Association for the Improvement
of American Infrastructure

Together, we move P3s forward.

The Evidence Project

PUBLIC-PRIVATE PARTNERSHIPS (P3S) FOUND TO MEET OR EXCEED PUBLIC AGENCY OBJECTIVES IN A STUDY OF SIX MAJOR PROJECTS

Study Source: The George Mason University Center for Transportation Public-Private Partnership Policy

Report Release Date: August 16, 2017

According to a recent study released by the George Mason University Center for Transportation Public-Private Partnership Policy, six case-study surface transportation infrastructure public-private partnership (P3) projects generally met or exceeded the objectives set by their sponsoring public agencies.

Based on documentary sources and stakeholder interviews, public-sector P3 objectives across the six study cases primarily targeted **cost reductions for the public sector** and/or **faster project completion times** compared to traditional procurement, ultimately generating substantial improvements across most of the study cases. In addition, public agencies effectively engaged P3 delivery approaches to:

1. **Increase access to private sector expertise and innovation**. For example, Texas' LBJ TEXpress Lanes project achieved substantial cost reductions after the P3 procurement process enabled an alternative private sector design proposal. Pursuing private sector expertise and innovation early in the procurement process tended to generate the strongest outcomes.
2. **Accelerate project delivery**. Colorado´s US 36 Express Lanes case, for instance, employed a P3 approach to overcome the twenty-year funding delay expected under traditional procurement. P3 approaches similarly accelerated Virginia's I-495 Capital Beltway HOT Lanes and I-95 HOV/HOT Lanes projects by at least six years, likely more.
3. **Improve cost and schedule certainty**. For instance, P3 approaches delivered Virginia's I-495 and I-95 projects on-time and within-budget. In cases with late delivery, P3 incentive structures – including more than $41 million in penalties for Florida´s Port of Miami (POM) Tunnel concessionaire – helped minimize delays. Cost certainty also proved important for preserving the Presidio Parkway project's complex, multi-party consortium.
4. **Manage project risks**. Virginia, for example, transferred revenue risks to the private sector for its I-495 and I-95 HOT Lanes projects. Florida, similarly, shared the POM Tunnel project's geotechnical risks with the private sector. Strong emphases on risk-transfer objectives tended to produce the strongest outcomes, although political risk management remained underdeveloped in several cases.
5. **Promote broader transit and development opportunities**. The P3 approach enabled Colorado's U.S. 36 Express Lanes project, for example, to transition from a highway project to a multimodal project including improved transit and bike facilities. Similar transit and local development objectives may prove especially beneficial for future projects.

The research also suggests that the public sector can improve P3 outcomes by:

I. **Providing comparative metrics for traditionally procured and P3-delivered projects**. Confronted with traditional procurement challenges and limited knowledge regarding potential P3 benefits, citizens and decision makers would benefit from comparative performance metrics developed across state departments of transportation.

II. **Providing citizen-friendly project information**. Given P3 projects' often sophisticated legal structures spanning many years, stakeholders, and processes, friendly and accessible communication approaches, as exemplified by California´s Presidio Parkway Phase II project website, can improve citizen engagement and public-sector accountability.

III. **Promoting intergovernmental knowledge exchange**. As surface transportation infrastructure projects become increasingly complex, governments should consider exchanging multi-agency process best practices to improve project delivery for both P3 and traditionally procured projects.

To access the full report, please see the Center's website: http://p3policy.gmu.edu. To learn more about the study or to request a briefing, contact Center Director Dr. Jonathan Gifford, at jgifford@gmu.edu.

Project/Report Title:
U.S. Surface Transportation Public-Private Partnerships: Objectives and Evidence

Authors:
Lisardo Bolaños
Morghan Transue
Porter Wheeler
Jonathan L. Gifford

Institution:
Center for Transportation Public-Private Partnership Policy
Schar School of Policy & Government
George Mason University
3351 N. Fairfax Drive MS3B1
Arlington, VA 22201 U.S.A.

ABSTRACT

Effective public-private partnership (P3) policy evaluations must acknowledge the multiple and varied reasons why public agencies pursue alternative procurement approaches. While economic efficiency typically ranks high among evaluation criteria, it rarely represents a public agency's sole or primary P3 objective. As a result, the following research conducts six U.S. surface transportation P3 case studies to identify the objectives pursued and the evidence available for effectiveness evaluations. The case findings demonstrate that the studied agencies pursued 1) private sector funding and financing; 2) private sector expertise and innovation; 3) accelerated project delivery; 4) cost, schedule, and quality certainty; 5) risk transfer and management; and 6) broader transit and development opportunities. The public agencies largely achieved these goals but might benefit by a) pursuing private-sector expertise and innovation earlier; b) elevating risk transfer objectives; c) incorporating broader transit, local development, and value capture opportunities; and d) improving outcome measurement, analysis, and transparency practices.

INTRODUCTION

As the public sector struggles to keep pace with growing infrastructure maintenance, rehabilitation, and improvement requirements, public-private partnerships (P3s) can offer a potential solution, leveraging scarce public funding and delivering infrastructure improvements (and associated public benefits) through the innovation, efficiency, and capital resources available in the private sector. Such partnerships typically contrast with traditional design-bid-build (DBB) procurement processes where the public sector agency develops a more or less complete design, usually with support from consulting engineers, and then conducts a competitive solicitation to select a construction firm to build the facility. Instead, P3s allow private-sector partners to take on design, construction, financing, operations, and/or maintenance responsibilities through more inclusive contractual agreements. Such contract types include, but are not limited to design-build (DB), design-build-finance (DBF), design-build-finance-operate (DBFO), and design-build-finance-operate-maintain (DBFOM).

Given public agencies' desire to consolidate contracting steps, shift design and operational risks to private partners, improve cost certainty, incorporate operations and maintenance, and accelerate project completion, P3s have become an increasingly popular delivery approach for infrastructure and related services within the United States. P3 procurement remains a relatively new approach however, with limited evaluation literature available to support policymakers and their decision-making. Existing evaluations have tended to focus on economic efficiency and/or financial metrics, depending on value for money (VfM) studies in particular along with occasional benefit-cost analyses. Such evaluations often assume an idealized public policy formation process, envisioning public policymakers defining clear policy objectives, ranking alternative approaches, and selecting the best option.[1,2] In practice, however, policymakers often bundle several objectives together to accommodate varied missions, priorities, constraints, and tradeoffs.[3] On occasion, policies develop without clearly specified objectives.[4–7] As a result, evaluators can risk missing important outcomes if they impose assumed economic motivations when studying projects. Such assumptions present particular concern given how complementary and/or competing goals can interact to influence benefit delivery.

P3 infrastructure projects present particular evaluation challenges given how they typically involve large scopes, multiple objectives, and large variations between projects, partners, and environments. P3s, by definition, attempt to unite both public and private sector objectives[8] amid broader societal concerns and institutional frameworks.[9] This typically generates a complex and multi-dimensional objective set that complicates evaluation. The objectives driving P3 adoption can include but are not limited to:[10–17]

- Providing relief from traffic congestion along specific corridors through traffic management and/or capacity expansions;
- Overcoming challenges presented by aging infrastructure systems;
- Overcoming annual budget constraints to enable large projects
- Transferring cost and schedule risks;
- Accelerating delivery schedules;
- Increasing project cost certainty and schedule certainty;
- Providing access to private sector expertise;

- Providing access to incremental capital sources;
- Exchanging project operations for large upfront payments;
- Refinancing existing projects and restructuring debt;
- Providing facility operation and maintenance assurances; and
- Incentivizing life-cycle cost management and risk sharing innovation;

Given this broad range of objectives, P3 evaluations focusing solely on financial and/or economic outcomes risk overlooking public agencies' primary objectives and underestimating true outcomes. Such evaluations threaten to undermine P3 procurement approaches by missing key agency objectives.

PURPOSE AND SCOPE

Study Purpose & Objectives

Given the P3 evaluation literature's limitations, this research project pursues three objectives. First, it aims to identify and analyze the broad range of public-sector objectives underlying surface transportation P3 projects in the U.S. Private-sector P3 objectives fell outside this study's scope. Second, the study aims to identify and evaluate the data sources available for measuring output and outcome measures for each of these public-sector objectives as appropriate for each project. Finally, the project aims to provide summary findings and recommendations regarding public-sector P3 objectives, data sources, and effectiveness evaluation for policymakers and practitioners considering P3 applications for infrastructure development and renewal.

Study Scope

Given the wide breadth of P3 projects and applications undertaken worldwide, the present research narrows its focus using three criteria. First, the research focused solely on U.S. surface transportation infrastructure projects, namely highway and transit projects, to make best use of the research center´s expertise and to provide insights for the U.S. decision-making audience. Second, the analysis restricts its focus to projects reaching financial close after 2003 to reflect the more mature P3 markets that[16] followed first-stage discovery processes and legal framework developments in pioneering states like Virginia and Texas. This scope also produced projects with more publically available information and more engaged public officials for participant interviews. Third, the study team limited the study scope to the construction contracts and long-term engagements that provide the greatest latitude for private engagement and innovation, namely design-build-finance-operate-maintain (DBFOM), DBFM, and DBOM contracts.

Based on these criteria, the research team identified twenty-two US surface transportation P3 projects for analysis (see Appendix A). In order to provide detailed analyses and actionable policy recommendations, the research team selected six of the twenty-two projects to evaluate for this initial exploratory study, weighing evaluation feasibility and costs when making the selections.[18] Particular attention was paid to the Commonwealth of Virginia's experience and to feedback from the Virginia Department of Transportation (VDOT). The selection process

resulted in the following six cases for study: Virginia's I-495 Express Lanes; Colorado's U.S. 36 Express Lanes; Virginia's I-95 Express Lanes; Florida's Port of Miami Tunnel; California's Presidio Parkway, Phase II; and Texas' LBJ TEXpress Lanes. The selected cases also served to pilot test the research team's document- and interview-based case methodology in advance of a full twenty-two-project study.

METHODS

In order to identify public-sector objectives, evaluate data sources, and provide recommendations in keeping with the study objectives discussed above, the research team undertook a case study approach to evaluate the six U.S. surface transportation P3 projects selected for preliminary study. This methodology follows an approach used to measure European P3 outcomes, although the present research does not develop performance indicators.[19]

Analytical data for this study derived from two sources: published resources and participant interviews. Published sources included academic articles, news reports, and government records as available. Public-sector documents - including environmental impact statements, cost-benefit analyses, audits, and value-for-money studies - received particular attention when available. Unfortunately, the public record can be very limited and can vary greatly by project and jurisdiction. In addition, public records might not always reflect the nuanced and informal processes underlying public decision-making. As a result, the research team also conducted semi-structured interviews (see Appendix B for the interview instrument) to solicit project objectives, results, and perceptions from key stakeholders, focusing primarily on sponsoring agencies and concessionaires. The George Mason University Institutional Review Board deemed the survey to be exempt from the university's human subjects review and protection process.

Employing an extensive contact network, the team identified senior public officials responsible for project oversight, public engagement, and financial evaluation (e.g. secretaries of transportation, chief financial officers, and project managers), conducting semi-structured interviews with as many as possible (hereafter referred to as "interview respondents" or "interviewees"). While issues of memory, personal interest, and professional interest can introduce data limitations, such interviews can provide valuable perspective when considered carefully and in combination with other sources. When a project involved multiple public partners, the team endeavored to contact officials from all relevant agencies. Although the present research focused on public-sector objectives, high-level officials from pertinent private concessionaires were also contacted and interviewed when possible to provide a more exhaustive view. The interview respondents' schedules often precluded timely interviews and many stakeholders had relocated or refocused during the years following their projects. To overcome such obstacles, the team pursued an array of contacts from the Center for Transportation Public-Private Partnership Policy's advisory board and from past consultancies. Support from the Association for the Improvement of American Infrastructure (AIAI) also facilitated participant responsiveness. Appendix C provides a full interview participant list. To encourage forthright discussion, the research team did not record the interviews or attribute specific statements to particular interviewees.

Before analyzing all six of the selected cases, the team selected two projects – Virginia's I-495 Express Lanes and Colorado's U.S. 36 Express Lanes – for small-scale preliminary study. These pilot studies identified important research questions for the remaining cases and helped streamline the interview instrument (see Appendix B). Having analyzed the remaining four projects – Virginia's I-95 Express Lanes, Florida's Port of Miami Tunnel, California's Presidio Parkway, and Texas' LBJ TEXpress Lanes – the team hopes to extend its research methodology to evaluate the final sixteen P3 projects identified in Appendix A to provide a complete analysis.

RESULTS

The following section provides case study findings for the six U.S. surface transportation projects investigated under the present research:

- Virginia's I-495 Express Lanes
- Colorado's U.S. 36 Express Lanes
- Florida's Port of Miami Tunnel
- Virginia's I-95 Express Lanes
- California's Presidio Parkway
- Texas' LBJ TEXpress Lanes

Each case provides a summary of the project's origins and P3 history, followed by an analysis of the project's objectives and outcomes as described by the published documentation and interview respondents. The case studies then conclude by discussing objectives identified for future projects based on the case experience. Appendix D provides summary tables for each case's location, participants, contract characteristics, funding and financial characteristics, procurement history, and risk allocation structure.

I-495 Capital Beltway HOT Lanes

Project Origin

Interstate 495 (I-495), also known as the Capital Beltway, is a 64-mile roadway ringing Washington, D.C. through the state of Maryland and the Commonwealth of Virginia. Funded primarily through the U.S. Highway Trust Fund, construction began in 1957 and the project opened in 1964 with two lanes running in each direction. The roadway was later expanded to four lanes in 1977. Since then, strong population growth, particularly around Tysons Corner, Virginia, driven by jobs created through increased government contracting,[20,21] has made the Washington Metropolitan Area, including Northern Virginia's portion of the I-495 Beltway, among the top ten most congested cities in the U.S. dating back to the early 1980s.[22,23]

Facing these challenges, the Virginia Department of Transportation (VDOT) conducted a Major Investment Study (MIS) in 1997, concluding that corridor improvements should promote high occupancy vehicle (HOV) travel and bus transit. The study also recommended that the Beltway be widened from 8 lanes to 16 lanes between the American Legion Bridge and the Springfield Interchange using traditional state-funded procurement. Public hearings held in May 2002, however, revealed strong public opposition to the project's $2.5 billion price tag and

significant land acquisition requirements – including roughly 350 residences, a new Capital One bank headquarters site, and 31 other businesses.

P3 Origin

Recognizing VDOT's mounting Beltway expansion challenges, the Fluor Corporation submitted an unsolicited conceptual project development proposal in June 2002. Virginia statutes allow public agencies to accept unsolicited proposals from private-sector entities based on a provision in the Public-Private Transportation Act of 1995 (PPTA).[24] In keeping with PPTA Implementation Guidelines, VDOT responded by creating an advisory committee and inviting competing proposals.[25] When no proposals were forthcoming within 45 days, VDOT asked Fluor to present a detailed proposal.

Fluor's proposal differed significantly from VDOT´s original 1997 I-495 expansion proposal. First, it aimed to build within the existing right of way. To accomplish this, the proposal reduced lane expansions to 12 lanes (4 new lanes, 2 each direction) from the original 16-lane plan (8 new lanes, 4 each direction). This change required the demolition of only seven houses versus the original 350. Second, the proposal introduced High Occupancy Tolling (HOT) Lanes, including open road toll (ORT) collection and dynamic toll pricing, aiming to increase project revenues and traffic speeds throughout the corridor. These tolling additions derived from Transurban Operations Inc., who joined Fluor's concessionaire team in 2004 after the companies partnered to present VDOT with an I-95 Bus Rapid Transit (BRT)/HOT lanes proposal in May 2004.[26,27] The proposal also added direct entrances from the Beltway into Tyson´s Corner, a major commercial center, to increase traffic flow and associated revenue.

VDOT and the private partners worked out the project details between 2002 and 2007. For example, the corridor alignment required revisions to reflect construction plans within the existing right of way. Fluor and Transurban obtained all required permits prior to construction and VDOT completed the National Environmental Policy Act (NEPA) process.

Commercial and financial close occurred in December 2007 with a Comprehensive Agreement signed between VDOT and Capital Beltway Express, (CBE) LLC. This Special Purpose Vehicle (SPV) – a company created to isolate the P3 project and its parent companies from one another's risks – included both Fluor and Transurban. The partners signed a DBFOM contract making CBE responsible for the highway's design, construction, financing, operation, and maintenance for 75 years following completion. According to the executed Comprehensive Agreement, the private concessionaire would a) expand a 14-mile stretch of highway to 12 lanes from 8 lanes; b) reconstruct the 8 preexisting general purpose lanes; c) incorporate High-Occupancy Tolling (HOT) into 4 of the 12 lanes; d) replace 58 bridges and reconstruct 10 interchanges; and e) add pedestrian and bicycle facility improvements. Construction began in July 2008 and the express lanes opened to the public four years later with early completion in November 2012.

Project funding sources totaled $2.1 billion, divided into 16.8% private equity, 28.5% Activity Bonds (tax-exempt bonds issued by the private concessionaire), 28.5% TIFIA loan, 23.9% VDOT funds, and 2.3% interest income (see Appendix D). With more than half of its

funding deriving from bonds and loans, the project relies on dynamically priced toll revenue. This dynamic toll pricing varies with current traffic conditions, without an upper limit, to accommodate the 45 mile-per-hour minimum speed defined in the comprehensive agreement. The agreement also includes a revenue-sharing scheme between the public and private partners. If traffic exceeds projections or the private partners refinance the project, VDOT can claim 5 to 30% of the gross revenues. If, on the other hand, HOV traffic reaches 24% or more of HOT lane traffic, VDOT will pay 70% of the concessionaire's lost toll revenue while traffic flow exceeds 3,200 vehicles per hour. This compensation mechanism could present a future contingent liability for VDOT, but the revenue sharing mechanism is expected to provide partial compensation.[28]

P3 Objectives & Outcomes

The following section describes the I-495 Express Lanes project's goals and outcomes to date, as described by public documents and interviews conducted with public sector and concessionaire interview respondents.

Congestion Management and User Experiences

According to the public sector interviewees, VDOT primarily aimed to **manage congestion** and **improve user experiences** along the I-495 corridor in Northern Virginia. Project documents, including the Final Environmental Impact Statement, support this view. The Final EIS pointed out that the I-495 improvements' should provide safer and more efficient travel; ease Beltway congestion and reduce "cut-through" traffic on local roadways and neighborhood streets; and meet the growing population's transportation needs.[23]

According to the interview respondents, the Express Lanes project has met VDOT's congestion-reduction objective by creating "congestion-free" HOT/HOV lanes and adding transit improvements. The Express Lanes improved driving-time certainty for HOT Lane customers and provided similar benefits for transit and HOV travelers. Specific HOT lane benefits include:[29]

- A 17-minute average timesaving during peak periods, compared to the general purpose lanes.
- Up to two-hour single-trip time savings compared to the general purpose lanes.
- An 8-15% increase in HOV usage (toll-exempt trips).
- A 33-minute average incident clearing time.
- 75% customer satisfaction in drivers´ satisfaction surveys.

Toll facility traffic diversions and the project's bridge, pavement, and highway design upgrades have also improved traffic flow in the general-purpose lanes. Additional benefits will also accrue from P3-specific direct access ramps connecting important business and residential sectors (e.g., Tysons Corner).

Access to Private Sector Expertise

Congestion management and user experience benefits would derive from the infrastructure project regardless of its delivery method, but the P3 approach's **access to private sector expertise** enabled the electronic tolling system, managed lanes, and increased HOV travel. For example, several interviewees stressed that **toll management** presented an important motivating factor behind VDOT's decision to pursue P3 procurement. HOT lanes technologies offered one way for VDOT to improve tolling enforcement,[30] but tolling had proved challenging in the past. Some interview respondents noted VDOT's limited tolling capacity, electronic tolling's infancy during project development, and the private sector's comparatively stronger experience.

