking provision.
- Preliminary considerations for potential governance models for each of the test cases and funding and financing alternatives were developed.

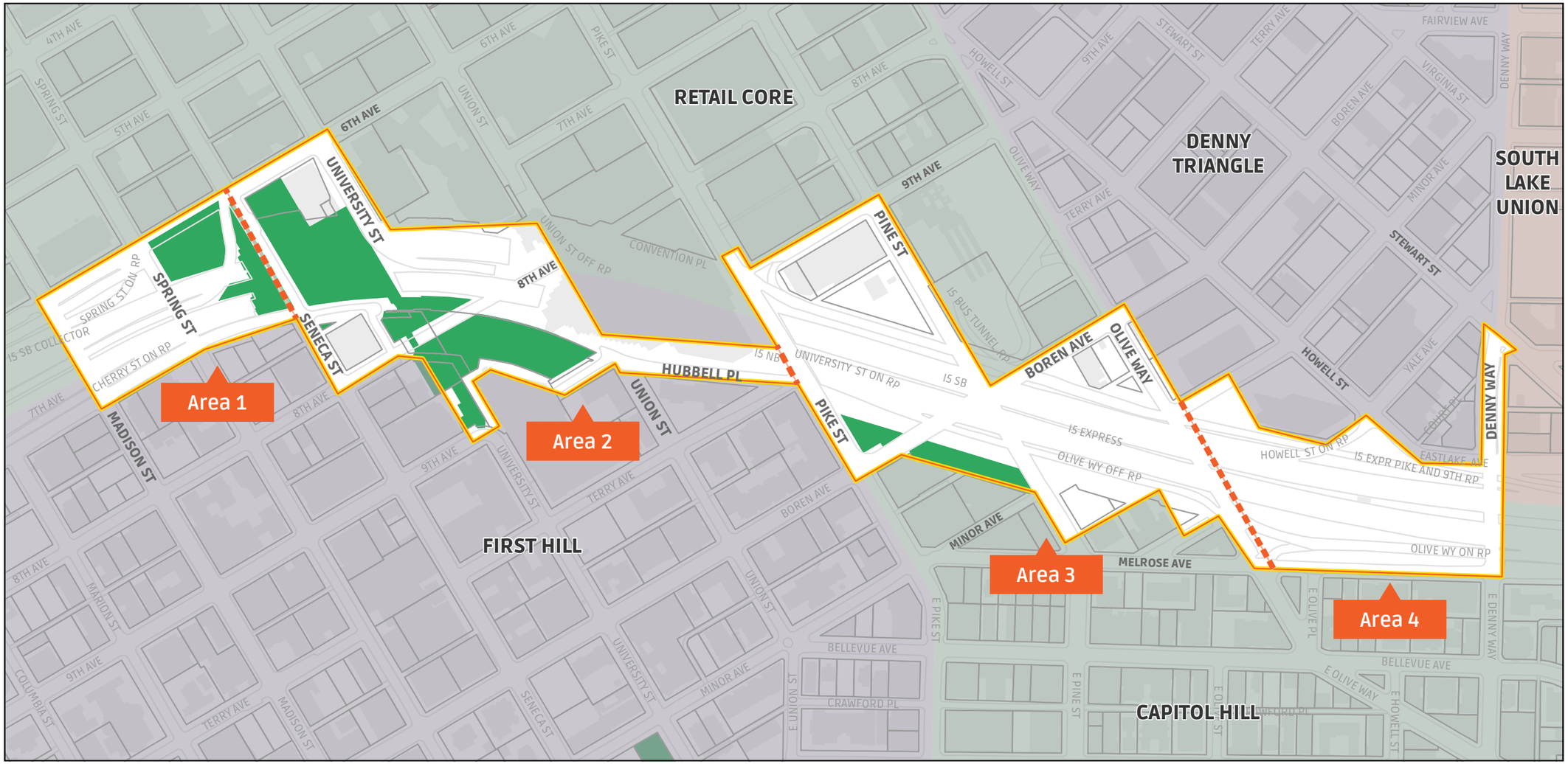
6.3 Key Study Assumptions

- The study did not make any conclusions or recommendations regarding the future of the existing I-5 highway corridor and considered the existing conditions of the roadway facility and related assets through downtown Seattle as a no-build baseline.
  - Existing I-5 structures were not assessed for deficiencies; Puget Sound Regional Council's 2018 State Facilities Action Plan (Puget Sound Regional Council (PSRC), 2018) was the basis for the I-5 asset analysis.
  - Although existing I-5 structures were not assessed, corridor assets are subject to major repair and rehabilitation within the timeline of the assumed construction of the lid. The specific investments, timeline, and extent to rehabilitation or replacement of the existing assets was not determined and could be covered under future studies on I-5 by WSDOT (WSDOT and City of Seattle, 2019).
- The study used concept-level structural design suitable for establishing rough-order-of-magnitude cost estimates.
  - Lid geometrical layouts were developed solely for exploring the opportunities, constraints, and technical questions that would need to be examined in more detail in future phases of analysis.
- The study assessed only structural modifications to the existing lids at Freeway Park and the WSCC necessary for potential edge integration with a future lid.
- The study assumed buildings could be integrated with the lid structural framing up through mid-rise load levels; vertical development costs assumed no significant underground improvements. High-rise loadings were assumed to be supported on terra firma (i.e., dry land or ground) using standard assumptions on property development costs.
  - Although absent from the estimate, determining vertical development costs to frame the lid structure could provide some efficiencies. The lid and mid- or high-rise buildings)—calculated independently for the financial analysis—could share a common foundation system to lower costs.
- Development program test cases examined only the range of feasibility and does not define the final program of the lid, land use or zoning.
- None of the test cases represented an actual or recommended site design or development proposal; the study does not present a preferred alternative.
- The study does not address traffic and utility impacts (temporary or permanent).
- The financial and economic assessment reported all costs and values in 2019 dollars and did not incorporate any 2020 impacts from the COVID-19 pandemic or associated socioeconomic impact or deflationary pressures.
- To evaluate the financial feasibility of a lid, total annual private-sector revenue potential from development[3] (i.e., the residual land value of each development program test case) was the only potential source of revenue included in the net cash flow analysis. Other sources of revenue were not considered.
- An assumed air rights lease payment to the State Motor Vehicle Fund was not included financial feasibility assessment at this stage, but would be an additional cost for future consideration on financial feasibility.[4]
- The timeframe considered for the analysis was 2035, which was consistent with the horizon of planning projections in city and regional planning models and policies, at the time the study was developed. The financial analysis assumed that the first lid area construction would commence in 2030 and would be completed in 2035.

3 This assumption responds to the City of Seattle's guiding questions for Test Case definitions.

4 This cost could be reduced or removed based on future discussions with the asset owner and consideration of legal requirements.

Figure 6-2. Study Site Analysis Areas



Legend

- Structural Assessment Boundary (Study Site)
- Area of Analysis
- Area Limit
- Parks and Open Space
- Building Outlines
- Roadway Pavement Edge
- Parcel Line

Area Limits

- Area 1: Between Madison Street and Seneca Street
- Area 2: Between Seneca Street and Pike Street
- Area 3: Between Pike Street and Olive Way
- Area 4: Between Olive Way and Denny Way

0 300 600 Feet

For the purpose of the feasibility study, the study site (or Structural Assessment Boundary) was divided into four areas of analysis. From south to north areas were comprised as follows: Area 1 is the section between Madison Street and Seneca Street; Area 2 is the section between Seneca Street and Pike Street; Area 3 is the section between Pike Street and Olive Way; and Area 4 is the section between Olive Way and Denny Way.

PART II.

Feasibility Study Analysis and Findings

7. Existing Conditions and Context

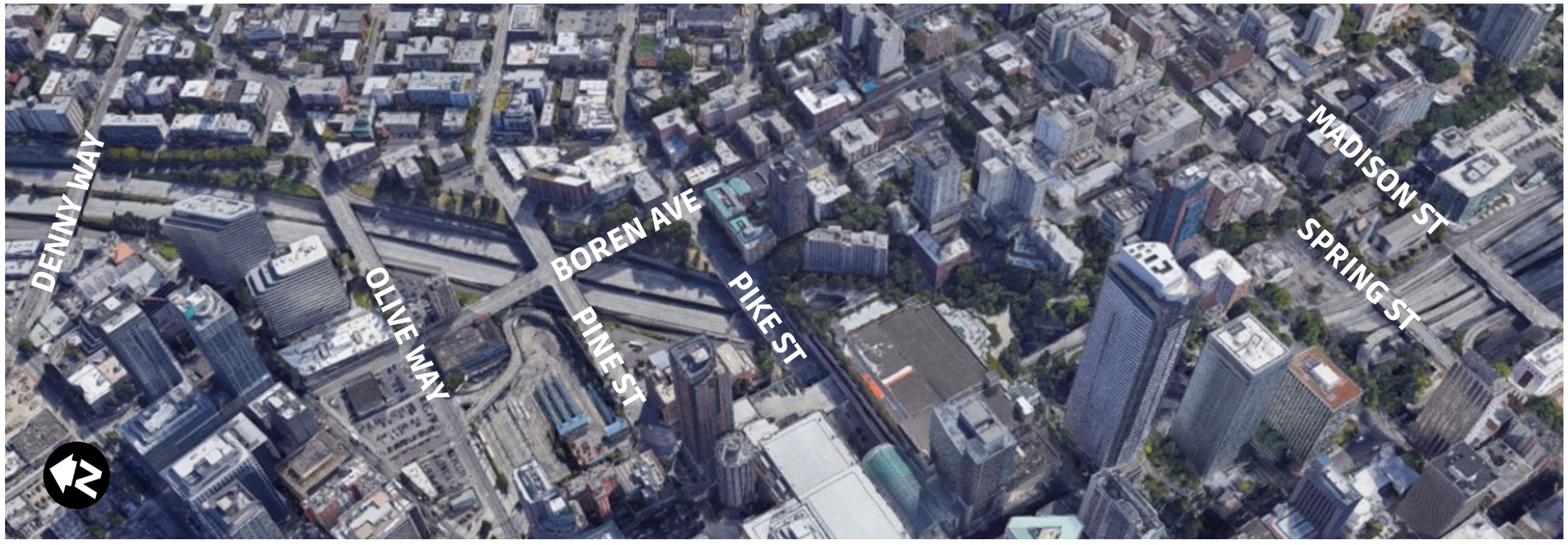
Creating new land over portions of the study site in downtown Seattle requires consideration of the potential effects on the existing conditions and an understanding of the urban context surrounding the project area. The assessment included the potential effects of the project on adjacent neighborhoods, transportation and utility infrastructure, and real estate market conditions. On-site constraints were also considered, which included structural features and I-5 operations. A multi-scale analysis and policy context was further memorialized in the Interstate 5 (I-5) Lid Feasibility Study (LFS) Existing Conditions and Context Memorandum.

7.1 Site Overview

The I-5 LFS focuses on a study site that extends 0.8-mile from Madison Street at its south end to Denny Way at the north (Figure 1-1; Figure 7-1). Key features of the study site include the following:

» The study site is nine times the size of CenturyLink Field and about six times the size of Cal Anderson Park, which is comparable in scale to the Seattle Waterfront from Pioneer Square to Belltown.

Figure 7-1. Aerial View of the Study Site



Aerial view of I-5 through the study site from Denny Way (north) to Madison Street (south). High-rise buildings characterize the urban form west of I-5, while low- to mid-rise buildings (with shorter urban blocks) are east of I-5.

» Mainline I-5 east-to-west has a width ranging from 160 to 218 feet, with an average freeway width of 175 feet along the 0.8-mile stretch; a total of 11.5 lane-miles run through the site.

» The land within the study site is primarily Washington Department of Transportation (WSDOT) right-of-way (Figure 7-3). WSDOT owns the highway facility with the Federal Highway Administration (FHWA) providing oversight because I-5 is part of the federal system and receives federal funds. WSDOT has the authority to enact an air rights lease agreement, or other similar right-of-way use agreement, and FHWA must confirm that any use of highway air rights would not conflict with the safety or performance of the facility (WSDOT, 2018).

- Freeway Park, portions of the Washington State Convention Center, and the Seattle Municipal Tower were constructed above WSDOT right-of-way.
- Sound Transit owns property within the study site currently planned as a Transit-Oriented Development (TOD) site.
- The City of Seattle manages the surface street network and Freeway Park.

7.2 Adjacent Neighborhoods

Land use, urban character, and demographics were analyzed within 5-, 10-, and 15-minute walksheds of the study site. The 15-minute walkshed from the boundary of the study site is defined as the "study area" for the purposes of the I-5 LFS.

As shown in Figure 7-2, the study site is in the heart of downtown Seattle, at the confluence of four distinct neighborhoods:

» Downtown Retail Core

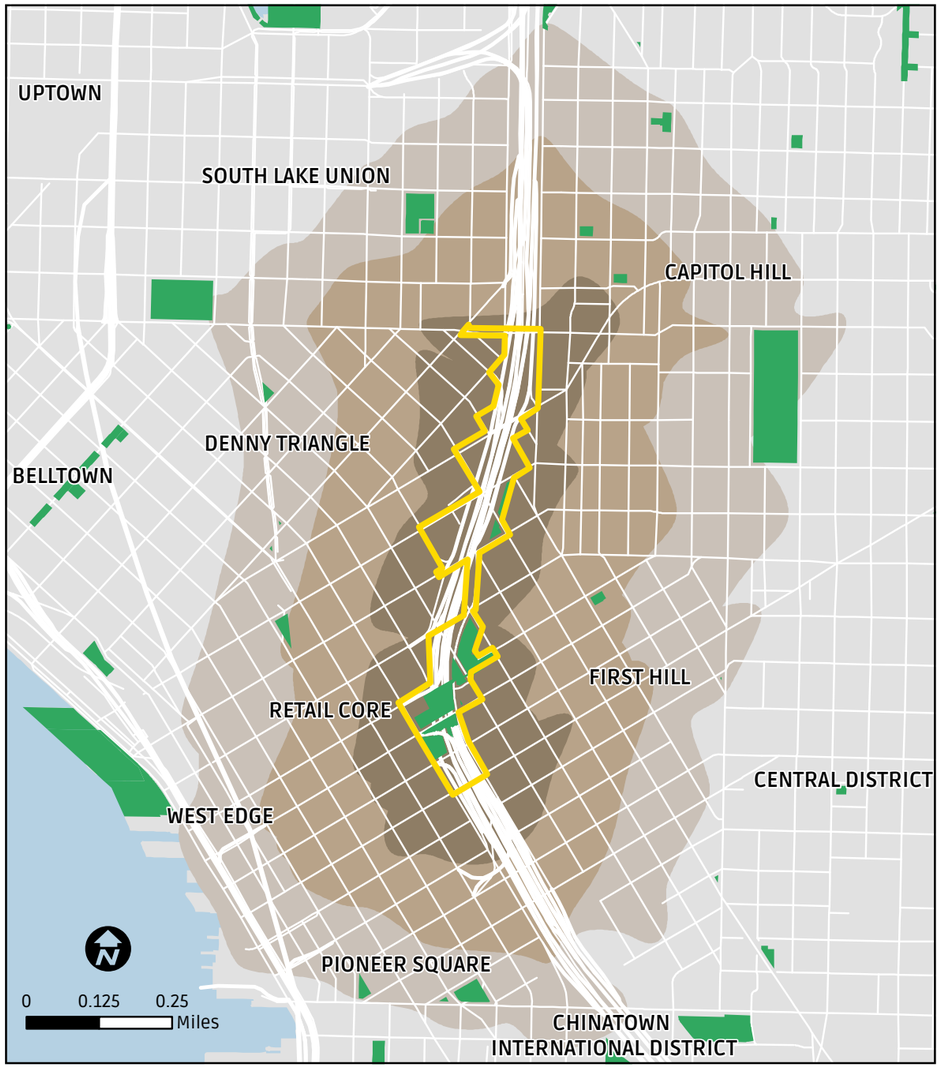
» Denny Triangle/South Lake Union

» Capitol Hill

» First Hill

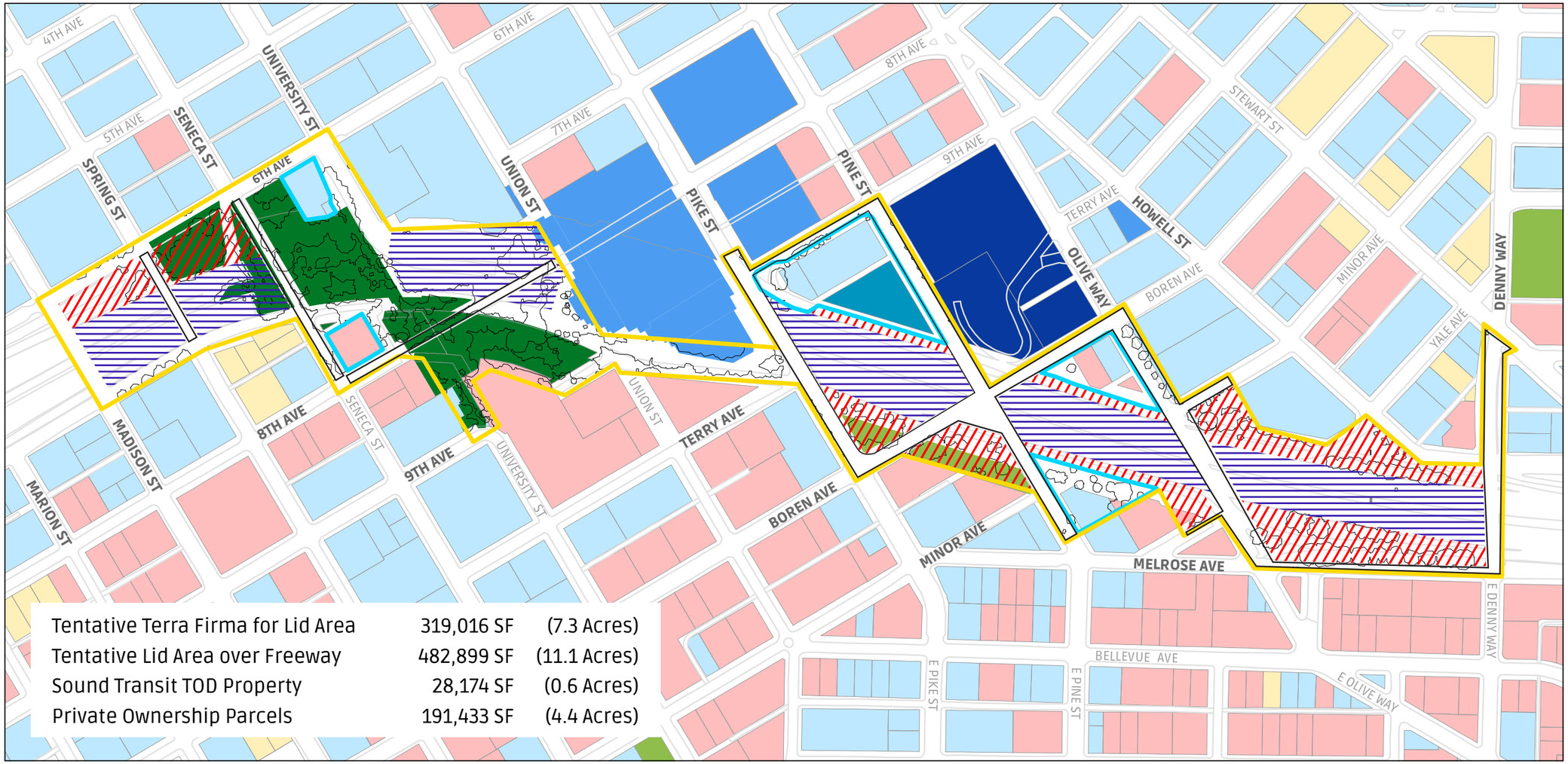
Since the construction of I-5 in the 1960s, urban character to the east and west of the freeway show some distinctions. Each of these neighborhoods has a unique land use pattern and building typology. Connecting the neighborhoods by spanning I-5 with a lid could unite or alter these areas. Figure 7-2 shows the four neighborhoods, and their key features are described below.

Figure 7-2. Adjacent Neighborhoods and Walksheds from Study Site



Map of the study site location and context within 5-, 10- and 15-minute walksheds (i.e., study area).

Figure 7-3. Land Use and Land Ownership in the Study Site



Land within the study site is primarily WSDOT right-of-way. For the purpose of the I-5 LFS, privately owned parcels were not considered for the structural assessment of a lid. Structural systems rely on having foundations built on terra firma (i.e., dry land or ground). This figure shows sections within the study site that allow building a lid over terra firma (red hash) and areas that would be feasible to lid over I-5 that are not over terra firma (purple hash)—in WSDOT right-of-way.

The **Downtown Retail Core** is the densest area of Seattle and has unlimited height zoning in some areas. The land use mix includes more office buildings, and single buildings sometimes occupy a full block. Although there is a variety of uses, office use, and high-rise buildings predominate in the Downtown Retail Core to the west of I-5.

The **Denny Triangle/South Lake Union** is an area with dense employment centers, and typically mid-rise, larger footprint buildings. Located west of I-5 between the Downtown Retail Core and Lake Union, this neighborhood has recently undergone remarkable transformation from low-density commercial and industrial uses to the home of Amazon and a global center of the tech industry.

Capitol Hill, to the east, typically has smaller lots and lower heights. For example, Melrose Avenue, adjacent to the site, is lined with residential buildings that are in the 12-story range. A mixed-use neighborhood with a large residential population, Capitol Hill retains a lower scale and is a hub of small businesses, restaurants, bars, art and music that is a source of pride. Capitol Hill was Seattle's first designated Arts District and has been a long-standing home to LGBTQIA+ communities and culture.

Zoning in the **First Hill** neighborhood allows high-rise development, and new residential towers have been built near the project area. This rapidly growing neighborhood comprises dense residential uses and important institutional uses, including major hospitals and higher education and religious institutions.

These four neighborhoods' unique urban characters were examined in order to inform the urban design considerations for the study site's test case development.

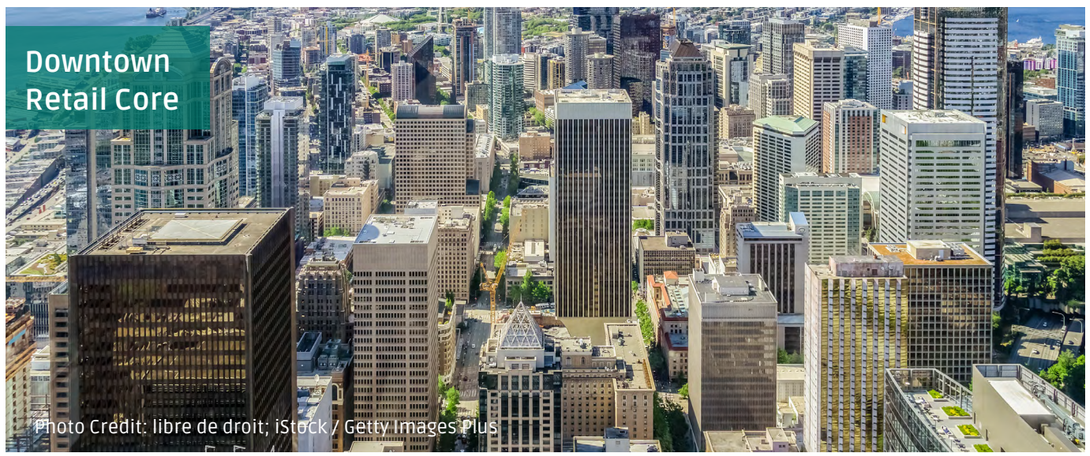
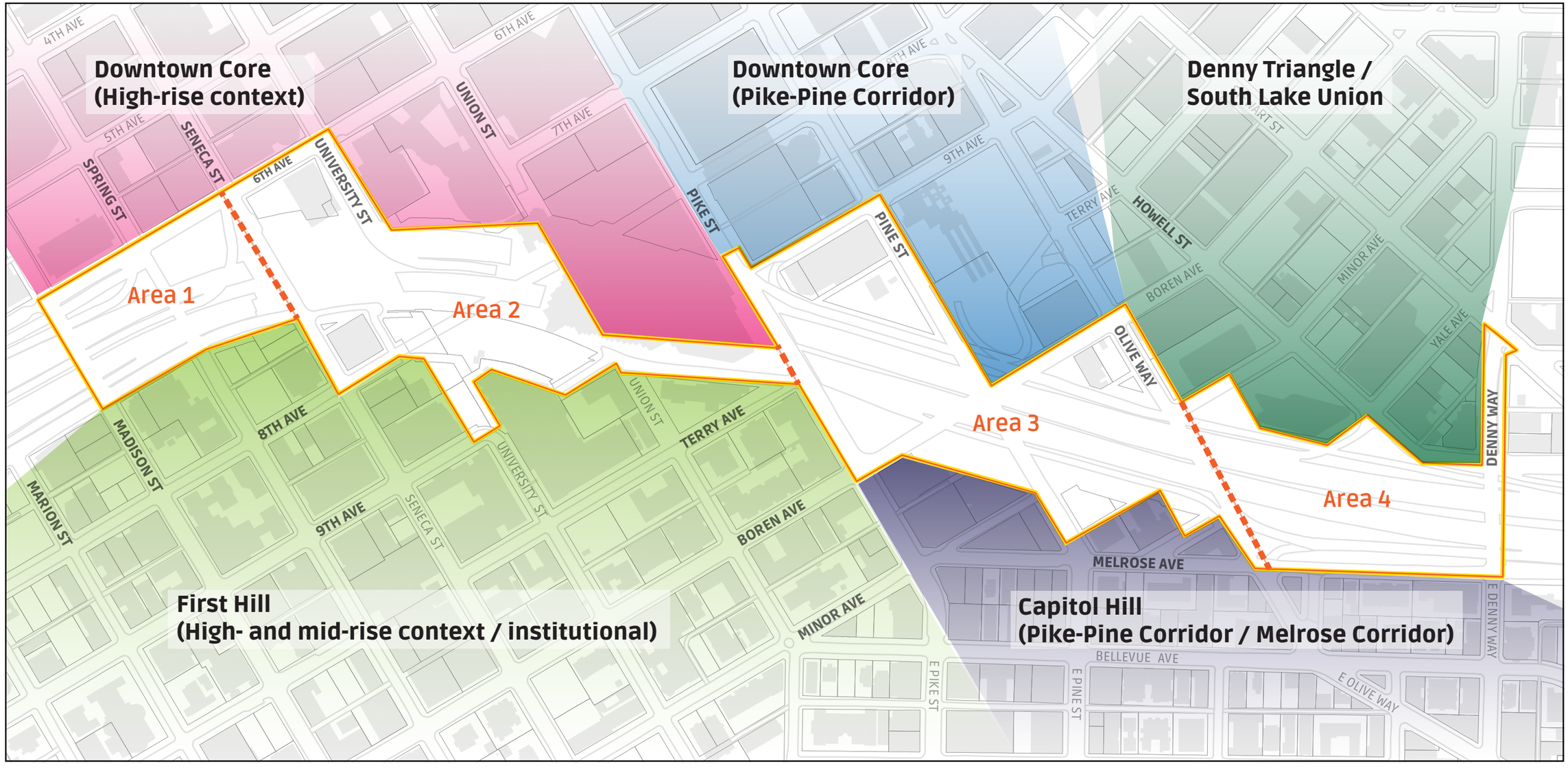


Figure 7-4. Urban Character of the Study Site



Legend

- Structural Assessment Boundary (Study Site)
- Area of Analysis
- Area Limit
- Building Outlines
- Parcel Line
- Roadway Pavement Edge

0 300 600 Feet

7.3 Demographics

A potential lid in downtown Seattle would need to provide for the needs of Seattle's future residents. Although housing policies, market conditions, and acute disruptions will play a significant role in shaping this community in the years to come, understanding historical and current demographic trends can help inform the feasibility and recommendations for future phases of exploration for a lid, to create equitable benefits and access to opportunity for future generations.

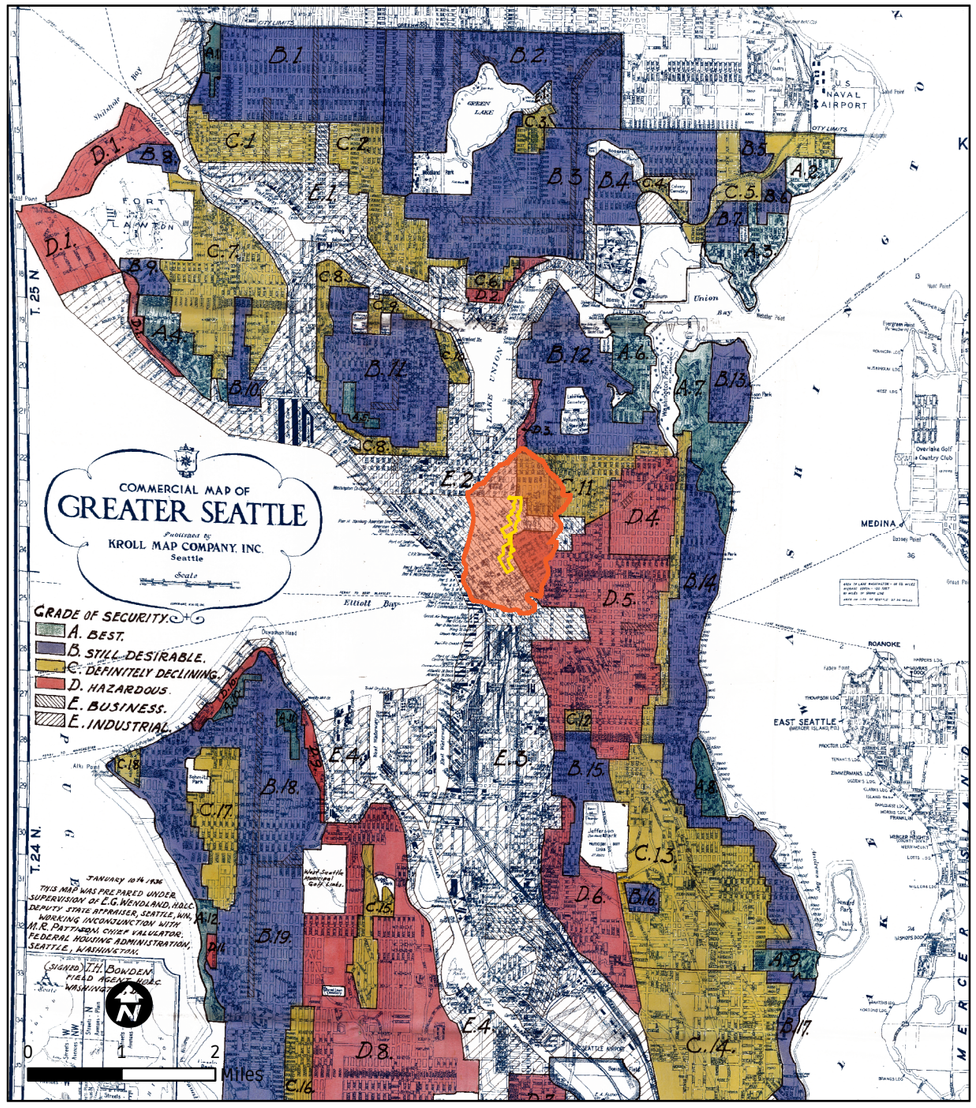
To understand the demographics of the study context, the I-5 LFS examined data for Seattle and the communities surrounding the study site within a 15-minute walkshed (i.e., the study area) (Figure 7-2), from the American Community Survey 2017 5-year Estimates (American Community Survey (ACS), 2018) and the 2019 Downtown Demographics prepared by the Downtown Seattle Association (DSA) (DSA, 2020c).[5]

Demographics in Historical Context

Current demographics tell only a part of Seattle's story. The exclusion of Native people from Seattle, redlining, racially restrictive covenants and exclusionary lending drew physical and economic boundaries to keep people of color out of certain neighborhoods with lasting impacts today (UW, 2004) (Figure 7-5). In the 1960s, the creation of I-5 through downtown created displacement that significantly changed the communities in and around the study area. While not in the scope of this feasibility study, understanding how history has shaped and fueled Seattle's economic health and other disparities is essential in further exploration of a lid.

5 The year of statistical data and the definition of the downtown boundary varies by source. The Downtown Seattle Association's boundary of analysis has the broadest definition by including South of Downtown (SODO) on its south end and establishing its eastern boundary at Broadway. The Imagine Greater Downtown initiative defines Greater Downtown with similar boundaries but does not consider SODO.

Figure 7-5. Historical Redlining Map in Relation to the Study Site



Legend

Structural Assessment Boundary (Study Site)

15-minute Walkshed

Source: 1936 Home Owners' Loan Corporation "Residential Security" map for Seattle. (Nelson, n.d.).

Population

» In 2019, approximately 747,000 residents lived in Seattle, with 88,000 people living downtown (DSA, 2020c).

- Since 2010, downtown population has increased 47 percent (Esri, 2019).[6]
- While citywide population has increased by 22 percent,6 in Greater Downtown, an estimated 15 percent of Seattle's residents and half of Seattle's employees lived and worked alongside many visitors on just 5 percent of the city's land area (SDOT, 2019).
- In the same period, the percentage of Black residents fell to 6.8 percent, below 7 percent for the first time since the 1960s. By contrast, the Black population in King County outside of Seattle increased by almost 50 percent (Balk, 2020).[7]
- Children were the fastest-growing demographic, with nearly 4,850 children living in downtown. School-aged children (ages 5–17) increased downtown by 133 percent since 2010 (Esri, 2019).

» In 2017, 40,000 people lived within the 15-minute walkshed of the lid study site (ACS, 2018).

- Within the 15-minute walkshed, the population was primarily young, single adults, with 25- to 34-year-olds comprising the largest age group in the study area (37.4 percent) (ACS, 2018).
- People within the 15-minute walkshed reported race and ethnic identities similar to those reported citywide (Figure 7-6). Approximately 36 percent of people in both areas were people of color (ACS, 2018) .

Households

» Downtown has a significantly higher percentage of rental housing than Seattle as a whole (Figure 7-7). Renter-occupied housing makes up 82 percent of downtown's 56,000 housing units. By comparison, 56 percent of the more than 338,000 housing units in Seattle are renter-occupied (Esri, 2019).

- Citywide, about 51 percent of households headed by a white person are rented, while 73 percent of households headed by a Black person are rented (Balk, 2020).

» Since 2010, about 76 percent of downtown households moved in, netting an average of six new households downtown per day in that time. In the same period, approximately 61 percent of Seattle households moved in, netting an average of 17 new households per day citywide (Esri, 2019).

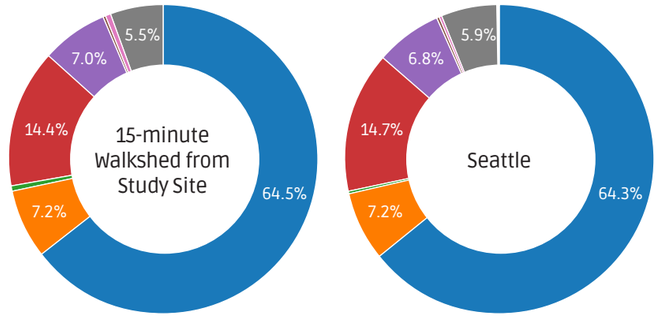
» In 2019, the asking rent per unit downtown was $2,230 compared to $1,884 in Seattle. The percentage change (2010–2019) in asking rent per unit downtown was 80 percent, which was higher than that for Seattle (62 percent), King County or the Puget Sound region (64 percent) in the same timeframe (DSA, 2020b).

» Overall, downtown households report having fewer vehicles than households citywide (Figure 7-8), notably with 41 percent of downtown households not owning a vehicle, compared to 17 percent of households citywide (Esri, 2019).

6 Data sourced from Esri Community Analyst is based on 2010–2019 data, derived from the U.S. Census Bureau. Boundaries of analysis correspond to Downtown Seattle Association's downtown definition (DSA, 2020c).

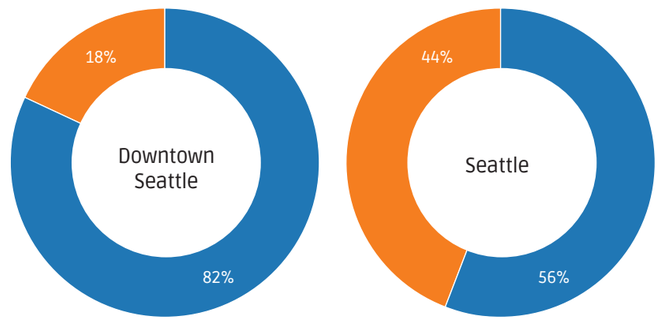
7 Source article is based on 2014–2018 U.S. Census Bureau data.

Figure 7-6. Race and Ethnicity



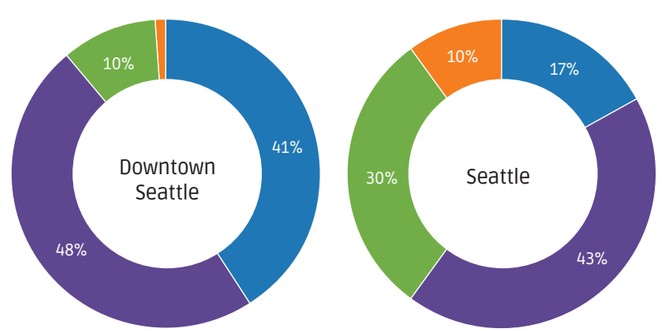
Source: Data sourced from American Community Survey 2017 5-Year Estimates (ACS, 2018)

Figure 7-7. Housing Tenure



Source: Data sourced from Esri Community Analyst 2014-2018 Estimates (Esri, 2019)

Figure 7-8. Vehicle Ownership



Source: Data sourced from Esri Community Analyst 2014-2018 Estimates (Esri, 2019)

Commuting Trends

» Walking was the main form of commute for nearly 40 percent of people within the 15-minute walkshed, compared to just under 10 percent citywide (Figure 7-9) (ACS, 2018).

» Commute times were less than 20 minutes for 44 percent of people within the 15-minute walkshed, compared to 31 percent citywide (ACS, 2018).

Photo Credit: SDOT Flickr

Income Level

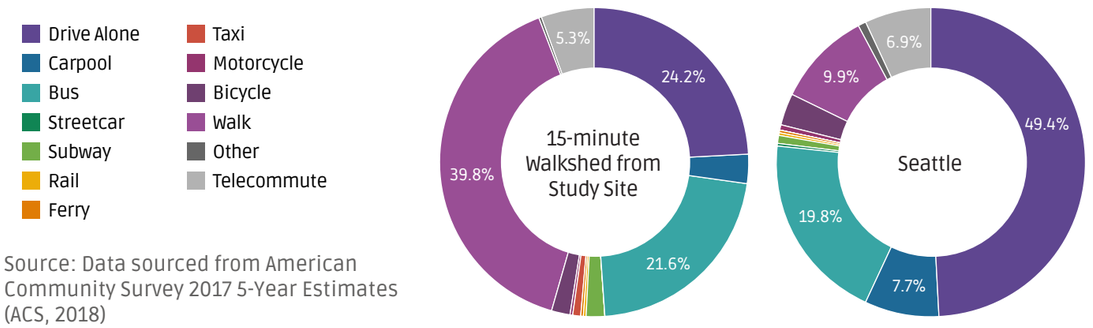
» The median household income downtown was $78,499 (Esri, 2019). Citywide, the median income for a household headed by a white person was $105,100, more than double the $42,500 median income for households headed by a Black person (Balk, 2020).

» The median household income in 2017 within the 15-minute walkshed was $63,612 compared to $85,063 citywide (ACS, 2018).

» Over 15 percent of people within the 15-minute walkshed were living below the poverty level, which was higher than the citywide 12 percent (Figure 7-10) (ACS, 2018).

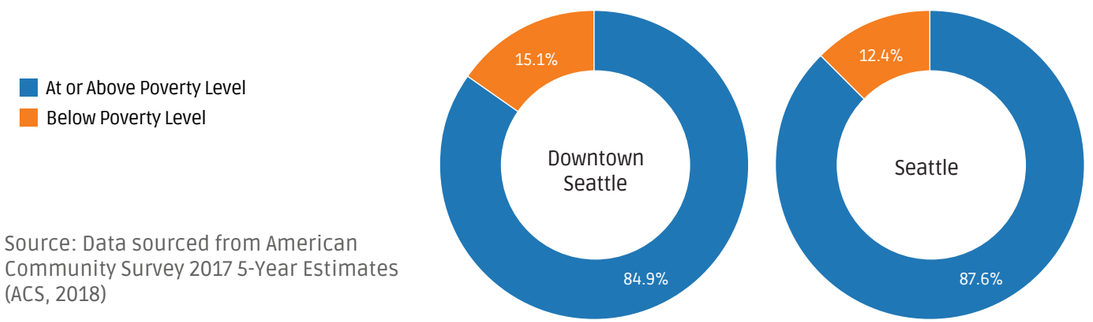
» These demographic and economic trends in the downtown neighborhoods are resulting in new demand for the services and conveniences that typically exist in dense residential neighborhoods. The community's need for schools is increasing, as is a desire for parks, public space, and retail amenities.

Figure 7-9. Commute Mode of Eligible Labor Force



Source: Data sourced from American Community Survey 2017 5-Year Estimates (ACS, 2018)

Figure 7-10. Individual Poverty Status



Source: Data sourced from American Community Survey 2017 5-Year Estimates (ACS, 2018)

7.4 Real Estate Market Context

Seattle has been the fastest-growing big city in the United States since 2010. Downtown represents half of recent development in the city, with nearly half (44 percent) of all downtown apartment units, more than one-quarter (28 percent) of downtown hotel rooms and one-fifth (21 percent) of downtown office space built in the last 10 years (DSA, 2019a).

A market scan was conducted to assess real estate market conditions, to forecast likely future demand in the study area, and estimate the study site's potential to capture demand for new commercial and residential uses. Market areas analyzed for residential, office, retail, and hospitality supply conditions included the downtown Seattle submarket, the city of Seattle, and neighboring cities of Shoreline, Kirkland, Redmond, Bellevue, and Renton (Figure 7-11).

The real estate market analysis was conducted prior to the COVID-19 pandemic in 2020. At the time of the analysis there was insufficient information to forecast the resulting direct and indirect impacts of the pandemic and likely recessionary period, respectively. For the purpose of this study, it is assumed that by the start of a lid construction in 2030, the Seattle economy will have gone through multiple economic cycles with varying degrees of economic expansion and contraction. The analysis of current conditions, prior to the COVID-19 pandemic, provided a baseline grounded on a period of sustained economic growth but also considered the impact of previous economic cycles to inform future socioeconomic conditions, property value trends, and financing terms (i.e., interest rates, depreciation, etc.).

The following key factors were considered in the real estate market assessment.

Demographic Trends

Seattle has been the fastest-growing big city in the U.S. since 2010. However, the rate of population growth in Seattle is expected to slow over the next 10 years, while regional growth is projected to continue at high rates through 2040.

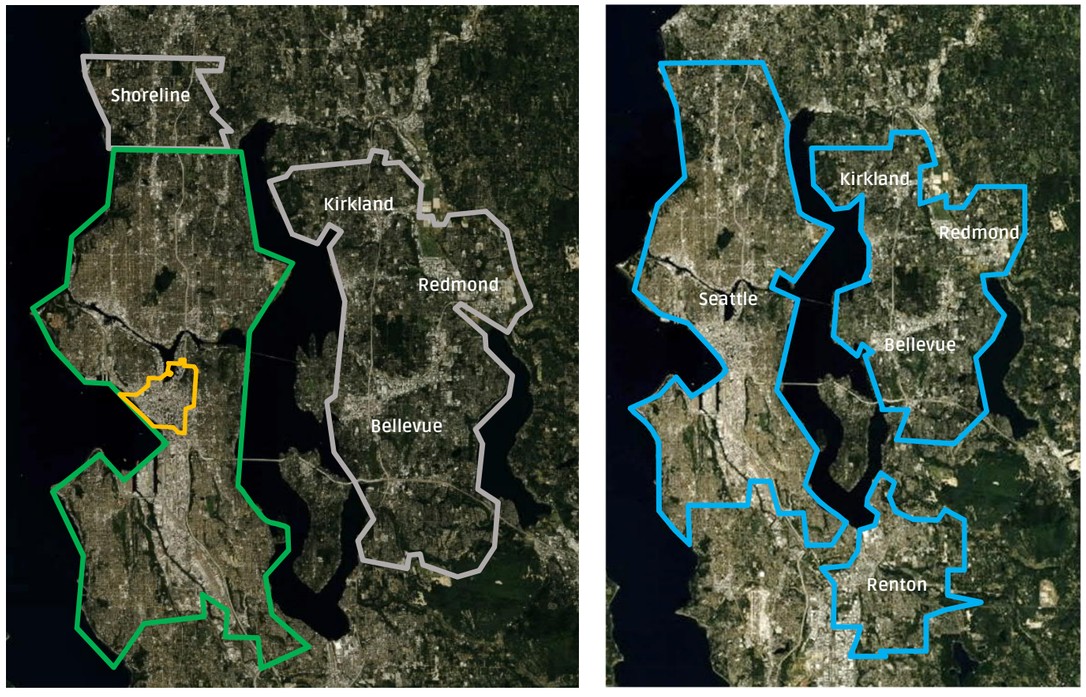
Job Growth

The region is supported by large employment anchors, and Seattle is the home to numerous Fortune 500 companies. After a period of stagnant employment growth between 2000 and 2010, Seattle entered a period of continued job growth, with a 3.34 percent average annual increase in employment per year since 2010. Although future employment growth rates in the near term will be affected by the COVID-19 pandemic, the analysis assumed that this impact will be temporary and that the economy will have rebounded by the time a lid is assumed to be constructed and development delivered.

Housing Supply

Housing unit delivery has not kept pace with job growth, with approximately 2.5 jobs added for every housing unit between 2010 and 2018 and an overall jobs-to-housing ratio of 1.69 in 2018. Nonetheless, housing production is catching up in the post-Great Recession period (December 2007 to June 2009). Since publication in 2015 of the City Seattle's 2035 housing goals, Seattle has already achieved one-third of its planned 20-year growth.

Figure 7-11. Representative Real Estate Market Scan Study Areas



Real estate market scan study areas for market-rate residential (left) and secondary study area for office (right).


Photo credit: Irina88w, iStock / Getty Images Plus

Site-Specific Development Strengths

The study site is adjacent to key retail, employment, and hospitality centers and is at the nexus of distinct neighborhoods: Downtown Seattle, South Lake Union, Capitol Hill, and First Hill. This area will be affected by several ongoing, transformative projects, such as the Convention Center addition, Yesler Terrace redevelopment, and Seattle Waterfront revitalization.

Findings from the real estate market scan suggest that the new urban space created by the lid could support up to 1,200 market-rate residential units, 1.8 million square feet of office, 200,000 square feet of retail, and 600 hotel rooms (Table 7-1).

Table 7-1. Real Estate Market Capture Ranges Estimated for the Study Site

Potential Development Program	Low-end range of Market Capture	High-end Range of Market Capture
Residential (market-rate rental)	800 units	1,200 units
Office	1.2 million square feet	1.8 million square feet
Retail	130,000 square feet	200,000 square feet
Hospitality	400 hotel rooms	600 hotel rooms

Source: I-5 Lid Feasibility Study Real Estate Market Scan (HR&A Advisors).

Estimates reflect market capture ranges for 2035, intended to inform development program test cases for a lid. All numbers are not adjusted to account for the existing pipeline. Future pipeline and churn will also meet a share of demand. These estimates do not include affordable housing units.

7.5 Affordability and Risk of Displacement

A heightened risk of displacement (OPCD, 2016) has accompanied the growth trends in downtown Seattle over the past decade, with increasing risk observed over the last decade (Figure 7-14). An assessment of the 11,731 low-income households (Figure 7-12) immediately adjacent to the study site (within 1,000 feet) revealed that of households identified within this boundary, 39 percent (4,613 households) were defined as low-income households because they earned 60 percent or less of the King County Area Median Income (AMI) of $96,000 per average household (HUD, 2020). In the same area, 2,151 subsidized housing units were identified, which corresponded closely to the 5-minute walkshed of the study site with housing units extracted from City of Seattle Geographic Information System data on rent- and income-restricted housing (City of Seattle, 2019c). The increase in the Displacement Risk Index in Greater Downtown neighborhoods was largely an effect of population growth and socioeconomic shifts in the region (with land use policies directing this growth downtown) and the lag in construction of new housing units to meet regional demand. Furthermore, areas where new housing was being constructed were often priced for middle- or high-income households,[8] often replacing housing stock once occupied by lower-income households (OPCD, 2016).

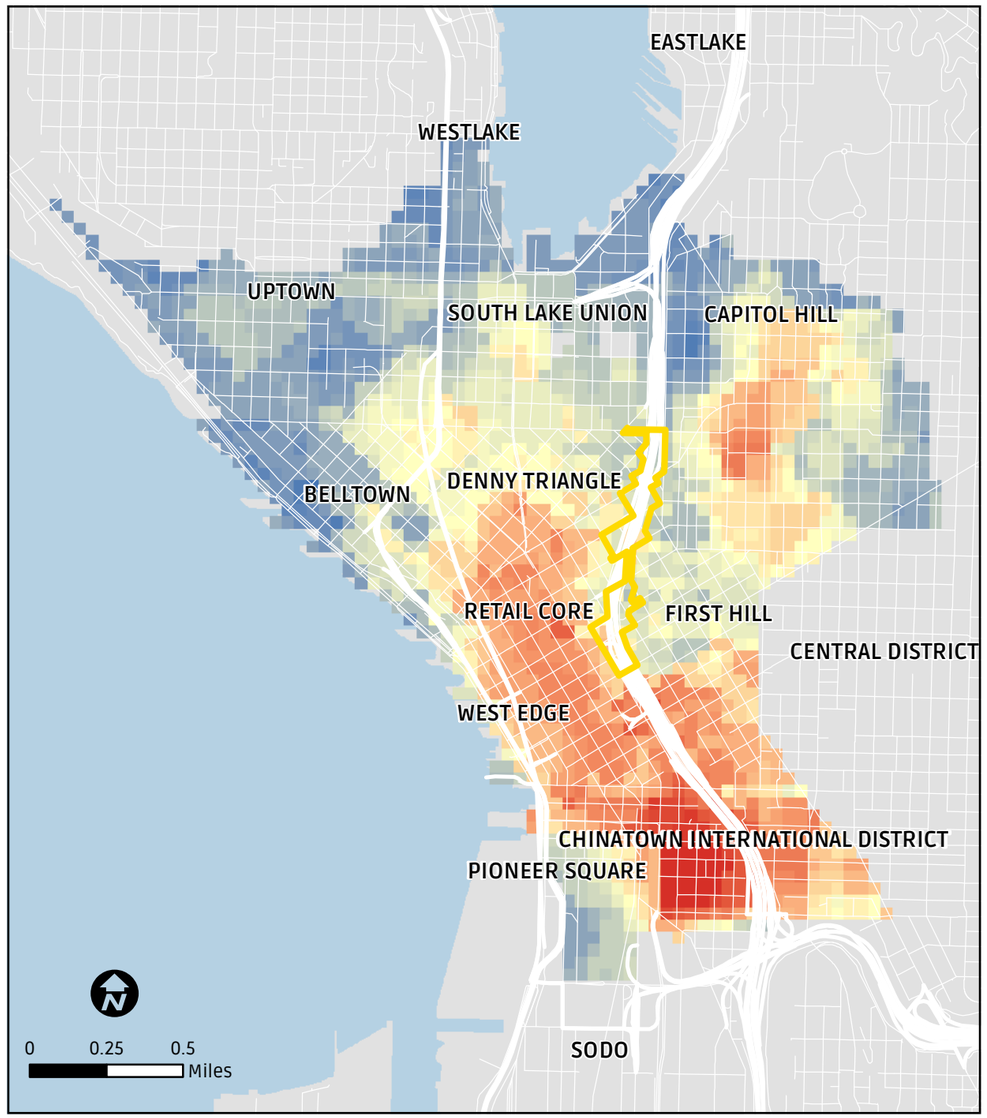
Figure 7-12. Definitions of Housing Affordability in the City of Seattle

Affordability (Spending up to 30% of gross monthly income on housing costs)		
City of Seattle median household income: **$76,000** (single person household) **$108,000** (four person household)		
Low-income Household Earns **<60%** of Area Median Income (AMI) **< $46,500** (single person household) **< $66,400** (four person household)	**Middle-income Household** Earns **60–120%** of Area Median Income (AMI) **$46,501–$93,000** (single person household) **$66,400–$132,850** (four person household)	**High-income Household** Earns **> 120%** of Area Median Income (AMI) **> $93,001** (single person household) **> $132,850** (four person household)

Adapted from (City of Seattle, 2019a); (Challenge Seattle, 2019).

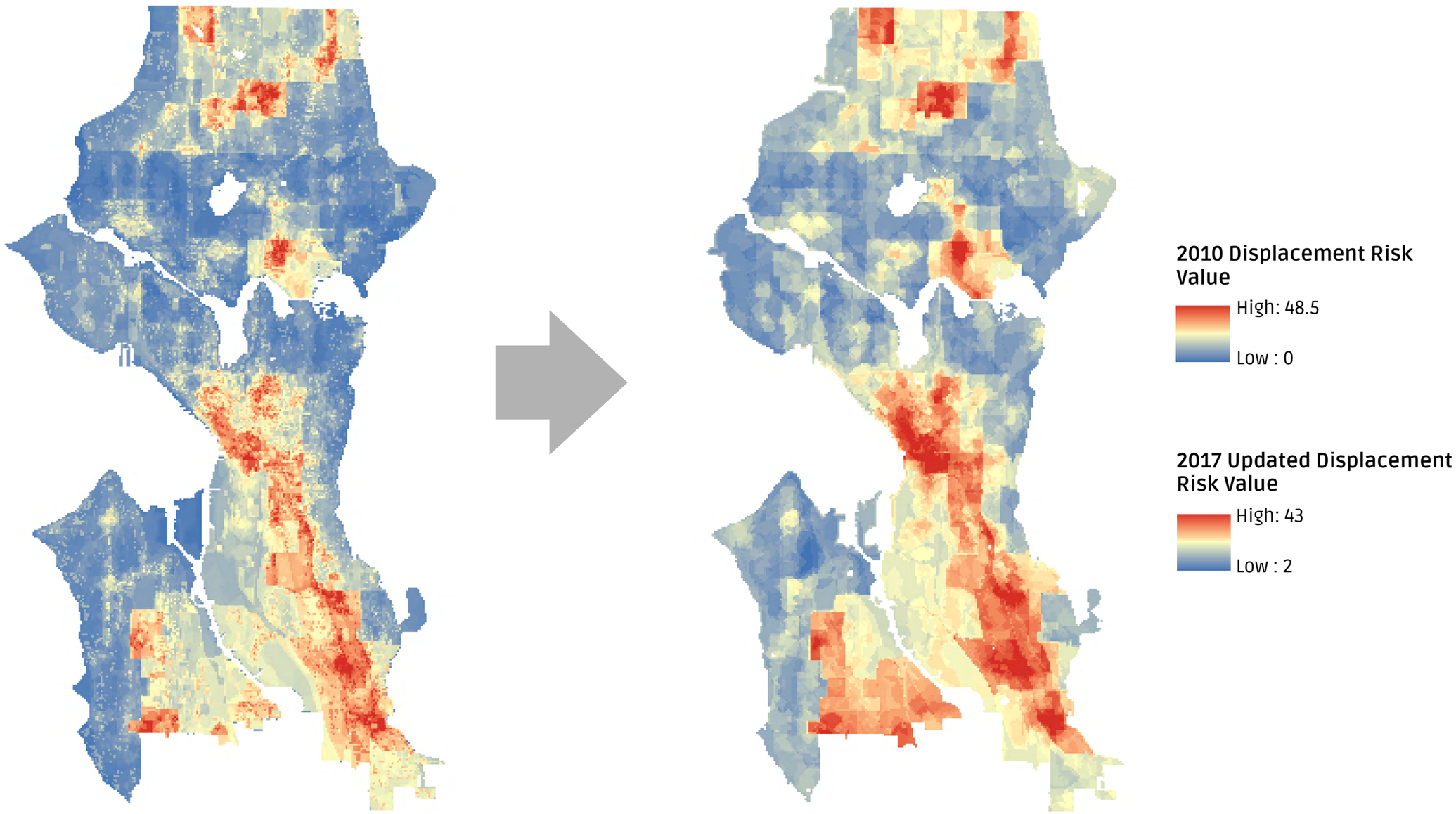
8 Middle-income households are defined as households earning between 60 percent and 120 percent of the Housing and Urban Development Area Median Income.

