I-5 Lid Feasibility Study

Economic and Financial Feasibility Memorandum

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City of Seattle

Economic and Financial Feasibility Memorandum
I-5 Lid Feasibility Study

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Task 5. Economic and Financial Feasibility Analysis

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Downtown Seattle Association (DSA)
Equitable Development Initiative Advisory Board (EDI)
Freeway Park Association (FPA)
Horizon House Residents Council
Lid I-5 Steering Committee and Advisory Council
Olive Tower residents
Seattle Commission for People with disAbilities
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
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Acronyms and Abbreviations

AMI	Area Median Income
B	Billion
BCA	Benefit-Cost Analysis
BUILD	Better Utilizing Investments to Leverage Development Grant Program
COVID	Coronavirus Disease
DSA	Downtown Seattle Association
FHWA	Federal Highway Administration
FLS	Fire and Life Safety
GSF	Gross Square Feet
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 Districts
M	Million
MHA	Mandatory Housing Affordability
N/A	Not Applicable
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Protection Agency
NPV	Net Present Value
NSF	Net Square Feet
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
R&R	Repair and Replacement
RLV	Residual Land Value
ROM	Rough-Order-of-Magnitude
SF	Square Feet
TIFIA	Transportation Infrastructure Finance and Innovation Act
USD	United States Dollars
WSCC	Washington State Convention Center
WSDOT	Washington State Department of Transportation

S Executive Summary

S.1 Background

The Interstate 5 (I-5) Lid Feasibility Study (LFS) was commissioned in February 2019 through the City of Seattle's Office of Planning and Community Development as part of the "community benefit agreement" related to the expansion of the Washington State Convention Center (WSCC). The funds for the LFS were awarded to the City of Seattle through the WSCC Community Package to explore the feasibility of building a new lid (i.e., overbuild or cap) or lids across I-5, expanding from the existing lids of Freeway Park and the WSCC. These funds were secured through the efforts of community members who have been exploring and advancing the proposal to lid I-5 through downtown Seattle, Washington.

The project is designed to understand the range of technical and financial feasibility of lidding the freeway, and to look at opportunities for maximizing public benefits. The technical aspect of the study identifies locations where the freeway could be spanned to support development, ranging from open space or landscaping to high-rise structures. The financial aspect analyzes the feasibility related to a range of benefits of lidding with considerations on the real estate market, funding and financing options, construction and phasing, operations and maintenance (O&M) costs, as well as various governance models.

This memorandum documents the approach, assumptions, and results of the economic and financial analysis components of the LFS. Following the analysis to understand the technical feasibility of lidding I-5,[1] three test cases were developed to explore not only urban design considerations but also primarily the financial and economic feasibilities of different hypothetical development programs on the lid. To evaluate overall feasibility from economic and financial perspectives, the analysis considered several factors:

- Lid capital and operating costs under three different development program test-case scenarios
- Real estate market conditions, including current supply, trends, and projections of demand for multifamily residential, office, retail and hotel uses
- Potential value generated by vertical development based on an estimate of the amount a developer or investor would be willing to pay for the rights to develop the programs (referred to from here on out as residual land value) considered under each test-case scenario
- Economic and fiscal impacts of each test-case scenario, including temporary and permanent jobs, economic activity, and generated state and local tax revenues
- Societal benefits stemming from several project benefits, including safety, travel-time reduction, reduced emissions, seismic upgrades, and others
- Governance models and project delivery options under each test-case scenario, including the roles of public and private stakeholders

[1] Refer to the I-5 LFS Technical Feasibility Memorandum

S.2 Key Takeaways

S.2.1 Project Costs

- The study estimates a capital cost range for the lid structure of $855 million to $2,863 million,[2] reflecting estimates (from a technical perspective) for the most robust and the leanest lid projects considered, as well as the applied cost contingency factors. Costs included in this study should not be taken as absolute.
  - Rough-order-of-magnitude 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 costs 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 prices in the vicinity of the study site shows that development on a lid would be on the higher end of land values for downtown Seattle (with cost-per-square-foot ranging from $700 to $2,000 on terra firma).
- The I-5 lid project's absolute estimated median construction cost 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, with consideration of varying load levels, mix of uses, and policy assumptions; costs are presented as full project costs as expressed by capital costs (i.e., the combination of both hard and soft costs for the lid project).
- Regarding test-case results, infrastructure capital costs for the full buildout of a lid structure is $966 million for low-end Test Case 1 (The Park Lid) and $2,298 million[3] for high-end Test Case 2 (Maximum Private Investment).

S.2.2 Financial Feasibility

- The test-case analysis assumes revenue generation from vertical development, where private investment could be feasible. However, while residual land value in Test Cases 2 and 3 could contribute to capital costs or ongoing maintenance costs, it probably would not fully offset the

[2] 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.

[3] This capital cost 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.

capital and maintenance costs associated with the lid. Other funding sources would be required.

- Test Case 1 (The Park Lid) does not include revenue-generating uses on the lid or the impact of open space on lid areas on the value of surrounding properties. However, this test case has the lowest annual funding gap compared to the rest of the test cases explored.
- This analysis does not specify annual air-rights lease payments to the State Motor Vehicle Fund, though it is understood that these may be required by Washington State Department of Transportation (WSDOT) in any future lid development scenario.
- Residual land value in Test Cases 2 and 3 is highly sensitive to assumptions regarding lid construction phasing, ramp removal, affordable and middle-income housing requirements, and parking requirements.
  - Ramp Removal. Removing the Olive Way on- and off-ramps would increase 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—and would reduce noise and emissions associated with vehicles on I-5. While ramp 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 Housing. Strictly from the perspective of lid capital costs and real estate development return, affordable housing tends to reduce the residual land value as a result of substituting revenue-generating uses on the lid. 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 the reduction in structural capital costs. Increased affordable housing could also provide access to other funding sources for both capital revenue contributions and ongoing operating and maintenance that are not available to market-rate developments.
  - Parking Requirements. As technology continues to disrupt the transportation sector (i.e., through ridesharing, connected and autonomous vehicles, etc.), it is unclear what sort of demand would exist for parking in downtown by the time a lid is built. For the purpose of this analysis, the study's base parking case assumed current demand for parking, and that 10 percent of the total amount of parking required to support vertical development would be provided on the lid and 90 percent would be provided off-site. Analysis also considered a reduced parking scenario, which would increase the resulting residual land value, because the costs associated with building parking and acquiring land for off-site parking would be alleviated. If reduced parking requirements are justifiable in the future in regard to both policy and market conditions, residual land values would increase accordingly, thus increasing overall financial feasibility of development scenarios.
- Not including debt service, Test Case 2 would generate an annual operating surplus because as the estimated residual land value associated with vertical development would be greater than annual O&M and periodic repair and replacement costs for the lid structure and park. 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 reflecting current low rates during the COVID-19 pandemic.

- The financial findings of this study are consistent with other large lid projects in urban areas in that revenue-generation opportunities cover only part of the overall lid capital and operating costs. The few exceptions are where the cost of constructing the lid structure is lower due to the physical location of a structure in a flat area and the high surrounding property values. Such examples exist at Hudson Yards in New York City, Capitol Crossing in Washington, D.C., and Fenway Center in Boston.

S.2.3 Economic and Societal Benefits

- The study confirms that with each test case, there would be significant direct and indirect economic opportunities with constructing a lid that would 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 would revitalize the economy with up to $3.1 billion in annual economic activity.[4]
- 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 would be worthy of consideration over the 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 served as a useful precedent to inform a future analysis of the amalgamation of different development options per lid area.

S.2.4 Governance and Project Delivery

- Project delivery is assumed to be the decision of the asset owner, WSDOT, with indications from the Federal Highway Administration 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 was the case with the Seattle Municipal Tower, which was developed by a private entity and sold to the city—and continued partnerships with the WSCC on their assets over I-5 through downtown Seattle.

[4] 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 private and public-private models are best able to harness private financing; that said, private development was 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 was sufficient legal authority to execute public, private, or public-private models. However, there is 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 was considered "conventional," so there would be 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.

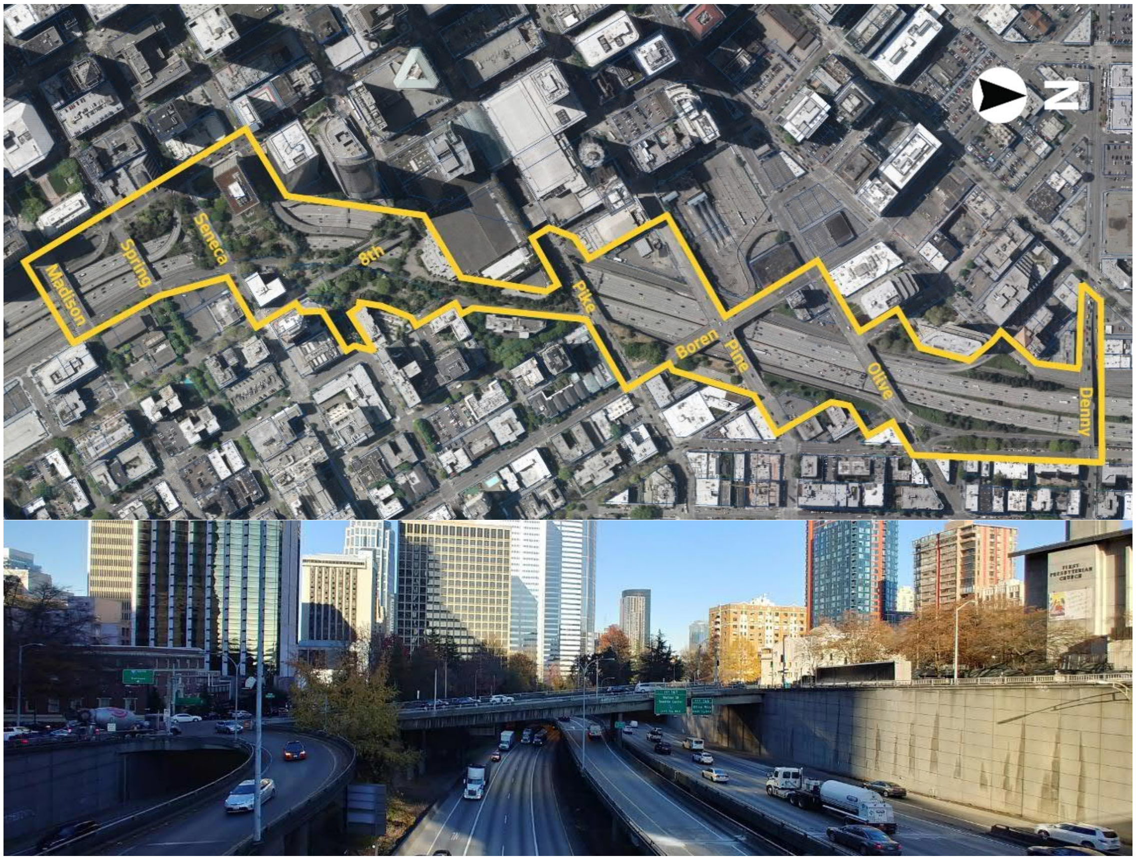
S.2.5 Funding and Financing Considerations

- Revenue generation from vertical development would be feasible but would not completely cover both capital and ongoing O&M 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 is far too soon to define 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.

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 range of technical and financial feasibility 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 study identifies locations of the study site where the freeway could be spanned to support development, ranging from open space to high-rise structures. Three theoretical development test cases were assessed to explore the range of cost, benefits, and outcomes of various levels of development intensity, and a mix of public and/or private uses. The economic and financial assessment analyzed the feasibility related to the benefits of lidding I-5 with considerations about the real estate market, operations and maintenance costs, construction and phasing, funding and financing options, as well as various governance models.

Figure 1-1. Study Site



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

The study is preliminary and pre-dates any planning, program definition, broader public engagement, and design. The scope of this study did not include developing an alternatives analysis, and thus 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 range of technical and financial feasibilities of the lid concept and serves 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 the future of downtown Seattle, 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 and Overview

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 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,[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 the operation and capacity of I-5, one of the region’s most critical transportation corridors. 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.

[5] See the I-5 LFS Technical Feasibility Memorandum

2.1 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 that 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.

2.2 Basis of Economic and Financial Analysis

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. This memorandum sheds light on the economic and financial performance of a lid that would create value from various approaches to public and private developments, as well as maintenance of the lid assets. This memorandum also helps evaluate lid development strategies to minimize costs and maximize economic and public benefits for surrounding downtown neighborhoods, the City of Seattle, and the greater state and regional economy.

The I-5 LFS Technical Feasibility Memorandum established cost bookends for the lid project established as potential rough-order-of-magnitude lid construction and capital cost ranges (estimated in 2019 USD), capital costs include the costs attributed to planning, design, and other costs attributed to delivering the lid project. The resulting analysis presents $855 million at the low-end to $2,863 million at the high-end capital cost range.[6] Through the development of test cases and evaluation of land uses as a result of the technical and urban analysis, the rough-order-of-magnitude (ROM) bookends were further refined as part of the test-case analysis to develop construction and capital costs for the economic and financial analysis.[7]

[6] These values are absent of right-of-way costs, federal and state asset replacement, or vertical development costs, but include other variable costs.
[7] See the I-5 LFS Test Case Memorandum

2.3 Key Study Assumptions

- The study does not make any conclusions or recommendations regarding the future of the existing I-5 highway corridor and considers 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 would be 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 ROM 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 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 values in 2019 USD and did not incorporate any 2020 impacts from the COVID-19 pandemic or associated socioeconomic impact or deflationary pressures.
- The only source of direct revenue generation analyzed was vertical development on the lid, expressed as residual land value.[8] Other potential revenue sources were not considered but could exist.
- The analysis did not consider the cost of, or sources of funding for, an assumed air-rights lease payment to the State Motor Vehicle Fund.[9]

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

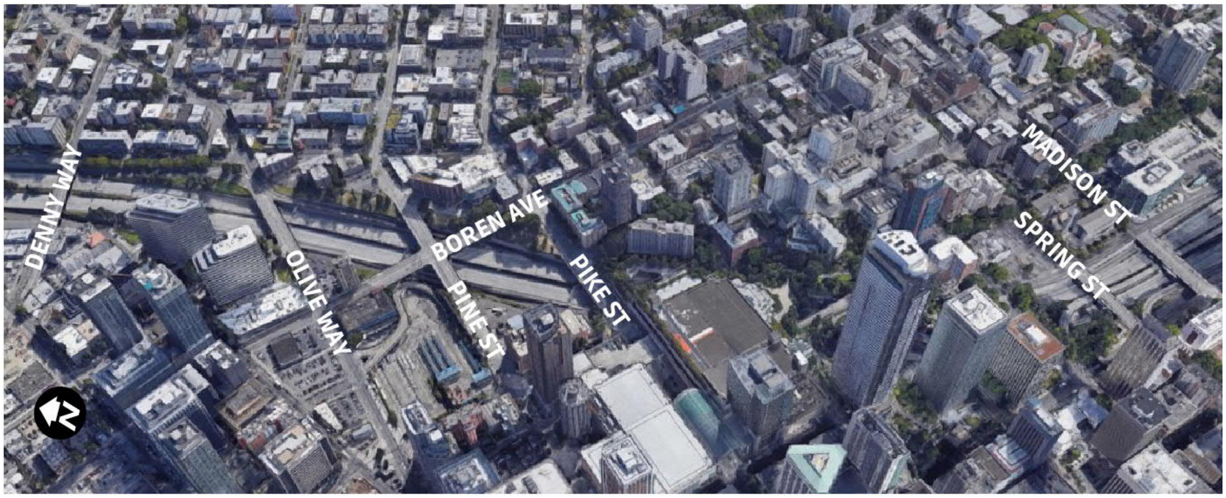
[9] This cost could be reduced or removed based on future discussions with the asset owner and consideration of legal requirements.

- 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.
- 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.

3. 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, which included structural features and I-5 operations, were also considered. 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.

Figure 3-1. Aerial View of the Study Site



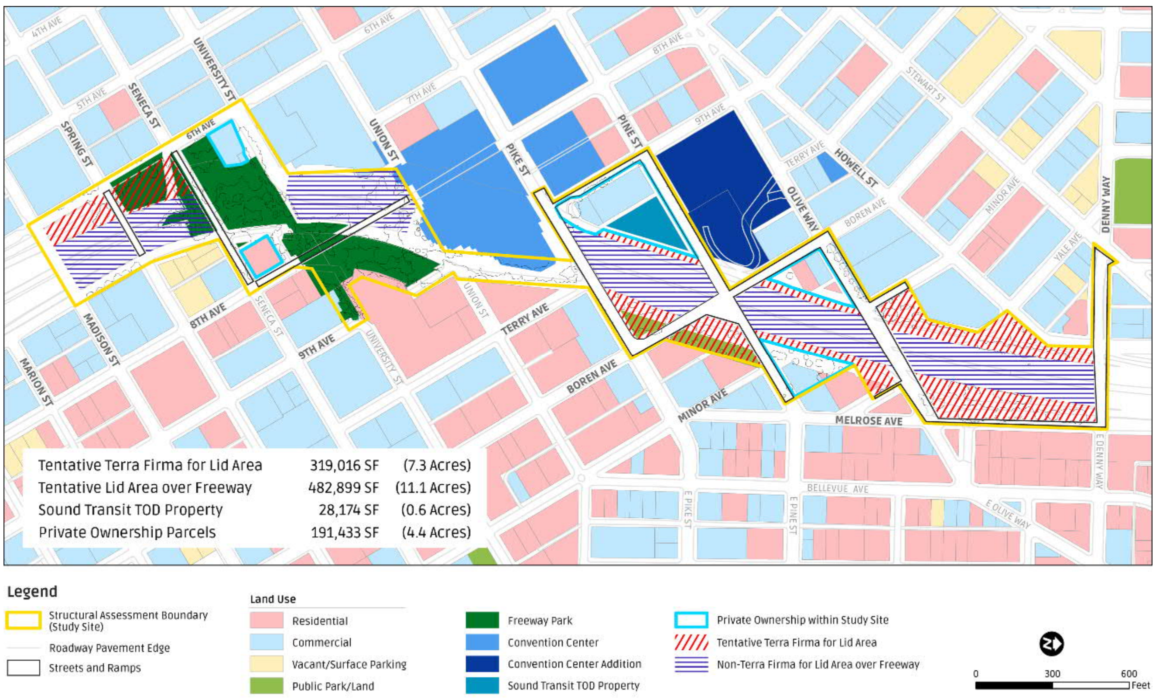
Aerial view of I-5 through the study site from Denny Way (north) to Madison Street (south). The urban form west of I-5 is characterized by high-rise buildings, while east of I-5 buildings are low- to mid-rise buildings, with shorter urban blocks.

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). 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.

- 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 WSDOT right-of-way. 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 site.
  - The City of Seattle manages the surface street network and Freeway Park.

Figure 3-2. 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.

3.1 Demographics

A potential lid in downtown Seattle should 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), 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, 2020).[10]

Demographics in Historical Context

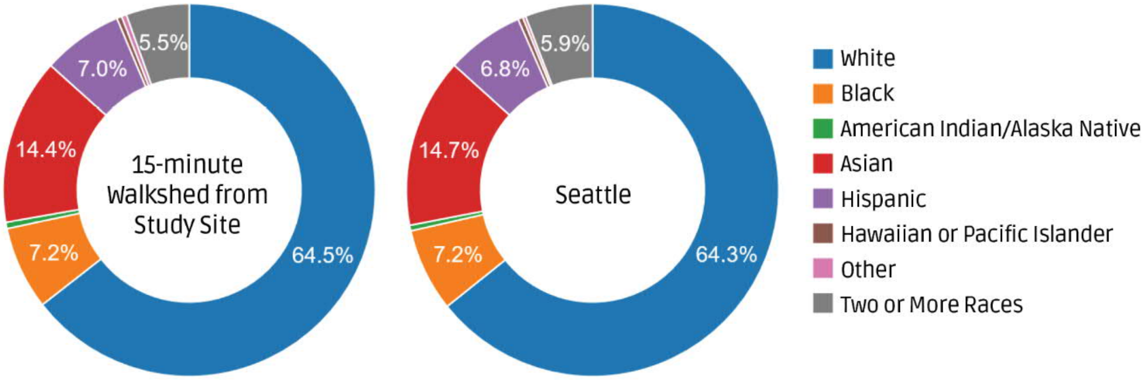
Current demographics tell only a part of Seattle's story. The exclusion of Native people from Seattle, redlining, racially restrictive covenants and exclusionary lending drew physical and economic boundaries to keep people of color out of certain neighborhoods with lasting impacts today (UW, 2004)Error! Reference source not found.. 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.

Population

- In 2019, approximately 747,000 residents lived in Seattle, with 88,000 people living downtown (DSA, 2020).
  - Since 2010, downtown population has increased 47 percent (Esri, 2019).[11]
  - While citywide population has increased by 22 percent,[11] 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).[12]
  - 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. Approximately 36 percent of people in both areas were people of color (ACS, 2018).

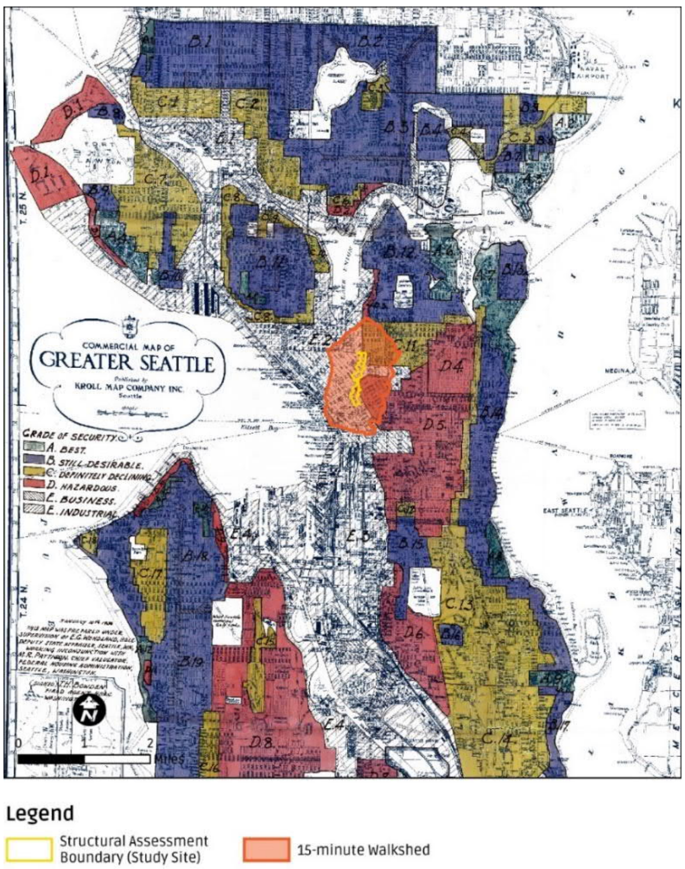
[10] The year of statistical data and the definition of the downtown boundary varies by source. The Downtown Seattle Association's boundary of analysis has the broadest definition by including South of Downtown (SODO) on its south end and establishing its eastern boundary at Broadway. The Imagine Greater Downtown initiative defines Greater Downtown with similar boundaries but does not consider SODO.
[11] 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, 2020).
[12] Source article is based on 2014–2018 U.S. Census Bureau data.

Figure 3-3. Race and Ethnicity in the Study Area and Seattle



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

Figure 3-4. Historical Redlining Map in Relation to the Study Site



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

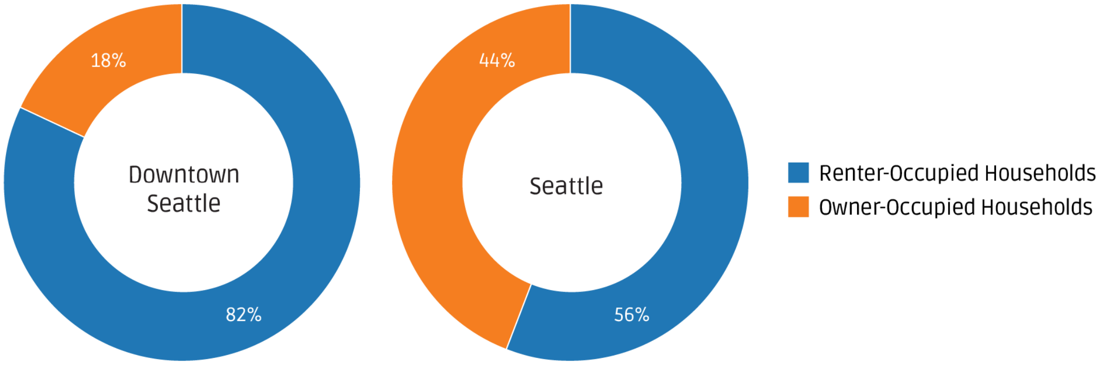
Households

- Downtown has a significantly higher percentage of rental housing than Seattle as a whole(Figure 3-5). 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).

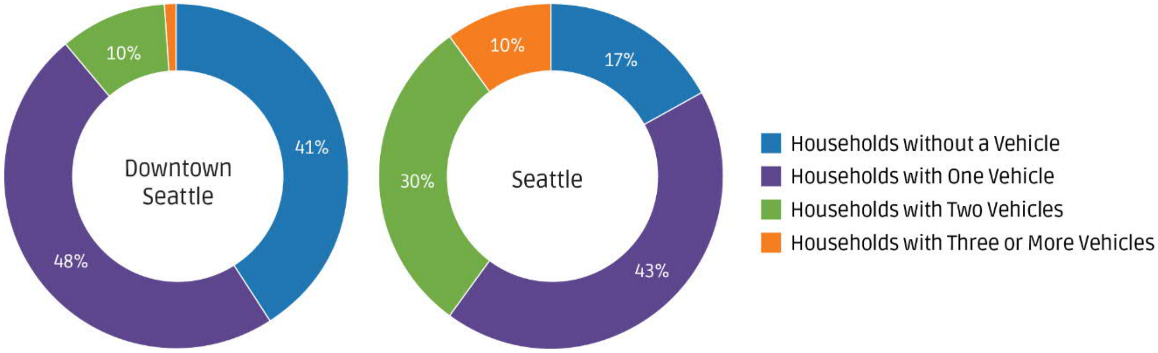
Figure 3-5. Housing Tenure



Source: Data sourced from Esri Community Analyst 2014-2018 Estimates (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 3-6), notably with 41 percent of downtown households not owning a vehicle, compared to 17 percent of households citywide (Esri, 2019).