As a result, the comprehensive agreement transferred **enforcement risks** to the private concessionaire. The concessionaire has since reported that only 3% of all Express Lanes trips (I-495 and I-95, see the I-95 case below) went unpaid, although the invoice stage collected on most of these. Of the unpaid trips, 2.5% end up in court.[31] To improve public relations and manage political risk, the concessionaire introduced a first-time forgiveness plan and a self-imposed court fees cap. Moreover, public agencies were concerned that congestion pricing would face political opposition, limiting their ability to recoup costs and comply with the 45 mile-per-hour minimum speed included in the comprehensive agreement. Consequently, the I-495 Comprehensive Agreement transferred toll collection and **technology deployment risks** to the private concessionaire, requiring that the private sector install and operate the system without additional compensation should the system encounter problems. With this cost constraint and the private concessionaire's toll revenue incentive, the agreement accelerated a superior and innovative technological solution.

Project Acceleration

Fluor´s unsolicited proposal presented an alternative project design that greatly reduced the number of affected residences, reducing the public opposition complicating VDOT's original expansion plan and **accelerating the project** compared to the timeline expected under traditional design-bid-build (DBB) procurement. The private partners also ensured this acceleration by implementing a robust communication strategy including community meetings. The P3 approach's significant private-sector financing also accelerated the project compared to the timeline expected under a traditional DBB delivery process.

In order to ensure access to low-interest debt, Virginia had established the Debt Capacity Advisory Committee (DCAC) in 1991 to maintain the Commonwealth´s AAA credit rating. The DCAC's model employs a non-binding debt-service ceiling equaling 5% of state revenues. Resulting reports recommended that the Commonwealth's maximum additional debt authorization equal $840 million for 2008, $370 million for 2009, $0 for 2010, $363 million for 2011, $466 million for 2012, $537 million for 2013, and $560 million for 2014.[32–38] The project's predicted $1.7 billion design-build cost would have required nearly five years' worth of the commonwealth's maximum allowable debt and several years delay. This delay would only increase if the Commonwealth committed funds to other projects like the I-95 HOV/HOT Lanes project discussed below. While the original project scope and traditional funding sources

suggest that VDOT felt able to embark on the improvements without compromising the state's AAA bond rating, this would have required several years' delay as the agency accumulated sufficient funds to proceed under a traditional delivery mechanism. Virginia´s Six Year Capital Plan (2008-2014) showed $18.4 billion in requested capital projects for the 2008 to 2014 period but only $7.7 billion in planned capital outlays.[39] As such, delivering the I-495 project via DBB would have required 26% of the Commonwealth's total six-year capital budget.

Instead, the P3 approach leveraged private-sector financial resources to accelerate the project and incorporated favorable contract provisions for the public agency. To make the project financially viable for VDOT and prevent the agency from absorbing the concessionaire's debt responsibilities in future, the I-495 Express Lanes Comprehensive Agreement shifted **revenue risk** entirely to the private sector. VDOT and the Commonwealth of Virginia avoided any contractual obligation to pay bondholders and lenders, including TIFIA, or to compensate the private concessionaire. This risk transfer relied on the private concessionaire's profit motivation to contain costs and generate adequate toll revenues to pay back any outstanding debt. Indeed, when early demand fell short of expectations, Transurban found it necessary to infuse an additional $280 million in equity and release $150 million in reserves into the project to stabilize its finances and debt service.[40,41] HOT-lane revenues reached 2012 expected levels only very recently, yet VDOT has not added funding or faced financial risk.

Cost Certainty & Time to Completion

The literature recognizes that P3s can help the public sector manage cost and schedule risks by conditioning payments and/or toll collection on facility delivery in accordance with predefined specifications.[12,42] One interviewee mentioned that VDOT worried about delivering the project within-budget given how construction would occur in a highly trafficked commercial area where any accidents would increase costs and delay delivery. As a result, the I-495 Express Lanes comprehensive agreement included toll-revenue incentives in a contract that bundled design and construction activities into a single, fixed-cost contract. This differs from DBB contracts (the traditional delivery mechanism) that typically involve separate contracts for design and construction activities.

Consolidating responsibility for component delivery with one party for a fixed sum reduces the contractor claims and change orders that arise from discrepancies and uncertain events.[43] Given these features, the private concessionaire preferred to absorb unexpected costs (e.g., water runoff problems) in order to open quickly and begin toll collection. In contrast, participants operating under traditional procurement can spend years disputing costs associated with unexpected construction expenses or delays. Furthermore, the DBFOM contract incentivizes the private partner to finish construction quickly in order collect tolls at the earliest possible date. Ultimately, the I-495 Express Lanes P3 met its estimated $1.7 billion design-build cost and completed construction 2 months faster than the contract's 5-year requirement.

VDOT also placed high priority on traffic flow during the project's construction phase, particularly along the active Tysons Corner corridor carrying 200,000 vehicles per day. As a result, the Comprehensive Agreement transferred **construction risk** to the private sector, establishing a fixed price for design and construction such that the concessionaire would take on

any additional costs arising from accidents or traffic management. Looking back, the interview respondents recognized that traffic moved well during the construction process thanks to constant coordination between the private concessionaire, regional authorities, and the area's main shopping mall, as well as an active communication strategy including portable electronic message signs.[44] VDOT also recognized, however, that the concessionaire placed higher priority on HOT lane completion, leaving some general purpose lane, ramp, and storm water pond improvements until after the project had reached Substantial Completion.[45]

Objectives for Future Projects

According to the interview respondents, VDOT's I-495 Express Lanes P3 experience points to three objectives not incorporated into the project but which may prove beneficial for future projects. First, the I-495 project's **transit development** objectives remained limited to toll exemptions for mass transit vehicles and commuter buses. The agency has since expanded its transit objectives in subsequent P3 projects, including the forthcoming Transform I-66 Outside the Beltway project, which will allocate a portion of its toll collection to support multimodal transportation improvements, including buses and Metrorail.[46,47]

Second, the I-495 Express Lanes P3 approach could have introduced special tax districts to capture capital gains from the surrounding real estate and dedicate these additional resources to diminish VDOT´s contribution and/or diminish the corridor's tolls. Future projects will likely employ this **value capture** approach to generate greater value from their transportation infrastructure investments.

Finally, interview respondents recognized that given the I-495 project's early role in Virginia's P3 program and procurement process, future projects might increase competition to **encourage innovation**, not only among private teams but also between procurement approaches, including public sector procurement, as occurred in the subsequent I-66 Outside the Beltway procurement process. Again, the I-66 Outside the Beltway project has incorporated these objectives, including conducting a Value for Money study and incorporating a competitive process considering technical factors like customer service and structure durability.[48]

U.S. 36 Express Lanes Phase II

Project Origin

Colorado's 18-mile, four-lane Boulder-Denver Turnpike connects northwestern Denver to Boulder, running from Interstate 25 (I-25) in Adams County to Foothills Parkway/Table Mesa Drive in Boulder. Opened as a toll road in 1951, the roadway experienced higher than expected demand as Boulder's population grew, allowing the state to repay its construction bonds in 1967 (13 years sooner than expected) and remove the tolls a year later.[49] Over time, the road was integrated into the longer U.S. Route 36 crossing Colorado East to West.

As the local population continued to grow over the following decades, the Colorado Department of Transportation (CDOT) increased the number of interchanges from 1 to 10,[50] roadway demand increased, and congestion worsened. Despite showing one of the highest

transit ridership rates in the Denver-Boulder Regional Transportation District (RTD),[51] the corridor regularly faced 3 to 4 hour daily congestion delays over the last decade, carrying 80,000 to 100,000 daily vehicle trips and operating at nearly 90% of its capacity.[51,52] Projections estimated that daily vehicle trips would grow to 165,000 by 2035, pushing the corridor past 100% of its operational capacity.[53] New facilities, by contrast, are typically designed to accommodate 85% of their total projected demand.[54]

Because regional population projections predicted increased travel demand, public agencies began studying infrastructure solutions as far back as the 1960s. A 1983 study, for example, evaluated rapid transit feasibility along the U.S. 36 corridor. Similarly, the RTD's 2003 U.S. 36 Major Investment Study evaluated Bus Rapid Transit and HOV lane plans.[51] Such plans aimed to improve mobility along the U.S. 36 corridor by increasing road capacity and expanding travel alternatives. Ultimately, five improvements were deemed necessary to meet corridor capacity, congestion management, and safety requirements: 1) increased trip capacity accommodating 12,200 projected person-trips per day by 2035; 2) expanded interchange capacity; 3) congestion reduction; 4) multi-modal transit and bikeway developments; and 5) highway facility updates.[51,55] Following a comment period, CDOT organized a Preferred Alternative Committee (PAC), composed of agency representatives, elected officials, and technical staff from local jurisdictions, to review project alternatives for the corridor. After seven months, the PAC recommended a Combined Alternative Package in July 2008 including[55]

- One buffer-separated managed lane in each direction, separated from the general-purpose lanes, allowing bus and HOV traffic without tolls. Single-occupant vehicles would access any remaining capacity through dynamically priced tolls.
- Auxiliary lanes between most interchanges, beginning at highway on-ramps and terminating at the following interchange off-ramps as exit-only lanes.
- Bikeways, including bike lanes, bike routes, and/or multi-use paths ranging from street sections reserved exclusively for bicycle use to physically separated pathways designated for multiple non-motorized users (including pedestrians).
- Enhanced bus service and facilities, including Bus Rapid Transit (BRT) stations and associated platforms located in the highway median or in highway on- and off-ramps.
- Alternative transportation strategies requiring limited capital investments, including minor intersection or interchange improvements, bus route structuring, and Intelligent Transportation System (ITS) improvements.

P3 Origin

CDOT faced severe funding constraints when it came to maintaining and expanding Colorado´s transportation system. First, fuel tax revenues had stagnated. Strong public opposition hampered lawmakers' ability to raise taxes, supported by the 1992 Taxpayer Bill of Rights (TABOR) amendment to Colorado's constitution limiting state and local revenue and expenditure growth.[56] Automotive fuel efficiency improvements further dampened the revenue stream. Second, increasing nation-wide infrastructure costs due to increased input prices, slow construction productivity growth, and regulatory restrictions[57] exacerbated funding constraints as transportation demand grew throughout the state. As a result, CDOT estimated that its transportation expansion and maintenance costs would exceed its roughly $1 billion budget (2007-2008) by $600 million annually.[54]

Given these funding constraints, CDOT could not procure its U.S. 36 improvement project using a design-bid-build (DBB) or design-build (DB) contract. According to one interviewee, CDOT possessed only about one third of the money needed to move the project forward. Even when CDOT and the Denver RTD pooled their resources to support a multimodal approach, they lacked sufficient resources to proceed. As a result, they divided the project into two phases.

Phase I involved a design-build (DB) contract covering a 10-mile stretch running from Pecos Street in Denver to 88th Street in Louisville, Colorado. This phase included: 1) five bridge replacements, 2) a bikeway, 3) Bus Rapid Transit (BRT) improvements, 4) general-purpose lane reconstruction and pavement replacement, and 5) the construction of one HOT lane in each direction. Multiple government agencies provided public funding for the project, including CDOT, RTD, the Denver Regional Council of Governments (DRCG), the county of Broomfield, and the cities of Broomfield and Westminster. The project also accessed a Transportation Investment Generating Economic Recovery (TIGER) grant from the U.S. Department of Transportation to complete studies and cover costs associated with obtaining a Transportation Infrastructure Finance and Innovation Act (TIFIA) loan backed by the HOT lanes' toll revenues. The TIFIA process also raised the possibility for Phase II financing using a P3 structure with a private borrower.[58] Phase I construction began in July 2012 and the facilities opened in June 2015, several months later than the expected December 2014 opening date.[59,60]

For Phase II, CDOT employed Value for Money (VfM) analyses to evaluate procurement options,[54] namely design-build (DB), design-build-finance-operate-maintain (DBFOM) with availability payments, and DBFOM with revenue risk. The traditional procurement approach's up to twenty–year projected delivery schedule proved too slow. Similarly, CDOT rejected the availability payment model since it implied debt increases, a substantial hurdle under TABOR restrictions. This left the revenue risk DBFOM approach.

Fortunately, the Colorado Senate had considered alternative infrastructure financing and delivery methods, approving the Funding Advancements for Surface Transportation and Economic Recovery Act (FASTER) in March 2009. This legislation increased dedicated government revenues for transportation infrastructure and launched the High Performance Transportation Enterprise (HPTE). This state-owned enterprise, run by CDOT, possessed authority to engage in public-private partnerships and other alternative delivery methods.[61] Most importantly, unlike CDOT, it was exempt from TABOR's debt financing restrictions. In addition, according to interviewees it addressed perceptions regarding inertia and P3 hostility stemming from CDOT's long history with design-bid-build (DBB) procurement.

HPTE began the Phase II procurement process in February 2012, issuing a Request for Qualifications (RFQ), to which four teams responded. The four teams were: 1) Plenary Roads Denver: The Plenary Group, Ames Construction, Inc., Granite Construction, HDR, Transfield Services and Goldman Sachs; 2) Denver Access Partners: Cintra Infraestructuras, S.A., Ferrovial Agroman US Corp., Lawrence Construction Company, and AZTEC Engineering Group, Inc.; 3) US 36 Development Partners: Isolux Corsán, Terracare Associates, Atkins, Bank of Tokyo-Mitsubishi UFJ, and THB Advisory; and 4) Accelerate 36 Consortium: Balfour Beatty Capital,

Edgemoor Infrastructure and Real Estate, Brisa, Atkinson Construction, Parsons Brinckerhoff, and Scotiabank. This last team was not shortlisted.

CDOT then issued a Request for Proposals (RFP) in October 2012. The selection process weighed financial aspects heavily (65%), considering subsidy requirements especially. The remaining selection criteria evaluated the proposals' technical aspects (35%). Based on this process, HPTE selected Plenary Roads Denver as the "best value" preferred bidder in April 2013. This Special Purpose Vehicle (SPV) – a company created to isolate the P3 project and its parent companies from one another's risks – included The Plenary Group, Ames Construction, Inc., Granite Construction, HDR, Transfield Services, and Goldman Sachs. The project's VfM analysis favored its selection based on the following criteria:

- Delivering the project with the lowest upfront subsidy
- Transferring risks to the concessionaire
- Relieving CDOT of Phase I operation and maintenance obligations
- Constructing Phase II Managed Lanes and reconstructing the general purpose lanes in an effective and economical way
- Facilitating RTD's Bus Rapid Transit programs
- Optimizing long-term asset conditions
- Minimizing public inconvenience and maximizing worker and traveler safety.

Plenary Roads Denver and the public partners signed the final Phase II DBFOM agreement in June 2013, giving the private partner responsibility for project design, construction, financing, operation, and maintenance over 50 years. For a 5.1-mile segment of the corridor, the private partners would expand the highway from 4 to 6 lanes by adding one high-occupancy toll (HOT) lane in each direction, improve Bus Rapid Transit (BRT), and add a bikeway. In addition, the private partner would take over operation and maintenance, including snow and ice removal, across the two HOT lanes and the four general-purpose lanes and take responsibility for Phase I debt. In the process, the P3 agreement transferred several project risks to the private concessionaire, including

- Project design and construction risks, both financial (costs) and scheduling (time)
- Roadway operation and maintenance risks (under a 50-year warranty)
- Snow and ice removal risks (already tested by a heavy winter snow storm after the deal was signed);
- Traffic and toll-dependent revenue risks; and
- Repayment risk for both TIFIA loans, removing CDOT´s debt responsibility for both phase I and phase II

Phase II construction began in March 2015, with the facility opening gradually, with a modest delay, throughout early 2016. Phase II funding totaled $258.6 million including 8.0% private equity, 8.0% Private Activity Bonds (tax-exempt bonds issued by the private concessionaire), 23.2% TIFIA loans, 19.2% HPTE funds, 11.8% RTD sales tax revenue, 5.8% federal funds, 7.3% state funds, 4.2% local funds., and 12.6% other financing (see Appendix D). Managed lane tolls from Phase I, Phase II, and a segment of I-25 provide revenue for debt service. Toll rates vary by time of day based on pre-set schedule. The toll rates remain subject to the HPTE Board approval and the private concessionaire shares revenues with HPTE when its return on investment exceeds 13.68%.

P3 Objectives & Outcomes

The following section describes the U.S. 36 Express Lanes project's goals and outcomes to date, as described by public documents and interviews conducted with public sector and concessionaire interview respondents. Fortunately, Colorado has released both VfM analyses and a legislative audit evaluating the P3 project's marginal impact compared to traditional delivery.[54,62] The audit in particular, conducted on the Legislative Audit Committee's behalf, recognizes the project's substantial net benefits for the State.[62]

Overcoming Debt Ceilings, Project Acceleration

P3 delivery approaches can help the public sector overcome debt ceiling limitations[10] by providing alternative capital sources – private equity and debt – thereby diminishing the public sector's upfront financial commitments. The VfM study and interviewees estimate that by tapping private sector resources and overcoming TABOR's debt-limitations, the P3 approach **accelerated project delivery** by ten to twenty years compared to traditional procurement.[54] Moreover, the state's efforts to include private resources likely attracted vital federal support.

In addition to leveraging private-sector financial resources to accelerate the project, the P3 approach incorporated favorable contract provisions for the public agencies. To make the project financially viable for CDOT and HPTE, the U.S. 36 Phase II P3 agreement shifted revenue risk and responsibility for repaying both the Phase I and Phase II loans to the private sector partners. Since the facility opened, traffic flows have met Plenary´s projections despite a sharp increase in bus ridership. Interviewees believed this occurred because new bus riders represent potential HOV carpoolers rather than HOT lane drivers. In addition, the P3 agreement includes provisions where the SPV shares an increasing proportion of its revenues with HPTE if its return on investment exceeds 13.68%. Rather than including a non-compete clause preventing the construction of competing infrastructure affecting the P3's revenue streams, the deal also includes a compensation mechanism for the concessionaire should CDOT and HPTE decide to build transportation infrastructure affecting traffic flow on U.S. 36. The public sector may also compensate Plenary if the HPTE Board rejects toll changes, leaving the managed lanes unable to meet performance expectations.

Trip Capacity, Congestion & Infrastructure Conditions

By accelerating Phase II project delivery and attracting vital federal and private-sector resources, the P3 approach enabled CDOT and HPTE to increase trip capacity, reduce congestion, and improve infrastructure conditions. In addition, Plenary Roads Denver introduced several alternate technical concepts (ATCs) to improve road quality, including pavement designs, profiling, drainage, and bikeway improvements and extensions. The concessionaire applied these improvements to the general-purpose lanes in addition to the managed lanes, **increasing peak hour travel speeds** by 20 to 29% for commuters across all travel lanes.[61]

Expanding Travel Options and Improving Transit Efficiency

The literature recognizes that P3s can help the public sector mitigate congestion by enabling road pricing and providing funds for high-level Bus Rapid Transit service.[63] In the U.S. 36 case, CDOT's capacity improvement plans coincided with RTD's inability to fund a desired light rail facility along the corridor. The P3 structure facilitated an alternative BRT approach using HOT lanes, adding **transit improvements** to the project's key objectives. According to public-sector officials, bus rides have increased 45% along the corridor since the HOT lanes opened in 2016 and bus travel time reliability also improved. The Phase II project also expanded the corridor's bikeways beyond Phase I efforts.