Figure 7-13. Displacement Risk Index in Greater Downtown as Measured in 2016



Source: (OPCD, 2016)

Figure 7-14. Displacement Risk Index in Seattle, 2010 and 2017



2010 Displacement Risk Index

2017 Update to Displacement Risk Index

Partial update of the City of Seattle's Displacement Risk Index data, from 2010 to 2017. An increase in the Displacement Risk Index values for downtown Seattle is patent in the 2017 partial update, compared to 2010 data.

Without a strategy and related investment to retain and increase housing options for all income levels, rapid displacement is anticipated to continue in the Greater Downtown neighborhoods as economic growth and job expansion continue. Efforts to add housing inventory may partially mitigate the impact, but added housing inventory needs to directly reflect the makeup of the housing units being displaced. The impacts to displacement trends as a result of the COVID-19 pandemic are largely unknown. For example, living in dense urban areas in close proximity to other people could be less desirable. At the same time, crowded transit systems may become less attractive and people may choose other modes of transportation or telecommuting models to access jobs and employment opportunities downtown. As the longer-term behavioral impact from the COVID-19 pandemic is difficult to project, the analysis assumed displacement will continue to occur at similar rates as experienced between 2010 and 2017.

Highlighted in Figure 7-15, the risk of residential displacement adjacent to the study site has largely increased from 2010 to 2017, with the more noticeable increases occurring in the Downtown Retail Core and Denny Triangle neighborhoods. Risks of displacement in Capitol Hill and First Hill have largely subsided or are in the process of decreasing because much of the displacement has already occurred with intensified development of those areas over the past decade. However, further analysis outside of the scope of this study, should assess potential impacts on displacement trends that could unfold resulting from improvements over I-5 if a lid were to be built, and corresponding development programs.

The City of Seattle has instituted several policies to promote equitable growth and reduce displacement risk. In addition to efforts to mitigate displacement of low-income households, recent efforts have also addressed displacement of middle-income households, specifically those who provide essential services such as teachers, nurses, police and fire fighters and are no longer able to afford to live in Seattle, increasing employee turnover and reducing direct engagement and interaction with the community. Challenge Seattle, an alliance of CEOs from 17 of the region's top employers (Challenge Seattle, 2019), and the recently created Middle Income Housing Advisory Council (City of Seattle, 2019a), are evaluating strategies for addressing Seattle's middle-income housing needs, including potential requirements for a certain percentage of newly constructed residential developments being available for households that meet pre-defined requirements, currently assumed to be 120 percent AMI (City of Seattle, 2019a).

Moreover, not only residents are being displaced. Small businesses, nonprofits and creative enterprises often rely on affordable commercial spaces to maintain their businesses. Neighborhoods like Capitol Hill and Pike-Pine—long-standing homes to LGBTQIA+ communities and culture; arts, dance, music and theater; and locally owned stores—are at risk of losing their cultural essence as older buildings are demolished and the price of commercial leases increase. The City of Seattle, through the Office of Arts & Culture and the Office of Economic Development, is looking at factors outside of residential displacement—including cultural displacement, particularly among communities of color—to address challenges around commercial affordability.

A lid over I-5 presents a unique opportunity to provide or fund additional affordable and middle-income housing in the heart of a neighborhood with both high displacement risk and high access to opportunity. It could create commercial and cultural spaces to help ensure this neighborhood extension contributes to a complete community centered on racial equity and affordability. While the current COVID-19 pandemic presents specific, near-term challenges for low- and middle-income households, the long-term ramifications on displacement is largely unknown because resulting behavioral changes in household location decisions and employment opportunities remain unclear after the analysis was conducted.

Without a strategy and related investment to retain and increase housing options for all income levels, rapid displacement is anticipated to continue in the Greater Downtown neighborhoods as economic growth and job expansion continue.

Figure 7-15. Change in Displacement Risk Index in the Study Site, 2010–2017

Legend

- Structural Assessment Boundary (Study Site)
- Parcel Line

Change in Displacement Risk

- Increased Displacement Risk
- No Change in Displacement Risk
- Decreased Displacement Risk

0 300 600 Feet

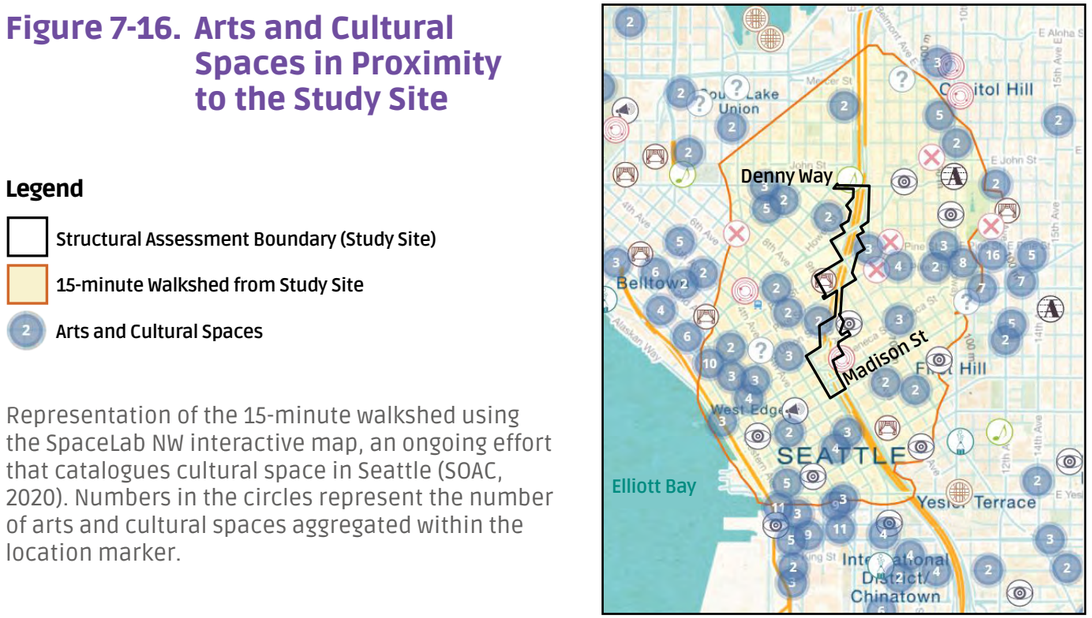
Partial update of the City of Seattle's Displacement Risk Index data, from 2010 to 2017. Increased displacement risk is apparent in the Downtown Retail Core (west of I-5) and in First Hill (east of I-5) in the immediacy of the study site.

7.6 Cultural and Civic Spaces

The neighborhoods surrounding the study site have a wealth of cultural uses and venues for performance and visual arts, music, and cinema. The COVID-19 pandemic has had a dramatic impact on arts and cultural nonprofits, and many face the possibility of closing or never fully recovering. At the time this study was completed (pre-COVID-19 pandemic), within the 15-minute walkshed of the study site there were approximately 116 non-profit and for-profit cultural spaces, almost 15 percent of the 834 cultural spaces citywide[9] (City of Seattle Office of Arts & Culture (SOAC), 2020). The number of cultural spaces in the 15-minute walkshed has grown significantly, with 41 percent opening since 2000. Yet, there are fewer cultural spaces immediately adjacent to I-5 relative to the surrounding area. A lid offers the potential to not only connect people across the freeway to cultural spaces downtown and on Capitol Hill, but also to create space for new cultural opportunities for artists, residents and visitors.

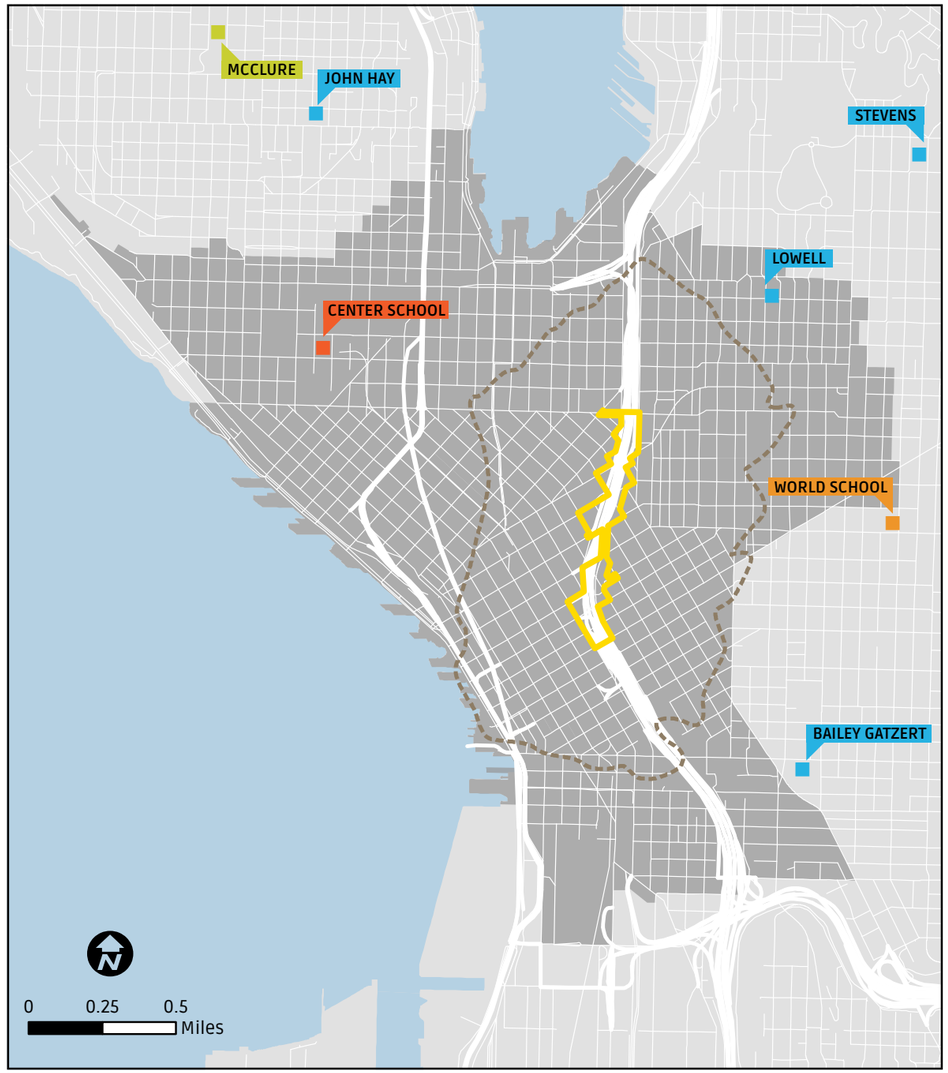
Further exploration of a lid also creates an opportunity to examine whether the lid could help address downtown Seattle's lack of public K through 12 schools (Figure 7-17), and provide space for more community centers or similar spaces that offer free or low-cost access to activities for youth, families and seniors.

Figure 7-16. Arts and Cultural Spaces in Proximity to the Study Site



Representation of the 15-minute walkshed using the SpaceLab NW interactive map, an ongoing effort that catalogues cultural space in Seattle (SOAC, 2020). Numbers in the circles represent the number of arts and cultural spaces aggregated within the location marker.

Figure 7-17. Public Schools in Greater Downtown



Elementary, middle and high schools are primarily on the edges of Greater Downtown, with only two (the Center School and Lowell Elementary) within the Greater Downtown boundary (City of Seattle, 2018d). None are within the 15-minute walkshed of the study site.

9 Data was sourced by creating a boundary of the 15-minute walkshed using the SpaceLab NW mapping tool. SpaceLab NW is a project of Seattle Office of Arts & Culture and 4Culture, in collaboration with Community Attributes Inc.

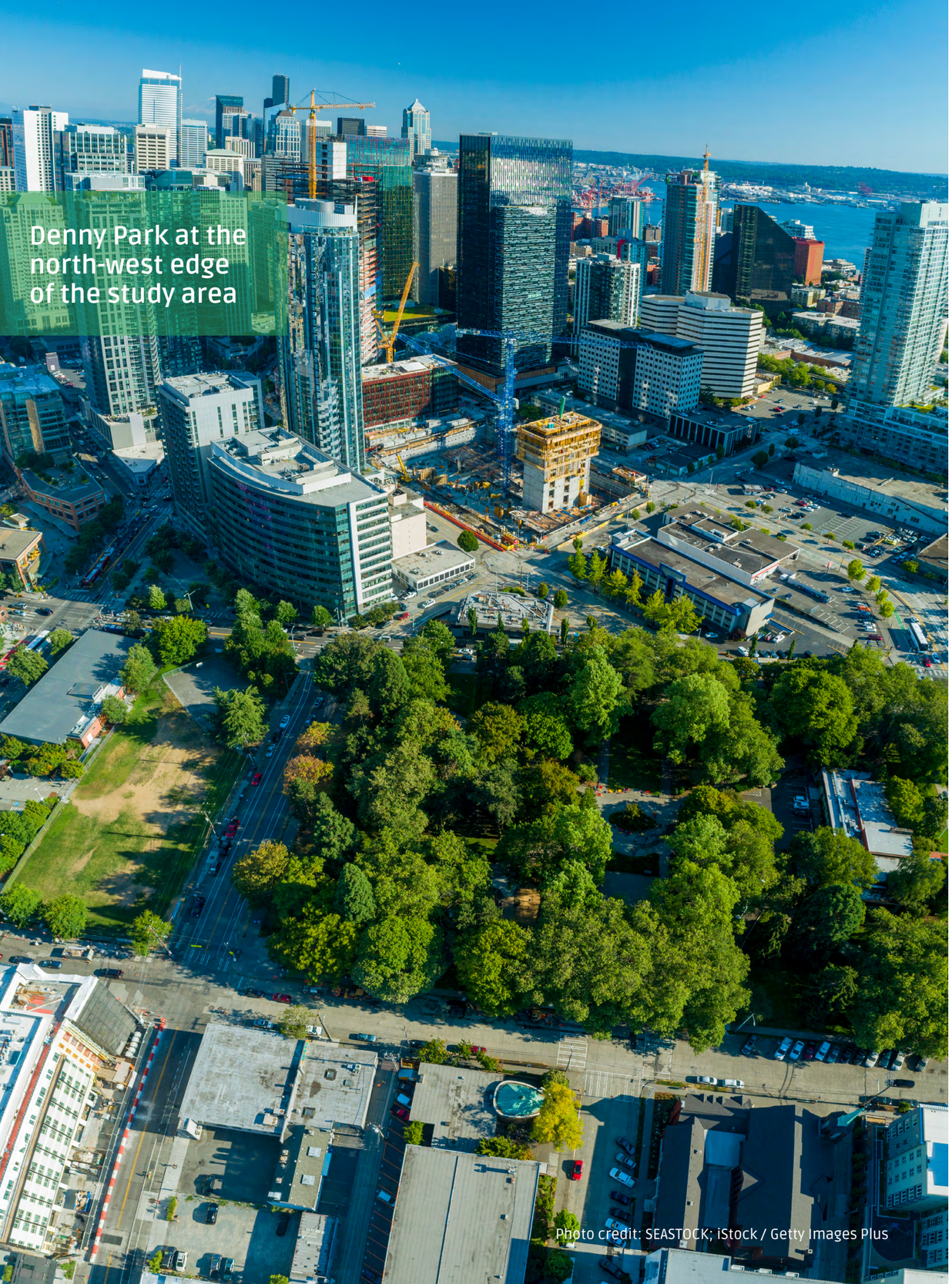


Photo credit: SEASTOCK; iStock / Getty Images Plus

7.7 Parks and Open Space

Downtown has a shortage of parks and open spaces (Figure 7-18), despite the concentration of jobs, residents, and the rising trend of children as the fastest-growing demographic. Imagine Greater Downtown identified seven "big ideas" to improve public spaces and mobility in the center of the city (SDOT, 2019). Two of the ideas—greening Greater Downtown and stitching the I-5 divide—recognize the need to create more parks and open space in the downtown area, where just 6 percent of total land downtown is allocated to parks and public open space compared to 12 percent citywide (SDOT, 2019). Only two major parks are within or near the study site:

» Cal Anderson Park, a 7-acre park on Capitol Hill on the eastern edge of the 15-minute walkshed.

» Freeway Park,[10] a 5.2-acre park that bridges First Hill and Downtown Retail Core on an existing lid over I-5 within the study site's boundary.

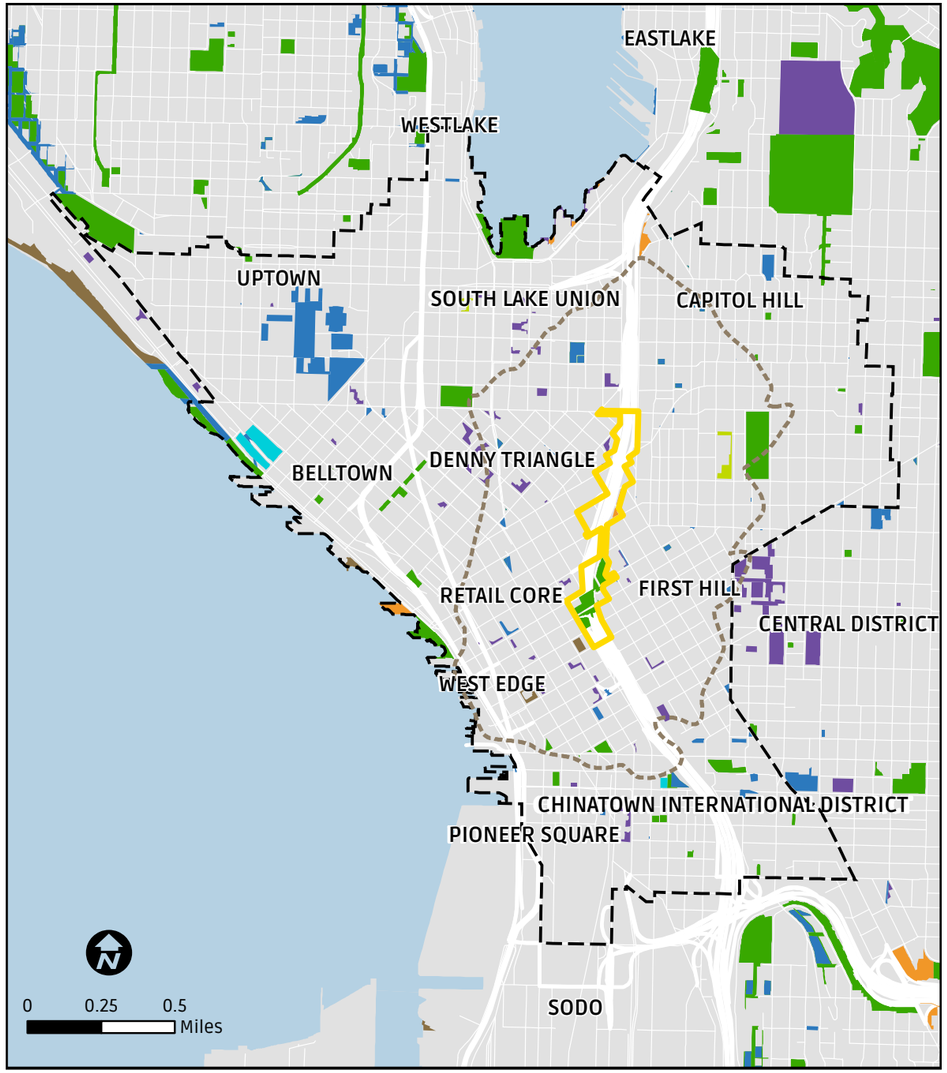
The analysis prepared by the University of Washington's Department of Urban Design and Planning Reconnecting the Emerald City revealed that close to 40 percent of all open space downtown consists of hardscapes that limit the environmental and health benefits well-managed green spaces can provide (UW, 2019). Lidding I-5 would present an opportunity to evaluate the potential expansion of Freeway Park,[11] north and south of the existing lid.

In addition, the Seattle Parks & Recreation 2017 Parks and Open Space Plan has a minimum citywide guideline for open space of 3.3 acres per 1,000 residents, and an aspirational goal of 10 acres per 1,000 residents, acknowledging that achieving the higher goal is challenging in denser areas like downtown (Seattle Parks & Recreation, 2017a). Moreover, the City of Seattle's Outside Citywide initiative recognizes that while Seattle has a robust and diverse public space network, there are opportunities to address inequitable distribution of open space, underutilized spaces, and a fragmented network that can be difficult to navigate (OPCD, 2019a). The initiative identified the area surrounding the lid study site as an area of poor access and highest priority for investment in open space expansion and improvements to elevate access to public space, as well as health and social justice outcomes (Figure 7-19). Lidding I-5 would present significant opportunity to expand green and open spaces downtown, helping the City of Seattle to advance its park an open space goals articulated in these plans that aspire to a greener, better connected, healthier and more equitable Seattle.

10 Freeway Park recently gained historic designation and is now included in the National Register of Historic Places. Any project that has the potential to affect Freeway Park's character-defining features will need to follow the processes outlined in the Code of Federal Regulations (CFR), 36 CFR Part 800 – Protection of Historic Properties.

11 It is important to note that the City of Seattle also received funding—as part of the "community benefit agreement" related to the expansion of the Washington State Convention Center—to make Freeway Park more attractive, safe and usable.

Figure 7-18. Parks and Public Space in Greater Downtown

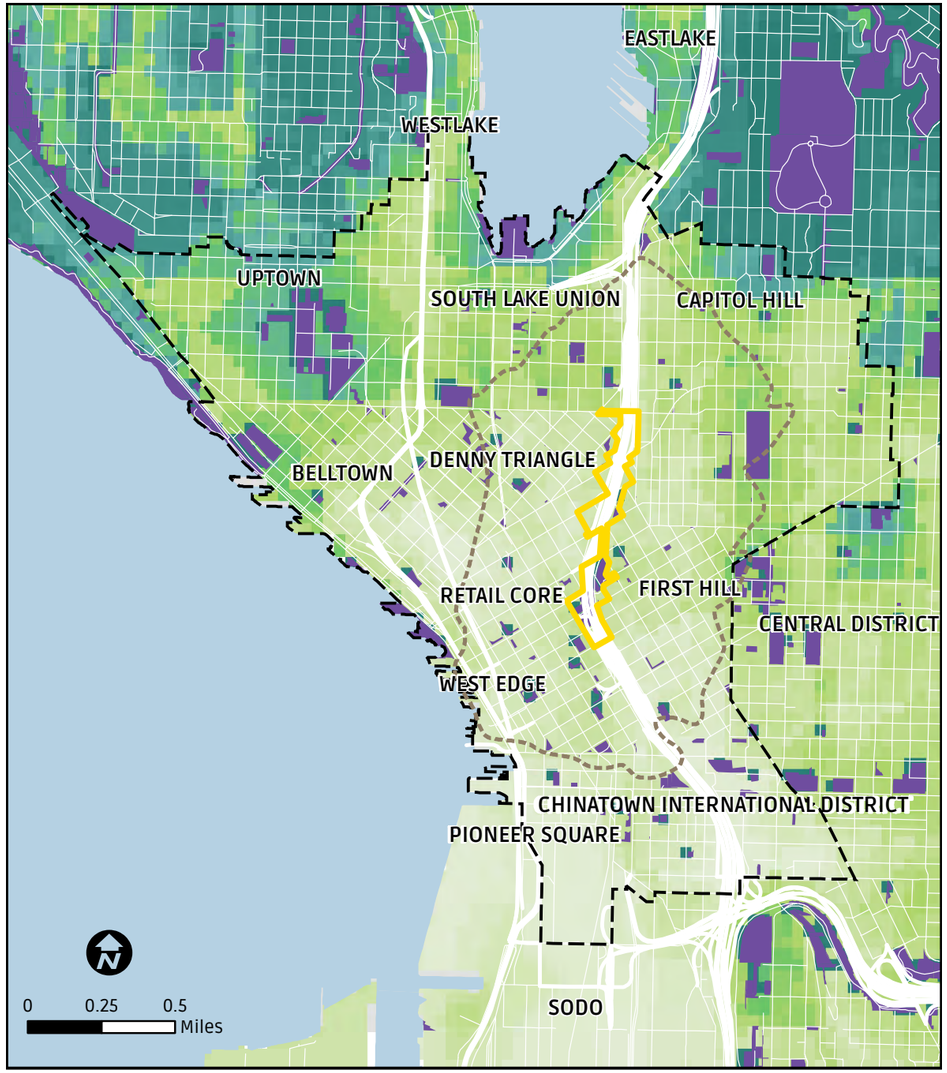


Legend

- Structural Assessment Boundary (Study Site)
- 15-minute Walkshed
- Greater Downtown
- City of Seattle (Non SPR)
- Seattle Parks & Recreation
- King County & Washington State
- Public Schools & Institutions
- Non-Profit
- Private Open Space
- Port of Seattle

Source: Outside Citywide (OPCD, 2019a)

Figure 7-19. Public Space Equity Map for Greater Downtown



Legend

- Structural Assessment Boundary (Study Site)
- 15-minute Walkshed
- Greater Downtown
- Public & Open Spaces

Public Space Priority Areas

- High Priority
- Low Priority

Source: City of Seattle, 2018.

7.8 Transportation and Multimodal Connections

The study site's location is strategic to transportation at multiple scales, with distinct challenges and opportunities from the regional scale to the study site scales The transportation systems connecting to I-5—local streets, highways, transit, freight and national defense infrastructure—rely heavily on I-5 as a functional highway spine. Above mainline I-5, a dense network of surface streets and transit services provide great access to this area. However, human-scale mobility options face the most challenges, particularly at the study site scale.

Traffic Operations

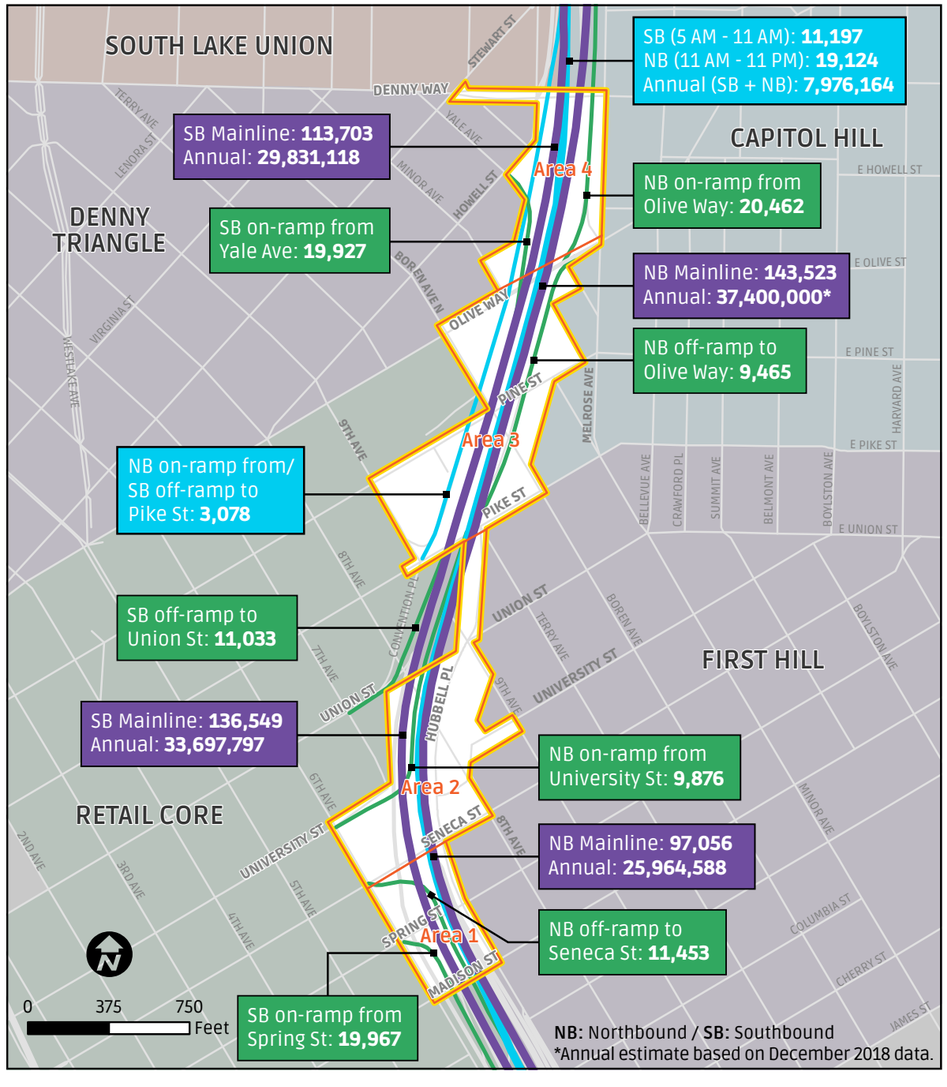
In terms of traffic operations on I-5, the study site is considered a "pinch point" of the 107-mile corridor from Marysville to Tumwater. A series of ramps, mergers, together with high volumes results in heavy congestion during peak periods.

The I-5 corridor carries 288,000 vehicles daily through its downtown segment, including mainline I-5 and express lanes in both directions (WSDOT, 2018) (Figure 7-20). Daily weekday traffic volumes in the central segment of I-5 through downtown are projected to increase 12 percent to 22 percent and are expected to be the most heavily used portions of I-5 in Seattle in 2035 (OPCD, 2019b).

The study site has eight on- and off- ramps that connect the I-5 corridor to and from the downtown street network. From south to north, these include the Spring Street on-ramp, Seneca Street off-ramp, University Street on-ramp, Union Street off-ramp, express lane reversible on- and off- ramp at Pike Street, Olive Way on- and off-ramps, and Yale Avenue on-ramp.

Nine vehicular bridges connect the surface street grid east-to-west across I-5. Freeway Park and Washington State Convention Center interrupt the street grid, so traffic volumes are higher on Madison Street and Boren Avenue with both over 23,000 Average Weekly Daily Traffic Volumes (City of Seattle, 2018a). Denny Way, which is one of the only connections between Capitol Hill and Denny Triangle/South Lake Union, also has high volumes, with approximately 22,500 Average Weekly Daily Traffic Volumes. Denny Way and Boren are the only designated Freight Major Access routes within the study site (SDOT, 2016). These overpasses are often congested during peak periods.

Figure 7-20. Traffic Volumes on I-5 through the Study Site



Legend

- Structural Assessment Boundary (Study Site)
- Area of Analysis

Average Weekday Daily Traffic (AWDT) Volumes

- Mainline I-5
- I-5 Express Lane (Reversible)
- Ramp

Data source: WSDOT CDR. Data from October 2018, excluding October 8th. Monthly average.

Pedestrian and Bicycle Connections

The vehicular bridges also serve as pedestrian connections. There are some notable deficiencies, such as the lack of sidewalks on some portions of the north side of Denny Way and the west side of 7th Avenue. Generally, these conditions increase the risk, travel distances and time for pedestrians traveling east-west over I-5. Despite the discomfort of walking on the overpasses, pedestrian volume counts reveal considerable foot traffic on these bridges, with the highest volumes on Pike and Pine Streets (Figure 7-22). Pike and Pine Streets represent strong desire lines between the Downtown Retail Core and Pike-Pine/ Capitol Hill and have the least topographic gain. Olive Way, a 170-foot-long crossing, is less frequently used by pedestrians.

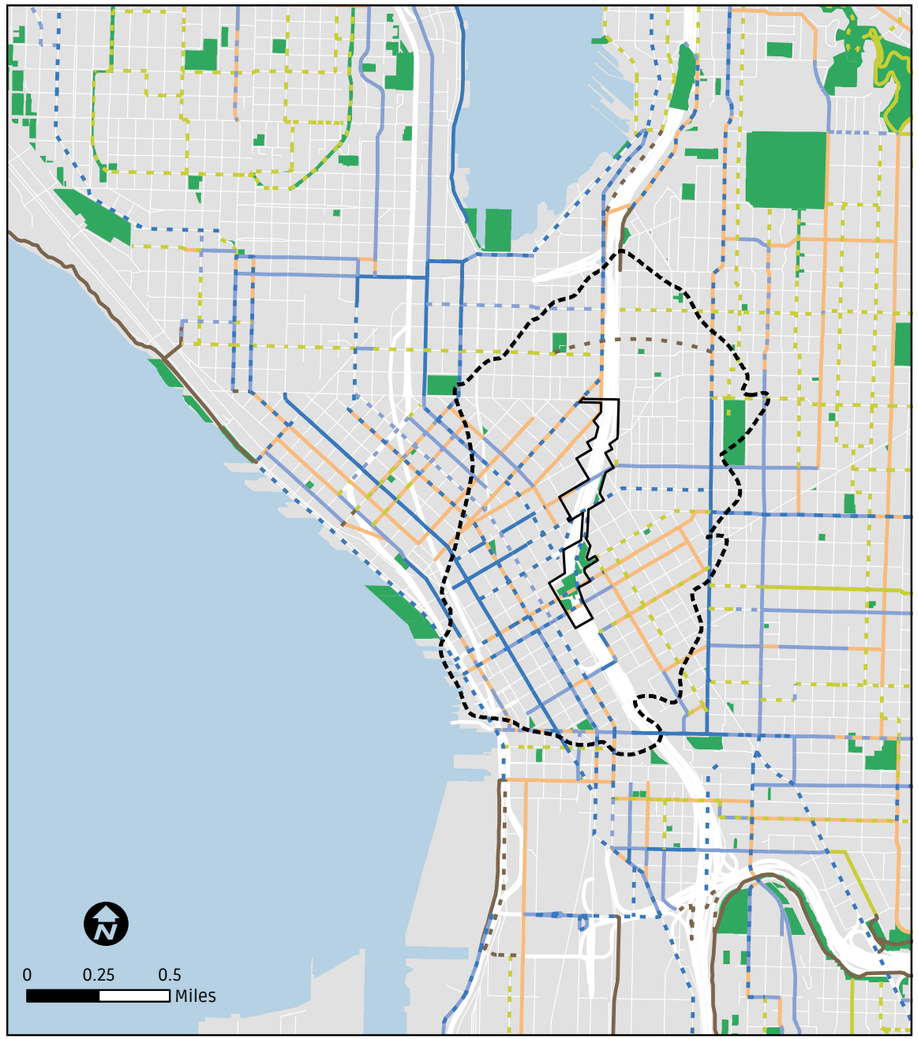
An analysis of origin-destination bicycle flows across I-5 overpasses reveals a similar travel pattern for bicycle traffic across the freeway (Figure 7-23). Pike and Pine Streets are the preferred bicycle routes across I-5, compared to other overpasses north of Pike Street. Madison Street again reveals a similar preference for cyclists as a route over I-5, south of Pike Street. Volume by direction of travel is likely influenced by roadway grade and elevation gain, given the study site's topography.

Protected bike lanes running east-west are planned for Pike, Pine, Seneca and Spring Streets (Figure 7-21). North-south bike facilities downtown run on 2nd, 4th and 5th Avenues. Broadway is a major north-south cycling connection through Capitol Hill and First Hill (SDOT, 2014).

Multiple factors, including road design, site topography, lack of direct paths and adequate pedestrian and bicycle facilities, generate significant road safety issues near the study site (Figure 7-24). Notably, complex intersection configurations and the confluence of more than two roadways and/or freeway ramps result in significant risk for people walking and biking. The intersection of Pike and Boren had the highest number of collisions in the study site, followed by 5th Avenue and Spring Street, 6th Avenue and Spring Street, Pine Street and Boren Avenue, and Melrose Avenue and Pine Street.

Although downtown neighborhoods have relatively high multimodal access and walkability, I-5 continues to present an east-west barrier for human-scale mobility through downtown.

Figure 7-21. Bicycle Facilities and Multi-Use Paths in Greater Downtown



Existing and planned bicycle facilities (City of Seattle, 2018c)

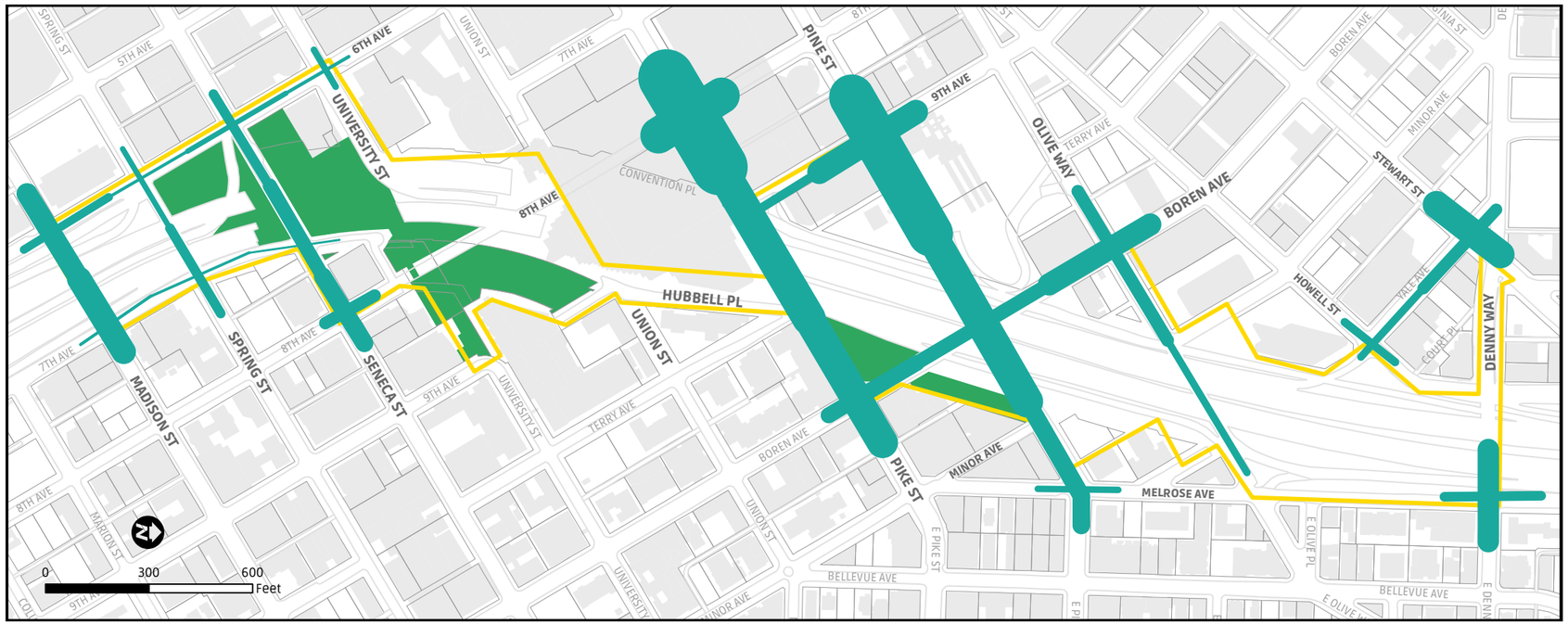
Figure 7-22. Pedestrian Volumes on I-5 Overpasses, 2018

Legend

- Structural Assessment Boundary (Study Site)
- Parcel Line
- Roadway Pavement Edge
- Park and Open Space
- Building Outlines

Pedestrian Volumes

- 100
- 500
- 1,000



Weekday PM peak period (4-6pm) pedestrian volume assembled from 2015-2018 SDOT Intersection Turning Movement Counts and 2016-2018 SDOT NBPD Pedestrian and Bike Counts (City of Seattle).

Figure 7-23. Bicycle Flows on I-5 Overpasses, 2018

Legend

- Structural Assessment Boundary (Study Site)
- Parcel Line
- Roadway Pavement Edge
- Park and Open Space
- Building Outlines

Bicycle Flows

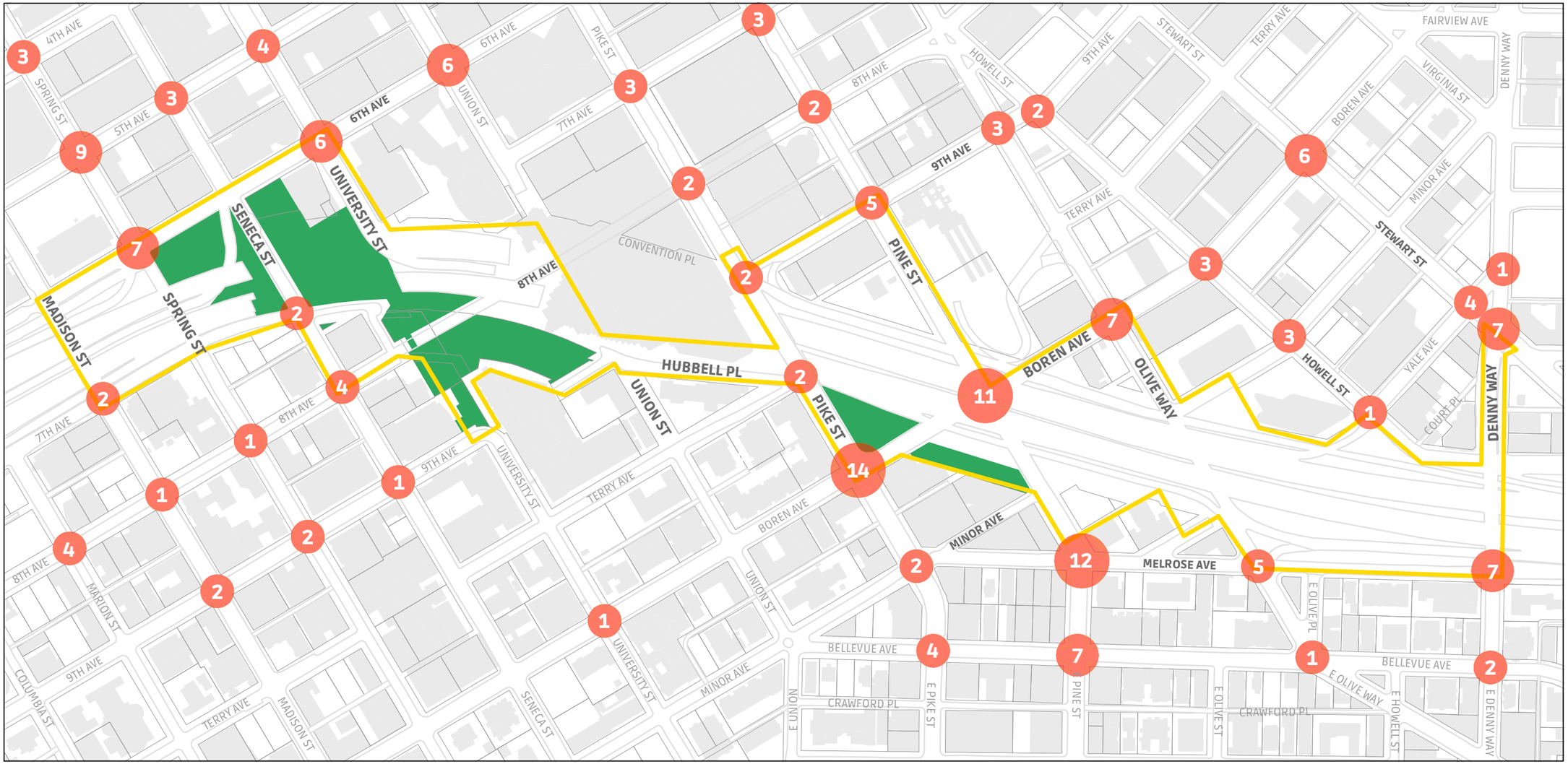
- Low
- Medium
- High

Travel Direction

- Eastbound
- Westbound

Observed bicycle counts were not available for this study. To estimate the relative use of the overpasses by people biking, an analysis of origin-destination bicycle flows across I-5 for the 2-hour PM peak period (4:00–6:00 PM) was performed, using 2018 origin-destination data. Eastbound and westbound bicycle flows across the overpasses were backchecked and interpolated using historical bicycle counts available at three study site locations.

Figure 7-24. Pedestrian and Bicycle Collisions In and Near the Study Site



Legend

- Structural Assessment Boundary (Study Site)
- Parcel Line
- Roadway Pavement Edge
- Park and Open Space
- Building Outlines
- Collisions

0 300 600 Feet

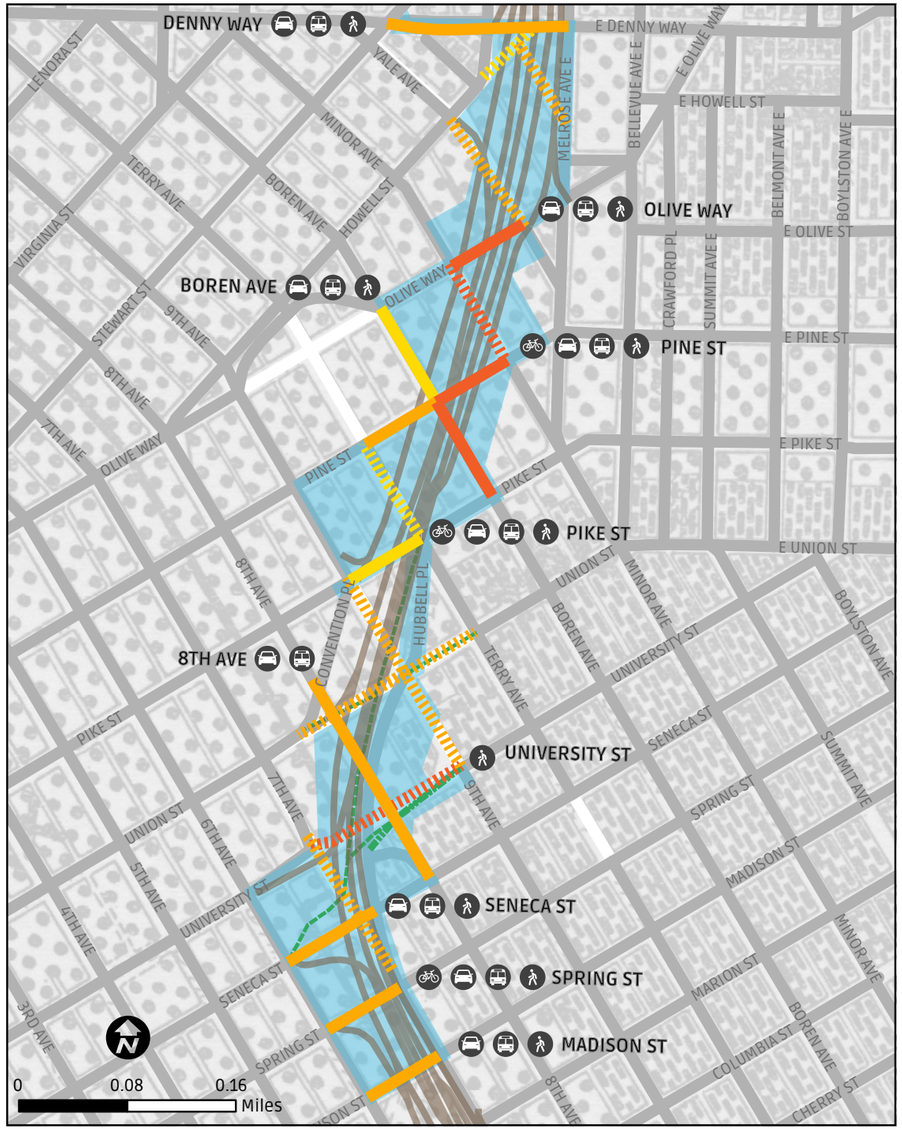
5-year pedestrian and bicycle collision data from January 2014-January 2019. (City of Seattle, 2018b)

Street Grid

Seattle's original street grid is challenged by three different orientations, resulting from a tension between city founders on whether the grid should follow cardinal directions, or the angle of the waterfront. The grid shift leads to some confusing areas, especially in the Denny Triangle area, with a "wedge" between Olive Way and Stewart Street. Even so, the grid prior to the construction of I-5 was relatively connected as it moved away from the waterfront and kept block size approximately to a 300- by 300-foot grid.

The construction of I-5 severed nine of 18 east-west connections, particularly Minor, Yale, and Terry Avenues. The loss of these connections disrupted the traditional grid. The recent growth of the adjacent neighborhoods has made a reconstruction of the lost connections between Capitol Hill and Denny Triangle/South Downtown increasingly important (Figure 7-25).

Figure 7-25. Historical vs. Current Street Grids in the Study Site



The street grid prior to the construction of I-5 was relatively connected as it moved away from the waterfront, as shown in the underlying image from the historical 1923 zoning map for downtown Seattle (City of Seattle, 2016). The figure illustrates the missing street connections that pre-date the construction of I-5 in the 1960s.

Transit

The neighborhoods adjacent to the study site are transit rich and have great multimodal mobility options. According to Commute Seattle's 2019 Center City Commute Mode Split Survey, walking, cycling and transit have become the most popular modes of travel, capturing more than 70 percent of downtown's estimated 247,000 daily commuters over single-occupancy vehicle travel (EMC Research, 2019).

Five Sound Transit Link light rail stations are within the 15-minute walkshed of the study site. With over 30 routes, King County Metro and Sound Transit provide a dense network of bus routes that either stop within or pass through the study area.

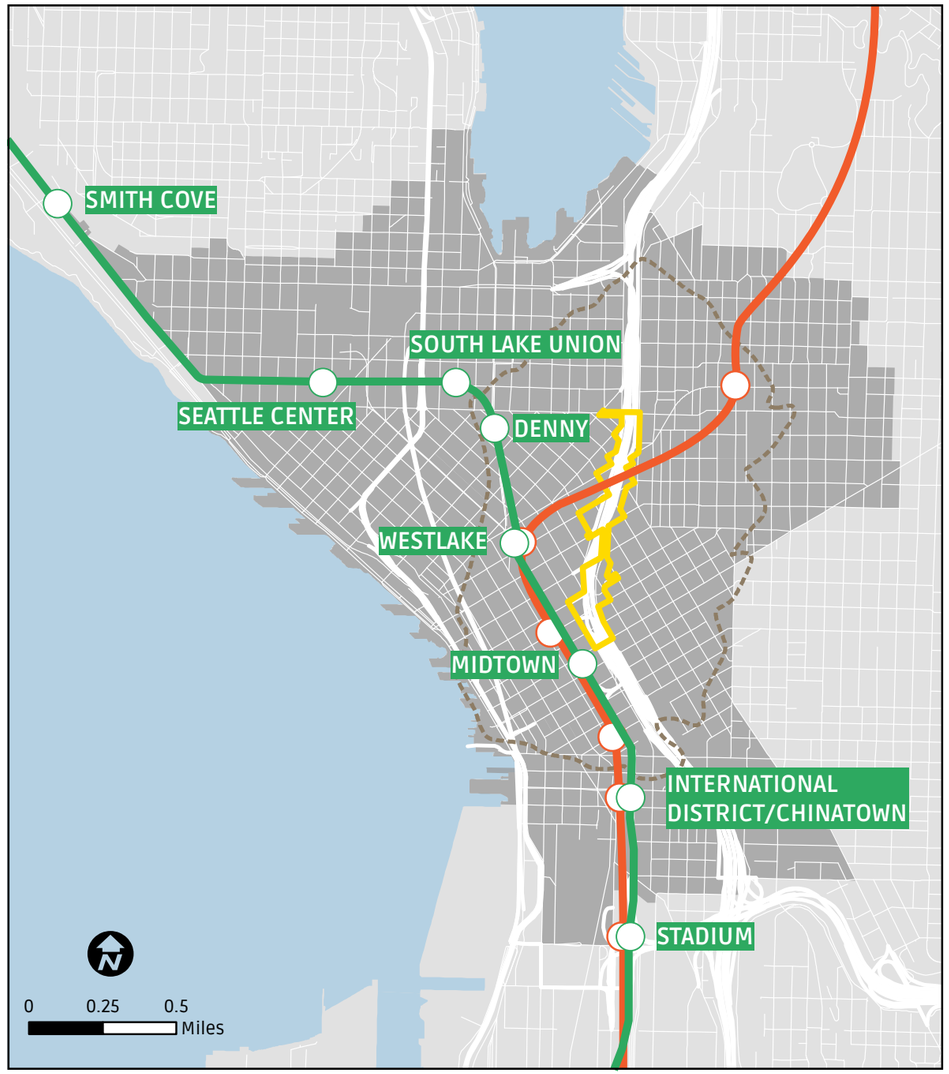
Weekday Daily Peak Transit Loads (King County Metro, 2018) shows that Denny Way is the most heavily traveled transit street, followed by Pine Street. Smaller volumes run on Madison, Spring and Seneca Streets. No routes travel north-south along surface streets in or near the site, making travel between parts of First Hill and Capitol Hill and South Lake Union indirect and time-consuming. Figure 7-26 shows the City of Seattle's transit street designations.

The planned expansion of the light rail network, including three new stations at 5th Avenue and in the Denny Triangle/South Lake Union neighborhood, will significantly increase transit access to the study site and adjacent neighborhoods (Figure 7-27) by 2035.

Figure 7-26. Transit Street Classifications

Source: (City of Seattle, 2019b)

Figure 7-27. Light Rail Access to the Study Site



Existing and proposed Sound Transit ST3 light rail stations (City of Seattle, 2018c)

Photo Credit: Gerardo Martinez Cons; iStock / Getty Images Plus

7.9 Infrastructure and Utilities

I-5 through the study site features extensive walls that support city streets on each side of the right-of-way, elevated viaducts, overpasses, on- and off-ramps, and city streets and buildings (Figure 7-28). There are also many subsurface features (e.g., tunnels, utility mains, and laterals).

There are 15 independent bridge structures and 33 different wall structures of cast-in-place (CIP) construction. The bridges are CIP box girders, slabs, or t-beams. The walls are either CIP cylinder walls or conventional CIP retaining walls.

Existing utility systems (Figure 7-29). (e.g., storm drain, sanitary sewer, water, gas, electrical, communications) are well developed and generally have adequate capacity to support current land uses and previously planned development.