Figure 3-6. Vehicle Ownership

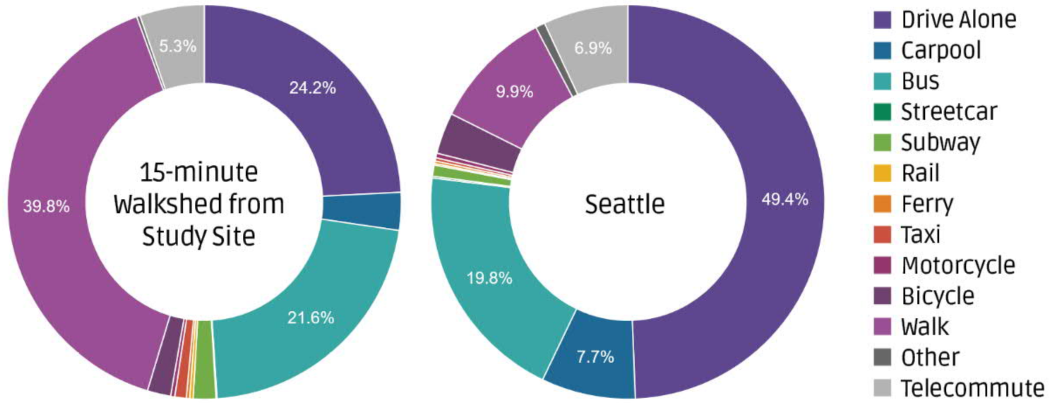


Source: Data sourced from Esri Community Analyst 2014-2018 Estimates (Esri, 2019)

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 (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).

Figure 3-7. Commute Mode of Eligible Labor Force

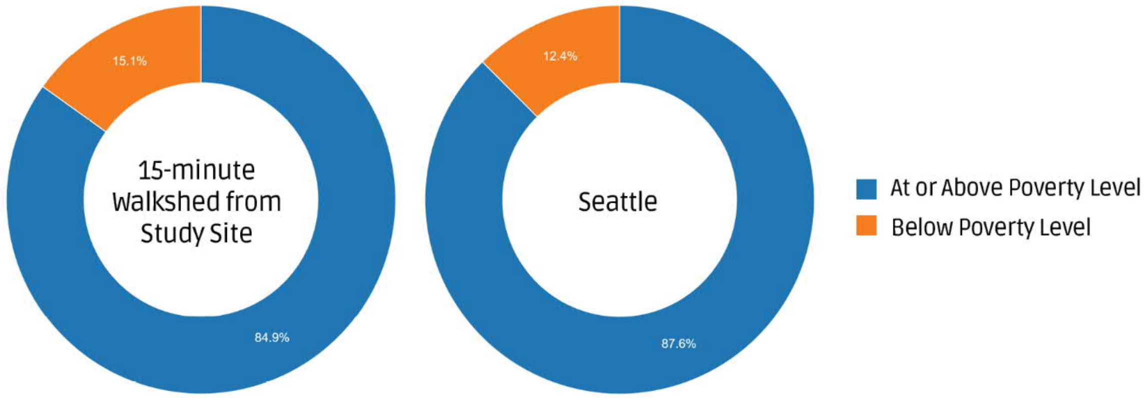


Source: Data sourced from American Community Survey 2017 5-Year Estimates (ACS, 2018)

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 3-8) (ACS, 2018).

Figure 3-8. Individual Poverty Status



Source: Data sourced from American Community Survey 2017 5-Year Estimates (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.

3.2 Real Estate Market Scan

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, 2019).

A market scan was conducted to assess real estate market conditions, to forecast likely future demand in the study area, and to 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 3-9).

Figure 3-9. 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)
Source: I-5 Lid Feasibility Study Real Estate Market Scan (HR&A Advisors)

This real estate market scan informed the creation of development program test cases and vertical development programs for the I-5 LFS. The project study area for the I-5 lid runs along a 0.8-mile sunken portion of I-5 from Madison Street (south end) to Denny Way (north end). The analysis described below includes an overview of regional demographic and economic trends, an assessment of real estate market conditions and trends, projections of future market growth, and an analysis of the potential for real estate development in the LFS study area to capture future market demand. 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, provides a baseline grounded on a period of sustained economic growth but also considers the impact of previous economic cycles to inform future socioeconomic conditions, property value trends, and financing terms (i.e., interest rates, depreciation, etc.).

3.2.1 Project Context

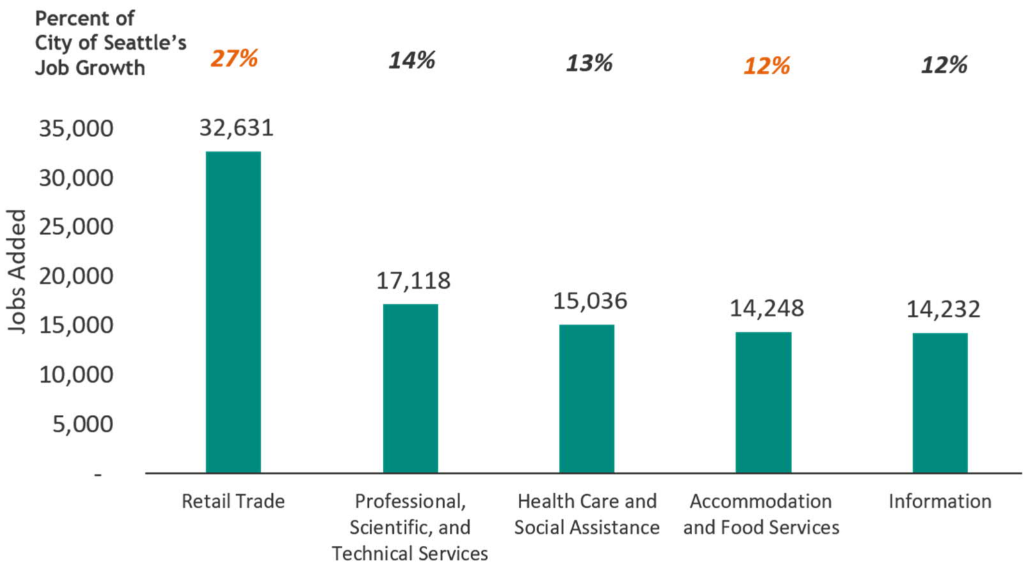
Regional Context

Between 2010 and 2018, Seattle's population increased 22 percent (from 610,000 to 745,000 residents). During this period, Seattle was the fastest-growing big city in the United States, and the level of population growth experienced had not been seen since the Klondike Gold Rush.

During this same period, the city has seen significant job growth, adding more than 17,000 jobs per year on average since 2010 at 3.34 percent employment compounded annual growth rate (CAGR), and reaching a total of 602,000 jobs in 2018. As a point of comparison, the city's employment CAGR between 2000 and 2010 was -0.82 percent, driven by slow growth between 2000 and 2008 and employment loss during the Great Recession.

While the growth of "tech" jobs in the Professional and Technical Services industry is widely credited for Seattle's economic growth, service jobs (those that support expanding neighborhood amenities like retail and food and beverage services, as well as hospitality) comprised 39 percent of the city's recent employment growth.

Table 3-1. Jobs Added in Largest Growth Industries in Seattle, 2010–2017



Source: (Puget Sound Regional Council (PSRC), 2017).

Seven Fortune 500 companies are headquartered in Seattle, including Amazon, which has 45,000 employees in the city, with headquarters in South Lake Union and Denny Triangle. The region is also home to large employment anchors across diverse industries, including Boeing, McChord Air Force Base, Amazon, Microsoft, and the University of Washington.

As of 2015, both job growth and housing unit deliveries have outpaced recent projections as the market responds to demand and industry expansion, with housing production achieving one-third of 2035 production goals (well ahead of projections). However, housing unit production has lagged in job growth. While the job-to-housing ratio in the city is 1.69, Seattle has added approximately 2.5 jobs for every housing unit added between 2010 and 2018.

Looking ahead, the Puget Sound Regional Council projects that Seattle's population growth between 2015 and 2040 will slow, but Puget Sound regional population growth will be sustained at close to 2015 rates through 2040, with regional household growth accelerating and job growth slowing.

As the economy and population have grown, Seattle has also seen record-high tourism and visitor spending. The number of overnight visitors grew by 18 percent between 2015 and 2018, with visitor expenditures growing 39 percent from $5.6 billion to $7.8 billion during this period. The impacts of these demographic trends on the real estate market are further analyzed below, with a focus on implications for future supportable demand on the lid.

Lid Study Area Context

The I-5 lid study site is at the nexus of four distinct neighborhoods with varying urban scales and characters: Downtown Seattle, South Lake Union, Capitol Hill, and First Hill. The study site is within blocks of key retail, employment, and hospitality nodes proximate to Downtown Seattle, including the Pike-Pine retail corridor, Amazon's campus to the northwest, and the WSCC.

Several planned and ongoing projects will transform the context of the lid study area in the coming decade:

- A major $1.8 billion renovation to the WSCC within the lid study site
- The redevelopment of Yesler Terrace into a mixed-income, mixed-use community on 30 acres to the southeast of the lid study site
- The Waterfront Seattle program's multi-year, $724 million investments to transform Seattle's waterfront with public space and connectivity improvements.

3.2.2 Real Estate Market

The following sections discuss the major asset types and assesses recent trends in the market and estimates of supportable demand based on analysis.

Residential: Existing Conditions

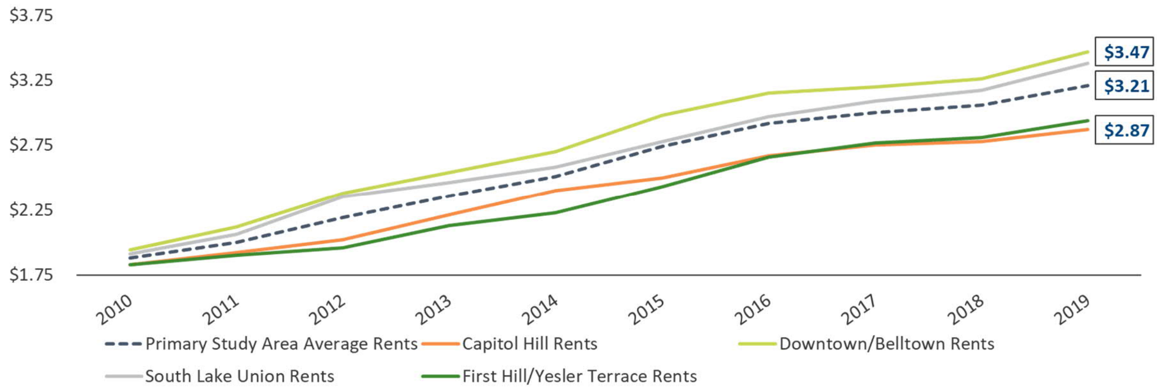
The Downtown Core contains approximately 47,000 multifamily units, with 19,000 (43 percent) of all units delivered since 2013.[13] During this cycle, a preference for urban living and Amazon's influence on the Downtown Core has made Seattle's Downtown Retail Core, Capitol Hill, South Lake Union and surrounding neighborhoods the fastest-growing multifamily submarket in the Puget Sound region. Demand for new housing in the Downtown Core is driven by educated millennials seeking amenity-laden urban neighborhoods and proximity to many of the region's "tech" jobs.

As shown in Figure 3-10, within the Downtown Core, the neighborhoods surrounding the lid offer a range of multifamily building typologies and rents, though overall, rents in the area are at the top of the regional market. Between 2010 and 2019, multifamily rents have diverged between the Downtown Core multifamily market and the surrounding region, with average rents of $3.21 per square foot per month

[13] "Downtown Core" is used in this memorandum to describe the Primary Study Area boundary for each land use, which includes the Downtown Retail Core, First Hill, Capitol Hill, South Lake Union, and Denny Triangle neighborhoods (Figure 3-9). Details of study area boundaries for each land use can be found in the full I-5 Lid Feasibility Study Real Estate Market Scan (October 2019). The Secondary Study Area also shown in Figure 3-9 includes the full city of Seattle, excluding the Primary Study Area, and the Tertiary Study Area shown in the same figure includes cities outside of Seattle that have recently experienced concentrations of multifamily development, including Bellevue, Kirkland, Redmond, and Shoreline.

in the Downtown Core compared with average rents of $2.41 per square foot per month across the rest of the city.

Figure 3-10. Rent Trends in Downtown Core Neighborhoods ($/SF), 2010-2019



Source: (CoStar Group, Inc., 2018).

However, high vacancy rates in the Downtown Core and faster-growing rents in cities and suburbs surrounding Seattle could suggest that market dynamics are shifting as residents seek value and high-quality housing and developers shift away from development in the increasingly saturated urban core. Although growth in the city is expected to slow over the next ten years, recent rezoning positions the Downtown Core for continued development and housing production, particularly to the east of the lid study area.

Residential: Demand

Residential demand analysis sizes and assesses the target market to guide development program recommendations. This market analysis projected multifamily rental demand through a segmentation of households in the market based on the following criteria:

- Household income required to rent a market-rate unit, assuming that between 20 percent and 30 percent of household income is spent on housing costs
- Preference for urban-format multifamily housing
- Household turnover rate for renter-occupied households

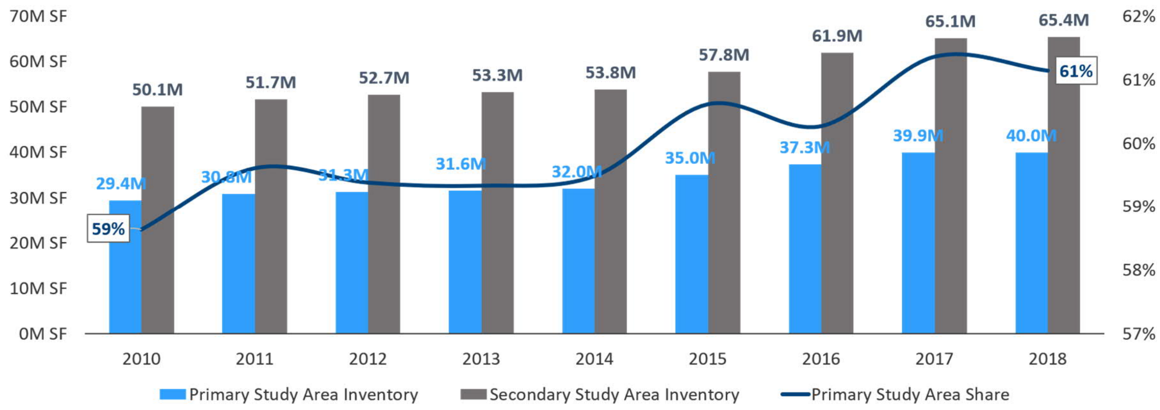
After determining the base year demand, the Seattle Office of Planning and Community Development (OPCD) housing unit projections were used to project demand in future years, applying the Downtown Core's historical share of citywide housing growth between 2010 and 2017 forward to estimate Downtown Core demand in 2035. Puget Sound Regional Council household projections for 2035 are used to estimate projected household growth in areas outside the city boundary.

With modest capture rates that account for demand for brand new product (3 percent capture of demand in the Downtown Core, 1 percent capture of citywide demand outside of the Downtown Core, and 0.5 percent of regional demand outside the city), the lid study area could likely support between 800 and 1,200 total market-rate units over a 10-year buildout period.

Office: Existing Conditions

The Downtown Core contains 40 million square feet of Class A office space, with inventory growing by over 25 percent between 2013 and 2018. The Downtown Core also continues to gain share of the citywide Class A office inventory, as shown in Figure 3-11. Additionally, the 7 million additional square feet of development currently in the pipeline will grow the Downtown Core inventory by 18 percent. Despite delivery of new space, office vacancy has declined over this same period, and the market has experienced robust rent growth and consistent absorption.

Figure 3-11. Downtown Core Share of City Class A Office Inventory, 2010–2018



Source: (CoStar Group, Inc., 2018).

The majority of recently delivered and ongoing or proposed office developments within the Downtown Core are west of I-5, within the Downtown and South Lake Union districts. Nearly a one-quarter of the office pipeline is Amazon space (including owner-occupied space), and Amazon's location decisions will continue to play a role in shaping the regional office market.

Recently delivered amenity-laden development attracts tech and other creative office tenants. Rents in the Downtown Core average $44/SF and are on par with citywide average rents of $43/SF but are significantly higher than rents in other office submarkets in the region: average rents in Bellevue are $36/SF, which are 22 percent lower than rents in the Downtown Core. To some extent, competing space in regional submarkets replicates Downtown Core conditions by delivering office space as part of larger mixed-use districts. A significant share of large lease transactions has occurred in Bellevue; office development within the lid study area will face increasingly competitive regional submarkets.

Office: Demand

Office demand analysis assesses the potential demand for office space based on projections for office-using job growth. Future demand for office space in the lid study area is estimated based on regional growth of office-using jobs and the anticipated portion of regional job growth that can be captured within the Downtown Core. This analysis relied on employment growth projections from the Puget Sound Regional Council, which indicates that office-using industries are growing regionally and potentially generating significant demand for space.

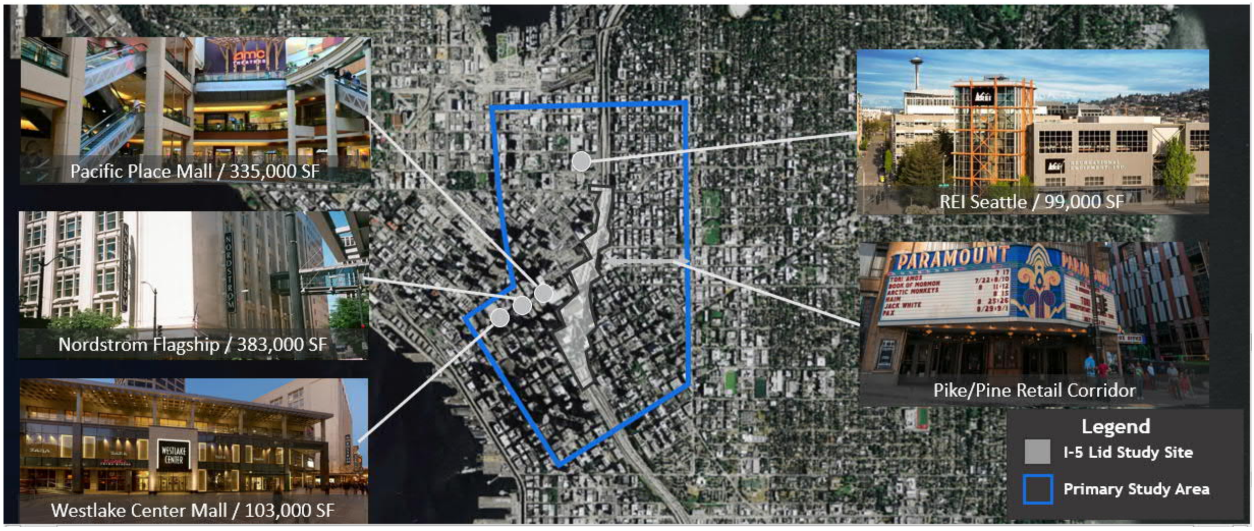
With a capture rate of 10 percent to 15 percent of the demand in the Downtown Core, preliminary conclusions suggest that the lid study area could likely support 1.2 million to 1.8 million square feet of office space over a 10-year buildout period.

Retail: Existing Conditions

Three million square feet of retail space is within a 10-minute walk shed of the lid study area, with nearly 700,000 square feet of space added since 2010. The character of existing retail in the Downtown

Core varies, with destination malls and department stores to the west of I-5 in the Downtown Retail Core, and specialty and food and beverage stories to the east of I-5 along the Pike-Pine Corridor (Figure 3-12). Newly constructed retail throughout the Downtown Core is primarily neighborhood-serving food and beverage stores and convenience retail.

Figure 3-12. Downtown Core Share of City Class A Office Inventory, 2010–2019



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

Seattle's sustained period of population and job growth has driven retail sales to nearly double in the city since 2010. However, retail market performance is mixed: rents have fluctuated since 2020 and declined in recent years, echoing a nationwide decline in retail performance.

The existence of large, established destination retail nodes in the study area make it unlikely that the lid could become a major retail destination, though there may be opportunities on the lid for visitor-serving, experiential retail for conventioneers. Neighborhood-serving retail will be important to creating amenity-laden office and multifamily development and a mixed-use community on the lid.

Retail: Demand

Given the uncertainty and declining performance of retail in the area and nationwide, this analysis focused on incremental retail delivered in the Primary Study Area (a 10-minute walkshed from the southernmost and northernmost ends of the I-5 Lid study site), as a fraction of multifamily and office development delivered in the same area during the past decade. Between 2010 and 2018, retail represented 6 percent of total office and multifamily deliveries by square footage. The ratio of retail to office and multifamily development in the pipeline is consistent with this relationship since 2010, with retail representing 7 percent of the pipeline (e.g., 70 square feet of retail for every 1,000 square feet of office and multifamily development).

Based on residential and office demand findings, the projected demand for residential and office development on the lid could support a retail program of between 130,000 and 220,000 square feet over a 10-year buildout, with retail representing 7 percent of the total commercial development program.

Hotel: Existing Conditions

The Downtown Core has 14,200 hotel rooms, with nearly 20 percent of these rooms added in the past two years after a period of no change or limited change in inventory. In 2018 alone, 2,100 new hotel rooms were completed, distributed among luxury, upper upscale, upscale, and boutique hotels.

Seattle has seen consecutive years of record tourism, with average annual visitation growing at 6 percent annually, and average annual spending growing at a rate of 12 percent annually between 2015 and 2018. An expanding office market, the WSCC expansion, growing tourism, and proximity to local attractions are key hotel market drivers in the Downtown Core. In response to the significant increase in supply, the average occupancy rate has declined and was 82 percent in 2018. Average Daily Rate (ADR) has continually increased since 2010, but the growth rate has slowed and ADR was $229 in 2018. There are 1,140 rooms under construction and an additional 3,540 rooms proposed over the next five years in the Downtown Core. About three-quarters of pipeline hotel rooms are within mixed-use hotel-residential projects.

Hotel: Demand

Hotel demand analysis evaluates potential drivers of new visitation, including new office space, tourism, and population growth to guide recommendations. This analysis evaluated the historical ratio of office space, visitation, and population to hotel room supply to estimate the demand for new hotel rooms based on office demand projections. The analysis then used the current ratio of business to leisure visitors to estimate the demand for business-focused vs. leisure-focused hotels. While this analysis used current market data, which included the impact of Airbnb or similar room-sharing platforms, it did not account for unanticipated future policy changes that could alter the lodging market or visitor decision-making around where to stay.

Based on this analysis, the lid study area could support 400 to 600 hotel rooms. New supply would respond to demand from different traveler types, and could be spread across two hotels, potentially including a larger, business-oriented hotel and a smaller, leisure-focused hotel.

3.2.3 Findings: Potential Development Program

Findings from the real estate market scan suggest that the new urban space created by the lid could support a high-end range of up to 1,200 market-rate residential units, 1.8 million square feet of office space, 200,000 square feet of retail space, and 600 hotel rooms (Table 3-2).

Table 3-2. 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

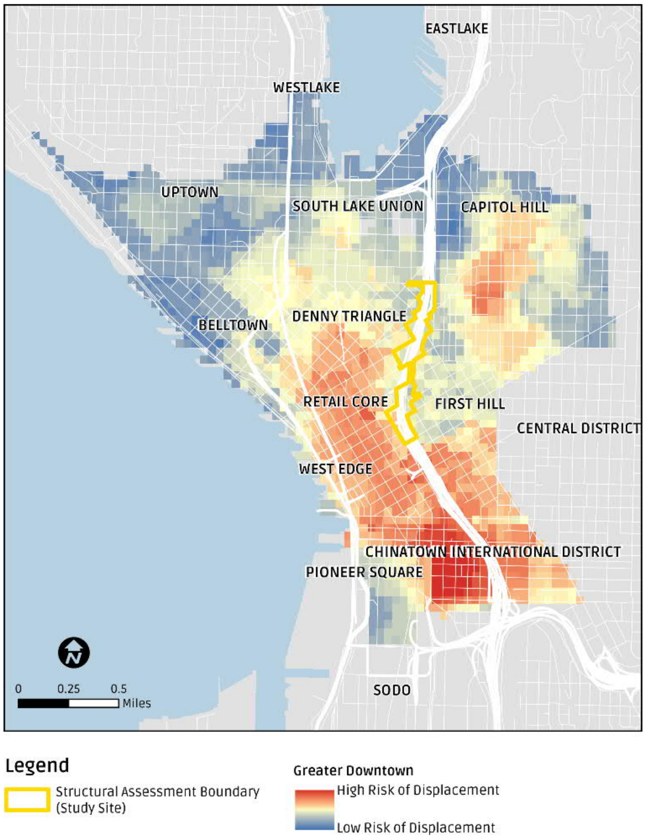
Source: I-5 Lid Feasibility Study Real Estate Market Scan (HR&A Advisors)
Estimates reflect market capture ranges for 2035, intended to inform development program test cases for a lid. All numbers are not adjusted to account for the existing pipeline. Future pipeline and churn will also meet a share of demand. These estimates do not include affordable housing units.

Additional details on the methodology, market areas, and data sources used in this analysis can be found in the I-5 LFS Real Estate Market Scan Memorandum.

3.3 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 3-13). An assessment of low-income households (Figure 3-14) immediately adjacent to the study site (within 1,000 feet) revealed that of the 11,731 households identified within this boundary, 39 percent (4,613 households) are low-income households as defined as within 60 percent of the King County Area Median Income (AMI) of $96,000 per average household (HUD, 2020); 2,151 subsidized housing units were identified in the same area, corresponding closely to the 5-minute walkshed of the study with housing units extracted from City of Seattle Geographic Information System data on rent- and income-restricted housing (City of Seattle, 2019b).The increase in the Displacement Risk Index in Greater Downtown neighborhoods is 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, in areas where new housing is being constructed, it is often priced for middle- or high-income households,[14] often replacing housing stock once occupied by lower-income households (OPCD, 2016).

Figure 3-13. Displacement Risk Index in Greater Downtown, 2016



Source: (OPCD, 2016)

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

Figure 3-14. Definitions of Housing Affordability in the City of Seattle

Affordability
(Spending up to 30% of gross monthly income on housing costs)

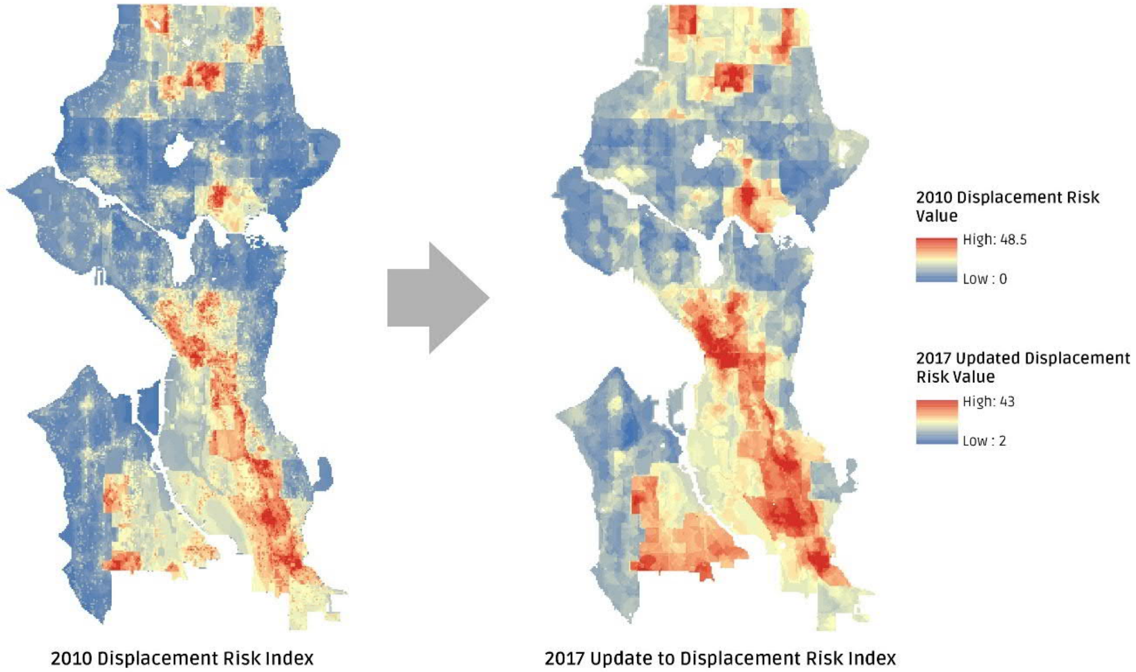
City of Seattle median household income:
$76,000 (single person household)
$108,000 (four person household)

Low-income Household	Middle-income Household	High-income Household
Earns **60%** of Area Median Income (AMI)	Earns **60–120%** of Area Median Income (AMI)	Earns **> 120%** of Area Median Income (AMI)
< $46,500 (single person household)	**$46,501–$93,000** (single person household)	**> $93,001** (single person household)
< $66,400 (four person household)	**$66,400–$132,850** (four person household)	**> $132,850** (four person household)

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

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 could 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 could become less attractive, and people could choose other modes of transportation or telecommuting models to access jobs and employment opportunities downtown. Because 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.