Cost & Time to Completion

The literature also recognizes that P3s can help the public sector manage cost and scheduling risks,[42,64,65] particularly through design-build contracts that bundle design and construction activities into single, fixed cost contracts, in contrast to traditional design-bid-build approaches that separate these activities into two separate contracts. By consolidating responsibility for component delivery with one party for a fixed sum, such contracts tend to reduce the contractor claims and change orders arising from discrepancies and uncertain events.[43] The U.S. 36 Phase II project employed this approach in its DBFOM agreement and **the project was delivered within-budget**. However, sources disagree regarding whether the concessionaire delivered the project on time; Phase II's opening was delayed by about two weeks, from late December 2015 to mid-January 2016, although the concessionaire contends that the lanes were open to traffic in 2015. The delivery delay derived from a major and unexpected flooding event that affected Colorado in September 2013.[66,67] The flooding delayed Phase I construction by about six months as contractors were diverted to repair, rebuild, and reopen hundreds of roadway miles throughout the state. As the resulting workflow disruptions spilled into winter, the flood generated a nearly one-year Phase I delay. Since both phases shared the same design-build team – Ames Construction Inc. and Granite Construction Inc. – this delay presented spillover effects for Phase II. The flood also triggered updates to floodplain maps and hydraulic performance models, delaying approval processes. HPTE and the concessionaire are still negotiating the financial consequences from these events, focusing on reparations and assigning added safety improvements.[68]

Objectives for Future Projects

Despite much success, the U.S 36 Phase II project and its partners stumbled when it came to **political risk** management. In the weeks leading up to the project's financial close, a sudden public opposition movement arose involving a grass roots social media campaign. While CDOT had engaged stakeholders and local officials to explain the project's characteristics, this proved insufficient to solidify public support. Lawmakers and citizens held public meetings to express their opposition, challenging the contract's length, perceived non-compete clause, lack of transparency, and ability to circumvent TABOR limits. While unable to stop the project, the opposition lobbied heavily for SB 14-197, which passed in both state houses three months after financial close. The bill aimed to increase P3 transparency by conducting town halls and, more

importantly, block future P3 projects by requiring legislative approval for agreements including terms longer than 35 years, non-compete clauses, or private sector force majeure clauses.

Governor Hickenlooper vetoed the bill but acknowledged the P3 process's transparency problems. He therefore issued Executive Order D 2014-010 to implement improvements, requiring at least three town-hall meetings with affected communities; uploading the P3 agreement to the HPTE website; considering transit alternatives when proposing HOT or managed lanes; and providing information to the General Assembly insofar as it does not jeopardize proprietary information. The interview respondents also mentioned that litigation arguing that HPTE lacked authority to engage in P3 transactions passed through the courts unsuccessfully. Given this tumultuous chain of events and despite the project's ultimate success, it appears the P3 partners did not properly identify, allocate, or address their project's political risks. In the future, partners should exceed normal expectations for public engagement and conduct continuous outreach on P3 projects through telephone surveys, social media, homeowner's association meetings, town hall meetings, press releases, individualized public meetings with special interest groups and community groups. HPTE should also provide easily digestible fact sheets on their website, covering the basics of P3 procurement, financing, challenges and benefits, especially economic benefits that are measurable.

Port of Miami Tunnel

Project Origin

Florida's Port of Miami (POM) traces its origins back to the first passenger ships arriving in mainland Miami in 1896 from the Miami River.[69] After this initial success, the U.S. Army Corps of Engineers constructed a manmade channel, the Main Shipping Channel in Biscayne Bay, also known as the Government Cut, between 1902 and 1915 to provide deeper ocean access for larger ships. As the port subsequently became South Florida's primary travel center for passengers travelling to New York, Baltimore, and Havana, operations grew sufficiently that proposals surfaced in the 1920s to move the facility to Dodge Island, an artificial island created by the earlier Government Cut development. Despite such early port development proposals, the City of Miami did not agree to pursue a port relocation project until the 1950s.[69] The city's final decision to expand port capacity and relocate the facility to its current Dodge Island location occurred in April 1960. The resulting Port of Miami (POM) opened in 1964.

By 2008, POM handled 4.1 million cruise passengers, more than any other U.S. port. The port's proximity to the Panama Canal has also driven important cargo traffic. As of 2008, POM represents the U.S.' 12th largest container port, processing 7.4 million tons of cargo and 0.8 million standard twenty-foot equivalent unit containers (TEUs).[70] More recently, the Miami Harbor Project, completed in 2015, dredged the channel to enable access for additional cargo on larger "Post-Panamax" container ships.[71]

This ever-increasing passenger and cargo traffic presented POM and its environs with infrastructure challenges, particularly regarding port access. For decades, the Port Boulevard Bridge provided primary POM-Dodge Island access by way of downtown Miami. A single-track railroad bridge existed but was not heavily used.[72] As passenger and container truck traffic

increased through this single-access point, the surrounding downtown Miami community objected to the resulting congestion and road accidents.[72,73] As of 2003, Miami ranked 6th in the U.S. for a) highest number of hours lost due to travel delays, b) highest excess fuel consumption, and c) highest congestion cost.[74] A Cambridge Systematics Inc. study projected that the Port of Miami would handle 5 million passengers and 1.5 million TEUs by 2015,[72] a 21% and 88% increase respectively from 2008. A URS Corporation traffic and demand study also projected that growing port activity would increase traffic from 26,000 vehicles per day in 2005 to 42,000 (+62%) by 2020 and 67,000 (+60%) by 2035.

Given these issues, Port*Miami*, an agency of the Miami-Dade County, first acknowledged a need for increased access capacity and route alternatives in 1979.[75] In response, the county´s Metropolitan Planning Organization (MPO) established the multi-jurisdictional Port of Miami Access Task Force in 1982 – including eight state, county, and local level agencies[75] – to consider port access improvements to diminish congestion in downtown Miami.[76] By 1983, the taskforce's option portfolio included a tunnel approach linking the port to Interstate 95,[77] and the County approved a three-phase plan including tunnel construction (third phase) in 1984.[78] The process continued five years later when the Florida Department of Transportation (FDOT) initiated corresponding engineering studies. By 1990, both FDOT and the Federal Highway Administration (FHWA) had selected this tunnel approach from amongst the taskforce's six project alternatives. The proposed tunnel, to be located under the Federal navigational channel within the Biscayne Bay Aquatic Preserve, would divert traffic away from downtown Miami by creating a direct linkage between I-395 on Watson Island and the Port of Miami on Dodge Island.

Despite the tunnel project's 1990 selection, several engineering challenges delayed procurement.[78,79] First, port infrastructure developments necessitated tunnel realignment to provide access for a new cargo truck control facility. Second, the Florida Department of Environmental Protection expressed concerns regarding the blasting and dredging required by the planned immersed-tube construction approach. To address these concerns, FDOT modified the construction plan to employ a boring approach, minimizing environmental impacts by boring a tunnel under the seabed. This bored tunnel approach received environmental approval in November 2000. Subsequent project updates in 2003 – including floodgates for updated hurricane projections, requested by Florida´s Turnpike Enterprise – required new environmental approvals. The project received these approvals in 2005.[77,80]

P3 Origin

While FDOT selected the tunnel approach for POM access expansion, it had no prior experience or specifications developed for major tunnel construction and maintenance, especially given the Biscayne Bay seabed's characteristics and technical challenges.[75] By 2005, these limitations motivated FDOT to pursue a P3 approach where it could shift risks, particularly construction and maintenance risks, to an experienced private partner.

FDOT began the procurement process in December 2005 by holding an Industry Forum to gauge private-sector interest in the project using a P3 approach. According to one interviewee, the event garnered vital interest from several international companies with relevant

experience. As a result, the agency issued a Request for Qualifications (RFQ) two months later, selecting a three-team short list in April 2006.[81] The selected teams included: 1) Miami Access Tunnel, composed of Bouygues Travaux Publics and Babcock & Brown; 2) FCC Construccion and Morgan Stanley, including FCC, Morgan Stanley, Hatch Mott MacDonald and Edwards & Kelcey; and 3) Miami Mobility Group, containing Dragados Concesiones de Infraestructuras, Dragados USA, Odebrecht Investimentos em Infra-Estructura, Odebrecht Construction, Parsons Transportation Group and DMJM Harris.

FDOT then issued a Request for Proposals (RFP) in November 2006. The agency faced strong toll opposition, but Florida's 1991 Statute 334.30 allowed it to employ annual performance payments based on the transportation facility's service availability or traffic levels. As a result, FDOT proposed shifting the project's risk to the private sector using an availability approach – where the public agency conditions compensation payments on the concessionaire´s service performance – rather than through tolling. The cruise ship industry in particular had expressed concern that tolls would place a burden on its employees and customers, shifting demand to competing ports.[79,82] Of the three proposals submitted, Miami Access Tunnel (MAT) LLC requested the lowest annual availability payment of $33.2 million. The other two groups, Miami Mobility Group and FCC Construction/Morgan Stanley, requested annual availability payments of $39.8 million and $63.2 million, respectively. In May 2007, FDOT publicized its Notice of Intent to Award the contract to MAT.[77]

Negotiations then took place to obtain financial contributions from the county, the City of Miami, and FDOT,[83] with FDOT officially naming MAT as the "best value proposer" in February 2008. By that time however, the 2008 Great Recession had destabilized MAT. Its primary funding partner, the Australian investment firm Babcock & Brown, lost 96% of its market value between October 2007 and October 2008 and was liquidated a few months afterwards.[84,85] As a result, FDOT cancelled the project in December 2008. Nevertheless, the remaining technical partner, the French conglomerate Bouygues, remained interested in the project given its experience with the 38-kilometer Channel Tunnel linking England and France 75 meters below the seabed. Bouygues pursued new financial partners, eventually partnering with Meridiam Infrastructure Finance in May 2009.[86,87] Concurrently, the Miami-Dade Mayor Carlos Alvarez successfully lobbied officials to continue the project under MAT rather than restart the procurement process.[88,89] This allowed the process to continue, maintaining MAT as the private partner. Financial close was reached in October 2009.[90]

The resulting design-build-finance-operate-maintain (DBFOM) contract assigned responsibility for tunnel design, construction, financing, operation and maintenance to the private MAT Concessionaire partners for 30 years. In particular, the project included three facility components: 1) two 1.2-kilometer-long and 12.5-meter-wide tunnels bored into the soft ground 75 meters below the Biscayne Bay seabed; 2) MacArthur Causeway (I-395) Bridge widening improvements; and 3) corresponding connections to the Dodge Island roadway system.

The project's original 2006 VfM study, conducted during the initial procurement stages, predicted that the DBFOM P3 approach would deliver a $59 million positive value above what the traditional design-bid-build (DBB) delivery approach could provide.[75] Accounting for the 2009 contract's provisions, the P3 approach's marginal VfM had increased to an estimated $398

million, although the estimate ranged between $291 and $501 million depending on the discount rate. According to the study, the increase derived not from differences in construction costs but from favorable availability payment costs (estimated $686 million) compared with the DBB approach's debt service (estimated $775 million) and operating expenses (estimated $309 million).[75] The VfM study also acknowledged several non-quantifiable P3 benefits, including: a) aligning design incentives to provide long-term, quality services during operations; b) improving FDOT cash management; and c) transferring key construction and maintenance risks to the private sector to address FDOT's experience limitations and improve performance.

Port of Miami Tunnel construction began in May 2010, with the facility opening to traffic in May 2014. Project financing totaled $1,072.6 million, including 7.5% private equity, 31.8% senior bank debt (obtained by MAT), 31.8% TIFIA loans (obtained by FDOT), and 28.9% FDOT funds (see Appendix D).[91] In contrast to the other projects analyzed in this study, FDOT avoided user fees in its funding approach. Instead, it first paid the concessionaire through milestone payments – disbursements given to the concessionaire as it reached predetermined design and construction milestones. Once the design and construction phases concluded and the operations and maintenance phase commenced, FDOT began employing availability payments, compensating the concessionaire for guaranteeing tunnel availability under predetermined service conditions.

P3 Objectives & Outcomes

The following section describes the Port of Miami Tunnel project's goals and outcomes to date, as described by public documents and interviews conducted with public sector and concessionaire interview respondents. Florida has released its VfM analyses describing the expected P3 project's marginal impact compared to traditional delivery.[75] In addition, FDOT has also published its Request for Qualifications (RFQ) and supplementary Project Information Memorandum along with traffic data collected during the year before and the year following the tunnel's opening.

Cost and Schedule Certainty

Procurement delays generated by the 2008 Recession complicate efforts to evaluate FDOT's desire to "facilitate a predictable and efficient implementation process" through the P3 approach.[92] Nevertheless, the literature recognizes that P3s can help the public sector manage cost and scheduling risks.[42,64,65] In the Port of Miami Tunnel case, FDOT included two related P3 objectives: 1) that the project partners "[a]gree to a long-term, guaranteed cost structure" and 2) that the project "[a]chieve the most efficient possible design, construction and maintenance."[92]

The P3 agreement provided cost assurance and incentivized on-time delivery through a design build (DB) fixed cost contract. Such contracts bundle design and construction activities into single, fixed-cost agreements, in contrast to traditional design-bid-build approaches that procure these activities separately. This bundled approach consolidates component delivery responsibility with one party for a fixed sum, reducing the contractor claims and change orders that arise from discrepancies and uncertain events.[43] In addition, by requiring that the concessionaire meet pre-determined specifications before collecting milestone and availability

payments, the agreement's payment structure incentivized subcontractor discipline and on-time delivery through the private concessionaire's profit motive. The availability payments approach should provide incentives to guarantee the project's future operations and maintenance cost structure while also incentivizing improved life-cycle asset management.[11] Such incentives were crucial given concerns, particularly within the cruise industry, that the POM Tunnel would produce the enormous cost and schedule overruns associated with Boston´s Big Dig project.[93,94]

Ultimately, mechanical air circulating jet fan malfunctions and problems with drainage piping delayed project completion from May 2014 to August 2014, costing Bouygues almost $9 million in $115,000 daily penalties and $32.5 million in lost availability payments.[76] While the concessionaire did not deliver the project on-time, interviewees stressed how the monetary penalties drove the private partners to minimize delays. In addition, the P3 approach delivered its design-build phase on budget in accordance with the cost offered during the competitive procurement process. As a result, as the VfM study suggested, the P3 approach likely provided more efficient procurement compared to the traditional alternative.[75]

Successful risk management also supported on-time and within-budget delivery. Both the interviewees and the project documents stressed how the public partners particularly wished to shift the tunnel's construction risk to private partners with proven records.[92] The P3 agreement successfully shifted construction-related risks in three ways. First, the agreement made the private concessionaire responsible for any **community impacts** arising from tunnel construction and operation beyond pre-determined levels. The cruise industry in particular, had raised concerns about tunnel construction hampering their operations. By aligning concessionaire incentives with community goals, such risk allocation provided an incentive for the concessionaire to minimize construction impacts. The interviewees noted no related disruptions.

Second, the project's construction phase faced **hurricane risks**. Under the P3 agreement, the concessionaire would absorb losses caused by category 1 or 2 hurricanes while FDOT would absorb losses caused by category 3 or higher storms. No storm-related disruptions took place and the concessionaire delivered the project within budget.

Third, FDOT and the private concessionaire chose to share any **geotechnical risks** relating to unexpected cost increases and/or scheduling delays caused by seabed conditions differing from those previously identified by FDOT. FDOT clarified that risk sharing would only apply to losses not covered by insurance.[95] Under the agreement, the concessionaire would absorb the first $10 million in uninsured losses. FDOT would then absorb losses up to $160 million before the concessionaire would absorb additional losses up to $180 million. Finally, the public and private partners would share any losses above $180 million, with FDOT absorbing 90% and the concessionaire absorbing 10%. However, in the case of a major unforeseen event, FDOT could terminate the P3 agreement following a termination settlement formula. FDOT allocated $180 million as a Contingency Reserve in case the uninsured losses materialized. Ultimately, the concessionaire provided $10 million and FDOT provided $58.5 million to solidify the porous coral limestone surrounding the tunnels.[96]

Congestion Management, User Experience, and Access to Private Sector Expertise

In developing the Port of Miami Tunnel, FDOT aimed to improve congestion management through downtown Miami and provide high quality tunnel service using the P3 approach.[92] During the year following its completion, the Port of Miami Tunnel diminished Port Boulevard's weekly average traffic volume through Downtown Miami by around 35% and reduced average weekly truck traffic by 77% when compared to the previous year.[97] This helped the Port of Miami handle passenger traffic that grew to 5.2 million by 2016 according to one interviewee. While only two thirds of the expected 1.5 million TEUs traveled through the port in 2016,[98] possibly due to the continued downturn in cargo volumes since the 2008 recession, future cargo outcome performance is expected to benefit from the recent Panama Canal expansion.

Although congestion management and user experience benefits can derive from infrastructure projects regardless of their delivery method, P3 contract agreements can enhance these benefits. In the POM case, the interviewees mentioned how such contract conditions – maximum times for clearing the tunnel following incidents, camera and fan functioning, etc. – enforced via Availability Payments, have worked to maintain high-level service quality for users.

Objectives for Future Projects

According to the interviewees, the Port of Miami Tunnel experience points to one objective not incorporated into the project but which may prove beneficial for future projects. The project's successful congestion management effort, both during and after the project, helped enable sizeable redevelopment projects in Downtown Miami. The original tunnel project did not focus on such developments as potential objectives or outcomes, and hence the project may have overlooked complementary development opportunities and/or inadequately measured resulting benefits. Future projects might consider parallel development opportunities earlier in the process to gain additional support and capture broader community value.

I-95 HOV/HOT Lanes

Project Origin

Interstate 95 (I-95) stretches through fifteen east coast states and the District of Columbia, covering 1,919.3 miles and connecting southern Florida to northern Maine. Before entering the District of Columbia, Virginia's 178.7 mile section stretches from Greensville County in the south to the City of Alexandria in the north.[99] In the decades following the roadway's construction between the 1950s and early 1980s, the sections running through the Northern Virginia-Washington, DC metropolitan area experienced increasing commuter congestion in addition to heavy north-south through traffic. With growing populations, congestion became particularly problematic in southeastern Fairfax County, northeastern Prince William County, and the suburbs surrounding the City of Fredericksburg.[100–102] Congestion in the Fredericksburg area, for example, grew by 400% between 1960 and 2006.[103]

Starting in 2002, as congestion continued to increase despite the high prevalence of carpoolers (particularly "sluggers" who engage in casual or instant carpooling), vanpoolers, and

commuter buses, viability studies considered extending HOV lanes into the corridor's southern portions.[103] Nevertheless, I-95 corridor HOV extensions and expansions failed to gain traction. By 2011, projections anticipated 40% population growth and 50% employment increases linked to regional military and employment centers along the corridor, including Tysons Corner and Quantico.[101,104]

P3 Origin

Responding to Northern Virginia's I-95 congestion challenges, Clark Construction, Shirley Contracting, and Koch Performance Roads submitted an original unsolicited proposal in October 2003 to provide congestion relief via a public-private partnership. Virginia's Public-Private Transportation Act of 1995 (PPTA) allows public agencies to accept unsolicited proposals from private-sector entities[24] and the Virginia Department of Transportation (VDOT) responded by creating an advisory panel and inviting competing proposals in keeping with PPTA Implementation Guidelines.[25] Fluor Virginia, Inc. submitted a competing proposal in March 2004 and the Virginia Commonwealth Transportation Board (CTB) approved further proposal evaluation ten months later.[104] In June 2005, Fluor, now joined by Transurban (USA) Development, Inc., submitted a detailed proposal that VDOT selected, leading to an Interim Agreement signed in October 2006.