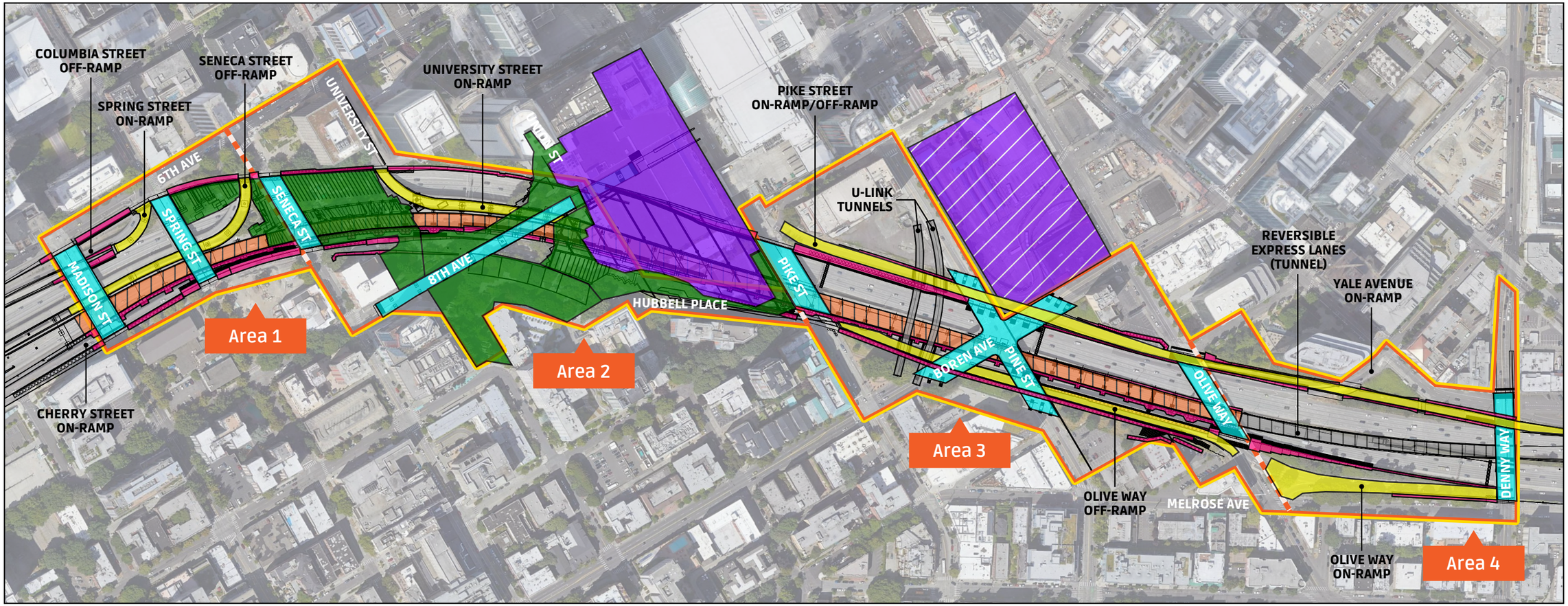
Some infrastructure, such as existing water, sewer, storm, power and communication systems, may not have adequate capacity to meet future demand for a new neighborhood on the study site. Most of these utilities are in city streets. Water lines do not cross over I-5 in the area of the lid study site and generally stay on the city streets.

I-5 separates the city water system into two different water pressure zones. The south pressure zone is to the west of I-5 (326 feet pressure head) and the Volunteer Park pressure zone is to the east of I-5 (530 feet pressure head). Most stormwater from the densely populated portions of Capitol Hill drains to the swale on Yale Avenue.

The water system crosses I-5 just south of Denny Way. West of the project area, the stormwater enters a combined sewer area. Two sanitary sewer basins cross the project limits. A lid could act as green infrastructure with sustainable ways to support new development in addition to potentially reducing pressure on existing sewer systems.

Approximately 30 percent of the runoff of the Capitol Hill basin would could be treated or retained on the lid, reducing runoff and pollution to our waterways and reducing excess demand of our existing infrastructure/sewer system.

Figure 7-28. Noteworthy Existing Elements and Structures within the Study Site



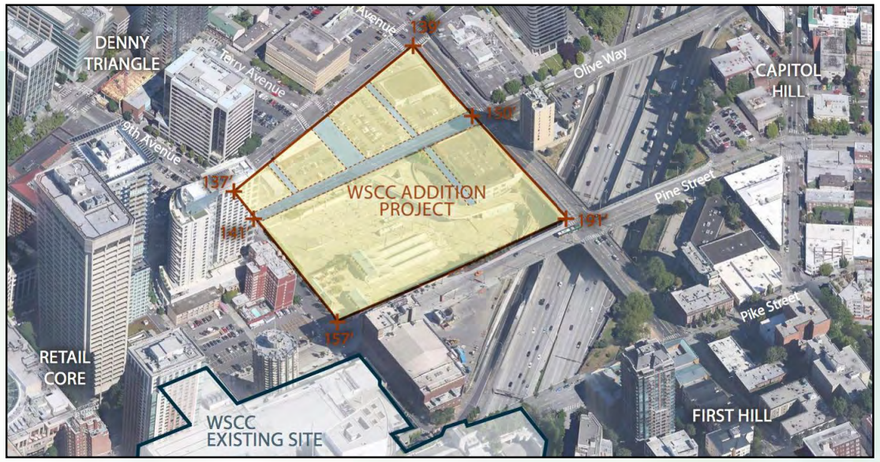
Legend

- Structural Assessment Boundary (Study Site)
- Area of Analysis
- Area Limit

Existing Elements and Structures

- NB I-5 (Elevated Structure)
- Overpasses
- Reversible Express Lanes
- On/Off Ramps
- Tunnels
- Freeway Park
- WSCC
- WSCC Addition
- Walls

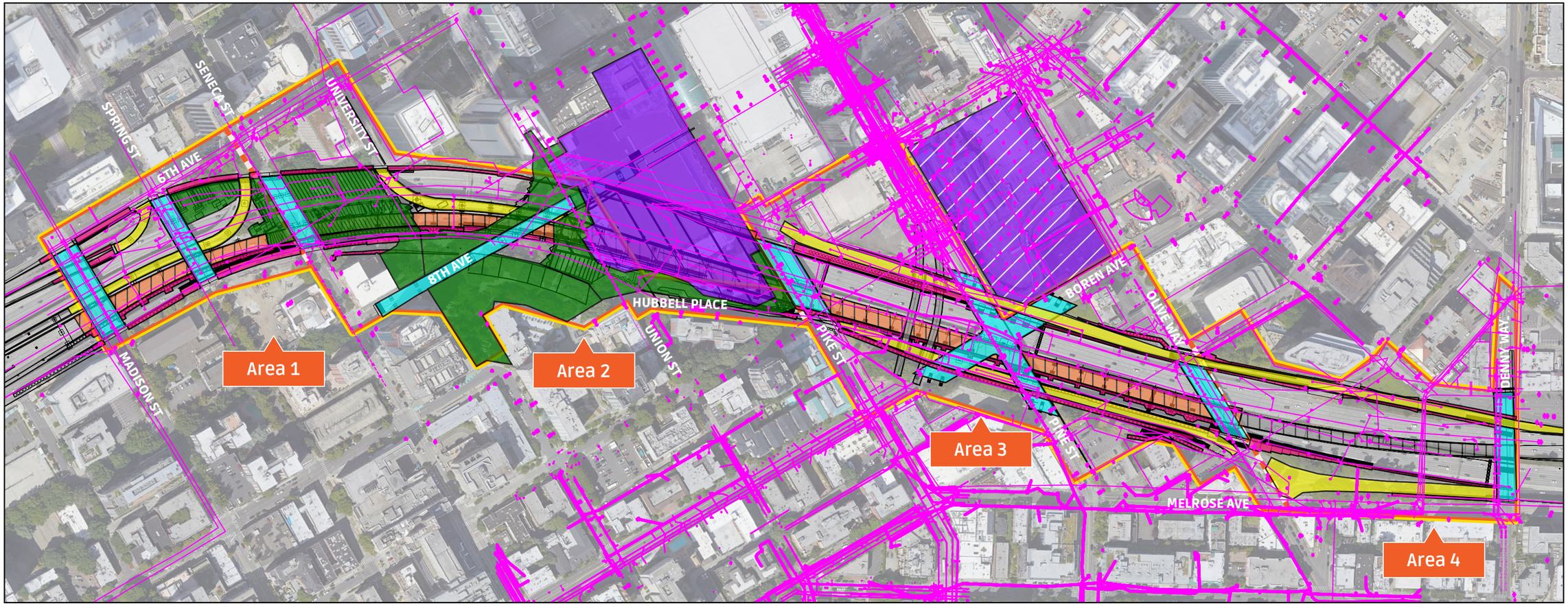
0 300 600 Feet



Washington State Convention Center (WSCC) Addition Project at the corner of Pine Street and Boren Avenue

Photo Credit: LMN Architects

Figure 7-29. Utilities within the Study Site



7.10 Topography

The location of the study site across a hillside creates a significant design challenge. The study site experiences grade variations in each cardinal direction (Figure 7-31).

Not a single section of the study site is flat, generally sloping down to the west and fluctuating north and south on I-5. This condition creates unique challenges and greater complexity and impacts in terms of connectivity and access, as well as in terms of edge conditions for the pedestrian environment (Figure 7-30).

The differences in elevation between mainline I-5 and surrounding surface streets are significant. Significant grade changes of up to 40 feet are in some sections of the study site. Establishing new pedestrian and bike connections on and across the study site would require a series of vertical pedestrian assists. Figure 7-32 further illustrates the grade variation in this cross-section of the study site near Spring Street, showing an east-west section at the Spring Street bridge with the dashed green and blue lines showing the heights of the adjacent bridges to the north and south.

Figure 7-30. Existing Edge Conditions along I-5

View of the north edge of the Pike Street Bridge over I-5, from Convention Place.

Figure 7-31. Topography through the Study Site

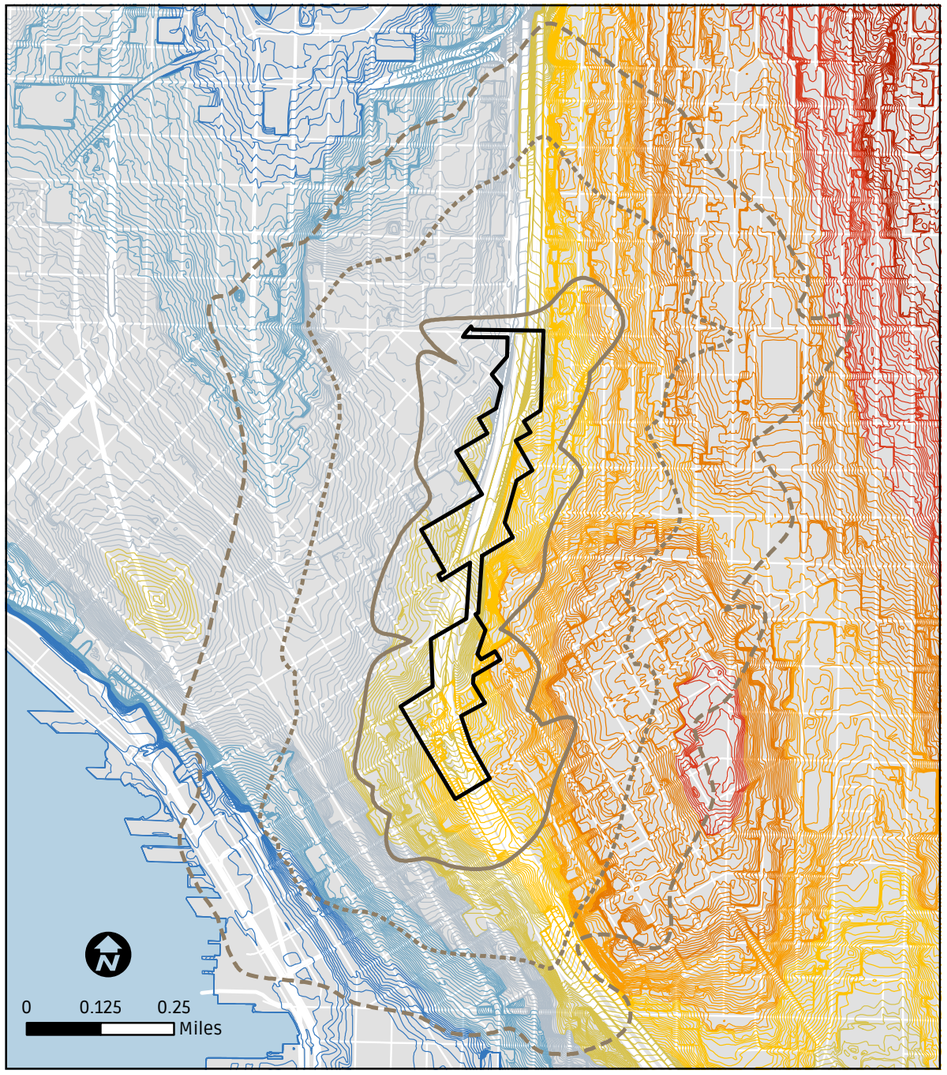
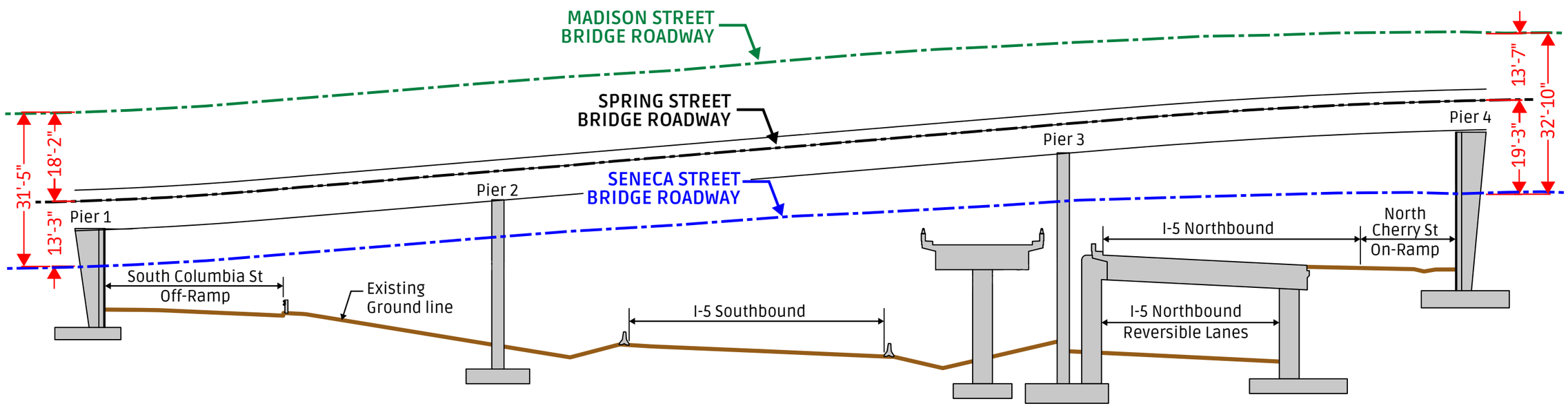


Figure 7-32. Grade Variation near Spring Street Bridge (north-facing view of I-5)



↑ Grade variation cross-section showing an east-west section at the Spring Street bridge with the dashed green and blue lines showing the heights of the adjacent bridges to the north and south.

← North-facing view of Spring Street from the Seneca Street off-ramp.

7.11 Seismic Vulnerability

Earthquakes are an unavoidable natural hazard facing Seattle and the Pacific Northwest region. I-5 is considered a lifeline route, according to the State Facilities Action Plan (PSRC, 2018), which confers it as a priority in terms of retrofit relative to other infrastructure not on lifeline routes. However, as noted in the State Facilities Action Plan (Figure 7-33), the stretch of the I-5 corridor through Seattle is considered a "High Cost Corridor Segment," with alternate routes identified as lifelines into and out of the city. As such, the 15 independent bridge structures and 33 wall structures within the study site extents may be vulnerable in a major seismic event. These structures, which will have exceeded their 75-year design life as defined by American Association of State Highway Transportation Officials by the time the lid structure could be built, would need to be assessed in future studies. Similarly, the seismic performance of a lid structure supporting a wide range of loads (e.g., open space to buildings) in a high seismic region would need to be further assessed in future phases of analysis. In any scenario, damage to I-5 structures through the study site could impair emergency services and economic activity for months, if not years.

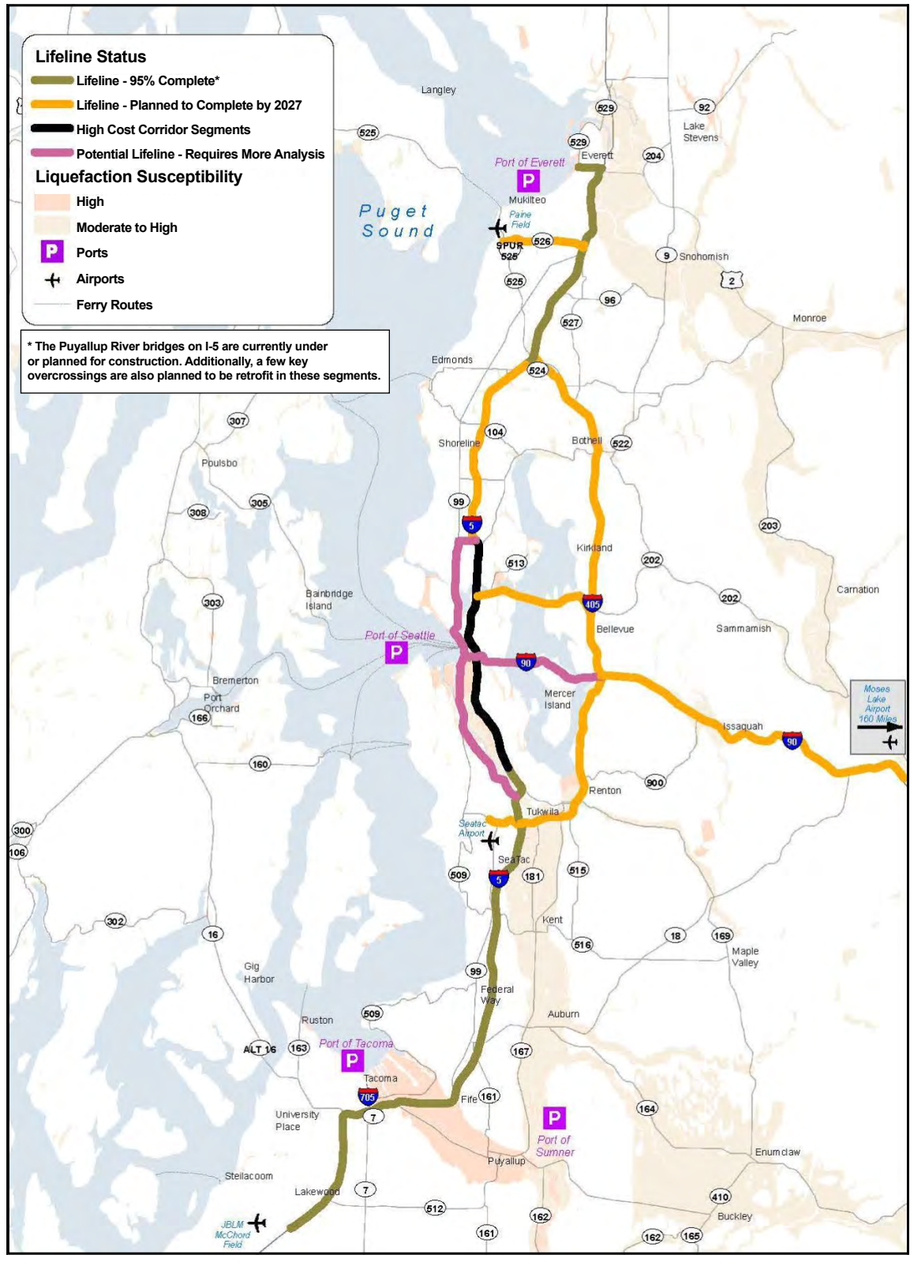
7.12 Environmental Quality

I-5 creates significant noise, air pollution, and visual impacts to thousands of people who live and work nearby and walk across it every day. A lid could significantly reduce the environmental burden to surrounding communities and ecosystem.

Air Quality and Emissions

Populations living near heavily traveled corridors like I-5 have higher levels of exposure to traffic-related air pollution in the air they breathe. Pollutants directly emitted from cars, trucks and other motor vehicles are found in higher concentrations near major roads, particularly within 500-600 feet downwind from the vicinity of heavily traveled corridors (EPA, 2014). Many of the pollutants found near roadways have been associated with adverse health effects and increased cancer risk. According to ongoing studies by the Puget Sound Clean Air Agency, diesel is the largest contributor to potential cancer risk throughout the Puget Sound region. Diesel risk contributed over 70 percent of the potential cancer risk at Seattle air pollutant monitoring sites (PSCAA, UW, 2010). EPA research suggests that some transportation design features can reduce traffic-related air pollutants directly downwind of a roadway; therefore, a lid could reduce direct exposure to criteria pollutants within the study area (EPA, 2014).

Figure 7-33. Regional Bridge Seismic Lifeline Routes, 2017



Source: (PSRC, 2018)

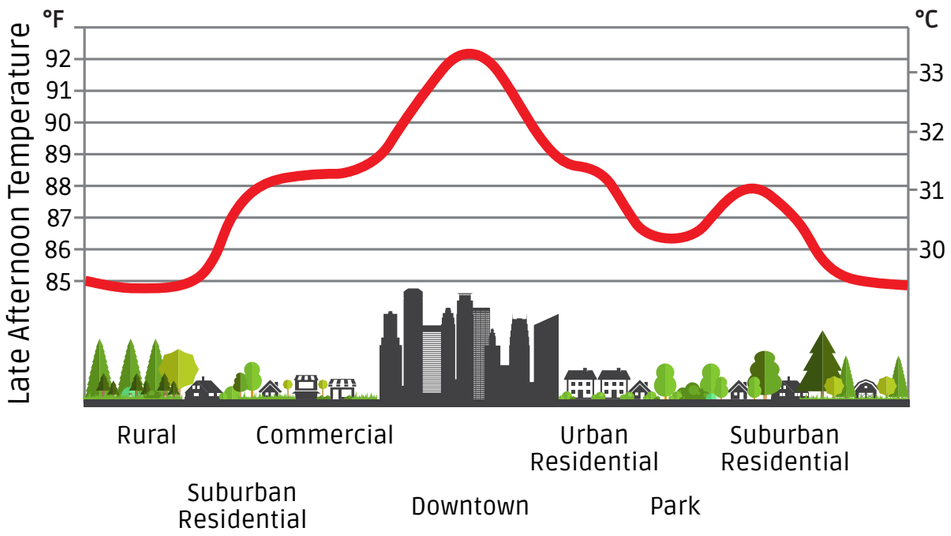
Noise

The study site is burdened with considerable freeway noise that negatively affects quality of life, enjoyment of outdoor spaces, and property values. Ambient noise over 66 decibels qualifies as an affected area, and a level where the State of Washington may offer mitigation with sound walls or berms (WSDOT, 2020c). An environmental impact statement for a project in the corridor showed that existing noise levels at 10 short-term monitoring sites ranged from 70 to 78 decibels, depending on the proximity to I-5 and side streets in the area (WSDOT, 2020e). A lid would act as a noise barrier in cases where it would interrupt the line of sight between a noise source (I-5) and a receiver (FHWA, 1974), and the noise reduction would depend on the material, size, and location.

Urban Heat Island Effect

A lid could enhance the microclimate in downtown Seattle, by modifying the cover over the 0.8 mile of road surfaces, pavements and buildings that elevate localized air temperatures by three to four degrees as compared to the air in neighboring, less developed regions or areas with increased vegetated cover (Figure 7-34). These temperature variations are associated with negative impacts on a community's environment and quality of life. Urban heat islands can lead to increased emissions of air pollutants and greenhouse gases, compromised human health and comfort, as well as impaired water quality from heated stormwater runoff (EPA, 2019).

Figure 7-34. Urban Heat Island Effect Profile



Stormwater and Runoff

A potential lid over I-5 is an opportunity to manage stormwater from parts of the Capitol Hill basin and to reduce the strain on the swale on Yale Avenue, which captures most of the neighborhood's stormwater. A lid could offer opportunities for green infrastructure and sustainable ways to support new development. Approximately 30 percent of the Capitol Hill basin runoff could be treated or retained on the lid, reducing runoff and pollution to the waterways and reducing excess demand of the existing infrastructure and sewer system. An I-5 lid project could also explore the opportunity to treat currently untreated runoff from I-5 itself.

Photo Credit: WSDOT Flickr

8. Technical Feasibility of Lidding I-5

Based on the work conducted for this study—and memorialized in the I-5 LFS Technical Feasibility Memorandum—it is technically feasible to construct a lid over I-5 through downtown Seattle, similar to the existing lids of the Washington State Convention Center (WSCC) and Freeway Park. This engineering feasibility assessment answered the question "where can a lid be built and what can it support?" and surfaced key considerations to factor in constructability, phasing and inform rough-order-of-magnitude cost ranges (which are preliminary in nature based on <5 percent design). The analysis explored the range of technical feasibility of lidding the freeway and established a bookends analysis (maximum and minimum lid areas) to understand the implications for building both the most robust and the leanest lid project, and still deliver a project that is aligned with the value proposition of this study.

From an engineering perspective, it is achievable to build a set of lid structures within the study site capable of supporting various load levels of development.

8.1 Constructability and Engineering Parameters

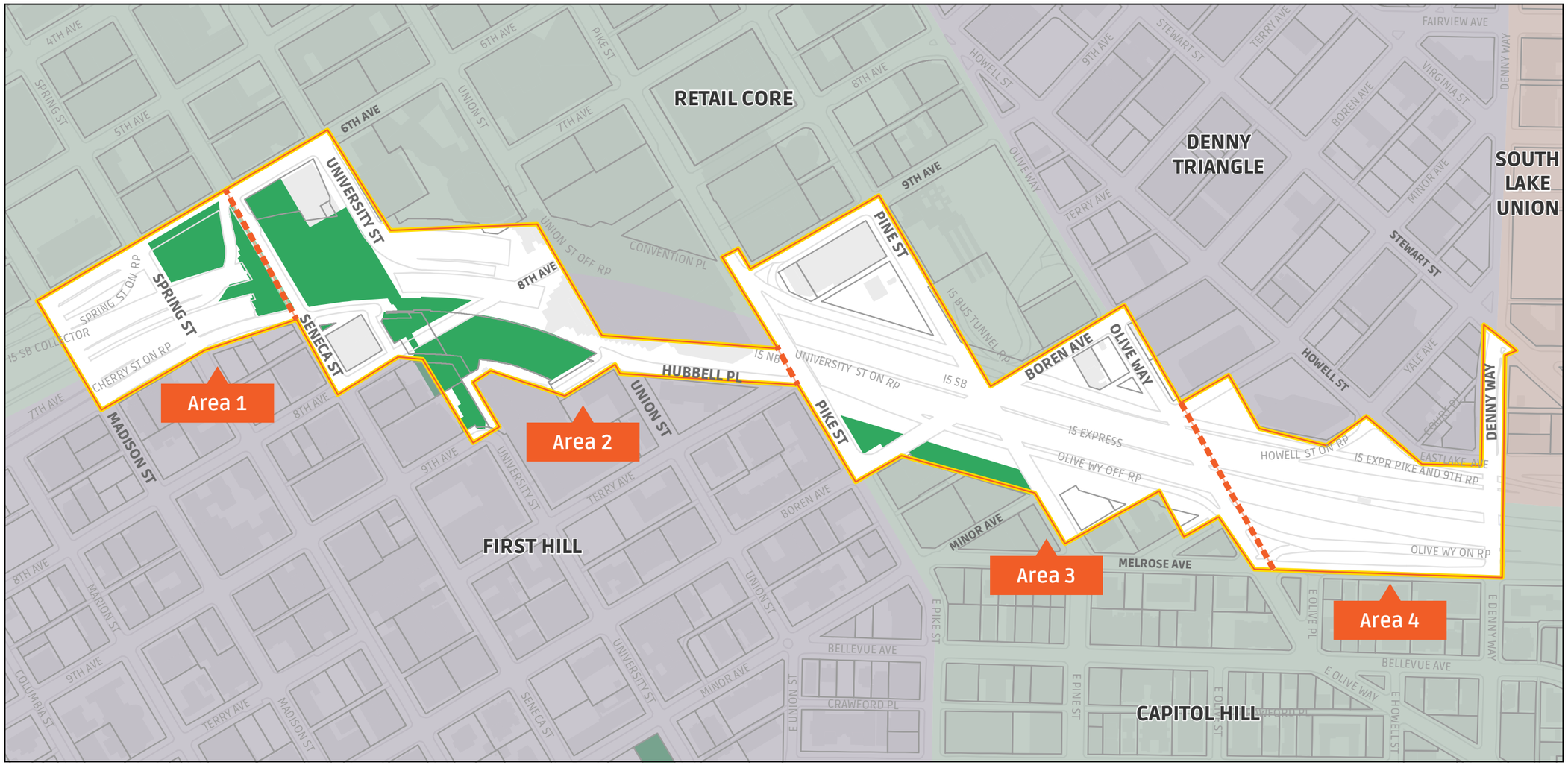
For the purpose of the engineering assessment, the study site was deemed the Structural Assessment Boundary (SAB) (Figure 8-2). From an engineering perspective, it is achievable to build a set of lid structures in the SAB capable of supporting various load levels of development (Figure 8-1). Lidding I-5—a complex, active freeway—could be done without reducing its current capacity and without significant impact on freeway operations as they stand today.

The I-5 LFS was designed to explore the range of technical feasibility of lidding the freeway, to understand the implications for building both the most robust lid project and the leanest lid project, and still deliver a project that is aligned with the value proposition of this study. These two analysis bookends in turn became financial bookends to answer the question on cost range for lidding I-5 through downtown Seattle.

Figure 8-1. Load Levels Considered in Feasibility Assessment

	Open Space Landscaping and pavilions (up to 3 stories)	Low-rise Residential 7 story (5 over 2) Structures	Mid-rise Residential/ Commercial 15 to 20 story Structures	High-rise Residential/ Commercial 45 story Structures
Dead Load (PSF)	1,000	600	2,650	6,815
Live Load (PSF)	250	430	1,150	2,100

Figure 8-2. Structural Assessment Boundary



Legend

- Structural Assessment Boundary (Study Site)
- Area of Analysis
- Area Limit
- Parks and Open Space
- Building Outlines
- Roadway Pavement Edge
- Parcel Line

Area Limits

Area 1: Between Madison Street and Seneca Street
Area 2: Between Seneca Street and Pike Street
Area 3: Between Pike Street and Olive Way
Area 4: Between Olive Way and Denny Way

0 300 600 Feet

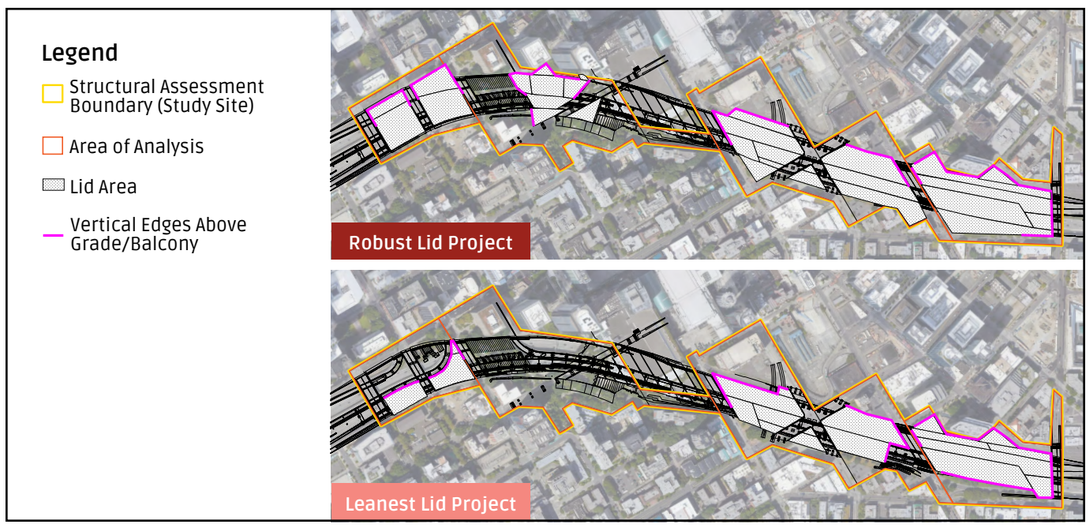
For the purpose of the engineering feasibility, the study site was considered the Structural Assessment Boundary, which was analyzed in four areas of lid development as shown in the present figure. Note: Private parcels, and existing buildings and lids were not considered to be affected or intervened for the purposes of the engineering feasibility analysis. Only edge integration with the existing lid of Freeway Park was assumed.

Table 8-1 captures the considerations to deliver the lid project bookends:

- For the robust lid project, the lid was conceptually designed to carry the highest possible structural load levels (i.e., up to mid-rise load levels), given site constraints, and assumed ramp removal as permissible to allow maximizing the lid area over I-5 right-of-way. High-rise load levels were assumed to be supported on terra firma.
- For the leanest lid project, the lid was conceptually designed to carry the lowest load level (i.e., open space loads) and assumed that the existing on- and off-ramps remained in place.

Table 8-1. Considerations for Construction of Lid Project Bookends

Consideration	Robust Lid Project	Leanest Lid Project
Lid Area	Maximum	Minimum
Load Levels	Mid Rise	Open Space
Ramp Removal	Yes	No
Lid Structure Seismic Classification	Critical	Essential
Discipline Specific (e.g., Fire, Life Safety, Utilities, Constructability, etc.)	High End	Low End
Overpasses Remain in Modified Form	Yes	Yes
Pedestrian Access Improvement at WSCC (along Hubble Place)	Yes	Yes

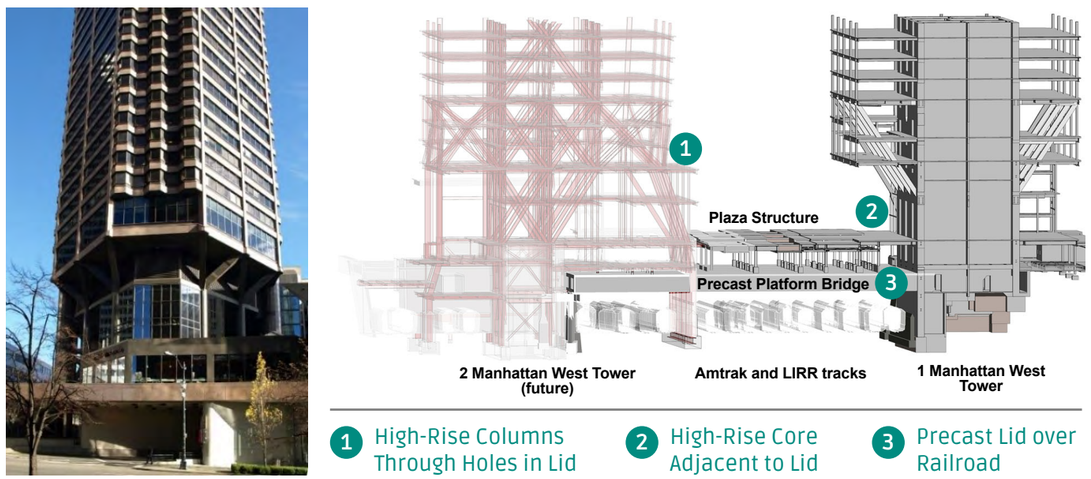


8.2 Lid Structural Framing

In order to define the lid's conceptual structural feasibility, only conventional bridge framing options were considered—namely, prestressed, precast concrete girders and steel-plate girders. From a vertical development perspective, it was considered conventional to frame an opening within a lower story to allow for an at-grade off-ramp to pass through the building. Figure 8-3 shows examples of conventional framing from the Manhattan West Towers in Hudson Yards in Manhattan and the Seattle Municipal Tower. Thought was given to other more creative and unique structure types and framing ideas; however, it was determined that to understand their feasibility would require a more in-depth assessment due to the geometric challenges and the vertical development load levels being considered. In addition, unique structure and framing types are likely more costly.

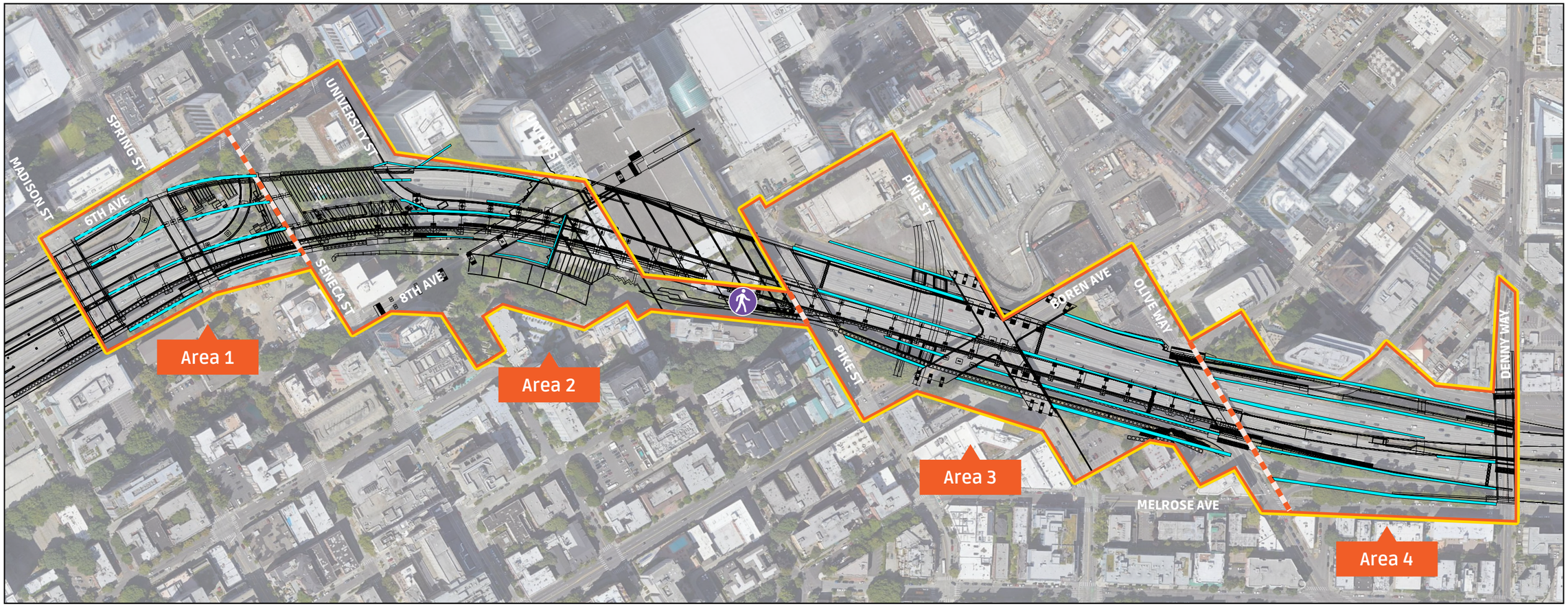
The focus on conventional means of framing provided a basis for technical feasibility and facilitated initial discussions with project stakeholders and interdisciplinary team members. It is anticipated that alternative framing concepts will be investigated in future studies. Figure 8-4 shows the associated identified potential pier locations (cyan lines) for a new lid structure through the SAB considered for the robust lid project.

Figure 8-3. Conventional Vertical Development Framing



Examples of conventional building framing considered: Seattle Municipal Tower (left) and the West Towers in Hudson Yards in Manhattan (right) (Petrov, Biswas, Johnson, & Seblani, 2019).

Figure 8-4. New Lid Structure Potential Pier Locations for a Robust Lid Project



8.3 Lid-Area Concepts (Geometric Layouts)

Lid-area concepts were developed based on a build zone assessment, detailed in the I-5 LFS Technical Feasibility Memorandum. Based on the conceptual geometric lid layouts within the SAB, the maximum lid-area potential for a robust lid project (Figure 8-5) and minimum lid area considered for the leanest lid project (Figure 8-6) within the study site are 17.4 acres and 11.5 acres, respectively.

As stated in the assumptions, for the purpose of the bookend analysis of the most robust lid project, removal of on- and off-ramps was deemed permissible. However, a comprehensive transportation and traffic network study, as well as utility impacts (temporary or permanent), would be necessary to evaluate the factual feasibility of these lid concepts, because removing on- and off-ramps could require significant costs to replace the function of access to downtown streets. In addition, a traffic study would be necessary to inform constructability and staging alternatives if this project were to advance to further stages of engineering and design. Urban design and site program could significantly shift the needs and configurations of these structures to be able to provide access, as well as functional and aesthetic design.

It is important to note that the load capacity potential of the conceptual geometric lid layouts is not even across the SAB nor within each lid subsection (Figure 8-7; Figure 8-8). This is an important consideration in terms of the possible development program and capacity of each test case considered, with significant urban design implications.

Since not all lid areas are created equal, the cost per square foot of a lid is not equivalent across the four lid areas of the SAB given the specific challenges and opportunities each lid area presents. High-load lid subareas would also have higher structural requirements that would result in higher lid capital costs. This is further explored in the economic and financial feasibility assessment (Chapter 10).

The resulting lid configurations are not flat or contiguous surfaces from edge to edge, given the topographical conditions of the site, and the constraints existing structures and ramp access impose.

8.4 Vertical Clearance and Edge Integration Challenges

Existing overpasses and structures (Figure 7-28) along the SAB pre-date current vertical clearance requirements. Any new lid structure would require meeting the 16-foot 6-inch minimum vertical clearance over existing I-5 structures, presenting significant challenges for edge integration with the surrounding urban context, and grade differences ranging from 5 to 15 feet from lid surface to the adjacent street grid and bridge overpasses, and up to 45 feet above the adjacent street grid below (refer to pink lines in Figure 8-5 and Figure 8-6 depicting vertical grade separation).

In addition to vertical clearance considerations, the existing topography of the site imposes additional challenges for structural framing and would be an important consideration for the new lid structure during design stages. Lid configurations resulting from this technical assessment are not flat or contiguous surfaces from edge to edge, given the topographical conditions of the site, and the constraints existing structures and ramp access impose. This can significantly affect the connectivity and accessibility potential for walking and cycling linkages both east-west and north-south. Figure 8-9 illustrates a representative cross-section showing the vertical grade separation from the surface of the lid to the surrounding context, significantly limiting lid edge integration. Unique design solutions would be required to maximize functionality of a lid development program, both to integrate buildings and allow vehicular and pedestrian access.

The lid framing could be built flat but would create large balconies above adjacent streets on the west edge of mainline I-5. The new lid could be framed to follow the grade variation of the site to minimize balconies; however, this would create a variable sloped lid surface that would not easily accommodate new vertical development.

Vertical Circulation

Lid edge integration challenges could be addressed by incorporating buildings and/or vertical circulation mechanisms across the SAB (Figure 8-10). A solution that involves buildings would require significant consideration on planning and project-delivery alternatives, to ensure capital cost efficiencies could be achieved through integrating the structural elements of both the lid and the buildings.

Given the above, it is important to note that the construction of a lid would not be equivalent to creating “flat land,” particularly if considered for vertical development. Any vertical development would need to be planned in tandem with the engineering design in future phases. This has important considerations affecting project delivery, governance models, financing, as well as considerations for the type of uses that could be accommodated on the lid. (For example, sites without terra firma available cannot accommodate underground parking for certain building types.)

Figure 8-5. Maximum Lid-Area Potential Considered for a Robust Lid Project

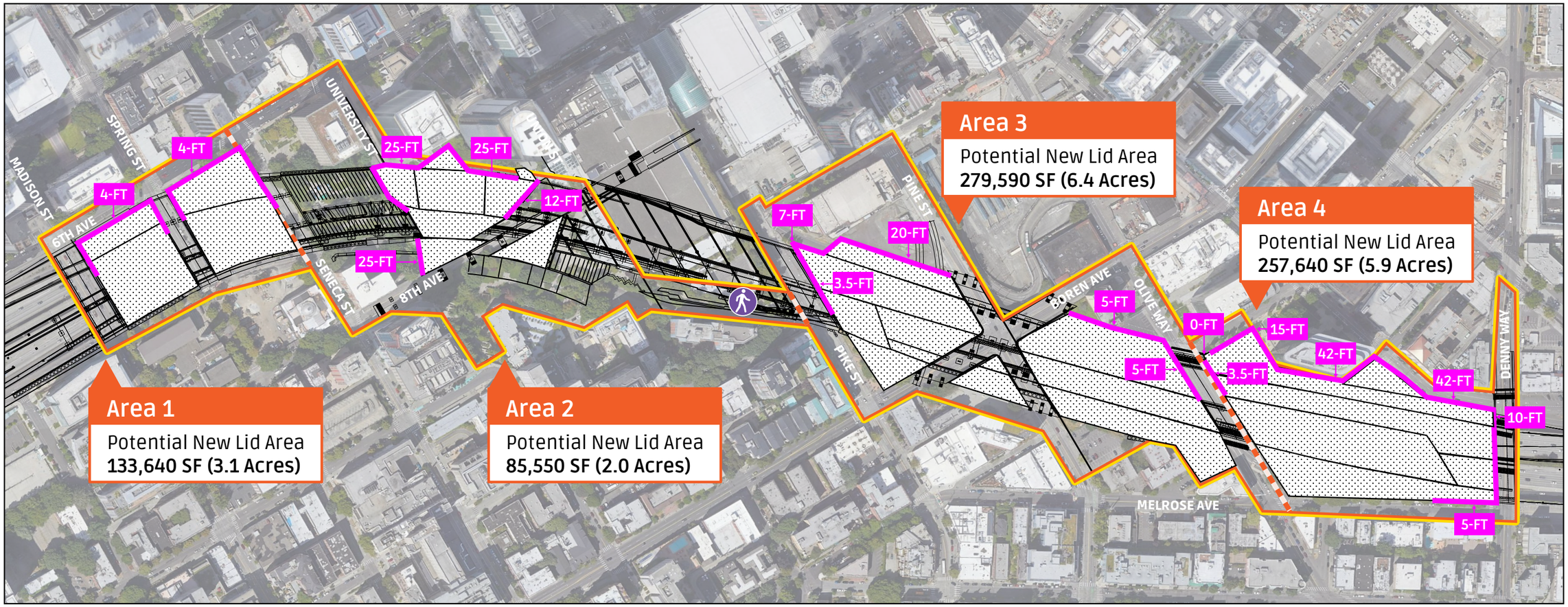
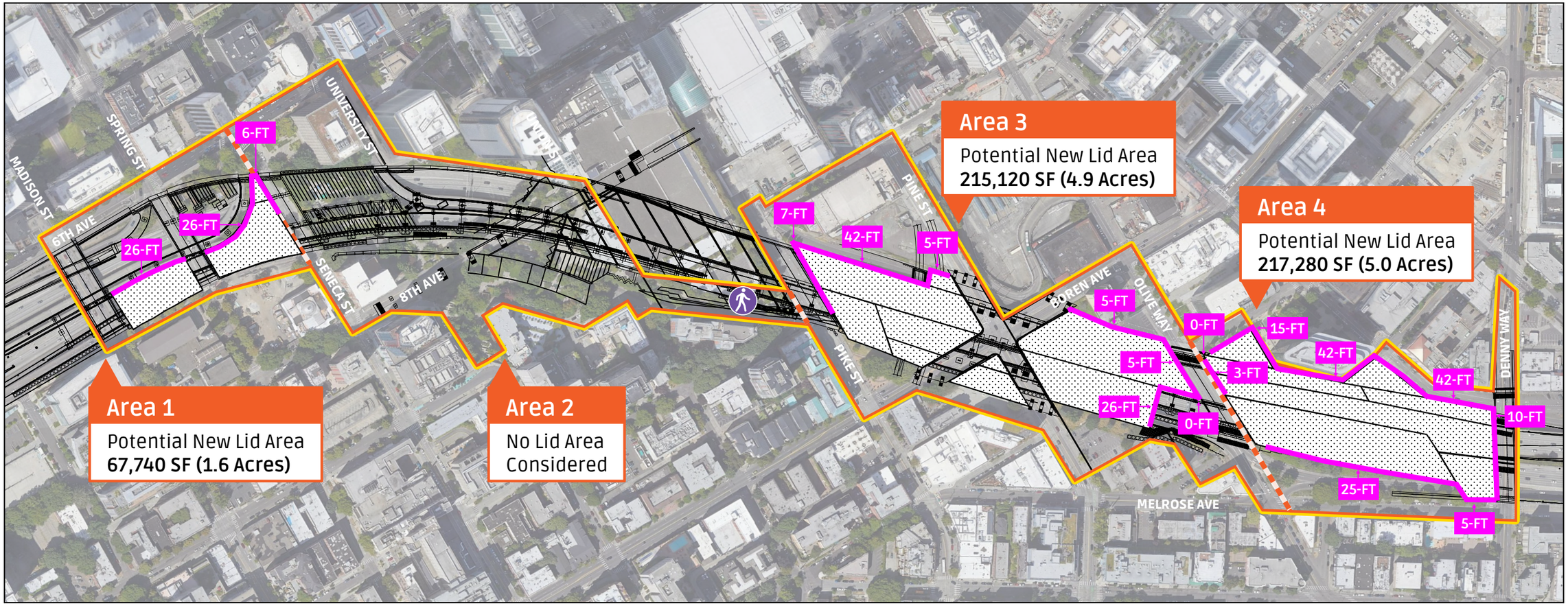


Figure 8-6. Minimum Lid-Area Potential Considered for the Leanest Lid Project



Legend

- Structural Assessment Boundary (Study Site)
- Area of Analysis
- Enhancement of the WSCC Pedestrian Walkway along Hubbell Place Considered
- Area Limit
- Lid Area
- Vertical Edges Above Grade/Balcony

Total Lid Area in SAB: 500,140 SF (11.5 Acres)

SF = Square Foot

0 300 600 Feet

Figure 8-7. Highest Load Levels for Maximum Developable Lid-Area Potential for the Robust Lid Project

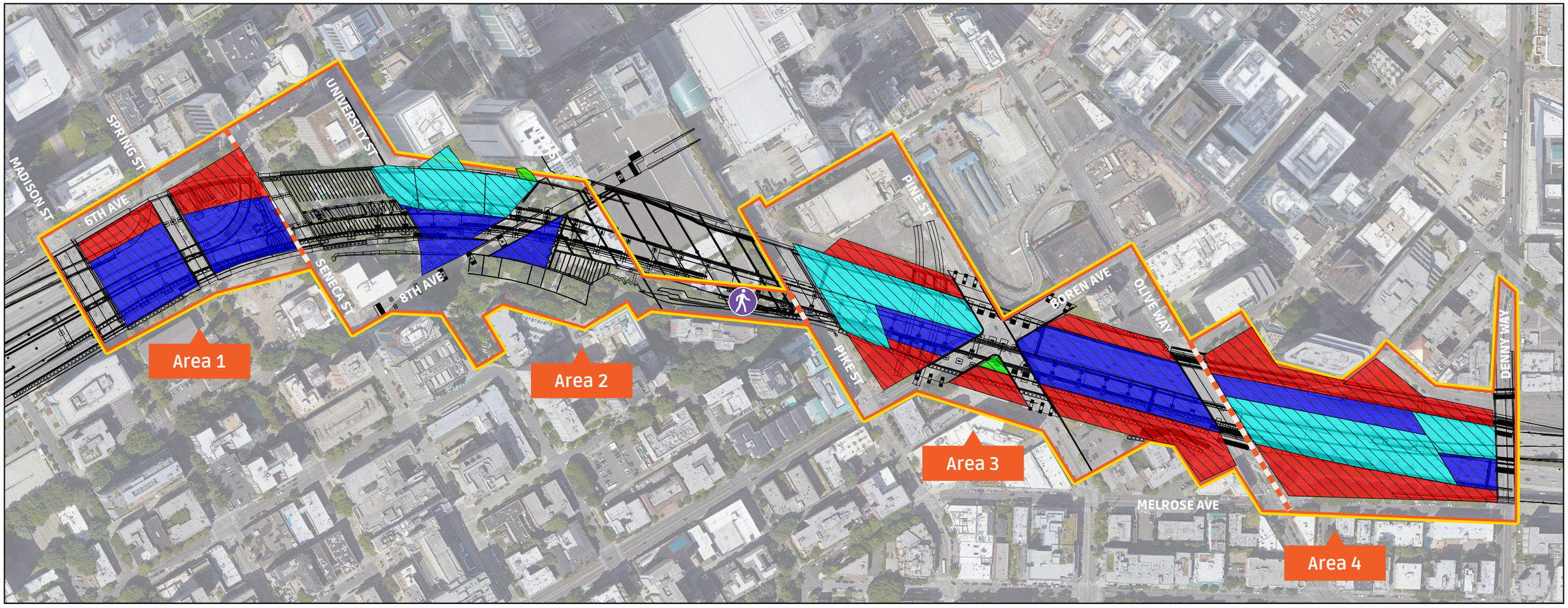


Figure 8-8. Highest Load Levels for Minimum Developable Lid-Area Potential for the Leanest Lid Project

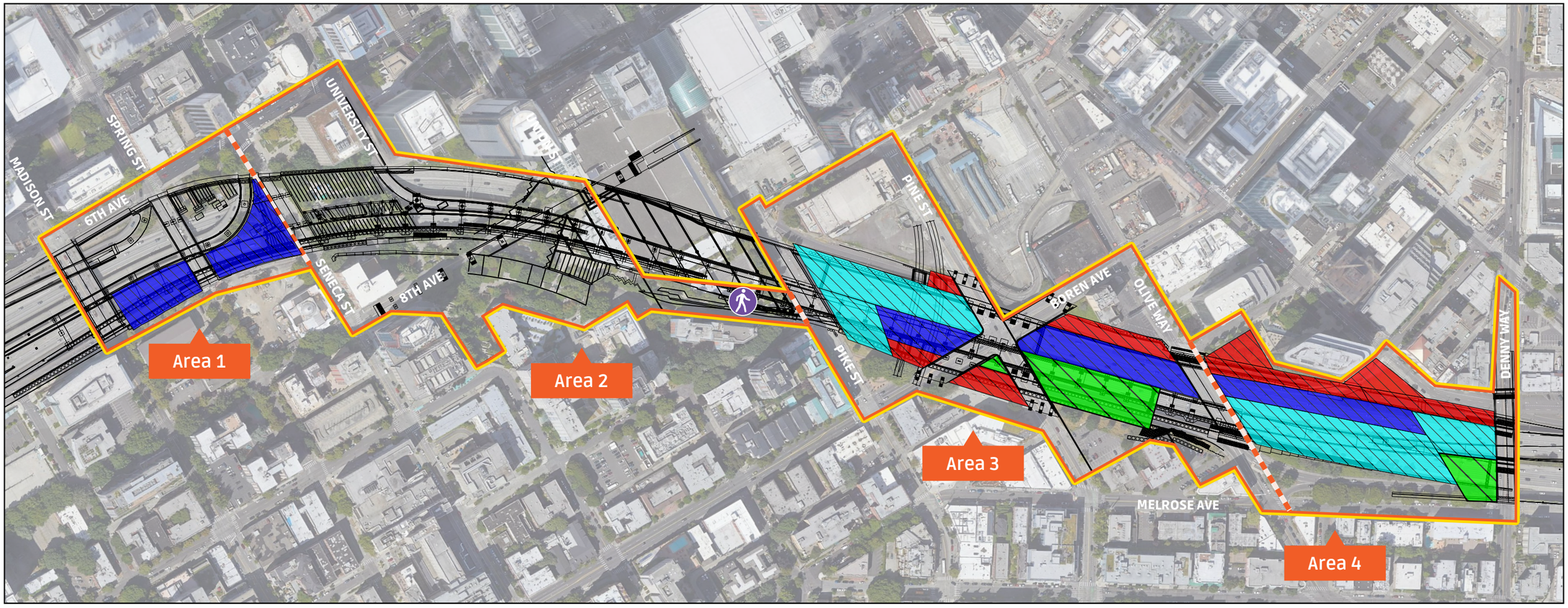
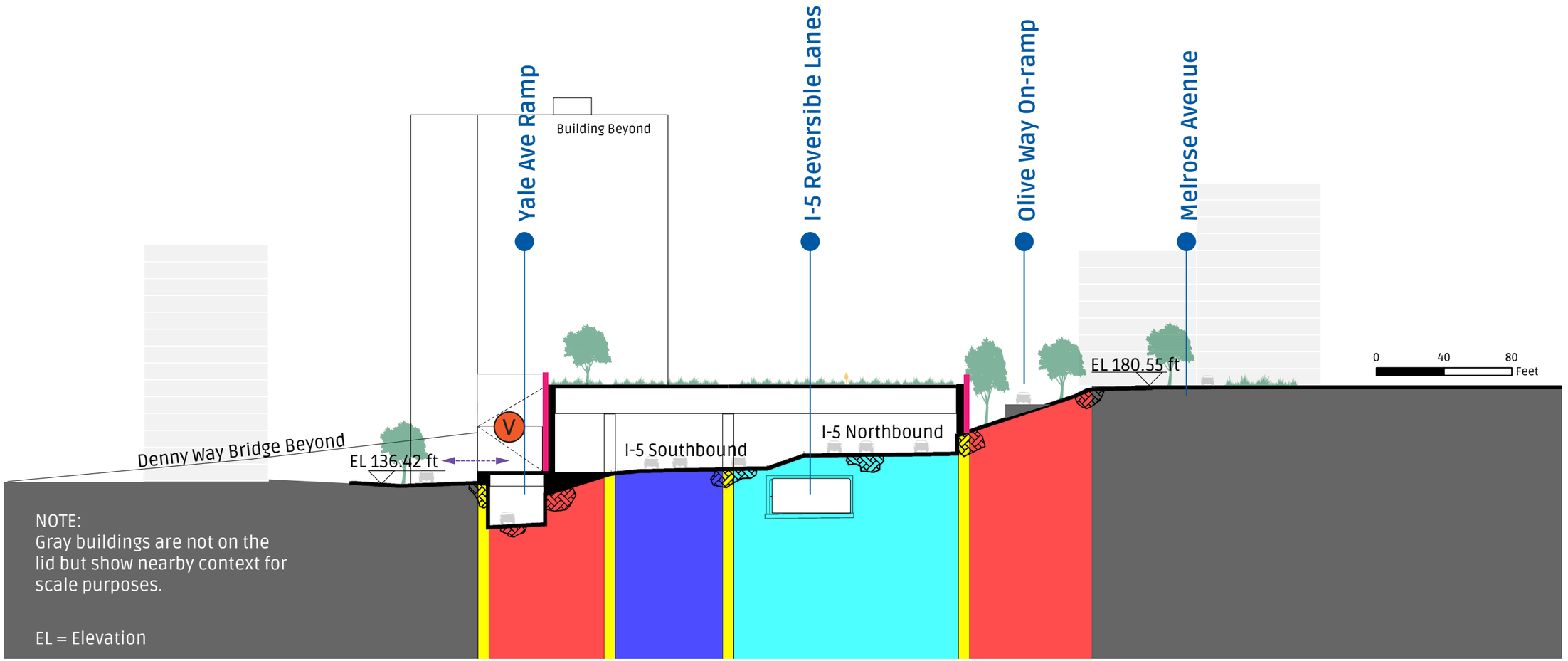
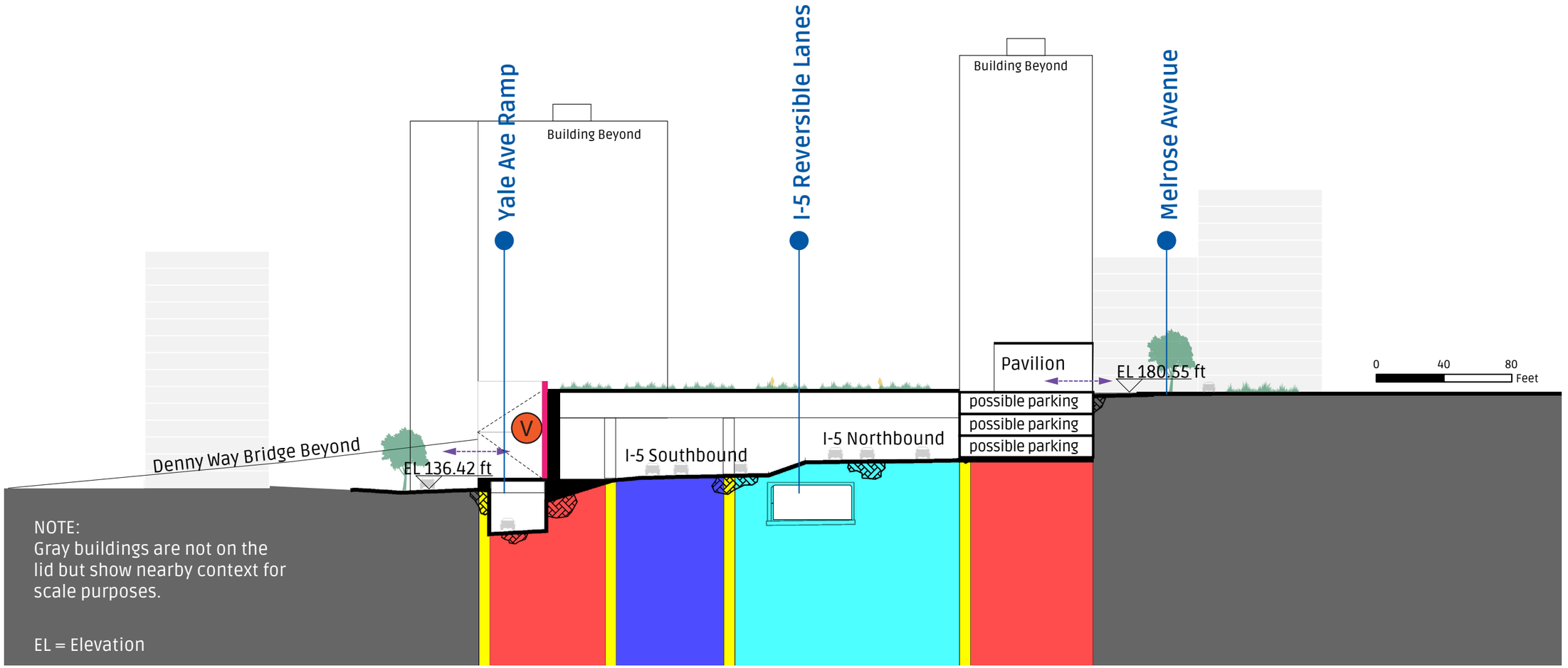


Figure 8-9. Schematic Cross-Section of a Low-Load Lid over I-5 (Area 4)



Pink vertical lines represent vertical edges of the lid that would be above-grade and experienced as “balconies” from the lid level. This is a representative cross-section of a conceptual open-space lid in Area 4, between Denny Way and Olive Way, where the most notable grade separation would be experienced.