Figure 3-15. Displacement Risk Index in Seattle, 2010 and 2017



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.

Highlighted in Figure 3-16, 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 result from improvements over I-5 if a lid were to be built and the corresponding development programs.

Figure 3-16. Change in Displacement Risk Index in the Study Site, 2010-2017

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

The City of Seattle has instituted several policies to promote equitable growth and to 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 who can no longer afford to live in Seattle, thus 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 made 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. The lid could create commercial and cultural spaces to help ensure this neighborhood extension would contribute 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.

3.4 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 500 to 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).

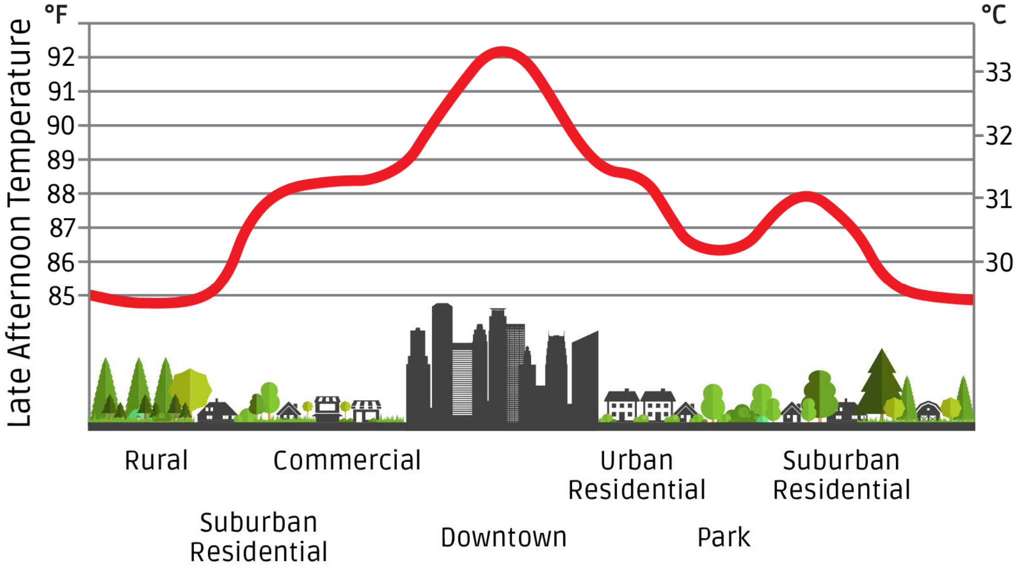
Noise

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); the amount of noise reduction would depend on the material, size, and location.

Urban Heat Island Effect

A lid could enhance the microclimate in downtown Seattle. Modifying the cover over the 0.8 mile of road surfaces, pavements, and buildings could 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 3-17). 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 3-17. 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.

4. Development Program Test Cases

Three test cases were developed to analyze the technical and financial feasibilities associated with lidding all or a portion of the study site (Figure 1-1):

- 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?

To investigate a proof of concept, these hypothetical test-case development programs defined scenarios and strategies to develop a lid by using broad urban design guidelines that would aid future decision-making. These explorations tested the lid's development intensity, urban form, mix of public to private uses, and policy assumptions. The I-5 LFS Test Case Memorandum contains the rationale for selecting the three test cases, including key assumptions and a description of the choices made for the buildings and uses included in each.

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 (Table 3-2). 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 possible civic uses).

The City of Seattle shaped the test cases using questions, key assumptions, and input from the study community. The consultant team worked closely with the City of Seattle and study community on the assumptions and parameters. 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.". Test Case 3 is a mid-density (or medium load) hybrid that mixes private investment with significant public benefit outcomes.

A test case is neither 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 or development proposal, and no preferred alternative was determined.

The resulting test-case development program exercises created input to calculate a test case's development capacity (i.e., determine the total area of a lid that would be 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, which is assumed to contribute to the financial feasibility assessment of the lid concepts.

An overbuild development over I-5, as measured by the three test cases, 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 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 4-1 summarizes a review of the development programs for each of the three test cases explored.

Table 4-1. 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).

5. Economic and Financial Feasibility of Lidding I-5

This analysis explored the range of economic opportunity and financial feasibility of the identified lid test cases, 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.

5.1 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 (Table 4-1). 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"[15] with development potential over WSDOT right-of-way[16] (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 following analysis 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 other quality of life and economic

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[15] The lid is not equivalent to creating ground on terra firma, as described in 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.

[16] 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.

competitiveness metrics—which would allow for a comprehensive cost-benefit analysis. Such analyses should be considered in future studies of a potential lid project.

5.2 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).

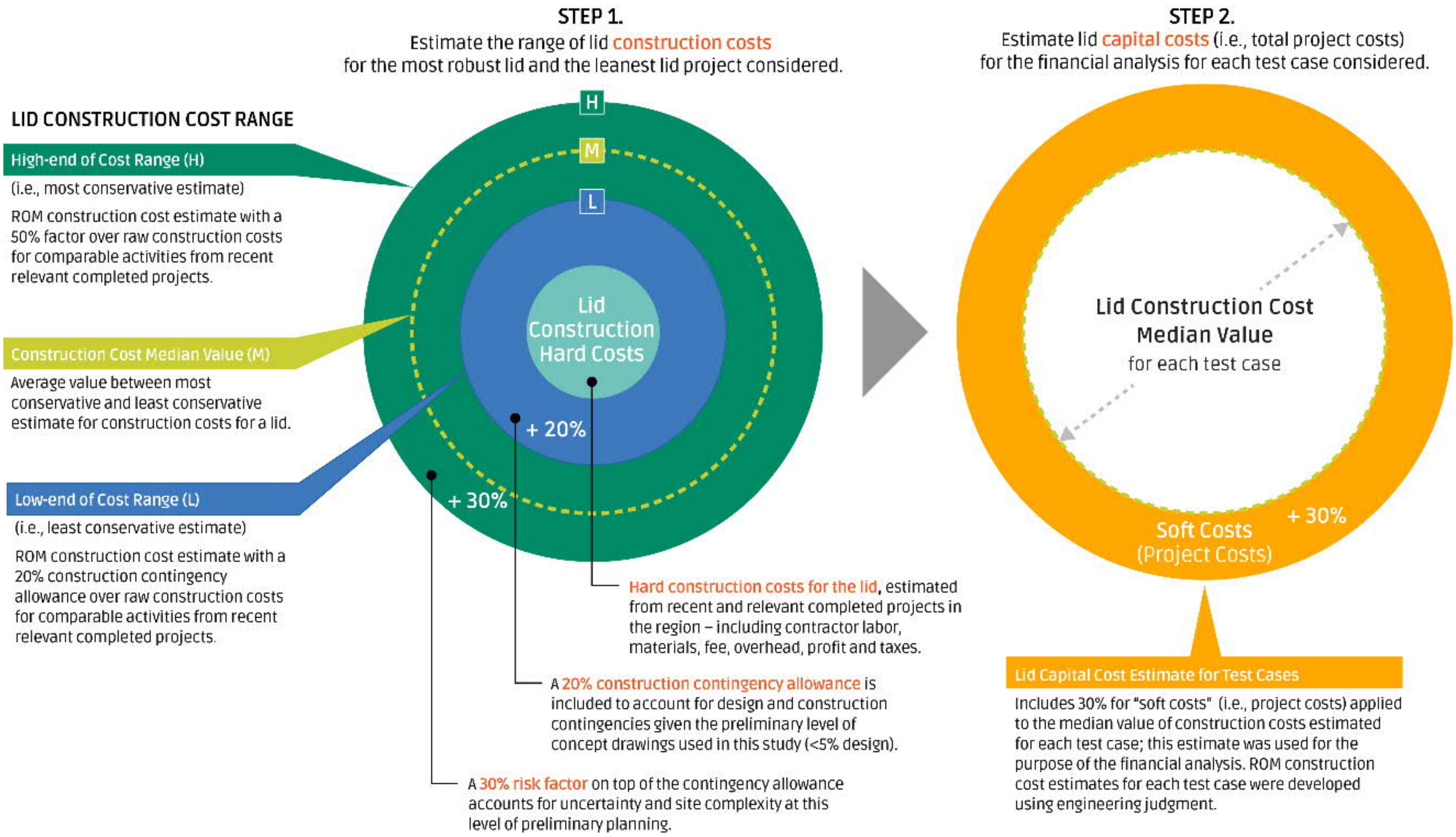
Corresponding O&M costs for other items such as utilities, surface streets, sidewalks, police enforcement, and fire protection were not assumed in the analysis. While there could be some mitigation discussed within the context of noise and potentially emissions, this analysis did not account for the 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.

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 bookends 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 judgement. 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).

Figure 5-1 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 bookends 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 judgement. 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).

Figure 5-1. Approach to Rough-Order-of-Magnitude Cost Estimates for the Study



Construction Costs Estimates

The I-5 LFS hard construction costs (covering materials and labor) estimated for the lid structure are 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 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 5-1 captures the considerations to deliver the project bookends.

Table 5-1. 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	
Pedestrian Access Improvement at WSCC (along Hubble Place)	Yes	

The robust lid project (

Figure 5-2) 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 5-3), 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.

Figure 5-2. Construction Cost-per-Square-Foot Ranges for a Robust Lid Project

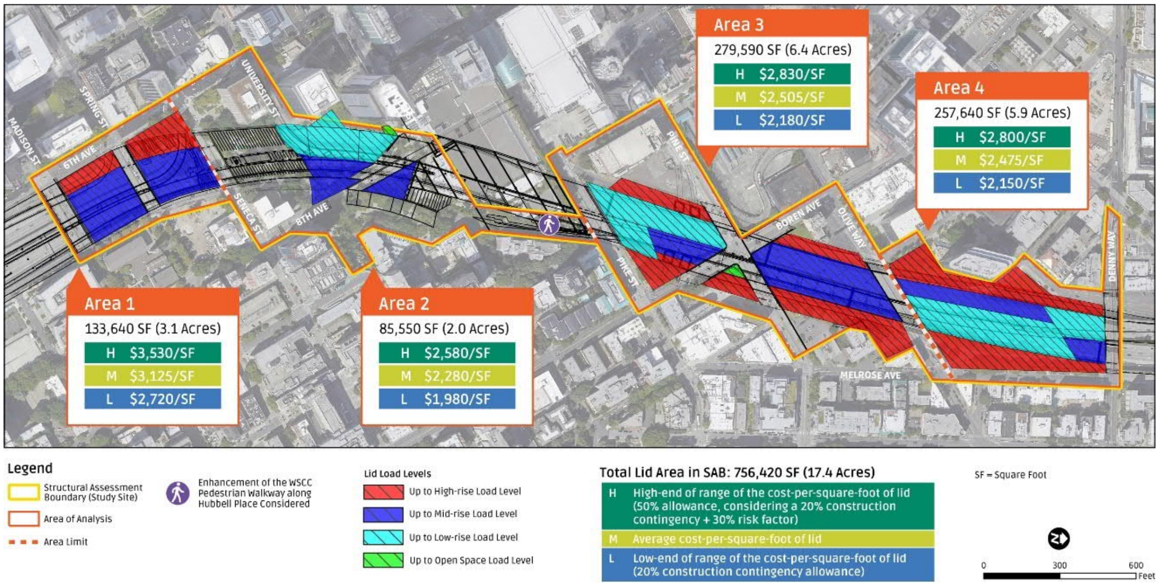
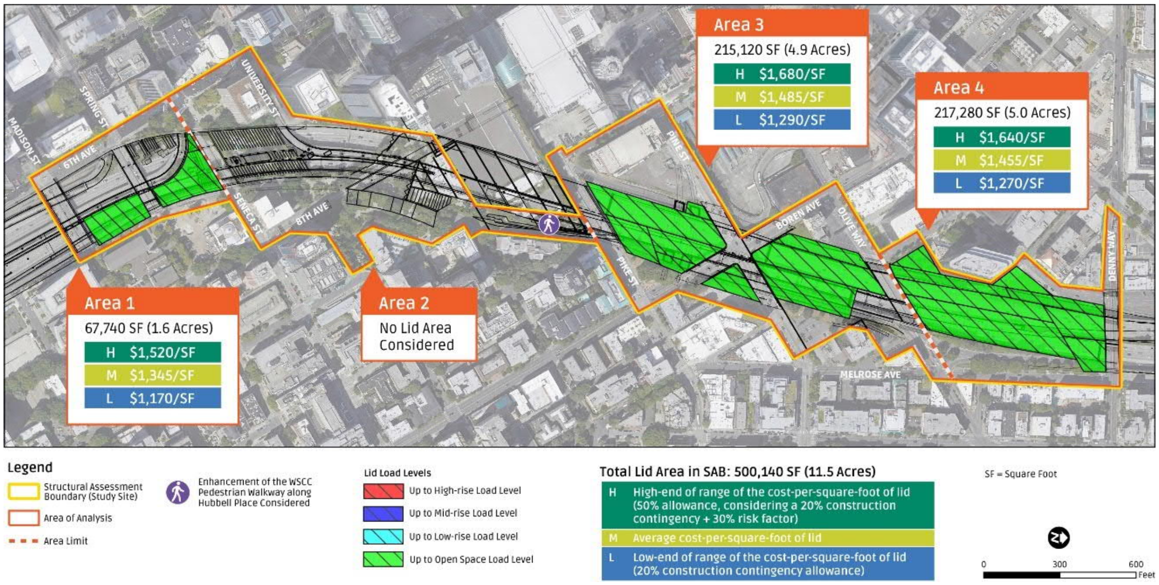


Figure 5-3. Construction Cost-per-Square-Foot Ranges for the Leanest Lid Project



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 the 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 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

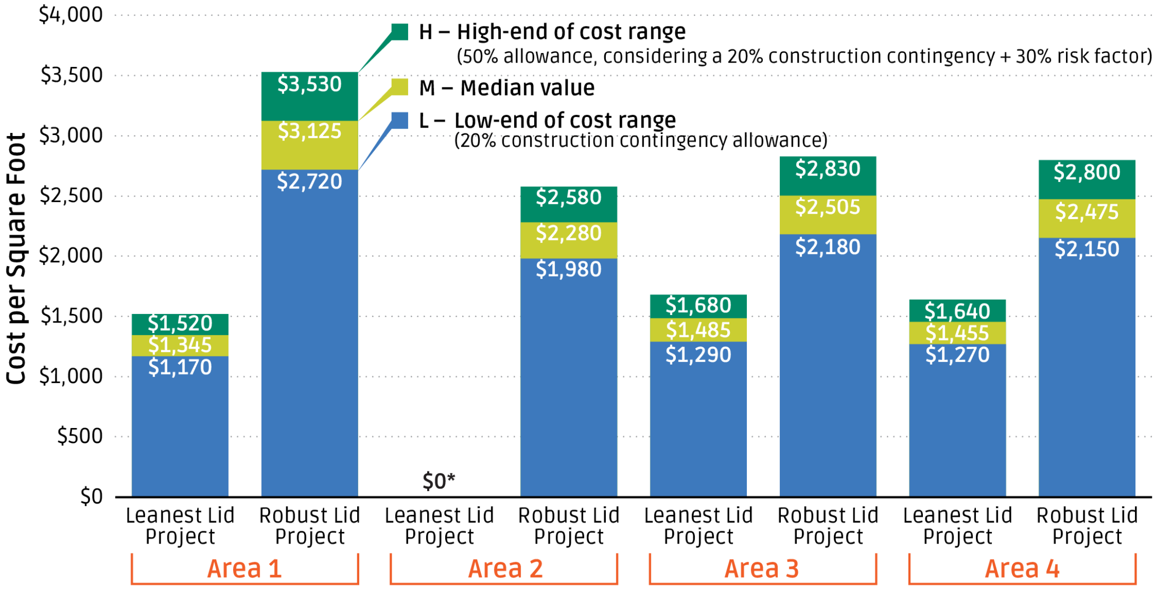
Figure 5-4 presents the ROM construction costs-per-square-foot ranges per lid area for the study's project bookends analysis (

Figure 5-2 and

Figure 5-3). Given the specific challenges 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 5-2). 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.

Figure 5-4. Construction Cost-per-Square-Foot Ranges per Lid Area in Project Bookends (Robust and Leanest Lid Projects) (2019 USD)



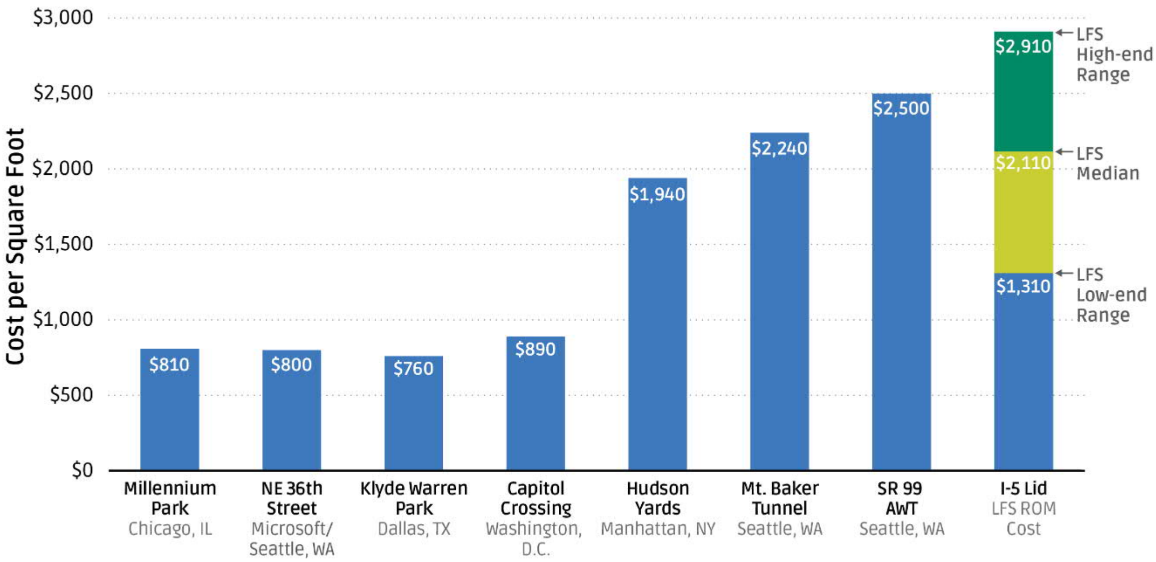
The costs-per-square-foot ranges are construction costs, and thus do not include right-of-way costs, federal and state asset replacement, and other variable costs. See also summarizes the approach taken to calculate cost inputs for the economic and financial analyses. First, construction costs (i.e., "hard costs") were estimated through a bookends 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 judgement. 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).

Figure 5-1 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.

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 5-5 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 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 fire, life, safety (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 5-5. 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 (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 bookends 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 judgement. 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).

Figure 5-1). Capital costs generally serve as the basis for financial and economic analysis to consider the impact of “soft costs”[17] (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

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 bookends 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 judgement. 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).

[17] 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.

Figure 5-1 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.

Table 5-2. 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 percent construction contingency ($)	Cost including 20 percent construction contingency & 30 percent risk allowance ($)	Area (SF)	Cost including 20 percent construction contingency ($)	Cost including 20 percent construction contingency & 30 percent risk allowance ($)	Cost Range ($)
Area 1	133,640	472 M	614 M	67,740	103 M	134 M	103 M – 614 M
Area 2	85,550	221 M	286 M	N/A	*33 M	*42 M	*33 M – 286 M
Area 3	279,590	791 M	1,027 M	215,120	361 M	468 M	361 M – 1,027 M
Area 4	257,640	721 M	936 M	217,280	358 M	464 M	358 M – 936 M
Total	756,420	2,205 M	2,863 M	500,140	855 M	1,108 M	855 M – 2,863 M

*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 and minimum 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.

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 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 bookends 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 judgement. 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).

Figure 5-1, for the purpose of the financial analysis, Table 5-3 summarizes the estimated capital costs for each test case. First, a lid construction cost was estimated for each test case[18] 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.[19]

Table 5-3. 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 ($)	Area (SF)	Cost ($)	Area (SF)	Cost ($)	Area (SF)	Cost ($)	Area (SF)	Cost ($)
Area 1	58,735	103 M	143,405	641 M	143,405	641 M	116,530	224 M	116,530	224 M
Area 2	N/A	*37 M	85,550	254 M	85,550	254 M	85,550	204 M	85,550	204 M
Area 3	231,850	449 M	239,035	779 M	251,500	820 M	230,850	489 M	245,745	521 M
Area 4	198,790	377 M	193,735	624 M	250,090	805 M	202,355	587 M	257,820	748 M
Total	489,375	966 M	661,725	2,298 M	730,545	2,520 M	635,285	1,505 M	705,645	1,698 M

*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 include other variable costs expressed in 2019 USD.

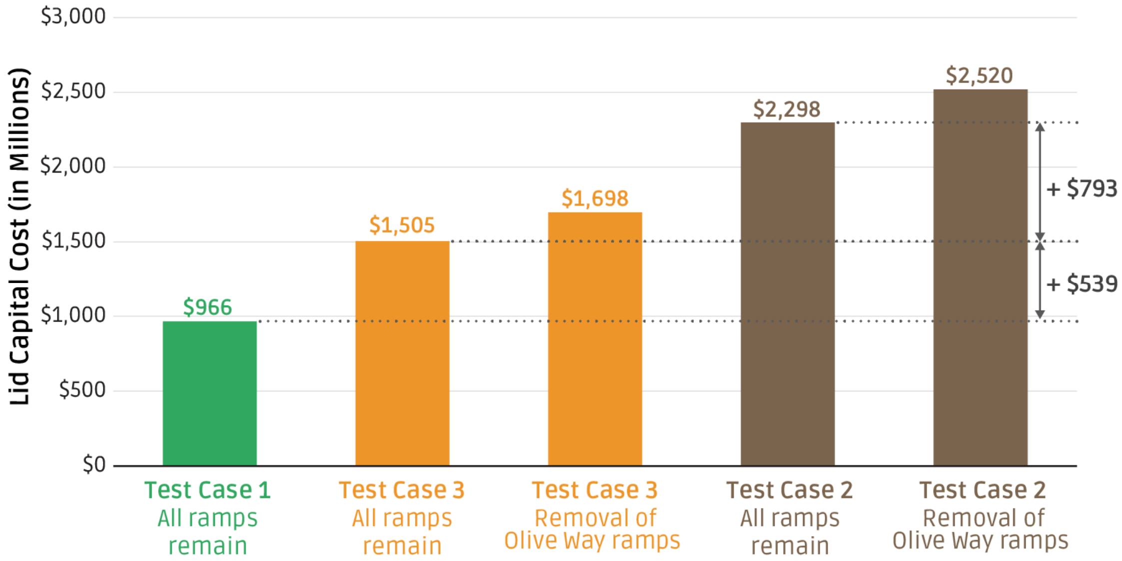
Second, to estimate the capital costs for each test case, the average (or median) ROM construction cost estimates were further adjusted by 30 percent to account for soft costs; the median value represents the mid-point between the most conservative and least conservative estimate to construct a lid. 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 5-5).

Figure 5-6 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

[18] 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.
[19] Construction costs for building public park space and civic spaces on pavilions are accounted for in the lid capital cost estimates.

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.

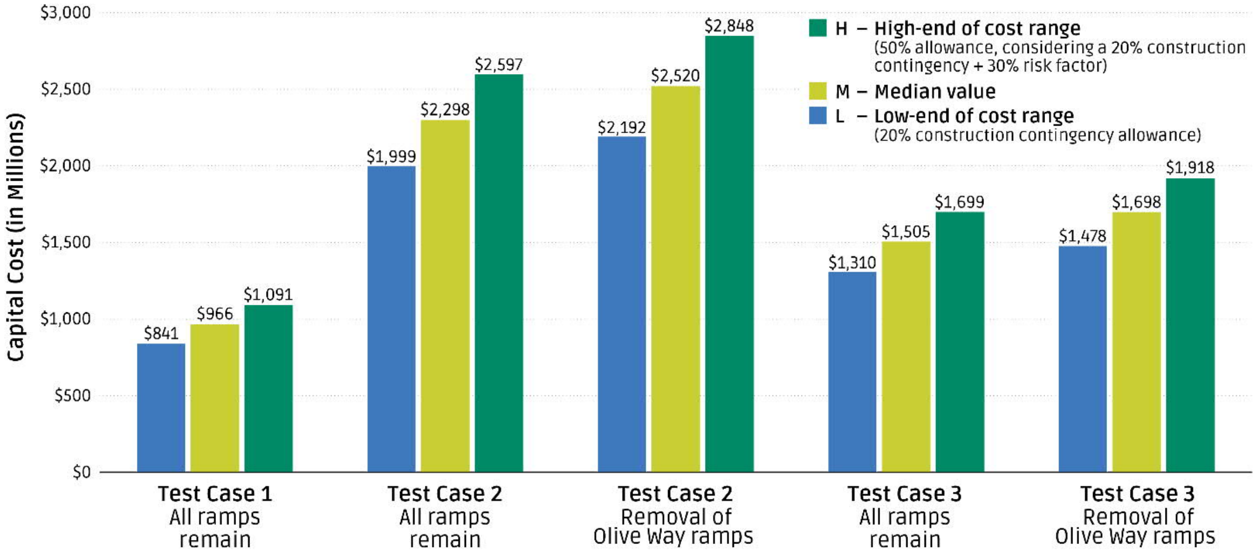
Figure 5-6. Lid Capital Cost Estimates by Test Case ($ millions)



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 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.