This Fluor-Transurban proposal and agreement - named the I-95/395 HOV/Bus/HOT Lanes project - included 56 miles of reversible High Occupancy Tolling (HOT) lanes, stretching from Fredericksburg, Virginia to the Pentagon in Arlington, Virginia. In the northern section, the project would expand the existing 28-mile High Occupancy Vehicle (HOV) lanes by adding one new reversible HOV/HOT lane. In the southern section, the project would extend the HOV/HOT lanes 28 miles southward, from Dumfries in Prince William County to Massaponax in Spotsylvania County.[105] The proposal also included park-and-ride expansions (to three thousand spaces), a Bus Rapid Transit (BRT) station in Lorton, Virginia, and $195 million for transit.[106]

Environmental, traffic, and revenue studies progressed until August 2009 when the Arlington County Board filed a federal lawsuit against the U.S. Department of Transportation (USDOT), the Federal Highway Administration (FHWA), VDOT, and the following institutional heads: Raymond LaHood, Secretary of the USDOT; Victor Mendez, Administrator of the FHWA; and Pierce Homer, former Secretary of Transportation for the Commonwealth of Virginia. The lawsuit - filed under the National Environmental Policy Act (NEPA), the Civil Rights Act of 1964, the Fifth and Fourteenth Amendments, and the Virginia Constitution - argued that the project: a) disproportionally affected minority neighborhoods, b) would increase rather than decrease congestion, and c) failed to fulfill federal environmental standards, having obtained a "Categorical Exclusion" from the FHWA allowing it to proceed without conducting an Environmental Assessement.[107–110] One month later, VDOT deferred the project despite objections from Fairfax County, one of the local governments involved in the project's northern section, who supported the project and opposed the lawsuit.[111] The Arlington County Board ultimately withdrew its lawsuit in February 2011 after VDOT conducted an Environmental Assessment and modified the project to eliminate the Arlington County portions.[101,112,113]

The newly reduced I-95 HOV/HOT Lanes project focused solely on HOV/HOT components with a tolling exemption for buses and emergency vehicles; the agency did not include the concessionaire's originally proposed transit grants, park-and-ride expansions, and BRT station. The modified plan widened the existing 14-mile, northern High Occupancy Vehicle (HOV) lanes from 2 to 3 lanes, ending on Edsall Road on I-395. It also improved the existing 6-mile HOV lanes between Route 234 and the Prince William Parkway and built new HOV/HOT lanes 9 miles southward from Dumfries in Prince William County to Garrisonville Road in Stafford County.[104]

The partners reached commercial and financial close in July 2012 with a DBFOM comprehensive agreement making 95 Express Lanes LLC, the Special Purpose Vehicle controlled by Fluor and Transurban, responsible for the highway's design, construction, financing, operation, and maintenance for 73 years following completion. A few months after financial close, Transurban bought out Fluor´s share in the project. Construction began that same month and the project opened to the public on time four years later in December 2014, as stipulated by the comprehensive agreement

Project funding totaled $922.7 million, divided into 30.4% private equity, 27.4% Private Activity Bonds (tax-exempt bonds issued by the private concessionaire), 32.5% TIFIA loan, 8.9% VDOT funds, and 0.8% interest (see Appendix D). The project relies on dynamically priced HOT revenue to repay this investment, with toll pricing varying with current traffic conditions, without an upper limit, to accommodate the 55 mile-per-hour minimum speed defined in the comprehensive agreement. The agreement also included a revenue-sharing scheme between the public and private partners. According to the agreement, VDOT can claim 5 to 40% of gross revenues depending on the concessionaire's internal rate of the return and the life of the project. If, on the other hand, HOV traffic reaches 35% or more of HOT lane traffic in two consecutive Toll Sections going in the same direction for any period lasting 15 consecutive minutes, VDOT will pay 70% of the concessionaire's lost toll revenue when traffic flow exceeds 1,450 vehicles per hour per traffic lane. This provision escalates up to 38% of HOT lane traffic and 1,550 vehicles per hour per traffic lane after the contract's first five years. The concessionaire also receives compensation when the proportion of exempted buses and emergency vehicles passing through the HOT lanes exceeds a threshold determined by a contract formula.

After the I-95 HOV/HOT Lanes project opened, and with new leadership within the Commonwealth of Virginia and Arlington County Board, the project faced a new expansion stage as corridor pressures continued to develop. For example, the U.S. Department of Defense had decided in September 2008 to locate its Washington Headquarters Services, or the "Mark Center," in Alexandria, Virginia. More than six thousand employees were expected to move to Seminary Road starting in 2015, generating great concern regarding the area's transportation infrastructure.[114]

In response to such pressures, VDOT presented a new plan in 2015, extending the northern HOT lanes into I-395 in Arlington without new interchanges. In addition, the project included several features from the original project plan, including a yearly $15 million transit commitment from the concessionaire. The Arlington County Board did not object to the plan[115]

and VDOT obtained environmental clearance from the FHWA after an Environmental Assessment review and a Finding of No Significant Impact (FONSI).[116,117] The original comprehensive agreement allowed VDOT to consider 95 Express Lanes LLC for expansion developments and owner or concessionaire enhancements without requiring a new procurement process. As a result, construction for the northern extension is expected begin in the summer of 2017 with an opening date in 2019.[116]

In addition, the need for southern improvements became apparent once the I-95 HOV/HOT Lanes opened and choke points created congestion at the southern terminus. As a result, two projects will extend the I-95 HOV/HOT lanes to the south. The first, the I-95 Express Lanes Southern Extension, extends the I-95 HOV/HOT Lanes two miles south of Garrisonville Road to alleviate pressure at choke points there.[118,119] This segment, also part of the P3 agreement, began construction in July 2016. A second project, the I-95 Express Lanes Fredericksburg Extension, could extend the lanes ten more miles to Route 17 in Stafford County.[120] In August 2017, Transurban broke ground on the I-395 segment that the commonwealth had previously removed in connection with disputes with Arlington County.

P3 Objectives & Outcomes

The following section describes the I-95 HOV/HOT Lanes project's goals and outcomes to date, as described by public documents and interviews conducted with public sector and concessionaire interview respondents.

Congestion Management and User Experience

According to the public sector interviewees, VDOT primarily aimed to **manage congestion** and **improve user experiences** along the I-95 corridor in Northern Virginia. Project documents support that assertion, considering High-Occupancy Toll (HOT) lanes a key element for achieving faster and more reliable travel times while also improving travel within general purpose lanes.[30,102]

According to the interviewees, the I-95 HOV/HOT Lanes project has met VDOT's congestion-reduction objective by creating "congestion-free" HOT/HOV lanes. The HOV/HOT lanes have improved driving-time certainty for HOT Lane customers and have provided similar benefits for transit and HOV travelers. Specific HOT lane benefits include a 17.5-minute average timesaving for travelers in the general purpose (GP) lanes; up to 3.5-hour single-trip timesaving compared to the general purpose lanes; and 75% customer satisfaction ratings in drivers´ satisfaction surveys.[31] In addition, the process successfully accommodated the local "slugging" (carpooling) community. Surveys report an 86% positive HOV/HOT lane impression within the community and HOV trips increased over 50% between December 2014 and November 2016.[31]

Access to Private Sector Expertise

Both the public documents and the interviewees stressed the importance of tolling for the project's advancement. For example, one interviewee noted how the variable congestion pricing

technology introduced through the P3 approach directly enabled the congestion management outcomes and trip-time certainties discussed above. Public documents also recognized that HOT technology deployment should decrease the enforcement risks (HOV and tolling violations) experienced by other states at the time.[30] While congestion management and user experience benefits would derive from infrastructure development regardless of delivery method, the P3 approach's **access to private sector expertise** enabled the electronic tolling system, managed lanes, and increased HOV travel, particularly given VDOT's prior tolling management challenges.

In addition, stakeholders expected the I-95 project to achieve economies of scale given the concessionaire's involvement in the I-495 Express Lanes project, employing the same operations center, tolling system, and maintenance team. At the same time, the I-95 and I-495 projects could generate network economies and help VDOT generate a Northern Virginian **HOV/transit network** that expanded user options and provided travel time reliability for vehicle and non-vehicle travelers along both corridors.

Debt Capacity & Project Acceleration

Policymakers often select P3 delivery approaches to overcome public sector debt ceilings,[10] using private equity and/or debt to diminish the public sector's upfront financial commitment. At least one interviewee mentioned Virginia's **debt capacity** as an important consideration when VDOT chose the I-95 HOV/HOT Lanes P3 approach. In order to ensure access to low-interest debt, Virginia had established the Debt Capacity Advisory Committee (DCAC) in 1991 to maintain the Commonwealth´s AAA credit rating. The DCAC's model employs a non-binding debt-service ceiling equaling 5% of state revenues.

From the interim agreement's signing in 2006 to the 2012 financial close, several DCAC reports recommended that the Commonwealth's maximum additional debt authorization equal $840 million for 2008, $370 million for 2009, $0 for 2010, $363 million for 2011, $466 million for 2012, $537 million for 2013, and $560 million for 2014.[32–38] As a result, the I-95 project's $718 million price tag would have required nearly one year's worth of the commonwealth's maximum allowable debt.

In addition, if Virginia had procured both the I-95 and I-495 projects using traditional procurement and public debt financing, the $2.1 billion dollar debt issue would have maxed out Virginia's debt issuing capacity for the following six years. The P3 DBFOM approach significantly **accelerated the project** compared to this traditional procurement timeline, especially considering VDOT's funding priorities did not include an I-95 project at that time.

In addition to leveraging private-sector financial resources to accelerate the project, the P3 approach also incorporated favorable contract provisions for the public agencies. The I-95 HOV/HOT Lanes Comprehensive Agreement **shifted revenue risk entirely to the private sector**. VDOT and the Commonwealth of Virginia avoided any contractual obligation to pay bondholders or compensate the private concessionaire. This risk transfer relied on the private concessionaire's profit motivation to contain costs and generate adequate toll revenues. The

resulting project has remained financially viable throughout and has not required additional private equity infusions or the use of reserve funds.

Cost Certainty & Time to Completion

The literature recognizes that P3s can help the public sector manage cost and schedule risks by conditioning payments and/or toll collection on facility delivery in accordance with predefined specifications.[12,42] Several interviewees mentioned that VDOT placed high priority on "on-time and on-budget" project delivery. As a result, the I-95 HOV/HOT Lanes comprehensive agreement incorporated toll-revenue incentives and a $718 million design-build fixed-cost contract to establish both cost and delivery schedule certainty. Such contracts bundle design and construction activities into single contracts for a fixed cost, in contrast to traditional design-bid-build approaches that procure these activities separately. By transferring construction risk and consolidating overall delivery responsibility with one private-sector party for a fixed sum, the contract reduces the contractor claims and change orders that arise from discrepancies and uncertain events when one contractor must construct another's design.[43] Ultimately, the concessionaire delivered the I-95 HOV/HOT Lanes on-time and on-budget.[121] The only significant procurement delay, generated by Arlington County's lawsuit, derived from sponsor disagreements rather than project delivery.[30]

Objectives for Future Projects

According to the interviewees, VDOT's I-95 HOV/HOT Lanes P3 experience points to several objectives not incorporated into the project but that could provide benefits for future projects.

First, future projects might do more to manage the **political risks** and opposition arising from fragmented political systems, particularly at the local level. In the I-95 case, the Arlington County Board's political opposition, focused especially on P3s and social justice concerns, not only delayed the project and diminished its scope but also undermined an important transit component. By prioritizing political risk management and considering a broader array of alternatives earlier in the process, the P3 partnership may have avoided some of this opposition or at the very least, reduced the procurement delay.

Second, interviewees had different perspectives about whether there had been sufficient competition arising through the unsolicited proposal process. Some interviewees felt there should have been more. Others pointed out that there were two competing proposals at the outset, and indeed that the party that submitted the unsolicited proposal lost out to the second proposal team that eventually delivered the project. Moreover, the procurement took nine years to reach financial close (2003-2012) over the course of three different gubernatorial administrations (two Democratic and one Republican). The 2008 Great Recession started in the middle of the process.

Finally, an owner self-assessment of the I-95 HOV/HOT Lanes P3 project provided several lessons for minimizing VDOT´s DB management transaction costs and promoting cost certainty for future projects. These include a) replicating the concessionaire's safety culture; b) incorporating over-the-shoulder (OTS) review processes to streamline the design process; and c)

requiring that the DB contractor show proficiency in conducting interface operations to avoid problems with the electrical assets.[122,123]

Presidio Parkway Phase II

Project Origin

Presidio Parkway, originally named Doyle Drive, is the 1.5-mile, six-lane segment of U.S. Route 101 providing southern access to San Francisco, California's Golden Gate Bridge. The original at-grade roadway and Marina and Presidio viaducts were constructed between 1936 and 1940 by the Golden Gate Bridge and Highway District (GGBHTD) – a special-purpose district incorporated by the State of California to manage the Golden Gate Bridge, the Golden Gate Transit buses, and the Golden Gate Ferry – with funding provided by the New Deal's Works Progress Administration (WPA) and Public Works Administration (PWA).[124,125]

Already facing traffic congestion in the early 1950s, GGBHTD showed interest in widening Doyle Drive beginning in 1955 and asked the California Department of Transportation (Caltrans) – which had taken responsibility for the roadway in 1945 – to add two new lanes in 1962. GGBHTD added an additional request for median barrier repairs in 1973 but citizens opposed both road widening proposals during the Draft Environmental Impact Statement phase.[126] Caltrans developed alternative congestion management proposals in the 1980s, but the project did not move forward.

In 1989, a ballot proposition created the San Francisco County Transportation Authority (SFCTA) to manage the city and county's transportation planning and improvements. In 1991, the SFCTA's board established the Doyle Drive Task Force to provide improvement recommendations. After two years of study, this group, including representatives from local government, public, and private organizations, proposed a "scenic parkway" plan. This plan suggested lowering freeway speeds to around 40-45 mph, improving the facility's compatibility with its surroundings, realigning the roadway to the nearby Palace of Fine Arts, and renovating the roadway's high viaduct.[127] The Board of Supervisors approved the plan and Caltrans subsequently included it among its proposed alternatives. SFCTA, funded by Caltrans, began the Doyle Drive Intermodal Study a year later,[127] ultimately developing a feasibility study in 1998.[128,129]

In the meantime, traffic and salted air had pushed several key Doyle Drive structures to the end of their useful life[130] and the roadway required "extensive seismic, structural and traffic safety upgrades."[128,131] As a result, SFCTA and Caltrans engaged in cooperative agreements in 2003 and 2006 for preliminary project development, design, and approval work.[131,132] The facility's location complicated project development somewhat and required that SFCTA and Caltrans coordinate with several other agencies including GGBHTD, the Metropolitan Transportation Commission (MTC), and the Bay Area Toll Authority (BATA). In addition, since the roadway traverses the former Presidio of San Francisco Military Reservation, which received National Historic Landmark District status in 1962, California's State Historic Preservation Office was involved. Furthermore, right of way ownership was divided between the National Park Service – who had taken over the site after the U.S. Army ended its active

presence in 1994 – and the Presidio Trust, formed in 1996.[133,134] The proposed developments also abutted the Golden Gate National Cemetery, requiring coordination with the U.S. Department of Veterans Affairs. Additional agencies whose residents would likely benefit from the project, including the Transportation Authority of Marin (TAM) and the Sonoma County Transportation Authority (SCTA), were also involved, along with the Federal Highway Administration.

In 2006, after completing the draft environmental impact study (DEIS), the SFCTA and Caltrans evaluated five alternatives: 1) do nothing; 2) rehabilitate the existing structure; 3) build a new facility in a new location; 4) rebuild the facility with elevated, at-grade, depressed, and tunnel options in phases; and 5) rebuild the facility with elevated, at-grade, depressed, and tunnel options by building a temporary detour structure to maintain the traffic flowing during construction. The agencies ultimately selected the final option, named Presidio Parkway.[135] This plan redesigned the existing, no-shoulder roadway with six ten-foot wide lanes to provide a) four 11-foot lanes, b) two 12-foot lanes, c) an eleven-foot, southbound auxiliary lane, d) ten-foot outside shoulders, and e) four-foot inside shoulders. The plan also improved scenic views by replacing the original viaducts with two cut-and-cover 1,000-foot-long tunnels and a 1,279-foot-long high viaduct. Additional improvements included a new at-grade road, and new access ramps from Doyle Drive to Girard Road. FHWA signed the Record of Decision for the plan in 2008.[129,136]

SFCTA and Caltrans decided to execute the project through eight contracts implemented under a traditional design-bid-build (DBB) delivery approach:[137]

1. Early 2009 through mid-2013: environmental mitigation; historic building stabilization, deconstruction, and/or relocation; wetland mitigation.
2. Early 2009 through Fall 2010: utility relocation
3. October 2009 through early 2011: the southbound High Viaduct; the Southern Park Presidio Interchange; the Ruckman Undercrossing; the southbound roadway section approaching the Golden Gate Bridge toll plaza; retaining walls.
4. December 2009 through early 2011: the southbound Battery Tunnel; at-grade road; at-grade temporary road detour; retaining walls.
5. Fall 2010 through Fall 2012: the northbound Battery Tunnel; Main Post Tunnel; demolishing low viaduct.
6. Fall 2010 through Fall 2012: the Girard Road Undercrossing; demolishing low viaduct.
7. Fall 2010 through Fall 2012: the northbound High Viaduct; the Northern Park Presidio Interchange; the northbound roadway section approaching the Golden Gate Bridge toll plaza.
8. April 2012 through April 2015: landscaping.

The agencies expected Phase I completion (contracts one through four) by early 2011 but instead encountered cost overruns and delays through April 2012,[133] driven primarily by change orders.

P3 Origin

In 1989, California's Assembly Bill (AB) 680 authorized Caltrans to develop four P3 demonstration projects, two of which came to fruition: State Route 91 and State Route 125, also known as South Bay Expressway. The state's 2006 AB 1467 then authorized Caltrans and regional transportation agencies to engage in P3s, although it limited the program to four projects designed to improve goods movement. Three years later, the legislature approved Senate Bill Second Extraordinary Session 4 (SBX2-4) in 2009, removing AB 1467's four-project limit[138] and eliminating its legislative approval requirement, replacing it with legislative review prior to final agreement execution. With this legislation passing during Presidio Parkway Phase I construction, Caltrans was able to consider P3 approaches for the remaining Phase II portions (contracts five through eight), scheduled to begin in Fall 2010. In addition, the American Recovery and Reinvestment Act (ARRA) of 2009, a stimulus package responding to the Great Recession, offered project development funds just as SBX2 4 passed. Bundling the remaining Phase II contracts via a P3 approach appeared ideal for Caltrans to accelerate the project and take advantage of this funding opportunity.[139]

The project's resulting VfM study, released in February 2010, concluded that a DBFOM P3 approach provided the more cost-effective alternative when compared to traditional design-bid-build (DBB) and design-build-finance (DBF) delivery approaches.[140] The DBFOM option generated $488 million in present value costs, compared to $635 million for the DBB approach and $652 for the DBF approach. According to the study, the main cost difference derived from total construction costs at completion, with both the DBF and the DBFOM models expected to offer incentives for lower-cost delivery.

In addition, the analysis expected that by transferring construction time and cost overrun risks to the private sector, the P3 structure would incentivize the private concessionaire to impose discipline on its subcontractors, minimizing costs, and earning revenues sooner. This in turn would increase cost and schedule certainty for the public sector partners. The analysis also expected that the P3 structure would improve the match between public sector resource availability and expenses through private sector financing, ultimately providing more efficient resource usage. The P3 agreement's contractual incentives supporting routine maintenance rather than expensive rehabilitation costs were also expected to provide more reliable maintenance. As a result, the study ultimately favored the DBFOM approach for its expected cost savings, cost and schedule certainty, efficient resource use, reliable maintenance service, and risk transfer (schedule, construction, operations and maintenance).

Following the VfM study, Caltrans and SFCTA began Phase II P3 procurement by issuing the Request for Qualifications (RFQ) in February 2010 and selecting a three-team short list in April 2010. The selected teams included: 1) Golden Gate Access Group, composed of ACS Infrastructure Development, Inc., CH2M Hill, Inc., Dragados USA, Inc./C.C. Myers, Inc. Joint Venture; 2) Golden Link Partners, composed of HOCHTIEF AGG, Meridiam Infrastructure SCA SICAR, HNTB Corporation, Flatiron West, Inc.; and 3) Royal Presidio SF Partners, composed of Global Via Infraestructuras, S.A., Parsons Transportation Group, Inc., Royal Presidio SF Constructors, FCC Construccion, S.A. Tutor Perini Corporation, Parsons Transportation Group, Inc. Caltrans and SFCTA then issued a Request for Proposals (RFP) in

July 2010. In November that year, the agencies publicized their Notice of Intent to Award the contract to Golden Link Partners.