Figure 8-10. Schematic Cross-Section of a High-Load Lid over I-5 (Area 4)



Pink vertical lines represent vertical edges of the lid that would be above-grade and experienced as “balconies” from the lid level. This is a representative cross-section of a conceptual high-load lid in lid Area 4, between Denny Way and Olive Way, where the most notable grade separation would be experienced. Edge conditions could be mitigated via a pavilion or building east of I-5 (Melrose Avenue access) replacing the Olive Way on-ramp, and with vertical circulation (i.e., stairs, escalators or elevators) on the west-end over the Yale Avenue ramp.

8.5 Fire and Life Safety System Requirements

Given that lidding mainline I-5 would change the configuration of the freeway from exposed open-air lanes to a 0.8-mile "tunnel," building a lid on this site would require installing a Fire and Life Safety (FLS) system. FLS systems encompass all the combined systems that ensure safety in the event of an incident, including mechanical/electrical/plumbing and tunnel (heating, ventilating, and air conditioning; lighting; FLS). The focus of the tunnel mechanical/electrical/plumbing and FLS assessment developed as part of this study, was to provide guidance on system requirements and to identify potential impacts on the project that could affect its feasibility. The way in which these systems interact was considered in the design of lid concepts and have a significant impact on the scope and cost of construction of a lid. The focus of this I-5 LFS was to identify the major tunnel systems, assess their requirements, describe ways they could affect the project, and provide a cost allowance. To that end, it should be noted that the FLS system requirement represents between 4 percent (leanest lid project estimate) to 12 percent (robust lid project estimate) of total construction costs for the lid project. Chapter 10 of this report further explores the financial feasibility of lidding I-5.

8.6 Environmental and Regulatory Requirements

I-5 is a WSDOT owned and operated facility with oversight from the FHWA. As a facility that receives federal funding, compliance with the National Environmental Policy Act (NEPA) is required when a federal action (such as funding, permits, or policy decisions) is taken. Therefore, prior to FHWA and WSDOT being able to fund, permit, or approve a modification to I-5, the NEPA process would need to be completed. During the NEPA process, compliance with other federal regulations and executive orders, such as those dealing with the National Historic Preservation Act of 1966 and environmental justice, would occur. In addition, Washington state and local agencies are required to comply with the State Environmental Policy Act (SEPA); the NEPA and SEPA processes can be combined. No specific environmental assessment was conducted as part of this phase of work beyond acknowledging these requirements.

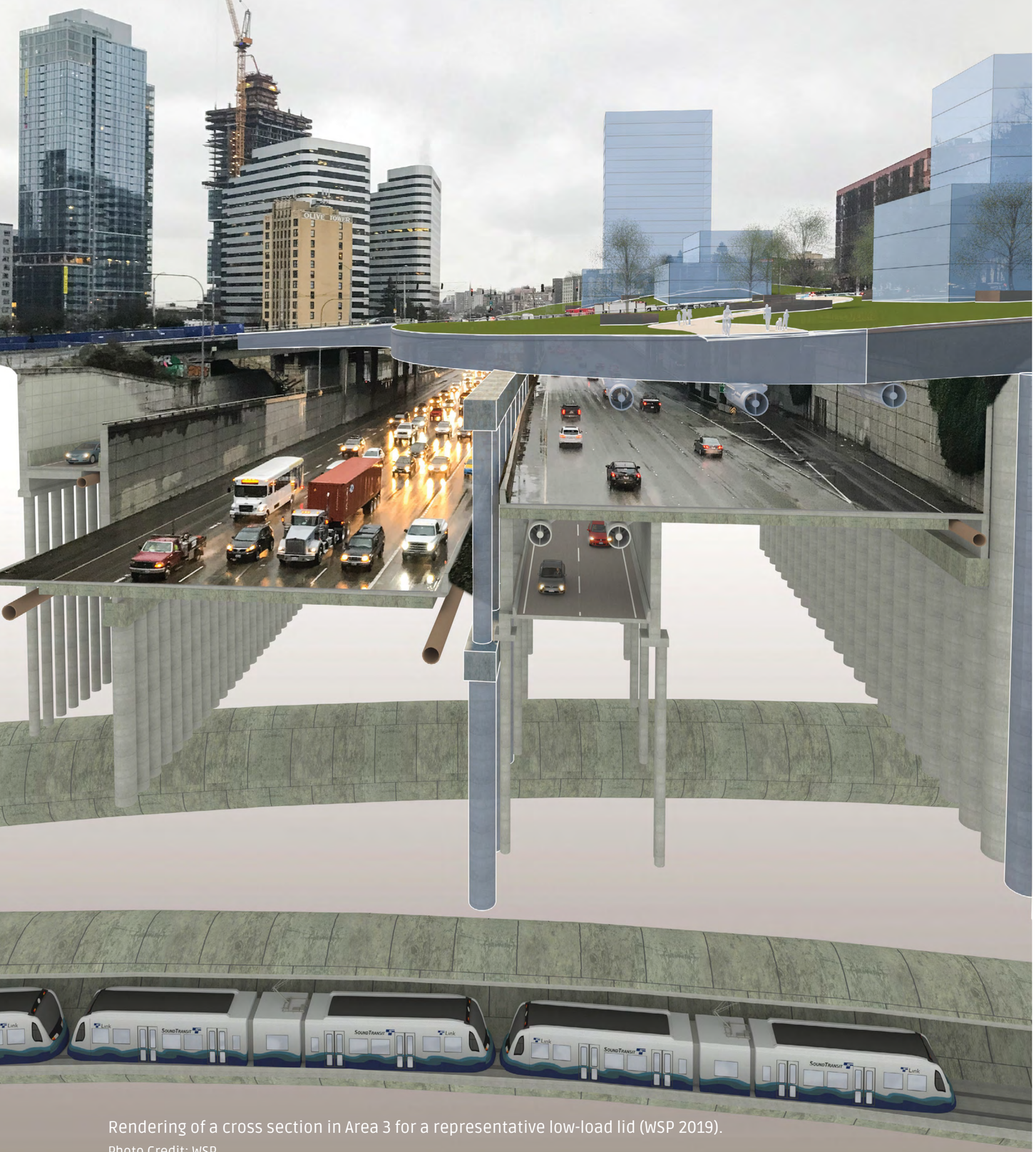
A successful lid design will require interdisciplinary coordination that integrates engineering decisions with urban design goals.

8.7 Iterative Technical Design

The technical feasibility assessment was performed agnostic of urban context, environmental considerations, noise impacts and user experience implications. Nonetheless, conceptual geometric lid layouts were developed through an iterative approach with the needs identified for urban design best practices, which would be explored in the test case framework analysis of this study. Future phases of work should consider impacts of engineering decisions through an approach that considers urban design goals.

Pine Street-Boren Avenue overpass in 1965

Photo Credit: Bruce McKim / The Seattle Times, 2018



Rendering of a cross section in Area 3 for a representative low-load lid (WSP 2019).
Photo Credit: WSP

8.8 Key Engineering Feasibility Takeaways

» Based on the work conducted for this study, it would be technically feasible to construct a lid over I-5 through downtown Seattle, similar to the existing lids of the WSCC and Freeway Park.
  - From a structural engineering perspective, it would be achievable to build a set of lid structures within the study site that would various load levels of development. Further understanding the geotechnical conditions, seismic hazards, and framing of the lid relative to any vertical development would be key focal points structurally.
  - Due to the preliminary nature of this study, a full stage-by-stage traffic and constructability assessment was not conducted, and future evaluation should ensue as the project advances toward 30 percent engineering and design.

» Based on the conceptual geometric lid layouts developed, the maximum lid-area potential for a robust lid project within the study site (considering the theoretical removal of all ramps) is 17.4 acres and the minimum lid area for the leanest lid project, (with all ramps remaining) is 11.5 acres.

» Lidding I-5—a complex, active freeway—could be done without reducing its current capacity and without significant impact on freeway operations as they stand today.

» Only conventional structural framing methods were considered in this study. Nonetheless, conventional framing makes it possible to build a high-rise building over ramps, with an opening within a lower story to allow for an at-grade ramp to pass through the building (similar to the Seattle Municipal Tower). Alternative framing concepts should be investigated in future studies when engineering analysis and design are beyond initial design (<5 percent).

» A comprehensive transportation and traffic network study, as well as utility impacts (temporary or permanent), would be necessary to evaluate the factual feasibility of any lid concept. A traffic study would be necessary to inform constructability and staging alternatives if this project were to advance to further stages of engineering and design, especially if ramps were removed.

» The resulting lid configurations from the I-5 LFS would not be flat or contiguous surfaces from edge to edge, given the topographical conditions of the site and the constraints existing structures and ramp access impose.
  - Vertical circulation options would be necessary for any development on the lid.
  - Moreover, building a lid would not be equivalent to building terra firma (or ground) that could then be developed; any vertical development (i.e., buildings) would need to be planned, designed and delivered in tandem—and integrated—with the lid deck structure.

» The load capacity potential of the conceptual lid layouts is not even across the study site nor within each lid subsection. This is an important consideration in terms of the possible development program and development capacity of each test case considered, with significant urban design implications.

» Given that lidding mainline I-5 would change the configuration of the freeway from exposed open-air lanes to a 0.8-mile "tunnel," building a lid on this site would require installing an FLS system.
  - An FLS system requirement represents between 4 percent (leanest lid project estimate) to 12 percent (robust lid project estimate) of total construction costs for the lid project.

» Future phases of work should consider impacts of engineering decisions through an approach that considers and prioritizes urban design goals.

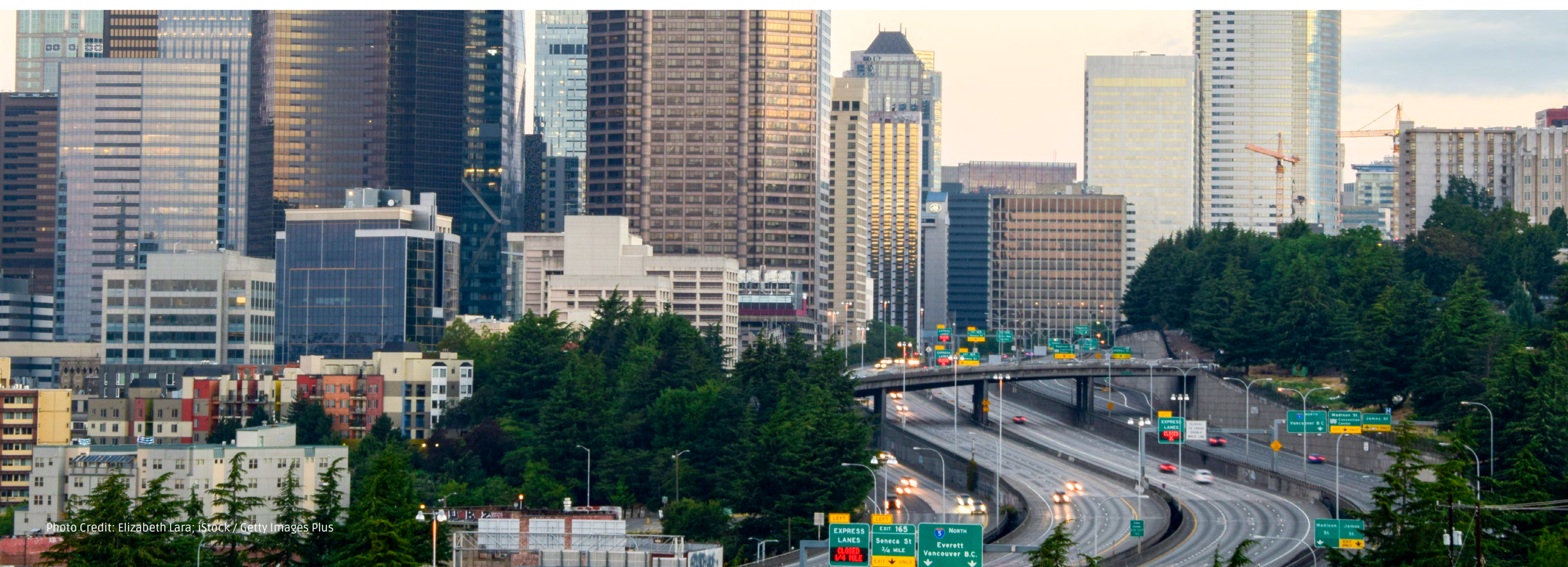


Photo Credit: Elizabeth Lara; iStock / Getty Images Plus

9. Development Program Test Cases

A lid over I-5 presents an opportunity to tackle some of the most pressing challenges facing Seattle. Building a lid would be like creating new land in the heart of downtown that could help stitch the gap I-5 created between neighborhoods and make space to accommodate a vast range of uses, with public benefit in mind.

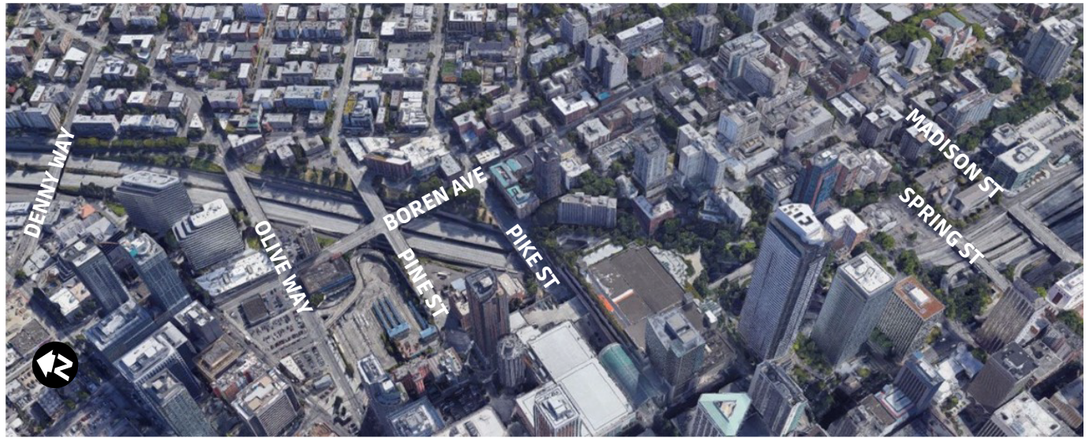
Three test cases were developed to explore the range of technical and financial feasibilities associated with lidding all or a portion of the study site, as well as surface key urban design and policy considerations for future decision-making.

- **Test Case 1 (The Park Lid)** assumes the most basic lid structure developed as a park space, similar to precedents of lids built in the Pacific Northwest, and seeks to answer the following guiding question: **What is the lowest capital cost to achieve the core public benefit outcomes?**
- **Test Case 2 (Maximum Private Investment)** considers a heavily developed structure, and seeks to answer the following question: **What is the maximum potential for market-rate development to help pay for a lid?**
- **Test Case 3 (Mid-Density Hybrid)** explores development intensity between Test Case 1 and Test Case 2 and considers the following question: **How would a context-sensitive public-private mix of development affect financial performance?**

Test cases were directed by the City of Seattle's guiding questions, key assumptions and the input from the Study Community, memorialized in a test case workbook. Test Case 1 (the lowest load and lowest capital-cost case) and Test Case 2 (the highest load and highest capital cost case, but also the highest potential revenue-generating case) provide "bookends" of analysis. Test Case 3 is a mid-density (or medium load) hybrid that mixes private investment with significant public benefit outcomes.

A test case is not a master plan nor is it a shovel-ready project, but rather a framework—led by public priorities and assumptions—to better understand development options and their trade-offs to inform future decision-making. Although complex constraints narrowed the range of options, the three test cases presented in this study are by no means the only potential scenarios. None of the test cases represent an actual or recommended site design, development proposal, or land use, and the I-5 LFS does not result in a "preferred alternative."

Figure 9-1. Aerial View of the Study Site



Aerial view of I-5 through the study site from Denny Way (north) to Madison Street (south). High-rise buildings characterize the urban form west of I-5, while low- to mid-rise buildings (with shorter urban blocks) are east of I-5.

A test case is not a master plan nor is it a shovel-ready project, but rather a framework—led by public priorities and assumptions—to better understand development options and their trade-offs to inform future decision-making.

The guiding principles and value proposition of the I-5 LFS served as guideposts for these exploratory scenarios. In addition, development of any new lid structure with new uses and buildings would need an extensive public outreach effort, as well as the full support and buy-in of the WSDOT, which owns and operates I-5.

9.1 General Considerations and Approach for Developing Test Cases

The design of the lid would be required to support the uses above it while seamlessly integrating with the daily I-5 operations below. The lid would also need to be physically accessible from the areas around it, connecting the new "land" with existing neighborhoods. Test cases were developed for proof of concept with theoretical uses and building layouts. Although representations do not have definitive technical accuracy, a detailed constructability analysis was performed in order to create viable development scenarios. The details of this analysis are memorialized in the I-5 LFS Test Case Memorandum.

Performed through an iterative and interdisciplinary approach, the exercise unveiled the following key issues that would need to be addressed in future phases of planning and design, if a lid concept were to be implemented:

- Which areas of the study site would be included as lids in each test case
- Which lid areas would be functional and accessible based on grade separation
- Necessary heights and thickness of the lid over I-5
- Locations of columns and foundations and where lanes would require realignment to maintain I-5 operations unaffected
- How and where future buildings could interface with the lid and the site edge conditions

All test cases reflect explorations of what it would mean to lid I-5 from Madison Street to Denny Way (Figure 9-1). Although key takeaways can be derived from looking at a section-by-section analysis for each of the four lid areas (see Figure 6-2), the I-5 LFS scope was to test the potential of a full lid over the study site. Analysis for all test cases assumed retention of all existing overpasses and on- and off-ramps, with the exception of looking at a variation in Test Cases 2 and 3 that considered removing the Olive Way on- and off-ramps.

Structural Systems

Location of columns and foundations (e.g., Figure 8-4), size and geometry of the lid area, as well as load capacity, corresponding to four load levels (Figure 8-1) were considered.

Infrastructure impacts on ramps, overpasses, existing structures and their historic designation was also assessed. Buildings or any vertical development structure were considered to be conventionally framed (Figure 8-3) as described in the technical feasibility assessment.

I-5 Ramps

The developable lid area in each area of analysis would be significantly affected by whether ramps are retained. All on- and off-ramps were deemed necessary to serve existing and projected vehicular access needs for I-5 in downtown. Any ramp modification or removal would require significant future analysis (and ultimately an Interchange Justification Report) to identify viable mitigation investments to maintain or improve I-5 and downtown street network operations and address impacts to upstream and downstream communities. Detailed traffic analysis was outside of the scope of work. The impact ramps have on lid design was analyzed, but only Test Cases 2 and 3 explored removing the Olive Way ramps in detail.

Photo Credit: SDOT Flickr

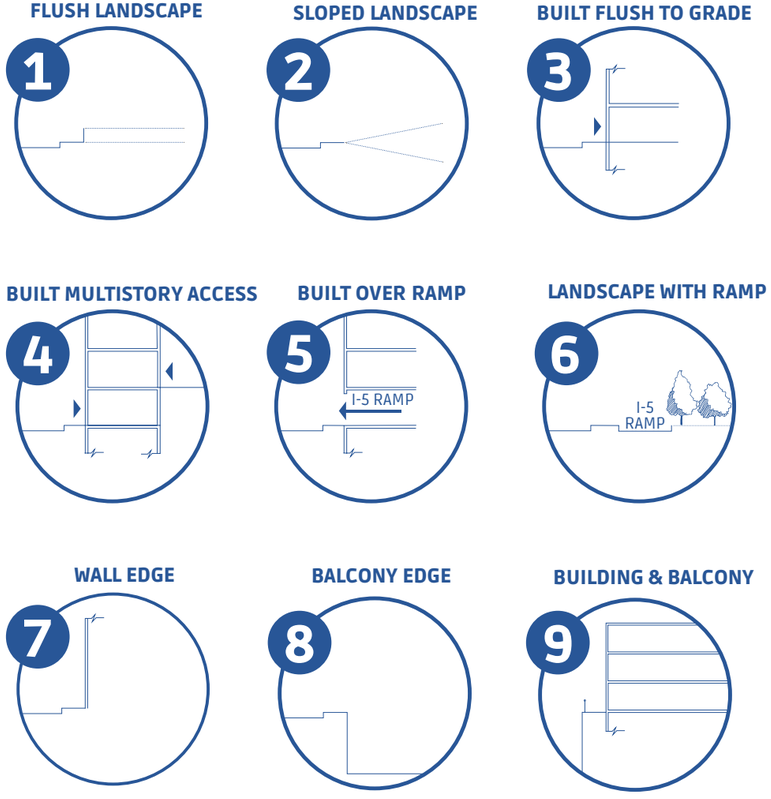
Edge Integration

Edge integration between the lid and the immediate surrounding area was evaluated to allow for lid access and enhance the human-scale experience around the study site. Section analysis was performed—considering site topography, grade changes and the resulting implications of vertical clearance requirements over I-5 structures on lid design—to ensure functionality and spatial accuracy in test-case representation. Edge conditions can be treated in a variety of ways, as shown in the nine edge treatments considered for the purpose of this exercise (Figure 9-2). For low slopes, landscaped edges can be flush to the sidewalk with low terraced planters. For more significant grade differences (approximately 10 feet or more), pavilions or buildings would be used where possible to allow for access along the edge (Typology 4, Figure 9-2).

Connections and Access

Opportunities to reconnect neighborhoods surrounding the site and create easy access to and across the lid were explored. Test cases attempted to establish pedestrian and bicycle connections across I-5 every 300 feet when possible, in line with the historical street grid. Vertical circulation needs were identified to allow for access to the lid and/or to buildings. This could take the form of stairs, escalators or elevators either in an exterior open space or in the interior of new buildings. All test cases considered widening the WSCC pedestrian walkway along Hubble Place. Vehicular connections were assumed unaffected. A 10-foot setback along streets for landscape, amenities and physical integration with the lid structure were given where possible. Detailed design solutions for each lid area were not developed; representations are only schematic.

Figure 9-2. Typology of Edge Treatments Considered



Source: Google Street View, 2019

Seattle Municipal Tower constructed over I-5 exit ramps

Source: Google Street View, 2019

Freeway Park's landscaped edges for low slope, near Seneca Street.

Source: Mikkio, 2003

Fisher Pavilion at the Seattle Center as grade mitigation

Building Typology

Building typologies considered are associated with the structural load capacity categories. The images shown in Figure 9-3 are representative examples of each typology. The high-rise can be a very high tower up to 680 feet tall (more appropriate to downtown), or a more moderate 400-foot tower. High-rise construction was considered only on terra firma locations (Figure 7-3).

It is important to note that the eventual success of the lid from an urban design standpoint would be the quality of the "plinth," or the area where buildings and the street level or open space integrate. With the grade changes at the site, some buildings may actually have more than one "plinth" level, with at-grade access from an adjacent street at one level and a second at-grade access at a level on the lid. A "podium" is defined as a lower (i.e., three-story) base of a building with a taller, slender tower. The podium may or may not have access to multiple grade levels.

While the I-5 LFS did not examine building design (including that of plinth levels), the footprints of the buildings shown in plan on Test Cases 2 and 3 were assumed to be part of a well-designed, well-landscaped human-scale set of levels. Space is available within the plinths of each building for street-level retail, cultural and civic space, and other amenities that are understood over time.

Urban Form and Neighborhood Context

Building heights, zoning and current land use were considered to inform test cases through a context-sensitive approach. The urban character on the west side of I-5 is different than the east side, with Capitol Hill having shorter and smaller buildings and block sizes than downtown. Urban character informed the test case development program, as represented in Figure 9-6. Consideration for the impact on the surrounding environment regarding noise, views, building orientation and shadows shaped the resulting test cases.

Mix of Uses

Ranging from public to private uses, the test case development programs were dictated by the assumptions provided by the City of Seattle's test case workbook. The private development uses on Test Cases 2 and 3 were established using the real estate market scan showcasing use types according to the lid's potential market capture estimated for 2035 (see Table 7-1). Test cases favored locating residential uses to the east and office/hotel to the west of the study site. Policy assumptions around parking, affordable housing, and civic space influenced test-case outcomes. For public uses in built spaces (i.e., "civic uses") a specific program was not defined. These would be spaces considered to host uses such as community centers, cultural space or schools, among other civic uses.

The resulting test case development program exercises allowed the creation of input to calculate a test case's development capacity (i.e., determine the total area of a lid used for siting buildings and their corresponding total square feet of development). Development capacity, in turn, can inform the revenue-generation potential of a lid test case, assumed to contribute to the financial feasibility assessment of the lid concepts. Test cases allowed the study to further explore the economic feasibility of the lid concept, potential governance models, funding and financing mechanisms, and project-delivery options.

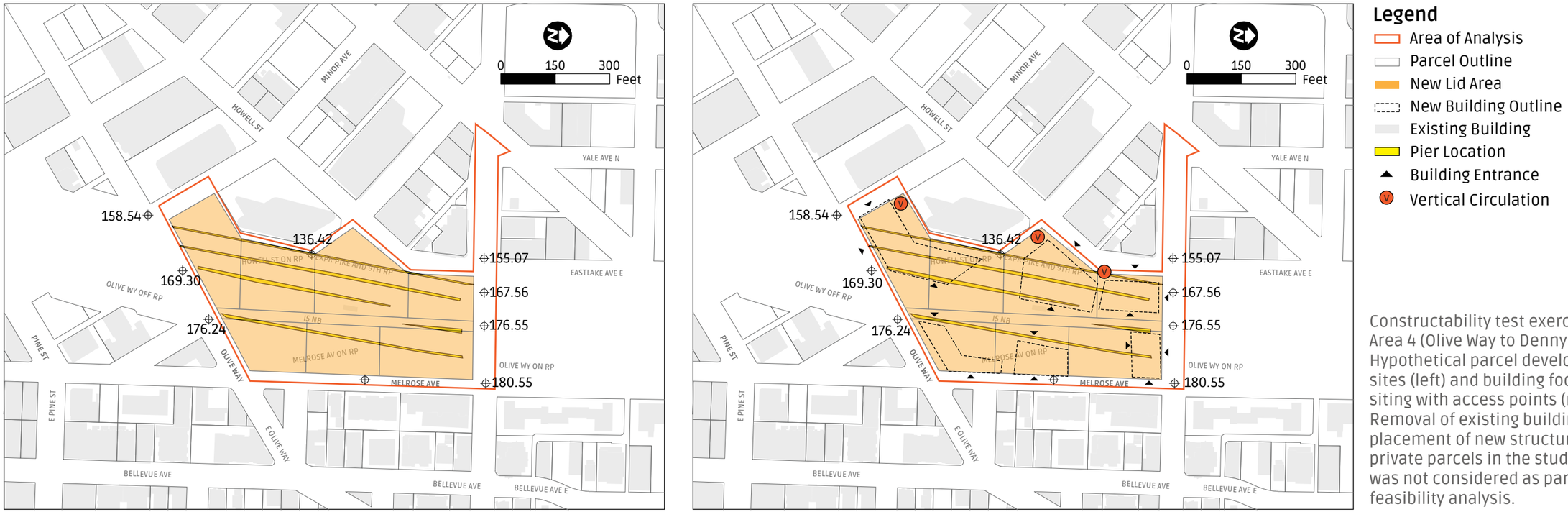
Figure 9-3. Building Typology for Test Cases

High-rise	Mid-rise	Low-rise	Pavillion
45 stories	20 stories	5-7 stories	Up to 3 stories
400 feet or 680 feet	200 feet	70 feet	30 feet

Figure 9-4. Representative Examples of a Building Plinth and Podium

Representative examples of a plinth (2 Union Square) (left), and a podium (First Light) (right).

Figure 9-5. Constructability Test for Proof of Concept, Area 4

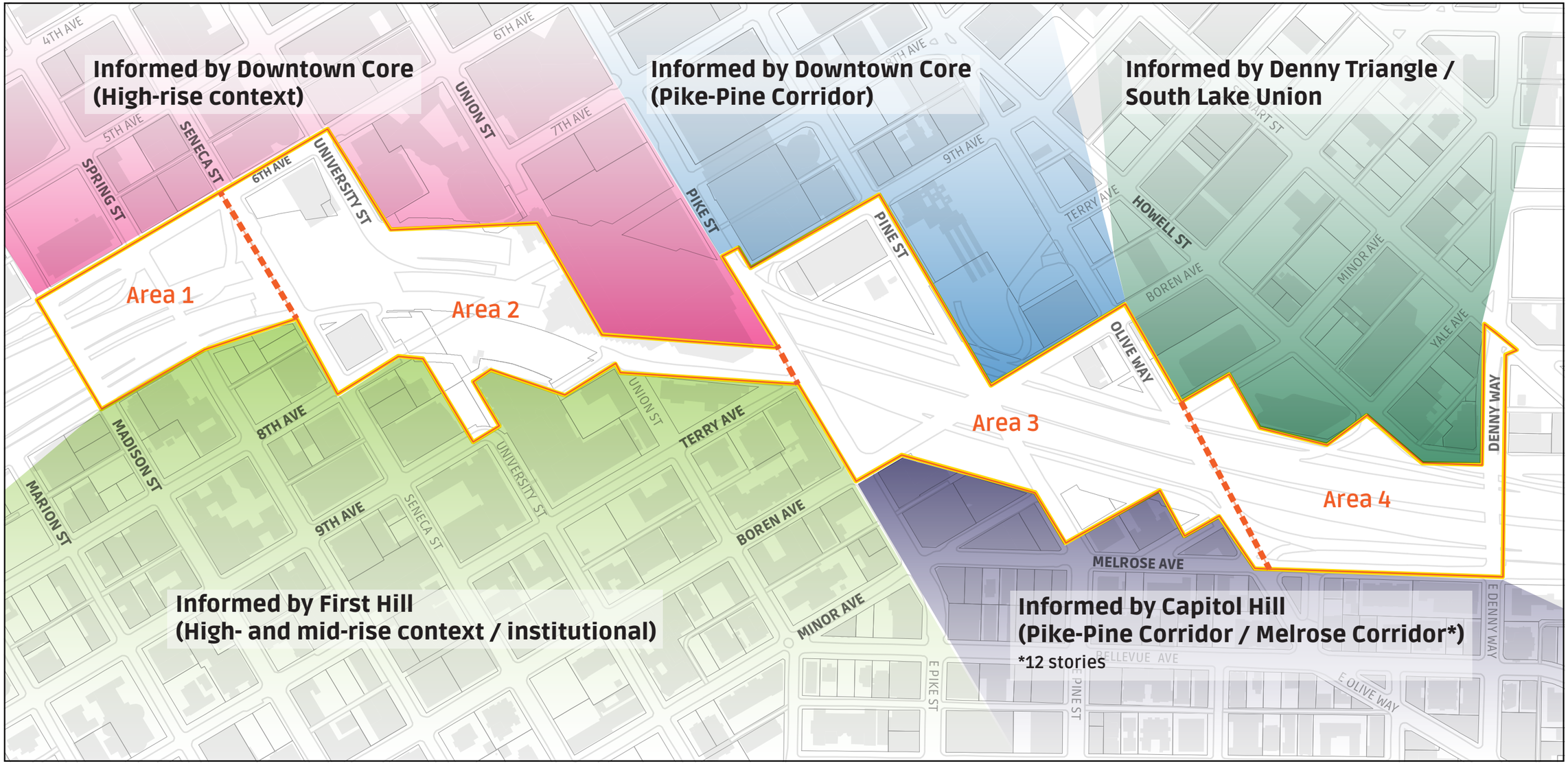


Constructability test exercise for Area 4 (Olive Way to Denny Way). Hypothetical parcel development sites (left) and building footprint siting with access points (right). Removal of existing buildings or placement of new structures on private parcels in the study site was not considered as part of the feasibility analysis.

Constructability Test for Proof of Concept

1. Develop lid geometrical layouts with understanding of site constraints
2. Calculate load capacity
3. Define development sites (parcels)
   - Consider access to parcels (pedestrians, parking/service, vehicular)
4. Test building sites by aligning building footprints and lid structure to develop Proof of Concept (see Figure 9-5)
   - Potential building footprints considered over lines of structure and access points (building-to-lid integration)
   - Building-to-edge integration
   - Establish allowable height with building footprint (function of tentative use and maximizing development potential)
5. Iterate to refine use and maximize vertical development potential

Figure 9-6. Urban Character Informing Test Case Development



Legend

- Structural Assessment Boundary (Study Site)
- Area of Analysis
- Area Limit
- Building Outlines
- Parcel Line
- Roadway Pavement Edge

0 300 600 Feet

9.2 Test Case 1: The Park Lid

What is the lowest capital cost to achieve the core public benefit outcomes?

Test Case 1 assumed the most basic lid structure developed as "standard" park space (i.e., landscaping, lighting, seating, pathways). Its purpose was to establish a baseline cost, as a financial feasibility bookend. More amenity-rich open spaces (e.g., active recreation spaces, programmable spaces, etc.) or the addition of structures for civic or other uses would require additional investment.

Although considered the most basic lid, it would still be structurally complex, and would result in converting I-5 into a tunnel beneath. The structure would require meeting safety, seismic and operational standards, including FLS requirements for the underlying tunnel and modifications to support the lid, while maintaining or improving safe operations of I-5.

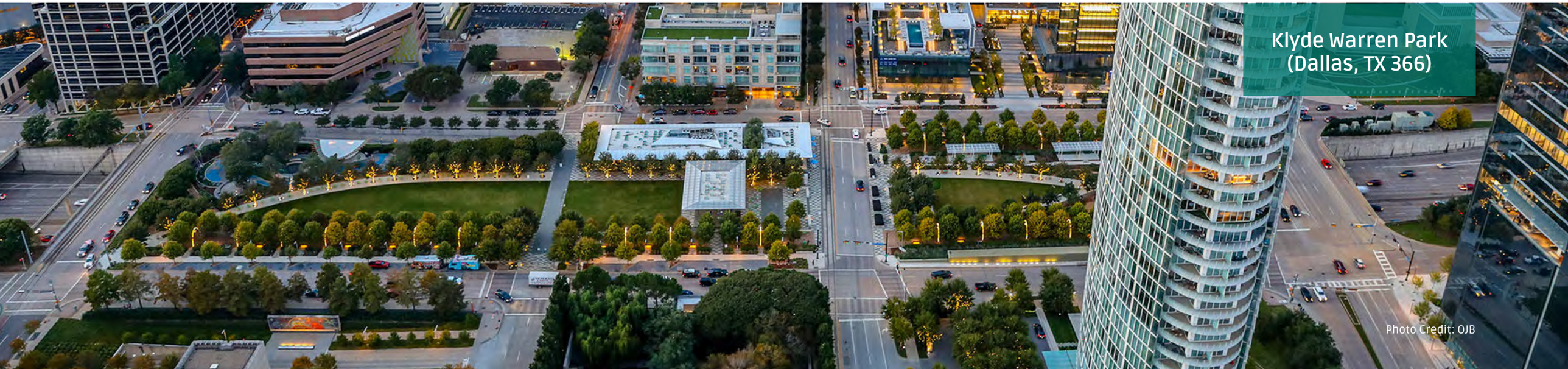
There would be no development on the lid apart from some pavilion structures (Figure 9-7) needed to address edge conditions (that is, provide for access to the lid in areas with significant grade change). Figure 9-8 shows where such structures would likely be located.

Removal, reconfiguration or relocation of ramps would enhance the lid's functionality and expand the amount of park space, but would also add considerable capital cost (for construction and to provide alternative I-5 access and modifications to the street network elsewhere). Further studies and cost-benefit analysis related to ramp modifications would be required to inform future decision-making.

Urban Character and Function

A lid may be the only way to find space for a large, relatively flat, open park space in the downtown neighborhoods. This space could allow for community cohesion and act as a gathering space for residents of all four neighborhoods. Aubrey Davis Park on the existing lid over I-90 on Mercer Island is roughly comparable, though it contains more amenities than what is assumed for this baseline test case (Figure 4-3).

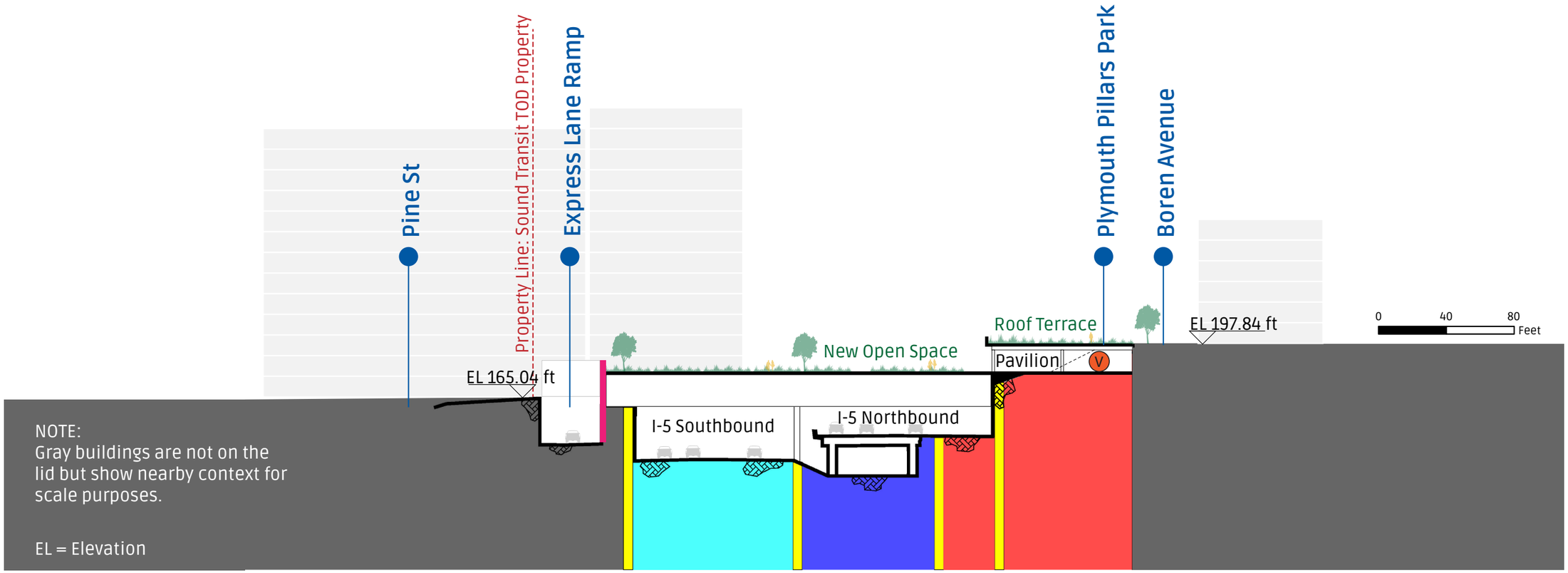
Test Case 1 creates large open spaces on the north end of the study site, but the challenging areas south of Union Street near Freeway Park have minimal improvements. Given that the goal of this test case was to establish a baseline cost with sufficient public benefit, and retaining all existing ramps, this test case did not consider a full lid over Area 1 (in order to preserve the Spring Street and Seneca Street ramps) or Area 2 (due to cost and low usability of a lid with significant slope). The Olive Way ramps significantly limit access and connectivity across I-5 between Pike Street and Denny Way, and creates above-grade lid edges from the surrounding context (i.e., it does not create a flat lid connecting each side of I-5 seamlessly). Although it creates 5 acres of new open space, it would only be accessible on its edges or via vertical circulation on the west side, with elevated balconies on both east and west edges (see Figure 9-11).



Klyde Warren Park (Dallas, TX 366)

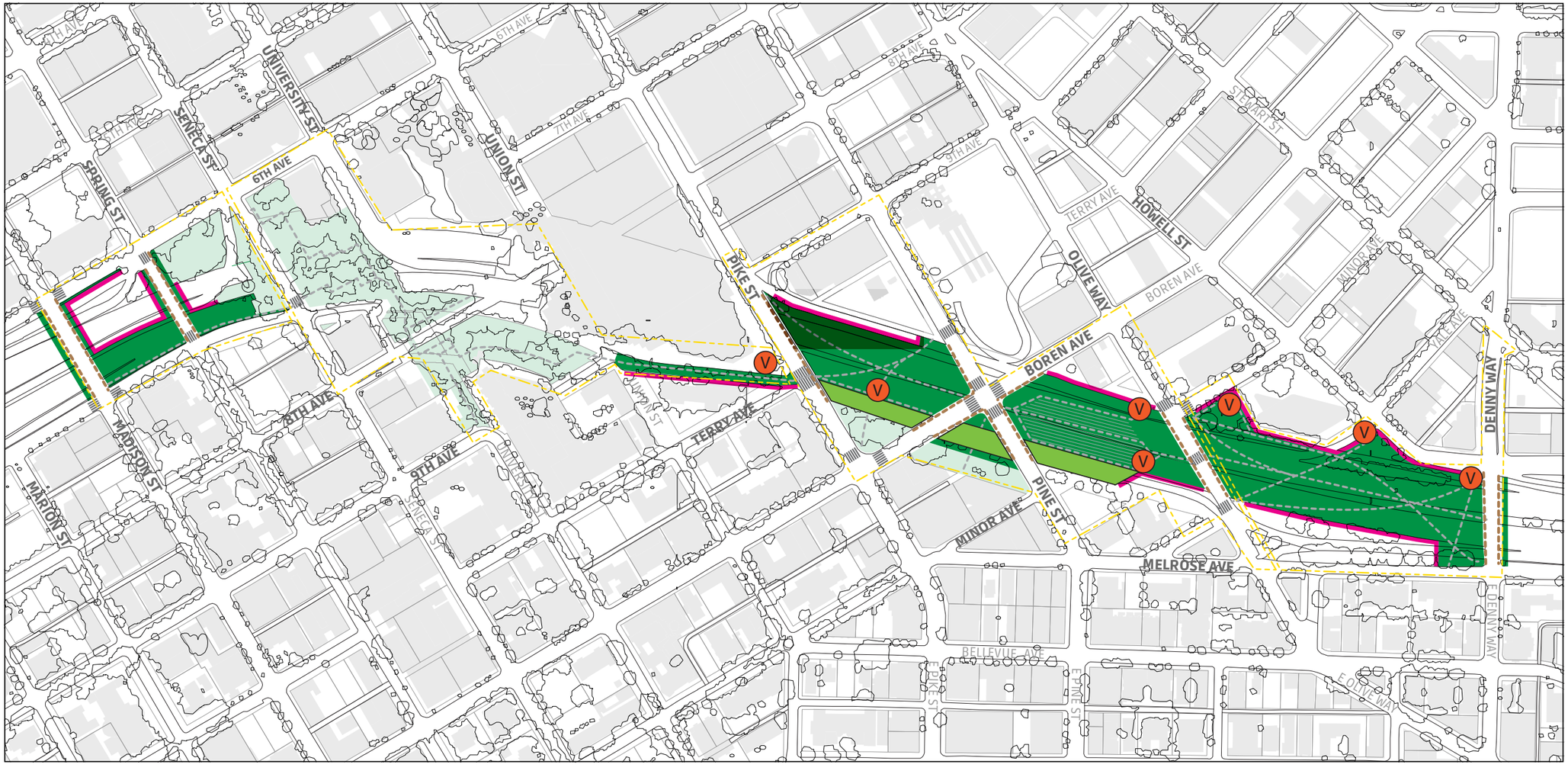
Photo Credit: OJB

Figure 9-7. Pavilions for Vertical Circulation and Edge Treatment



Schematic cross-section of Area 3 for Test Case 1, showing the use of pavilions as a strategy for edge integration and vertical circulation to the lid level. Pink vertical lines represent vertical edges of the lid that would be above-grade and experienced as "balconies" from the lid.

Figure 9-8. Test Case 1 – The Park Lid



9.3 Test Case 2: Maximum Private Investment

What is the maximum potential for market-rate development to help pay for a lid?

This test case assumes maximum development on the lid based on structural load capacity and application of standard development requirements for low-, mid- and high-rise development in Seattle. Aimed at identifying whether a market-supportable program could pay for a lid via an air rights lease, the built space was generally informed by the prevailing density west of I-5. All development is assumed to be market-rate in order to maximize revenue-generation that could offset the lid structure's costs, as a bookend of financial analysis.

Figure 9-9 illustrates the distribution of approximate building footprints by development intensity (load capacity) assumed for this exercise. The mix of uses (commercial, residential, etc.) were established based on the market scan, assuming development seeking maximum profitability and summarized in Table 9-1. Development requirements for housing affordability assumes Mandatory Housing Affordability (MHA) payments and no on-site affordable housing. Given constrains to provide underground parking, only 10 percent of spaces are assumed to be provided on-site, and the rest offsite in the vicinity of the lid. The test case assumes requirements to provide privately owned public spaces by use type (20 SF per 1,000 SF of office area; and 15 percent of residential parcel area).

Analysis for Test Case 2 assumes retention of all on- and off-ramps. Test cases include buildings with "over-ramp" development (as in the existing Seattle Municipal Tower, see Figure 9-2). Additionally, a scenario with removal of the Olive Way on- and off- ramps was analyzed, to explore the development potential that could be increased over terra firma gained over the Olive Way ramps (see Figure 7-3). In addition, this has an important result, whereby the lid significantly increases pedestrian connections across I-5, between Denny and Olive Way, with enhanced edge conditions at the human-scale.