Figure 5-7 shows the capital cost range for each test case, including the low-end factoring in the 20-percent design and construction contingency, the high end using the 50-percent construction contingency and risk factor, and the average of the two ends of the range as a median value.

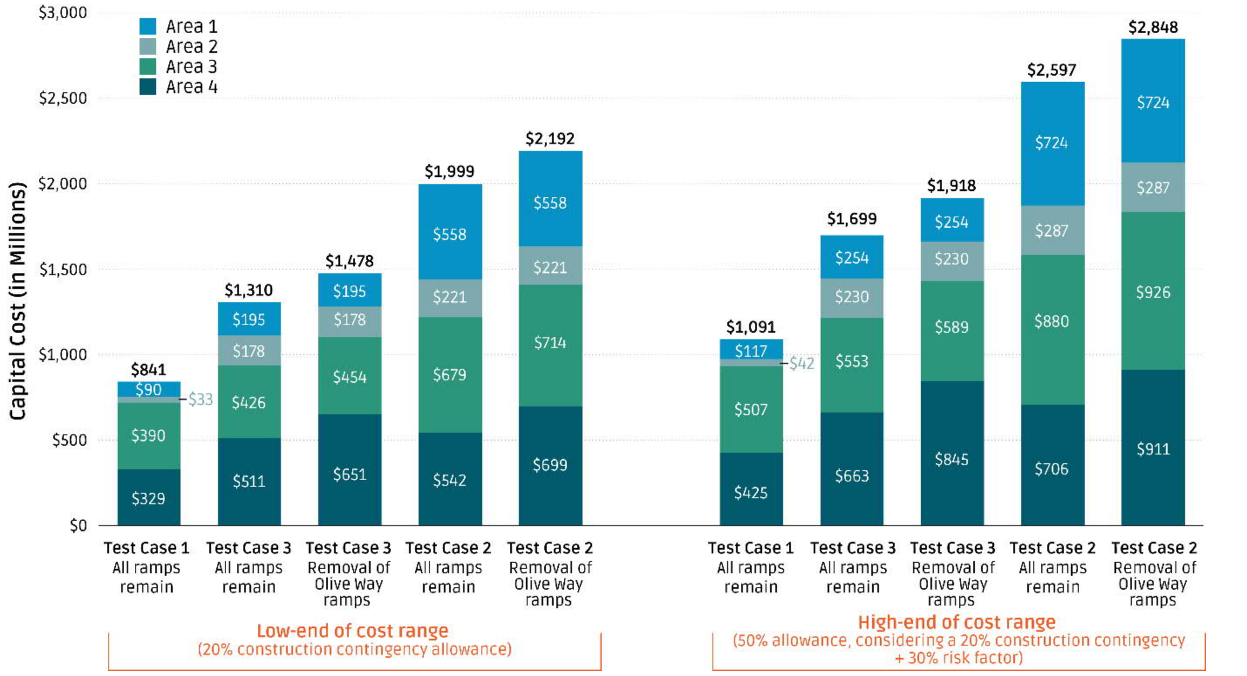
Figure 5-7. Range of Lid Capital Cost Estimates by Test Case ($ millions)



Using the 20-percent design and construction contingency and the 50-percent contingency and risk factor results in a wide range of cost estimates across test cases, from $841 million on the low end of the Test Case 1 range to $2.8 billion on the high end of the Test Case 2 (Removal of Olive Way ramps) range. The average of the low end and high end of the range is used for further analysis to evaluate the financial feasibility of each test case described in later sections.

Figure 5-8 highlights the range of capital costs by lid area for each test case.

Figure 5-8. Range of Lid Capital Cost Estimates by Test Case and Lid Area ($ millions)



In Test Cases 2 and 3, total capital cost by specific lid area is primarily a function of the relative size of each area. However, the amount of development programmed in each area also affects the relative cost in each area compared to Test Case 1. For Test Case 3, Area 4 represents the largest share in cost increase over Test Case 1, because the largest amount of Test Case 3 development would be planned in this area. In Test Case 2, Area 1 would contribute the most to the capital cost increase over Test Case 1, ranging from approximately 30 to 40 percent of the total. With all ramps remaining in Test Case 2, the most development would occur in Area 1. However, in Test Case 2 with the Olive Way ramps removed, development would be more proportional across Areas 1, 3, and 4. Also in this case, Area 1's higher incremental cost over Test Case 1 is a function of Area 1's lower cost in Test Case 1 ($90 million to $117 million) and the construction cost-per-square-foot data. As shown in Figure 5-4, Area 1 has the largest difference between the robust lid and leanest lid project bookends, suggesting higher sensitivity to the denser development scenario of Test Case 2.

Roadway and Lid Operations and Maintenance Costs

For the purpose of the financial feasibility analysis, in order to determine the lifecycle financial analysis of the project, annual O&M costs for the lid structure and lid improvements were estimated for each test case (Table 5-12). These O&M 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 Structural Assessment Boundary (i.e., study site).

The O&M cost values for the components below the lid structure were provided by WSDOT and are based on other applicable highway tunnel and lid facilities. Annual O&M costs for a potential lid are were estimated on a per-lane-mile basis based on WSDOT experience with the I-90 Mount Baker Tunnel (Seattle) and Mercer Island's Aubrey Davis Park lid over I-90. Costs attributed to lidding the highway include the incremental costs for FLS equipment, ventilation, lighting, and other associated costs. Consistent with capital cost estimates, a 20- to 50-percent contingency and risk range was applied to O&M costs to establish a range, with the median being applied as the basis for financial analysis. The study assumes that all existing roadway O&M costs would continue to be funded through WSDOT maintenance programs and would not transfer to the operator of the lid or be paid from potential revenue generated from lid uses.

Corresponding O&M costs for other cost items—including upgrades to utilities, surface streets, sidewalks, and incremental police enforcement, and fire protection—were not assumed in the analysis. The assumption is that the incremental costs for these items could be offset or more than fully offset by reductions in maintenance and preservation activities for some of the existing aging assets the lid would replace.

Public Park and Civic Structures Operations and Maintenance Costs

Public park space assumptions were included for Test Cases 1 (The Park Lid) and 3 (Mid-Density Hybrid). To capture the O&M costs associated with the park space atop the lid in both test cases, park facility O&M costs were estimated per square foot based on average reported O&M cost data for Cal Anderson Park and Freeway Park from Seattle Parks and Recreation. On a per-square-foot-basis, park ($0.14 per SF) and pavilion civic structures ($0.36 per SF) were included, based on the current (2019) budgets for Occidental Park and Westlake Parks and the Yesler Terrace pavilion structure.[20] Table 5-12 captures the park O&M cost estimates per test case.

[20] Costs were based off Seattle Parks and Recreation annual O&M expenditures between January and the end of November 2019. Costs were provided for Yesler Terrace, Cal Anderson Park, and Freeway Park and exclude park activation activities provided through a contract with the Downtown Seattle Association.

For the purpose of the financial analysis, the study assumes equivalent levels of activation to those spaces in downtown Seattle, in terms of both cost and potential revenue generation and contributions to offset activation costs. Sources of funding could include Seattle Parks and Recreation, holiday and special event revenue, sponsorships, local neighborhood funding, and miscellaneous revenue attributed to items such as food trucks and permit fees.

Repair and Replacement Costs

Consistent with O&M costs, periodic repair and replacement (R&R) cost values were estimated for costs attributed to lidding or tunneling I-5—including FLS equipment, ventilation, lighting, and other associated costs—for each test case (Table 5-12). R&R cost values are annualized and calculated on a per-square-foot basis as a percentage of total capital expenditures as established in the capital cost estimates. The study assumes that all existing roadway R&R costs would continue to be funded through WSDOT preservation programs and for the purposes of test cases analysis, would not transfer to the operator of the lid or be paid from potential revenue generated from lid activities.

WSDOT has not verified the R&R cost values assumed for the financial feasibility analysis. The values employed represent cost assumptions based on rehabilitation plans for other WSDOT highway facilities, primarily the SR 99 Tunnel, which include costs associated to a state-of-the art ventilation and fire suppression system.

Preservation and operating costs associated with private vertical development (i.e., market-rate buildings) on the lid were incorporated as part of the real estate pro forma estimates for Test Cases 2 and 3. Major periodic repair costs for park and pavilion spaces for Test Case 1 were assumed to be annualized and embedded in the public park O&M costs.

5.3 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 3.2 Real Estate Market Scan) 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 land value for a private-sector developer.

The test cases are described fully in the I-5 LFS Test Case Memorandum.

Results of this analysis are expressed as residual land value (RLV). RLV is the value that a developer or investor would pay after accounting for costs, revenues, and profit associated with 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.

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.

5.3.1 Analysis of Land Sales Values on Terra Firma

The terra firma (i.e., dry land or ground) value analysis reviewed vacant and developable land transactions in the near-to-moderate proximity of the lid study site. This analysis precedes the LFS economic and financial feasibility assessment of land value by asset type and is intended to provide context on the land markets in neighborhoods surrounding the I-5 lid study site.

Six land sale transactions were identified within three Downtown Core neighborhoods: Downtown Retail Core, South Lake Union, and Capitol Hill. Table 5-4 lists the transaction details for each site.

Table 5-4. Comparable Land Sales within Proximity of the I-5 Lid Study Site

Address	Parcel Area (SF)	Proposed Use	Sale Price (2019 USD)	Sale Date	Sale Price per SF (2019 USD)
South Lake Union					
215 9th Ave N	7,405	Multifamily	$5,370,664	Apr-17	$725
120 Terry Ave N	29,185	Multifamily	$21,680,789	Mar-15	$743
Downtown Retail Core					
2000 3rd Ave	19,602	Multifamily	$35,616,815	Dec-18	$1,816
804 8th Ave	7,405	Commercial	$15,125,960	Dec-16	$2,042
Capitol Hill					
1427 11th Ave	15,246	Multifamily	$6,100,505	Aug-14	$400
1812 Broadway	23,087	Commercial	$27,577,591	Dec-18	$1,194

Source: (CoStar Group, Inc., 2018)

Despite the proximity of these sites to the lid study site, the comparability of the sites to the lid is constrained by the following:

1. Limited Recent Transactions: There are only a few vacant land transactions in each neighborhood in recent years that could be referenced for this analysis, limiting our ability to accurately measure the land market.
2. Market-Rate Transactions: The transactions referenced above are market-rate deals that reflect the highest and best use of land; however, potential development on the I-5 Lid would also need to serve City of Seattle, regional, and State of Washington priorities, including affordable housing, provision of community facilities, and open space. This analysis does not review land values of sites with these types of uses.
3. Prepared Sites: Most land prices referenced incorporate off-site improvements (e.g., gutter, sidewalk, electricity, gas, sewer, and water), which could command premiums from land buyers who do not wish to undertake these improvements themselves.

Figure 5-9 shows King County assessed land values of parcels surrounding the lid study area to highlight the spatial distribution of land values across Seattle (King County, 2019). This map illustrates the spatial distribution and relative "value" of property in Seattle (as approximated by assessed values, which tend to differ from market value). Relative assessed values are shown per square foot of lot area for all property types, excluding government and tax-exempt properties, where higher value lots are darker in color. The western and southwestern edges of the study site show a clustering of high land values.

Figure 5-9. Relative Assessed Value per Square Foot by Parcel

Developed by HR&A Advisors using Data from King County Department of Assessments (King County, 2019)

The analysis finds a competitive land market in the neighborhoods surrounding the lid study site, albeit one with limited transaction volume. Commercial and mixed-use neighborhoods like South Lake Union and Capitol Hill could be expected to sell in the range of $700 to $1,200 per square foot or higher, while high-density development near Downtown Seattle could sell in the $1,500 to $2,000 range or higher.

5.3.2 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 5-5 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; 1 percent (low-end range) and 3 percent (high-end range) was assumed for properties within 0 to 500 feet of the lid.

Table 5-5. 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	$2.967 B	1.0 percent	$29.7 M	3.0 percent	$89.0 M
500-1,000 feet	333	$2.674 B	0.5 percent	$13.4 M	1.5 percent	$40.1 M

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

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 percent 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, a 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 5-5 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.

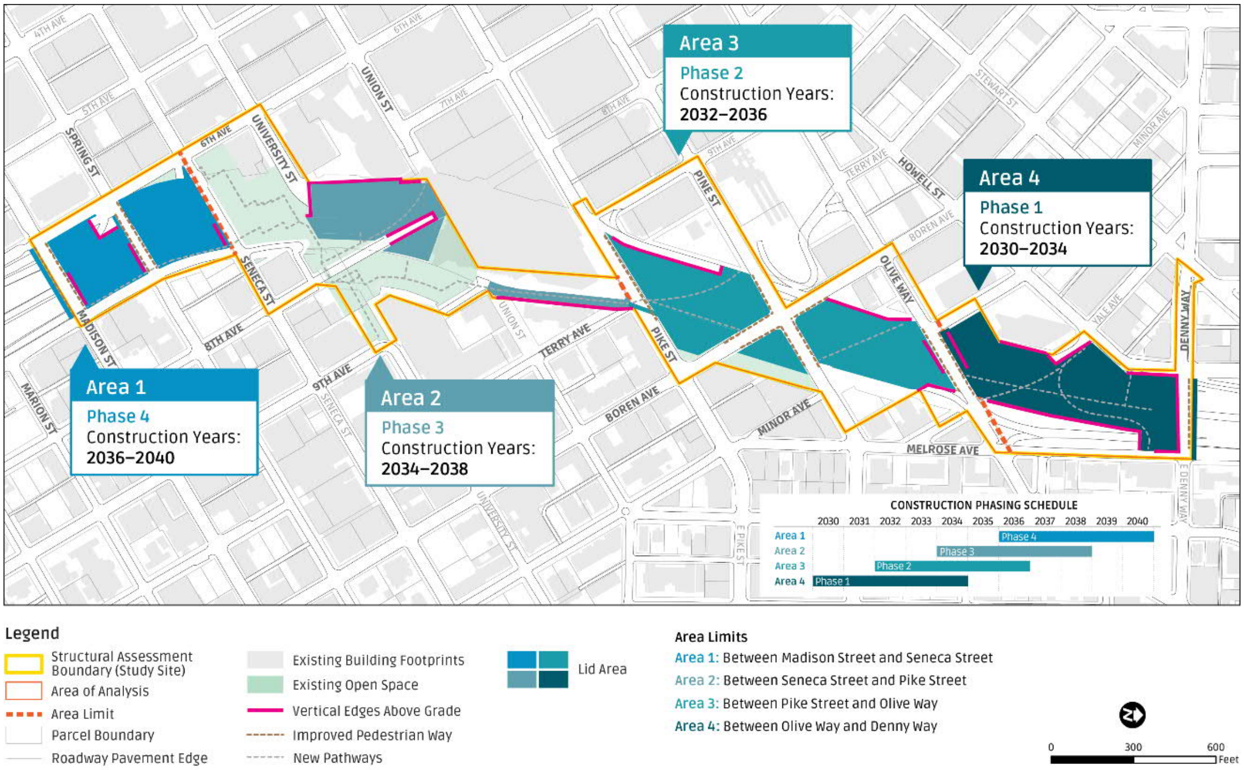
5.3.3 Vertical Development Program & Phasing

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:

- 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 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 5-10), 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.

Figure 5-10. Lid Construction Phasing Assumptions for Test Cases 2 and 3



Vertical development construction phasing assumes the following:

- Vertical development construction would take place 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 development and reduce RLV in present value terms.[21]

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 market scan, Section 3.2 of this memorandum) 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 between 2035 and 2052 (extending to 2055 to account for additional development in Test Case 2 with removal of Olive Way ramps). See

- Table 5-7 for a detailed breakdown of anticipated timing for vertical development.
- In each test case, the first phase of vertical development is assumed to begin in Area 4, leveraging its proximity to South Lake Union and related market momentum for residential and

[21] 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.

office uses. Area 3 would be the next phase of vertical development, benefitting from its proximity to the Washington State Convention Center and Downtown Retail Core. Later phases of vertical development are on Areas 2 and 1, which benefit from adjacency to the Downtown central business district, First Hill, the Central District, and Freeway Park, offering the opportunity to provide greater connectivity between adjacent, established neighborhoods.

Based on technical considerations such as load capacity of the lid, the study considered several building typologies by land use and density (refer to the I-5 LFS Test Case Memorandum). Table 5-6 shows the building square footage by vertical development group based on land use and building types for all test cases other than Test Case 1, which does not include vertical development. Appendix A - I-5 Lid Feasibility Study Vertical Development Phasing shows the full phasing rationale by building (annualized) and cumulative vertical development by development group.

Table 5-6. Supportable Vertical Development Capacity by Use and Building Type (Gross SF)

Test Case 2									
	Total	Residential			Office		Hotel	Retail	Civic
		Low-Rise	Mid-Rise	High-Rise	Mid-Rise	High-Rise			
All Ramps Remain	8,041,090	332,890	297,250	2,303,940	3,244,280	1,232,410	282,540	347,780	N/A
Removal of Olive Way Ramps	10,336,030	304,180	297,250	4,132,800	3,680,230	1,232,410	282,540	406,620	N/A
Test Case 3									
	Total	Residential			Office		Hotel	Retail	Civic
		Low-Rise	Mid-Rise	High-Rise	Mid-Rise	High-Rise			
All Ramps Remain	2,810,940	173,160	448,250		1,199,730	654,720	46,600	147,3400	141,140
Removal of Olive Way Ramps	3,417,130	173,160	1,001,760		1,199,730	654,720	46,600	169,000	172,160

Table 5-7. Vertical Development Construction Phasing Assumptions

Test Case	Vertical Development Construction Start Date	Vertical Development Construction End Date	Stabilization (Stabilized Occupancy)
Test Case 2 All Ramps Remain	2035	2052	2054
Test Case 2 Removal of Olive Way Ramps	2035	2055	2057
Test Case 3 All Ramps Remain	2035	2052	2054
Test Case 3 Removal of Olive Way Ramps	2035	2052	2054

5.3.4 Revenues from Vertical Development

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.[22]

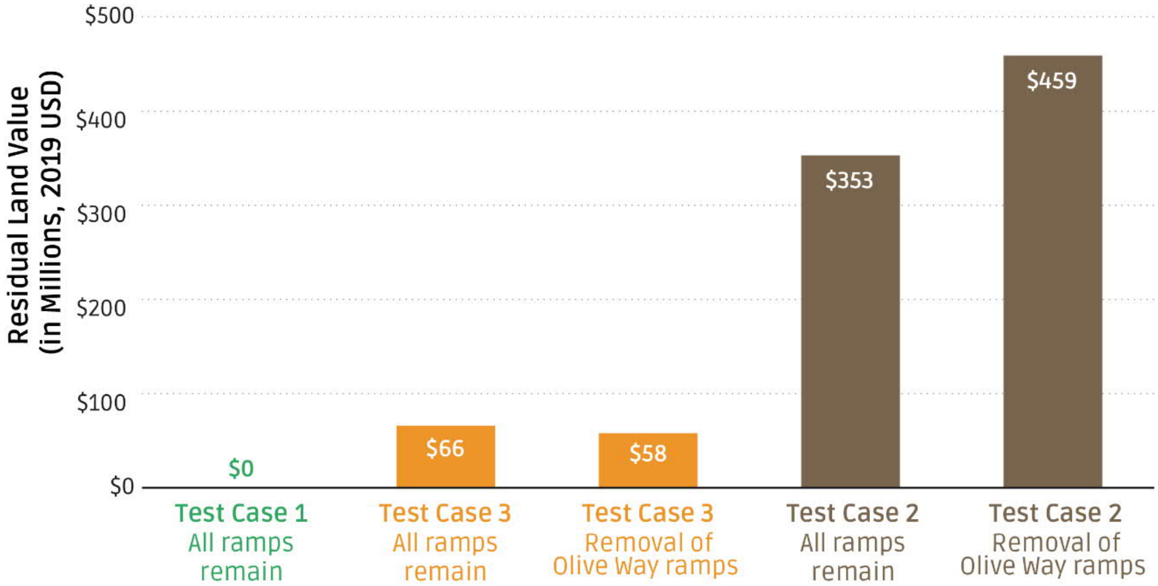
Table 11-1 and Table 11-2 in Appendix B - I-5 Lid Feasibility Study Vertical Development Feasibility Pro Forma show the vertical development revenue and cost assumptions considered for Test Cases 2 and 3, which were generated through the market scan, inputs from local real-estate market experts, and local requirements and regulations (for instance, for required Mandatory Housing Affordability [MHA] payments, parking requirements, and other factors that can be found in Table 4-1). All analysis was performed on a per-square-foot basis to determine RLV, and then applied to the vertical development program for each test case. As noted earlier in this memorandum, analysis assumed that parking would be delivered on and off the lid, with 10 percent of total required parking developed as part of the vertical development and the remaining 90 percent of required parking constructed off-site on land near the lid structure. The land acquisition and construction costs associated with the off-site parking were accounted for within the cost of vertical development.

As shown in Figure 5-11, the development program analyzed for 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 (Table 5-6), 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 more detail, see Table 10-1 in Appendix A - I-5 Lid Feasibility Study Vertical Development Phasing or Table 11-6 in Appendix B - I-5 Lid Feasibility Study Vertical Development Feasibility Pro Forma, which shows the RLV by vertical development group by test case in nominal and 2019 USD.

[22] 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.

Figure 5-11. Total Residual Land Value from Private Vertical Development by Test Case (in Millions, 2019 USD)



For the purpose of this study, RLV is expressed in total (as shown Figure 5-11) and as an annualized revenue stream (as shown in Table 5-8); 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.

Table 5-8. 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	N/A	$19.8 M	$25.5 M	$3.7 M	$3.3 M
Fully Stabilized Year	N/A	2050	2053	2050	2050

Refer to Appendix B - I-5 Lid Feasibility Study Vertical Development Feasibility Pro Forma for details on annualized value of development.

5.4 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. The financial evaluation uses a net-present-value method to express feasibility, estimated in 2019 USD, with 2030[23] 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.

Financial Assumptions

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 the following:

- Funding Sources – The analysis assumes that no funding sources would be available to offset capital costs and that these costs would be financed through debt issuance. It is possible that certain federal, state, or local sources could be available, but no sources were assumed for the purposes of the financial analysis. Section 7, Funding and Financing, examines potential sources of funding further.
- Financing Sources – The baseline financing scenario assumes that 49 percent of lid capital costs would be funded through a Transportation Infrastructure Finance and Innovation Act (TIFIA)-like mechanism (USDOT, 2020b), which typically includes favorable terms such as a below-market interest rate and longer payback duration. The remaining 50 percent balance would be funded by more conventional municipal debt issuance. This assumes that there is debt capacity available to support the identified capital costs and corresponding financing requirements.
- Interest Rates – The 50 percent financed through the TIFIA-like mechanism is assumed to have a 2.5 percent interest rate and 35-year loan repayment. Municipal debt is assumed to have a 4.5 percent interest rate and 30-year loan repayment. An interest rate sensitivity analysis was conducted, the results of which are further described below.

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 memorandum. 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.

[23] Completion of the construction of the first lid subsection 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.

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 allows for a straightforward comparison of the resulting funding gap that would need to be filled to deliver each test case (Table 5-9). 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 memorandum.

Table 5-9. 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	N/A	$353 M	$459 M	$66 M	$58 M
-	Lid Capital Cost	$966 M	$2,298 M	$2,520 M	$1,505 M	$1,698
=	Funding Gap	$(966 M)	$(1,945 M)	$(2,061 M)	$(1,439 M)	$(1,640 M)
	RLV as percentage of total lid capital cost	N/A	15%	18%	4%	3%

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 incremental 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 necessary for a full benefit-cost analysis of the project.

Impact of Parking Requirements on Lid Financial Profile

As described in Section 5.3.4, 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[24] would be provided on the lid with the remaining 90 percent constructed off-site.[25] Table 5-10 shows for Test Cases 2 and 3, the number of required off-site parking spaces (90 percent of total required parking) and the assumed amount of required land within proximity to the lid based on the parking requirements for each test case.

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[24] Parking ratios used in this study were informed by the assumptions provided in the City of Seattle's 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.

[25] For the purpose of the analysis, off-site property to deliver parking facilities is assumed to be available within proximity of the lid.

Table 5-10. Off-Site Parking Spaces and Required Land

Test Case	Off-site Parking Spaces	Off-site Land (Acres)
Test Case 2 - All Ramps Remain	4,000	8.1
Test Case 2 - Removal of Olive Way Ramps	4,900	10.0
Test Case 3 - All Ramps Remain	1,330	2.7
Test Case 3 - Removal of Olive Way Ramps	1,460	2.9

In a theoretical scenario where only 10 percent of parking spaces would be delivered on-site and the balance would not be built at all,[26] 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 off-site 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.

Table 5-11. 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	N/A	$805 M	$1,021 M	$217 M	$223 M
-	Lid Capital Cost	$966 M	$2,298 M	$2,520 M	$1,505 M	$1,698
=	Funding Gap	$(966 M)	$(1,493 M)	$(1,499 M)	$(1,288 M)	$(1,475 M)
	Residual Land Value as percentage of total lid capital cost	N/A	35%	41%	14%	13%

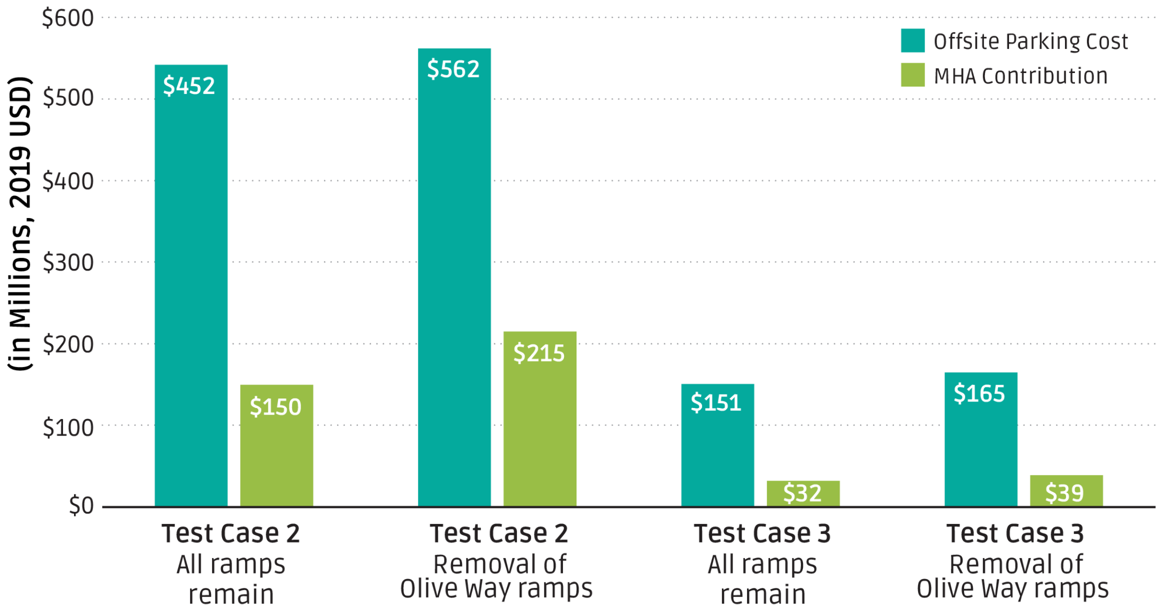
Evaluating the impact of parking requirements as a variable raises important considerations around the potential public value outcomes of the project. Comparing the off-site parking costs to the MHA contribution for affordable housing by test case reveals the cost-of-opportunity to potentially allocate 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 off-site 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 5-12).