From this point onward, public opposition challenged the project. First, the Legislative Analyst's Office (LAO), after a request from then California State Senator Alan Lowenthal, published an analysis in December 2010 reporting that the Presidio Parkway project was not "a good fit for a P3 procurement approach." Specifically, the report objected to the project's limited use of user fees, Caltrans' risk retention (including risks related to endangered species and archaeological artifacts), and the unknown destination of public resources freed up by the P3 investment.[141,142] A subsequent P3 analysis by LAO, completed in 2012 and therefore after the Presidio Parkway P3 comprehensive agreement had been signed, stressed inadequate risk transfer, weaknesses in the VfM analysis, and limited transparency during the procurement process.[143] SFCTA defended the agreement, noting the many risks shifted to the private sector, the VfM analysis, DBB and DBF comparators and independent review, and the 20% price savings generated by the P3 procurement process.[144]

Second, the Professional Engineers in California Government (PECG) union also opposed the project, suing Caltrans and SFCTA in November 2010 and obtaining a temporary restraining order the following month. PECG argued that the project did not comply with California´s Streets and Highways Code section 143 as amended in the state's 2009 P3 legislation since it relied on fuel taxes rather than tolls or user fees alone.[145,146] The restraining order was dissolved a month later by an Alameda County Superior Court judge, after which Caltrans and SFCTA awarded Golden Link Partners as the preferred bidder in January 2011.[141] A judge dismissed the PECG lawsuit in February 2011. The 1st District Court of Appeal confirmed this ruling in August 2011, followed by another ruling confirmation by the California Supreme Court that November.[147–149] Nevertheless, the lawsuit delayed the project as lenders remained unwilling to sign agreements with the private concessionaire until the litigation process was resolved. Financial close, expected for June 2011,[133,147] was instead delayed to June 2012.

The resulting DBFOM contract assigned responsibility for Phase II design, construction, and financing to the Golden Link Concessionaire special purpose vehicle (SPV) – a company created to isolate the P3 project and its parent companies from one another's risks – along with operations and maintenance responsibilities for all Phase I and Phase II components for 30 years following construction. Project financing totaled $364.7 million, including 12.5% private equity, 45.7% bank loans, and 41.8% TIFIA loans (see Appendix D).[150] Caltrans did not employ user fees in its funding approach, instead paying the concessionaire through milestone payments – disbursements given to the concessionaire as it finished the construction stage. Once the design and construction phases concluded and the operations and maintenance phase commenced, Caltrans employed availability payments, compensating the concessionaire for guaranteeing road, tunnel, and viaduct availability under predetermined service conditions. Funds for these availability payments will derive from SFCTA, Caltrans, the Metropolitan Transportation Commission (MTC), the Golden Gate Bridge, GGBHTD, the Sonoma County Transportation Authority (SCTA), and Transportation Authority of Marin County (TAM). The agencies had considered tolling but could not reach consensus.[151] SFCTA considered the P3 approach "a project delivery method not a funding method."[151]

Presidio Parkway Phase II construction began in June 2012, with the facility opening to traffic in July 2015.

P3 Objectives & Outcomes

The following section describes the Presidio Parkway Phase II project's goals and outcomes to date, as described by public documents and interviews conducted with public sector and concessionaire interview respondents.

Cost Certainty & Time to Completion

The literature recognizes that P3s can help the public sector manage cost and scheduling risks,[42,64,65] particularly through design-build contracts that bundle design and construction activities into single, fixed cost contracts, in contrast to traditional design-bid-build (DBB) approaches that separate these activities into two separate contracts. By consolidating responsibility for component delivery with one party for a fixed sum, such contracts tend to reduce the contractor claims and change orders arising from discrepancies and uncertain events.[43]

The Presidio Parkway project's public-sector sponsors explicitly recognized their desire for **increased cost and schedule certainty** with optimal risk transfer.[140] As part the project's VfM study, an analysis evaluated cost overruns for Caltrans' DBB projects in order to assess the P3 project's benefits. The analysis found that Caltrans' DBB projects costing more than $300 million experienced cost overruns averaging 76% of their original cost with a 70% standard deviation.[140] As a result, SFCTA, for example, considered the P3 approach "an insurance policy against cost and delay risk."[151] According to the VfM study, the P3 approach provided the greatest cost and schedule certainty[140] by consolidating the four remaining contracts into a single contract to reduce lengthy approvals and to reduce problems arising from contractor coordination. In addition, a $185 million construction completion milestone payment provided strong concessionaire incentives for on-time delivery. The agreement also included operations and maintenance-related noncompliance points costs linked to availability payment deductions; these serve as incentives for maintaining service levels during operations while minimizing the cost impact of unexpected repairs.

While this private-sector risk transfer operated effectively, public-sector stakeholder coordination ultimately proved problematic for construction completion. While the project achieved substantial completion on-time in July 2015 and is open to traffic, some portions remained unfinished. In particular, delays to landscaping originating with disagreements between Caltrans and the Presidio Trust[133,134] impacted the $185 million construction completion milestone payment. Since the delay originated with the public sector, Golden State Concessionaire sued Caltrans for $225 million and settled for $91 million in September 2016.[133] This increased the project's overall cost although the P3 alternative remains more attractive than the DBB option.[133,140] As of June 2017, the project's landscaping component remains unfinished.

Access to Financial Resources & Project Acceleration

The P3 approach also aimed to achieve the best use of public funds, VfM, and risk transfer outcomes.[140] In this regard, neither Caltrans nor SFCTA devoted funds to finance Presidio Parkway Phase II design or construction. Even those criticizing the project recognize that the P3 approach and the private-sector financing it generated freed up several hundred million dollars for Caltrans to use for other projects.[142] Moreover, the concessionaire, not the public-sector partners, remains responsible for senior bank loan and TIFIA loan repayment.

The P3 approach also helped accelerate the project to access federal ARRA development resources.[139] The original public procurement plan expected project completion by June 2013 although the expected traffic opening date would have fallen shortly after the end of Contract 7 in December 2012. In reality, the project opened in July 2015 although the delays generally fell outside the P3 procurement process. First, pre-P3 Phase I delays stretched the first half of the schedule from February 2011 to August 2013. Second, the twelve-month delay to financial close caused by the PECG lawsuit fell outside the concessionaire's control. Third, the Caltrans-Presidio Trust disagreement, which is not P3 specific, introduced important delays and by the time of the writing has not been resolved. As a result, the P3 approach's impact on project acceleration remains unclear.

Objectives for Future Projects

The Presidio Parkway experience points to **accessing private-sector expertise and innovation** as an important objective for future projects. Private-sector expertise and innovation thrives best when public-sector agencies establish flexible performance goals rather than rigid design solutions. While the Presidio Phase II project benefitted from private-sector expertise, it remained constrained by the design established for Phase I. More private-sector consultation earlier in the process may have provided additional innovation, although the project's multi-stakeholder governance structure generated complexity at the expense of flexibility and likely left innovations and cost savings unrealized. Future projects might learn from this experience by focusing more attention on clear inter-government agreements that minimize conflict and focus on performance objectives, especially regarding environmental mitigation components. States may benefit from sharing their experiences with inter-governmental agreements to identify best-practices and risky-practices when dealing with federal and local agencies.

IH 635 LBJ Managed Lanes or LBJ TEXpress

Project Origin

The 37-mile U.S Interstate Highway 635 (IH 635), also known as the LBJ Freeway, rings the Texas City of Dallas on its northern and eastern sides. Funded primarily through the U.S. Highway Trust Fund (90%), the highway's construction began with the freeway's northern portion in 1967, moving eastward until completion in 1981.[152] As strong regional economic activity and population growth developed between the 1960s and 1990s, driven especially by Texas Instruments' 1958 Dallas relocation and subsequent growth, traffic congestion also increased.

By the late 1980s, the Texas Department of Transportation (TxDOT) decided to evaluate options for tackling the increasing IH 635 congestion, including a portion of IH 35E that intersects IH 635's Northwestern segment. The first study, conducted in 1987, contributed to a roadway improvement plan and a year later TxDOT identified six improvement options, ranging from improving transit access to expanding highway capacity from 8 to 18 traffic lanes.[152] By 1992, TxDOT had concentrated on a roadway expansion plan, including two additional traffic lanes (increasing the general purpose lanes to 10 from 8), 2 HOV lanes, and 4 elevated managed lanes.

The planned expansion's eminent domain requirements would have impacted 84 homes, 66 businesses, and 148 apartments, however. This spurred increasingly organized public opposition reminiscent of the antagonism faced by other Texas projects like the Central Expressway, where public opposition to a double-deck roadway plan delayed project approvals by 12 years.[152,153] To avoid a protracted conflict, TxDOT tabled the expansion plan in 1992 and explored alternatives, ultimately settling on a tunnel approach in 1996 that would add new six managed lanes below ground.

Despite receiving environmental clearance in 2002 – through a Finding of No Significant Impact (FONSI) – TxDOT lacked the resources to deliver the high-cost tunnel design. In the meantime, traffic congestion continued to worsen. By the mid-2000s, Texas' Dallas-Fort-Worth-Arlington region ranked among the top 5 most congested cities in the U.S.[154] Originally designed to carry 180,000 vehicles, IH 635 was carrying 270,000 vehicles by 2009, with traffic expected to reach 450,000 by 2020.[155]

P3 Origin

Texas' 2003 House Bill 3588 authorized TxDOT to conduct transportation P3s using Comprehensive Development Agreements (CDA).[156] Following this authorizing legislation, and recognizing the limited public resources available for traditional IH 635 project delivery, the Texas Transportation Commission, TxDOT's governing body, authorized CDA procurement for the tunnel project in April 2005 (Texas' first P3 project). That May, TxDOT issued a Request for Qualifications (RFQ), receiving four proposals by September. The teams submitting proposals and their primary partners included: 1) Cintra: Cintra, Concesiones de Infraestructuras de Transporte, S.A., Ferrovial Agroman, S.A., Archer Western Contractors, LTD.; 2) ACS-Zachry Partnership: Dragados Concesiones de Infraestructuras, S.A., Zachry American Infrastructure, DMJM + Harris, Inc.; 3) Dallas Mobility Link: Transurban (USA), Inc., Skanska BOT AB (Skanska BOT), Fluor Enterprises, Inc.; and 4) Macquarie 635 Partnership, L.P.: Macquarie Infrastructure Group, Macquarie Securities (USA), Inc., Kiewit Development Company. TxDOT shortlisted all four teams for the subsequent Request for Proposals (RFP) phase.

Cintra's RFQ submission differed significantly from TxDOT´s original plan. Rather than employing a tunnel approach to add the six managed lanes, Cintra suggested using a trench. By reconstructing the six general purpose lanes and employing cantilevers, this proposal allowed for eight general purpose lanes with three of them running above the trench. Two to three frontage

lanes would also run in each direction. This innovative design proposal presented attractive construction, operations, and maintenance savings compared to the tunnel plan. As a result, TxDOT expressed a willingness to accept changes to their original tunnel design and the resulting environmental re-examinations (ultimately obtained in June 2008) during the remainder of the procurement process.

TxDOT issued its Request for Proposals for the IH 635 project in September 2007, with a March 2008 proposal submission deadline, coinciding with the 2007-2009 global financial crisis. In June 2007, Macquarie had decided to dissolve its Macquarie 635 Partnership to join Cintra´s team as a financial advisor via Macquarie Capital (USA), Inc. By October 2007, the Dallas Mobility Link team had also withdrawn from the process. Facing such challenges, TxDOT released a series of addenda pushing the proposal submission deadline forward, ultimately setting on a January 2009 deadline. The agency received final RFP responses from Cintra and ACS-Zachry Partnership that month and selected Cintra's submission as the best value proposal one month later.

Financial close was reached in June 2010 with a CDA signed between TxDOT and LBJ Infrastructure Group (LBJIG). This Special Purpose Vehicle (SPV) – a company created to isolate the P3 project and its parent companies from one another's risks – included Cintra Concesiones de Infraestructuras de Transporte S.A. and Meridiam Infrastructure, the Dallas Police and Fire Pension System (DPFPS), and APG Investments as investors. The partners signed a DBFOM contract making LBJIG responsible for the highway's design, construction, financing, operation, and maintenance for 52 years, inclusive of construction and operations. The final project design included 13.3 miles of managed lanes affecting 10.7 northwestern miles of IH 635 and 5.8 miles of IH 35E; 9.7 miles of sub-surface lanes would be constructed below the IH 635 general purpose lanes. The project also included: eight reconstructed lanes over the managed lane section; improved cross street bridges; reconstruction of the Joe Ratcliff pedestrian walkway bridge; sound walls, etc. Construction began in January 2011 and the project opened four years later as the LBJ TEXpress Lanes in September 2015 following a 2012 Northern Texas Managed Lanes naming competition.

Total LBJ TEXpress Lanes project funding came to $2.6 billion, divided into 25.8% private equity, 22.9% Private Activity Bonds (tax-exempt bonds issued by the private concessionaire), 32.1% TIFIA loan (to the concessionaire), 18.5% public sector funds, and 0.6% toll revenues during construction (see Appendix D). The project's financing relies on a dynamic tolling process with a three-component pricing scheme.[157,158] First, tolls increase with traffic volume. Second, the managed lanes are divided into three segments of different lengths, with vehicles charged distinct tolls as they enter each segment. A vehicle traveling along the LBJ TEXpress Lanes' full 13.3 mile length will be charged three times, as if the roadway involved three separate tolls. Third, the tolling system varies by vehicle type. For example, while single-occupancy, two-axle passenger vehicles pay the base toll rate, motorcycles and High Occupancy Vehicles with two or more occupants (HOV+2) pay half the base toll rate. The system varies all the way up to large trucks paying 5 times the base toll rate. Exempt vehicles, including transit vehicles, pay no tolls.

The LBJ TEXpress Lanes comprehensive development agreement also includes a revenue-sharing scheme between the public and private partners based on the resulting toll revenues. Starting at the end of the third year of operations, and depending on cumulative toll revenue levels, the concessionaire pays a proportion of its revenues to TxDOT according to a graduated scale. Additionally, while the TIFIA loan requires interest payments beginning in the sixth year of operations, if toll revenues rise higher than forecasted, the CDA requires that fifty percent of the unexpected toll revenue be devoted to TIFIA loan prepayment during those first five years, after accounting for the concessionaire's responsibility to TxDOT.

P3 Objectives & Outcomes

The following section describes the LBJ TEXpress project's goals and outcomes to date, as described by public documents and interviews conducted with public sector and concessionaire interview respondents.

Project Acceleration, Access to Financial Resources, and Cost Minimization

As the interviewees noted, public opposition to vertical and lateral IH 635 expansions ("not higher, not wider") drove TxDOT to initially choose the costly tunnel approach. By promoting competition and incorporating private-sector expertise into the LBJ TEXpress Lanes procurement process, the P3 approach enabled TxDOT to consider a different approach: a $1,223 million open trench rather than a $2,150 million tunnel.[159] Cintra's innovative trench-cantilever design also generated hundreds of millions of dollars in efficiencies (according to Cintra) through ten of the concessionaire's 24 proposed Alternative Technical Concepts (ATCs).[160]

Nevertheless, TxDOT's $700 million in resources remained insufficient to cover the project's expected cost. The P3 procurement approach then allowed TxDOT to access essential private-sector financial resources, in the end costing the state only $490 million in public funding. Ultimately, the P3 approach's design innovations, cost reductions, and private-sector financing accelerated the project by about 10 to 15 years compared to traditional DBB procurement, according to a 2015 TxDOT self-assessment for the Sunset Advisory Committee, a Texas legislative group assessing state agency performance.[161,162] FHWA, similarly, concluded that the P3 approach and resulting TIFIA loan, by diminishing the project's cost and attracting resources from the federal government, the financial sector, and private companies, accelerated project delivery by 19 years.[163,164]

The P3 contract also shifted the **risk of O&M cost increases** to the concessionaire. So far, this risk transfer appears favorable for TxDOT. For example, one interviewee mentioned how the concessionaire will likely pay to rebuild a bridge facing structural problems, increasing maintenance costs. The resulting road availability diminishment might also trigger financial penalties if the concessionaire fails to meet contract standards. In a separate project, similar non-compliance claims deriving from pavement defects amounted to $428,000 for State Highway 130 (SH130), another Texas P3, as reported during that concessionaire's bankruptcy process.[165,166] TxDOT will not encounter financial burdens for such developments, suggesting successful risk transfer from the public-sector perspective.

Cost Certainty & Time to Completion

The literature recognizes that P3s can help the public sector manage cost and scheduling risks[42,64,65] by bundling and subcontracting design and construction components within single, fixed-cost private-sector contracts. This differs from traditional design-bid-build delivery mechanisms that separate design and construction activities into two separate contracts. The single-contract design-build (DB) approach offers advantages by consolidating delivery responsibility with one party for a fixed sum, thereby reducing the contractor claims and change orders that arise from design changes developing from discrepancies and uncertain events.[43]

Citizens had expressed concerns to TxDOT that the original tunnel design could generate cost and schedule overruns similar to those demonstrated by Boston's 3.5-mile Big Dig tunnel project.[94,167] As a result, the LBJ managed lanes agreement included per-day delay penalties and allocated any design and/or construction cost overruns to the contractor.[168] The resulting project delivery experienced no change orders (other than TXDOT requests), opening on-budget and 3 months ahead of schedule.[169]

The excavations required to construct the managed lanes trench appear to have affected nearby structures, however. In February 2017, a Dallas jury ordered the contractor, Trinity Infrastructure, to provide $248,000 to compensate a homeowner for construction impacts, including cracked walls, ceilings, and floors.[170] Residents of over two hundred homes are suing the contractor, possibly requiring up to $60 million in total compensation, although the contractor is unwilling to settle and will most likely appeal the decision. The private-sector partners will bear responsibility for these costs, not TxDOT, suggesting successful risk transfer from the public-sector perspective.

Congestion Management

The interviewees agreed that the LBJ TEXpress Lanes' P3 development approach allowed TxDOT to **manage congestion**, the project's original objective. Looking at the project's third segment (westbound) in April 2011, prior to construction, and again in April 2015, sixteen months after this segment opened to the public:[160,171]

- Overall congestion time has decreased by 77%.
- General purpose lane congestion, measured as the percentage of total vehicles travelling at speeds below 50 mph, has diminished from 23% in April 2011 to 5% in April 2015.
- The managed lanes have improved driving-time certainty for their customers, with average speeds consistently maintained around 70 mph and consistently above the 50 mph minimum mandated speed.
- Average 2015 rush hour managed lane speeds have remained at least 10% higher than speeds in the general purpose lanes.
- Despite a 10% increase in general purpose lane traffic volumes, average rush-hour traffic speeds in those lanes have risen to above 50 mph in 2015, compared to 40 mph speeds in 2011.
- Customer satisfaction rates for both the managed and general purpose lanes have improved from 46% in 2013 to 76% in 2016.

Objectives for Future Projects

Overall, both owner and concessionaire representatives expressed satisfaction with the LBJ TEXpress Lane project outcomes, judging it a huge success across multiple goals. Nevertheless, the LBJ TEXpress Lanes experience does suggest at least one additional objective for future consideration.

Texas statutes do not support longer-term availability payment structures, so TxDOT relies on revenue-risk structures, typically implying tolls, as its primary alternative to the traditional pay-as-you-go DBB approach. Such toll reliance has generated backlash in Texas and political support for P3s has varied considerably as a result. Moving forward, tolling and related issues will require significant community outreach in order to proceed and expand.

Value capture approaches offer an alternative. In the highly developed IH 635 corridor case, greater attention to air rights and abutting property issues might have provided additional project benefits and alternative revenue opportunities. Future projects might benefit from this experience by incorporating broader value capture benefits into their objective sets.

DISCUSSION

The six P3 case analyses presented above offer important findings addressing this research project's three primary objectives. First, they identify the broad range of public-sector objectives underlying surface transportation P3 projects in the U.S and evaluate the projects' success in meeting these objectives. Second, the case study findings highlight the data sources available for measuring output and outcome measures for each of these public-sector objectives, as appropriate for each project, while also identifying key gaps. Finally, the case study findings suggest trends in P3 objective formation and evaluation and suggest recommendations regarding public-sector P3 objectives, data sources, and effectiveness evaluation for policymakers and practitioners considering P3 applications for infrastructure development and renewal.