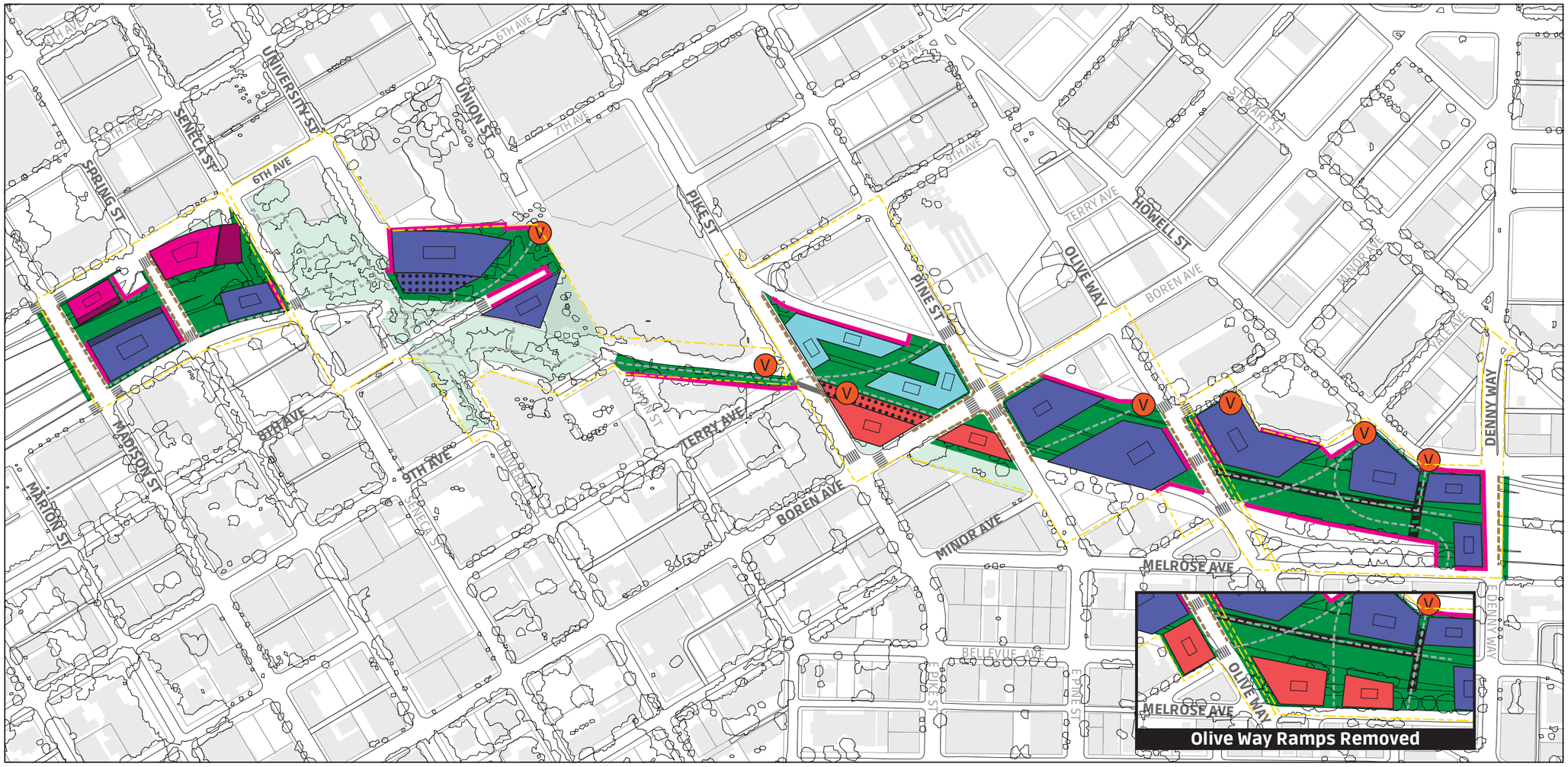
Urban Character and Function

Test Case 2 reconnects neighborhoods across I-5, with office and residential high- and mid-rise buildings that would create permeability through a network of privately owned public spaces. A hotel and ground-floor commercial spaces would add to the mix of uses on the site. This test case explores creating a neighborhood extension that would bring the urban character of downtown blocks over I-5. Capitol Crossing in Washington, D.C. is comparable as a concept, with a lid that accommodates five new mixed-use buildings, seamlessly integrating both sides of I-395 in Washington, D.C. (Figure 4-2).

Buildings in Test Case 2 serve as vertical circulation paths to overcome the significant grade changes on the site. They also allow for an accessible and safer pedestrian crossing over Pike Street, with a pedestrian overpass directly linking the WSCC walkway to a building plinth.

While various public benefits could be achieved through this test case, such as improved pedestrian realm and reduced noise, maximizing private development could vary in public policy outcomes outlined in the study's guiding principles.

Figure 9-9. Test Case 2 – Maximum Private Investment



Legend

- Structural Assessment Boundary (Study Site)
- Parcel Boundary
- Roadway Pavement Edge
- Vertical Edges Above Grade
- Bridge Connection
- Existing Open Space
- Test Case Lid Surface
- Existing Building Footprints
- Building Plinth
- Building Cantilever
- Pavilion: Up to 30ft
- Low-Rise: 70ft
- Mid-Rise: 200ft
- High-Rise: 400ft
- Downtown: 680ft High-Rise
- Improved Pedestrian Way
- New Pathways
- Crosswalks
- Vertical Circulation
- Fire Lane

0 300 600 Feet

Schematic plan view of Test Case 2. All I-5 ramps remain; a scenario with Olive Way ramps removed was explored and is shown in the lower-right corner.

9.4 Test Case 3: Mid-Density Hybrid

How would a context-sensitive public-private mix of development affect financial performance?

This test case considers the financial impact of a more mixed approach to development on the lid, with public park space and civic uses mixed with on-site affordable housing and market-rate development (including residential, commercial and hospitality). Like all other test cases, this is not a recommended development program. Its purpose is to test the financial outcomes of an illustrative "mid-density" approach that mixes public and private investment.

Test Case 3 does not aim to advance the most financially expedient development scenario possible; rather, it sets a vision focused on investment in public goods to ensure the future of downtown Seattle remains inclusive, affordable, and resilient. In this regard, this test case is the most assumption-driven, and prioritizes context-sensitive development and amenities to create a complete community. The main assumptions driving this scenario relate to ensuring at least 5 acres of public park space, 5 percent of total built space to be dedicated to civic uses and 40 percent of the residential uses to be dedicated to affordable housing. These percentages are for analysis purposes only, to reflect public policy priorities and test the effect on overall financial feasibility.

Test Case 3 is one of many possible scenarios between the low and high bookends of development, but illustrates that density can occur within context, and provide needed open space with active edges near the important Pike-Pine corridor.

Urban Character and Function

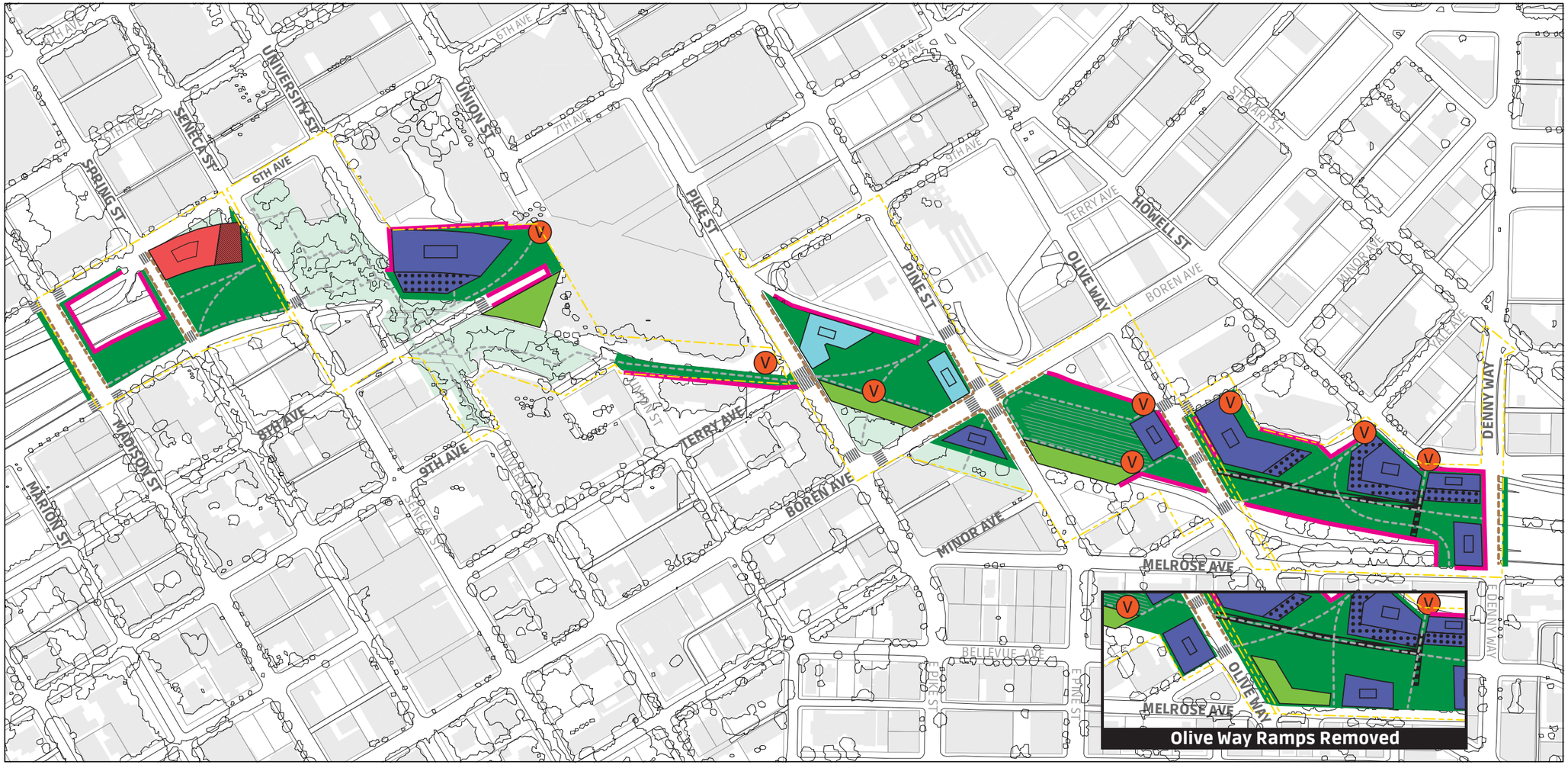
This test case creates a mixed-use neighborhood extension to reconnect the urban fabric across I-5, with ample park space and low- and mid-rise buildings. It brings the urban character and form of Capitol Hill and First Hill over I-5, closer to the Downtown Retail Core. It serves as a community and civic district, that supports a mixed-income neighborhood. As a hybrid between Test Cases 1 and 2, it showcases open spaces that would allow for community cohesion and act as a gathering space for residents of all four neighborhoods.

Building intensity is lower than Test Case 2, factoring in both the load capacity and the surrounding urban context. The illustration on Figure 9-10 shows the potential resulting distribution of open space and approximate building footprints. This test case considers additional park space and buildings in the immediate surroundings of Freeway Park, adding active uses to its edges and seeking to reduce noise impacts from the freeway.

Similar to Test Case 2, a scenario with removal of the Olive Way on- and off- ramps was analyzed, which significantly increases potential pedestrian connections across I-5, between Denny Way and Olive Way, with enhanced edge conditions at the human-scale (Figure 9-11). This also allows for additional development capacity that could, for example, be allocated to affordable housing provision.

Although not a lid, the development on Yesler Terrace is adequate and comparable in terms of community composition. Yesler Terrace is a mixed-use neighborhood built around open space. This example informed the assumption around the amount of community space considered for this test case.

Figure 9-10. Test Case 3 – Mid-Density Hybrid



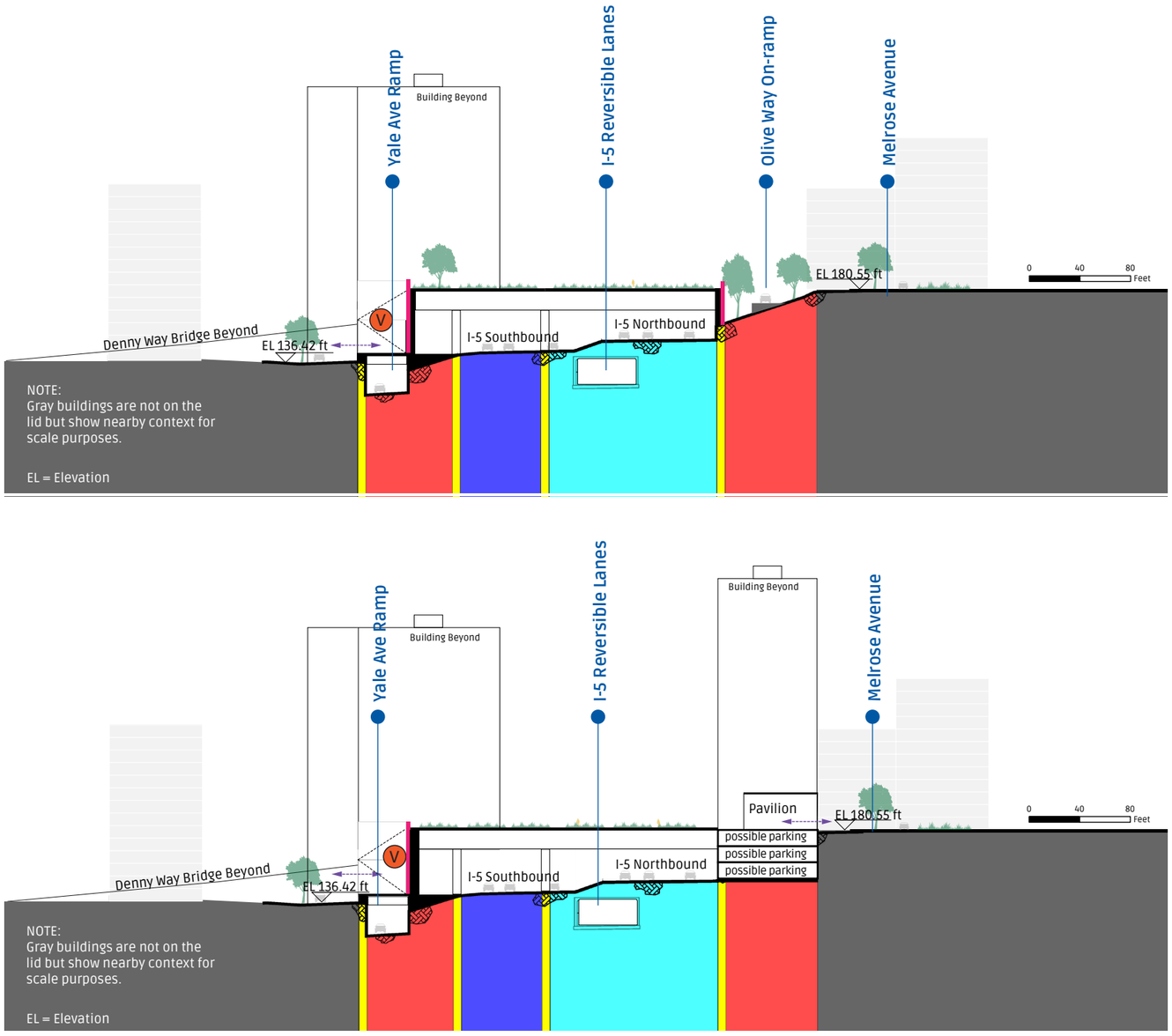
Legend

- Structural Assessment Boundary (Study Site)
- Parcel Boundary
- Roadway Pavement Edge
- Vertical Edges Above Grade
- Bridge Connection
- Existing Open Space
- Test Case Lid Surface
- Existing Building Footprints
- Building Plinth
- Building Cantilever
- Pavilion: Up to 30ft
- Low-Rise: 70ft
- Mid-Rise: 200ft
- High-Rise: 400ft
- Downtown: 680ft High-Rise
- Improved Pedestrian Way
- New Pathways
- Crosswalks
- Vertical Circulation
- Fire Lane

0 300 600 Feet

Schematic plan view of Test Case 3. All I-5 ramps remain; a scenario with Olive Way ramps removed was explored and is shown in the lower-right corner.

Figure 9-11. Schematic Outcome of Removing Olive Way Ramps in Test Case 3



Schematic cross-sections of Area 4, with and without Olive Way off-ramp. Like Test Case 2, the removal of Olive Way ramps in Test Case 3 could provide the opportunity for integrating Melrose Avenue to the lid, reestablishing lost pedestrian connections across I-5 between Olive Way and Denny Way. Pink vertical lines represent vertical edges of the lid that would be above-grade and experienced as “balconies” from the lid.


Photo Credit: OJB

9.5 Key Urban Design and Planning Takeaways

An overbuild development over I-5, as measured by the three test cases explored, could bring substantial benefit to Seattle, including up to 4,500 total new market-rate housing units (Test Case 2), up to 10 new acres of open space in the heart of downtown (Test Cases 1 and 3), and opportunity for new civic spaces (including space for a school or community facilities) and retail amenities to serve new residents and the surrounding community (Test Cases 1 and 3). Test Case 3 (Mid-Density Hybrid) could create at least 380,000 to 620,000 SF of new affordable housing, contributing toward the City of Seattle's housing affordability policy goals.

Table 9-1 summarizes a review of the development programs for each of the three test cases.

Various physical, operational, structural, and economic conditions affect the potential development program on a lid over I-5. While these development conditions are complex, they expose a set of distinct, valuable findings that can be used to guide development of a future lid. A summary of urban design and planning considerations with respect to the three test cases include the following:

» A lid over I-5 that supports development is not equivalent to creating new flat land over "dirt." Load capacity and grade variations vary across the various lid areas and require that any building or vertical development be planned along with the lid structure. In that sense, a lid is not creating even "land" parcels that could be leased independently.

» Downtown Seattle's topography makes design for a lid different and more challenging than lids in other cities or contexts.

- There are varied topographic conditions along the edges of the site; some areas present manageable slopes while others are major discontinuities east-to-west and north to south. With grade changes ranging from approximately one story (i.e., 10 to 14 feet high) to over 40 feet, many conditions need to be resolved between the lid structure, adjacent topography and vertical edges of buildings. Pavilions and buildings can incorporate necessary vertical circulation and vertical assist for connectivity needs.
- By using buildings to mitigate the grade changes, it is possible to have multiple "ground" floors, similar to the Fisher Pavilion at Seattle Center.
- While the topographic conditions are challenging in the design of the lid, there are opportunities to create new terrain with the lid that allow for relatively flat and functional spaces for open space or vertical development.

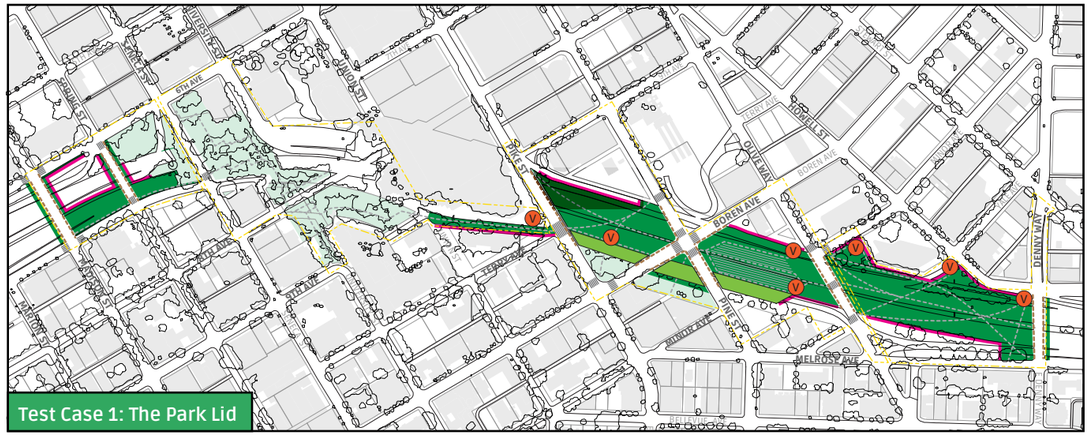
Table 9-1. Summary of Development Programs for Test Cases Considered

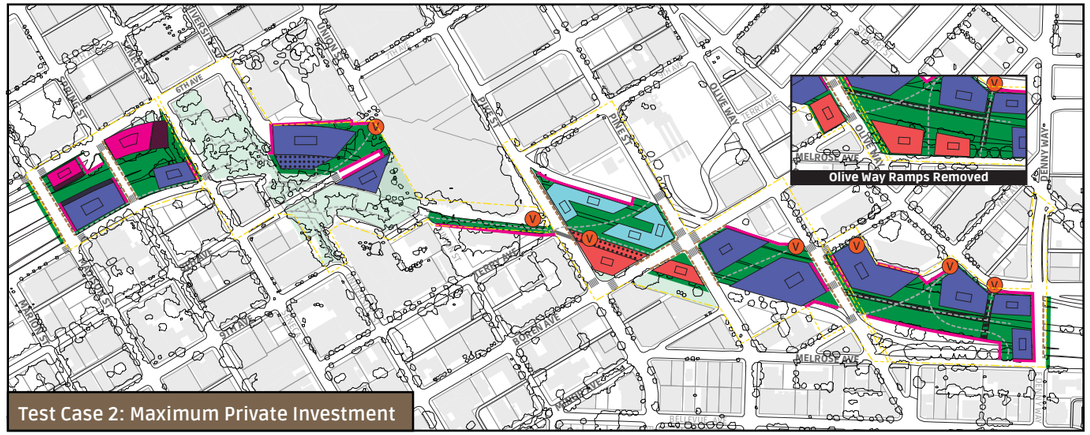
	Test Case 1 All Ramps Remain	Test Case 2 All Ramps Remain	Test Case 2 Removal of Olive Way Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
Residential* (Total)	NA	**2.9M SF**	**4.7M SF**	**621K SF**	**1.2M SF**
Market-Rate Housing	NA	2.9M SF	4.7M SF	373K SF	0.72M SF
Affordable Housing (Middle-Income)	NA	0 SF	0 SF	93K SF	180K SF
Affordable Housing (Lower-Income)	NA	0 SF	0 SF	155K SF	300K SF
MHA Contribution	NA	**$150M**	**$215M**	**$32M**	**$39M**
Office	NA	4.5M SF	4.9M SF	1.9M SF	1.9M SF
Hotel	NA	280K SF	280K SF	50K SF	50K SF
Retail	NA	350K SF	410K SF	150K SF	170K SF
Total Vertical Development	**NA**	**8.0M SF**	**10.3M SF**	**2.8M SF**	**3.4M SF**
Park Space	9.8 acres	0 acres	0 acres	7.7 acres	7.7 acres
Privately-Owned Public Space	0 acres	2.5 acres	2.7 acres	1.1 acres	1.2 acres
Pavilion	63K SF	20K SF	20K SF	46K SF	46K SF
Fire / Life Safety Building	25K SF	25K SF	25K SF	25K SF	25K SF
Total Lid Area	**11.2 acres**	**15.2 acres**	**16.8 acres**	**14.6 acres**	**16.2 acres**
Parking 10% onsite	0	160K SF 1.1K spaces	190K SF 1.3K spaces	56K SF 390 spaces	64K SF 450 spaces
Parking 90% offsite (nearby lid)	0	1.4M SF 9.7K spaces	1.7M SF 12.1K spaces	500K SF 3.5K spaces	580K SF 4K spaces

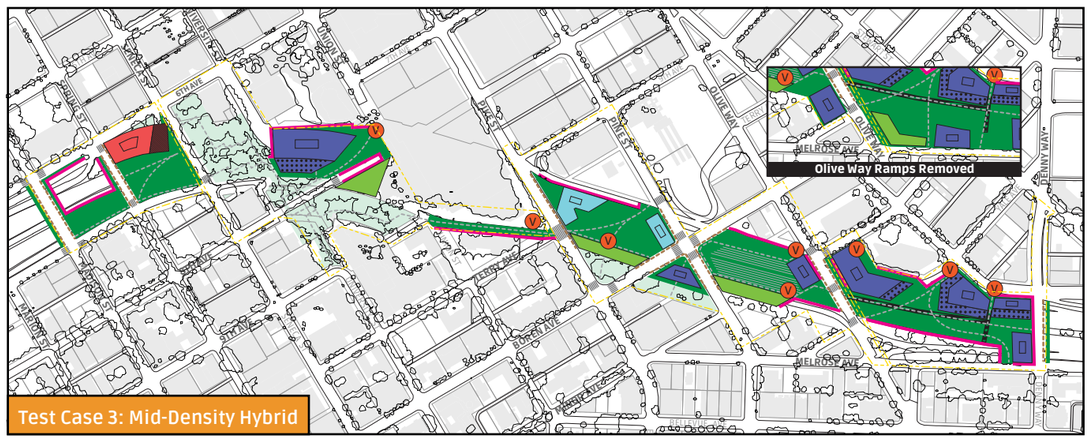
*Affordable Housing Assumptions:

Test Case 2: No affordable housing delivered onsite; MHA contributions to Seattle Office of Housing fund.

Test Case 3: 40% of all residential housing is affordable; 25% reserved for lower-income housing (households below 60% AMI); 15% for middle-income housing (households at 60-120% of AMI).







» In addition to topography, the complexity of the various structural layers of I-5 makes building a lid more challenging than lids in other cities and contexts.
  - I-5 is an extremely complicated piece of infrastructure with retaining walls, on- and off-ramps, travel lanes and express lanes that rise and fall to meet with grades to the east and west. There are limited locations for bringing structure to grade in order to support a lid and buildings on top of a lid.
  - All test cases would need to provide FLS equipment and space for a facility, because the lid would technically make I-5 a tunnel below it. All test cases assumed an approximately 25,000 SF FLS facility atop I-5.

» I-5 on- and off-ramps play an important access function to and from downtown neighborhoods. However, the test case explorations revealed that retaining the ramps presents significant barriers to connectivity of the lid to its surroundings, diminishing the quality of the pedestrian environment, and ability to construct and access buildings. For the most part, the test case explorations assume that the existing ramps remain; further traffic analysis and coordination with WSDOT would be required to explore other options.

» A lid could re-establish pedestrian and bike connections that are increasingly important between Capitol Hill and Denny Triangle/Downtown Retail Core.

» Zoning and land uses are different on the west side (Downtown Retail Core) than on the east side of I-5 (Capitol Hill and First Hill). Programming would need to consider these differences in urban form and appropriate transitions, be informed by local stakeholders and be guided by the City of Seattle's policy principles.

» Freeway Park is a unique open space, but also lacks activity at its edges that contributes to perceptions of lack of safety. There are opportunities to increase activity along the edges of the park, but Freeway Park's historic designation would require significant coordination because the lid would tentatively alter its signature walls and box gardens at its edges.

» Consideration should be given to Plymouth Pillars Park and the off-leash dog park along the east edge of I-5. These are well-used and appreciated assets by the community.

» Expansion of the WSCC would change the use and feel of the eastern portion of downtown, adjacent to the lid.

» Regarding connectivity, Pike and Pine Streets are the most heavily used pedestrian and bike connections east-to-west.
  - The importance of Pike and Pine Streets make lid Area 3 a priority. The existing north-south connection between Freeway Park and Pike Street is narrow and is not as welcoming to foot traffic. In order to enhance this connection, a widened, landscaped path was considered in all scenarios.

» While demand for parking is unknown for 2035, parking is a known challenge because there is limited ability to use below-grade area for parking under the lid.
  - The idea of a parking district, using some yet-to-be-determined location for a parking reservoir, was used as an assumption. There may, with detailed design, be some ability to find creative on-site solutions, as was the case when the WSCC was built. In any event, parking demand at the time the lid is designed, would be a major factor for development economics.

10. Economic and Financial Feasibility of Lidding I-5

The Interstate 5 (I-5) Lid Feasibility Study (LFS) explored the range of financial feasibility and economic opportunity of a lid. The economic and financial feasibility assessment answered the question "how might test cases perform?", and surfaced key considerations relative to project delivery, policy assumptions, governance models, and funding and financing mechanism for the lid concept.

Based on the work conducted for this study—and memorialized in the I-5 LFS Economic and Financial Feasibility Memorandum—revenue from private investment in vertical development on a lid would contribute to the capital and ongoing maintenance cost of a lid project, but would likely not be sufficient to fully offset them. Other funding sources would be required.

COVID-19 Context

The COVID-19 pandemic has significantly affected socioeconomic market conditions and the commercial and residential property sectors since the analysis was developed. The evaluation provided in the economic and financial analysis of this study was based on pre-COVID-19 market conditions but was developed based on historical trends that capture multiple full economic cycles. As stated in the key study assumptions—and for the purposes of this study—by the time the lid is assumed to start construction in 2030, it is anticipated that the Seattle market would have gone through one or more full economic and development cycles, thus capturing those long-range economic trends in the study design.

However, the study confirms that with each test case there would be significant direct and indirect economic opportunity with the construction of a lid. The robust fiscal and economic benefits of a lid, in addition to the public benefits described in this study, make a lid project worthy of consideration despite the significant funding challenges.

10.1 Economic and Financial Evaluation Approach

To estimate project-wide economic feasibility, financial analyses were completed to measure total project costs against total potential project revenues of the I-5 lid for the three test cases explored (see Table 9-1). Net cash-flow results estimate the annualized projected financial gap between revenue generation from development on the lid, and the costs attributed to the construction and preservation of the lid (Equation 1), to answer the question "**What is the maximum potential for market-rate development to help pay for a lid?**" and further explore "**How would a context-sensitive public-private mix of development affect financial performance?**".

Equation 1. Funding Gap per Test Case

\+ [Revenue from Development on the Lid]
− [Construction and Preservation Costs of the Lid]
= Funding Gap

The underlying assumption is that a lid over I-5 would create "land"[12] with development potential over WSDOT right-of-way[13] (WSDOT, 2020a). Consistent with the approach used by precedent lids studied, the residual land value associated with vertical development on the lid could be paid as a one-time purchase price (as in a typical fee purchase) or converted into an annualized revenue stream. For the purposes of evaluating the financial feasibility of the lid to conceptually answer the question "What is the maximum potential for market-rate development to help pay for a lid?", this analysis shows residual land value converted into an annualized revenue stream over 99 years, but does not make a specific recommendation as to how transactions for development rights should be structured. The mechanisms for such transactions would need to be determined by a future master developer (or developers) and WSDOT and the City of Seattle. The residual land values discussed in this section do not account for an air rights lease payment to the State Motor Vehicle Fund.

The financial evaluation tested sensitivity to several variables, including capital cost contingency and risk ranges, interest rates affecting the costs of capital, ramp removal, development capacity, and policy assumptions around affordable housing, civic space and parking provision.

In addition to financial performance, the economic benefits from a lid project were expressed as overall net benefits in the form of increased state and local tax revenues, and economic impacts generated from project expenditure and on-site activities (e.g., employment and economic activity). This analysis did not capture (i.e., monetize) the test cases' potential societal benefits—such as reduced exposure to air pollution, noise, safety improvements, benefits of open space, and the other quality of life and economic competitiveness metrics—which would allow for a comprehensive cost-benefit analysis. Such analyses should be considered in future studies of a potential lid project.

12 As discussed in the Technical Feasibility and Test Case chapters, the lid is not equivalent to creating ground on terra firma, (refer to the I-5 LFS Technical Feasibility Memorandum). The lid deck structure would have to be designed and delivered in tandem with any vertical development, requiring a previously approved master plan that integrates the structural systems of buildings and lid so as to not compromise the functionality of either structure. Implementing a lid over I-5 would have important implications in the planning, design, funding, project delivery, and preservation of the lid asset.

13 Air rights over interstate right-of-way are determined by WSDOT as directed in Chapter 11 of the WSDOT Right of Way Manual (WSDOT, 2020a). As the entity with ownership of the facility, WSDOT can seek formal FHWA approval for any alternative use of property, including private development.

10.2 Cost Inputs

The study estimated rough-order-of-magnitude (ROM) costs to use in the economic and financial analysis. Costs included in the analysis consist of a range of estimated construction costs to build the lid, incremental ongoing annual O&M costs, periodic repair and rehabilitation costs of the lid structure, and annual park space O&M costs. Operating and preservation costs for vertical development (i.e., private development on Test Cases 2 and 3) are included in the pro forma real estate analysis for each of the primary types of development (i.e., residential, office, retail, hotel).

Corresponding O&M costs for other items such as utilities, surface streets, sidewalks, police enforcement, and fire protection were not assumed in the analysis. While there could be some mitigation discussed within the context of noise, and potentially emissions, this analysis did not account for the costs of those mitigation measures. Future planning and design analysis should provide the basis for estimating the cost of mitigation for items such as noise channeled by the lid to nearby sensitivity areas, or existing buildings and infrastructure.

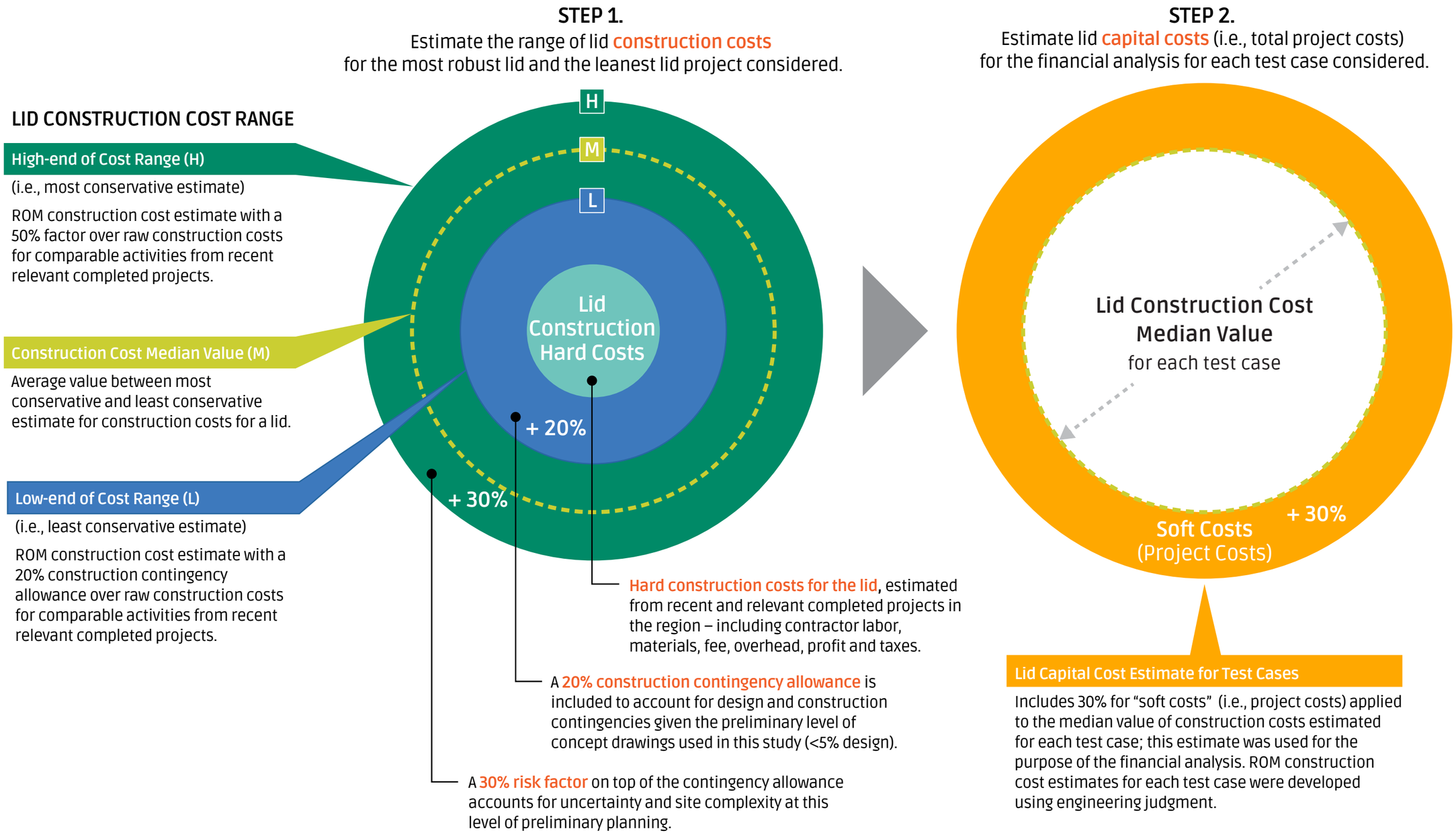
Displacement risks attributed to increasing property values as a result of the lid construction—resulting in increased residential and commercial rents—should be considered preliminary. Assumed investments in affordable housing both on and off the lid are anticipated to partially mitigate the risk, but other methods of displacement mitigation—and the benefit-cost of those alternatives—may need to be evaluated as part of future studies.

Figure 10-1 summarizes the approach taken to calculate cost inputs for the economic and financial analyses. First, construction costs (i.e., "hard costs") were estimated through a bookend analysis to provide a cost range for lidding I-5 through downtown Seattle. Construction costs were then estimated for each test case based on engineering judgment. Second, lid project capital costs to account for total project costs, including right-of-way and variable costs (i.e., "soft costs") were estimated for use in the financial analysis for each test case. Costs included in this study are parametric (i.e., based on unit prices and quantities) and should not be interpreted as anything beyond initial design (<5 percent).

Construction Cost Estimates

The I-5 LFS hard construction costs (covering materials and labor) estimated for the lid structure based on recent and relevant completed regional projects that involved similar construction activities to those that would be required to construct a lid over I-5. Federal and state asset replacement, right-of-way costs, and other variable costs are not included in construction cost estimates. Due to the preliminary nature of the project, ROM costs were

Figure 10-1. Approach to Rough-Order-of-Magnitude Cost Estimates for the Study



estimated in lieu of specific cost estimates, based on engineering judgement and supported by limited analysis. These preliminary costs are suitable given the level of engineering analysis performed to date (<5 percent design).

The ROM costs are intended to capture the full spectrum of potential construction costs for the project based on the lid's intended function (i.e., ability to support various structural loads). The study was designed to explore the technical feasibility of lidding the freeway, to understand the implications for building both a robust lid project and the leanest lid project (i.e., project "bookends"), and to still deliver a project that aligns with the value proposition of this study. These two bookends of analysis in turn became financial bookends to answer the question on cost range for lidding I-5 through downtown Seattle.

Table 8-1 captures the considerations to deliver the project bookends:

» The robust lid project (Figure 10-3), would carry the largest possible structural load levels (given site constraints) and ramps would be removed (as permissible) to allow maximizing the lid area over the I-5 right-of-way.

» For the leanest lid project (Figure 10-4), the lid was conceptually designed to carry the lowest load level (i.e., open space loads) and the existing on- and off-ramps would remain in place.

WSDOT's Cost Estimate Validation Process (CEVP®) was not used to create the ROM cost ranges for the study and no formal risk modeling was performed. Instead, a 20-percent construction contingency was included in all construction cost estimates, in lieu of detailed line-item contingencies for design and construction as is typically done with quantity-based estimates—in line with the WSDOT standard approach. The ROM construction cost estimate with a 20-percent construction contingency allowance establishes the low end of the cost range estimates for a lid project (i.e., the least conservative construction estimate considered for the purposes of the I-5 LFS analysis).

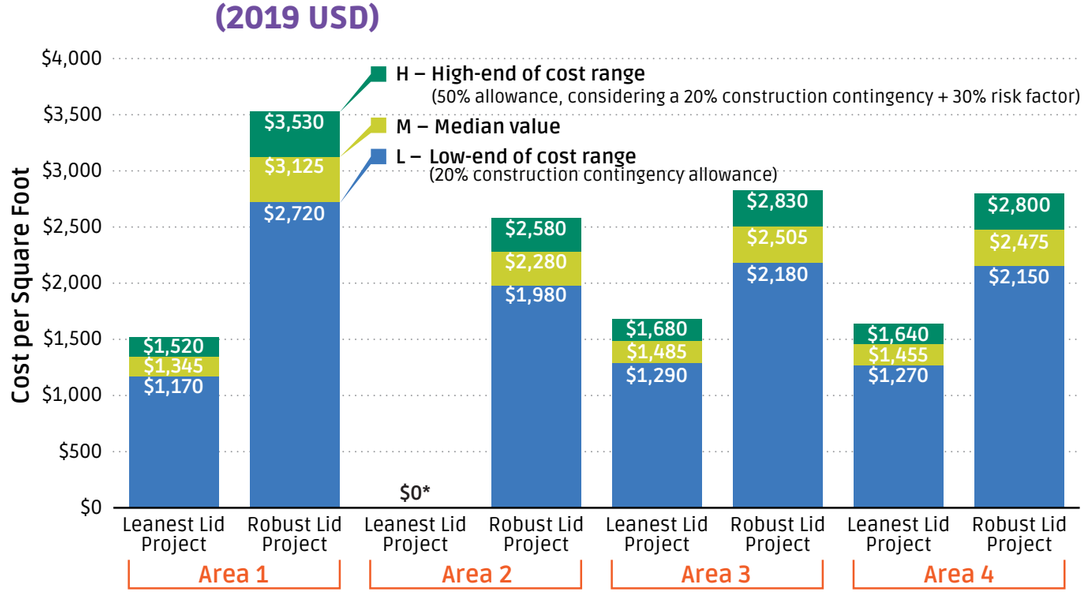
Although ROM construction cost estimates are based on metrics from recently completed comparable projects, these projects do not necessarily capture the complexities of working along the I-5 corridor through downtown Seattle. Such complexities include challenging site topography, uncertain soil conditions and seismic hazards, constrained right-of-way within a built-out dense urban environment, and aging existing infrastructure among others. To illustrate the potential impacts associated with project uncertainty and site complexities, construction costs were also estimated with a 30-percent risk factor over the construction contingency allowance. WSDOT recommended a 50-percent increase to the study's raw construction cost estimates—which included both the 20-percent construction contingency allowance and the 30-percent risk factor for the project uncertainty and site complexities of the corridor—an approach consistent with other preliminary planning-level studies. This 50-percent allowance established high-end of the cost range estimates for the lid project (i.e., the most conservative construction cost estimate considered for the purposes of the I-5 LFS analysis).

The more robust lid project cost does not consider costs associated with secondary traffic and transportation network impacts related to ramp removal, which would have upstream and downstream effects and can be estimated only when performing a comprehensive transportation network study. These costs and studies would need to be considered and estimated in future evaluations of the lid concept.

Construction Cost-per-Square-Foot Ranges

Figure 10-2 presents the ROM construction costs-per-square-foot ranges per lid area for the study's project bookends analysis (Figure 10-3 and Figure 10-4). Given the specific challenges

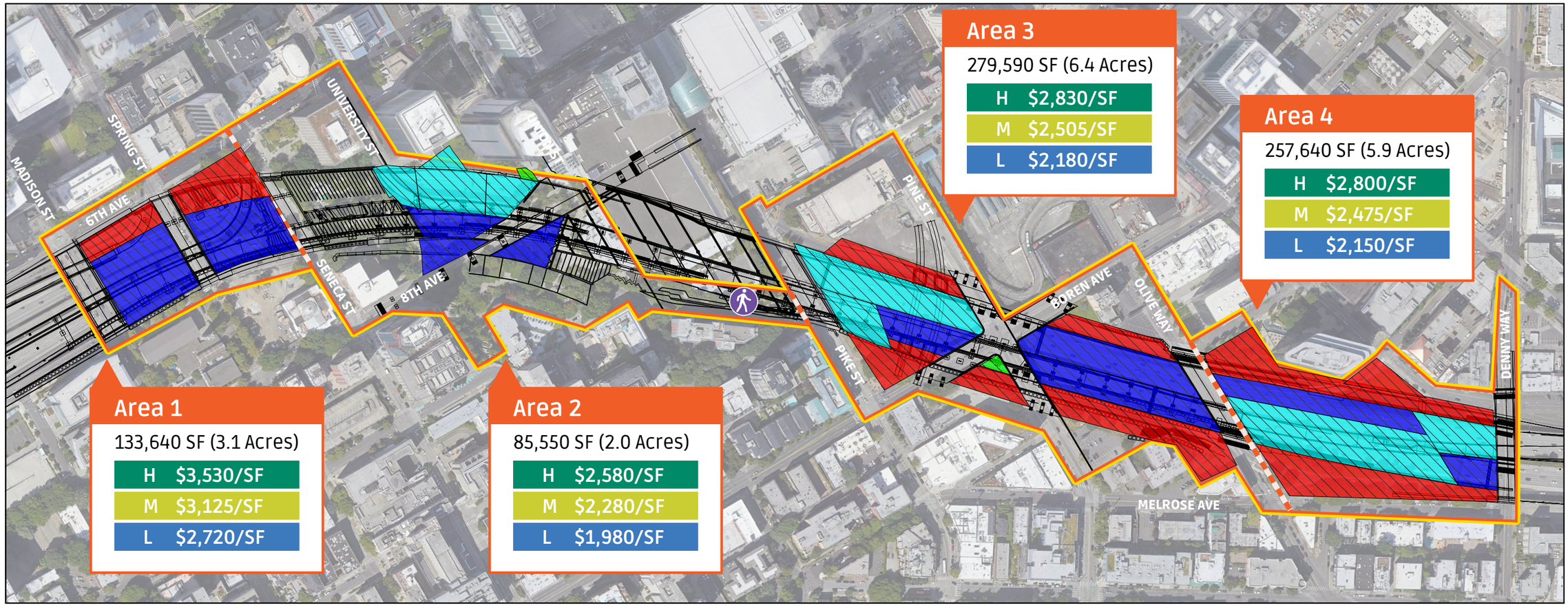
Figure 10-2. Construction Cost-per-Square-Foot Ranges per Lid Area in Project Bookends (Robust and Leanest Lid Projects) (2019 USD)



The costs-per-square-foot ranges are construction costs, and thus do not include right-of-way costs, federal and state asset replacement, and other variable costs. See also Figure 10-1 for a definition of the ROM cost estimates.

*Area 2 includes lump-sum construction costs of $25 million and $32 million (at 20 percent and 50-percent compounded contingency allowance and risk factor, respectively) for enhancing the WSCC pedestrian walkway along Hubble Place.

Figure 10-3. Construction Cost-per-Square-Foot Ranges for a Robust Lid Project



Legend

- Structural Assessment Boundary (Study Site)
- Area of Analysis
- Area Limit
- Enhancement of the WSCC Pedestrian Walkway along Hubbell Place Considered

Lid Load Levels

- Up to High-rise Load Level
- Up to Mid-rise Load Level
- Up to Low-rise Load Level
- Up to Open Space Load Level

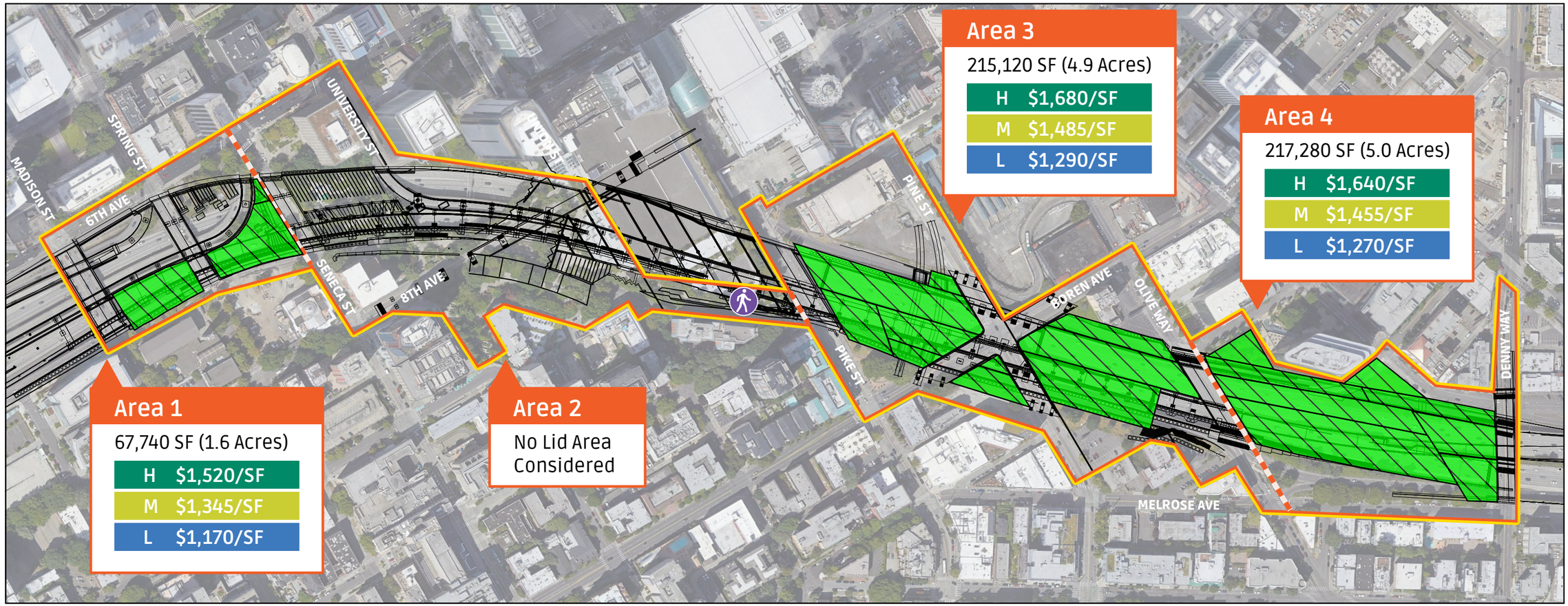
Total Lid Area in SAB: 756,420 SF (17.4 Acres)

- H High-end of range of the cost-per-square-foot of lid (50% allowance, considering a 20% construction contingency + 30% risk factor)
- M Average cost-per-square-foot of lid
- L Low-end of range of the cost-per-square-foot of lid (20% construction contingency allowance)

SF = Square Foot

0 300 600 Feet

Figure 10-4. Construction Cost-per-Square-Foot Ranges for the Leanest Lid Project



Legend

- Structural Assessment Boundary (Study Site)
- Area of Analysis
- Area Limit
- Enhancement of the WSCC Pedestrian Walkway along Hubbell Place Considered

Lid Load Levels

- Up to High-rise Load Level
- Up to Mid-rise Load Level
- Up to Low-rise Load Level
- Up to Open Space Load Level

Total Lid Area in SAB: 500,140 SF (11.5 Acres)

H	High-end of range of the cost-per-square-foot of lid (50% allowance, considering a 20% construction contingency + 30% risk factor)
M	Average cost-per-square-foot of lid
L	Low-end of range of the cost-per-square-foot of lid (20% construction contingency allowance)

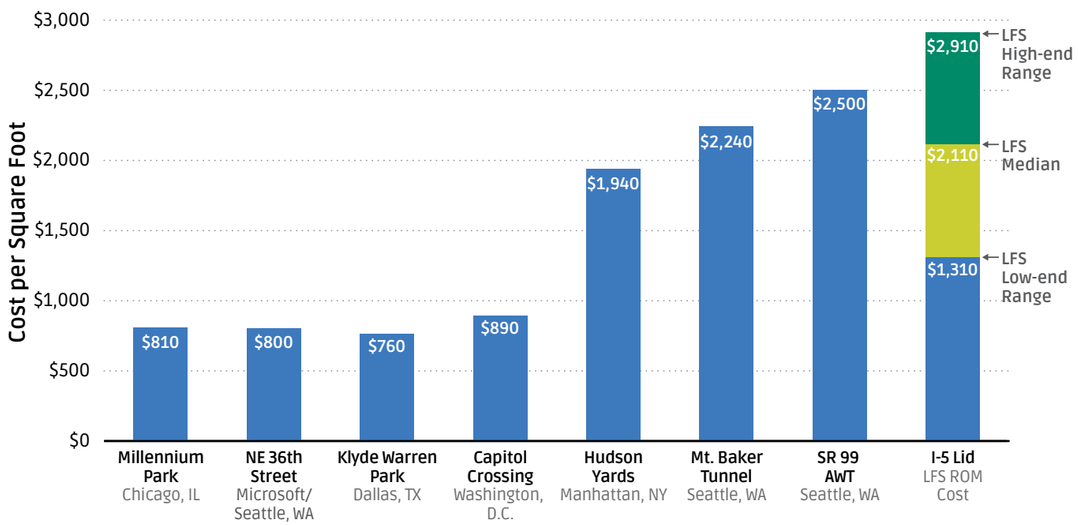
SF = Square Foot

0 300 600 Feet

and opportunities each lid area presents, not all lid areas would be created equal, and thus, the cost per square foot of a lid is not equivalent across the four lid areas of the study site (Figure 10-3). High-load lid areas would have more structural requirements that would result in higher lid construction costs. Significant costs exist in the below grade structural supporting elements of the lid structure, partially due to the larger vertical loads (i.e., loads designed to support mid- and high-rise buildings) and the fact the structure would be in a highly seismic region.

In addition to category-specific cost inputs from other recent and relevant completed projects, the total resulting costs were compared to local, regional, and national comparable projects on a constant, or real, 2019 dollar-per-square-foot basis. Figure 10-5 shows the findings of this comparison. The low-end value of the construction cost range for the I-5 lid is higher in cost but closely agrees with other comparable projects that support open space loads. The high-end value construction cost-per-square-foot estimate is well above of other comparable projects in the region. This is likely due to the need to account for project contingency and risk, the project length, and the need for FLS components considered in this study. The cost range (i.e., median value) of the LFS falls between the cost of Hudson Yards in Manhattan (a similar lid structure supporting high-rise vertical development) and the SR 99 Alaskan Way Viaduct tunnel (AWT) costs.

Figure 10-5. Construction Cost-per-Square-Foot Comparison of Representative Projects (2019 USD)



Comparable costs represent construction costs, not capital costs. Other variable and right-of-way costs are not included.

Capital Cost Estimates

Construction costs were further adjusted by 30 percent to yield an estimate of total capital costs of a lid project (Figure 10-1). Capital costs generally serve as the basis for financial and economic analysis to consider the impact of "soft costs"[14] (i.e., other variable project costs) on the financial viability of the project and opportunity cost attributed to project investments. As with construction costs, these capital costs do not include right-of-way costs, federal and state asset replacement, or vertical development costs. All estimates were normalized and estimated in 2019 USD.

Capital Cost Estimates for Lid Project Bookends

Figure 10-1 summarizes the capital cost estimates for the lid project bookends: a more robust lid project and the leanest lid project. Assuming a 20-percent construction contingency (low-end of cost range) and a 50-percent construction contingency and risk factor (high-end of cost range) on construction costs yielded a broad range of capital costs for a lid project. The resulting ranges are $855 million to $1,108 million for the leanest lid project and $2,205 million to $2,863 million for the robust lid project.

It should be noted that given that overbuilding mainline I-5 would change the configuration of the freeway from exposed open-air lanes to a 0.8-mile tunnel, lidding I-5 through downtown Seattle would require installing an FLS system. This requirement represents 4 percent (leanest lid project estimate) to 12 percent (robust lid project estimate) of total construction costs for the lid project.

Moreover, ROM costs are based on the capital investments required to support the construction of the lid over I-5 and do not assume the rebuilding of I-5, including walls, elevated structures, and overpasses. The existing I-5 structures evaluated were built in the 1960s with most of the assets operating past their designed life by 2030. The study assumed that further evaluation would occur as part of I-5 master planning efforts, which have yet to be funded and developed. The master planning and initial design analysis could conclude that many of these assets would need to be replaced to address deterioration and/or improve operating performance of I-5 through downtown Seattle.

Capital Cost Estimates by Test Case

As expressed in Figure 10-1, for the purpose of the financial analysis, Table 10-2 summarizes the estimated capital costs for each test case. First, a lid construction cost was estimated

14 **Soft costs** account for activities such as further project evaluation by WSDOT and the City of Seattle, consideration of third-party involvement, costs incurred during initial conception of the lid project, alternatives analysis and preferred alternative selection, planning—including public outreach and environmental permitting, design, and procurement—additional planning-level contingencies, and other miscellaneous costs leading up to construction and commissioning, or start-up.

Table 10-1. Capital Cost Breakdown per Lid Area for the Project Bookend Analysis (2019 USD)

Lid Area of Analysis	Robust Lid Project (Maximum lid area and load considered)			Leanest Lid Project (Minimum lid area and load considered)			Lid Project Cost Range
	Area (SF)	Cost including 20% construction contingency ($)	Cost including 20% construction contingency & 30% risk allowance ($)	Area (SF)	Cost including 20% construction contingency ($)	Cost including 20% construction contingency & 30% risk allowance ($)	Cost Range ($)
Area 1	133,640	472M	614M	67,740	103M	134M	103M – 614M
Area 2	85,550	221M	286M	N/A	*33M	*42M	*33M – 286M
Area 3	279,590	791M	1,027M	215,120	361M	468M	361M – 1,027M
Area 4	257,640	721M	936M	217,280	358M	464M	358M – 936M
Total	756,420	2,205M	2,863M	500,140	855M	1,108M	855M – 2,863M

*Cost consideration for enhancement of the WSCC pedestrian walkway along Hubble Place.