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

[26] 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, this scenario could be consistent with potential future market demand.

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.

Figure 5-12. Developer Offsite Parking Cost and Mandatory Housing Affordability Requirement Contributions by Test Case (in Millions, USD 2019)



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 5-12). The upfront capital cost was assumed to be financed through municipal debt. RLV associated with vertical development could be collected through a fee purchase, annualized payments, or other mechanisms, and is the only revenue sources analyzed in this study. The comparison of the annualized revenue stream associated with vertical development against ongoing operating costs and debt-service costs 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 RLV or other revenue would likely be required to be allocated toward the State Motor Vehicle Fund through an air-rights lease, described in the following section, though not reflected in this memorandum. 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 5-12 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 5-12, 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,[27] 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[28] 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 6 of this report. It is assumed that fair-market value would be determined through an appraisal commissioned by WSDOT Real Estate Services.

[27] 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.
[28] 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 5-12. Annual Lid 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. Section 7, "Funding and Financing" 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.

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.

Interest Rate Sensitivity Analysis

Given the possibility that interest rates at the time the project is ready to be financed could differ from current market conditions, an interest rate sensitivity analysis was conducted. The range of rates used was based on research of historical municipal bond interest rates dating back to 2000 (across multiple economic cycles [recessionary and expansionary periods]). Since 2000, long-term municipal rates have declined steadily, with average indices showing a peak of just over 6 percent to as low as 2.5 percent more recently. Based on historical trends, sensitivity to a range of 3 percent to 6 percent for municipal debt issuance and 1.25 percent to 4 percent for TIFIA was tested. Error! Reference source not found.Table 5-13 shows the results in terms of the resulting annual debt service.

Table 5-13. Annual Debt Service Range by Test Case and Interest Rate Scenario (in Millions, USD 2019)

	Test Case 1 All Ramps Remain	Test Case 2 All Ramps Remain	Test Case 3 All Ramps Remain
Low Interest Rate	$42 M	$100 M	$65 M
Baseline Assumptions	$51 M	$121 M	$79 M
High Interest Rate	$61 M	$145 M	$95 M

Annual debt service ranges from as low as $42 million per year in Test Case 1 under the low-interest-rate scenario to as high as $145 million in Test Case 2 (with ramps remaining) using the high end of the interest rate range. Although current market rates are lower, the middle of the range of long-term historical rates was used in the baseline analysis to account for potential variance in future rates. Assuming no funding sources and that 100 percent of lid capital costs would be financed, it is possible that the resulting annual debt service could vary by as much as +/- 20 percent, depending on future municipal debt market conditions.

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. Cost and revenue potential is anticipated to vary by lid area, depending on the uses proposed in each test case.

Table 5-14. 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	$(0.6) M	$1.9 M	$1.9 M	$(0.7) M	$(0.7) M
Area 2	$(1.0) M	$1.7 M	$1.7 M	$0.0 M	$0.0 M
Area 3	$(1.6) M	$6.0 M	$7.6 M	$(1.1) M	$(1.5) M
Area 4	$(1.1) M	$4.3 M	$8.5 M	$0.6 M	$0.4 M
Total*	$(4.2) M	$14.0 M	$19.8 M	$(1.2) M	$(1.4) M

*Totals may not match sum due to rounding.

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 5-15) 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.[29] Based on these assumptions, the development scenarios result in the following affordable housing benefits, summarized in Table 5-16.

Table 5-15. 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 percent of units	$20/SF or 9 percent of units	$33/SF or 11 percent of units
Commercial Use	$8/SF	$12/SF	$15/SF

[29] 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 3-14). 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.

Table 5-16. 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	$150 M	$215 M	$ 32 M	$39 M
SF of Lower-Income Residential Uses	N/A	N/A	240,000 SF	390,000 SF
SF of Middle-Income Residential Uses	N/A	N/A	140,000 SF	230,000 SF

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 5-17). 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[30].

Table 5-17. 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)

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.

Result Summary

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.

[30] 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 5-12.

5.5 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 5-6)
- Ongoing O&M activities of the lid (Table 5-12)
- Real estate development (Table 4-1)
- Ongoing real estate uses on-site (Table 4-1, Table 11-1, Table 11-2, and Table 5-18)

For this analysis, the input-output software IMPLAN was used to translate direct expenditures from the activities described in the previous bullets into direct, indirect, and induced effects on employment, labor income, value added, and total output. These economic terms are defined as follows:

- Direct economic impacts are 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.
- Indirect economic impacts 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 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.
- Employment represents the number of full- and part-time workers supported by the project.
- Labor income represents all forms of employment income, including compensation (wages, benefits, and payroll taxes) firms paid to employees, and income earned by self-employed workers or unincorporated sole proprietorships.
- Value added, which is analogous to gross domestic product (GDP), represents the difference between "output"-(i.e., sales, other operating income, and change in inventory) and the cost of intermediate inputs required to produce that output (i.e., the goods and services purchased from other firms or industries). It includes labor income as well as taxes on production and imports, and other property type income. "Value added," "gross domestic product," and "GDP" are used interchangeably throughout this report.
- Total Output signifies the total value of goods and services produced as a result of the project, or the sum of the value of intermediate inputs (the goods and services purchased from other firms or industries) and the value added. Direct output for the construction period equals the sum of the hard and soft costs of construction, not counting inflation or discounting.

To calculate the economic impacts of spending during the construction period and producer durables throughout the analysis period, the expected increase in industry spending is input into the IMPLAN model. For ongoing impacts resulting from new commercial activity, the expected number of new employees is entered into the model. These estimates are generated using IMPLAN's input-output model, a technique that quantifies the aggregate economic impact of direct spending in a local economy over the analysis period. The project costs and related economic impacts for each test case reflect the differences in parameters of each proposed scenario.

For the purposes of estimating ongoing, on-site employment driven by office, retail, residential, and hospitality uses in Test Cases 2 and 3, various worker generation factors, such as net square feet (NSF) per worker, were applied to the total private land uses planned, as shown in Table 5-18.

Table 5-18. Worker Generation Assumptions

Category	Assumption
Office	188 NSF per worker
Hotel	1,300 NSF per worker
Retail	400 NSF per worker
Residential	50 units per worker

Assumption values were developed by HR&A Advisors, based off of an analysis of square-feet-per-worker data for various sources, including the Metropolitan Washington Council of Governments, Wren Investments, Jones Lang LaSalle, and NAIOP.

For non-residential uses, these worker generation factors were combined with the total space planned to be built and building efficiency factors (the gross-to-net square-feet ratios shown in Table 11-2to arrive at an estimate for on-site employment. For example, if 100,000 total (gross) square feet of office was planned, assuming an 85 percent gross-to-net square-foot ratio for office would imply 85,000 NSF. An assumption of 188 NSF per worker would then yield an estimate of 452 employees. For residential uses, 50 units per worker was assumed.

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 billion 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 5-19. Total Direct, Indirect, and Induced Economic Impacts by Test Case, 2030-2075

	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
Employment	6,400	996,000	1,146,000	418,000	423,000
Labor Income	$0.6 B	$78.5 B	$90.3 B	$33.1 B	$33.4 B
Value Added	$0.9 B	$69.1 B	$79.8 B	$29.0 B	$29.5 B
Output	$1.4 B	$120.0 B	$138.2 B	$50.6 B	$51.3 B

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 (Figure 5-6), 2) real estate development (Table 4-1), and 3) economic activity from ongoing on-site operations (Table 5-17 for expenditure on lid O&M, R&R, and park O&M and Table 4-1, Table 11-1, Table 11-2 and Table 5-13 for workers on site). 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, 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).

Table 5-20 shows average annual employment, which represents the number of full- and part-time workers who would be supported by the project during each phase.

Table 5-20. 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 Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
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)	N/A	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	N/A	25,000	29,000	10,600	10,600

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

Table 5-21 shows average annual labor income, which represents the total value of employee compensation (wages and benefits) supported by the project, as well as proprietor income.

Table 5-21. Average Annual Labor Income 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 Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
Average Annual Direct, Indirect, and Induced Labor Income – Construction Phase					
Derived from Lid Construction (10 years)	$43 M	$101 M	$107 M	$70 M	$78 M
Derived from Real Estate Construction (18 years)	N/A	$81 M	$107 M	$27 M	$33 M
Average Annual Direct, Indirect, and Induced Labor Income – Operating Phase					
Derived from Lid Operating Costs	$3 M	$4 M	$4 M	$3 M	$3 M
Derived from Real Estate Activity	N/A	$1,998 M	$2,295 M	$836 M	$839 M

Value added, which is analogous to GDP, represents the difference between “output” (i.e., sales, other operating income, and change in inventory) and the cost of intermediate inputs required to produce that output (i.e., the goods and services purchased from other firms or industries). It includes labor income as well as taxes on production and imports, and other property type income. Table 5-22 shows total value added by project phase.

Table 5-22. Average Annual Value Added 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 Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
Average Annual Direct, Indirect, and Induced Value Added – Construction Phase					
Derived from Lid Construction (10 years)	$75 M	$179 M	$188 M	$123 M	$138 M
Derived from Real Estate Construction (18 years)	N/A	$117 M	$157 M	$38 M	$48 M
Average Annual Direct, Indirect, and Induced Value Added – Operating Phase					
Derived from Lid Operating Costs	$3 M	$4 M	$4 M	$4 M	$4 M
Derived from Real Estate Activity	N/A	$1,713 M	$1,972 M	$710 M	$715 M

Output signifies the total value of goods and services produced as a result of the project, or the sum of the value of intermediate inputs (the goods and services purchased from other firms or industries) and the value added. Table 5-23 shows total output generated by project activity by phase.

Table 5-23. Average Annual Output Added 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 Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
Average Annual Direct, Indirect, and Induced Output – Construction Phase					
Derived from Lid Construction (10 years)	$125 M	$295 M	$311 M	$203 M	$229 M
Derived from Real Estate Construction (18 years)	N/A	$173 M	$227 M	$58 M	$71 M
Average Annual Direct, Indirect, and Induced Output – Operating Phase					
Derived from Lid Operating Costs	$5 M	$7 M	$7 M	$6 M	$6 M
Derived from Real Estate Activity	N/A	$2,993 M	$3,442 M	$1,245 M	$1,251 M

The projected economic impact benefits of the proposed project scenarios reflect the effects of the spending on the construction of the lid structure over I-5 and related development on the regional economy. In addition to those directly employed in the construction of the lid structure and related development areas and employed by the businesses in the development areas, the earnings of employee households flow through the economy with their purchases of goods and services from other businesses. Thereby, a multiplier effect can be determined as every dollar in direct spending continues to be spent throughout the local economy, such as on restaurants, retail purchases and housing. The analysis enables a side-by-side comparison of the alternative scenarios to determine how the initial investment in construction and development will ripple through the economy to support our local communities.

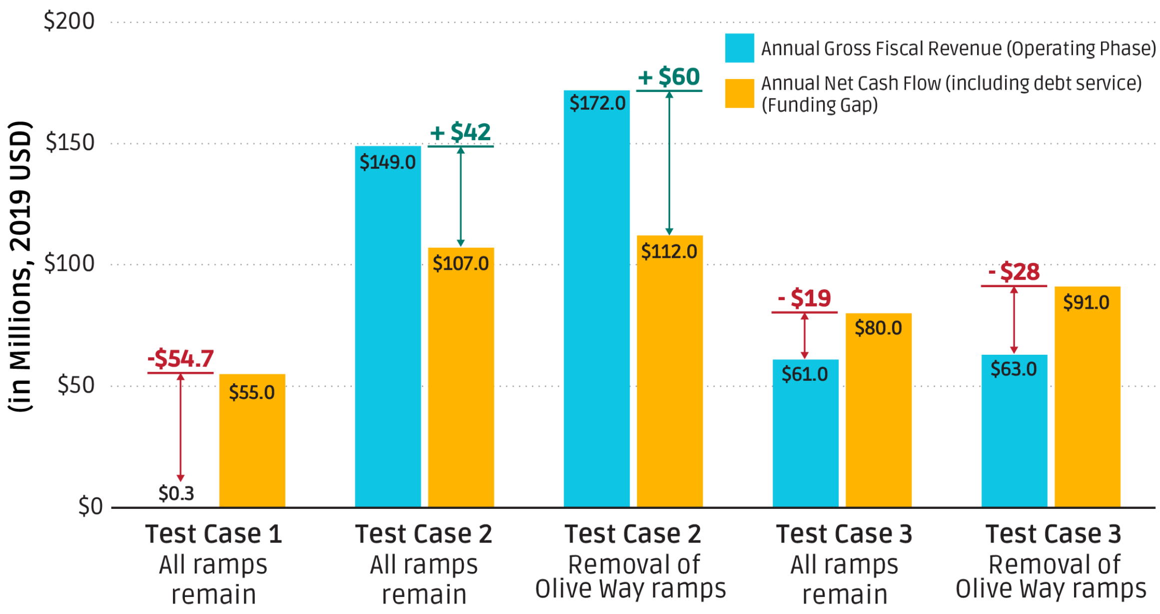
The I-5 lid associated economic activity would also generate positive fiscal impacts in the form of state and local tax revenues from various sources, including property tax, sales and use tax, income tax, and others. These impacts are proportional to economic impacts, with Test Case 2 providing the highest gross impacts (Table 5-28).

Table 5-24. 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 Ramps	Test Case 3 All Ramps Remain	Test Case 3 Removal of Olive Way Ramps
Average Annual Direct, Indirect, and Induced Fiscal Impact – Construction Phase					
Lid Construction (10 years)	$ 4.5 M	$ 11 M	$ 11 M	$ 7 M	$ 8 M
Real Estate Construction (18 years)	N/A	$ 7 M	$ 9 M	$ 2 M	$ 3 M
Average Annual Direct, Indirect, and Induced Fiscal Impact – Operating Phase					
Derived from Lid Operating Costs	$ 0.3 M	$ 0.4 M	$ 0.4 M	$ 0.4 M	$ 0.4 M
Derived from Real Estate Activity	N/A	$ 149 M	$ 172 M	$ 61 M	$ 63 M
Annual Net Cash Flow					
Net Cash Flow Including Debt (Gap)	$ (55) M	$ 42 M	$ 60 M	$ (19) M	$ (28) M

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 5-13). 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 5-13. Annual State and Local Gross Tax Revenue by Test Case and Construction Phase (in Millions, 2019 USD)

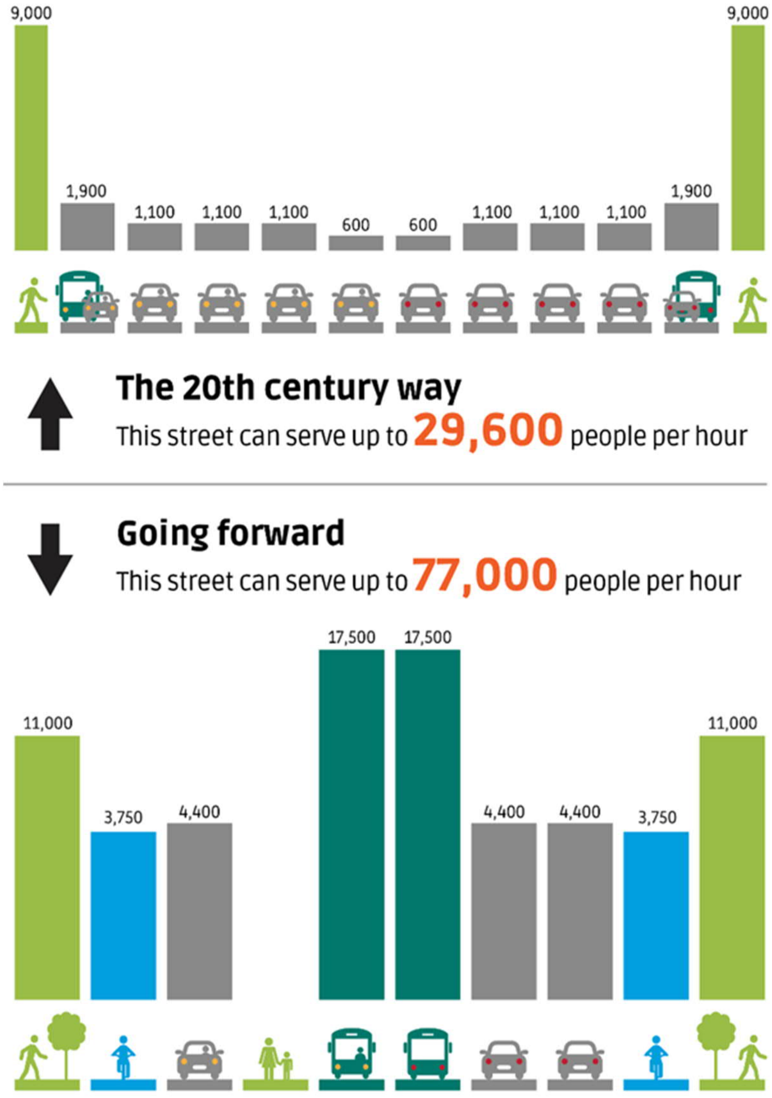


5.6 Societal Benefits

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, including improved overall traffic flow and efficiency through measures such as reconfiguring highway access points, ITS improvements (including improved ramp metering), and prioritizing efficient transit services both below and above the I-5 lid. As shown in Table 5-10, when possible, the transportation sector is moving toward a new paradigm of maximizing the efficiency and flow of person-trips through the 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.

Figure 5-14. Expecting More Out of Existing Right of Way



Source: (WSDOT, 2019)

The method for evaluating societal benefits is often conducted using a benefit-cost analysis (BCA) 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 BCA is to assess whether the expected benefits of a project justify the costs from a social perspective.

A BCA 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. Costs have been covered in Section 5.2, Cost Inputs, with the following section focuses on evaluation of the societal benefits. 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 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,[31] 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.

[31] 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.

- 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 5-15.

Figure 5-15. 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

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.

5.6.1.1 Economic Competitiveness

The following sections detail the process for monetizing factors as presented in Figure 5-15.

The I-5 lid concept could eventually lead to master planning efforts and a defined program of projects that would ultimately contribute to increasing the economic competitiveness of the City of Seattle, Puget Sound Region, Greater Northwest, and communities and businesses throughout the I-5 system currently affected by delays through the Seattle metropolitan region. Improvements in the mobility of people and goods in the study area can be measured and monetized through conventional four-step travel demand modeling. An updated Dynamic Traffic Assignment (DTA) model is available for the Seattle region, most recently restructured to evaluate entry and exist points along I-5, specifically through downtown Seattle. The DTA model accounts for regional socioeconomic trends that have experienced rapid growth in both population and employment. To further complicate regional modeling, three recently passed revenue packages—at the city level (MOVE Seattle), regional level (Sound Transit 3), and state level (Connecting Washington)—are creating multimodal connections and facility improvements that are leading to changes in travel behavior and community patterns. Modeling the potential impacts of the existing and future investments in the underlying no-build scenario, in which no improvements attributed to the capital costs for the lid are assumed and I-5 is maintained and rehabilitated to federal and state guidelines, will be a critical component in correctly monetizing the incremental benefits from the build scenarios. WSDOT has not completed a detailed technical evaluation of the primary I-5 assets through downtown Seattle, and the corresponding investment requirements over the next 20-30 years for the accurate evaluation of a no-build scenario. For purposes of economic competitiveness in the I-5 Lid study, comparative evaluation was limited to the various I-5 Lid development alternatives.

The quantitative variables likely to be included in an eventual BCA would be established largely through evaluating travel time savings, transportation mode shift, and VMT, quantified through travel demand modeling that would leverage existing regional evaluation tools, including the Puget Sound Regional Council 4k trip-based model. The potential closure or reconfiguration of I-5 ramps in downtown Seattle related to constructing a lid structure could reduce lane weaving on I-5, and improve travel movements through Seattle, which would generate travel time savings for thousands of drivers, passengers, and freight vehicles per day, specifically through trips. However, some of the benefits from improved traffic flow for through trips may be slightly mitigated by increased travel time and VMT for previous ramp users who will need to modify their trip routes to reach their destinations.

In addition, any improvements to existing I-5 overpasses through the project area—including active transportation improvements, transit prioritization, or lane configuration—could affect travel behavior, mode choice, and travel time for trips in Seattle. Depending on the extent of development on the lid, there will be various levels of work and recreational trips generated from the lid improvements that may also need to be evaluated within the context of local and regional travel patterns.

Other improvements such as ramp metering, increased lane width, cordon pricing in Seattle, or congestion pricing on I-5 would offset impacts as well on travel time and person miles travelled.

Reduced Vehicle O&M Costs and Fuel Costs

Vehicle operating cost savings includes the cost of fuel, as well as maintenance and repair, replacement of tires, and the depreciation of the vehicle over time. Consumption rates per VMT are used to calculate the vehicle operating cost savings. Estimates of VMT and unit costs for each component of vehicle operating cost are applied to the consumption rates to calculate the total vehicle operating cost. Table 5-25 presents the assumptions used in estimating vehicle operating costs. Values will also include additional out-of-pocket operating costs such as user fees and parking fees once improvements have been defined.

Fuel efficiency values are derived from the U.S. Energy Information Administration (EIA), which provides estimates for fuel efficiency through 2050. The values used to calculate fuel efficiency can be found in the table published by EIA titled “Transportation Sector Key Indicators and Delivered Energy Consumption.” (EIA, 2018)). The following fuel efficiency values were used for the different vehicle classes:

- “Light Duty Stock” energy efficiency (mpg) for passenger vehicles
- “Freight truck” energy efficiency (mpg) for trucks

Table 5-25. Operating Cost Savings Assumptions and Sources

Variable	Unit	Value	Source
Auto Maintenance, Repair & Tires	2018$ / VMT	$0.086	AAA "Your Driving Costs" 2018
Auto Depreciation	2018$ / VMT	$0.239	AAA "Your Driving Costs" 2018
Truck Maintenance & Repair	2018$ / VMT	$0.17	ATRI 2018 Update
Truck Tires	2018$ / VMT	$0.04	ATRI 2018 Update
Truck Depreciation	2018$ / VMT	$0.23	AAA "Your Driving Costs" 2018
Gasoline Costs	2017$ / gal, incl. taxes	range from $2.53 (2019) to $3.67 (2050)	US EIA, "Annual Energy Outlook 2018," Table 12
Diesel Costs	2017$ / gal, incl. taxes	range from $2.78 (2019) to $4.09 (2050)	US EIA, "Annual Energy Outlook 2019," Table 12
Fuel Growth post-2050	% Growth	1.2% for gasoline; 1.3% for diesel	Calculated based on CAGR from EIA forecast
Federal Fuel Taxes	2019$	$0.184 for gasoline; $0.244 for diesel	API, "State Motor Fuel Taxes by State", January 2019
State of Washington Fuel Taxes	2019$	$0.494 for gasoline; $0.494 for diesel	API, "State Motor Fuel Taxes by State", January 2019
Auto Fuel Efficiency	Miles per Gallon	range from 23.67 (2019) to 38.18 (2050)	US EIA, "Annual Energy Outlook 2019," Table 7
Truck Fuel Efficiency	Miles per Gallon	range from 7.34 (2019) to 10.45 (2050)	US EIA, "Annual Energy Outlook 2019," Table 7
Fuel Efficiency Growth post-2050	% Growth	1.6% for gasoline; 1.2% for diesel	Calculated based on CAGR from EIA forecast
Auto Fuel Efficiency Adjustment Factor	Factor	range from 1.00 (55 MPH) to 3.70 (5 MPH)	US EIA 2013
Truck Fuel Efficiency Adjustment Factor	Factor	range from 1.00 (55 MPH) to 2.57 (5 MPH)	US EIA 2013

Connectivity and Travel Time Savings

Travel time savings include in-vehicle travel time savings for auto drivers and passengers, transit riders, as well as truck drivers. Travel time is considered a cost to users, and its value depends on the inconvenience that travelers attribute to time spent traveling. A reduction in travel time translates into more time available for work, leisure, or other activities.

The I-5 improvements, to be identified through a future master planning effort, would likely provide a greater degree of connectivity across I-5 by linking critical residential neighborhoods with employment centers, as well as improvements in travel time along the I-5 system. Improvements would be partially prioritized through their ability to alleviate peak-hour congestion along I-5 and on adjacent arterials, thus reducing travel time and allowing higher travel speeds for commuters, freight traffic, and recreational users throughout the region.

Table 5-26 presents assumptions similar to what will be used in the estimation of travel time savings benefits.

Table 5-26. Travel Time Savings Assumptions and Sources

Variable	Unit	Value	Source
Value of Travel Time Savings - Personal, Local	2018$ per person hour	$15.20	US DOT Guidance, January 2020
Value of Travel Time Savings - Business, Local	2018$ per person hour	$27.10	US DOT Guidance, January 2020
Value of Travel Time Savings - All Purposes, Local	2018$ per person hour	$16.60	US DOT Guidance, January 2020
Value of Travel Time Savings - Personal, Intercity	2018$ per person hour	$21.30	US DOT Guidance, January 2020
Value of Travel Time Savings – Truck Drivers	2018$ per person hour	$29.50	US DOT Guidance, January 2020
Value of Travel Time Savings – Bus Drivers	2018$ per person hour	$31.00	US DOT Guidance, January 2020
Average Vehicle Occupancy Rate, Passenger Vehicle	Persons per vehicle	1.67	US DOT Guidance, January 2020
Average Vehicle Occupancy Rate, Truck	Persons per vehicle	1	US DOT Guidance, January 2020

Real Estate Creation and Increased Valuation of Existing Property

The anticipated creation of real estate on the lid and value creation to adjacent land is covered in the financial benefits by considering pro formas for the three test case scenarios and adjacent property value impacts, respectively. The benefits are the result of potential creation of new useable space across the I-5 highway in downtown Seattle, thus connecting neighborhoods and potentially providing a destination for the region as a recreational facility, civic attraction, or urban park space. While the exact use of a potential lid structure has yet to be determined, certain anticipated real estate benefits would occur with any resulting improvement.

Real estate creation is likely to be the primary benefit attributed to property valuation. Measured as a one-off benefit at the time of construction completion in the BCA, the lid structure would offer highly valued land above a freeway where no land exists today. Projected real-estate market rates would be used as the basis for the valuation in the year the project(s) is(are) anticipated to be complete. While increases in property values for existing property as the result of a transportation improvement are largely considered to be a transfer payment with no net increase in societal economic benefits, the creation of land should be considered as a new economic opportunity that increases the overall societal economic outcome.