P3 Project Objective Formation and Evaluation

The research discussed above aimed first to identify and analyze the broad range of public-sector objectives underlying surface transportation P3 projects in the U.S. In the six cases analyzed throughout this report, public-sector agencies tended to develop project concepts addressing a practical transportation problem or set of problems. In all six cases, the relevant transportation problems centered primarily on traffic congestion and the safety and service quality issues that stem from it, although seismic safety improvements were also important in the Presidio Parkway case. Although public agencies can employ P3 approaches to exchange existing project facilities and/or operations for large upfront payments, such transfers did not factor into any of the cases selected for this study.

Despite recognizing the traffic congestion problem, the public agencies then encountered barriers that prevented them from procuring project solutions through traditional means. Two general barrier categories in particular applied across the six study cases. First, the public agencies involved in the I-495, U.S. 36, LBJ, Presidio, and to some degree I-95 cases

encountered financial limitations (both short and long term), often exacerbated by debt limits (U.S. 36 in particular). The second barrier typically stemmed from project design and/or technical limitations. In the study cases, such limitations arose through environmental and legal challenges, eminent domain opposition, aesthetic opposition, tolling challenges, and/or the technical challenges related to tunnel construction.

Given these barriers and the jurisdictions' limited experience with P3 procurement, the public agencies then engaged with P3 procurement approaches to address their financial and technical barriers and achieve their original congestion management and user experience goals. As such, primary public-sector P3 objectives included 1) accessing private-sector funding and financing; 2) accessing private-sector expertise and innovation; and 3) accelerating project delivery via the preceding objectives. In addition, many agencies constructed P3 agreements to achieve a broader range of benefits including: a) cost, schedule, and facility or service quality certainty; b) risk assessment and management, including revenue, political, construction, environmental and technical risks in particular; and c) incorporating broader transportation features, particularly transit.

Overall, the public agencies represented in the six study cases generally met their P3 objectives. First, private-sector funding and financing played a significant role in nearly all the study cases. Privately acquired resources provided the bulk of the required resources for I-495, I-95, and LBJ in particular, and private resources proved essential for addressing debt ceiling limitations in Colorado's U.S. 36 case. While the Port of Miami Tunnel case made use of private financial resources, the P3 approach in this case centered more on technical aspects. Second, private-sector expertise and innovation also played a significant role in nearly all the study cases. Private-sector tolling, managed lane, and HOT/HOV lane expertise played particularly strong roles in Virginia's I-495 and I-95 cases for example. Similarly, the POM Tunnel and LBJ cases benefited greatly from private-sector expertise and innovation for their tunnel and trench-cantilever plans respectively.

Third, taking both the private sector financial and technical successes together, the public-sector agencies were also successful in employing P3 approaches to accelerate their projects compared to the timelines expected under traditional procurement. Both the I-495 and I-95 projects revived stalling projects and circumvented funding delays. Similarly, P3-enabled funding and/or technical advances accelerated both the U.S. 36 and LBJ projects by 10 to 20 years.

As a result, the case P3s were also largely successful in meeting their original congestion management and user experience goals. The I-495, I-95, and LBJ projects, for instance, increased travel speeds, decreased travel times, improved user satisfaction, and improved travel flow. The U.S. 36 project also increased travel speeds and increased transit ridership. The POM Tunnel, in turn, produced significant traffic reductions in downtown Miami.

The case projects were also largely successful in generating greater cost, schedule, and quality certainty for the public sector. P3 contracts enabled on time and within-budget delivery for I-495, I-95, and LBJ, for example, and while the U.S. 36 and POM Tunnel cases both experienced delays, their P3 agreements strongly incentivized delay minimization and their

concessionaires ultimately delivered both projects within budget. The cases also demonstrated successful risk transfer efforts across the studied projects, especially regarding tolling, revenue, construction, and technical risks.

Evidence and Methodology

This study's second objective aimed to identify and evaluate the data sources available for measuring output and outcome measures for each public-sector objective. Two sources especially, published documentation and responsible participant interviews, formed the basis of this analysis.

Looking first at the published sources, project documents demonstrated great variation among the analytical practices employed by public-sector agencies to identify and assess P3 project objectives. Projects often lacked readily available documentation elaborating on the P3 approach's marginal impact compared to traditional delivery. For instance, some state departments of transportation either did not require or did not develop full Value for Money (VfM) analyses, removing a valuable information source from consideration.[11] Additionally, many agencies did not develop project performance analyses like legislative audits and many objectives lacked clear efforts to evaluate achievement and communicate findings with the public.

In many cases, these limited evaluation efforts were exacerbated by transparency practices that varied widely by project and jurisdiction. Some public agencies, like the Texas Department of Transportation, developed comprehensive project websites including environmental studies, document timelines, presentations from public meetings, approval documents, RFP and RFQ documents, proposal documents, and comprehensive agreements. Such sites provide ready public access to essential information and encourage evaluation efforts. Other agencies and projects, in contrast, lacked readily accessible, targeted digital portals and/or distributed documentation across several locations. This was particularly true for older projects, although Presidio documentation also proved given continuing legal disputes initiated by members of the public consortium.

Looking next at the interview protocol, the interview respondents provided valuable insights, particularly in cases and jurisdictions lacking analyses and/or readily accessible documents. First, they often identified and/or provided key documents for analysis. Second, they noted high priority objectives when published sources offered long objective lists and they highlighted secondary objectives not stressed in the available literature. Third, they provided process-related insights, identified obstacles, and supplied information regarding goal achievement. While valuable, such insights were considered carefully and in relation to the published record. Many stakeholders had relocated or refocused during the years following their projects and their corporate, institutional, and/or personal interests may have colored their perspectives. This limited the possibility to obtain the viewpoints of all decision makers, particularly when the project´s procurement process took several administrations to be completed and the project scope got modified along the way.

Lessons & Recommendations

Finally, the preceding research aimed to provide summary findings and recommendations regarding public-sector P3 objectives, data sources, and effectiveness evaluation for policymakers and practitioners considering P3 applications for infrastructure development and renewal.

At the most general level, the case study findings reveal that public agencies pursue P3 procurement approaches for a variety of reasons. While private funding and financing was important in nearly all the study cases, it provided only one of several motivations for P3 selection. Equally important were access to private sector expertise and innovation, project acceleration, risk management, and cost, delivery, and quality certainty. The P3 agreements studied in this analysis were largely successful in meeting these goals, demonstrating the need to consider broader public objectives when evaluating P3s.

The study cases also demonstrated the potential for broader P3 objectives when public agencies select procurement approaches and formulate P3 comprehensive agreements. P3s were relatively new for most case jurisdictions at the time of project development and as a result, the projects likely missed several potential P3 objectives that might provide additional benefits in future projects. Three in particular stand out from the six case analyses.

First, public agencies could do more to access private sector expertise and innovations earlier in the project development process. While nearly all the case projects accessed private-sector expertise and innovations, this often happened accidentally or in a limited fashion. In the I-495 case, for example, unsolicited private-sector proposals provided design innovations greatly diminishing the land acquisition requirements and the community opposition it generated. The LBJ case benefited greatly from the private sector's innovative trench-cantilever design, but this option developed in the RFQ process, rather than during the preceding project-design years. Similarly, while the Presidio Phase II project benefitted from private-sector expertise, it remained constrained by the established design inherited from Phase I. More private-sector consultation earlier in the process, particularly for large and/or complex projects, may have provided additional innovation. This recommendation likely applies to the POM Tunnel case as well, considering the Europe's Eurotunnel experience back in the early 1990s.

Second, although risk-transfer featured in all six case studies, it often appeared as a secondary goal compared to financial, technical, and/or project acceleration goals. Risk transfer can offer significant benefits for public stakeholders and should probably rank higher among the public-sector's primary P3 objectives. Public agencies should focus additional attention on political risk in particular. Political risk generates special drawbacks for P3 delivery methods, especially when they involve tolling or other user fees. Several case projects encountered opposition difficulties – U.S. 36, Port of Miami Tunnel, I-95, Presidio – but P3s can manage such risks through careful consideration, communication, and public engagement. While diminishing political risk might not merit full "objective" status, public and private entities pursuing P3 approaches should all work together to increase and maintain public support.

Third, public agencies might consider expanding their P3 project scopes beyond simple highway expansion plans to incorporate broader transit, local development, and value capture opportunities. The U.S. 36 case, for example, demonstrated how transit, bike facilities, and associated improvements could be incorporated into a project originally designed to expand capacity for vehicular traffic. Other case projects proceeded with narrower scopes and likely left potential transit, economic development, and related value capture opportunities underdeveloped. The competitive procurement processes noted with respect to accessing additional private sector expertise and innovation would likely generate innovation in this respect as well.

The case study findings also suggest the need for improved outcome measurement, analysis, and transparency practices for P3 project documentation, particularly through comprehensive public-sector websites. Public agencies might also consider standardizing data and analyses across projects with access to related documentation. Such recommendations apply particularly to older P3 projects and become increasingly relevant as longer-term contracts make documents relevant for many decades beyond financial close, a situation not typically presented by traditional design-bid-build procurement. Life cycle asset management evaluations in particular suggest special challenges. Furthermore, "citizens' guides" explaining comprehensive agreements, as some agencies provide for FEIS, may help improve communication and citizen engagement.

Study Limits & Insights for Further Study

Given this study's preliminary nature and the small number of cases analyzed, the research offers intriguing findings but cannot support sweeping claims regarding universal P3 objectives, outcomes, and evidence. The six study cases present similar objective profiles, outcomes, and limitations, but other projects will likely offer a more diverse picture. As a result, continued research evaluating the remaining projects listed in Appendix A will be necessary to expand knowledge regarding P3 objectives in the U.S. surface transportation sector. The research team has already acquired private funding to continue this research effort with three additional case studies. Future research efforts might also revise the study methodology, weighing the relative advantages and disadvantages presented by limiting the project universe to projects already reaching "final acceptance." Future efforts should also consider assessing the opinions of decision makers throughout the project, considering that different administrations are often involved in the procurement and delivery of the project. While the final acceptance criteria helps ensure information availability, it might also omit projects demonstrating alternative P3 challenges that offer valuable lessons for future projects. In addition, further efforts might pursue information from federal TIFIA and FHWA sources.

CONCLUSIONS

- Public agencies pursue a range of objectives through P3 procurement approaches. The six study cases collectively demonstrated the following objective profile:
    - Accessing private sector funding and financing
    - Accessing private sector expertise and innovation
    - Accelerating project delivery
    - Ensuring cost, schedule, and facility and/or service quality certainty

    - Transferring risks to the private sector
    - Incorporating broader transit, local development, and value capture opportunities
- The public agencies participating in the six study cases were largely successful in achieving their goals through P3 procurement approaches.
- Public agencies may benefit by
    - Doing more to access private-sector expertise and innovation earlier in the project-development process, particularly through competition.
    - Place more emphasis access private-sector expertise and innovation, on cost and schedule certainty, on risk transfer, and on incorporating broader transit objectives when conducting P3 projects and when communicating with the public.
    - Identify best-practices and risk-transfer practices that may help manage political risk.
    - Incorporating broader transit, local development, and value capture opportunities into their P3 projects
    - Improving outcome measurement, analysis, and transparency practices.

RECOMMENDATIONS

1. First, this study recommends continued analysis for the remaining case projects listed in Appendix A. The work discussed in this report demonstrates the viability of the case study approach and has yielded useful information for state transportation agencies regarding public-sector P3 transportation objectives and potential challenges for achieving them.
2. Second, this study recommends that states strengthen the availability of their P3 project information on-line, in line with best practices observed at some state websites, notably those of California and Texas. In particular, "one stop shopping" for the wide variety of project-related documents - including NEPA documents, court cases and decisions, and other materials - would give stakeholders easier access and support a more informed and engaged citizenry. [Note: Following the completion of this research, TXDOT removed substantial information about LBJ I-635 from its webpage. Cached versions of some of the pages were retained by the research team.]

ACKNOWLEDGEMENTS

The current report is part of the Center for Transportation Public Private Partnership Policy project on P3 Evidence. The report received support from the Virginia Transportation Research Council (VTRC), (award no. 11120010). The researchers particularly appreciate Nossaman's Geoffrey Yarema for his guidance in developing the project. All errors are the responsibility of the authors.

REFERENCES

1. Bardach, Eugene. *A practical guide for policy analysis. The eightfold path to more effective problem solving*. (CQ Press & SAGE Publications Ltd, 2012).
2. McLaughlin, J. A. & Jordan, G. B. Using Logic Models. in *Handbook of practical program evaluation* (eds. Wholey, J. S., Hatry, H. P. & Newcomer, K. E.) 7–32 (Jossey-Bass, 2004).

3. Wilson, J. Q. *Bureaucracy: what government agencies do and why they do it*. (Basic Books, 1989).
4. Cohen, M. D., March, J. G. & Olsen, J. P. A garbage can model of organizational choice. *Administrative science quarterly* 1–25 (1972).
5. Schneider, A. L. *Policy design for democracy*. (University Press of Kansas, 1997).
6. Stone, D. *Policy paradox: the art of political decision making*. (W.W. Norton & Co, 2012).
7. Braybrooke, D. & Lindblom, C. *A Strategy of Decision. Policy evaluation as a social process*. (Free Press, 1970).
8. *Public-private partnerships: in pursuit of risk sharing and value for money*. (OECD, 2008).
9. Verhoest, K. *et al.* Introducing the national context for PPPs -elements and dimensions. in *Public private partnerships in transport: trends and theory* (ed. Roumboutsos, A.) 9–18 (Routledge, 2015).
10. Department of the Treasury. *Expanding our Nation's Infrastructure through Innovative Financing*. (U.S. Department of the Treasury, 2014).
11. FHWA. Value for Money Assessment for Public-Private Partnerships: A Primer. (2012).
12. U.S. DOT. *Risk Assessment for Public-Private Partnerships: A Primer*. (U.S. Department of Transportation (USDOT), 2012).
13. Chasey, A., Maddex, W. & Bansal, A. Comparison of Public-Private Partnerships and Traditional Procurement Methods in North American Highway Construction. *Transportation Research Record: Journal of the Transportation Research Board* **2268,** 26–32 (2012).
14. *Private financing of public transportation infrastructure: utilizing public-private partnerships*. (Lexington Books, 2015).
15. Gifford, J. Transportation Finance. in *The Oxford Handbook of State and Local Government Finance* (eds. Ebel, R. D. & Petersen, J. E.) 594–623 (Oxford University Press, 2012).
16. Oliveira, M., Costa, J., Ribeiro, J. & Macário, R. Finding an institutional evolutionary maturity concept. An exploratory analysis for European experience in PPPs. in *Public private partnerships in transport: trends and theory* (ed. Roumboutsos, A.) 44–63 (Routledge, 2015).
17. Buckberg, E. Expanding the Market for Infrastructure Public-Private Partnerships. *U.S. Department of the Treasury* (2015). Available at: https://www.treasury.gov/connect/blog/Pages/Expanding-the-Market-for-Infrastructure-Public-Private-Partnerships-.aspx. (Accessed: 3rd January 2017)
18. Wholey, J. S. Evaluability Assessment. in *Handbook of practical program evaluation* (eds. Wholey, J. S., Hatry, H. P. & Newcomer, K. E.) 33–62 (Jossey-Bass, 2004).
19. Liyanage, C., Njuangang, S. & Villalba-romero, F. Measuring success in PPP road projects in Europe. A performance measurement system (PMS). in *Public private partnerships in transport: trends and theory* (ed. Roumboutsos, A.) 237–261 (Routledge, 2015).
20. Frey, W. H. *Population Growth in Metro America since 1980: Putting the Volatile 2000s in Perspective*. (Brookings, 2012).
21. Mullins, L. The Audacious Plan to Turn a Sprawling DC Suburb Into a Big City | Washingtonian. *Washingtonian* **50,** (2015).
22. Texas A&M Transportation Institute. *Annual Urban Mobility Scorecard. Congestion Data for your City*. (Texas A&M Transportation Institute, 2015).
23. VDOT & FHWA. Capital Beltway Study. Final Environmental Impact Statement. Section 4(f) Evaluation. (2006).

24. Gifford, J. L. & Transue, M. The Evolution of Virginia's Public-Private Partnership Enabling Statutes. *Journal of Corporation Law* 265–282 (2015).
25. Virginia DOT. *Implementation Guidelines of the Public-Private Transportation Act of 1995*. (Virginia Department of Transportation, 2001).
26. Transurban. Annual Report 2004. (2004).
27. Transurban. Annual Report 2005. (2005).
28. Minnesota DOT. *Innovative Finance in Action. Virginia I-495 HOT Lanes*. (Minnesota Department of Transportation, 2009).
29. Transurban (USA) Inc. 495 Express Lanes. (2017).
30. VDOT. *I-95 HOV/HOT Lanes Design Public Hearing. I-95 Transit and Transportation Demand Management Plan*. (Virginia Department of Transportation (VDOT), 2011).
31. Aument, J. Virginia Express Lanes. (2017).
32. Debt Capacity Advisory Committee. *Report to the Governor and General Assembly*. (2007).
33. Debt Capacity Advisory Committee. *Report to the Governor and General Assembly*. (2008).
34. Debt Capacity Advisory Committee. *Report to the Governor and General Assembly*. (2009).
35. Debt Capacity Advisory Committee. *Report to the Governor and General Assembly*. (2010).
36. Debt Capacity Advisory Committee. *Report to the Governor and General Assembly*. (2011).
37. Debt Capacity Advisory Committee. *Report to the Governor and General Assembly*. (2012).
38. Debt Capacity Advisory Committee. *Report to the Governor and General Assembly*. (2013).
39. Virginia Department of Planning & Budget. *Six-Year Capital Outlay Plan (2008-2014)*. (2008).
40. Wiggins, J. & Willitts, W. Tollroad operator Transurban hits traffic jam with US project. *The Sydney Morning Herald* (2014). Available at: http://www.smh.com.au/business/tollroad-operator-transurban-hits-traffic-jam-with-us-project-20140212-32j96. (Accessed: 31st March 2017)
41. NCPPP. Transurban to Restructure I-495 Toll Lanes Financing. *The National Council for Public-Private Partnerships (NCPPP)* (2014). Available at: http://www.ncppp.org/transurban-to-restructure-i-495-toll-lanes-financing/. (Accessed: 31st March 2017)
42. Lawther, W. C. & Martin, L. L. An Introduction to Private Sector Financing of Transportation Infrastructure. in *Private financing of public transportation infrastructure: utilizing public-private partnerships* (eds. Lawther, W. C. & Martin, L. L.) 1–18 (Lexington Books, 2015).
43. Songer, A. D. & Molenaar, K. R. Selecting Design-Build: Public and Private Sector Owner Attitudes. *Journal of Management in Engineering* **12,** 47–53 (1996).
44. Cloyed, L. Virginia's 495 Express Lanes: Funding, Construction and Operations. (2013).
45. VA P3. *I-495 Express Lanes Lessons Learned During Design-Build Phase*. (Virginia P3 Office, Virginia Department of Transportation (VDOT), 2015).
46. Virginia DOT. Transform 66 Inside the Beltway Fact Sheet. (2016).
47. CTB. *Resolution of the Commonwealth Transportation Board*. (Commonwealth Transportation Board (CTB), 2016).
48. Layne, A. Transform66: Outside the Beltway. P3 Procurement Update. (2016).
49. Pettem, S. Toll road to Denver opened 60 years ago -. *Boulder Daily Camera* (2012). Available at: http://www.dailycamera.com/ci_19691714?source=most_viewed. (Accessed: 15th March 2017)