Range of financial bookends of analysis, expressed in capital costs per lid area corresponding to the maximum (Figure 8-5) and minimum (Figure 8-6) potential developable lid area considered in the technical feasibility assessment. Cost breakdown does not include right-of-way costs and federal and state asset replacement but does include other variable costs expressed in 2019 USD.

Table 10-2. Test Case Average Capital Cost Breakdown per Lid Area (2019 USD)

Lid Area of Analysis	Test Case 1 All Ramps Remain		Test Case 2 All Ramps Remain		Test Case 2 Removal of Olive Way Ramps		Test Case 3 All Ramps Remain		Test Case 3 Removal of Olive Way Ramps	
	Area (SF)	Cost ($)	Area (SF)	Cost (S)	Area (SF)	Cost (S)	Area (SF)	Cost (S)	Area (SF)	Cost (S)
Area 1	58,735	103M	143,405	641M	143,405	641M	116,530	224M	116,530	224M
Area 2	N/A	*37M	85,550	254M	85,550	254M	85,550	204M	85,550	204M
Area 3	231,850	449M	239,035	779M	251,500	820M	230,850	489M	245,745	521M
Area 4	198,790	377M	193,735	624M	250,090	805M	202,355	587M	257,820	748M
Total	489,375	966M	661,725	2,298M	730,545	2,520M	635,285	1,505M	705,645	1,698M

*Cost consideration to enhance the WSCC pedestrian walkway along Hubble Place.

Capital costs assumed for the lid in each test case are expressed as the median value of lid capital costs within the value range of 20 percent design and construction contingency (low-end of cost range) and the compounded 50 percent contingency and risk factor (high-end of cost range). Cost breakdown does not include right-of-way costs and federal and state asset replacement but does includes other variable costs expressed in 2019 USD.

for each test case[15] using engineering judgement regarding the load requirements and structural systems assumed. All test case construction cost estimates are expressed as the total cost associated with constructing a lid over I-5 from Madison Street to Denny Way (i.e., a full lid buildout), but reflect the load requirements and structural configurations explored in each development program, at the lid area-of-analysis level (e.g., cost considerations related to ramp removal or retainage, vertical development and building types, lid framing, etc. for each lid section). These values do not include the costs for the vertical development on the lid (i.e., the construction cost assumed for buildings in Test Cases 2 and 3), which were evaluated separately as part of the vertical development pro forma analysis.[16]

Second, to estimate the capital costs for each test case, the average (or median) ROM construction cost estimates were further adjusted by 30 percent to account for soft costs; the median value represents the midpoint between the most conservative and least conservative estimate to construct a lid. This median value was used in the financial feasibility analysis to ensure that the considered costs would be in line with the cost-per-square-foot construction cost values of other representative projects in the region (Figure 10-5).

Figure 10-6 compares the capital costs for each test case explored in this feasibility study. As would be expected, the structural requirements to bear larger loads from vertical development results in significant increases in lid capital costs. The median value for capital costs results in a $539 million (56 percent) increase for Test Case 3 over Test Case 1 when all ramps remain, and a $1.32 billion (138 percent) increase for Test Case 2 over Test Case 1 when all ramps remain. Although absent from the estimate, there may be some efficiencies in determining vertical development costs as they relate to the assumed framing of the lid structure. The opportunity being that the two structural systems—the lid structure and the mid- and high-rise buildings (i.e., vertical development)—were calculated independently for the purpose of the financial analysis; however, if built, they would both share a common foundation system, and so there would be cost-saving opportunities that have not been recognized by this study and should be explored in future studies when the appropriate level of detailed design is performed.

15 It is important to note that the assumed lid geometries and areas per test case are slightly different than those in the assumed lid bookend analysis to estimate construction costs. This is due to consideration given to urban design criteria used for edge and building integration to the lid structure, thus yielding slightly different lid geometries and different absolute magnitudes in cost.

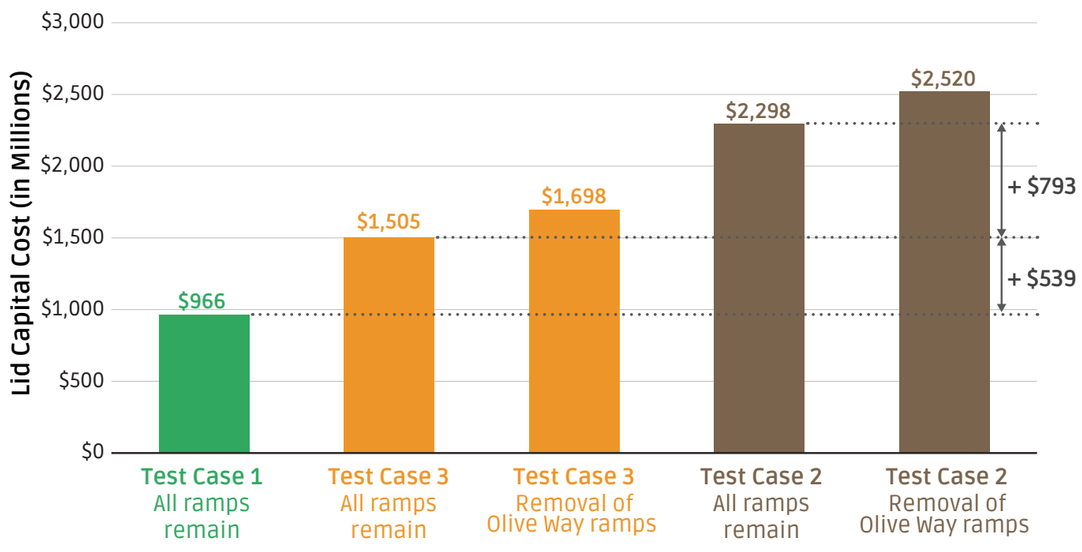
16 Construction costs for building public park space and civic spaces on pavilions are accounted for in the lid capital cost estimates.

Other Preservation and Operating Costs

To determine the life-cycle financial analysis of the project, annual O&M costs, and periodic repair and replacement (R&R) costs for the lid structure and lid improvements were estimated for each test case considered (Table 10-8). These O&M and R&R costs represent the maintenance costs specifically associated to the lid—both the lid structure and the associated maintenance costs over what is currently budgeted for the roadway and existing assets on I-5 within the SAB (i.e., study site). In addition, O&M costs for public park and civic structures were also considered. The approach to estimating preservation and maintenance costs for the project is further memorialized in the I-5 LFS Economic and Financial Feasibility Memorandum.

Preservation and operating costs associated to private vertical development (i.e., market-rate buildings) on the lid are incorporated as part of the real estate pro forma estimates for Test Cases 2 and 3.

Figure 10-6. Lid Capital Cost Estimates by Test Case ($ millions)



For the purpose of the financial feasibility analysis, the lid capital costs assumed for each test case are expressed as the median value of lid capital costs within the value range of 20 percent design and construction contingency (low-end of cost range) and the compounded 50 percent construction contingency and risk factor (high-end of cost range). These estimates do not include values are absent of right-of-way costs, federal and state asset replacement, or vertical development costs, but do include other variable costs. Capital cost estimates are reflected in 2019 USD. To express the difference in cost estimates for all test cases where ramps would remain, this figure shows that Test Case 3 (Mid-density Hybrid) has a higher cost than Test Case 1 (The Park Lid) by $539 million, whereas the difference between Test Case 2 (Maximum Private Investment) and Test Case 3 is $793 million.

10.3 Revenue from Vertical Development

The sole direct source of revenue assumed to offset lid capital and operating costs in this analysis was the residual land value that could be generated through vertical development (i.e., buildings) on the lid, to be delivered by the private sector. The focus of the analysis of vertical development was to answer the test case guiding questions "What is the maximum potential for market-rate development to help pay for a lid?" and "How would a context-sensitive public-private mix of development affect financial performance?".

Revenue and cost assumptions used in this analysis were based on current and projected commercial and residential market conditions (described in Section 7.4 Real Estate Market Context) and other factors further described in the following sections. Test cases for vertical development were directed by the City of Seattle's following key assumptions and the input from the Study Community.

» Test Case 2 (Maximum Private Investment) assumes that the maximum amount of vertical development would be built on the lid structure, while satisfying affordable housing requirements through fee contributions as required by Seattle's Mandatory Housing Affordability policy.

» Test Case 3 (Mid-Density Hybrid) assumes lower-density development (compared to Test Case 2) and that 40-percent of the built residential area would be set aside for affordable housing, and would not generate residual lane value for a private sector developer.

Results of this analysis are expressed as residual land value (RLV). RLV is the land value that a developer or investor would pay after accounting for costs, revenues, and profit associated with a development. For the purpose of this study, a master developer is assumed to be the party responsible for developing the land attributed to the I-5 lid project area, including any land adjacent to the lid structure that is part of the defined project boundaries. A master developer could either assign development-ready parcels on the lid to third parties or develop them directly. For this analysis, the total RLV generated by development is considered to be available to offset costs associated with constructing and operating the lid structure. This information is shown in the following sections as an annualized stream of revenues, though this study does not recommend a specific structure for a future transaction between a master developer, WSDOT, and the City of Seattle, nor does this analysis account for an annual air rights lease payment to the State Motor Vehicle Fund. This analysis is further described in the I-5 LFS Economic and Financial Feasibility Memorandum, Appendix B—I-5 Lid Feasibility Study Vertical Development Feasibility Pro Forma.

In addition, the following sections describe the potential incremental value that could accrue to surrounding parcels once a lid is complete, assuming that any environmental impacts, including emissions and noise from I-5, would be mitigated to some extent. This incremental value has been analyzed solely for the purposes of understanding the potential incremental value creation that could be attributed to the lid project.

10.3.1 Potential Impacts to Land Value in the Surrounding Area of the Project

Calculating the incremental assessed property value for parcels in the general vicinity of the I-5 lid project would depend on both the proximity of the property to the lid and the types of amenities provided on the lid facility. For example, a park- and civic space-oriented improvement would affect a building adjacent to the lid differently than a high-rise building that blocks an existing view (or creates new concerns regarding noise and pollution) that could partially offset the benefit of mitigating noise and emissions from I-5 highway operations. Likewise, development on the lid could also result in increasing congestion and surface street emissions. Regarding parks and recreational facilities' impacts on property valuation, excellent parks—defined as a signature park that is well maintained and exceptionally attractive—can increase land value within a 500-foot radius by up to 20 percent, while a poor-quality park that is unkept, generates noise, and presents safety challenges can reduce property values within a 500-foot radius by as much as 5 percent (Farr, 2018).

Given the preliminary nature of this study, the impact of property valuation regarding proximity to a lid could not be evaluated conclusively. To approximate potential, incremental real estate values from lidding I-5, a simplified approach was applied using assessed property values within a 500- and 1,000-foot range and applying factors based on both industry research and the recent valuation methodology used to estimate the potential revenue generation as a result of the Waterfront Seattle project (ABS Valuation, 2019).

For the Waterfront Seattle analysis, and other similar Local Improvement Districts (LID), there was an assumed and measurable impact on the assessed value of property in the area surrounding the infrastructure investment. The projected incremental assessed value of the defined parcels was then monetized as revenue to support the construction and maintenance of the asset. For purposes of the I-5 LFS financial evaluation, no incremental revenue through a mechanism such as a LID was assumed; however, values were estimated to understand the magnitude of assessed property value within a 1,000-foot range of the project.

Table 10-3 indicates the extent of potential assessed property value creation. A conservative range of property value impacts was assumed with incremental values of 0.5 percent (low-end range) and 1.5 percent (high-end range) for properties within 500 to 1,000 feet of the lid;

Table 10-3. Incremental Assessed Value Assumed to be Created on Adjacent Parcels

Distance from I-5 Lid Project*	Number of parcels (King County, 2019)	Current assessed value of parcels (King County, 2019)	Low-end Range Factor	Low-end Range Incremental Value	High-end Range Factor	High-end Range Incremental Value
0 – 500 feet	295	$2.967B	1.0%	$29.7M	3.0%	$89.0M
500 – 1,000 feet	333	$2.674B	0.5%	$13.4M	1.5%	$40.1M

* Distance estimated from the I-5 lid feasibility study site boundary.

1 percent (low-end range) and 3 percent (high-end range) was assumed for properties within 0 to 500 feet of the lid.

In the Waterfront Seattle example, incremental property tax revenue for existing parcels in the project vicinity (between 500 and 2,000 feet from the project) anticipated assessed value increases of 0 to 4 percent based on detailed parcel analysis. The resulting summary level comparison resulted in a market value without the improvement of $56.4 billion and increasing to $56.8 billion with the improvement, an average increase of 0.79 percent (ABS Valuation, 2019). In the case of Waterfront Seattle, a further adjustment of 39.2 percent was applied to align the assessed values with the revenue-generation requirements as set out in the LID Ordinance (ABS Valuation, 2019). Property owners within the LID boundaries can make a single payment within 30 days of receiving their assessment or finance the assessment over 20 years, paying in installments with incremental interest and financing costs (City of Seattle, 2017b).

Through evaluation of the assessed values of existing parcels within a 1,000-foot range of the I-5 lid project boundary, the identified parcels could increase in value from $43 million in the low-end of the range to $129 million in the conservative high-end of the range. Similar to the Waterfront Seattle improvement, an LID or other value capture mechanism, could also be used as a partial funding approach to monetize some of the incremental property value creation through a one-off assessment or series of assessments. However, some of the parcels underlying the analysis in Table 10-3 are within the Waterfront Seattle LID boundaries. Increased residential and commercial rents from these projected value increases could also exacerbate displacement pressure in the area. While a thoughtful, integrated anti-displacement strategy could help counter these impacts, that too would require investment to be effective.

10.3.2 Value Creation on the Lid Structure

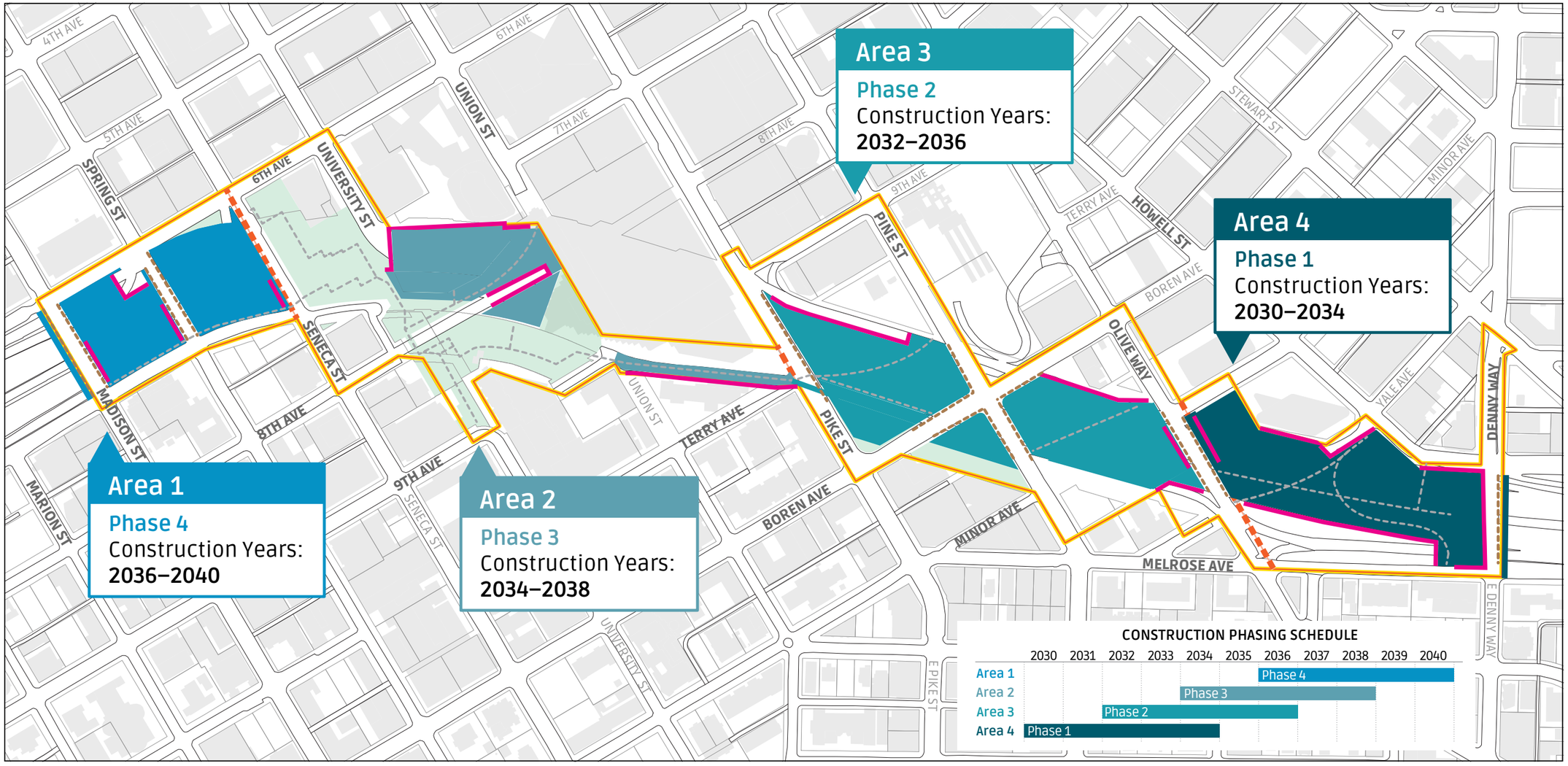
To evaluate the impact of new developable "land" created as a result of the lid structure, real estate development scenarios in Test Cases 2 and 3 assumed the following vertical development program and phasing:

- Land use and zoning would enable vertical development of the test cases on the lid.
- Vertical development would be delivered through a public-private partnership, with a master developer responsible for delivering the vertical development program
- FHWA would authorize WSDOT to engage in an air rights lease agreement with the master developer.
- Vertical development would be phased over time, as described in the I-5 LFS Economic and Financial Feasibility Memorandum, Section 5.3.3, and summarized below.

From a life-cycle cost perspective, the full lid—from Denny Way to Madison Street—was estimated to be constructed in four phases starting from north to south (Figure 10-7), with each phase being three to four years. Each phase was assumed to overlap by two years, resulting in a total construction duration of 10 years, from 2030 to 2040—a relatively conservative delivery schedule.

The analysis assumed vertical development construction (i.e., buildings) would take place only after each lid area construction phase is completed. This assumption is meant to maximize the impact of RLV generated by vertical development (in present value terms) versus waiting to begin development until the entire lid is constructed. However, the RLV of vertical development could be affected by moving to an integrated delivery model for the lid and vertical development, potentially reducing construction time, or a longer lid construction duration or delayed, which would delay the receipt of revenues from vertical

Figure 10-7. Lid Construction Phasing Assumptions for Test Cases 2 and 3



Legend

- Structural Assessment Boundary (Study Site)
- Area of Analysis
- Area Limit
- Parcel Boundary
- Roadway Pavement Edge
- Existing Building Footprints
- Existing Open Space
- Vertical Edges Above Grade
- Improved Pedestrian Way
- New Pathways
- Lid Area

Area Limits

Area 1: Between Madison Street and Seneca Street
Area 2: Between Seneca Street and Pike Street
Area 3: Between Pike Street and Olive Way
Area 4: Between Olive Way and Denny Way

0 300 600 Feet

development and reduce RLV in present value terms.[17] The vertical development program's phasing is also based on the lid's market capture potential (see Table 7-1), as identified in the I-5 Lid Feasibility Study Real Estate Market Scan and the program assumptions defined for each test case (see Table 9-1). The pace of vertical development delivery and absorption is also constrained by the amount of supportable annual market demand for various real estate uses (as determined in the I-5 Lid Feasibility Study Real Estate Market Scan and the vertical development capacity associated with each test case (refer to the I-5 LFS Test Case Memorandum for more detail). Vertical development is projected to occur between2035 to 2052 (extending to 2055 to account for additional development in Test Case 2 with removal of Olive Way ramps).

This analysis considers the RLV of vertical development on the lid under the different test cases. As described previously and in the glossary, RLV is the value that a developer or investor can pay for development rights (or land and development rights) after accounting for costs, revenues, and profit associated with development. Analysis was conducted through a multi-year discounted cash flow that calculates RLV for each development site by first determining the capitalized value of the income streams generated from the vertical development program, and then subtracting all development costs.[18]

As shown in Figure 10-8, the development program analyzed in Test Case 2 generates the highest RLV, driven by relatively high density and MHA fee payments versus on-site development of affordable housing. The resulting RLV for Test Case 2 is $353 million (2019 USD). If the Olive Way ramps are removed, the development program in Test Case 2 could be increased by 2.3 million square feet of vertical development (see Figure 9-9 and Table 9-1), increasing the value by 30 percent to $459 million (2019 USD).

Test Case 3 results in a lower RLV than Test Case 2 due to its lower assumed amount of vertical development and the provision of 40 percent affordable and middle-income housing (resulting in a loss of value to a master developer). Test Case 1 does not include private vertical development and therefore does not generate RLV.

For the purpose of the I-5 LFS financial analysis, RLV is expressed in total (as shown in Figure 10-8) and as an annualized revenue stream (as shown in Table 10-4); however this study does not recommend a structure for a transaction between WSDOT and a master developer to confer development rights on the lid or constitute a formal valuation of the fair market value for the "land" created on the lid per FHWA requirements. RLV shown in this study is only a preliminary test of the potential for private vertical development to offset the capital and operating costs associated with the lid structure. Moreover, the annualized revenue streams shown in this section do not take into account any lease payment or requirement to the State Motor Vehicle Fund, though such a payment may be required by WSDOT.

Figure 10-8. Total Residual Land Value from Private Vertical Development by Test Case (in Millions, 2019 USD)

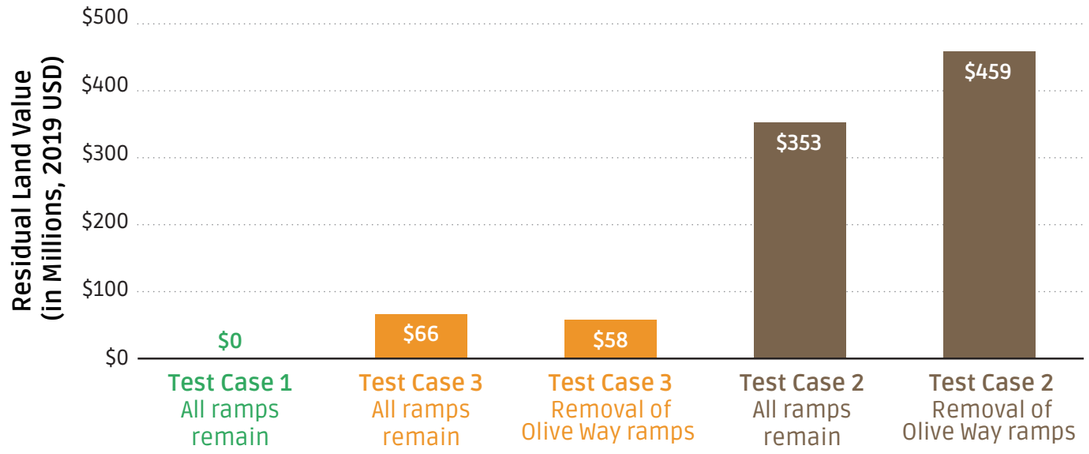


Table 10-4. Stabilized Year Revenue from Vertical Development by Test Case (2019 USD)

	Test Case 1 All Ramps Remain	Test Case 2 All Ramps Remain	Test Case 2 Removal of Olive Way Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
Stabilized Year Revenue from Vertical Development	NA	$19.8M	$25.5M	$3.7M	$3.3M
Fully Stabilized Year	NA	2050	2053	2050	2050

The annual private-sector revenue contribution refers to the annual revenue available from a master developer for a lid project after accounting for the vertical development costs on the lid. This contribution could be considered as a lease payment for right-of-way use over I-5. Refer to the I-5 LFS Economic and Financial Feasibility Memorandum, for details on annualized value of development.

17 Future phases of exploration of a lid project (once further planning and design is available) could determine if the construction of buildings should coincide more closely with the lid construction, analyzing private-sector appetite and the impact on land value of an integrated schedule, through Alternative Public Works Delivery. Specific project-delivery considerations and detailed financing assumptions were simplified, with private financing for building construction commencing later in the project cycle, so that financing and construction of lid structural systems would be assumed to be delivered first and vertical development beginning later.

18 The discounted cash flow pro forma model and RLV calculation do not include horizontal costs or any other infrastructure related costs, as the LFS assumes that the buildings can be integrated with the lid's structural framing for both low-rise and mid-rise structures. High-rise structures were assumed to be supported on terra firma (i.e., existing land) using standard assumptions for property development costs

10.3.3 Financial Feasibility Results

The financial feasibility evaluation incorporates the net cash flow of total project costs associated with developing the lid against total project revenues to compare the relative financial performance of each test case explored (Equation 1 highlighted in Section 10.1). The financial evaluation uses a net-present-value method to express feasibility, estimated in normalized 2019 USD, with 2030[19] as a timeframe for project start-up, 2040 as the year of project completion for Test Case 1, and 2052 as the year of project completion for Test Cases 2 and 3. In addition to the various infrastructure costs and vertical revenue assumptions, described in the previous sections, the financial evaluation makes additional assumptions with respect to the funding and financing mechanisms that would be used to pay for construction and maintenance of the lid including interest rates, and other financing terms and obligations, further described in the I-5 LFS Economic and Financial Feasibility Memorandum.

Results reflected in this section are strictly in terms of project-level financial feasibility from the landowner's perspective (assumed to be WSDOT), taking into consideration the costs required to build and maintain the lid and the revenue collected from private development above the lid. Some of the additional external quantitative and qualitative benefits and impacts that each test case generates—such as the benefits of park and open space in Test Case 1, maximum development benefits in Test Case 2, and affordable housing in Test Case 3—are further evaluated in other sections of this report. As previously noted, the air rights lease payment to the State Motor Vehicle Fund is not included in the analysis and would be evaluated with further understanding of lid programming, fair-market value of the land, and further discussions with the landowner.

Lid Financial Profile – Lid Capital Cost and Residual Land Value

A simplified evaluation comparing the total capital cost of each test case to the RLV that could be generated through vertical development for a straightforward comparison of the resulting funding gap that would need to be filled to deliver each test case (Table 10-5). This calculation is preliminary and does not consider additional ongoing costs likely to be incurred, such as the annual air rights lease payments to the State Motor Vehicle Fund, as noted throughout this section.

Although Test Case 1 does not include vertical development, and therefore is not assumed to generate RLV in this context, its lower overall capital cost results in the lowest funding gap to deliver a lid over I-5. While Test Case 2 assumes maximum vertical development and generates as much as six times the RLV as that of Test Case 3, it is not sufficient to offset the capital costs required to structurally support a denser development scenario. As a result, Test Case 2 produces a larger funding gap than that of Test Case 3 both with and without the assumed removal of Olive Way ramps. It is important to note that the financial analysis does not make any assumption about which potential stakeholder would absorb the incremental costs associated with denser vertical development. This analysis also does not consider other potential fiscal or societal benefits that would be incorporated in a full benefit-cost analysis of the project.

Table 10-5. Funding Gap by Test Case Considering Lid Capital Costs and Residual Land Value of Vertical Development (2019 USD)

	Test Case 1 All Ramps Remain	Test Case 2 All Ramps Remain	Test Case 2 Removal of Olive Way Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
+ Residual Land Value	NA	$353M	$459M	$66M	$58M
– Lid Capital Cost	$966M	$2,298M	$2,520M	$1,505M	$1,698M
= Funding Gap	($966M)	($1,945M)	($2,061M)	($1,439M)	($1,640M)
RLV as percentage of total lid capital cost	NA	15%	18%	4%	3%

Impact of Parking Requirements on Lid Financial Profile

As described in Section 10.3.2, due to site constraints that limit the options for constructing underground parking for buildings on the lid, Test Cases 2 and 3 assume that 10 percent of total parking required per use type[20] would be provided on the lid with the remaining 90 percent constructed offsite.[21] In a theoretical scenario where only 10 percent of parking

19 Completion of the construction of the first lid sub-section is assumed in 2035; Test Cases 2 and 3 assume beginning vertical development construction on that first lid subsection in 2035. Real estate construction is assumed to be completed in 2052 in both Test Case 3 scenarios and Test Case 2 with all ramps remaining, and 2055 for Test Case 2 with the removal of Olive Way ramps.

20 Parking ratios used in this study were informed by the assumptions provided in the test case workbook. These parking ratios are generally consistent with current market-rate values for similar development types in downtown Seattle. The City of Seattle does not have any parking requirements downtown.

21 For the purpose of the analysis, offsite property to deliver parking facilities is assumed to be available within proximity of the lid.

spaces would be delivered on-site and the balance would not be built at all,[22] the resulting reductions in development costs would increase RLV dramatically. The RLV in Test Case 2 would increase by $450 million to $560 million and in Test Case 3 by $150 million to $165 million. In other words, the incremental gain in RLV from reducing parking to only 10 percent of the assumed requirement on-site would be equivalent to the cost of providing offsite parking. A reduced parking requirement would be a meaningful tool to increasing RLV and the ability for proceeds from vertical development to narrow the overall project funding gap.

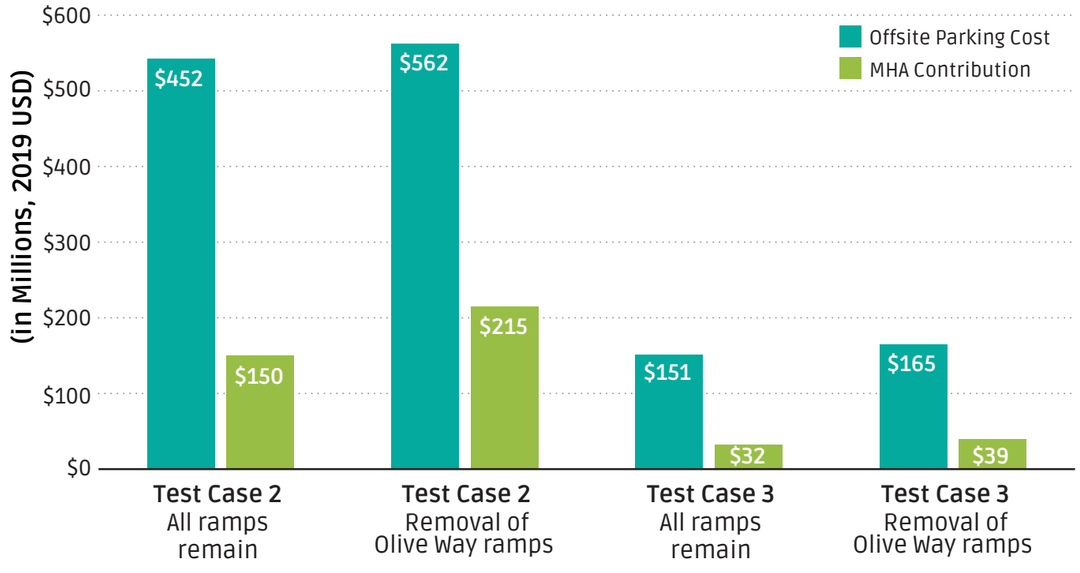
Evaluating the impact of parking requirements as a variable raises important considerations around the potential public value outcomes of the project. Comparing the off-site parking costs to the MHA contribution for affordable housing by test case reveals the cost-of-opportunity to potentially allocate said revenue to further defray lid costs in the form of other uses with higher public value, such as using it toward building park space, "land" for affordable housing or other civic uses on the lid. Moreover, the cost of providing offsite parking facilities to meet 100 percent of the assumed parking requirement significantly limits RLV and has a greater impact on RLV than the cost of complying with MHA (Figure 10-9).

However, currently, such a dramatic reduction in parking would likely affect residential and commercial marketability from the perspective of interest from end-users, as well as strain parking capacity in the surrounding area. Future changes to parking demand is unknown, though, and will likely continue to evolve between now and construction of a lid. It is noteworthy that 41 percent of households in downtown Seattle do not own a vehicle (Esri, 2019); if this trend were to continue and expand, reduction in parking provision might align with future market demand. If factors such as access to transit or ongoing trends in transportation technology (e.g., ridesharing, connected and autonomous vehicles, etc.) result in lower demand for parking, the impact on RLV could be beneficial to offsetting the costs associated with constructing a lid.

Table 10-6. Funding Gap by Test Case Considering Lid Capital Costs and Residual Land Value of Vertical Development with a Reduced Parking Requirement (2019 USD)

		Test Case 1 All Ramps Remain	Test Case 2 All Ramps Remain	Test Case 2 Removal of Olive Way Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
+	Residual Land Value (RLV)	NA	$805M	$1,021M	$217M	$223M
–	Lid Capital Cost	$966M	$2,298M	$2,520M	$1,505M	$1,698M
=	Funding Gap	($966M)	($1,493M)	($1,499M)	($1,288M)	($1,475M)
	RLV as % of total lid capital cost	NA	35%	41%	14%	13%

Figure 10-9. Developer Offsite Parking Cost and Mandatory Housing Affordability Requirement Contributions by Test Case (in Millions, USD 2019)



22 It is noteworthy that 41 percent of households in downtown Seattle do not own a vehicle (Esri, 2019); if this trend were to continue and expand, reduction in parking provision might align with future market demand.

Ongoing Revenue and Costs of the Lid

To estimate both the ongoing and periodic public-sector costs that would result from each test case exploration, the revenue and cost profile of each test case was forecast over time (Table 10-8). The upfront capital cost is assumed to be financed through municipal debt and the RLV is assumed to be converted to an annual private-sector contribution. The RLV per test case represents the full annual private-sector contribution (or payment) to the lid project for a full buildout, expressed in the cash flow (Table 10-8) as the total annual revenue from vertical development that was estimated in this study, based on market conditions. This comparison of the lid project's income from private vertical development and additional ongoing operating cost and debt-service cost is designed to reflect overall project-level financial feasibility of building the lid, prior to assigning revenue collection or cost responsibility to any single entity. While debt service is shown as being offset by net operating revenue, from the perspective of the State of Washington, some amount of total, private revenue contribution in Test Case 2 and 3 could in practice be allocated directly toward the Motor Vehicle Fund as payment for an air rights lease, described in the following section. Estimated lid O&M costs, R&R costs, and park O&M costs are then included to estimate the ongoing public-sector financial obligation of each test case. Table 10-8 shows this in the year 2057, which is the first year that all real estate development would be fully absorbed, and the full facility would be in normal operations.

Annual Air Rights Lease Payments to the State Motor Vehicle Fund

Annual air rights lease payments to the State Motor Vehicle Fund were excluded from the analysis in Table 10-8, but are anticipated to be required. While no private revenue contributions were assumed in Test Case 1, if the park lid is developed without considering it as mitigations and enhancements integral to a transportation project led by WSDOT,[23] some amount of air rights lease payment would be owed to the State of Washington and paid to the Motor Vehicle Fund. The air rights use of a public park and pavilions would be assumed to be based on fair-market value[24] of adjacent land uses in accordance with established FHWA requirements, with verification on potential for reductions in the amount by the State Attorney General.

Terms of previous air rights lease agreements such as the Seattle Municipal Tower and the WSCC have varied. The original 77-year Seattle Municipal Tower lease agreement with the private developer established a payment based on a percentage-rent structure, calculated as the greater of 3.175 percent of net operating income from tenant leases or $750,000 per year. The latter was established as the annual payment when the City of Seattle took over the property from the developer in 1995. The lease terms were recently renegotiated between the City of Seattle and State of Washington. The most recent WSCC lease terms consist of a fixed payment amount of $475,000 per year. The lease payment to the Motor Vehicle Fund must be based on fair-market value of adjacent land uses in accordance with FHWA policy discussed in Section 11.2 of this report. It is assumed that fair-market value would be determined through an appraisal commissioned by WSDOT Real Estate Services.

Notably Test Case 2 has an annual net operating revenue before accounting for debt, due to higher revenue generated from its vertical development program. However, Test Case 2 also has the largest total annual funding gap when debt service is included. While the annual debt-service profile is a key consideration, operating revenue is shown with and without, to account for yet-to-be-determined policy and development decisions with respect to funding and financing options for the lid structure. Using a conservative approach, the analysis assumed no additional direct funding sources and that all capital costs would be covered through financing. With further refinement of the funding plan, the debt-service profile would evolve, potentially resulting in a more favorable outcome for Test Cases 1 and 3.

Financial Profile by Lid Area

Although the scope and approach of this feasibility study is to evaluate the feasibility of lidding I-5 from Madison Street to Denny Way as a complete buildout project, valuable insights can be derived from a lid area-level of analysis (Figure 6-2). Cost and revenue potential is anticipated to vary by lid area depending on the uses proposed in each test case.

Table 10-7. Annual Operating Cash Flow by Test Case Lid Area (in Millions, 2019 USD)

	Test Case 1 All Ramps Remain	Test Case 2 All Ramps Remain	Test Case 2 Removal of Olive Way Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
Area 1	($0.6M)	$1.9M	$1.9M	($0.7M)	($0.7M)
Area 2	($1.0M)	$1.7M	$1.7M	$0.0M	$0.0M
Area 3	($1.6M)	$6.0M	$7.6M	($1.1M)	($1.5M)
Area 4	($1.1M)	$4.3M	$8.5M	$0.6M	$0.4M
Total	**($4.2M)**	**$14.0M**	**$19.8M**	**($1.2M)**	**($1.4M)**

*Totals may not match sum due to rounding.

23 An air rights lease payment was not required of other recent lid projects on I-90 and SR 520 because they were classified as mitigations integral to a transportation project led by WSDOT where payment requirements were exempt.

24 FHWA 23 CFR 710.403(e) requires that the state highway agency receive fair market value for non-proprietary government use and private use of limited access highways.

Table 10-8. Annual Lid Project Capital and Operating Cash Flow by Test Case (Millions, 2019 USD)

	Test Case 1 All Ramps Remain	Test Case 2 All Ramps Remain	Test Case 2 Removal of Olive Way Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
ANNUAL REVENUE					
⊕ Vertical Development Revenue*	$0M	$19.8M	$25.5M	$3.7M	$3.3M
ANNUAL OPERATING CASH FLOW					
⊖ Lid Infrastructure O&M	($2.9M)	($2.9M)	($2.4M)	($2.9M)	($2.4M)
⊖ Lid Infrastructure R&R	($1.3M)	($3.0M)	($3.3M)	($2.0M)	($2.2M)
⊖ Public Park O&M	($0.07M)	($0.006M)	($0.006M)	($0.006M)	($0.006M)
⊜ ANNUAL NET OPERATING REVENUE (EXCLUDING DEBT)	**($4.2M)**	**$14.0M**	**$19.8M**	**($1.2M)**	**($1.4M)**
ANNUAL NET CASH FLOW					
⊖ Air Rights Lease Payment	(TBD)	(TBD)	(TBD)	(TBD)	(TBD)
⊖ Debt Service	($51M)	($121M)	($132M)	($79M)	($89M)
⊖ TOTAL ANNUAL FUNDING GAP	**($55M)**	**($107M)**	**($112M)**	**($80M)**	**($91M)**

* The annual lid project cash flow by test case reflects the financial analysis that was designed to answer the question **"What is the maximum potential for market-rate development to help pay for a lid?"** (Test Case 2) and further explore **"How would a context-sensitive public-private mix of development affect financial performance?"** (Test Case 3). Given these guiding questions for the study directed by the City of Seattle with input from the Study Committee defined the financial feasibility approach, RLV associated with vertical development is the only source of revenue that was considered for this analysis. It is important to note that an air rights lease payment would be expected by the State of Washington and payable to the Motor Vehicle Fund for any development on top of the lid, including public parks (i.e., including for Test Case 1, the park lid). This would be based on fair-market value of adjacent land uses, unless considered as mitigation and enhancements integral to a transportation project led by WSDOT. The cash-flow analysis assumes a full buildout of the lid project by 2057. Revenue from vertical development is assumed to begin once development is fully absorbed. Chapter 12, "Funding and Financing Considerations" explores how the funding gap expressed in this cash flow could be met through various sources of funding.

ANNUAL REVENUE expresses the total annual available revenue stream for the project. This study considered the developer's residual land value (RLV) as the sole revenue source for this analysis. Additional revenue sources are possible but were not considered or quantified for the purpose of this study.

Vertical Development Revenue is the annualized RLV for vertical development. RLV is the amount a (private-sector) master developer would pay for the development rights on the lid. This is the sole source of revenue generation considered to offset the costs associated with constructing and maintaining the lid structure.

ANNUAL OPERATING CASH FLOW expresses the annual cost of maintaining the lid against the revenue stream from private vertical development.

Lid Infrastructure Operations & Maintenance Costs are the incremental ongoing routine annual operating and maintenance costs of the lid structure and associated incremental maintenance of the roadway, including fire life safety equipment, ventilation, and lighting. O&M costs for vertical development on the lid are considered to be the responsibility of the master developer and are not reflected in the cash flow of the lid project.

Lid Infrastructure Repair & Replacement Costs are the periodic repair and rehabilitation costs of the lid structure, and other associated costs attributed to lidding or tunneling I-5, including fire and life safety equipment, ventilation, and lighting.

Public Park Operations & Maintenance Costs is the annual cost of maintaining public park space and pavilion civic structures on the lid.

ANNUAL NET OPERATING REVENUE (EXCLUDING DEBT) is the annual funding gap (or surplus revenue) resulting from the revenue from private vertical development and the annual cost of maintaining the lid structure and on-lid parks and civic structures.

ANNUAL NET CASH FLOW expresses the annual cost of both financing the capital cost (i.e., debt service) and maintaining the lid against the revenue stream from private vertical development.

Air Rights Lease Revenue is what a master developer (private sector) or project sponsor would pay to the State Motor Vehicle Fund annually for non-proprietary government use and private use atop a lid, such as market-rate buildings. The lease payment would be based on fair market value of adjacent land uses in accordance with FHWA policy and assumed to be based on an appraisal commissioned by WSDOT. This cost was not estimated as part of this analysis. Sources of funding for this payment could vary and are not defined in this study.

Debt Service is the annual cost of capital that would be required to finance the repayment of interest and principal on the debt incurred by the public sector to build the lid (i.e., infrastructure financing costs).

TOTAL ANNUAL FUNDING GAP is the annual net funding gap of the project for both financing the capital costs and maintaining the lid against the revenue stream from private vertical development. For the purpose of this study, it corresponds to the annual funding gap to be likely covered by the public sector to build a lid over I-5. The Air Rights Lease Payment, once estimated in future phases of analysis, could increase the total annual funding gap in all cases.

Given there is no revenue potential from development in Test Case 1, the annual operating cash flow is a function of lid-area size and planned public uses. While land size is minimal on some lid areas, there would still be incremental costs incurred for under-lid maintenance, including FLS and ventilation components not required today on un-lidded portions. Future studies where preferred alternatives are assessed would yield important insights when consideration is given to the cost-benefit analysis at the lid-area level (i.e., the value and function each lid area would bring to the value proposition of the project). From a financial perspective, in Test Case 2, Areas 3 and 4 have the highest net revenue potential both with and without the Olive Way ramps. Across all test cases, Area 4 performs well financially, and as a result has been identified as the logical first phase of real estate development in Test Cases 2 and 3.

Impact of Affordable Housing Policies on Lid Financial Feasibility

Test Cases 2 and 3 assume different affordable housing policies, which were further assessed to understand their overall impacts to each test case scenario. Both test cases assumed that the required MHA fee (Table 10-9) would be paid to the Seattle Office of Housing fund for all market-rate development. Test Case 2 did not assume any additional on-site affordable housing, while Test Case 3 assumed that 40 percent of the residential area would be allocated to affordable and middle-income housing, 25 percent of which would be reserved for lower-income housing and 15 percent for middle-income housing.[25] Based on these assumptions, the development scenarios result in the following affordable housing benefits, summarized Table 10-10.

The cost of building affordable housing on the lid in Test Case 3 was not included in the financial analysis. However, the cost of delivering the "land" as part of a future lid investment was assumed at discounted rates of $300 per square foot for lower-income housing and $800 per square foot for middle-income housing (Table 10-11). This allowed for an approximation of the total subsidy of lid "land" resulting from the development mix relative to lid capital costs. The target percentage allocation of land area to middle- and lower-income housing combined with the discounted land transaction rates above results in an average affordable housing land rate per square foot of $612.50 of land on the lid.[26]

Based on the above factors, assigning specific buildings as affordable housing on lid Areas 3 and 4 would result in an estimated subsidy of $103 million needed in the scenario with all ramps remaining and $123 million needed if the Olive Way ramps are removed.

Table 10-9. Mandatory Housing Affordability Fee Payment Schedule for Market-Rate Development

	Low-Rise Development	Mid-Rise Development	High-Rise Development
Residential Use	$13/SF or 6% of units	$20/SF or 9% of units	$33/SF or 11% of units
Commercial Use	$8/SF	$12/SF	$15/SF

Table 10-10. Affordable Housing Benefits by Test Case

	Test Case 2 All Ramps Remain	Test Case 2 Removal of Olive Way Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
MHA Payment	$150M	$215M	$32M	$39M
SF of Lower-Income Residential Uses	NA	NA	240,000 SF	390,000 SF
SF of Middle-Income Residential Uses	NA	NA	140,000 SF	230,000 SF

Table 10-11. Test Case 3 Affordable Housing Land Subsidy by Lid Area (2019 USD/SF)

	Area 1	Area 2	Area 3	Area 4	Average
Average Affordable Housing Land Rate per SF	$600	$600	$600	$600	**$600**
Lid Capital Cost per SF	($1,900)	($2,400)	($2,100)	($2,900)	**($2,400)**
Gap per SF	($1,300)	($1,800)	($1,500)	($2,300)	**($1,800)**

25 Lower income is defined as households earning 60 percent of the AMI and below, and middle-income as households earning between 60 percent and 120 percent of AMI (Figure 7-13). The target of 25 percent of residential development assigned as affordable for lower-income households is consistent with policy guiding redevelopment at nearby Yesler Terrace and the additional 15 percent for middle-income housing reflects the City of Seattle's policy priority at the time the analysis was being completed, as well as market need.

26 For the purpose of estimating a ROM value for affordable housing land subsidy, the average affordable housing land rate per square foot of land on the lid was rounded to $600/SF in Table 10-8

Summary of Results

Based on RLV generated by vertical development and assumed lid capital costs, this study finds a funding gap between -$970 million and $1.9 billion for lid development. While these funding gaps suggest that public investment would be necessary to facilitate development, significant public benefits in the form of new public facilities for civic uses and open space could be delivered because of this project. In addition, the project would unlock potential future tax revenue, including but not limited to real estate taxes both on the lid and incremental tax revenue for property adjacent to the lid.

10.4 Economic and Fiscal Impact Analysis

An economic impact analysis was conducted to estimate the direct, indirect and induced economic benefits of the project using IMPLAN, an industry-standard economic modelling tool that quantifies the aggregate economic impact of direct spending in a local economy. Impacts were estimated from the following sources in each test case:

- Initial lid capital expenditures (Figure 10-6)
- Ongoing O&M activities of the lid (Table 10-8)
- Real estate development (Table 9-1)
- Ongoing real estate uses on-site (Table 9-1)

Direct spending on construction and operations of the lid can be expected to generate substantial economic benefits in King County and Washington state. Depending on the scenario, the project is forecast to support from 6,400 up to 1.1 million jobs and between $0.6 and $90.3 billion in labor income, and generate between $1.4 billion and $138.2 billion in total economic activity within the region over the analysis period (i.e., from 2030-2075). Table 10-12 summarizes the total economic benefits by impact category and scenario for the proposed project by lid phase and activity.

Direct, indirect, and induced economic impacts would be highest in Test Case 2 due to the highest amount of economic activity in the three primary phases modeled: 1) lid capital costs, 2) real estate development, and 3) economic activity from ongoing on-site operations. From the perspective of the regional economy, the higher the capital investment in lid capital costs and real estate development, the greater the level of jobs supported, labor income, and overall economic activity generated from construction. Once all construction is complete, on-site office, retail, hotel, and residential uses would support additional employment.

Assuming this median value of construction costs (Table 10-2), the construction of the lid would create $1.4 billion of direct, indirect and induced economic activity for Test Case 1, up to $2.5 billion for Test Case 3, and up to $3.7 billion for Test Case 2. In comparison, the Waterfront Seattle project is anticipated to result in ongoing economic impact of $288 million with 2,385 permanent jobs (HR&A Advisors, 2019) and the Terminal 5 improvements by the Port of Seattle will lead to an estimated $2 billion in direct business output and 6,000 jobs (Northwest Seaport Alliance, 2019).

The I-5 lid associated economic activity would also generate positive fiscal impacts in the form of state and local tax revenues from various sources, including property tax, sales and use tax, income tax, and others. These impacts would be proportional to economic impacts, with Test Case 2 providing the highest gross impacts (Table 10-13).

Table 10-12. Average Annual Employment by Test Case (Construction and Operating Phases)

	Test Case 1 All Ramps Remain	Test Case 2 All Ramps Remain	Test Case 2 Removal of Olive Way Ramp	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramp
Average Annual Direct, Indirect, and Induced Employment* – Construction Phase					
Derived from Lid Construction (10 years)	500	1,200	1,300	800	900
Derived from Real Estate Construction (18 years)	NA	1,000	1,300	300	400
Average Annual Direct, Indirect, and Induced Employment – Operating Phase					
Derived from Lid Operating Costs	40	50	50	40	40
Derived from Real Estate Activity	NA	25,000	29,000	10,600	10,600

* Annual employment understood as number of direct, indirect, and induced jobs per year.

Although Test Case 2 would have the highest annual cost inclusive of debt service, total state and local generated gross fiscal revenues would exceed this cost by $42 million per year with all ramps remaining and $60 million per year with the removal of Olive Way ramps (Figure 10-10). Conversely, annual costs for Test Cases 1 and 3 would exceed generated fiscal revenue by $55 million per year in Test Case 1 and by $19 million per year with all ramps remaining and $28 million per year with the removal of Olive Way ramps in Test Case 3.

Figure 10-10. Annual Gross Fiscal Revenue Relative to Cost to Build a Lid by Test Case (in Millions, 2019 USD)

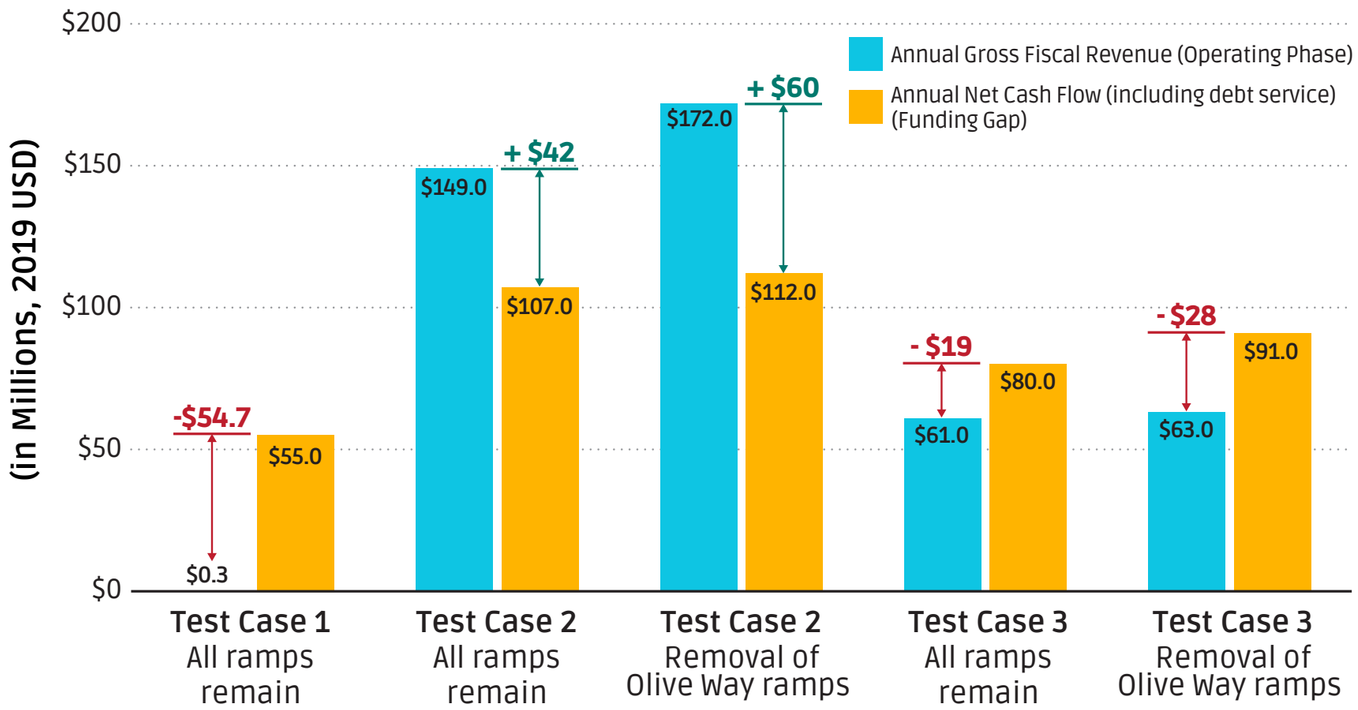


Table 10-13. Annual State and Local Tax Revenue and Net Cash Flow by Test Case (Construction and Operating Phases, 2019 USD)

	Test Case 1 All Ramps Remain	Test Case 2 All Ramps Remain	Test Case 2 Removal of Olive Way Ramp	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramp
Average Annual Direct, Indirect, and Induced Fiscal Impact – Construction Phase					
Lid Construction (10 years)	$4.5 M	$11M	$11M	$7M	$8M
Real Estate Construction (18 years)	NA	$7M	$9M	$2M	$3M
Average Annual Direct, Indirect, and Induced Fiscal Impact – Operating Phase					
Derived from Lid Operating Costs	$0.3M	$0.4M	$0.4M	$0.4M	$0.4M
Derived from Real Estate Activity	NA	$149M	$172M	$61M	$63M
Annual Net Cash Flow					
Net Cash Flow Including Debt (Gap)	($55M)	$42M	$60M	($19M)	($28M)

10.5 Societal Benefits

The financial and monetized direct economic value, including direct and indirect and induced jobs, represent the critical components when evaluating the project from a financial standpoint; however, much of the greatest value from the I-5 lid project would be the societal benefits resulting from the lid improvements and reconnecting the Downtown Core.

Both Washington state and Seattle could see further benefit by considering operations both above and below the lid structure, including improved overall traffic flow and efficiency (through measures such as reconfiguring highway access points), ITS improvements (including improved ramp metering), and prioritizing of efficient transit services both below and above the I-5 lid. As shown in Figure 10-11, the transportation sector is moving toward a new paradigm of maximizing the efficiency and flow of person-trips through existing right-of-way as opposed to relying on capital and right-of-way intensive projects to expand the footprint of facilities (WSDOT, 2019). Investments in traffic management and mode prioritization could also provide positive impacts on existing alignments and improved connectivity resulting in enhanced safety for all users.