Any lid project across I-5 would have the added benefit of reducing noise and emissions for properties currently adjacent to I-5. It is anticipated that any private market-rate residential or commercial properties would benefit from increased property values. However, some of these benefits would already be monetized by quantifying benefits attributed to noise and emissions, while, as mentioned above, within the context of new lid space, changes to the value of existing properties would likely not result in overall net societal improvements. As such, increased property value for existing properties would be evaluated from a qualitative standpoint in the BCA.

5.6.1.2 Effects on Safety

Safety benefits are expected to be achieved in regard to both infrastructure improvements that would reduce the number of collisions on I-5 and urban connections to I-5, and improved accessibility to people residing along the current WSDOT I-5 right-of-way.

Reduced Incidents

An eventual master planning effort would identify capital projects that the BCA could assume would reduce collisions compared to the “no build” scenario. Projects that include ramp metering, investments in pedestrian and bicycle safety, and adjustments to surface street configurations could all result in substantial crash reductions. Recent crash statistics going back 10 years for WSDOT, Seattle, and various other municipalities along the study area would need to be evaluated to determine both the severity and likelihood of future collisions with the highlighted improvements. Based on currently available data, there are typically high numbers of both fatalities and severe injury incidents along the I-5 system, specifically around entry/exit points where there are increased occurrences of weaving between lanes and slow and stopped vehicle conditions.

The cost savings that arise from reducing the number of incidents include direct savings (e.g., reduced personal medical expenses, lost wages, and lower individual insurance premiums), as well as significant avoided costs to society (e.g., second-party medical and litigation fees, emergency response costs, incident congestion costs, and litigation costs). The value of all such benefits—direct and societal—could also be approximated by the cost of service disruptions to other travelers, emergency response costs to the region, medical costs, litigation costs, vehicle damages, and economic productivity loss due to workers’ inactivity.

Monetized values for fatalities and incidents categorized on the AIS scale are reported in the U.S. DOT’s guidance for “Treatment of the Economic Value of a Statistical Life” (USDOT, 2020), which includes low and high ranges of 20 percent lower and higher, respectively, used in sensitivity analysis. The National Highway Traffic and Safety Administration reported values pertaining to only property damage incidents were provided in 2018 dollars (USDOT, 2020). One year of escalation was applied to derive 2018 dollars. Table 5-27 lists the values used in the sensitivity analysis for each incident type:

Table 5-27. Monetized Incident Values

Incident Type	Unit Value (2018 $)
Fatality	$9,600,000
AIS 5	$5,692,800
AIS 4	$2,553,600
AIS 3	$1,008,000
AIS 2	$451,200
AIS 1	$28,800
Property Damage Only	$4,400

Source: (USDOT, 2020)

5.6.1.3 Sustainability and Resiliency

Eventual master planning processes would likely include recommendations that would create environmental sustainability and resiliency benefits. Benefits would potentially include reduced air pollution associated with decreased automobile and commercial truck travel, through improved connectivity and travel both on I-5 as well as through connectivity on surface streets. Resiliency benefits would potentially result from seismic improvements to assets along the I-5 system, specifically 70 identified assets through downtown Seattle, and improved drainage and water management, which would also contribute to state of good repair and reduced roadway damage.

Reduced Emissions

The benefits of reducing air pollution include decreases in health complications, disturbances to the natural environment, and avoided property damages. Five forms of emissions would be identified, measured, and monetized: nitrous oxide, particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide, volatile organic compounds, and carbon dioxide.

Primarily related to reduced direct exposure to residents and workers in buildings within a certain radius of I-5, but also associated with decreases in VMT, the reduced emissions would benefit persons who do not directly use the road facility. Reduced gasoline and diesel consumption due to less miles traveled would result in fewer emissions—including sulfur dioxide and fine particulate matter ($PM_{2.5}$)—being released into the local environment.

Upon confirming the reduction of VMT and the area around I-5 where residents and workers would benefit from highway lidding or other emissions mitigation measures, the unit value assumptions provided in Table 5-28 provide an example of the current values that would be applied to monetize the reduced emissions.

Table 5-28. Environmental Sustainability Benefits Assumptions and Sources

Variable	Unit	Value	Source
Cost of Carbon Dioxide emissions	2018$ per metric ton	$1 through 2035, $2 thereafter	US DOT Guidance, January 2020 (converted from short tons)
Cost of Nitrogen Oxide emissions	2018$ per metric ton	$8,600	US DOT Guidance, January 2020 (converted from short tons)
Cost of $PM_{2.5}$ Emissions	2018$ per metric ton	$387,300	US DOT Guidance, January 2020 (converted from short tons)
Cost of Sulfur Dioxide Emissions	2018$ per metric ton	$50,100	US DOT Guidance, January 2020 (converted from short tons)
Cost of Volatile Organic Compounds Emissions	2018$ per metric ton	$2,100	US DOT Guidance, January 2020 (converted from short tons)
Emissions per Vehicle Miles Traveled	Metric tons of emissions per VMT	Varies by year, fuel type, and emission type	California Air Resources Board EMFAC Database, 2017; Cal B/C, 2010; EPA MOVES, 2014
Emissions Speed Adjustment Factors	Factor	Varies by year, fuel type, emission type, and speed	California Air Resources Board EMFAC Database, 2014

Drainage

The opportunity to improve, enhance, or replace existing drainage along I-5 could provide additional overall project benefits, both qualitative and potentially quantitative. Drainage and water treatment would be a key consideration in any project improvement evaluated in the master planning process with both initial capital costs and ongoing maintenance costs a part of overall project costs.

Benefits from drainage improvements would range from reduced potential for untreated water contaminants as a result of improvements in water collection and downstream treatment; reduced future costs due to potential reduction in flood-related interruptions and road closures; and reduced injuries and incidents on roadways evaluated as part of the study. The risk of future flooding- or drainage-related delays on the roadways would be evaluated using historical data, which would include the evaluation of the cost of flooding conducted by WSDOT as part of their 2008 report on storm-related closures of I-5 and consideration of future flooding risk as evaluated by King County Water and Land Services, and Seattle Public Utilities.

Seismic Upgrades

One of the primary potential benefits associated with capital improvements along the I-5 system would seismic reinforcement and mitigation that would allow the facility to withstand an earthquake of 9.0 in magnitude. The 60 assets along the I-5 study area would potentially need to be evaluated to ensure compliance with current seismic mitigation guidelines.

Complete asset failure can be evaluated through the substantial disbenefits related to travel time, VMT, emissions, and safety. The BCA methodology would consider an evaluation procedure (Baker & Miller, 2000) that was developed to consider a major earthquake with defined probability and compares the travel-related and damage-avoidance benefits that would be generated by retrofit improvements with their associated implementation costs. Emphasis is placed on travel impacts because other, non-transportation economic impacts are impossible to quantify without being able to predict all of the impacts to the built environment associated with a major seismic event. (Baker & Miller, 2000)

These avoided disbenefits—along with the cost of full asset replacement in the event of a major earthquake—could be incorporated into the BCA model using a probability factor based on historical seismic data and an additional factor for more common lower magnitude seismic events. Depending on the confidence level of the predictive accuracy on seismic events and the types of capital investments being considered, seismic benefits may also be evaluated as a qualitative measure.

5.6.1.4 State of Good Repair

An eventual state-of-good-repair condition benefits analysis would include maintenance and repair savings, deferral of replacement cost savings, and reduced VMT, which would lead to less road and facility damage and the use of designs and technologies to increase resilience performance during natural hazard events and long-term use.

As the traffic volumes in the I-5 system are projected to continue to increase, the reduced VMT would result in a decline in damage to both I-5 and local infrastructure affected by traffic congestion and constraints due to connectivity. The prevented damage to local road infrastructure are calculated on a per-VMT basis and applied to modeled reductions by class of vehicle (heavy truck, passenger vehicle) to estimate the overall quantitative benefits. Table 5-29 contains the unit values proposed for evaluating the reduced cost of maintenance from reduced vehicle use. An urban and rural split of 94 percent and 6 percent, respectively, is typically applied to create a weighted average of the FHWA values for those environments.

Table 5-29. State-of-Good-Repair Values, Auto and Truck, 94-6 Urban-Rural Split (2018 $)

	Pavement Damage Cost per VMT Likely
Auto	$0.0017
Truck	$0.1477

Source: (FHWA, 2000)

5.6.1.5 Quality of Life

Quality-of-life benefits can result from projects identified and prioritized through the eventual master planning process that could provide increased accessibility and mobility to existing and future users of the I-5 system. Key benefits are derived from a mode shift to more active transportation methods as a result of safe and direct access to improved facilities, direct access to outdoor recreational and park spaces, and reduced noise levels.

Health Benefits

Health benefits apply to new bicyclists who would otherwise not be able to use a facility under existing conditions. These bicyclists realize benefits by increased daily physical activity, which has been shown to improve the health of users and reduce future medical costs. For the I-5 lid, any consideration of improved active transportation or trail facilities across I-5 or along I-5 could be evaluated and eventually monetized as potential quantifiable benefits during the master planning process. Similarly, if active transportation facilities along I-5 are included as priority investments as part of future studies, they could be monetized and considered in an eventual BCA as part of the master planning process. Smaller capital investments or improvements to existing assets that do not result in significant increases in bicycling or mode shift to bicycling will be considered as qualitative benefits.

The National Cooperative Highway Research Program (NCHRP) Report 552: Guidelines for Analysis of Investments in Bicycle Facilities (NCHRP, 2006) (NCHRP Report 552 Guidelines) identified 10 studies that estimated the overall health benefit of increased physical activity. These benefits ranged from $19 to $1,175 per new bicyclist per year, with a median value of $128 (all values in 2006 $), with detailed review available in Appendix E of that document. These values were adjusted to 2018 dollars with resulting values of $23.65, $159.30, and $1,462.35 for low, likely, and high values of health benefits, respectively. The NCHRP Report 552 Guidelines state that this benefit is ascribed per daily new user; because bicyclist volumes represent one-way trips, the volume is divided by two to estimate the number of total users. This is slightly conservative because not all bicyclists use the same route for the return trip. The benefit is thus defined:

$$Health\ Benefit = \frac{b_n}{2} \cdot H$$

Where:

b_n = volume of daily new bicyclists, divided by two to convert to trips
H = distribution of value of per-capita health benefit, 2018$

Similar levels of health benefits have also been studied for pedestrians and they would be considered with any increase in pedestrian movements across the I-5 facility as a result of proposed investments defined through a master planning process, including trip generation from any investments on a proposed lid facility.

Commuter Mobility Benefits

Commuters experience a benefit because research has shown that bicyclists and pedestrians prefer using certain facilities over others, with dedicated bicycle infrastructure showing the greatest monetized value of benefit. Similar to the health benefits evaluated in the previous section, any improved bicycle or pedestrian facilities across or along I-5 could be evaluated for their potential quantifiable benefits to increase commuter trips by walking or bicycling. If bicycle or pedestrian facilities along I-5 are included as priority investments as part of the master planning process, they would be monetized and considered in the BCA. Smaller capital investments or improvements to existing assets that would not result in significant increases in bicycle or pedestrian commute travel or mode shift to bicycle or pedestrian travel would be considered as qualitative benefits.

Mobility Benefits - Bicyclists

NCHRP Report 552 Guidelines reviewed available research and found that bicycle commuters are willing to spend 20.38 extra minutes per trip (NCHRP, 2006) to travel on- an off-street bicycle trails for a higher level of safety, more pleasant and lower stress experience, and lack of auto impacts such as road spray and exhaust fumes. These benefits can be directly applied to new commute trip bicyclists according to the following formula (modified from NCHRP Report 552):

$$Commute\ Mobility_{bicylcists} = \frac{20.38}{60} \cdot b_{n,c} \cdot \bar{W} \cdot 5 \cdot VOT$$

Where:

$20.38/60$ = additional value of off-road bike facility in minutes, converted to hours
$b_{n,c}$ = volume of daily new commute bicyclists
$\bar{W}$ = weighted average of workweeks per year
5 = number of work days per week
VOT = distribution of value of time, 2016$ / hr

NCHRP Report 552 Guidelines assumed 50 commute weeks per year. The value of time applied for this benefit is the same as that previously documented and used for travel time savings for local travel across all trip purposes.

Mobility Benefits - Pedestrians

Although previous applications of mobility benefits in the United States have typically applied only to bicyclists, research in Europe has valued commuter benefits from improved facilities for pedestrians as well. The UK Department for Transport Guidance on the Appraisal of Walking and Cycling Schemes ((UK DfT, 2012)) has monetized benefits for pedestrians. Accordingly, improvements in the commute experience for pedestrians can also be monetized. The Department for Transport study identified valuation for several aspects of the commuter experience. Table 5-30 includes only those aspects that would be improved by this project, using an average 2010 exchange rate of 1 GBP = 1.545 USD (Oanda, 2019).

Table 5-30. Monetized Value of Aspects of the Pedestrian Environment

Category	Value, 2010 pence/km	Value, 2018 $/mi
Street Lighting	3.8	0.12
Reduced Crowding	1.9	0.06

Pavement Evenness	0.9	0.02
Total	6.6	0.20

Source: (UK DfT, 2012)

The resulting commuter mobility benefit for pedestrians is computed as follows:

$$Commute\ Mobility_{pedestrians} = p_c \cdot \bar{L} \cdot \bar{W} \cdot 5 \cdot V$$

Where:

p_c = volume of daily commute pedestrians
$\bar{L}$ = weighted average of trip length on trail, miles
$\bar{W}$ = weighted average of workweeks per year
5 = number of work days per week
V = distribution of value of benefit, 2014$ / mile

It should be noted that the pedestrian commuter mobility benefit applies to all commuter pedestrians who use the facility or inhabit the facility, as could be the case with future lid concepts. The facility would bring connectivity benefits, reduced noise and GHG emissions (monetized separately), reduced crowding, and smooth pavement and access to all pedestrians.

Recreation Bicycle Benefits

The NCHRP Report 552 Guidelines also identified benefits for recreational users of bicycle facilities. These benefits result from the time spent performing recreational activity, because this represents a revealed preference in how recreational bicyclists choose to spend their time. As opposed to recreational pedestrian trips, recreational bicycle trips may be more apparent and quantifiable with the inclusion of new bicycle facilities, specifically protected or separated facilities.

Use time is assumed to be one hour per bicyclist including preparation and clean-up time ((NCHRP, 2006). The value of time for this benefit is assumed to be lower than the value of time used for commuters or the population at large. The NCHRP Report 552 Guidelines indicate a value of $10 per hour in 2006 dollars, which becomes $12.46 per hour in 2018 dollars. The benefit is computed as follows:

$$Recreation\ Benefit = \frac{b_{n,r}}{2} \cdot 365 \cdot VOT_r$$

Where:

$b_{n,r}$ = volume of daily new recreational bicyclists, divided by two to convert to trips
365 = number of recreation days per year, per NCHRP Report 552
VOT_r = distribution of recreational value of time, 2016$ / hr

The recreational benefit would likely be calculated and quantified only for bicycle trips because the recreational value of these improvements for pedestrians could be difficult to quantify. In addition, depending on the type of improvement, it could shift recreational trips from other routes, rather than create specific benefits from increased recreational trips associated with the investment. However, based on the type of investment being evaluated in the master planning process developed through Partnering for the Future of I-5, there could be an interest in quantifying recreational pedestrian trips if there is adequate supporting data. Alternatively, pedestrian recreational benefits would be considered as qualitative benefit.

Reduced Noise

Reducing VMT or creating noise barriers creates environmental benefits in the form of noise reduction. On a per-VMT basis, these unit values can be estimated based on an FHWA cost allocation study report. ((FHWA, 2000)) For purposes of an eventual master planning study, two distinct noise reduction benefits could be attributed to the lid project. Strategies that could involve (1) a traditional evaluation of reduced VMT multiplied by the noise factors based on type of vehicles projected to use I-5 with fewer entry/exist point impacts and surface street improvements, and (2) analysis of direct reduction in noise through potential investments in a lid structure over I-5. Depending on how much the lid structure covers the highway and its proximity to residential and commercial buildings, the impact from noise mitigation could vary significantly, depending on the recommended design approach.

When calculating the impact of truck noise, a 60 kip 4-axle single-unit trucks would be assumed as a proxy for the average type of heavy vehicle travelling on the I-5 system. Further refinement would be considered with any additional traffic analysis by vehicle class.

An urban and rural split of 94 percent and 6 percent, respectively, is typically applied to create a weighted average of the FHWA values for those environments. All values would be adjusted from the study's 2000 values to 2018 dollars using a CPI adjustment (BLS, 2019); see Table 5-31 for the standard values that would be applied in 2018 dollars.

Table 5-31. Noise Costs, Auto and Truck, 94-6 Urban-Rural Split (2018 $)

	Noise Costs per VMT Likely
Auto	$0.0012
Truck	$0.0317

Source: (FHWA, 2000)

5.7 Key Financial and Economic Feasibility Takeaways

- The study estimated a capital cost range for the lid structure of $855 million to $2,863 million,[32] 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).
- 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 expressed by capital costs (i.e., the combination of both hard and soft costs for the lid project).
- 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 bookend—and $2,298 million[33] for Test Case 2 (Maximum Private Investment)–the high-end test-case analysis bookend.
- 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.

[32] 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.

[33] 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.

- 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.
  - Ramps 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 benefits 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 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 development.
  - 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 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.[34]
- 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 over its the 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.

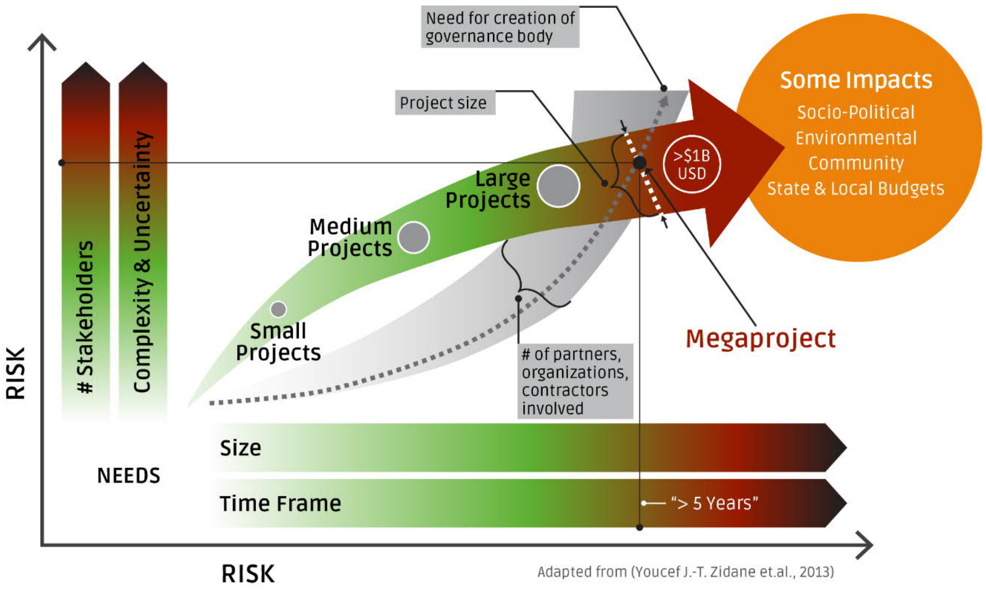
[34] In comparison, the Waterfront Seattle project is anticipated to result in ongoing economic impact of $288 million with 2,385 permanent jobs (HR&A Advisors, 2019) and the Terminal 5 improvements by the Port of Seattle will lead to an estimated $2 billion in direct business output and 6,000 jobs (Northwest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

6. 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. The underlying assumption is that a lid over I-5 would create "land" with development potential over WSDOT right-of-way (WSDOT, 2020a).. From a regulatory perspective, RLV associated with vertical development could be converted into a long-term (for example, 99 years) annual air-rights payment. Test Case 1 is assumed to be a fully public governance model whereas Test Cases 2 and 3 are explorations that assume delivering a lid project through a public-private partnership between a master developer working closely with WSDOT and the City of Seattle, under an air-rights lease agreement. This chapter contemplates governance models and project delivery methods for the "land" generated by lidding I-5 in the three test cases described in the study.

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 6-1)[35,36] (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.

Figure 6-1. Project Size Characteristics and Relative Considerations



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

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35 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.

36 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 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 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.

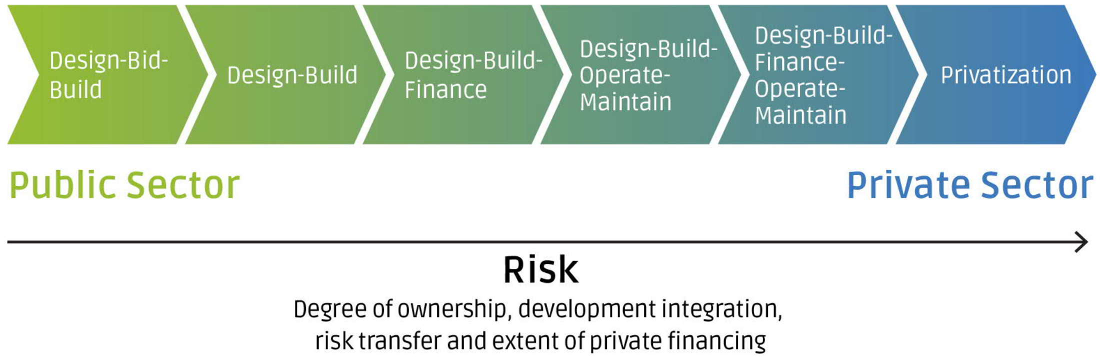
Before any definition is made about the project-delivery mechanism or governance structure for successful project implementation, a master planning and visioning exercise that reflects the role of the community, and clear policy goals, should be established first.[37] Test cases explored in this feasibility study were created only as frameworks to understand the implication of development models but were not proposed as desired development programs.

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.

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 to 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, 2020b). Alternative project delivery methods—shown in the gradient colors between "Design-Bid-Build" and "Privatization" in Figure 6-2—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 the value of the asset created.

[37] 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 6-2. Spectrum of Project Delivery Options



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 6-1 illustrates the governance models considered in this study.

Table 6-1. 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 though 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)

6.1 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 6-2). 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 6-2 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 6-2. 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

6.2 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.

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

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).

6.3 Challenges and Opportunities for Test Cases Considered

6.3.1 Publicly Managed Public Spaces

Under a publicly managed public space governance model of a lid, the owner (WSDOT) could retain all ownership, including responsibilities or shared responsibilities with another public entity for operation and maintenance of public spaces. There would be limited private-sector interest in the land made available by the lid because that land would be used for parkland and greenspace. This scenario relies heavily on the municipal and state economic and fiscal environment since all funding and financing would be derived from those sources or federal sources. As a result, the phasing for the project would be more complex because it would require programming funds from public sources and that would lead to a progressive implementation.

Given the region's stakeholders' experience in managing public spaces, particularly on or adjacent to freeway development, there is ample legal and regulatory ability as well as institutional readiness to use this governance model. For instance, the WSCC is a civic entity, and under the governance structure, they own, operate, and maintain the portion of the lid where the facility would encroach. The convention center has an air-rights agreement with WSDOT. An exception is the Mercer Island Aubrey Davis Park, which was constructed as mitigation for the I-90 freeway.

This governance model allocates roles and responsibilities among recognized public entities, and therefore is a model that faces the least resistance from stakeholders. The I-5 lid project would then likely be procured using a traditional project delivery method, such as design-bid-build. In this project delivery method, the sponsoring agency takes on most risks (except construction itself), utilizes public financing, selects a contractor to perform the work based on the lowest price, and assumes all operation and maintenance responsibilities and costs.

Nationally, many parks constructed over freeways are owned by the municipality, which also has responsibility for operations and maintenance. A museum is at the Margaret T. Hance Park in Phoenix. The park is owned by the city and is a good example of not only publicly managed space, but also programming for a park.

Margaret T. Hance Park - Arizona

The 32-acre Margaret T. Hance "Deck Park" is just north of downtown Phoenix above a one-half mile stretch of US Interstate Highway 10. The park was completed in 1992 and serves as a unique intersection between a number of neighborhoods including Roosevelt, Broadway, Evans Churchill, and Downtown Phoenix. The park is also bordered by a number of cultural institutions and residential units, both multi- and single-family. Hance Park is also uniquely bisected by North Central Avenue, a north-south arterial roadway that acts as a major man-made boundary dividing the east end of the park from the west end.

Consisting primarily of open landscaped areas, Hance Park has a number of on-site and adjacent cultural institutions, including the Burton Barr Central Library, Arizona Humanities, Japanese Friendship Garden, Irish Cultural Center, Arizona Jewish Historical Society, and the Phoenix Center for the Arts. In addition, Hance Park has on-site amenities like drinking fountains, grills, reservable ramadas, playground, dog park, restrooms, walking path, and a lighted sand volleyball court. The location of Hance Park and its cultural landmarks help define it as midpoint, bridging the Midtown Arts District to the north and Downtown Phoenix to the south. The park's location along the newly developed light rail system also makes it more easily accessible to thousands.

Although Hance Park was completed in 1992, the full vision for the park has yet to be realized and the park was viewed as an underutilized asset. In 2010, the Hance Park Conservancy, a non-profit entity, was formed to promote and advocate for the park. The conservancy is responsible for programming at the park and raises non-public funds for special events and activities. In 2011, the Hance Park Master Plan Steering Committee was formed and appointed by the Phoenix Parks and Recreation Department. This committee was tasked with recommending a new master plan for the continued development of Hance Park. In 2016, the steering committee and conservancy completed a new master plan and conceptual drawings for Hance Park. As a result of the master plan, Hance Park began a 10-year, $118 million redevelopment to provide a greater variety of amenities such as an amphitheater, skate park, food vending, and a large water feature.

Margaret T. Hance Park, continued

Downtown Phoenix has a seen a recent surge in residential development, including on the park's perimeter, due to both increased population and demand for downtown living as well as an anticipation of a reinvigorated Hance Park. Major developments include the 149-unit Portland on the Park, the 49-unit En Hance Park, and the 105-guestroom Found:Re Hotel to the south as well as the 25-unit ArtHaus, 367-unit Muse Apartments, and 280-unit Broadstone Arts District to the north. These residential developments have added high-density residential units to the local supply in an area that has historically housed single-family-detached homes. The development of the Found:Re Hotel has added to the artistic framework of the community, while also adding an upscale lodging establishment between midtown and downtown Phoenix. A 2017 economic impact analysis reflected on the benefits and drivers for revitalization surrounding Hance Park. The study concludes that improvements to Hance Park will result in $6.6 billion direct new spending in Phoenix over a thirty-year period as well as more than $115 million in tax revenue for the City of Phoenix and State of Arizona as a result of the project.

6.3.2 Privately Managed Public Spaces

Privately managed public spaces are predicated on the sale of land to private real estate developers, either through outright fee ownership or a fair-market value air-rights structure. The proceeds of the sale would then be rededicated to the project's construction costs. As noted earlier, the FHWA does not restrict private development constructed over interstate assets if it does not inhibit the purpose and function of the transportation asset itself.