50. Daniel, J. R., Schachter, H. & Liu, R. (Rachel). *Feasibility and Efficacy of Public Transportation Partnerships. Volume Ii – Case Studies*. (NJDOT & USDOT, 2014).
51. FHWA, FTA, CDOT & RTD. *Final Environmental Impact Statement / Final Section 4(f) Evaluation. Volume I*. https://www.codot.gov/projects/us36eis/documents/us-36-final-eis-volume-i (2009).
52. 36 Commuting Solutions. *2014 US 36 Mobility Report*. (2015).
53. Colorado DOT. *Colorado's U.S. 36 Managed Lane/Bus Rapid Transit (BRT) Project: A Sustainable Transportation Investment Generating Economic Recovery (TIGER) Grant Application*. (Colorado Department of Transportation, 2009).
54. CDOT. Project Report: Achieving Value for Money. U.S. 36 Express Lanes Public-Private Partnership. (2014).
55. FHWA & FTA. *Record of Decision for the US 36 Corridor*. (Federal Highway Administration And Federal Transit Administration, 2009).
56. Watkins, K. *Memorandum on State Spending Limitations: TABOR and Referendum C*. (Colorado Legislaslative Council Staff, 2009).
57. Gifford, J. L., Bolaños, L., Transue, M. & Kweun, J. Y. The Governance of Surface Transportation in the 21st Century: VDOT Institutional Responses to Environmental Changes. in (2015).
58. Colorado HPTE. Request for Qualifications to Finance, Design and Construct the Us 36 Phase 2 Corridor, and Operate and Maintain the Managed Lanes in the Us 36 Corridor and I-25 Express Lanes Through a Public-Private Partnership. (2012).
59. Aguilar, J. The mother of all cone zones: Reconstruction of U.S. 36 starts this week. *Estes Park Trail-Gazette* (2012). Available at: http://www.eptrail.com/ci_21137539/mother-all-cone-zones-reconstruction-u-s-36. (Accessed: 28th June 2017)
60. Colorado HPTE. U.S. 36 and I-25 Managed Lanes. Senior Revenue Bonds series. (2014).
61. Colorado HPTE. Fiscal Year 2016 Annual Report. (2017).
62. Clary Consulting, LLC. *US-36 Public-Private Partnership (P3) Project Performance Audit*. (Legislative Audit Committee of the Colorado General Assembly, 2015).
63. DeCorla-Souza, P. & Barker, W. G. Innovative public-private partnership models for road pricing/BRT initiatives. *Journal of Public Transportation* **8,** 4 (2005).
64. USDOT. *Challenges and Opportunities Series: Public Private Partnerships in Transportation Delivery*. (U.S. Department of Transportation (USDOT), 2012).
65. Lawther, W. C. Evaluation of Public-Private Partnerships for Transportation Infrastructure Financing: Process and Goal Achievement. in *Private financing of public transportation infrastructure: utilizing public-private partnerships* (eds. Lawther, W. C. & Martin, L. L.) 135–178 (Lexington Books, 2015).
66. Colorado DOT. US 36 Lyons to Estes Park —. *Colorado DOT* (2014). Available at: https://www.codot.gov/projects/floodrelatedprojects/completed-projects/us-36-lyons-to-estes. (Accessed: 16th March 2017)
67. Aguilar, J. Colorado re-emerging from $2.9 billion flood disaster a year later. *The Denver Post* (2014). Available at: http://www.denverpost.com/2014/09/06/colorado-re-emerging-from-2-9-billion-flood-disaster-a-year-later/. (Accessed: 16th March 2017)
68. Colorado DOT. US 36 Lyons to Estes Park. *Colorado DOT* (2014). Available at: https://www.codot.gov/projects/floodrelatedprojects/completed-projects/us-36-lyons-to-estes. (Accessed: 2nd April 2017)

69. NOAA. *Biscayne Bay: Environmental History and Annotated Bibliography*. (US Department of Commerce - National Oceanic and Atmospheric Administration (NOAA), 2000).
70. Miami Dade County, Seaport Department. Port of Miami Comprehensive Annual Financial Report 2008. (2009).
71. PortMiami. 2035 Master Plan. (2011).
72. Cambridge Systematics, Inc. Port of Miami Freight Access Study. (2007).
73. Norton, F. Train Tunnel To Port Of Miami Seen As Way To Ease Congestion Promote Downtown Development. *Miami Today* (2002). Available at: http://www.miamitodaynews.com/news/020613/story1.shtml. (Accessed: 23rd March 2017)
74. Schrank, D. & Lomax, T. *The 2005 Urban Mobility Report*. (Texas Transportation Institute, 2005).
75. FDOT. *Value for Money Analysis. The Port of Miami Tunnel and Access Improvement Project*. (Florida DOT, 2010).
76. Bipartisan Policy Center. Case Study: Infrastructure Public-Private Partnerships. (2016).
77. AECOM Consult Team. *Case Studies of Transportation Public-Private Partnerships in the United States*. (U.S. Department of Transportation (USDOT) Federal Highway Administration, 2007).
78. Easley, J. V. *Overview of Prior Studies*. (Florida Department of Transportation, 2005).
79. Build America Bureau. Port of Miami Tunnel, Miami, FL. *U.S. Department of Transportation* (2014). Available at: https://www.transportation.gov/policy-initiatives/build-america/port-miami-tunnel-miami-fl. (Accessed: 2nd April 2017)
80. Parsons Brinckerhoff. *Design Basis Report. Port of Miami Tunnel & Access Improvements*. (2005).
81. Fountain, R. P. *Memo - Shortlisted teams*. (Florida Department of Transportation, 2007).
82. Minnesota DOT. *Port of Miami Tunnel: Case Study on a DBFOM Contract with Availability Payments*. (Minnesota Department of Transportation, 2011).
83. Sadler, D. Florida Department of Transportation - Portof Miami Tunnel. (2013).
84. Sheehan, P. Big boys' greed pulls us all. *The Sydney Morning Herald* (2008). Available at: http://www.smh.com.au/news/opinion/paul-sheehan/australias-richest-man-youre-having-a-laugh-/2008/10/26/1224955851150.html. (Accessed: 3rd April 2017)
85. Murdoch, S. It's game over for investment bank Babcock & Brown. *The Australian* (2009). Available at: http://www.theaustralian.com.au/business/news/game-over-for-babcock/news-story/395745e3c045ed08a26a88a314ae4a36. (Accessed: 3rd April 2017)
86. Wallis, P. Bouygues gets second chance on Port link. Miami Port Tunnel on life support. *TunnelTalk* (2009). Available at: http://www.tunneltalk.com/Miami-Port-Tunnel-on-life-support.php. (Accessed: 3rd April 2017)
87. Wallis, P. Port of Miami Tunnel finally a project. *TunnelTalk* (2009). Available at: http://tunneltalk.com/Miami-Port-Tunnel-Oct09-Miami-Port-Tunnel-finally-a-project.php. (Accessed: 3rd April 2017)
88. Gilpatrick, B. FDOT agrees to move forward on Port of Miami Tunnel | Naked Politics. *Miami Herald* (2009). Available at: http://miamiherald.typepad.com/nakedpolitics/2009/04/fdot-agrees-to-move-forward-on-port-of-miami-tunnel.html. (Accessed: 3rd May 2017)
89. Burgess, G. *Monthly Report from the Florida Department of Transportation on the Port of Miami Tunnel*. (Miami-Dade County, 2009).

90. Sigo, S. Miami Tunnel Reaches Closure. *The Bond Buyer* (2009). Available at: http://www.bondbuyer.com/issues/118_200/miami-tunnel-project-1002638-1.html. (Accessed: 3rd April 2017)
91. USDOT. *Transportation Infrastructure Finance and Innovation Act. 2016 Report to Congress*. (U.S. Department of Transportation (USDOT), 2016).
92. Florida DOT. Port of Miami Tunnel - Project Information Memorandum. (2006).
93. Maza, E. Port of Miami Tunnel Project Could Be South Florida's Big Dig. *Miami New Times* (2010). Available at: http://www.miaminewtimes.com/news/port-of-miami-tunnel-project-could-be-south-floridas-big-dig-6552797. (Accessed: 3rd April 2017)
94. Flint, A. 10 years later, did the Big Dig deliver? *The Boston Globe* (2015). Available at: https://www.bostonglobe.com/magazine/2015/12/29/years-later-did-big-dig-deliver/tSb8PIMS4QJUETsMpA7SpI/story.html. (Accessed: 4th April 2017)
95. Florida DOT. Port of Miami Tunnel and Access Improvement Project. Supplement to Project Information Memorandum. (2006).
96. Gimenez, C. A. *Correspondence from the Florida Department of Transportation re: Port of Miami Tunnel Project - Settlement of Geotechnical Issues*. (Miami-Dade County, 2013).
97. Calderon, J. S. *Memorandum: Port Miami Traffic Data Collection-Port of Miami Tunnel and Port Blvd Bridge*. (Florida Department of Transportation (FDOT), 2014).
98. Miami Dade County, Seaport Department. Port of Miami Comprehensive Annual Financial Report 2015. (2016).
99. FHWA. FHWA Route Log and Finder List - Interstate Highway System -. *U.S. Department of Transportation (USDOT) Federal Highway Administration (FHWA)* (2016). Available at: https://www.fhwa.dot.gov/planning/national_highway_system/interstate_highway_system/routefinder/table01.cfm. (Accessed: 31st May 2017)
100. Schrank, D. & Lomas, T. *The 2005 Urban Mobility Report*. (Texas Transportation Institute, 2005).
101. Connaughton, S. Advancing New I-95 HOV/HOT Lanes Project, HOV/transit ramp at Mark Center. (2011).
102. VDOT. *I-95 HOT Lanes Interchange Justification Report, Phase I*. (Virginia Department of Transportation (VDOT), 2011).
103. USDOT, FHWA & VDOT. *Environmental Assessment I-95 HOT Lanes Project*. (U.S. Department of Transportation (USDOT) Federal Highway Administration (FHWA) Virginia Department of Transportation (VDOT), 2011).
104. Kilpatrick, C. I-I-95 Hov/Hot Lanes 95 Hov/Hot Lanes Project. Major Business Terms. (2011).
105. VDOT & DRPT. *I-95/395 HOV/Bus/HOT Lanes Project Overview*. (Virginia Department of Transportation (VDOT), Virginia Department of Rail and Public Transportation (DRPT), 2007).
106. I-95/I-395 Transit/TDM Technical Advisory Committee. *I-95/I-395 Transit/TDM Study. Final Report*. (2008).
107. Cullum, J. Arlington Stands Alone In HOT Lanes Lawsuit » AlexandriaNews. *AlexandriaNews* (2009). Available at: https://alexandrianews.org/2009/top-stories/arlington-stands-along-in-hot-lanes-lawsuit/9379/. (Accessed: 25th May 2017)
108. Halsey III, A. Lawsuit Over Virginia HOT Lanes Spurs Mixed Reactions from Advocacy Groups. *The Washington Post* (2009).

109. Zimmerman, C. *Letter to Speaker Howell and Senator Colgan Concerning the I-395/95 HOT Lanes Project and the Arlington Litigation*. (Arlington County, 2011).
110. U.S. District Court for the District of Columbia. *County Board of Arlington, VA v U.S.DOT, Honorable Raymond H. Lahood, FHWA, Victor Mendez, VDOT, Honorable Pierce R. Homer*. (U.S. District Court for the District of Columbia, 2009).
111. Bulova, S. Fairfax County's Concerns Regarding I-95/395 HOT Lanes Project. (2009).
112. ARLnow.com. Arlington Will Withdraw HOT Lanes Suit. *ARLnow.com - Arlington, Va. Local News* (2011).
113. Helderman, R. Va. cancels plans for I-395 HOT lanes. *POST Now* (2011). Available at: http://voices.washingtonpost.com/local-breaking-news/virginia/va-cancels-plans-for-i-395-hot-lanes-inside-beltway.html?wprss=local-breaking-news. (Accessed: 26th May 2017)
114. Goodman, C. Va. congressmen criticize Mark Center occupancy plan. *The Washington Post* (2011). Available at: https://www.washingtonpost.com/blogs/virginia-politics/post/va-congressmen-criticize-mark-center-occupancy-plan/2011/07/14/gIQAXCunEI_blog.html?utm_term=.fe38a5bfc003. (Accessed: 26th May 2017)
115. Thomson, R. Arlington says maybe to new HOT lanes plan. *The Washington Post* (2016). Available at: https://www.washingtonpost.com/news/dr-gridlock/wp/2016/12/14/arlington-says-maybe-to-new-hot-lanes-plan/?utm_term=.e7a4a40237ea. (Accessed: 26th May 2017)
116. VDOT. I-395 Express Lanes Extension. *Virginia Department of Transportation (VDOT)* (2017). Available at: http://www.virginiadot.org/projects/northernvirginia/395_express.asp. (Accessed: 26th May 2017)
117. Thomson, R. Virginia to extend I-95/395 HOT lanes north to D.C. line -. *The Washington Post* (2015). Available at: https://www.washingtonpost.com/news/dr-gridlock/wp/2015/11/20/virginia-to-extend-i-95395-hot-lanes-north-to-d-c-line/?utm_term=.504922478767. (Accessed: 26th May 2017)
118. VDOT. I-95 Express Lanes Southern Extension. *Virginia Department of Transportation (VDOT)* (2017). Available at: http://virginiadot.org/projects/northernvirginia/95_express_lanes_southern_terminus.asp. (Accessed: 26th May 2017)
119. VDOT. I-95 Express Lanes Southern Terminus Extension Stafford County, Virginia. Public Information Meeting. (2016).
120. VDOT. I-95 Express Lanes Fredericksburg Extension. *Virginia Department of Transportation (VDOT)* (2017). Available at: http://www.virginiadot.org/projects/fredericksburg/i-95_express_lanes_fredericksburg_extension.asp. (Accessed: 27th June 2017)
121. VDOT. Gov. McAuliffe Announces 95 Express Lanes Open Dec. 14. *Virginia Department of Transportation (VDOT)* (2014). Available at: http://www.virginiadot.org/newsroom/statewide/2014/gov._mcauliffe_announces_9578379.asp. (Accessed: 30th May 2017)
122. VA P3. *I95 Express Lanes Lessons Learned during the Design-Build Phase*. (Virginia P3 Office, Virginia Department of Transportation (VDOT), 2015).
123. VA P3. *I95 Express Lanes Best Practices during the Design-Build Phase*. (Virginia P3 Office, Virginia Department of Transportation (VDOT), 2015).

124. Presidio Parkway. The Doyle Drive Historic Corridor. *Presidio Parkway* (2017). Available at: http://www.presidioparkway.org/about/history/display_new_deal.aspx. (Accessed: 21st June 2017)
125. Golden Gate Bridge and Highway District. About us. *Golden Gate Bridge and Highway District* (2017). Available at: http://goldengate.org/organization/. (Accessed: 28th June 2017)
126. SFCTA, FHWA & Caltrans. *South Access to the Golden Gate Bridge - Doyle Drive FEIS/R*. (Federal Highway Administration (FHWA) San Francisco County Transportation Authority (SFCTA) California Department of Transportation (Caltrans), 2008).
127. San Francisco Guideway Associates. *Final Report Doly Drive Intermodal Study*. (San Francisco County Transportation Authority (SFCTA), 1996).
128. Superior Court of the State of California. *Professional Engineers in California Government et al. v. Department of Transportation et al.* (Superior Court of the State of California, 2011).
129. LaForte, A. & Saage, L. *Memorandum to Citizens Advisory Committee to adopt a motion of support for the affirmation of the Authority´s Funding commitment to the Presidio Parkway Project.* (2011).
130. ARUP PB Joint Venture, CirclePoint & MPA Design. *Doyle Drive Replacement Project. Summary of Sustainability Program: Phase I*. (San Francisco County Transportation Authority (SFCTA), 2007).
131. FHWA, SFCTA & Caltrans. *South Access to the Golden Gate Bridge - Doyle Drive Project. Project Management Plan*. (Federal Highway Administration (FHWA) San Francisco County Transportation Authority (SFCTA) California Department of Transportation (Caltrans), 2009).
132. Pimentel, R. *Memorandum to Citizens Advisory Committee to Adopt a Motion of Support for a Resolution Authorizing the Executive Director to Execute Cooperative Agreements between the San Francisco County Transportation Authority and the California Department of Transportation for Receipt of Federal and State Funds*. (San Francisco County Transportation Authority (SFCTA), 2006).
133. Reinhardt, W. G. Caltrans Settles Presidio Parkway Claims for $91 Million. *Public Works Financing* **318,** 1 (2016).
134. The Presidio Trust. *Milestones. Presidio Trust 2012 Year-end Report to Congress and the Community*. (Presidio Trust, 2012).
135. *Draft Version of Proprietary Report*.
136. Caltrans. *Presidio Parkway Project Public Private Agreement Volume II (Technical Requirements)*. (California Department of Transportation (Caltrans), 2010).
137. FHWA, SFCTA & Caltrans. *South Access to the Golden Gate Bridge – Doyle Drive Construction Staging and Risk Management*. (Federal Highway Administration (FHWA) San Francisco County Transportation Authority (SFCTA) California Department of Transportation (Caltrans), 2009).
138. Caltrans. Public-Private Partnerships. *California Department of Transportation* (2017). Available at: http://www.dot.ca.gov/hq/innovfinance/public-private-partnerships/PPP_main.html. (Accessed: 21st June 2017)
139. WSP | Parsons Brinckerhoff. *Report on Highway Public-Private Partnership Concessions in the United States*. (U.S. Department of Transportation (USDOT) Federal Highway Administration (FHWA) Office of Innovative Program Delivery, 2016).