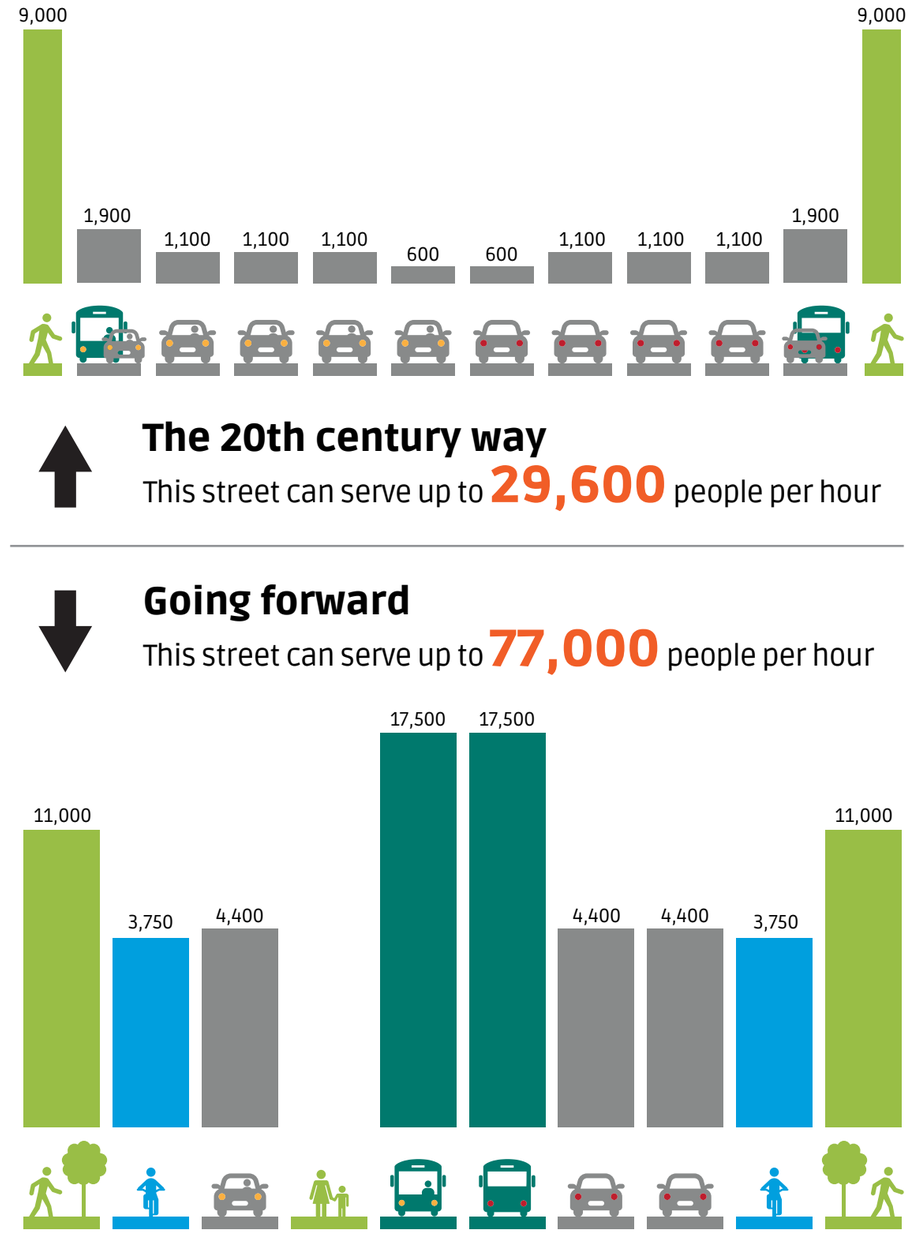
The method for evaluating societal benefits is often conducted using a benefit-cost analysis framework to assess the economic advantages (benefits) and disadvantages (costs) of an investment alternative.

- Benefits and costs are broadly defined and are quantified in monetary terms to the extent possible.
- The overall goal of a benefit-cost analysis is to assess whether the expected benefits of a project justify the costs from a social perspective.
- A benefit-cost analysis framework attempts to capture the net welfare change created by a project, including cost savings and increases in welfare (benefits), as well as disbenefits where costs can be identified (e.g., construction closure impact), and welfare reductions where some groups are expected to be made worse off as a result of the proposed investments.

While the I-5 LFS does not attempt to quantify the potential benefits attributed to some of these measures, assuming they would be evaluated when the project reaches 10- to 30-percent design, the framework for evaluating such strategies was created in compliance with federal U.S. Department of Transportation guidance (USDOT, 2020).

It should also be noted that the WSDOT and City of Seattle applied for a joint $4.2 million Better Utilizing Investments to Leverage Development (BUILD) discretionary grant in 2019 for

Figure 10-11. Expecting More Out of Existing Right-of-Way



Source: (WSDOT, 2019)

the **Partnering for the Future of I-5** (WSDOT and City of Seattle, 2019), which outlined funding for a two-tiered study approach that would include the following:

» Tier One: **Systemwide Scenario Analysis** – WSDOT would lead a collaborative effort to screen concepts and scenarios for the entire 107-mile stretch of I-5 between Tumwater and Arlington. Given future multimodal transportation demands, this project would lay the foundation for an interconnected mobility system that would support the region's long-term economic vitality.

» Tier Two: **Community Connections and Leveraged Development** – The in-depth analysis within the most constrained portion of I-5 in downtown Seattle would focus on seismic risks, structural conditions, and operational characteristics of the I-5 infrastructure, including its relationship to operations of Seattle's downtown street network. It would have a more focused audience and require oversight and engagement of constituencies within Seattle.

While the grant application was unsuccessful,[27] the Tier Two concept would focus on reconnecting neighborhoods that I-5 has divided for over 50 years and would create new open space and development opportunities in the most land-constrained area of Seattle (i.e., the I-5 lid project being considered in this study and the test-case analysis).

Through the development of the **Partnering for the Future of I-5** grant application, WSDOT and the City of Seattle set the foundation for a master plan outlining operational strategies and capital investment options that would improve the reliability, safety, and competitiveness of the I-5 system, thereby increasing the overall economic position of the region. The societal benefits would augment the eventual master planning process by providing quantitative metrics that help to evaluate how different project alternatives could accomplish the overall goals of a larger project.

Measurement of societal benefits would support the eventual WSDOT and Seattle master planning efforts to do the following:

» Optimize the existing system and invest strategically – consistent with WSDOT's Practical Solutions approach (WSDOT, 2020b) to project planning and management, use data-driven performance measures and local partner engagement to seek lower-cost approaches and efficient funding mechanisms.

» Embrace new and emerging technologies – assess how emerging technologies change the ways in which people interact, work, travel, and shop, and how they can positively affect safety and mobility on the I-5 system.

» Coordinate land use and transportation – make transportation and land use decisions considering how to maximize accessibility and make better use of resources.

» Increase travel choices – optimize access to public transportation and non-motorized travel options to increase system efficiency.

» Keep freight and goods moving – make freight transportation an intrinsic part of the I-5 system solutions.

» Maintain and preserve our assets – take care of the basic investments that are already in place.

While the quantifiable factors would not be available until specific projects have been prioritized with preliminary design complete, the project stakeholders and community can consider several benefits as highlighted in Figure 10-12.

Monetized benefits and benefits that are analyzed with a qualitative rather than quantitative approach would be more evident as the eventual master planning effort defines projects that are moved into design.

Figure 10-12. Overview of Anticipated Benefits

Economic Competitiveness	Safety	Sustainability/ Resiliency	State of Good Repair	Quality of Life
Reduced Vehicle O&M	Reduced Incidents (I-5)	Reduced Emissions (I-5)	Reduced Road Damage (I-5)	Health Benefits
Fuel Savings	Reduced Incidents (Surface Streets)	Reduced Emissions (Surface Streets)	Reduced Road Damage (Surface Streets)	Commuter Mobility
Connectivity	Police Coverage Crime Reduction	Reduced Roadway Expansion		Recreational Benefits
Travel Time Savings		Drainage		Accessibility (Parks/Schools)
Real Estate Creation		Seismic Upgrades		Reduced Noise
Real Estate Valuation				ADA Access

27 The Partnering for the Future of I-5 grant application was not awarded in the FY19 BUILD program; there is no current funding effort in process.

Source: waterfrontseattle.org

Upon further development and evaluation of the proposed test cases through further work the following primary actions would be required to provide accurate and defensible monetized societal benefits from the I-5 project:

- Refined cost estimates, including capital, right-of-way, O&M, and R&R for an established no-build baseline and development alternatives.
  - Thorough evaluation of the current I-5 assets for the no-build baseline to determine asset life, replacement timeframe and cost.
- Project schedule by year with details on planning, design, right-of-way acquisition and construction.
- Detailed traffic analysis to evaluate travel time savings and vehicle miles traveled for each primary mode (passenger vehicle, freight, transit riders, active transportation broken out between pedestrians and bicyclists) for baseline conditions without the improvement and projected changes as a result of the improvement.
- Collection of noise and emissions data to accurately monetize the impact on noise and emissions for the surrounding neighborhood as a result of the I-5 improvements.
- Evaluation on access to public and civic spaces in a no-build baseline and with the addition of park and civic amenities as a result of the project.
- Analysis of safety- and crash-related data for the no-build baseline and with the improvements, including impacts from changing travel behavior on crash risk and probability.
- Evaluation of seismic risk on the current assets and the cost of improving the assets to accommodate the lid structure, further to what has already been evaluated.
- Evaluation of current drainage and other utility assets under a no-build case and potential benefits from replacing/augmenting current assets as part of build alternatives.

Photo Credit: Christopher Boswell; iStock / Getty Images Plus

10.6 Key Financial and Economic Feasibility Takeaways

» The study estimated a capital cost range for the lid structure of $855 million to $2,863 million,[28] reflecting estimates for lid project bookends. The bookends refer to the most robust and the leanest lid projects considered, from a technical perspective, as well as to the cost contingency factors applied. Costs included in this study are parametric and should not be taken as absolute.

- ROM construction cost estimates were adjusted using a 20- to 50-percent construction contingency allowance and risk factor. The study considers the 50-percent increase over hard construction costs to be the higher-end of the cost range (most conservative estimate), and the 20-percent contingency values as the lower-end of the cost range (least conservative estimate).

» The median construction cost values for a lid capable of supporting open space loads was estimated at $1,500/SF and $2,500/SF for a lid capable of supporting high-load levels (mid- and high-rise vertical development). The structural requirements to bear higher loads from vertical development results in significant increases in lid capital costs (over 50 percent compared to open space loads). How these costs would be shared by public-private stakeholders or between public agencies was not determined by this study and would require future exploration.

- Comparing the cost-per-square-foot of new lid area to pre-COVID-19 pandemic land acquisition values in the vicinity of the study site show that development on a lid would be on the higher-end of land values for downtown Seattle (with cost-per-square-foot values ranging from $700 to $2,000 on terra firma).[29]

» The I-5 lid project's absolute estimated median construction cost value of $2,100/SF is comparable to other large overbuild and tunnel projects, including Hudson Yards in New York ($1,940/SF), the Mt. Baker Tunnel in Seattle ($2,240/SF), and the SR 99 Replacement Tunnel in Seattle ($2,500/SF).

» When considering the test case analysis, the total cost of the I-5 lid project ranges from an average of $2,230 per square-foot for Test Case 1 (The Park Lid) to $3,952 per square-foot for Test Case 2 (Maximum Private Investment). Test cases further explored the range of financial feasibility of a lid, by considering various load levels, mix of uses and policy assumptions; costs are represented as full project costs as expressed by capital costs (i.e., the combination of both hard and soft costs for the lid project).

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28 These values are absent of right-of-way costs, federal and state asset replacement, or vertical development costs, but include other variable costs. All estimates are normalized and estimated in 2019 USD.

29 Values from the analysis of land sales on terra firma (i.e., dry land or ground) can be found in the I-5 LFS Economic and Financial Feasibility Memorandum, Section 5.3.1.

- Regarding test case results, the range of infrastructure capital costs for the full buildout of a lid structure is $966 million for Test Case 1 (The Park Lid) – the low-end test-case analysis bookends—and $2,298 million[30] for Test Case 2 (Maximum Private Investment)—the high-end of the test-case analysis bookends.
- The test case analysis assumes revenue generation from vertical development, where private investment could be feasible. However, based on current commercial and residential market conditions, the RLV generated by development in Test Cases 2 and 3 would contribute to capital costs or ongoing maintenance costs but would not be sufficient to fully offset the associated capital and maintenance costs of the lid. Other funding sources would be required.
- Test Case 1 (The Park Lid) did not consider any revenue generation uses on the lid; however, this test case has the lowest annual funding gap compared to Test Cases 2 and 3. Furthermore, the impact of a lid on real estate values of adjacent properties could be considered in future evaluations of project funding sources.
- Annual air rights lease payments to the State Motor Vehicle Fund were excluded from the analysis but are anticipated with further development of the project. While no private revenue contributions were assumed in Test Case 1, some amount of air rights lease payment would be owed to the State of Washington and paid to the Motor Vehicle Fund. Estimated annual private-sector air rights lease payments in Test Cases 2 and 3 would likely come directly or indirectly from revenue associated with vertical development and could also be used to support O&M, R&R, and debt service.
- For Test Cases 2 and 3, resulting revenue-generation potential and offset of capital and maintenance costs are highly sensitive to assumptions on phasing, ramps removal, affordable and middle-income housing requirements, and parking requirements.
  - Ramp Removal. Removing Olive Way on- and off-ramps increased capital costs by 10 percent in Test Case 2 and 13 percent in Test Case 3, while significantly increasing vertical development capacity, and pedestrian connectivity across I-5. Both test cases would reduce noise and emissions associated to vehicles on I-5. While ramps removal would add to overall benefits, it would also likely add risk in the form of project delay for Interchange Justification Reports, in addition to any potentially adverse impacts to traffic patterns and congestion in the surrounding area that could offset some of the noise and emission reduction benefit from covering I-5. Future transportation network studies would be necessary to determine the impacts on the project of any ramp modification.
  - Affordable and Middle Income Housing. Strictly from the perspective of lid capital costs and revenues associated with vertical development, inclusionary housing reduces RLV. Although Test Case 3 shows a lower return on cost due to a higher amount of affordable housing delivered on-site, the overall incremental funding requirements would be lower due to reduced in structural capital costs. An increased amount or different type of affordable housing could also provide access to other funding sources for both capital and ongoing O&M that are not available to market-rate developments.
  - Parking Requirements. As the impacts of future technology trends and disruption to the transportation sector continue to evolve (i.e., ridesharing, connected and autonomous vehicles, etc.) it is unclear if parking demand downtown will be in high demand when a lid is built. For the purpose of the study, parking requirements were assumed to be provided 10 percent on the lid and 90 percent off-site, incurring significant incremental land costs. If reduced parking requirements are justifiable in the future in regard to both policy and market conditions, RLV would increase accordingly and would increase overall financial feasibility of development scenarios. However, reducing assumptions on parking in the current market environment could lead to reduced value if lack of parking access reduced market demand and the value of the market-rate units.
- Not including debt service, Test Case 2 would generate an annual operating surplus because achievable annual development revenue would be greater than annual costs from lid O&M, R&R, and park O&M. Analyzed by lid area, Area 4 achieved an annual operating surplus in both Test Cases 2 and 3.
- The financial evaluation results for all the test cases is highly sensitive to assumptions on debt capacity and interest rates attributed to issued debt. A conservative approach was taken in assuming all capital costs would be financed through a combination of federal financing programs and municipal debt at interest rates consistent with historical averages and not the current low rates during the COVID-19 pandemic.

The study confirms that with each test case there is significant direct and indirect economic opportunity with the construction of a lid that reconnects downtown Seattle.

30 This capital cost value of a lid for Test Case 2 assumes all ramps would remain. The exercise that evaluates the removal of Olive Way ramps for Test Case 2 resulted in a higher capital cost of $2,520 million but also higher revenue-generation potential.


Photo Credit: Jose Luis Stephens; iStock / Getty Images Plus

- The financial findings are consistent with other large lid projects in urban areas in that development and associated revenue generation covers only part of the overall lid capital and operating costs. The few exceptions are where the construction of the lid structure was lower due to the physical location of the structure in a flat area combined with a market with very high property values, in the example of Hudson Yards in New York City, Capitol Crossing in Washington, D.C., and Fenway Center in Boston.
- The study confirms that with each test case there is significant direct and indirect economic opportunity with the construction of a lid to reconnect downtown Seattle. A lid project could tentatively support 5,000 to 13,000 direct, indirect, and induced jobs over 10 years from construction alone and revitalize the economy with up to $3.1 billion in annual economic activity.[31]
- The project would also provide additional opportunity to coordinate with WSDOT to both preserve and mitigate the impacts of aging highway infrastructure as part of the lid project.
- To fully inform future decision-making on a lid project, an alternatives analysis could be conducted to identify the project's full societal benefits in relation to costs. Still, the economic feasibility assessment reveals that the robust fiscal and economic benefits of a lid are worthy of consideration despite its significant funding challenges. For example, although Test Case 2 appears to have the largest funding gap and potentially would be least aligned with the guiding principles of this study, it would also yield the highest economic and fiscal benefits. In fact, when considering annual gross fiscal revenue, it would exceed the annual funding gap to build a lid by $42 million to $60 million every year, during the lid's operating phase.
- Evaluation of the project test cases within the context of phasing and lid area construction impacts identifies opportunities to prioritize sections that provide the greatest economic and social benefits. This study did not perform an evaluation that considered a "mix and match" approach; test cases developed for this study serve as a useful precedent to inform a future analysis of the amalgamation of different development options per lid area.

31 In comparison, the Waterfront Seattle project is anticipated to result in ongoing economic impact of $288 million with 2,385 permanent jobs (HR&A Advisors, 2019) and the Terminal 5 improvements by the Port of Seattle will lead to an estimated $2 billion in direct business output and 6,000 jobs (Northwest Seaport Alliance, 2019).

11. Governance Models and Project-Delivery Considerations

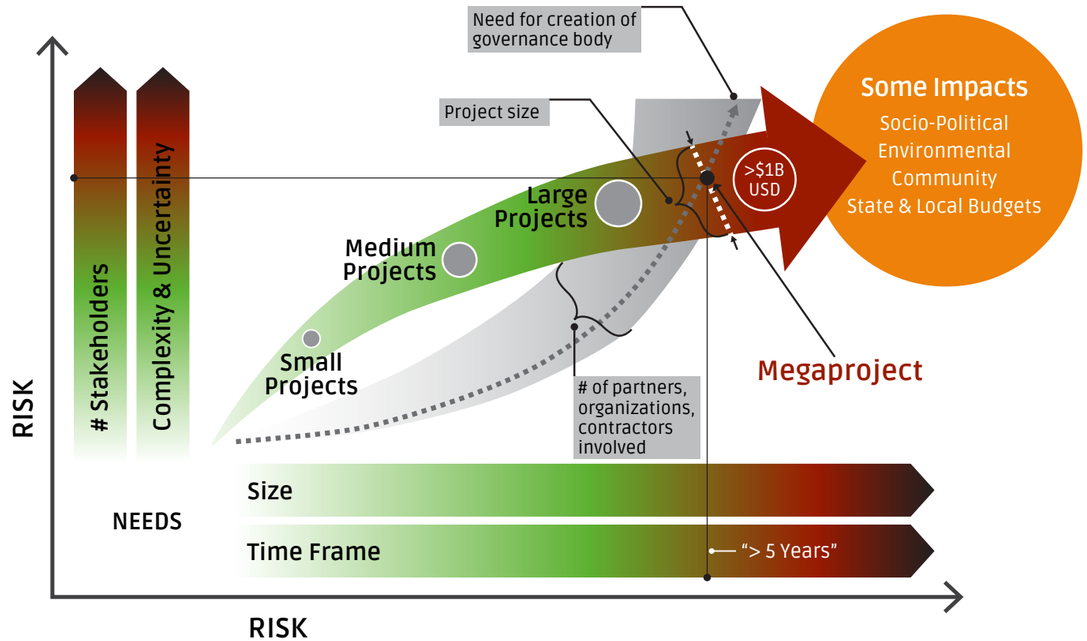
The feasibility of lidding I-5 requires consideration of the legal, regulatory and institutional context, as well as the available methods and models for both delivering and managing the project. Given the size, complexity, cost, and duration to plan and build a lid project of this magnitude, a lid over I-5 could be defined as a megaproject (Figure 11-1)[32,33] (Zidane, Johansen, & Ekambaram, 2013). Megaprojects have the possibility of becoming landmarks for a region and could bring significant benefits, yet their success relies on thoughtful process design, project or program management and robust community engagement and public involvement. Although no specific recommendations are set forth, the exploration of a governance model at this stage of a project should be nimble enough to allow for innovation that can unlock opportunity of what would be truly possible in future explorations of a lid project.

The goal of this chapter is to explain—at a high level—how a potential I-5 lid project could be procured, designed, constructed, financed and managed. The project-delivery method and governance model for an I-5 lid are inextricably linked because project-delivery must be within the asset owner's governance model. First, a review of the existing experience on other lid facilities, highway overbuilds, as well as large-scale projects in Seattle was carried out to determine applicability of different methods and models that have already proven feasible in this context. Factors that influence how decision-makers balance the risks and rewards of governance models in delivering large infrastructure projects—beyond financial feasibility—were also examined.

When the concept for a project is considered, such as in the case of this study, decision-makers begin to identify the goals for the project concept given constituents' needs. Understanding a project's goals and value proposition allows decision-makers to sketch out the realm of the possible given legal, regulatory, financial, and constructability requirements or gaps. As a result, with the end in mind, the discussion focuses primarily on the benefits, drawbacks, and risks of different governance models in light of the conditions of each test case evaluated in this study.

Fundamentally, the delivery of such a project can come in the form of public-led, privately developed, or shared public-private partnerships. In all cases, the public agency that takes

Figure 11-1. Project Size Characteristics and Relative Considerations



Adapted from (Zidane, Johansen, & Ekambaram, 2013)

32 One of the definitions of megaprojects is that they are the projects in which the cost exceeds $1 billion USD, exceeds five years in duration, and requires the management of numerous, concurrent, and complex activities.

33 This feasibility study does not present any recommendations, nor does it recommend a preferred alternative. Future consideration on the size, location and project boundaries could influence the level of complexity of the project, and thus, the approach to project implementation.

the lead on a project is referred to as the sponsoring agency. Additionally, public partnerships can be formed where multiple agencies (in this case WSDOT, City of Seattle, or others such as King County) can jointly deliver a project. A public-private partnership involves a developer (i.e., a private entity), or master developer, to bring capital to the table early to help implement a project with public payment or project-generated revenue streams that directly pay back the developer over time.

Before any definition is made about the project-delivery mechanism or governance structure for successful project implementation, a master planning and visioning exercise that reflects the role of the community, and clear policy goals, should be established first.[34] Test cases explored in this feasibility study were created only as frameworks to understand the implication of development models but were not proposed as desired development programs.

For the purposes of this study, project delivery refers to the procurement and contractual method chosen by the sponsoring agency to produce a competitive bidding field in the business community and select a developer best able to carry out the required responsibilities. **Alternative project delivery** refers to methods in which the sponsoring agency enters a partnership with a private business venture (FHWA, 2020a). Alternative project delivery methods shown in the gradient colors between "Design-Bid-Build" and "Privatization" in Figure 11-2 vary based on the distribution of project and financing risks and ownership of a public asset. In such cases where an agreement with a private party is considered, the public contribution for a lid project is not a "gift of public funds" and is assumed to be negotiated under lease terms based on value of the asset created.

Next, the sponsoring agency needs to determine how much risk is necessary to allocate to the developer(s) to make the project financially feasible, including the degree of ownership the sponsoring agency is willing to share or transfer to the developer. For the purposes of this study, different configurations of ownership are referred to as the "governance" models. Table 11-1 illustrates the governance models considered in this study.

34 The following lid precedents have undergone such master planning and policy goal definition exercises: Sunnyside Yard Master Plan exercise effort (New York City Economic Development Corporation (NYC EDC), 2020); Hollywood Freeway Central Park (EDAW, 2008); and Philadelphia's Master Plan for the Central Delaware to create Penn's Landing Park (Delaware River Waterfront Corporation, 2017), among others.

Figure 11-2. Spectrum of Project-Delivery Options

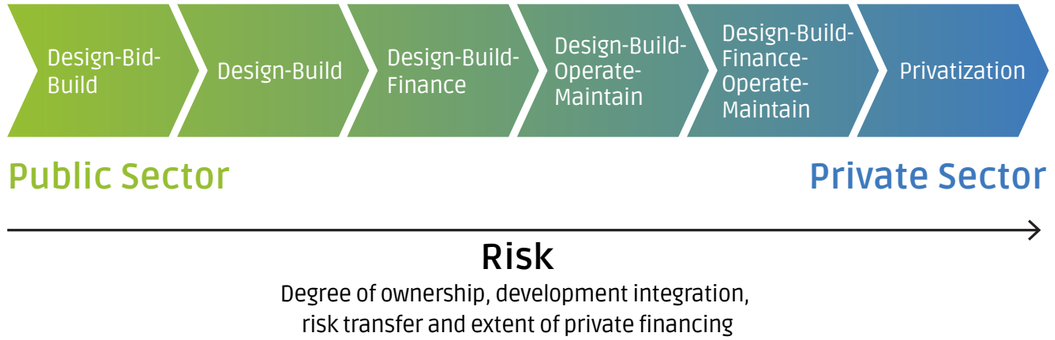


Table 11-1. Governance Models in Representative Lid Projects

Governance Models	Description	Delivery Methods Associated with Model	Examples
Public	**Publicly Managed Public Spaces**	Design-Bid-Build, Design-Build	Mercer Island's Aubrey Davis Park (WA) Margaret T. Hance Park, Phoenix (AZ) Golden Gate Park (CA)
Private	**Privately Managed Private Assets**	Master Developer delivers through Design-Build, Construction Manager At Risk, Construction Manager/ General Contractor	Copley Place, Boston (MA) Capitol Crossing, Washington, D.C.
Public-Private	**Jointly Managed Public Spaces and Private Assets** WSDOT retains some ownership for some or all parcels or WSDOT may lease "land" on the lid.	**Public Spaces:** Design-Bid-Build, Design-Build **Private Assets:** Master Developer delivers through Design-Build, Construction Manager At Risk, Construction Manager/ General Contractor	Klyde Warren Park, Dallas (TX) Lytle Park, Cincinnati (OH) Presidio Parkway (CA)

Before any definition is made about the project-delivery mechanism or governance structure for successful project implementation, a master planning and visioning exercise that reflects the role of the community, and clear policy goals, should be established first.

11.1 Assumptions for Governance Models and Project-Delivery Analysis

The key assumptions in the following sections—established in coordination with the Technical Advisory Team—informed and guided the governance model and project-delivery analysis.

Asset Ownership

The FHWA and WSDOT have authority over what occurs on I-5 because it is a federal interstate highway and is owned by WSDOT. WSDOT has extensive experience with lids over interstate highways, often to mitigate the impacts of a new freeway through a community.

Existing Experience with Air Rights Leases and Operational Agreements

A right-of-way use agreement to develop WSDOT property can be executed with a public entity or private party (WSDOT, 2020a). WSDOT and the City of Seattle have experience with air rights leases and operational agreements, and those experiences should inform how a lease, or an agreement would be structured for this project. For instance, Seattle Municipal Tower was built by a private developer and subsequently sold to the City of Seattle. The Seattle Municipal Tower was constructed in an arrangement with WSDOT under a 77-year air rights lease because the building straddles I-5 off-ramps and a pedestrian tunnel as well as land owned by WSDOT. The WSCC was similarly constructed via an air rights lease with WSDOT. Freeway Park is another example of an air rights operational agreement between WSDOT and City of Seattle over I-5. The experience from these arrangements demonstrates the feasibility in executing these types of agreements.

The financial feasibility analysis of the test cases explored in the I-5 LFS are predicated on the concept that financial feasibility rests upon the ability to direct revenues from the use of "land" on top of the lid by a master developer from a vertical development program to offset project costs, including the air space lease costs, defined by a valuation based on fair-market value of adjacent land uses to be commissioned by WSDOT at a later date. RLVs referenced in this study are a preliminary estimate of the value that could offset project costs.

Development rights could be conferred through a fee purchase mechanism, air rights lease mechanism, or through other structures. This study anticipates that an air rights lease agreement would be the primary legal instrument necessary to confer development rights to private developers over the I-5 right-of-way. The I-5 LFS governance models and project-delivery analysis considered this type of right-of-way agreement to be the appropriate legal mechanism to establish a relationship between the public- and private-sector entities; however, this study did not define or address the use of an air rights lease payment toward the project by the asset owner. Future definitions around the mechanism for funding and financing the project and payment of the air rights lease to the State Motor Vehicle Fund would be necessary.

Legal and Regulatory Authority

Washington state statutes authorize the creation of Public Development Authorities (PDAs) as a governance structure that could be applicable for managing developable space on an I-5 lid. A PDA is best used for unusual endeavors, where the parent municipality is not the most appropriate body to oversee projects beyond what is normally carried out by the municipality. It is anticipated that a PDA could be used for this project even if the ultimate use of the land on the lid is varied, such as parks, pavilions, low- and middle-income affordable housing, private development and other uses with multiple ownership entities. A PDA created by the City of Seattle or WSDOT could provide the governance structure for the project and could be used under different project-delivery methods and for diverse uses and entities (Table 11-2). Depending on the revenues generated by the activities on the project, the PDA could issue IRS Procedure 63-20 bonds (IRS, 1982) to fund certain elements of the development.

Another potential tool is a Public Facilities District (PFD). PFDs can be established by cities or counties to develop regional facilities, such as convention centers or special events centers. The purpose of PFDs is to develop, manage and operate those public facilities as well as levy a local sales tax to support the new facility. PFDs establish a board to govern the facility and then can contract with other public entities to develop those facilities. Washington state statutes indicate that PFDs have a limited purpose—special regional facilities—so this structure would apply only if the City of Seattle or WSDOT determine that they intend to construct a facility that meets that statutory requirement. If so, then they could levy the local sales tax to support O&M for the facility on the lid. A PFD alone would not serve to manage the real estate development on the lid; however, a facility that supports greenspace on the lid is a possibility for the three test cases. Table 11-2 displays representative PDAs and PFDs in the Puget Sound region.

WSDOT owns I-5 and possesses legal authority to enact an air rights lease agreement or create a Public Development Authority with the City of Seattle to deliver a lid project.

Table 11-2. Representative Public Authorities and Districts

Agency	Type of Organization	Chartering Sponsor	Primary Function
WSCC (Washington State Convention Center PDA) www.wscc.com	PDA (Public Development Authority), municipal corporation	King County	Taxation district; management, operations, capital improvements, fiscal solvency of WA State Convention Center facility
WA State Public Stadium Authority www.stadium.org	PSA (Public Stadium Authority)	State of WA	Capital construction and operations of CenturyLink Field and Event Center (major league football + soccer stadium; event / exhibition center)
WA State Major League Baseball PFD www.ballpark.org	PFD (Public Facilities District), a municipal corporation	King County, WA State	Facility owner; capital development, expansion and operations of T-Mobile Park (major league baseball field and stadium)
SCIDpda (Seattle Chinatown-International District PDA) www.scidpda.org	PDA (Preservation and Development Authority)	City of Seattle	Affordable housing development; commercial property management; community & economic development; community engagement; real estate development
Pike Place Market PDA www.pikeplacemarket.org	PDA (Preservation and Development Authority)	City of Seattle	Preserve, rehabilitate and protect Market facilities; support farm and food retailing, small businesses and low-income housing / residency
Kent Special Events Center PFD	PFD (Public Facilities District), a municipal corporation	City of Kent	Develop, own and operate and finance regional center for hockey and other uses
Capitol Hill Housing Improvement Program www.capitolhillhousing.org	PDA (Public Development Authority)	City of Seattle	Preserve, improve, restore affordable housing in Capitol Hill neighborhood (Seattle)
Museum Development Authority	PDA (Public Development Authority)	City of Seattle	Construct, manage, operate Seattle Art Museum

11.2 Federal Highway Administration Considerations

Because the project would be over a federal interstate, the FHWA would likely provide regulatory approvals to develop private "land," when applicable. As the entity with ownership of the facility, WSDOT would seek FHWA approval for private development, when applicable. Any alternative use of property would require approval by FHWA, and FHWA would determine if the use of the property is in the public interest and consistent with the operations of the highway facility. Excess property within the approved right-of-way could be sold or conveyed to a public or private entity per FHWA approval. Previous experience and policy statements show that FHWA would require any air rights agreement to be based on fair-market values for non-highway improvements on WSDOT right-of-way (The Code of Federal Regulations, 81 § 57729, 710.409, 2016). WSDOT would determine what is fair-market value based on land acquisition values and appraisal of adjacent parcels on terra firma to establish an agreed upon contribution to the State Motor Vehicle Fund.

Restrictions by FHWA on Private Development

Private development has occurred over several interstate highways across the country. Since FHWA has not made any blanket restrictions on private development, these examples have been carried out under different project-delivery methods and governance models. If FHWA approves private development, the development must be consistent with the continued use, operations, maintenance, and safety of the highway facility; must not impair the highway or interfere with the free and safe flow of traffic; and, must be in the public interest (The Code of Federal Regulations, 81 § 57729, 710.405, 2016). While WSDOT would likely maintain construction oversight on all project facilities activities, FHWA does not limit ownership, and private developers can own the facilities they construct (**The Code of Federal Regulations**, 81 § 57729, 710.405, 2016).

As the entity with ownership of the facility, WSDOT would seek FHWA approval for private development, when applicable.

11.3 Challenges and Opportunities for Test Cases Considered

In light of the findings of the technical, urban design and economic and financial analyses of this feasibility study, consideration was given to the respective challenges and opportunities for project delivery and governance for each test case explored. Table 11-3 summarizes the most appropriate method and models given the vision and assumptions established for each test case.

For the purpose of this study, it was assumed that existing agreements on the WSCC and Freeway Park lids would not be renegotiated, or the air rights leases modified; however, future explorations should evaluate whether integrating these lids to the new agreement(s) would be worthwhile. In addition, references to O&M with respect to each test case refers to the O&M responsibilities for activities occurring on developable space on the lid, rather than O&M occurring on the lid facility itself or below the lid.

Table 11-3. Summary of Governance Models and Project Delivery Characteristics per Test Case

	Test Case 1 The Park Lid	Test Case 2 Maximum Private Investment	Test Case 3 Mid-density Hybrid
Governance Model Description	A public model using a PDA created by the City of Seattle and WSDOT, under an air rights lease agreement. The PDA would then enter into operational agreements with applicable entities, such as non-profit organizations, concessionaries, or other public entities.	A private model, relying on a "Master Developer" approach with an air rights lease agreement between a private developer or developers and WSDOT. The City of Seattle would likely use an overlay district approach to set standards around zoning, taxation, and various urban policies. Privately owned public spaces would be privately managed.	A public-private model under an air rights lease agreement between WSDOT (asset owner) and a PDA created by the City of Seattle. The PDA would then enter into development agreements with entities that may include a master developer or developers (including affordable housing developers), non-profit organizations or other public entities.
Project-Delivery Options	Design, Bid, Build or Alternative Public Works Delivery Public funding and financing (with or without philanthropic contributions)	Master Developer utilizes its preferred delivery method (e.g., Design-Build, Construction Manager At Risk, General Contractor/ Construction Manager, etc.). Public funding for the lid structure (with private air rights lease payments) and private financing for real estate development.	For public elements: Design, Bid, Build or Alternative Public Works Delivery For private elements: Preferred delivery method of the selected developer(s) if and where private parcellation through separate structural systems is possible. Public funding for the lid structure and public elements (with or without private philanthropy), with private air rights lease payments. Private financing for real estate development.
Possible agreement type(s) involved	Ordinance to create a Public Development Authority Air rights lease agreement Operating agreements	Interagency agreements to confer authority of the overlay district Air rights lease agreement Operating agreements	Ordinance to create a Public Development Authority Interagency agreements to confer authority of the overlay district Air rights lease agreement Concession and/or operating agreements
Pros	Coordinated phasing, sufficient legal capacity, stronger stakeholder support from public agencies given conventional model, and potentially, greater appeal for philanthropic dollars.	Coordinated phasing, ability to leverage private financing, sufficient legal capacity, transfer of O&M to private sector, ability to manage project through a single point of contact.	Sufficient legal capacity, stronger stakeholder support given public oversight, ability to leverage some private financing and philanthropic dollars and delivers on the value proposition of greatest public benefits.
Cons	Limited revenue generation and therefore less funding and financing potential.	Ability to maintain public interest becomes more difficult given that it would deliver the least amount of public benefit. Moreover, less appeal to attract a broad source of philanthropic dollars.	Agreement complexity leads to a higher risk of miscommunication and misaligned risk transfer.

Test Case 1 – The Park Lid

Test Case 1 explored the possibility of lidding I-5 to create an 11-acre park from Madison Street to Denny Way. The governance structure that could be appropriate for Test Case 1 is a public governance model (Table 11-1). The vision for Test Case 1 could be met using a PDA created by the City of Seattle and WSDOT with operational agreements covering O&M and allowed activities. This structure is similar to other highway lids in the region that rely on interagency agreements but are not managed by a PDA. The City of Seattle or PDA would then enter into operational agreements with the entities that would build, maintain and operate the pavilions on lid Area 3, the only area not committed exclusively to open space (Figure 9-8).

Creating a park on a lid is a major endeavor, but it does not stop at building the park. Great cities have great parks, but those parks must be actively managed and brought to life through interactive placemaking in order to realize their full social, economic, and environmental impacts. Operating and maintaining a park is only a part of the equation. Providing free daily, weekly and monthly activities and events brings the space to life and creates the foot traffic needed to support the surrounding development. Municipal parks departments are not typically tasked with this kind of activation nor are they able to afford the level of maintenance and daily security patrols required to deliver these kinds of parks.

Several successful models allow a third party to manage public parks. In Dallas, a dedicated non-profit organization—the Woodall Rodgers Park Foundation—was created to manage the park. This Section 501(c)(3) organization entered into a development agreement with the City of Dallas to build the park and an operating agreement to manage it after opening for the next 90 years. It is the responsibility of the foundation to pay for all costs related to park maintenance, operations and programing. No city funding goes into the annual operating budget of the park. The City of Dallas is responsible for maintaining the tunnel below the park. The foundation generates its own operating income through five revenue streams: a Public Improvement District, sponsorships, food-and-beverage income from a restaurant lease and food trucks, event rental income, and donations from the philanthropic community. A public-run park would not have the ability to tap into nor maximize these revenue streams. Klyde Warren Park hosts over 1 million guests annually and provides 1,300 free programs and events. It is a model for a highly programmed and well-maintained public park that is privately managed.

Another model is a hybrid allowing for the municipal parks department to maintain and operate the park while a separate entity programs and activates it. The financial responsibility for the park is shared between the parks department and the other entity. There is an existing model in Seattle for Freeway Park and the Freeway Park Association, with involvement of the Downtown Seattle Association. In Phoenix, Hance Park is maintained by the City of Phoenix but affiliated with the Hance Park Conservancy to raise funds for programming. These related non-profit entities are afforded the right to secure philanthropic dollars for the park where a parks department could not.

Opportunities: Test Case 1 presents the maximum space for parkland or greenspace. There is an opportunity to streamline policies for space management, as what occurred with the Alaskan Way Viaduct in the state agreement with the City of Seattle regarding O&M for right-of-way. Similarly, there is an opportunity to implement an overlay district, which would allow for different zoning and policy for a joint governance model. Examples like the City of Seattle's existing partnerships and special districts (Table 11-2) show that this option governance is relevant to this test case.

Challenges: This test case poses the least amount of financial upside (relative to the other test cases) and the greatest reliance on public funds. Without an agreement with developers regarding the open space, or an alternative reliable revenue source for activation and preservation of the park, there is no ability to transfer those costs and risks to a third party. Even with no revenue generated from private development, air rights lease payments could still need to be made to the State Motor Vehicle Fund as well.

Test Case 2 – Maximum Private Investment

Test Case 2 explored the possibility of lidding I-5 to create an extension of the Downtown Retail Core through maximizing private investment on a lid development to capture the maximum development capacity that is technically feasible (given load capacity – Figure 8-5) (Figure 9-9). The governance structure applicable to Test Case 2 is a private model (Table 11-1), relying on a master-developer approach requiring a fee purchase mechanism, air rights lease agreement, or other mechanism—between the developer or developers and the asset owner, WSDOT. This test case requires the lid structure and buildings to be designed and delivered in tandem, requiring deep coordination between asset owner and developer and clear financing mechanisms or vehicles for this to be done transparently and effectively. As such, a private governance model paired with an alternative project-delivery method and contract would ensure that the phasing and buildout are coordinated effectively.

The City of Seattle would form a PDA as it pertains to zoning and land use entitlement on the lid, as well as policy goals (Table 9-1). To meet the vision for Test Case 2, the right-of-way use agreement (or multiple agreements) would vary based on the location of buildings in each lid area (Figure 6-2 and Figure 7-3). Areas 1, 3 and 4 include terra firma within WSDOT right-of-way. Based on WSDOT and FHWA policy, the value of the annual air rights lease payment to the State Motor Vehicle Fund would be fair-market value based on nearby properties. The two buildings in lid Area 1 would require a limited amount of cantilevered area over the

freeway, similar to the Seattle Municipal Tower example.[35] The development project relative to this governance model is unknown, and this test case explored only the development capacity with a hypothetical development program concept. Test Case 2 presents a potential alternative for real estate developers seeking to develop a "campus" and not solely a parcel-by-parcel based development program.

Opportunities: This test case presents the maximum development capacity conceived for this lid. Despite rapidly changing economic conditions, this test case could also present the greatest opportunity to meet new, unforeseen market needs. From new construction models (Walker, 2020) or other technology-forward innovations that would take advantage of the unique proximity of the lid location, it would require the developer appetite necessary to purchase or lease the land at a rate that is workable for the sponsoring agency. As with a public-private model scenario, the right-of-way use agreement or lease presents an opportunity to create an overlay district in order to guide private development and enhance neighborhood cohesion.

Challenges: The projected total capital cost for the lid ranges from $2,000 to $3,500 per square foot, depending on test case and assumptions on ramp operations. A potential new development, regardless of the density, would be done at a premium in comparison to the current market value for individual adjacent parcels downtown. However, a larger developable site, in comparison to individual parcels, could result in a price premium for the full lid area. For any proposed development program, an analysis would be required to be performed to determine the "fair reuse land value"—meaning the amount of capital the project could provide for a right-of-way use agreement or lease and remain financially viable. This is a technique used by redevelopment agencies across the country where the land acquisition, relocation, demolition, environmental remediation and offsite improvements exceed what the development sought by the redevelopment agency can support. That analysis also meets the test that validates that the public contribution is not "a gift of public funds" prohibited in virtually every state constitution because the public funds provided are the lease amount necessary for the project to proceed.

A public funding and financing strategy identifying the potential programs available to the city or state to support the gap between the fair reuse land value and the lid costs where the project would sit, is further described in Chapter 12, Funding and Financing Considerations.

35 The right-of-way use lease for that area would be negotiated based on the cost of the cantilevered area either through an adjustment in the lease recognizing the cost delta, or through a public financing contribution to pay the difference. The balance of the new development under Test Case 2 would be constructed on the lid.

Test Case 3 – Mid-Density Hybrid

Test Case 3 explored the possibility of lidding I-5 to create a mixed-income neighborhood extension from Madison Street to Denny Way (Figure 9-10), with context-sensitive density relative to the surrounding neighborhoods. The governance model applicable for Test Case 3 is a public-private model, based on a long-term right-of-way use agreement or air rights lease with a payment to the State Motor Vehicle Fund between WSDOT and the City of Seattle or between WSDOT and a quasi-public entity like a PDA. The PDA would govern public space. Public entities could then procure a master developer to manage real estate development on space made available on the lid. The master developer would be responsible for self-performing and/or contracting with other developers—including affordable housing developers—to manage development on a parcel-by-parcel basis.

A public-private governance model would not preclude private development in this test case; the difference is that governance would be held ultimately by the public agencies engaged in the project, and private development would occur under their oversight. A PDA would be implemented to manage open space, and that agreement would specify the operational requirements for public spaces. A PFD could also be established to support the development of open space facilities and thereby levy a local sales tax to fund both the development of the facility as well as O&M for the open space.

Opportunities: This test case presents a blend of both open space and civic space, along with private development. The public entities would retain control and would oversee development of public and civic spaces; a developer would adhere to the master plan for development on the lid, and pay for the right to develop property adjacent to the open space in exchange for managing and maintaining the open space and providing an MHA contribution to the Seattle Office of Housing to fund affordable housing. If this test case vision is further developed and brought forth to the business community via a Request for Information and market sounding process, decision-makers may find that the developer community may have suggestions that could increase developer appetite for the project. Those suggestions may include maximizing developable space for real estate, allowing the private developer to build and manage public spaces over a concession term, bundling the developable space with other projects in the City of Seattle's real estate portfolio to achieve a greater economy of scale, or other innovative ideas for the use and purpose of the space made available by the lid project. With these additions, project owner(s) could then consider the benefit of engaging a developer to provide financing to design, build, finance, operate and maintain the entire project on the lid under the oversight of the project owner(s). In exchange for managing and funding the open space, public agencies would likely need to provide a developer (or multiple developers) with flexibility on how they are able to program the development to ensure a financial return to justify the investment. This possibility would require further exploration and careful consideration if the trade-off in public ownership of the project meets constituents' needs for the space.

Challenges: Using a public-private contracting approach, the risks to procurement and delivery are relatively high and not as well-known in the Seattle context. A public-private agreement using a PDA or concession tends to absorb an agency's time and resources due to the complexity of stakeholder relationships and the need to perform due diligence on the developer's approach, as was the case with the SR 520 lid (WSDOT, 2020d). The City of Seattle and WSDOT have experience with these agreements, but a larger discussion would be required around whether these institutions have the capacity and resources needed at the time this decision would be evaluated, to put a public-private agreement in place, as well as provide the requisite oversight.

While it is envisioned that this test case would use a public governance model, the level of engagement by the private sector to develop the space on the lid would mean that public-private functions and uses would be blended to an extent. That blend could result in ongoing disputes, negotiations, and claims. If, for instance, there was a force majeure event, the parties in the PDA and master developer could make overlapping claims on damage to structural systems. It would be essential, then, to ensure that risks and responsibilities are well delineated and that a dispute and resolution process is agreed upon to expedite claims resolution and share in the cost of risk mitigation, further complicating an already complex legal agreement between all parties.

11.4 Primary Risks

In reviewing the benefits and drawbacks of governance models applicable to each test case, overarching risks specific to governance could prove very challenging. It is worth noting that the project, in and of itself, is complex, which is consistent with the risk and characteristics of megaprojects. When relative risk is described, it is from a base assumption that a lid project of this nature is already an inherently higher risk than traditional infrastructure projects (Figure 11-1). The economic benefits show that a project like this, though high risk, is also high reward as is the case with the removal or transition of urban freeways—including the Alaskan Way Viaduct in Seattle, Park East Freeway in Milwaukee, and Embarcadero Freeway in San Francisco—as well as highway lids in Dallas and Phoenix, which are now undergoing plans for expansion and enhancements, respectively. When considering what delivery methods and governance models would enable each of the test cases, the risk of each is appraised in the following ways:

» In the public's best interest
» From the perspective of the asset owner
» In relation to the other test cases
» In relation to the other delivery methods and governance models
» Knowing that the project itself is extraordinarily complex

Deeming one alternative higher risk than another does not mean that it is off the table for consideration; instead, it is important that decision-makers are made aware of the issues and risks that are trade-offs for the benefits of the overall project. Consistent political support over time would advance the project, as well as strategies for sustained funding and to deal with complex regulatory and legal requirements.

Consistent leadership over multiple administrations would be required, as well as strategies for sustained funding and to work through highly regulatory and legal requirements. To gain this momentum in political will, early leadership to create a compelling common vision and align varied constituent needs, process and stakeholders would set the tone for the long term, spanning generations. A project of this scale and complexity would leave a lasting legacy not only on the surrounding neighborhoods, but also for the entire city of Seattle. Early "wins" would set the project on a definitive course.

For every test case, economic, sociopolitical, and legal and regulatory risks would need to be managed. Regarding economic risks, the project sponsors would need to evaluate advantages and disadvantages to public or private project delivery methods during various points in an economic cycle, recognizing the anticipated life of the asset and assumed 99-year lease. Economic strategies and consideration of the jurisdiction's priorities vis-a-vis its project portfolio would be necessary to ensure economic viability over the long-term. In addition, project sponsors would need to plan for and acknowledge the legal requirements and challenges of other recent lid and development projects. Major projects expected to last over five years require deft management and planning for cultivating and stewarding the engagement of elected leadership, addressing community and public needs, and designing a project-delivery structure that can withstand leadership change. When elected leadership changes (local, state, federal), it tends to affect funding priorities, with an inextricable interplay between these.

Consistent leadership perhaps spanning beyond a generation, would be required, as well as strategies to deal with sustained funding and highly regulatory and legal requirements.

In addition, as with any megaproject, the number of stakeholders involved would be significant. Identifying and engaging with critical stakeholders would be strategic. The stakeholder profiles changes, depending on the type of governance model (i.e., public model means that non-profit entity is likely to be engaged; private model means that neighborhood stakeholders may be concerned about private management).

Risk management begins while the project's initial concept is developed:

- Develop "value for money" to understand which financing/funding strategies yield the best results; these strategies are then further refined as the public agencies engage with the private sector and adapt to a changing economic environment.
- Develop a master plan to make a cohesive vision for the project, which guides how development occurs regardless of the governance model chosen. This is the City of Seattle's opportunity to provide the overarching framework that public entities or private parties must meet.
- Undergo an inclusive and comprehensive public process/engagement with community and stakeholders.
- Embark on design and environmental planning and permitting to lay the foundation for an alternative project-delivery method as private parties would anticipate the project owner to mitigate permitting risk prior to closing the transaction.

These steps are taken when the project sponsor determines which project-delivery method and governance model is likely to yield the desired public vision.

11.5 Factors Impacting Governance Model Selection

Based on the benefits, drawbacks, identified risks, and economic reality of each test case, this section contemplates the strengths of the proposed governance models in terms of delivering an I-5 lid in each of the test cases. A lid over I-5 in the heart of Seattle is inherently higher risk than other projects; the challenge is to select a vision, delivery method and governance model that balances those risks in relation to the outcome that provides the greatest public benefit. The ultimate result, however, could be a combination of these governance structures, with some portions of the lid provided to developers through right-of-way use agreements and other portions owned by the City of Seattle for park purposes and others for affordable housing. In all cases there would be an assumed air rights lease payment to the State Motor Vehicle Fund and a right-of-way use agreement negotiated between the City of Seattle and State of Washington.

Given that the projected total capital cost for the lid ranges from $2,000 to $3,500 per square foot, depending on test case and assumptions on ramp operations, the availability of funding and financing is a critical decision factor because private development alone would not pay for project costs. The engagement of elected leadership would be necessary at the local and state levels to help overcome these funding challenges.

There is no single "silver bullet" approach to procuring and governing a lid project; as shown in this section, each option has its benefits, drawbacks and risks. Decision-makers need to prioritize which decision factors, seen in Table 11-4, are most important and in the public interest. Prioritizing these decision factors based on the chosen vision for the lid project then produces the delivery method and governance model likely to achieve that vision. Based on the discussion in this chapter, Table 11-4 summarizes the potential challenges and benefits associated with each governance model.

Table 11-4. Governance Model Decision Factors

Governance Model Decision Factors	Public	Private	Public-Private
Market Conditions and Developer Appetite	○	●	●
Availability of Funding and Financing	○	◑	◑
Legal and Regulatory Ability	●	●	◑
Shift of O&M Risk to Private Sector	○	◑	●
Phasing	○	◕	●
Stakeholder Management	●	○	◑
Institutional Readiness	●	◑	◑

Rating Scale

● = Most Promising ◕ = High Potential ◑ = Some Potential/Challenging ○ = Most Challenging

Photo Credit: SDOT Flickr

11.6 Key Project-Delivery Methods and Governance Takeaways

- Project delivery is assumed to be the decision of the asset owner, WSDOT, with indications from FHWA that private revenue generation over a highway facility is permissible as long as all safety and access considerations have been evaluated and met to the degree required by WSDOT.
- There is precedent for partnerships between WSDOT and various municipalities on the O&M of public spaces over existing highway infrastructure as well as private development of revenue-generating assets, as is the case with the Seattle Municipal Tower, developed by a private entity and sold to the City of Seattle, and continued partnerships with the WSCC on their assets over I-5 through downtown Seattle.
- The private and public-private models are best able to harness private financing; that said, private development is not assumed to be sufficient to cover all project costs. Moreover, this study did not determine the air rights lease payment to the State Motor Vehicle Fund, which would depend on the resulting valuation to be requested by WSDOT at the time the project is evaluated by the asset owner, and could affect a developer's appetite for a lid project.
- In all test cases, there is sufficient legal authority to execute public, private or public-private models. However, there's an ever-present risk that authority could be challenged in court or whether the complexity of the legal agreement necessitates more public agency involvement.
- The public governance model is considered "conventional," so there is greater stakeholder comfort and institutional knowledge to execute a model like this.
- The public-private model shows the most promise across these decision factors. However, the State of Washington lacks a local precedent and a model of this nature could require intensive oversight from the public sector.

12. Funding and Financing Considerations

Although the project would provide a net economic benefit in the form of direct, indirect, and induced jobs, economic growth, and incremental state/local tax revenue, the direct revenue generation would likely not be sufficient to cover both capital and ongoing incremental operations and preservation costs.

» Test Case 1 presents various opportunities for agreements among different public entities to maintain public ownership and maintain the facility and greenspace, either with Seattle Parks and Recreation, a non-profit entity, or a maintenance contract with a private entity.

» Test Case 2 focuses on private investments, which reduces the need for public funding for both constructing the lid and maintaining both the above-ground and below-ground assets and air rights lease payments to the State Motor Vehicle Fund that have yet to be determined.

» Test Case 3 provides the greatest opportunity for diverse funding sources, including public and private entities for constructing and maintaining civic and park space and private and non-profit entities for contributions toward building construction and maintenance.

Funding would not come from a single source and would reflect the complexity of current funding for megaprojects, which often entails a combination of local, regional, state, and federal sources and includes a combination of grants, direct and indirect funding, and financing programs.

As an example, the Waterfront Seattle project relied on a diverse set of capital funding sources (ABS Valuation, 2019):

» City Funding Sources: $260 M (35.7 percent)

» State Funding Sources: $198 M (27.2 percent)

» Local Improvement District: $160 M (22.0 percent)

» Philanthropy: $110 M (15.1 percent)

The near-term focus should be on funding the next phase of analysis through various established local and state budgets supplemented by local, regional, state, and federal grant program funding. Once the project has been further refined and initial design work has been completed, there would be opportunities for developing a capital and maintenance funding plan that would leverage a variety of funding sources for both the supporting infrastructure and above-the-lid vertical development.