In this scenario, developer appetite is very much tied to existing market conditions. A developer's understanding of the required rate of return on a development project (also known as a hurdle rate) considers the cost of money, capitalization rates, and perceived risks. A developer would evaluate the fair-market value of land, development costs (such as hard and soft costs of building, tenant allowance/fit-out, parking costs, and financing fees/interest), and operating costs (such as rent, vacancy rates, and operating expenses). The developer accounts for the costs of any operations and maintenance as well. The developer then determines the required rate of return by dividing the net operating income by the development cost. Depending on the value of the land, the sponsoring agency would receive private funds in exchange for development rights and can dedicate those funds to the project. It is anticipated, per the financial and economic analysis in this summary report, that the revenue generated by vertical development (in RLV) would not cover all project costs.

There is an upside in that the sale of property would help meet a funding gap between public sources for the I-5 lid project. However, there will be higher scrutiny on the effect of displacement in the surrounding neighborhood particularly if ownership is transferred to the private sector. Private development tends to obscure the public value of the transaction since ownership is conveyed to the private sector. Project proponents will need to be ready to respond to such legitimate concerns.

National best practice shows that public-sector entities tend to use master developer or air-rights agreements to engage private developers to purchase and develop land. These agreements can dictate what parcels are dedicated to public spaces, how operations costs and risks are shared, and the form and function of the development to ensure neighborhood cohesion or meet other community goals. If managed through an air-rights or master developer agreement, the project would likely be phased and the timing of those phases would depend on the projected financial feasibility for the development. Capital Crossing in Washington, D.C., and Copley Place in Boston are examples of privately held development that were used to fund transportation investment as well as stimulate urban development. The agreement may be used to govern the development, but the private-sector entities hold ultimate ownership over the land.

Capitol Crossing – Washington, D.C.

Capitol Crossing is a 2.2-million-square-foot real estate development situated over I-395 in Washington, D.C. This 7-acre lid, currently under construction in the city's central business district, is a fully private development project managed by Property Group Partners (PGP). The history of the project stretches over decades with different developers assuming the air rights to the project over time. PGP intends to use its air-rights agreement with the District of Columbia to build five LEED-certified buildings, of which four buildings will be dedicated to office space and one building to residential. According to the District of Columbia, this $1.3 billion project is projected to generate $40 million in annual property tax revenue and $120 million in air-rights lease payments to the District of Columbia. The project broke ground in 2015 and is expected to be complete in 2021.

It is important to note that this is a fully private endeavor, meaning that the District of Columbia receives lease payments and has general oversight like any other real estate development in the city. However, the construction of the lid and development of "land" on the lid is led by the private developer. One of the challenges for a project like Capitol Crossing is to have sufficient land value to justify the platform building cost. Robert Braunohler, regional vice president for PGP, noted that "there are only two cities where land value is high enough and they are New York and Washington. There aren't just empty sites just sitting around" (FHWA, 2020).

6.3.3 Public-Private Managed Public Spaces

Public space that is managed jointly by public and private entities may be referred to as a public-private partnership or P3. P3s can be funded and operated through a partnership between a public-sector entity and one or more private-sector companies. Not unlike traditional approaches, P3s involve a contract between a sponsoring agency (such as a municipality or state department of transportation) and a private party, in which the private party provides a public service. With a P3, the private sector may assume substantially more project financial, technical, and operational risks in the project that are traditionally managed by the public-sector entity. The private developer would provide upfront capital to support the I-5 lid project and would anticipate earning a return on investment through ongoing payments from the sponsoring agency over the course of a concession, such as 20 to 30 years. As such, existing market conditions influence developer appetite for such a project.

It is assumed that a PDA created by the City of Seattle would be the appropriate legal vehicle to establish the public-private governance model. This would retain ownership by the public sector and set forth transparent governance to ensure that community needs are met while the project is constructed and land is developed for an array of purposes. While a legal and regulatory possibility, decision-makers need to decide if there are sufficient internal capacity to provide oversight and management of the private developer and the PDA entity.

The P3 delivery method addresses challenges that public agencies have with limited up-front capital resources for projects, thereby allowing the allocation of public funds for other local priorities. The benefit of private-sector engagement through P3 delivery of capital projects is that P3 projects deliver enhanced capital and operating performance through a whole-lifecycle management approach to project execution, mitigating for public-sector risks such as lack of up-front, near-term capital funds and technical expertise to deliver the projects. P3 delivery also provides schedule and cost certainty through appropriate transfer of such risks from the public to the private sectors.

Under this model, the private sector could view the project as too high of a risk to be financially feasible. Some of the factors for their concern could be the viability of the circulation system should the existing streets and ramps remain. Other concerns could be the complexity of the construction, particularly if WSDOT requires the developer to take on construction and insurance related risks. Others could question how the market will respond to housing, office, or hotel offerings over a freeway.

Klyde Warren Park – Dallas, Texas

Completed in 2012, the 5.2 acre Klyde Warren Park in Dallas, Texas, spans the eight-lane Woodall Rodgers Freeway. The park sits on over 300 concrete beams uniquely positioned to act as planters for the vegetation above. Klyde Warren Park serves as a connector between two neighborhoods that were formerly divided by a recessed freeway. The total park project cost approximately $110 million, with more than 45 percent of project costs covered by private donors. Approximately 52 percent of the park was funded by the City of Dallas, with sources including bond funds, highway funds from the state, and federal stimulus funds through a U.S. DOT TIGER discretionary grant.

Since opening, the park has served as a bridge between the Uptown neighborhood and the Downtown Dallas Arts District. A number of cultural institutions are situated around the park including the Nasher Sculpture Center, the Meyerson Symphony Center, the Perot Museum of Nature and Science, and the AT&T Performing Arts Center as well as a number of high rise apartment buildings, office buildings, and the 218-room Ritz-Carlton Dallas. To the east of the park is also the Dallas Museum of Art and the central business district, while the west side of the park faces Uptown and the American Airlines Center.

Klyde Warren Park is owned by the City of Dallas but is privately operated by the Woodall Rodgers Park Foundation. The foundation was formed in 2004 to source funding as well as maintain the park. The public-private partnership allows the City of Dallas to own the park’s land and permanent fixtures, while the Woodall Rodgers Park Foundation manages all programming, operations, and maintenance at the park.

Klyde Warren Park, continued

Klyde Warren Park has generated a substantial economic impact on the surrounding community, and especially the real estate community. According to CBRE, lease rates at sites immediately surrounding the park increased substantially between 2012 and 2015. In addition to driving up average lease rates in both commercial and residential developments surrounding the park, the opening of Klyde Warren Park also spurred new developments in the immediate area, such as a 19-story office tower and a 32-story residential tower as well as the approximate $175 million redevelopment of the Statler Hilton and the $220 million redevelopment of the Olympic Building. Phase II of development for the park is currently under consideration, including constructing a parking garage, ice rink, expanded playground, event space and connections to adjacent cultural institutions.

6.4 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 6-3 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 6-3. 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.

	Test Case 1 The Park Lid	Test Case 2 Maximum Private Investment	Test Case 3 Mid-density Hybrid
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 6-1). 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.

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 6-2) 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. The governance structure applicable to Test Case 2 is a private model (Table 6-1), 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 4-1). 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. 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.[38] 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

[38] 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.

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 off-site 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 Section 7, Funding and Financing.

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, 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.

6.5 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 6-1). 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.

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

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.

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 change, 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.

6.6 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 6-4, 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 6-4 summarizes the potential challenges and benefits associated with each governance model.

Table 6-4. Governance Model Decision Factors

Governance Model Decision Factors	Public	Private	Public-Private
Market Conditions and Developer Appetite	Most Challenging	Most Promising	Most Promising
Availability of Funding and Financing	Most Challenging	Some Potential/Challenging	Some Potential/Challenging
Legal and Regulatory Ability	Most Promising	Most Promising	Some Potential/Challenging
Shift of O&M Risk to Private Sector	Most Challenging	Some Potential/Challenging	Most Promising
Phasing	Most Challenging	High Potential	Most Promising
Stakeholder Management	Most Promising	Most Challenging	Some Potential/Challenging
Institutional Readiness	Most Promising	Some Potential/Challenging	Some Potential/Challenging

Rating Scale:

Most Promising High Potential Some Potential/Challenging Most Challenging

6.7 Summary of 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.

7. Funding and Financing

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 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 7-1, 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.

Table 7-1. 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	$16.0 B	Gas Tax
State	Washington Department of Transportation	Statewide Transportation Improvement Program (STIP)	No	2020	2023	$3.3 B	Existing Funding
State	Washington Department of Commerce	CERB Local Infrastructure Financing Tool (LIFT)	No	Annual Funding		$7.5 M	Existing Funding
State	Washington Department of Commerce	Community Economic Revitalization Board	No	2017	2019	$28.8 M	Existing Funding
State	Washington Department of Transportation	Transportation Partnership Program	No	2005	2021	$7.1 B	Existing Funding
Regional	Sound Transit	Sound Transit 2	Yes	2008	2023	$13.4 B	Sales Tax, MVET
Regional	Sound Transit	Sound Transit 3	Yes	2017	2041	$53.8 B	Sales Tax, MVET, Property Tax
Regional	Port of Seattle	Annual Funding Package	No	2020	2021	$76.4 M	Property Tax
County	King County Metro Transit	Metro Connects	No	2017	2040	$2.0 B	Sales Tax
County	King County Parks and Recreation	Parks, Recreation, Trails and Open Space Levy	Yes	2020	2025	$810 M	Property Tax
City	City of Seattle	MOVE Seattle Levy	Yes	2015	2024	$930 M	Property Tax
City	City of Seattle	Parks & Recreation Capital Improvement Program	No	2020	2025	$87.3 M	Property Tax, REET
City	City of Seattle	Transportation Capital Improvement Program	No	2020	2025	$4.2 B	Property Tax, REET
City	City of Seattle	Seattle Public Utilities Capital Improvement Program	No	2020	2025	$1.5 B	Property Tax, REET
City	City of Seattle	Seattle Housing Levy	Yes	2016	2023	$290 M	Property Tax
City	City of Seattle	Seattle Transportation Benefit District	Yes	2015	2020	$50 M	Sales Tax, Vehicle License Fee
City	City of Seattle	Families, Education, Preschool, and Promise Levy	Yes	2019	2026	$619 M	Property Tax

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
- 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, regressiveness of sales tax, and a recent voter-backed restriction on vehicle fees through initiative I-976.

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 7-2.

Table 7-2. 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 percent 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

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.

7.1 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.

8. 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 FHWA 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; 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, or build case, alternatives to the underlying baseline or 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.
- Capitalization Rate – the capitalization rate (also known as cap rate) is used in commercial real estate to indicate the rate of return that is expected to be generated on a real-estate investment property.
- Capitalized Value – assessment of the value of an asset, based on the total income expected to be realized over its economic life span.
- 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 – represents 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.
- Gross Square Feet (GSF) – gross square feet is the total area of enclosed space measured to the exterior walls of a building. The relationship between this is also known as gross-to-net square feet ratio.
- Gross-to-Net Square Feet Ratio – relationship between the net square feet and gross square feet. Also referred to as efficiency ratio, it reflects the net square feet compared to the gross square feet.

- 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 paid to employees, and income earned by self-employed workers or unincorporated sole proprietorships.
- Lease-up – lease-up schedule is the time it takes newly available properties to attract tenants and reach stabilized occupancy or vacancy.
- 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. Responsibilities of the master developer would include 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 (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.
- Net Present Value (NPV) – net present value is the difference between the present value of cash inflows and the present value of cash outflows over a period of time.
- Net Square Feet (NSF) – net square feet is the usable area or space that is the result of the gross square feet minus unusable area (i.e., walls, columns, etc.). Net square feet differs from leasable square feet as the latter includes the common areas of a commercial building.
- Present Value – 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 the State of Washington, 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. 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 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 – 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.
- Vacancy – vacancy or vacancy rate is the percentage of all available units in a rental property, such as a hotel or apartment complex, that are vacant or unoccupied at a particular time.

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10. Appendix A - I-5 Lid Feasibility Study Vertical Development Phasing

The study assumed that each phase would take three years to be delivered and that the next phase would not begin until the prior one was completed. For all test cases, the development would start in Area 4 (in the northern edge of the Lid) followed by Area 3, and then a combination of Areas 2 and 1 in order to accommodate multiple uses being developed simultaneously.

Development Phasing Rationale

- For both Test Cases 2 and 3 the development would start with Buildings 14 and 15, residential high-rise and office mid-rise, respectively. Both buildings are in Area 4 and could leverage their proximity to South Lake Union, with a strong residential market that commands higher rents with supportive office uses.
- As development moves south, the next two phases would concentrate on Area 3, with the largest development program. Greater and varied development in this subarea is supported by recent development trends, the strength of the Downtown Retail Core, the high rent potential associated with Downtown, and the proximity to central Downtown Retail Core.
- The last two phases would focus on the development south of the Washington State Convention Center (WSCC). The proximity to the WSCC established office district, and surrounding neighborhoods could make this an appropriate node for new office space and building from the development of the previous phases, create a greater connection to other neighborhoods, and include residential development.

Based on absorption potential and the timeline for lid construction, analysis assumed the following schedule for delivery of vertical development on the lid (see Table 10-1,

Table 5-7) divided by development groups of three years for each one.

Table 10-1. Vertical Development Construction Phasing Assumptions

Test Case	Lid Area of Analysis (See Figure 5-10)	Vertical Development Construction Start Date	Vertical Development Absorption Start Date	Stabilization (Stabilized Occupancy)	Vertical Development Group
Test Case 2 All Ramps Remain	4 4 4, 3 3 2 1	2035 2038 2041 2044 2047 2050	2037 2040 2043 2046 2049 2052	2039 2042 2045 2048 2052 2054	1 2 3 4 5 6
Test Case 2 Removal of Olive Way Ramps	4 4 4, 3 3 3, 2 1 1	2035 2038 2041 2044 2047 2050 2053	2037 2040 2043 2046 2049 2052 2055	2039 2042 2045 2048 2052 2054 2057	1 2 3 4 5 6 7
Test Case 3 All Ramps Remain	4 4 4 3 2 1	2035 2038 2041 2044 2047 2050	2037 2040 2043 2046 2049 2052	2039 2042 2045 2048 2052 2054	1 2 3 4 5 6
Test Case 3 Removal of Olive Way Ramps	4 4 4, 3 3 2 1	2035 2038 2041 2044 2047 2050	2037 2040 2043 2046 2049 2052	2039 2042 2045 2048 2052 2054	1 2 3 4 5 6

Test Case 2

Figure 10-1 shows the buildings proposed in Test Case 2, with the Olive Way ramps. Table 10-2 shows the buildings developed by phase and use for that development. Figure 10-2 shows the annualized vertical development by building typology and land use and Figure 10-3 shows the cumulative vertical development by building typology and use. Table 10-3 shows the building square footage by vertical development group based on land use.

Figure 10-1. Test Case 2 (All Ramps Remain) Proposed Buildings

Table 10-2. Test Case 2 (All Ramps Remain) Buildings Developed by Group & Use

Group	Buildings per Group & Use
1	14 (Residential High-Rise), 15 (Office Mid-Rise)
2	12 (Office Mid-Rise), 16 (Residential High-Rise)
3	11 (Office Mid-Rise), 13 (Office Mid-Rise)
4	7 (Residential Low-Rise), 8 (Residential Low-Rise), 9 (Residential High-Rise, 10 (Residential High-Rise)
5	1 (Residential High-Rise), 2 Office Mid-Rise), 4 (Office Mid-Rise)
6	3 (Residential Mid-Rise), 5 (Office Mid-Rise), 6 (Hotel)

Figure 10-2. Test Case 2 (All Ramps Remain), Annual Vertical Development Delivered (GSF)

Figure 10-3. Test Case 2 (All Ramps Remain), Cumulative Vertical Development Delivered

Table 10-3. Supportable Vertical Development Capacity by Group, Test Case 2 (All Ramps Remain) – Gross SF

Test Case 2 -All Ramps Remain									
Group	Total	Residential			Office		Hotel	Retail	Civic
		Low-Rise	Mid-Rise	High-Rise	Mid-Rise	High-Rise			
1	786,710			298,490	442,260			45,960	N/A
2	239,960			226,760				13,200	N/A
3	1,883,960				1,767,090			116,870	N/A
4	1,275,620	332,890		886,820				55,910	N/A
5	918,250				589,730		282,540	45,980	N/A
6	2,936,590		297,250	891,870	445,200	1,232,410		69,860	N/A
7									N/A
Total	8,041,090	332,890	297,250	2,303,940	3,244,280	1,232,410	282,540	347,780	N/A

Figure 10-4 and Table 10-4 and Table 10-5 show the buildings and square footage development capacity for Test Case 2, Removal of Olive Way Ramps. Figure 10-5 shows the annualized development by building typology and land use and Figure 10-6 shows the cumulative vertical development by building typology and use.

Figure 10-4. Test Case 2 (Removal of Olive Way Ramps) Proposed Buildings

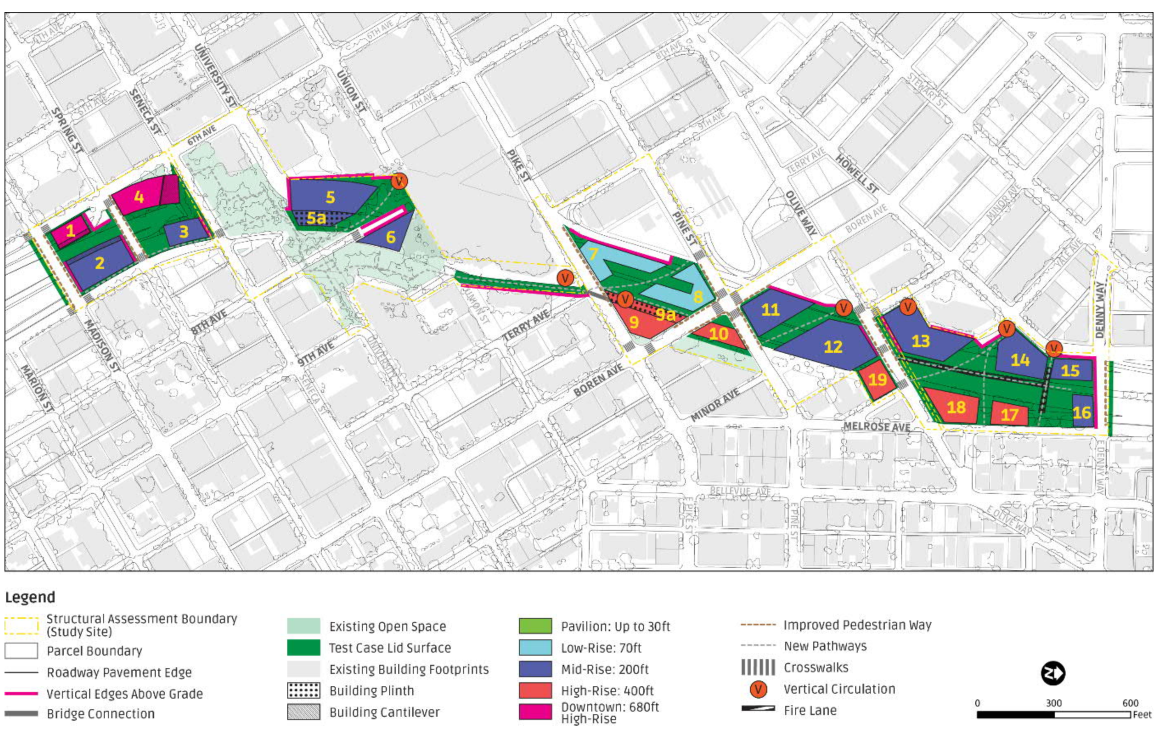


Table 10-4. Test Case 2 (Removal of Olive Way Ramps) Buildings Developed by Group & Use

Group	Buildings per Group & Use
1	14 (Residential High-Rise), 15 (Office Mid-Rise), 18 (Residential High-Rise)
2	12 (Office Mid-Rise), 16 (Residential High-Rise), 17 (Residential High-Rise)
3	11 (Office Mid-Rise), 13 (Office Mid-Rise), 19 (Residential High-Rise)
4	7 (Residential Low-Rise), 8 (Residential Low-Rise), 9 (Residential High-Rise, 10 (Residential High-Rise)
5	1 (Residential High-Rise), 2 Office Mid-Rise), 4 (Office Mid-Rise)
6	3 (Residential Mid-Rise), 5 (Office Mid-Rise), 6 (Hotel)

Figure 10-5. Test Case 2 (Removal of Olive Way Ramps) Vertical Development Delivered by Year

Figure 10-6. Test Case 2 (Removal of Olive Way Ramps) Cumulative Vertical Development Delivered by Year

Table 10-5. Supportable Vertical Development Capacity by Building Group, Test Case 2 (Removal of Olive Way Ramps) – Gross SF

Test Case 2 - Removal of Olive Way Ramps									
Group	Total	Residential			Office		Hotel	Retail	Civic
		Low-Rise	Mid-Rise	High-Rise	Mid-Rise	High-Rise			
1	971,990			566,890	365,450			39,650	N/A
2	1,136,050				1,067,070			68,980	N/A
3	1,775,780			949,780	750,620			75,380	N/A
4	2,017,960	304,180		1,160,430	462,160			91,190	N/A
5	1,497,660			563,830	589,730		282,540	61,560	N/A
6	1,373,350			891,870	445,200			36,280	N/A
7	1,563,240		297,250			1,232,410		33,580	N/A
Total	10,336,030	304,180	297,250	4,132,800	3,680,230	1,232,410	282,540	406,620	N/A

Test Case 3

Figure 10-7 shows the buildings proposed in Test Case 3, All Ramps Remain. Table 10-6 and Table 10-7 show the buildings and square footage development capacity. Figure 10-8 shows the annualized vertical development by building typology and land use and Figure 10-9shows the cumulative vertical development by building typology and use.

Figure 10-7. Test Case 3 (All Ramps Remain) Proposed Buildings

Table 10-6. Test Case 3 (All Ramps Remain) Buildings Developed by Group & Use

Group	Buildings per Group & Use
1	14 (Office Mid-Rise), 15 (Residential Mid-Rise)
2	16 (Residential Mid-Rise)
3	13 (Office Mid-Rise)
4	7 (Residential Low-Rise), 8 (Residential Low-Rise), 10 (Residential Mid-Rise)
5	4 (Office High-Rise)
6	5 (Office Mid-Rise), 6 (Hotel)

Figure 10-8. Test Case 3 (All Ramps Remain) Vertical Development Delivered by Year

Figure 10-9. Test Case 3 (All Ramps Remain) Cumulative Vertical Development Delivered by Year

Table 10-7. Supportable Vertical Development Capacity by Group, Test Case 3 (All Ramps Remain) – Gross SF

Test Case 3 -All Ramps Remain									
Group	Total	Residential			Office		Hotel	Retail	Civic
		Low-Rise	Mid-Rise	High-Rise	Mid-Rise	High-Rise			
1	447,230		165,890		238,520			20,460	22,360
2	143,980		129,580					7,200	7,200
3	452,620				402,830			27,160	22,630
4	367,040	173,160	152,780					22,150	18,950
5	714,850					654,720		24,390	35,740
6	685,220				558,380		46,600	45,980	34,260
7									
Total	2,810,940	173,160	448,250		1,199,730	654,720	46,600	147,340	141,140

Figure 10-10 and Table 10-8 and Table 10-9 show the buildings and square footage development capacity Test Case 3, without Olive Way Ramps. Figure 10-11 shows the annualized development by building typology and land use and Figure 10-12 shows the cumulative vertical development by building typology and use.

Figure 10-10. Test Case 3 (Removal of Olive Way Ramps) Proposed Buildings

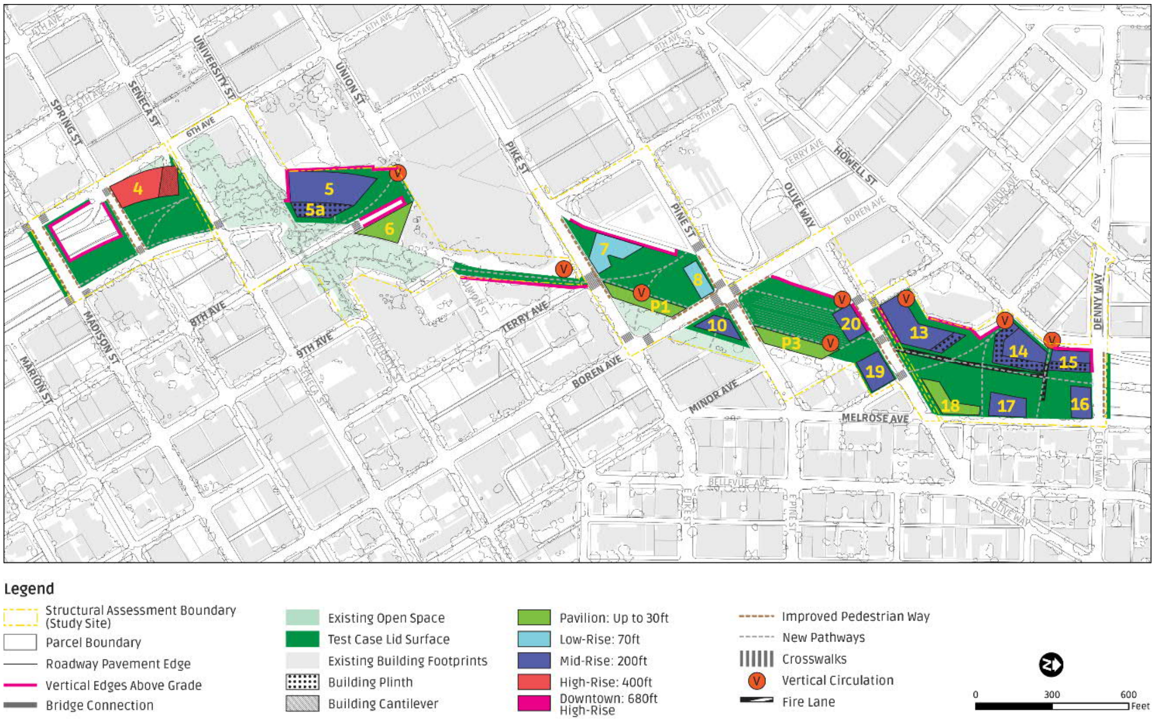


Table 10-8. Test Case 3 (Removal of Olive Way Ramps) Buildings Developed by Group & Use

Group	Buildings per Group & Use
1	14 (Office Mid-Rise), 15 (Residential Mid-Rise)
2	16 (Residential Mid-Rise), 17 (Residential Mid-Rise)
3	13 (Office Mid-Rise), 19 (Residential Mid-Rise)
4	7 (Residential Low-Rise), 8 (Residential Low-Rise), 10 (Residential Mid-Rise)
5	4 (Office High-Rise)
6	5 (Office Mid-Rise), 6 (Hotel)

Figure 10-11. Test Case 3 (Removal of Olive Way Ramps) Vertical Development Delivered by Year

Figure 10-12. Test Case 3 (Removal of Olive Way Ramps) Cumulative Vertical Development Delivered by Year

Table 10-9. Supportable Vertical Development Capacity by Group, Test Case 3 (Removal of Olive Way Ramps) – Gross SF

Test Case 3 -Removal of Olive Way Ramps									
Group	Total	Residential			Office		Hotel	Retail	Civic
		Low-Rise	Mid-Rise	High-Rise	Mid-Rise	High-Rise			
1	447,980		165,890		238,520			20,460	23,110
2	318,850		286,970					15,940	15,940
3	883,190		396,120		402,830			40,080	44,160
4	367,040	173,160	152,780					22,150	18,950
5	714,850					654,720		24,390	35,740
6	685,220				558,380		46,600	45,980	34,260
7									
Total	3,417,130	173,160	1,001,760		1,199,730	654,720	46,600	169,000	172,160

11. Appendix B - I-5 Lid Feasibility Study Vertical Development Feasibility Pro Forma

Analysis to determine the residual land value (RLV) associated with vertical development on the lid was conducted through a multi-year cost and revenue Discounted Cash Flow pro forma model in Excel. This model projects the costs of development and operations of specific land uses and building types as well as the revenues associated with leasing, financing, or disposing of completed and fully operating, stabilized property. The model assumes that development and operation of buildings provide value to a developer, meaning that the capitalized value of the income streams from development is worth more than the associated costs. The model calculates the RLV for each development site by first determining the capitalized value of the income streams generated from the vertical development program on the site and then subtracting all hard and soft costs associated with development.