Opportunities in Upcoming Revenue Packages/Levies

Voter-approved funding packages, capital improvement programs, and other levies are often the primary funding source for major capital investments from infrastructure to schools, to affordable housing and parks and civic spaces. As provided in Table 12-1, several major funding packages—including WSDOT Connecting Washington, SDOT MOVE Seattle and City of Seattle Housing Levy—would expire during the planning phases of the I-5 lid project, with opportunities to include funding as replacement programs for the expiring levies are developed. For the I-5 lid to successfully receive public funding through a revenue package or levy, the community outreach and value proposition must be made to the funders whose support would be needed to advance funding programs.

As potential next steps toward developing a lid project proceed, consideration of potential public investment would be critical. Key steps would need to include the following:

» Identification of capital project funding opportunities via relevant state, regional, and local levies, including:

- Connecting Washington Replacement
- MOVE Seattle Levy Replacement (after 2024)
- Seattle Parks & Recreation Levy
- Other potential levies based on potential lid uses - Washington and Seattle Public Schools, Fire and Police, subsidized/affordable housing, Public Utilities

Table 12-1. Primary Revenue Packages and Levies

Source	Agency	Name of the Funding Package	Required Voter Approval?	Start Year	End Year	Value	Tax/Fee Funding Source(s)
State	Washington Department of Transportation	Connecting Washington	No	2015	2031	$16.0B	Gas Tax
State	Washington Department of Transportation	Statewide Transportation Improvement Program (STIP)	No	2020	2023	$3.3B	Existing Funding
State	Washington Department of Commerce	CERB Local Infrastructure Financing Tool (LIFT)	No	Annual Funding	Annual Funding	$7.5M	Existing Funding
State	Washington Department of Commerce	Community Economic Revitalization Board	No	2017	2019	$28.8M	Existing Funding
State	Washington Department of Transportation	Transportation Partnership Program	No	2005	2021	$7.1B	Existing Funding
Regional	Sound Transit	Sound Transit 2	Yes	2008	2023	$13.4B	Sales Tax, MVET
Regional	Sound Transit	Sound Transit 3	Yes	2017	2041	$53.8B	Sales Tax, MVET, Property Tax
Regional	Port of Seattle	Annual Funding Package	No	2020	2021	$76.4M	Property Tax
County	King County Metro Transit	Metro Connects	No	2017	2040	$2.0B	Sales Tax
County	King County Parks and Recreation	Parks, Recreation, Trails and Open Space Levy	Yes	2020	2025	$810M	Property Tax
City	City of Seattle	MOVE Seattle Levy	Yes	2015	2024	$930M	Property Tax
City	City of Seattle	Parks & Recreation Capital Improvement Program	No	2020	2025	$87.3M	Property Tax, REET
City	City of Seattle	Transportation Capital Improvement Program	No	2020	2025	$4.2B	Property Tax, REET
City	City of Seattle	Seattle Public Utilities Capital Improvement Program	No	2020	2025	$1.5B	Property Tax, REET
City	City of Seattle	Seattle Housing Levy	Yes	2016	2023	$290M	Property Tax
City	City of Seattle	Seattle Transportation Benefit District	Yes	2015	2020	$50M	Sales Tax, Vehicle License Fee
City	City of Seattle	Families, Education, Preschool, and Promise Levy	Yes	2019	2026	$619M	Property Tax

- Ongoing close coordination with agencies and elected officials to include I-5 lid-related projects in these levies.
- Coordination with agencies on related planning and capital needs, such as funding for WSDOT's I-5 System Partnership.

Clearly, I-5 lid improvements would need to be assessed within the context of other competing priorities of the primary funding agencies and associated revenue packages. Opportunities and challenges in this regard would become more apparent as specific project details are further developed and refined.

Taxes and Fees

Depending on the structure of project delivery and governance, financing would likely be a primary component of capital funding with future debt obligations paid back through ongoing tax and fee revenue either directly to the public agency or an availability payment to a private entity.

With no existing or planned income tax revenue measure, to either support financing or ongoing maintenance, the tax and fee options in Washington state are limited to primarily property tax, sales tax, and vehicle fees. Each taxation measure comes with its own set of challenges including over-dependence by agencies, and legislative restrictions that include property tax increment restrictions, and regressiveness of sales tax.

Potential new sources of revenue generation—including cordon pricing in Seattle, tolling on I-5, carbon taxes, and headcount taxes—would likely have multiple competing needs for the generated revenue, some of which may be legislatively defined. Primary sources for initial consideration would include those shown in Table 12-2.

Funding the Next Steps

As the project continues to the next phases, there would be opportunities to leverage various funding sources for planning and preliminary design studies. Furthermore, with the onset of the COVID-19 pandemic there is increasing interest in federal stimulus funds to support the economy and help accelerate job recovery. While any such package (if approved) would likely prioritize "shovel ready" projects, there may be funds set aside for planning-level efforts. Efforts such as the recent WSDOT and City of Seattle BUILD grant application for I-5 Lid planning funds create both awareness of the project and the framework for next steps. Various federal grant programs and federal funds administered through the Puget Sound Regional Council should be evaluated as the scope for the next phase of work is further defined.

Table 12-2. Potential Revenue Options

Source	Magnitude of Potential Revenue Generation	Considerations
Local Option Sales Tax	High	Voter tax fatigue, regressive, requires legislative and voter approval
Employer Headcount Tax	Medium	Up to a $2.00 per month per employee headcount tax with voter approval is authorized
Property Tax / Real Estate Excise Tax	Medium	Voter tax fatigue, requires voter approval, limits on annual increases
Toll (I-5), cordon price (City of Seattle)	Medium	Legal authority restricts toll revenue use but could include lid structures (example SR 520)
Vehicle Emission Fee / Carbon Tax	High/Medium	Voter opposition, not legislatively authorized, competing uses/purposes for revenue
Commercial Parking Tax	Low	City of Seattle is already administering 12.5% fee, which could be difficult to increase
Motor Fuel Tax / Motor Fuel Sales Tax	Medium	Would likely be part of future WSDOT revenue package for capital funding
Corporate Income Tax	High	Requires legislative authorization and likely a public vote
Mileage Based User Fee	Low	Would likely be part of future WSDOT revenue package and could replace fuel tax for financing
Motor Vehicle License Fee	Medium	Recent public opposition (I-976), competing needs at the city level

Revenue-generation from vertical development is feasible but would not be sufficient to completely cover both capital and ongoing maintenance costs of a lid. Other funding and financing mechanisms would be needed, and all funding and financing options should uphold the public's interest.

Photo Credit: Christopher Boswell; iStock / Getty Images Plus

12.1 Key Funding and Financing Takeaways

- Revenue-generation from vertical development is feasible but would not be sufficient to completely cover both capital and ongoing maintenance costs of a lid. Other funding and financing mechanisms would be needed, and all funding and financing options should uphold the public's interest.
- Although it's far too soon to be definitive about the funding sources and financing approach for the lid's capital costs, the magnitude and complexity of the project would require multiple municipal, county, regional, state, and federal sources and could also rely on philanthropic or private-sector contributions above and beyond direct investments in lid assets.
- The analysis assumed that 100 percent of capital costs would be financed, with no initial federal, state, or local funding sources. This was a conservative assumption and resulted in a high amount of forecast annual debt service, ranging from $51 million per year in Test Case 1 to $132 million per year in Test Case 2 (with the removal of Olive Way ramps).
- The next phase of planning would help to further refine cost estimates and funding and financing opportunities.
- In coordination with WSDOT, an evaluation of I-5 through a master planning effort could identify clear opportunities to mitigate or reduce the cost of upgrading and/or replacing existing aging assets along the corridor while lowering the potential cost of lid construction and improving I-5 operations. It could also provide a better understanding of the operational and environmental opportunities—and cost impacts—from potential changes to travel behavior related to trip generation for lid uses, improvements in urban mobility, and potential changes to I-5 on- and off-ramps and the surrounding downtown street network.
- Further quantitative analysis could help to support the inclusion of I-5 lid design and construction costs in upcoming local, regional and state long-term funding ballot measures.

PART III.

Future Considerations and Next Steps

13. A Blueprint for Lidding I-5

This chapter provides some key considerations for decision-makers and project stakeholders regarding potential next steps for advancing the exploration of additional lids over I-5. Shaping the future of Greater Downtown as a welcoming place for all demands rethinking the approach to equitable development, to public space design and management, to mobility, and to new forms of that can help create and sustain city-shaping infrastructure that advances multiple priorities. Lidding I-5 through downtown presents an opportunity to tackle some of the most pressing challenges facing Seattle. This requires contemplating opportunities to increase affordable housing, support and protect local industries and small businesses, and make vital investments in infrastructure, community facilities and open space. The goals established in the value proposition of this study provide a framework for exploring, evaluating and prioritizing these opportunities.

This report is an important milestone in initially exploring a long-range vision that could fundamentally shape the future of downtown Seattle. Its findings can also inform how to plan and approach the preservation and upgrade of critical transportation infrastructure. Moving forward would require clarity and definition of priorities, project leadership, process design and other decisions innate to a project of this scale.

This report is an important milestone in initially exploring a long-range vision that could fundamentally shape the future of downtown Seattle. Its findings can also inform how to plan and approach the preservation and upgrade of critical transportation infrastructure.

13.1 Critical Elements for Decision-making

To further study the feasibility of lidding I-5, the City of Seattle and partner entities would need to develop and execute a detailed course of action, requiring a high level of commitment on the part of the City of Seattle, Washington Department of Transportation (WSDOT), and other stakeholders. From a technical and urban design perspective, this study establishes that there could be a case for lidding I-5. However, before significantly advancing planning efforts, the concept warrants further exploration to understand the social benefits and effects, as well as policy and implementation risks of this long-term endeavor. Project exploration requires the development of a shared vision and an extensive evaluation of impacts and priorities, which this feasibility study did not identify because it focused mainly on technical feasibility.

For any successful lid project, or any megaproject for that matter, clarity of project sponsor and goals is necessary. A decision to move the project forward would require resources and institutional support, and strategic discussions would be necessary to define and coalesce around key elements of success, to arrive at project definitions. Although this decision-making process is not linear—in fact it is iterative in nature—a series of examinations to create shared understanding and agreement on the following elements would be a prerequisite to set a path for successful project development.

Project Sponsor

Advancing the concept of lidding I-5 requires identification of a project sponsor(s). A project sponsor can be any government entity with the jurisdiction and institutional capacity to spearhead project development. It is clear from previous lid efforts and the present feasibility study that delivering a lid that is aligned with the value proposition stated in this report, requires a partnership between the City of Seattle and WSDOT, the asset-owner of I-5. Any next step would require clarity around project jurisdiction, ownership,

sponsorship and partnership, which would likely require the engagement of many entities. There would also be considerations for contributions to the Motor Vehicle Fund that would need be determined between the City of Seattle and the State of Washington and would be based on the fair market values of the land based on zoning and adjacent land uses. These partnerships can be strengthened in preparing a project definition that establishes governance and decision-making authority. WSDOT and the City of Seattle have established a partnership in their willingness to collaborate on this feasibility study, as well as in jointly pursuing a Better Utilizing Investments to Leverage Development (BUILD) Grant application to study the future of the I-5 System[36] (WSDOT and City of Seattle, 2019). Advancing a lid should continue to strengthen these partnerships, which have the authority for various types of interactions, including to initiate, approve, review, validate, support or provide input to the project. Ultimately, defining a lid project through downtown Seattle lies with those who have project authority, institutional capacity and intent to advance the project.

Project Vision

A well-articulated vision and understanding of project motivation, goals and objectives is essential. A vision clearly defines project purpose, beneficiaries, distribution of benefits and impacts, costs and desired outcomes after successful project completion. A vision creates clarity, unifies efforts and constituents, and inspires the project community to dedicate resources and effort to see the project through. The value proposition and guiding principles articulated in this study, as well as the concepts developed by advocacy efforts prior to this study, provide a solid foundation for defining a project vision. However, clarity around the definition of public value and who reaps that value from a lid project is needed.

In order to move the project forward, project vision would ideally be developed collaboratively between WSDOT and the City of Seattle, with input from various stakeholders and the project community. Given that furthering a project of this nature comes with a significant investment of public resources, it is essential that those with project authority can ensure the outcomes of this project are committed to advance the City of Seattle's goals to support those at greatest risk of disparity, displacement and disenfranchisement. Future steps should identify how to design a process that leads with equity, to ensure that equity impacts are rigorously and holistically considered and advanced in the design and implementation of a lid, including consideration of process equity, distributional equity and cross-generational equity.

Project outcomes would be measurable and in alignment with policies and evidence-based metrics to shape positive outcomes for future communities in downtown. This should be done in the context of multi-generational outcomes related to historical planning and investment decisions. Moreover, a project vision and desired outcomes need to examine the disproportionate impacts of the COVID-19 pandemic on people of color and address the ways in which a lid project can be a catalyst to dismantle racial injustices and improve Black, Indigenous and people of color health and economic outcomes.

Equity-centered Accountability

All aspects of future work to realize a lid will present critical opportunities to advance racial equity—from the governance model, who partakes in the decision-making process, to the project delivery mechanism. How the project sponsor(s) respond to these opportunities will either move the City of Seattle and region closer to their goal to end institutionalized racism and race-based disparities in government or further perpetuate disparity, displacement, and oppression of communities of color.

Racial equity goals and outcomes are often identified by decision-makers and influencers without seeking and uplifting the leadership of Black, Indigenous and People of Color. Exploration of a lid presents an opportunity to replace this pattern with a practice of co-powering with communities of color to define equity-centered processes, investments and outcomes. Starting with co-creation of racial equity accountability measures that work in tandem with the City of Seattle's Race and Social Justice Initiative and equity policies can guide future actions and decisions related to community engagement, project leadership and governance models.

36 The Partnering for the Future of I-5 grant application was not awarded in the FY19 BUILD program; there is no current funding effort in process.

Project Leadership

To maintain continued momentum for next steps of exploring and advancing a lid, project leadership is required, with the opportunity to have a wide range of potential project champions. A project of this scale would benefit from leadership from various sources, including from political, social, civic and institutional agents and advocates. Moreover, an inclusive coalition with a diversity of perspectives and lived experiences, would help advance equitable project exploration by seeking to serve a wide range of constituencies and objectives. A coordinated effort among project advocates and those with project authority would enable a streamlined understanding of activities and priorities for an effective and directed course of action for next steps. Project leadership has the opportunity to coalesce various formal platforms and efforts that have explored the idea of lidding I-5 through downtown Seattle, such as the Imagine Greater Downtown idea to "stitch the I-5 divide."

Project Priority

Agencies with project authority and/or leadership spearheading the lid project would always require evaluating the timing, effort and investment of resources to further this initiative in the context of competing projects and priorities for the city and the region. Establishing a shared understanding of the opportunities and challenges of a lid through downtown Seattle, as well as a clear framework for the criteria to guide the factors that justify this effort to align investment with equity, sustainability and financial responsibility, would be required for future phases.

A benefit-cost analysis or an alternatives analysis of various lid concepts would support development of a project scope and definition through an iterative assessment that considers project purpose, boundaries or size/scale, and lid program, use and function. These evaluations warrant consideration of alternative "build" and "no-build" scenarios as I-5 reaches its design life in the future. In addition, a decision-making framework that contributes to racial equity outcomes, could identify opportunities for a project of this scale to reduce race-based disparities. Preparation and consideration of next steps, a decision-making framework and established priorities for when decisionmakers and the project is positioned to move ahead would better allow for successful project development in future steps.

Project Catalyst

Different drivers could catalyze or precipitate the discussion of a lid over I-5 in the foreseeable future. Readiness to engage in this conversation by the various entities, project partners and stakeholders, regardless of the trigger, is commended. In order to advance this project to further phases of exploration, the project motivational triggers could be precipitated by the following:

- **Unplanned critical events.** Any decision around the future of the assets on or over I-5 that could potentially be precipitated by an affectation on a structure, requiring immediate attention and investment, could tentatively prioritize the evaluation of lidding I-5. One potential scenario could be a failing structure during a force majeure event, including seismic vulnerabilities that would require expedient repair and replacement of an I-5 asset through downtown.
- **Deterministic decisions impacting project viability.** Any project or planning effort on I-5 through downtown Seattle, or also in Greater Downtown within the study area, that could preclude consideration of a lid through downtown Seattle. This includes the State of Washington's initiative on I-5, either regarding an I-5 System Master Plan or other asset-management considerations and efforts, including those around traffic management and tolling. In this regard, it would be desirable for various levels of government and agencies to work in a coordinated fashion when planning upcoming projects, to ensure projects do not preclude or complicate lidding I-5, prior to determining project viability.
- **Directed intent.** Next phases of a lid exploration could be spearheaded by targeted efforts directed by project advocacy and/or planning efforts. These efforts could be driven by either a government entity or by champions and stakeholders that mobilize decisionmakers with agency to further advance project exploration. Directed intent could encourage other projects akin to the concept of lidding I-5 to catalyze momentum within a larger framework of incremental achievements to reduce the impacts of the freeway.

Those with project authority and/or leadership can opt for an explicit or implicit strategy regarding the project catalyst; either path would benefit from preparations and discussions around project development and approach toward advancing the lid concept.

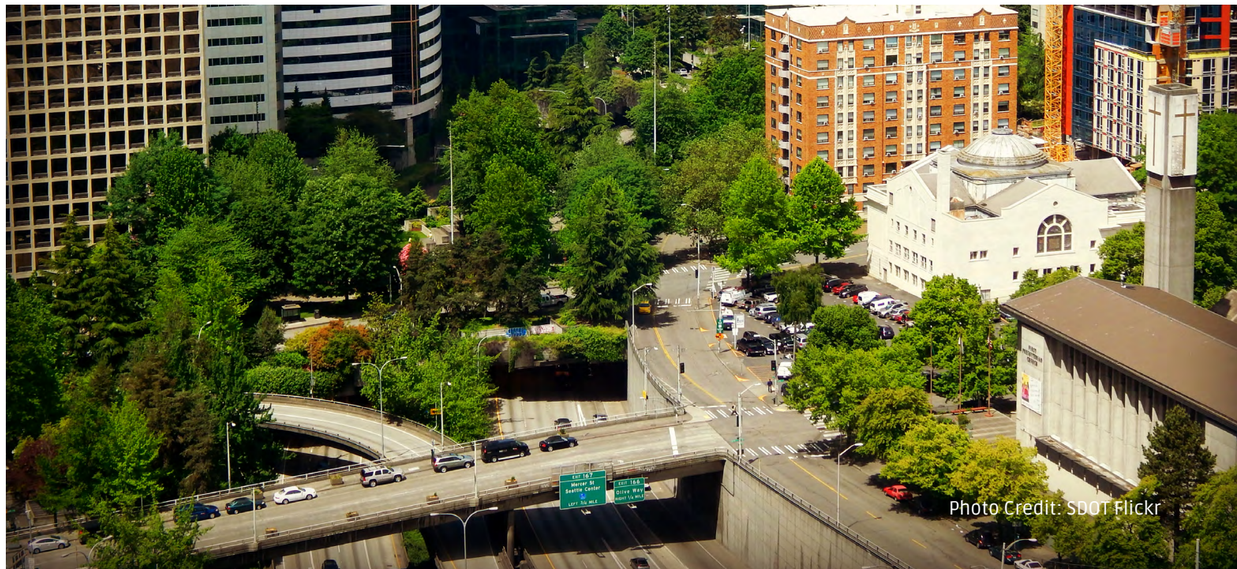


Photo Credit: SDOT Flickr

13.2 Considerations for Future Project Development

This feasibility study surfaced several considerations necessary to successfully move forward project development undertakings. Policy and planning decisions regarding both the future of the I-5 corridor and to inform the programmatic uses on a lid—such as additional affordable housing, parking requirements or non-revenue generating community uses; state and federal (FHWA) requirements around development over state right-of-way; shifts in macro market trends; changes in state and local debt limits, obligations and capacity; or changes in construction costs—would all influence the ultimate feasibility of this lid project. Some noteworthy considerations for project development are detailed below.

Future of the I-5 System

Advancing the concept of a lid over I-5 would require clarity around the future decisions and goals of the I-5 system to not mutually preclude project goals and to identify efficiencies. An I-5 System Master Plan outlining the strategies, priorities and asset-management considerations around ownership, phasing, freeway operations, and funding sources would be indispensable, particularly for the downtown two-mile segment of the facility. The goal to maintain efficient, safe and resilient movement of people and goods on I-5 is aligned with the value proposition of this study. Nonetheless, the historical legacy of highway development through urban areas and future growth challenges of the region along the I-5 corridor allow us to reframe how we view the corridor as more than a highway to create public value. There is an opportunity to rethink the future of the interstate highway system to support future generations and help meet the challenges of future growth in a way that protects our economy, environment and communities, evaluating how to rebuild the entire interstate highway system with lids (with varying functions) in mind through dense urban cores. In order to move forward with determination on both efforts, a decisive move to support funding of an I-5 System Master Plan would be necessary, as identified in the Call to Action of the I-5 System Partnership (WSDOT, 2019).

Policy and Planning Definitions for Downtown Seattle

Planning is a vehicle to integrate the exploration of a lid into a formal process that can both support sustained momentum for a project, identify the role of a lid in local and regional development and provide a rationale for continued resource allocation to fund the necessary studies and process. It is also the mechanism to assign institutional responsibility and priority to this exploration. Moreover, it is the means to provide clarity around strategic policy goals and outcomes that should inform the exploration of the programmatic uses on a lid project.

» The goals and role of a lid (or lids) should be examined in upcoming state, county and local comprehensive planning periodic updates as opportunities to reevaluate existing policies for the development of downtown Seattle, in response to the Growth Management Act and in alignment with the Puget Sound Regional Council's Vison 2050.

  - Examining existing policies and regulations that are potentially a barrier to advancing the concept of mix-use lids or identifying the gaps or omission of lids (i.e., decks, overbuilds, bridges, etc.) in policy documents would be an important step to support future evaluation of these projects in Washington state.

Sound Opportunities for Project Exploration

The scale of the lid project analyzed in this feasibility study would merit an analysis of regional priorities in relation to budget allocation for competing efforts and needs. However, there are both direct and indirect opportunities to advance the exploration of a lid with minimal risk:

» **Direct opportunities.** Investing in studies that can support multiple projects, objectives and policy goals, beyond those solely exploring a lid concept, are valuable opportunities to gain insight of a lid over I-5. Examples include the following:

  - Advancing a robust transportation and traffic analysis of the surface transportation network and I-5 through downtown Seattle, assessing the impacts of ramp modification throughout the study site and beyond.
  - Structural assessment, rehabilitation, retrofit, and preservation needs of bridges and assets on I-5 through downtown Seattle.

» **Indirect opportunities.** As other projects either on I-5 or downtown Seattle develop, these may include considerations to ensure those efforts will not preclude or complicate the option of a lid in the future. A lid project and its objectives can be made part of how current and future projects, planning efforts and policies are approached. Embedding how a decision might affect a lid project can help further the understanding of a lid in the near future.

» Land use, transportation, and economic development policy goals should examine the role and function of a lid to understand whether a lid over I-5 through downtown Seattle could contribute to these strategies. It is critical to address structural issues downtown (some with a historic legacy), but it is important to recognize that structural issues cannot all be solved at the project level, not even for a megaproject. Policy modeling and establishing neighborhood-level policy goals and outcomes when strategic policy efforts that also inform the growth and development of downtown Seattle are reviewed or updated—with an eye toward how a lid project could help contribute to comprehensive growth and development goals—can ensure lid project outcomes are examined in alignment with a broader policy context.

- A targeted reexamination of city zoning may be necessary to accommodate further growth and keep the cost of living and doing business in Seattle affordable. With half of all private development concentrated downtown, it is essential to make investments in public spaces and civic amenities (DSA, 2019a). Moreover, housing and commercial affordability strategies downtown and potential displacement impacts need to be analyzed and mitigated, at a neighborhood or "district" level. Land use and zoning changes would ultimately inform the air rights use of a lid, because the air rights lease payment to the State Motor Vehicle Fund of a lid project would be based on fair market value of adjacent land uses in accordance with established FHWA requirements.
- Clarity around future affordable housing, parking, and open space policy and goals would significantly influence the function a lid would play in downtown Seattle. District-level goals for these policies could be reflected in Seattle's Comprehensive Plan, local transportation modal plans, as well as on land use and zoning decisions downtown, with evidence-based policy metrics to inform the outcomes of future programming of a lid over I-5.
- Close examination and consideration around the location of affordable housing and other civic uses on a lid versus other locations in Seattle with similar access to opportunity needs to be assessed. Special consideration should be given to the program alternatives when analyzing said access to opportunity of a lid development with regard to "land" development costs, as well as the impact to health and other potential externalities that arise from placing these uses in proximity to a freeway.

Reframing Project Limitations and Delimitations

The following project limitations and delimitations of the present feasibility study should be considered in future phases of analysis:

» **Project scale and boundaries.** The current feasibility study site was established over a 0.8-mile sunken portion of I-5 from Denny Way (north end) to Madison Street (south end). Depending on the project vision and goals, future consideration and feasibility analysis could be expanded beyond the project boundaries—to explore opportunities to lid I-5 north of Denny Way to Thomas Street and south of Madison Street to Yesler Way—or could be focused on specific lid segments within the current study site. Moreover, evaluation of the project test cases within the context of phasing and impact of building specific lid segments would be important in future analyses to identify and prioritize lidding freeway segments that provide the greatest economic and social benefits. While this study analyzed the full project boundary as a single lid project, it could be approached differently. Project scale, priority segments or alternatives to how to satisfy project goals with different means (e.g., pedestrian bridge enhancements, land banking approaches, among others) should be further evaluated prior to advancing engineering and design.

Definition of the Function of a Lid Over I-5

» Clearly defining the public value proposition of a lid along with the urban and economic function it can play for downtown Seattle and the region, requires an evaluation and alternatives analyses informed by broader public process to ensure a place-based outcome is pursued that can maximize benefits for all. Test cases revealed varying definitions of "value" and how that can be understood as economic, fiscal benefit or otherwise.

» Further evaluation around what kind of lid it would be and what purpose it would serve are questions that still need to be addressed. How the test cases explored in this study compare to a business-as-usual ("no build") scenario through a policy matrix analysis and a qualitative trade-off matrix comparing each scenario to how it might perform to deliver the vision set out by the guiding principles, capital costs to the public sector, maintenance and preservation costs to the public sector, real estate value creation, fiscal benefits, place-based value to the immediate community, and overall economic impacts of the project—among other considerations—would be warranted. Moreover, this feasibility study did not assess alternative alignments to I-5; an exploration of other traffic alternatives and function of the segment could yield different approaches to achieving project goals.

» **Innovation and emerging technologies.** Opportunities to further explore the function of the lid as green infrastructure would be commended, including its function for stormwater treatment, air pollution abatement with landscaping, green roofs, among other ecotechnologies for environmental stewardship. Moreover, opportunities to explore unconventional uses and project partners embrace new and emerging technologies, such as the concept of skyport mobility hubs that are being explored around the country.

Risk Appetite of Real Estate Development Industry

Test case analysis around financial feasibility, governance models and project-delivery mechanisms revealed there could be significant risks relative to the project financial gains, from the perspective of private-sector investors seeking to partner with the public sector to deliver a lid project that incorporates real estate development. Furthermore, the analysis did not assume what the agreed-upon annual air rights lease payment to the State Motor Vehicle Fund would be. Before advancing the exploration of various lid programmatic options, investor sentiment and risk appetite of the real estate market on a lid should be gauged.

Megaprojects have a high degree of complexity, and it is too early to assess the perceived risk profile of developing atop the lid and the resulting risk premium required (defined as the extra yield gained for holding a risky asset, or the additional sum payable or return to compensate investors for adopting a particular risk) by the private sector. Investors responding to the changing levels of uncertainty in macroeconomic environments post-COVID-19 context, would warrant further examination. Discussions to understand the ability and willingness of the private sector to engage in various project-delivery mechanisms, manage financial risks, insurance obligations and project schedule coordination with the public sector to deliver buildings in tandem with a lid (indistinctly from market cycles), with consideration of the various governance models, should ensue before framing the lid project alternatives analysis and program definition.

The amount of risk and uncertainty investors are willing to accept should be gauged before advancing the various lid programmatic options.

13.3 Next Steps for Project Development

The next phases of the project should include a more extensive investigation of project vision, scope and sponsorship. Assuming the project was ready to advance to an implementation stage, where a project sponsor was identified, a partnership that involves the City of Seattle and WSDOT was documented and resourced, and institutional capacity to move forward were in place, some next steps and actions for project development would take place:

» **Agency alignment,** institutional coordination and partnership between the City of Seattle, WSDOT and FHWA on project goals, project boundaries, a coordination mechanism and policy alignment.

» **Community engagement** that provides feedback into the development of the lid project through all future phases of analysis with a commitment to advancing racial equity, ending race-based disparities and establishing a practice of co-powering with communities of color to define equity-centered processes, investments and outcomes.

» **Downtown Seattle transportation and traffic impact study** to analyze impacts to the surface street network and mainline I-5 in order to improve project viability.

- Traffic analysis would be necessary to inform the project's alternatives analysis, assess impacts on ramp removal or modification, advance lid engineering to 30 percent design, identify access points to I-5 from the study area, construction staging and functionality during and after the lid is built.
- In addition, traffic analyses would be required to perform a robust benefit-cost analysis to monetize social benefits and demonstrate economic outcomes to increase the likelihood of successful federal and state funding efforts (e.g., pursuing grants).

» **Geotechnical explorations and assessment of site conditions** to ensure better understanding of project cost and design. This would include structural assessment to determine the future of the independent bridges and assets on I-5 within the boundaries of the project to determine rehabilitation, retrofit, and preservation needs.

» **Development of a Preferred Alternative and Master Plan** to clarify a project vision, project sponsor and a lid project purpose and need statement.

- The project sponsor could initiate a Planning and Environmental Linkage[37] (PEL) study to identify a preferred alternative for a lid project, which would help streamline the National Environmental Policy Act (NEPA) and Washington State Environmental Policy

37 Planning and Environment Linkage (PEL) is a collaborative and integrated approach to transportation decision-making. PEL considers environmental, community, and economic goals early in the planning process, generally at the sketch or plan level. The information, analysis, and products developed during planning would then inform the project's environmental review process (NEPA and SEPA) and would help the project sponsor meet agency requirements of least cost planning and practical design (WSDOT, 2020f).

Act (SEPA) processes. The NEPA and SEPA process would determine the project's environmental requirements and commitments, following a hierarchy to avoid, minimize or mitigate impacts. These commitments could help provide clarity between the City of Seattle and WSDOT on park and open space ownership and management.

- This assumes there would be a defined strategy for the lid to interface with the I-5 system requirements for the downtown segment; tolling and congestion pricing decisions would also be important considerations.
- The lid master plan and alternatives analysis within a PEL study would require policy modeling for various programmatic scenarios to arrive at a detailed development program. It would also require formulation of rezoning and related actions.
- Project phasing would be determined as part of this planning process; if vertical development is considered, identification of private-sector involvement would ensue. A downtown utility supply and demand study to determine requirements would also be required.
- Most importantly, this master planning process would require a comprehensive and inclusive community engagement process for its development. This process would align community goals with a preferred alternative, that centers on racial justice and equitable outcomes. The community would also be engaged to provide feedback on user experience based on accessibility challenges resulting from the site topography, to inform social benefits.

» **Engineering and design (30 percent design)** would follow, with consideration of phases of construction and coordination for traffic management and utility impacts to maintaining all necessary services during and after lid construction. Whether this phase is carried out by the public sector or the public sector with private partners with an alternative delivery mechanism, would need to be determined. A fully integrated urban design and engineering approach is commended.

» **Project-delivery method clarity** including a strategy for funding and financing the construction and preservation of the lid asset. If the lid project includes private development, identification of a master developer would be necessary.

» **Decisions on project governance structures** to manage project planning and implementation would be necessary. The governance structure, including schedule and project-delivery mechanisms, would be considered in the evaluation of public financing strategies.

- The governance body would establish preliminary working agreements between primary land and asset owners.
- Financial analysis, including the responsibility for air rights lease payments to the Motor Vehicle Fund, and other costs including but not limited to operations and maintenance (O&M) costs, repair and replacement costs, debt payments, insurance costs, and other financial risks would be defined.

» **Understanding of asset-management decisions** regarding which entity would take ownership of various elements during lid construction and for preservation and maintenance purposes; understanding of right-of-way elements, work needs outside of existing right-of-way such as temporary construction easements, or rights of entries.

What comes next?

Analysis on traffic impacts including the removal of ramps and improved traffic flow on I-5, revenue-generating opportunities, and availability of new land for civic uses would need to be further examined in future studies to understand both economic impacts as well as opportunities for project delivery, governance, and incremental funding and financing for construction and operations of the lid.

» An I-5 System Master Plan is inextricably linked with the future of a lid project.

» Public outreach and community engagement to determine a preferred alternative.

» Structural assessment, rehabilitation, retrofit, and preservation needs of bridges and assets on I-5 through downtown Seattle as a strategy for resilience.

» Downtown Seattle Transportation and Traffic impact study (surface network and I-5)

» Exploration of incremental policies and projects to materialize the guiding principles of this study, such as enhancements for pedestrian and bicycle connections on bridges across I-5.

South-facing view of I-5 and Freeway Park from Olive Way overpass

Photo Credit: Darryl Brooks; iStock / Getty Images Plus

13.4 Conclusion

The findings of the I-5 Lid Feasibility Study reveal that it is technically feasible to construct a lid over I-5 through downtown Seattle, from Madison Street to Denny Way. The urban design exploration showed that a lid would be desirable to reconnect communities across I-5. As a value proposition, in terms of public policy outcomes, a lid could be favorable. From a purely financial cost perspective, it is constrained, with significant public investment required to deliver a lid project. Revenue-generation from vertical development is feasible but would not completely cover both capital and ongoing maintenance costs of a lid. Other funding and financing mechanisms would be needed, and all funding and financing options should uphold the public's interest.

The study confirms that with each test case there are significant direct and indirect economic opportunities with the construction of a lid. The robust fiscal and economic benefits of a lid, in addition to the public benefits described, would be significant and at a scale that could potentially exceed costs. This is critical to consider in the context of long-term fiscal benefit in light of the funding challenges of a lid project. Nonetheless, future analysis to better understand social benefits and impacts is necessary, refining the definition of public value, and examining the distribution of benefits and burdens of each decision that would lead to lidding I-5. Although test case explorations provided important insights and laid the groundwork for future alternatives analyses to define project scope and vision, these decisions require a broader public process and deep racial equity analysis to have place-based outcomes that would maximize benefits for all.

A visionary undertaking of this scope and scale would be achieved only through strong and sustained partnership. The exploration of a lid should serve as a catalyst for important conversations to rethink the future of downtown Seattle; policy planning and goals examinations should ensue, particularly in the aftermath of the COVID-19 pandemic and racial justice demands. Infrastructure projects of this scale take multiple years to conceptualize, analyze, design and complete. Though currently in the conceptual phase, this study aspires that the analysis and results herein would serve the City of Seattle and its partners, now and in the coming years, as we move from crisis into recovery, reconnection and resilience.

Glossary

Alternative project delivery – project solicitation evaluation, selection, contracting and delivery methods that vary from project delivery using a conventional design-bid-build procurement. Based on Federal Highway Administration guidance, alternative delivery options for a new build facility may include but are not limited to Private Contract Fee Service; Construction Manager / General Contractor; Design-Build, Design-Build-Operate-Maintain, Design-Build-Finance, and Design-Build-Finance-Operate-Maintain concessions; and Special Purpose IRS 63-20 Alternative Project Delivery.

Benefit Cost Analysis – economic analysis technique primarily used to compare development (build) alternatives to the underlying baseline (no-build). The analysis monetizes direct and societal benefits of each build case and subtracts the incremental costs attributed to the build case in comparison to the no-build baseline.

Direct Economic Impacts – those impacts that result from project spending alone; for example, construction spending results in employment for construction workers, engineers, and designers who are specifically hired to work on a project.

Discount Rate – discount rate refers to the interest rate used in discounted cash flow analysis to determine the present value of future cash flows.

Discounted Cash Flow (DCF) – valuation method used to estimate the value of an investment based on its future cash flows. DCF analysis attempts to estimate the value of an investment today, based on projections of how much money it will generate in the future using discount rates.

Economic Activity (Output) – the total contribution of the I-5 lid project investment to gross regional product.

Employment – the number of full- and part-time workers supported by project investment.

Governance – the establishment of applicable policies by the members of the assumed governing body, which could include both public and private stakeholders. In addition to establishing policies, ongoing monitoring of policies is often the purview of the governing body.

Hard Costs – refers to any costs associated with the physical construction of the building and any equipment that is fixed. Hard costs can be related to the building's structure, the site and to the landscape.

Indirect Economic Impacts – impacts that occur when direct project expenditures cycle through intermediate steps in the local supply chain and generate increased demand for intermediate goods and services; for example, a construction project generates demand for steel as an intermediate good.

Induced Economic Impacts – impacts that occur as labor income generated by direct project spending is spent on household goods and services; for example, construction workers spend their take-home pay on housing costs, at the grocery store, and elsewhere in the local economy.

Labor Income – all forms of employment income, including compensation (wages, benefits, and payroll taxes) firms pay to employees, and income earned by self-employed workers or unincorporated sole proprietorships.

Master Developer – a master developer is designated as the owner or owners of the real estate and is responsible for implementing a development master plan. For the purpose of this study, a master developer is responsible for developing the land attributed to the I-5 project area, including any land adjacent to the lid structure that is part of the defined project boundaries. The master developer would be responsible for site planning, design and engineering, infrastructure and utilities planning, site preparation, managing the development of land within the defined project boundaries, and asset management of the above lid and adjacent development. The master developer would also be responsible for the financial components of the above lid and associated assets.

Net Operating Income – net operating income (NOI) is a calculation used to analyze the profitability of income-generating real estate investments. NOI equals all revenue from the property, minus all reasonably necessary operating expenses. NOI is a before-tax figure-appearing on a property's income and cash flow statement- that excludes principal and interest payments on loans, capital expenditures, depreciation, and amortization.

Present Value – is the current value of a future sum of money or stream of cash flows given a specified rate of return.

Pro forma – a Latin term that means "for the sake of form" or "as a matter of form", refers in a financial analysis context to a method of calculating future financial results using certain projections and/or assumptions.

Project Delivery Method – the structure and legal agreements developed to support project funding and financing, project construction, ongoing routine operations and maintenance expenditures, and periodic repair and replacement expenditures between the asset owner and one or more contracted parties.

Public Development Authorities (PDA) – specific to Washington state, a Public Development Authority (PDA) is a legally established government-owned corporation. A PDA is legally separate from the city or county that establishes it. Under state and federal law, all PDA contracts must specify that liabilities incurred by the corporation must be satisfied exclusively from their own assets. In Seattle, each PDA is governed by a volunteer council that oversees PDA activities and staff.

Residual Land Value (RLV) – the value that a developer or investor can pay for development rights (or land and development rights) after accounting for costs, revenues, and profit associated with development. For this analysis, RLV was calculated for each real estate use and then applied to the development program in each scenario and test case.

Rough Order-of-Magnitude (ROM) Cost – the first estimate in the life-cycle cost analysis of a project that is typically applied to project-screening-level efforts. In the case of the I-5 lid analysis, ROM cost estimates were used in-lieu of a quantity-based estimate in-line with the standard Washington State Department of Transportation (WSDOT) approach. The use of ROM costs estimates is due to the preliminary nature of the project (i.e., <5 percent design with only limited supporting quantity determinations). Being metric based, quantity-based item specific costs don't exist; only allowances exist for various types of work based on past experience. As the project moves forward, it would be required to develop quantity-based item specific estimates in-line with the WSDOT standard approach.

Soft Costs – soft costs are any costs that are not considered direct construction costs. Soft costs include everything from architectural and engineering fees, to legal fees, pre- and post-construction expenses, permits and taxes, insurance, etc. Soft costs also include movable furniture and equipment (as opposed to fixed equipment included in hard costs) such as computer data equipment, telephone systems, etc.

Stabilized – refers to a completed property that has achieved a target occupancy. The stabilization year is the first year during which the property operates at target occupancy.

References

ABS Valuation. (2019, November 18). Summary of Final Special Benefit/Proportionate Assessment Study for Waterfront Seattle Project Local Improvement District (LID). Retrieved from Waterfront Seattle: https://waterfrontseattle.blob.core.windows.net/media/Default/WFS%20LID/2019_1204_report_delivered.pdf.pdf

AAmerican Community Survey (ACS). (2018, November 28). 2013-2017 ACS 5-year Estimates. Retrieved from United States Census Bureau: https://www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes/2017/5-year.html

Balk, G. (2015, September 14). Seattle's population boom approaching Gold Rush numbers. Retrieved from The Seattle Times: https://www.seattletimes.com/seattle-news/data/seattles-population-boom-approaching-gold-rush-numbers/

Balk, G. (2020, June 16). Percentage of Black residents in Seattle is at its lowest point in 50 years. Retrieved from The Seattle Times: https://www.seattletimes.com/seattle-news/data/percentage-of-blacks-living-in-seattle-at-lowest-point-in-50-years/

Challenge Seattle. (2019). The invisible crisis: A Call to Action on Middle-Income Housing Affordability. Retrieved from https://21652974-25d8-4ff1-bbc0-8687c8ec1f64.filesusr.com/ugd/e29733_0b19d38c86764c9a9dea7a54f181dd79.pdf

City of Seattle. (2016). Series 1801-92: Published Documents Collection. Retrieved from archives.seattl.gov: http://archives.seattle.gov/digital-collections/index.php/Detail/collections/325

City of Seattle. (2017a). 2017 Parks and Open Space Plan. Retrieved from Seattle Parks and Recreation: https://www.seattle.gov/parks/about-us/policies-and-plans/2017-parks-and-open-space-plan

City of Seattle. (2017b, November). SDOT Waterfront LID Formation Summary and Fiscal Note. Retrieved from Office of the City Clerk: https://seattle.legistar.com/View.ashx?M=F&ID=6990939&GUID=A90984CC-7101-4F52-AFEB-AC814E7A2C7B

City of Seattle. (2018a). 2018 Traffic Flow Counts. Retrieved from Open Data Portal: https://data-seattlecitygis.opendata.arcgis.com/datasets/2018-traffic-flow-counts?geometry=-122.366%2C47.607%2C-122.301%2C47.617

City of Seattle. (2018b). Collisions. Retrieved from Seattle GeoData: https://data-seattlecitygis.opendata.arcgis.com/datasets/collisions

City of Seattle. (2018c). Existing Bike Facilities. Retrieved from Seattle GeoData: http://data-seattlecitygis.opendata.arcgis.com/datasets/existing-bike-facilities

City of Seattle. (2018d). Public Schools. Retrieved from Open Data Portal: http://data-seattlecitygis.opendata.arcgis.com/datasets/a2e1128bd7a041358ce455c628ec9834_8

City of Seattle. (2018e). Pedestrian Counts. Unpublished Raw Data.

City of Seattle. (2019a). Middle Income Housing Advisory Council. Retrieved May 18, 2020, from http://www.seattle.gov/middle-income-housing-advisory-council

City of Seattle. (2019b). Transit Classification. Retrieved from Seattle GeoData: https://data-seattlecitygis.opendata.arcgis.com/datasets/transit-classification?orderBy=SURFACEDATE_1&orderByAsc=false

City of Seattle. (2019c, June). Rent and Income Restricted Housing Data. Retrieved from Open Data Portal: https://data.seattle.gov/browse?category=Community&provenance=official

City of Seattle. (2020). Seattle Affordable Middle-Income - Policy Recommendations. Retrieved from https://durkan.seattle.gov/wp-content/uploads/sites/9/2020/01/AMIHAC-Final-Report-2020-01-22-.pdf

City of Seattle Department of Transportation (SDOT). (2014). City of Seattle Bike Master Plan. Retrieved from https://www.seattle.gov/Documents/Departments/SDOT/About/DocumentLibrary/BicycleMasterPlan/SBMP_21March_FINAL_full%20doc.pdf

City of Seattle Department of Transportation (SDOT). (2016). City of Seattle Freight Master Plan. Retrieved from https://www.seattle.gov/Documents/Departments/SDOT/About/DocumentLibrary/FMP_Report_2016E.pdf

City of Seattle Department of Transportation (SDOT). (2019). Imagine Greater Downtown. Retrieved May 18, 2020, from https://www.seattle.gov/Documents/Departments/SDOT/PlanningProgram/IGD_Full%20Plan_ADA.pdf

City of Seattle Office of Arts & Culture (SOAC). (2020). SpaceLab NW. Retrieved May 18, 2020, from https://www.seattle.gov/arts/programs/cultural-space/spacelab-nw

City of Seattle Office of Planning & Community Development (OPCD). (2016, May). Seattle 2035 – Gowth and Equity: Analyzing Impacts on Displacement and Opportunity Related to Seattle's Growth Strategy. Retrieved from Comprehensive Plan: https://www.seattle.gov/Documents/Departments/OPCD/OngoingInitiatives/SeattlesComprehensivePlan/FinalGrowthandEquityAnalysis.pdf

City of Seattle Office of Planning and Community Development (OPCD). (2019a, September). Outside Citywide Vision. Retrieved May 18, 2020, from Outside Citywide: https://www.seattle.gov/Documents/Departments/OPCD/OngoingInitiatives/OutsideCitywide/OutsideCitywideVision.pdf

City of Seattle Office of Planning and Community Development (OPCD). (2019b). Seattle 2035: Urban Village Indicators Monitoring Report. Retrieved from Seattle's Comprehensive Plan: http://www.seattle.gov/Documents/Departments/OPCD/OngoingInitiatives/SeattlesComprehensivePlan/CouncilAdopted2019_Appendices.pdf

Deleware River Waterfront Corporation. (2017). Master Plan for the Central Delaware. Retrieved from Delaware River Waterfront: https://www.delawareriverwaterfront.com/planning/masterplan-for-the-central-delaware

Downtown Seattle Association (DSA). (2019a). Development Guide: 2019 year-end update. Retrieved from https://cdn.downtownseattle.org/files/research/development-guide.pdf

Downtown Seattle Association (DSA). (2020b, July). Diverse Options for a Market in Demand. Retrieved from Research & Development: https://downtownseattle.org/programs-and-services/research-and-development/housing/

Downtown Seattle Association (DSA). (2020c). State of Downtown – Economic Report. Retrieved from https://downtownseattle.org/programs-and-services/research-and-development/residents/

EDAW. (2008, October). Hollywood Freeway Central Park - Feasibility Report. Retrieved from https://hollywoodcentralpark.org/sites/default/files/docs/HFCP_Feasibility_Report_011415.pdf

EMC Research. (2019, April). 2019 Seattle Center City Commute Mode Split Survey Results Report. Retrieved from Commute Seattle: https://commuteseattle.com/wp-content/uploads/2015/05/2019-Mode-Split-Final-Report.pdf

Esri. (2019, July). Community Analyst. Retrieved from Esri.

Farr, D. (2018). Sustainable Nation: Urban Design Patterns for the Future (First Edition). Wiley.

Federal Highway Administration (FHWA). (1974). The Audible Landscape: A Manual for Highway Noise and Land Use. Retrieved from https://www.fhwa.dot.gov/ENVIRonment/noise/noise_compatible_planning/federal_approach/audible_landscape/audible_landscape.pdf

Federal Highway Administration (FHWA). (2020a). Alternative Project Delivery Defined. Retrieved from https://www.fhwa.dot.gov/ipd/alternative_project_delivery/defined/

Federal Highway Administration (FHWA). (2020b). Project Profile: Capitol Crossing / Third Street Tunnel. Retrieved from Center for Innovative FInance Support: https://www.fhwa.dot.gov/ipd/project_profiles/dc_capitol_crossing.aspx

HR&A Advisors. (2019). Beyond Real Estate Increment: The Value of the Central Seattle Waterfront. Retrieved from Friends of Waterfront Seattle: https://www.friendsofwaterfrontseattle.org/wp-content/uploads/2019/09/friends-of-waterfront-seattle-hr-a-central-seattle-waterfront-study.pdf

King County. (2019). Retrieved from King County Department of Assessments: https://info.kingcounty.gov/assessor/DataDownload/default.aspx

King County Metro. (2018). APC OBS Data.

LID I-5 Steering Committee. (2019, March 12). Local Freeway Lid History. Retrieved from https://lidi5.org/history/

Nelson, R. e. (n.d.). Mapping Inequality – Redlining in New Deal America. Retrieved May 18, 2020, from https://dsl.richmond.edu/panorama/redlining/#loc=11/47.593/-122.528&city=seattle-wa

New York City Economic Development Corporation (NYC EDC). (2020). Sunnyside Yard Master Plan. Retrieved from https://edc.nyc/project/sunnyside-yard

Northwest Seaport Alliance. (2019). Terminal 5 Improvements. Retrieved from The Northwest Seaport Alliance: https://www.nwseaportalliance.com/about/strategic-plan/t5

OBJ. (2020). Klyde Warren Park. Retrieved from https://www.ojb.com/project/klyde-warren-park

Petrov, G. I., Biswas, P., Johnson, R. B., & Seblani, A. &. (2019). Supertall Over the Train Tracks – One Manhattan West Tower. Structural Engineering International, Volume 29. Retrieved from https://www.tandfonline.com/doi/full/10.1080/10168664.2018.1516125

Puget Sound Clean Air Agency, University of Washington. (2010). Tacoma and Seattle Area Air Toxics Evalutation. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.398.5878&rep=rep1&type=pdf

Puget Sound Regional Council (PSRC). (2018). The Regional Transportation Plan — 2018: Appendix I State Facilities Action Plan. Retrieved from https://www.psrc.org/sites/default/files/rtp-appendixi-statefacilitiesactionplan.pdf

United States Census Bureau. (2020). City and Town Population Totals: 2010-2019. Retrieved from https://www.census.gov/data/tables/time-series/demo/popest/2010s-total-cities-and-towns.html

United States Department of Transportation (USDOT). (2020, January 29). Benefit-Cost Analysis Guidance for Discretionary Grant Programs. Retrieved from https://www.transportation.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance-discretionary-grant-programs-0

United States Environmental Protection Agency (EPA). (2014, August). Near Roadway Air Pollution and Health: Frequently Asked Questions. Retrieved from https://www.epa.gov/sites/production/files/2015-11/documents/420f14044_0.pdf

United States Environmental Protection Agency (EPA). (2019, November 25). Heat Island Impacts. Retrieved from https://www.epa.gov/heat-islands/heat-island-impacts

United States Housing and Urban Development (HUD). (2020). Income Limits. Retrieved from Office of Policy Development and Research: https://www.huduser.gov/portal/datasets/il/il2020/select_Geography.odn

United States Internal Revenue Service (IRS). (1982). Revenue Procedure 82-26, CB 467. Retrieved from https://www.irs.gov/pub/irs-tege/rp1982_39.pdf

University of Washington. (2004). Segregated Seattle: Seattle Civil Rights and Labor History Project. Retrieved from washington.edu: https://depts.washington.edu/civilr/segregated.htm

University of Washington. (2019). Reconnecting the Emerald City: Comprehensive Design Guidleines for the I-5 Lid. Department of Urban Design and Planning. Retrieved May 18, 2020, from https://www.seattle.gov/Documents/Departments/OPCD/OngoingInitiatives/LidI5FeasibilityStudy/507SeattleStudio_Web.pdf

Walker, A. (2020, January 29). Could a 35-story, all-wood skyscraper cut housing costs? Retrieved from curbed.com: https://www.curbed.com/2020/1/29/21110943/sidewalk-labs-mass-timber-gensler-michael-green

Washington State Department of Transportation (WSDOT). (2018). CDR Data from October 2018 (Excluding October 8th).

Washington State Department of Transportation (WSDOT). (2019, October 03). I-5 System Partnership. Retrieved from https://www.wsdot.wa.gov/construction-planning/i-5-system-partnership

Washington State Department of Transportation (WSDOT). (2020a). Right of Way Manual. Development Division - Real Estate Services. Retrieved from https://www.wsdot.wa.gov/publications/manuals/fulltext/M26-01/ROW.pdf

Washington State Department of Transportation (WSDOT). (2020b). Moving Washington forward Practical Solutions. Retrieved from https://www.wsdot.wa.gov/about/practical-solutions/moving-washington-forward

Washington State Department of Transportation (WSDOT). (2020c, March). 2020 Traffic Noise Policy and Procedures. Retrieved from https://www.wsdot.wa.gov/sites/default/files/2020/03/10/ENV-ANE-NoisePolicy2020.pdf

Washington State Department of Transportation (WSDOT). (2020d). SR 520 Bridge Replacement and HOV Program - I-5 to Lake Washington Planning Documents. Retrieved from https://www.wsdot.wa.gov/Projects/SR520Bridge/Library/Seattleprocess.htm

Washington State Department of Transportation (WSDOT). (2020e). I-5 – NB Seneca to SR 520 - Mobility Improvements. Retrieved from https://www.wsdot.wa.gov/Projects/I5/SenecaTo520Improve/default.htm

Washington State Department of Transportation (WSDOT). (2020f, July). Environmental planning and Planning Environmental Linkage (PEL). Retrieved from https://wsdot.wa.gov/environment/environmental-technical/nepa-sepa-guidance/planning-environmental-linkage

Washington State Department of Transportation (WSDOT), City of Seattle. (2019). Partnering for the Future of I-5, FY 2019 BUILD Grant Application.

Washington State Employment Security Department (ESD). (2020, April). Index of Washington State and Labor Market Areas, 1990-2019. Retrieved from Labor Market and Economic Analysis: https://esd.wa.gov/labormarketinfo

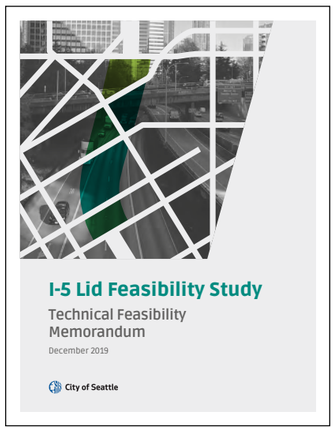
Washington State Office of Financial Management (OFM). (2020). Historical Estimates of April 1 Population and Housing for the State, Counties, and Cities. Retrieved from Washington Data and Research: https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/historical-estimates-april-1-population-and-housing-state-counties-and-cities

Zidane, Y. J.-T., Johansen, A., & Ekambaram, A. (2013). Megaprojects-Challenges and Lessons Learned. Procedia - Social and Behavioral Sciences, 349-357. Retrieved from https://www.sciencedirect.com/science/article/pii/S1877042813004709

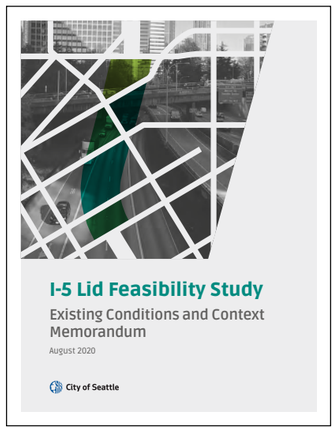
I-5 Lid Feasibility Study Supporting Memorandums

Revised March 2021

Technical Feasibility Memorandum



Existing Conditions and Context Memorandum



Economic and Financial Feasibility Memorandum

Project Funding Efforts

Test Case Memorandum

Real Estate Market Scan

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I-5 Lid Feasibility Study

Summary Report

September 2020

City of Seattle