Table 11-1. Vertical Development Assumptions – Residential Uses

Residential Use Assumption	Low-Rise	Mid-Rise	High-Rise
Building Efficiency*			
Gross-to-Net Square Feet Ratio (percent)	85 percent	85 percent	85 percent
Average Unit Size (Net SF or NSF)	900 NSF	900 NSF	900 NSF
Vertical Parking Costs			
Cost Per Space - Structured	$54,250	$54,250	$54,250
Development Costs			
Hard Costs (per Gross SF or GSF)	$220	$275	$290
Soft Costs Excluding Financing & Loan Fees (percent)	21 percent	21 percent	21 percent
Hard Costs (per NSF)	$259	$324	$341
Soft Costs (per NSF)	$54	$68	$72
Parking Costs (per NSF)	$3	$3	$3
Additional Civic Space Costs (per NSF)	NA	NA	NA
Total Construction Costs (per NSF)	$316	$394	$416
Total Construction Costs (per GSF)	$269	$335	$353
Timing			
Average Construction Duration (Months)	24 Mo.	24 Mo.	24 Mo.
Lease-Up/Sale Period (Months)	12 Mo.	18 Mo.	18 Mo.
Stabilization	36 Mo.	42 Mo.	42 Mo.
Ongoing Assumptions			
Lease Structure	Gross	Gross	Gross
Vacancy Contingency (percent)	5.0 percent	5.0 percent	5.0 percent
Operating Costs			
Total Operating Costs (percent of Revenue)	27.0 percent	27.0 percent	27.0 percent
Revenues**			
Rent (per NSF per Year)	$45	$45	$50
Rent (per NSF per Month)	$4	$4	$4

Note: For residential uses, development costs include the cost of parking assumed to be provided onsite, which comprises 10 percent of total required parking.
*Gross Square Feet (GSF) is the total area of enclosed space measured to the exterior walls of a building, whereas Net Square Feet (NSF) is the usable area or space that is the result of the GSF minus unusable area (i.e., walls, columns, etc.). The relationship between this is also known as Gross-to-Net Square Feet Ratio.
** Residential rents shown are for market-rate residential uses (and do not reflect affordable housing rents).

Table 11-2. Vertical Development Assumptions – Commercial Uses

Commercial Use Assumptions	Office Mid-Rise	Office High-Rise	Hotel	Retail
Building Efficiency				
Gross-to-Net Square Feet Ratio (percent)	85 percent	85 percent	70 percent	85 percent
Average Unit Size (Net SF or NSF)			250 NSF	
Vertical Parking Costs				
Cost Per Space - Structured	$54,250	$54,250	$54,250	$54,250
Development Costs				
Hard Costs (per Gross SF or GSF)	$245	$280	$950	$175
Soft Costs Excluding Financing & Loan Fees (percent)	21 percent	21 percent	25 percent	21 percent
Hard Costs (per NSF)	$288	$329	$1,357	$206
Soft Costs (per NSF)	$61	$69	$339	$43
Parking Costs (per NSF)	$5	$5	$0	$0
Additional Civic Space Costs (per NSF)	NA	NA	NA	NA
Total Construction Costs (per NSF)	$353	$403	$1,696	$249
Total Construction Costs (per GSF)	$300	$343	$1,188	$212
Timing				
Average Construction Duration (Months)	24 Mo.	24 Mo.	24 Mo.	24 Mo.
Lease-Up/Sale Period (Months)	24 Mo.	30 Mo.	36 Mo.	12 Mo.
Stabilization	48 Mo.	54 Mo.	60 Mo.	36 Mo.
Ongoing Assumptions				
Lease Structure	Gross	Gross		
Vacancy Contingency (percent)	5.0 percent	5.0 percent	23.0 percent	2.0 percent
Operating Costs				
Total Operating Costs (percent of Revenue)	25.0 percent	25.0 percent	55.0 percent	0.0 percent
Revenues *				
Rent (per NSF per Year)	$65	$65		$28
Rent (per NSF per Month)	$5	$5	$0	$2

Note: Development costs include the cost of parking assumed to be provided onsite, which comprises 10 percent of total required parking.

Table 11-3 summarizes the RLVs calculated for Test Case 2 (All Ramps Remain & Removal of Olive Way Ramps) and Test Case 3 (All Ramps Remain & Removal of Olive Way Ramps) as defined in the Development Program Test Cases and memorialized in the I-5 LFS Test Case Memorandum. Analysis assumes a range of potential floor area ratios (or FAR, which is a measure of density as defined by a building's total floor area in relation to the size of the lot/parcel). FAR calculations were based on FAR comparables for projects of similar density and contexts.

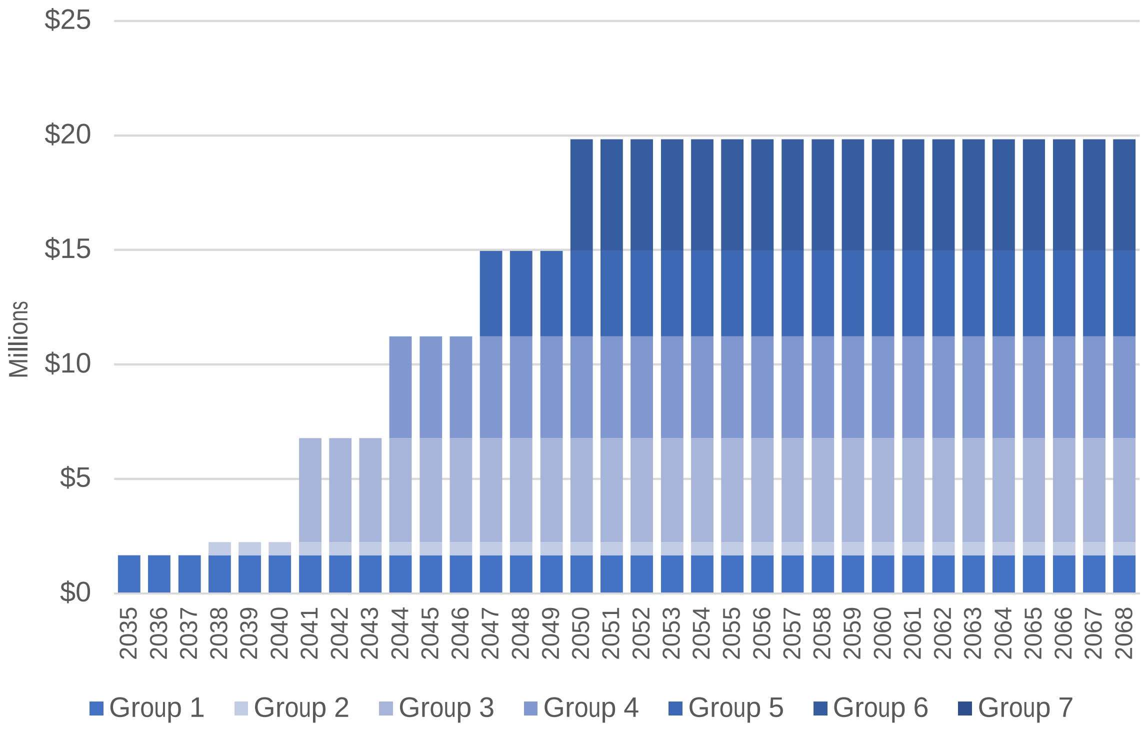
Table 11-3. Residual Land Value (RLV) by Use – Reduced Parking Scenario (2019 USD)

Test Case 2 (All Ramps Remain & Removal of Olive Way Ramps)							
Use	RLV per NSF	RLV per GSF	RLV per Unit/Hotel Key	RLV per SF of Land		FAR (Range)	
				Min	Max	Min	Max
Residential Low-Rise	$122	$104	$109,741	$207	$415	2	4
Residential Mid-Rise	$40	$34	$36,148	$171	$273	5	8
Residential High-Rise	$56	$48	$50,297	$475	$713	10	15
Office Mid-Rise	$53	$45		$226	$361	5	8
Office High-Rise	($1)	($1)		($13)	($19)	10	15
Hotel	$166	$116	$41,529	$581	$930	5	8
Retail	$100	$85		$170	$340	2	4
Test Case 3 (All Ramps Remain & Removal of Olive Way Ramps)							
Use	RLV per NSF	RLV per GSF	RLV per Unit/Hotel Key	RLV per SF of Land		FAR (Range)	
				Min	Max	Min	Max
Residential Low-Rise	$63	$54	$56,830	$107	$215	2	4
Residential Mid-Rise	($21)	($17)	($18,455)	($87)	($139)	5	8
Residential High-Rise						10	15
Office Mid-Rise	$53	$45		$226	$361	5	8
Office High-Rise	($2)	($1)		($13)	($20)	10	15
Hotel						5	8
Retail	$100	$85		$170	$340	2	4

Note: Minimum and maximum FAR assumptions were based on FAR comparables for similar density projects

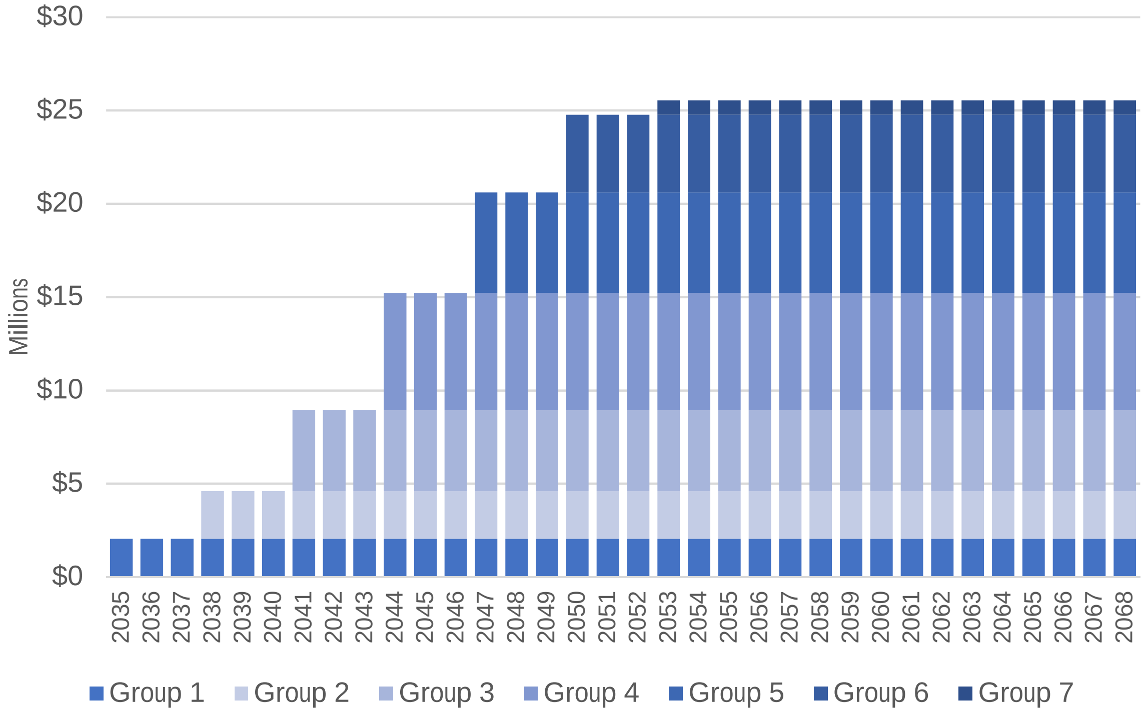
The following four figures (Figure 11-1, Figure 11-2, Figure 11-3, Figure 11-4) show RLV for each test case and scenario as an annualized revenue stream over 99 years to illustrate the RLV over a potential long-term lease structure (the longest term thought to be reasonable for public-private partnerships).

Figure 11-1. Residual Land Value as an Annualized Payment Stream by Vertical Development Group, Test Case 2 (All Ramps Remain) (2019 USD, Adjusted for Inflation)



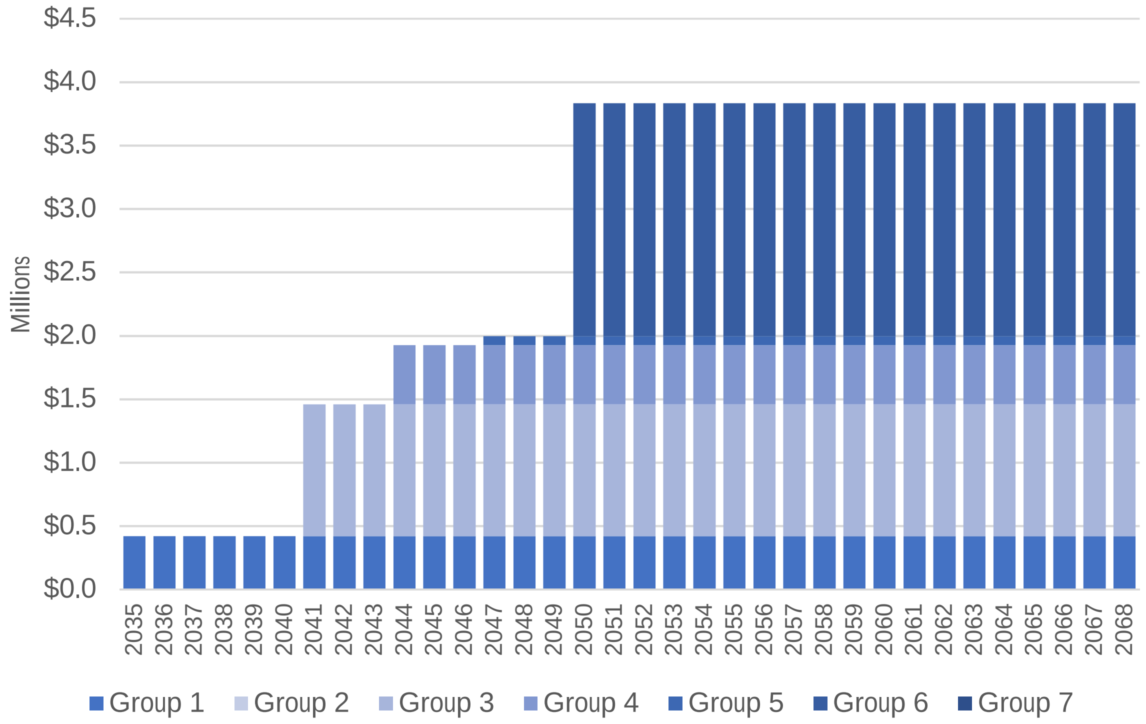
Note: Annual revenues are shown in real-value terms adjusted by inflation to 2019 USD.

Figure 11-2. Residual Land Value as an Annualized Payment Stream by Vertical Development Group, Test Case 2 (Removal of Olive Way Ramps), (2019 USD, Adjusted for Inflation)



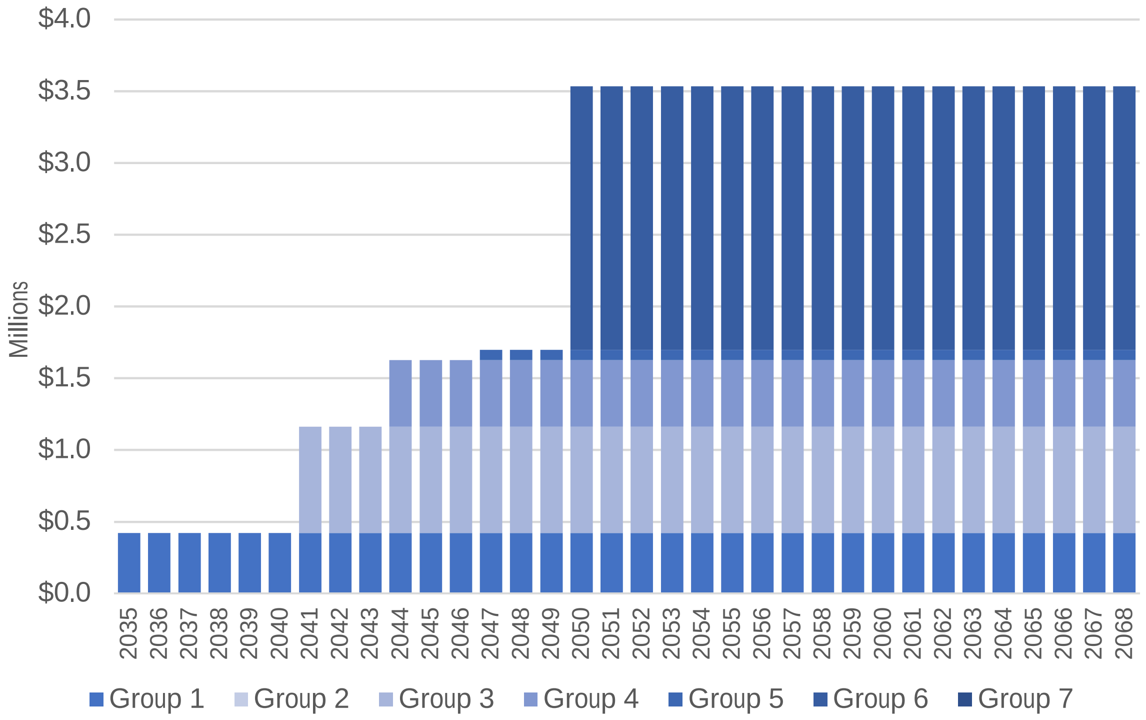
Note: Annual revenues are shown in real-value terms adjusted by inflation to 2019 USD.

Figure 11-3. Residual Land Value as an Annualized Payment Stream by Vertical Development Group, Test Case 3 (All Ramps Remain), (2019 USD, Adjusted for Inflation)



Note: Annual revenues are shown in real-value terms adjusted by inflation to 2019 USD.

Figure 11-4. Residual Land Value as an Annualized Payment Stream by Vertical Development Group, Test Case 3 (Removal of Olive Way Ramps), (2019 USD, Adjusted for Inflation)



Note: Annual revenues are shown in real value terms adjusted by inflation to 2019 USD.

Table 11-4 summarizes RLV by development group, showing values in nominal dollars, in real 2019 dollars (adjusted for inflation), and a net present value for demand when a lid is built based on the present value of annualized cash flows at a 7.0 percent discount rate. The discount rate used in this analysis reflects a mid-point between assumed expected public- and private-sector discount rates.

The left-most column shows RLVs for a reduced parking scenario, in which only 10 percent of parking spaces are required, and these are delivered on-site, per the assumptions provided by the City of Seattle in the test case workbook (this column is labeled as “Reduced Parking”). The next set of columns of Table 11-4 assume that development is required to comply with current requirements, and that 10 percent of that parking is built on the lid and 90 percent is built off-site (or off the lid), which would require significant expenditures for land on which to build parking (these columns are labeled as “Full Parking”).

Table 11-4. Residual Land Value by Vertical Development Group – Nominal (2019 USD) and Net Present Value (NPV)

Test Case 2 – All Ramps Remain					
Group	Lid Areas	Reduced Parking	Full Parking		
		Nominal Value	Nominal Value	2019 USD	NPV @ 7.0%
1	4	$86,310,000	$39,020,000	$37,130,000	$34,090,000
2	4	$24,280,000	$13,130,000	$11,600,000	$9,370,000
3	4, 3	$262,670,000	$106,700,000	$87,550,000	$62,120,000
4	3	$173,790,000	$104,200,000	$79,400,000	$49,520,000
5	2	$147,780,000	$87,410,000	$61,850,000	$33,910,000
6	1	$377,820,000	$114,350,000	$75,130,000	$36,220,000
7					
Total		$1,072,650,000	$464,810,000	$352,660,000	$225,230,000
Test Case 2 - Removal of Olive Way Ramps					
Group	Lid Areas	Reduced Parking	Full Parking		
		Nominal Value	Nominal Value	2019 USD	NPV @ 7.0%
1	4	$101,680,000	$47,970,000	$45,650,000	$41,910,000
2	4	$147,140,000	$59,660,000	$52,720,000	$42,550,000
3	4, 3	$218,100,000	$101,530,000	$83,310,000	$59,120,000
4	3	$275,070,000	$147,650,000	$112,510,000	$70,180,000
5	3, 2	$221,150,000	$126,140,000	$89,250,000	$48,940,000
6	1	$205,380,000	$97,310,000	$63,940,000	$30,820,000
7	1	$185,700,000	$18,320,000	$11,180,000	$4,740,000
Total		$1,354,220,000	$598,580,000	$458,560,000	$298,260,000
Test Case 3 – All Ramps Remain					
Group	Lid Areas	Reduced Parking	Full Parking		
		Nominal Value	Nominal Value	2019 USD	NPV @ 7.0%
1	4	$32,550,000	$9,860,000	$9,380,000	$8,610,000
2	4	$2,000,000	$0	$0	$0
3	4, 3	$59,930,000	$24,370,000	$20,000,000	$14,190,000
4	3	$22,110,000	$10,900,000	$8,310,000	$5,180,000
5	1	$68,730,000	$1,650,000	$1,170,000	$640,000
6	2	$104,610,000	$43,050,000	$28,290,000	$13,630,000
7					
Total		$289,930,000	$89,830,000	$67,150,000	$42,250,000
Test Case 3 – Removal of Olive Way Ramps					
Group	Lid Areas	Reduced Parking	Full Parking		
		Nominal Value	Nominal Value	2019 USD%	NPV @ 7.0%
1	4	$32,550,000	$9,840,000	$9,360,000	$8,600,000
2	4	$4,420,000	$0	$0	$0
3	4, 3	$65,590,000	$17,410,000	$14,290,000	$10,140,000
4	3	$22,100,000	$10,880,000	$8,290,000	$5,170,000
5	1	$68,730,000	$1,650,000	$1,170,000	$640,000
6	2	$104,610,000	$43,050,000	$28,290,000	$13,630,000
7					
Total		$298,000,000	$82,830,000	$61,400,000	$38,180,000

Following the same methodology, Table 11-5 includes RLVs by lid area based on lid construction phasing assumptions for Test Cases 2 and 3 (see Figure 5-10).

Table 11-5. Residual Land Value by Lid Area - Nominal (2019 USD) and Net Present Value (NPV)

Test Case 2 – All Ramps Remain				
Lid Area	Reduced Parking	Full Parking		
	Nominal Value	Nominal Value	2019 USD	NPV @ 7.0%
4	$197,550,000	$87,580,000	$77,810,000	$64,090,000
3	$349,490,000	$175,460,000	$137,870,000	$91,020,000
2	$147,780,000	$87,410,000	$61,850,000	$33,910,000
1	$377,820,000	$114,350,000	$75,130,000	$36,220,000
Total	$1,072,640,000	$464,800,000	$352,660,000	$225,240,000
Test Case 2 – Removal of Olive Way Ramps				
Lid Area	Reduced Parking	Full Parking		
	Nominal Value	Nominal Value	2019 USD	NPV @ 7.0%
4	$355,460,000	$163,960,000	$144,600,000	$117,270,000
3	$459,910,000	$231,580,000	$177,010,000	$111,520,000
2	$147,770,000	$87,400,000	$61,840,000	$33,910,000
1	$391,080,000	$115,630,000	$75,110,000	$35,550,000
Total	$1,354,220,000	$598,570,000	$458,560,000	$298,250,000
Test Case 3 – All Ramps Remain				
Lid Area	Reduced Parking	Full Parking		
	Nominal Value	Nominal Value	2019 USD	NPV @ 7.0%
4	$94,480,000	$32,410,000	$27,770,000	$21,510,000
3	$22,110,000	$10,900,000	$8,310,000	$5,180,000
2	$104,610,000	$43,050,000	$28,290,000	$13,630,000
1	$68,730,000	$1,650,000	$1,170,000	$640,000
Total	$289,930,000	$88,010,000	$65,540,000	$40,960,000
Test Case 3 - Removal of Olive Way Ramps				
Lid Area	Reduced Parking	Full Parking		
	Nominal Value	Nominal Value	2019 USD	NPV @ 7.0%
4	$96,900,000	$30,150,000	$25,770,000	$19,890,000
3	$27,760,000	$3,920,000	$2,580,000	$1,120,000
2	$104,610,000	$43,050,000	$28,290,000	$13,630,000
1	$68,730,000	$1,650,000	$1,170,000	$640,000
Total	$298,000,000	$78,770,000	$57,810,000	$35,280,000

Table 11-6 shows the annualized RLV by vertical development group by test case and the first year in which that payment would be available based on the timing of development of each lid area.

Table 11-6. Annualized Residual Land Value by Vertical Development Group by Test Case (2019 USD)

Test Case 2 - All Ramps Remain			
Group	Lid Areas	First Year of Payment	Annual Payment
1	4	2035	$1,665,000
2	4	2038	$560,000
3	4, 3	2041	$4,552,000
4	3	2044	$4,445,000
5	2	2047	$3,729,000
6	1	2050	$4,878,000
7		2053	$0
Total			$19,829,000
Test Case 2 - Removal of Olive Way Ramps			
Group	Lid Areas	First Year of Payment	Annual Payment
1	4	2035	$2,046,000
2	4	2038	$2,545,000
3	4, 3	2041	$4,332,000
4	3	2044	$6,299,000
5	3, 2	2047	$5,381,000
6	1	2050	$4,151,000
7	1	2053	$781,000
Total			$25,535,000
Test Case 3 – All Ramps Remain			
Group	Lid Areas	First Year of Payment	Annual Payment
1	4	2035	$421,000
2	4	2038	$0
3	4, 3	2041	$1,040,000
4	3	2044	$465,000
5	1	2047	$70,000
6	2	2050	$1,837,000
7		2053	$0
Total			$3,833,000
Test Case 3 – Removal of Olive Way Ramps			
Group	Lid Areas	First Year of Payment	Annual Payment
1	4	2035	$420,000
2	4	2038	$0
3	4, 3	2041	$743,000
4	3	2044	$464,000
5	1	2047	$70,000
6	2	2050	$1,837,000
7		2053	$0
Total			$3,534,000