140. Arup & Parsons Brinckerhoff. *Analysis of Delivery Options for the Presidio Parkway Project*. (Caltrans, 2010).
141. Carlsen, R. Caltrans Awards P3 Contract for Presidio Parkway Second Phase. *ENRCalifornia* (2011). Available at: http://www.enr.com/articles/19363-caltrans-awards-p3-contract-for-presidio-parkway-second-phase. (Accessed: 22nd June 2017)
142. Taylor, M. *Letter to Senator Alan Lowenthal on Public-Private Parnterships*. (Legislative Analysts Office (LAO), 2010).
143. Taylor, M. *Maximizing State Benefits From Public-Private Partnerships*. (Legislative Analysts Office (LAO), 2012).
144. SFCTA. *New Report Presents Inaccurate Critique of the Presidio Parkway Project. LAO Incorrectly Characterizes Project Procurement Process*. (San Francisco County Transportation Authority (SFCTA), 2012).
145. Aguilar, K. *Appellate court clears way for Presidio Parkway Project to move forward as a Public-Private Partnership*. (Hanson Bridgett Infrastructure Practice Group, 2011).
146. Carlsen, R. California Judge Dismisses Engineer Union's Lawsuit on P3 Project. *ENRCalifornia* (2011). Available at: http://www.enr.com/articles/19396-california-judge-dismisses-engineer-union-s-lawsuit-on-p3-project. (Accessed: 19th June 2017)
147. Ortega, N. & Ajise, K. *Memorandum to Chari and Commissioners. Update on Presidio Parkway Public-Private Partnership Project*. (California Department of Transportation (Caltrans), 2011).
148. Roberts, S. California Supreme Court Allows Presidio Parkway to Proceed as P3. *Infra Insight Blog* (2011). Available at: http://www.infrainsightblog.com/2011/11/articles/p3s/california-supreme-court-allows-presidio-parkway-to-proceed-as-p3/. (Accessed: 21st June 2017)
149. The Court of Appeal of the State of California. First Appellate District. *Professional Engineers in California Government et al. v. Department of Transportation et al.* (The Court of Appeal of the State of California. First Appellate District, 2011).
150. FHWA. Project Profiles. (2016). Available at: https://www.fhwa.dot.gov/ipd/project_profiles/index.htm. (Accessed: 3rd March 2014)
151. Moscovich, J. L. Presidio Parkway P3. The Case for Flexibility in Project Delivery and Finance. (2011).
152. Slotboom, E. Dallas Freeways. in *Dallas-Fort Worth freeways: Texas-sized ambition* (Dallas Morning News & AIA Dallas Columns Magazine, 2014).
153. Slotboom, E. Central Expressway. in *Dallas-Fort Worth freeways: Texas-sized ambition* (Dallas Morning News & AIA Dallas Columns Magazine, 2014).
154. INRIX. *National Traffic Scorecard. 2010 Annual Report. Back on the Road to Gridlock.* (2011).
155. LBJ Development Partners. *IH 635 Managed Lanes Project a Partnership for Delivering a 21st Century Transportation System*. (2009).
156. TxDOT. *Comprehensive Development Agreements*. (Texas Department of Transportation (TxDOT), 2015).
157. LBJ Development Partners. IH 635 Managed Lanes Project. Appendix D.4. Draft Tolling Plan. (2009).
158. LBJ Infrastructure Group. Vehicle Classification Shapes. *LBJ TEXpress Lanes* (2017). Available at: http://www.lbjtexpress.com/pricing/vehicle-classification-shapes. (Accessed: 14th May 2017)

159. TxDOT. *IH 635 Managed Lanes Project Update*. (Texas Department of Transportation (TxDOT), 2007).
160. Sanchez, R. NTE/LBJ Managed Lanes Facts and Benefits. (2016).
161. TxDOT. *Self-Evaluation Report Submitted to the Sunset Advisory Commission*. (Texas Department of Transportation (TxDOT), 2015).
162. Sunset Advisory Commission. Texas Department of Transportation. Sunset Staff Report with Commission Decisions. 2016–2017. (2017).
163. Build America Bureau. IH 635 Managed Lanes. *U.S. Department of Transportation* (2016). Available at: https://www.transportation.gov/tifia/financed-projects/ih-635-managed-lanes. (Accessed: 15th May 2017)
164. Sharn, L. LBJ Managed Lanes, The Ultimate Greenfield Test. *Public Works Financing* (2010).
165. Buchanan, B. B. *SH 130 Segment 5 & 6. CSJ: 3583-02-003. Breaches or failures regarding uncured Category 2 Defects*. (Texas Department of Transportation (TxDOT), 2016).
166. SH130 Concession, Zachry Toll Road, Cintra TX. *Debtors' Reply to Texas Department of Transportation's Objection to Debtors' Notice of (i) Potential Assumption or Assumption and Assignment of Certain Executory Contracts and Unexpired Leases Under the Plan, (ii) Fixing of Cure Claims Related Thereto, and (iii) Deadline to Object Thereto. Case No. 16-10262 Case No. 16-10263 Case No. 16-10264*. (SH 130 Concession Company, LLC; Zachry Toll Road -56 LP; Cintra TX 56 LLC, 2017).
167. Resource Systems Group Inc. LBJ Freeway Corridor Study. (2004).
168. LBJ Infrastructure Group, LLC IH-635 Managed Lanes Project. *$615,000,000 Texas Private Activity Bond Surface Transportation Corporation. Senior Lien Revenue Bonds. Series 2010 (Tax-Exempt)*. (2010).
169. Reinhardt, W. LBJ Express A P3 Benchmark. *Public Works Financing* (2015).
170. Wilonsky, R. Bumpy road could lie ahead for LBJ Express builder after jury awards $248,000 to homeowner. *Dallas News* (2017). Available at: https://www.dallasnews.com/news/courts/2017/02/10/bumpy-road-lie-ahead-lbj-express-builder-jury-awards-248000-homeowner. (Accessed: 15th May 2017)
171. Sanchez, R. NTE & LBJ Managed Lanes Some Facts After the First Year of Operations. (2016).
172. Project Financial Advisory Ltd. (PFAL). Transportation Financing Case Studies. (2016).
173. WCX. *Performance-Based Infrastructure (PBI) Transportation Project Case Studies*. (West Coast Infrastructure Exchange (WCX), 2015).

APPENDIX A: U.S. SURFACE TRANSPORTATION P3s

State	Year of Financial Close	Project	Project Type	Contract Type	Project Status as of June 2017
California	2012	Presidio Parkway Phase II*	Road	DBFOM	Operating
Colorado	2010	Eagle P3	Commuter Rail	DBFOM	Under Construction
Colorado	2014	US-36 and I-25 Managed Lanes Phase II, US 36 Express Lanes/BRT Phase II*	Road	DBFOM	Operating
Florida	2009	I-595 Managed Lanes P3	Road	DBFOM	Operating
Florida	2009	Port of Miami Tunnel*	Tunnel	DBFOM	Operating
Florida	2014	I-4 Ultimate Improvements	Road	DBFOM	Under construction
Indiana	2013	Ohio River Bridges Project, East End Crossing	Bridge	DBFOM	Under construction
Indiana	2014	I-69 Section 5	Road	DBFOM	Under Construction
Maryland	2016	Maryland Purple Line	Commuter Rail	DBFOM	Procurement
New York	2007	LaGuardia Airport Central Terminal Building (CTB)	Airport Terminal	DBFOM	Operating
New York - New Jersey	2013	Goethals Bridge	Bridge	DBFM	Under Construction
North Carolina	2015	I-77 HOT Lanes	Road	DBFOM	Under construction
Ohio	2015	Portsmouth Bypass, Southern Ohio Veterans Memorial Highway, SR 823	Road	DBFOM	Under Construction
Pennsylvania	2016	Pennsylvania Rapid Bridge Replacement Project	Bridge	DBFM	Under Construction
Texas	2008	State Highway 130, Segments 5 & 6	Road	DBFOM	Operating
Texas	2009	North Tarrant Express Segments 1 & 2A	Road	DBFOM	Operating
Texas	2010	I-635 LBJ TEXpress Managed Lanes*	Road	DBFOM	Operating
Texas	2013	North Tarrant Express Segment 3A, I-35	Road	DBFOM	Under Construction
Texas	2014	State Highway 183 Managed Lanes, Midtown Express	Road	DBOM	Under Construction
Virginia	2007	I-495 Capital Beltway HOT Lanes*	Road	DBFOM	Operating
Virginia	2012	Elizabeth River Tunnels, Midtown Tunnel	Tunnel	DBFOM	Operating
Virginia	2012	I-95 HOV/HOT Lanes, Express Lanes*	Road	DBFOM	Operating

* Selected for initial evaluation with feedback from the Virginia Department of Transportation. See the Study Scope section in the body text for selection criteria.

APPENDIX B: INTERVIEW GUIDE

Thank you for taking the time to respond to our interview. The objective of this interview is to develop evidence for evaluating the efficacy of the P3 approach by examining the different policy objectives that project sponsors pursue in concert with available project parameters and your view of project outcomes to date. Neither your identity nor your affiliation will be revealed when we summarize the responses provided to us in our research report.

1. Background on Individual(s) Interviewed:

Name and Date	
Interviewed by	
Contact	
Position and Project Role	
Suggested By	

2. Origin of the Project:

What was the origin of the project?	
Which agency was in charge and when was planning initiated?	
Was the project put on long-range plan? When was it put on?	
Was the project considered for traditional funding?	

3. Origin of the Project as a P3:

Were other Alternative Delivery Methods (ADM) considered? Which ADMs were considered? When?	
How were the delivery options screened?	
How was the P3 approach selected? By the Governor? DOT Secretary? Congressional delegation?	
Was the P3 approach urged by groups outside the government?	

4. P3 Objectives:

What were the original agency´s objectives when opting for the P3 delivery method? Options to discuss: Expedited Project Completion. Cost certainty. Certainty of Project Completion. Consolidated contracting. Reduced Design and Construction Costs. Reduced Life-Cycle Costs. Shift risks to contractor. Overcome public budget shortfalls. Avoid public debt ceiling. Assured maintenance.	
Were the objectives modified once the P3 delivery method was selected? If so, how?	
If applicable: how were objectives affected by competitive bid? By unsolicited proposal? By public hearings?	

5. P3 Outcomes to date:

Were the agency´s objectives achieved?	
How is the agency measuring if the objectives are achieved?	
Which are the top benefits of the P3 approach for this project?	
Which are the top shortcomings of the P3 approach for this project?	
Was the P3 approach pivotal into achieving the objectives of the project vis a vis the DBB approach? How?	
Any Alternative Technical Concepts realized? Provide examples.	
Suggested sources for more detailed quantitative data?	

6. Project Estimated and Actual Costs and Time to Completion

Category	Estimated originally using Traditional Procurement	Estimated originally using the P3s approach	Actual
Design and construction costs			
Maintenance costs			
Financing costs			
Time to completion			

7. Project risks

What risks were shifted to the private sector?	
Any risks actually suffered by contractor and absorbed?	
Did risk stick where assigned (or renegotiated)?	
Expected value of transferred risks?	

8. Retrospective

Would you do the project again, regardless of the delivery method?	
Would you do the project again, as a P3?	
What are the lessons learned from the project?	
Has the State embarked on further P3 projects? Why or why not?	

Thank you very much for participating in our survey.
We hope we can contact you again for clarification of your responses.

APPENDIX C. LIST OF INTERVIEW RESPONDENTS

Name	Relevant Experience
Teresita Alvarez	District Modal Development Administrator at FDOT
Jennifer Aument	Group General Manager North America at Transurban
George Burgess	Previous: Miami-Dade County Manager Now: Senior Government Relations Strategist and Consultant
Peggy Caitlin	Previous: Deputy Executive Director Colorado Department of Transportation (CDOT) Now: Partner Catlin & Company, LLC
Michael Cheroutes	Previous: Director of HPTE Now: Director of the Center for infrastructure Investment.
Brian Clark	Lead financial person at Plenary Group
Lowell Clary	Previous: Assistant Secretary at FDOT Now: President Clary Consulting Company
Larry Cloyed	Sr. Program Manager at VDOT
Leon Corbett	Project Finance Office Manager at FDOT
Ken Daley	Previous: Transurban
Nicholas Farber	Operations manager at HPTE
Adam Hesketh	CFO North America at Transurban
Christopher Hodgkins	CEO at Miami Access Tunnel Concessionaire, LLC
Dusty Holcombe	Previous: Deputy Director Virginia Office of Public-Private Partnership (VAP3) Now: Vice President, Transportation - Infrastructure at RSH
Pierce R. Homer	Previous: Secretary of Transportation. Now: Transportation Director of Moffatt & Nichol
John Hudspeth	Engineer at TxDOT
Charlie Kilpatrick, PE	Commissioner at VDOT
Kevin Lynsky	Deputy Director at Port of Miami
Belén Marcos	President at Cintra US
Nizar Melehani	Previous: Program Manager at Caltrans Now: P3 Project Director / Presidio Parkway Project (P3) at Caltrans
Katie Nees	Previous: Director for the Strategic Projects Division at TxDOT Now: HNTB, Dallas, TX
Ed Pensock	Previous: Director of Turnpike Corridor Systems at TxDOT. Division Director at TxDOT Now: Private consultant
Barbara Reese	Previous: CFO at VDOT Now: Barbara Reese & Associates
Leonard Salazar	Project Manager at FDOT
Alistair Sawers	Previous: Principal P3 Advisory at WSP (previously known as WSP Parsons Brinckerhoff) Now: VP P3 Advisory Services at TransSystems
Jacqueline Sequeira	Construction manager at FDOT
Susan Shaw	VDOT NOVA Mega Projects Director and Design-Build Program Manager
Simon Stachnik	Lead technical person at Plenary Group
James Wolfe	Previous: Secretary of Transportation District 4. Now: Vice President, National P3 Market Sector Leader at RS&H
Russell Zapalac	Previous: Chief Planning and Project Officer at TxDOT Now: Executive Vice President and Chief Strategy Officer at Halff Associates, Inc.

APPENDIX D. PROJECT SNAPSHOTS

I-495 Capital Beltway

Location	
State	Virginia
County	Fairfax

Participants	
Public-Sector Agencies	Virginia Department of Transportation, VDOT's Office of Public-Private Partnerships
Special Purpose Vehicle (SPV)	Capital Beltway Express, (CBE) LLC
Private-Sector Partners	Fluor Corporation; Transurban (USA) Operations Inc.

Contract Characteristics	
Contract Type	DBFOM – Design, Build, Finance, Operate, Maintain
Infrastructure Type	Highway
Infrastructure Details	Expansion of a 14-mile highway from 8 to 12 lanes. The reconstruction of the preexisting eight general purpose lanes. Project also includes two new HOT lanes in each direction. Replacement of 58 bridges and reconstruction of 10 interchanges. Also pedestrian and bicycle facility improvements.
Unsolicited Proposal	Yes
Financial Close	2007
Duration	75 year after the construction period

Financial Characteristics[150]	
Equity	$ 348 million
TIFIA Loan	$ 589 million
Private Activity Bonds	$ 589 million
VDOT Grant	$ 409 million
VDOT Change-Order Funding	$ 86 million
Interest Income	$ 47 million
Total	$ 2,068 million

Funding Characteristics	
Funding	Demand risk, with up-front VDOT funding for specific items
Managed Lanes	Yes
Toll Type	Dynamic Variable: Rate varies based on current traffic conditions
Procurement event	
June 2002	Unsolicited proposal No other company submitted a competing proposal
October 2003	Detailed proposal submitted
December 2007	Commercial close
December 2007	Financial close
July 2008	Construction starts
November 2012	Open to traffic

Risk Allocation		
VDOT	Regulatory	• National Environmental Policy Act (NEPA) • Long range transportation plan • FHWA approval to tolling • Local county approvals • Changes in law
	Financing	• Bond issue • Commonwealth contribution
	Design Build	
	Operations and Maintenance	• Snow and ice removal• Tag account management
Shared	Regulatory	• Unknown hazardous materials remediation
	Financing	• Interest rate risk prior to closing
	Design Build	• Force majeure event
	Operations and Maintenance	• Policing the HOT lanes
Private Partner	Regulatory	• Federal/State water quality permits; technical documents supporting design changes (for NEPA)
	Financing	• Debt repayment • Equity • TIFIA financing • Revenue
	Design Build	• Detailed design • Services coordination • Design build cost • Project completion • Tolling technology • System performance • Construction management • DBE/SWAM • Warranty
	Operations and Maintenance	• Revenue risk (toll revenue insufficient for debt service), including higher than forecast HOV3/transit use of HOT lanes • Operating performance and meeting required standards from VDOT/FHWA• Operating costs for HOT lanes • Communication costs • EZPass tag management risks • Roadside assistance • Routine and preventative maintenance • Major maintenance • Tolling system operation, upgrades • Toll enforcement • Changes in interstate highways standards • Customer queries and disputes • Changes in EZPass requirements and standards

Official Data Sources	
Project webpage	https://expresslanes.com
VDOT webpage	http://www.p3virginia.org/projects/i-495-express-lanes
FHWA webpage	http://www.fhwa.dot.gov/ipd/project_profiles/va_capital_beltway.asp

U.S. 36 Express Lanes Phase II

Location	
State	Colorado
County	Boulder

Participants	
Public-Sector Agencies	Colorado Department of Transportation (CDOT); High-Performance Transportation Enterprise (HPTE); Regional Transportation District (RTD); Denver Regional Council of Governments (DRCOG); Boulder County; Town of Superior; City of Lafayette; City of Louisville; State of Colorado
Special Purpose Vehicle (SPV)	Plenary Roads Denver Ltd. (PRD)
Private-Sector Partners	The Plenary Group

Contract Characteristics	
Contract Type	DBFOM – Design, Build, Finance, Operate, Maintain
Infrastructure Type	Highway and bus rapid transit (BRT)
Infrastructure Details	Expansion of a 5.1-mile highway segment from 4 to 6 lanes. The additional lanes are HOT lanes, one in each direction. Agreement also includes Bus Rapid Transit (BRT) improvements and a bikeway along the corridor. O&M of the two HOT lanes and the four general-purpose lanes. Clearance of ice and snow.
Unsolicited Proposal	No
Financial Close	2014
Duration	50 years after construction

Financial Characteristics[150]	
Equity	$ 20.6 million
TIFIA loan	$ 60.0 million
Private Activity Bonds	$ 20.6 million
HPTE capital payment	$ 49.6 million
Local funds	$ 10.8 million
State funds	$ 18.9 million
RTD sales tax revenue	$ 30.5 million
Federal funds	$ 15.0 million
Subordinated debt	$ 20.6 million
I-25/U.S. 36 Toll Revenues	$ 8.6 million
Other	$ 3.4 million
Total	$ 258.6 million

Funding Characteristics	
Funding	Demand risk, with federal, State, local, & RTD contributions
Managed lanes	Yes
Toll type	Fixed Variable: Rate varies by time of day, based on pre-set schedule Tolls are collected on Phase I, Phase II and on US-25

Procurement event	
February 2012	RFQ issued
April 2012	Deadline to submit qualifications.
May 2012	Three teams shortlisted
October 2012	RFP issued
April 2013	Preferred bidder selected
June 2013	Commercial close
February 2014	Financial close
March 2014	Construction starts
January 2016	Open to traffic
March 2016	Open for tolling
June 2016	Official opening

Risk allocation [54,62,172]		
Public Partners	Regulatory	• National Environmental Policy Act (NEPA) • Long range transportation plan • Local county approvals • Changes in law
	Financing	
	Design Build	• ROW acquisitions required for highway construction–including relevant cost and scheduling risks • Repair of latent defects in work completed prior to contract commencement or undertaken by other CDOT contractors • Soil or other remediation resulting from undisclosed contamination •Force Majeure
	Operations & Maintenance	• Bringing highway to pre-established conditions following significant natural events •Force Majeure • Police and Emergency services
Shared	Regulatory	
	Financing	• General premium cost increases for insurance required by the contract
	Design Build	• Utility relocation—including relevant cost and scheduling risks •Geotechnical condition
	Operations & Maintenance	• Revenue shared after a minimum rate-of-return targets are met
Private Partner	Regulatory	• Environmental Permitting & Licensing Updates
	Financing	• Debt repayment • Equity • TIFIA financing • Revenue • Repayment of the Phase 1 TIFIA Loan
	Design Build	• Highway and structure design • Highway and structure constructions – including relevant cost and scheduling risks • Geotechnical
	Operations & Maintenance	• Revenue risk (toll revenue insufficient for debt service) • Operations and maintenance • Snow and ice removal for both the general purpose and the managed lanes • Facility handback at contract conclusion, fulfilling CDOT and HPTE requirements regarding the highway's residual life

Official Data Sources	
Project webpage	http://36commutingsolutions.org
CDOT webpage	https://codot.gov/projects/US36ExpressLanes/88th-to-table-mesa
FHWA webpage	http://www.fhwa.dot.gov/ipd/project_profiles/co_us36_managed_lanes_phase2.aspx
TIFIA webpage	https://www.transportation.gov/tifia/financed-projects/us-36-managed-lane-bus-rapid-transit-project-phase-2

Port of Miami Tunnel

Location	
State	Florida
County	Miami-Dade County

Participants	
Public-Sector Agencies	Florida Department of Transportation (FDOT); Miami-Dade County; City of Miami
Special Purpose Vehicle (SPV)	Miami Access Tunnel (MAT), LLC
Private-Sector Partners	Meridiam Infrastructure Finance, S.a.r.l.; Bouygues Travaux Publics, S.A.

Contract Characteristics	
Contract Type	DBFOM –Design, Build, Finance, Operate, Maintain
Infrastructure Type	Tunnel
Infrastructure Details	Construction of a tunnel linking Port of Miami to MacArthur Causeway and I-395. Tunnel is 39 feet in diameter and 4,200 feet long.
Unsolicited Proposal	No
Financial Close	October 2009
Duration	30 years of O&M

Financial Characteristics[150]	
Equity	$ 80.3 million
TIFIA loan	$ 341.0 million
Senior bank debt	$ 341.5 million
FDOT development funds	$ 209.8 million
FDOT milestone payment	$ 100.00 million
Total	$ 1,072.6 million

Funding Characteristics	
Funding	Availability payments based on hours of lane availability, compliance with safety and O&M standards. 50% of the capital cost comes from FDOT and the rest from local governments.
Managed Lanes	N/A
Toll Type	N/A

Procurement event	
February 2006	RFQ issued
April 2006	Teams shortlisted
November 2006	RFP issued
March 2007	Proposals received from the three teams.
February 2008	MAT is selected as Best Value Proposer.
December 2008	Deferred due to private sector financial problems
April-May 2009	A new private partner takes over the project (Meridiam Infrastructure replaces Babcock & Brown)
June 2009	Commercial close
October 2009	Financial close
May 2010	Construction starts
May 2014	Open to traffic

Risk allocation[75,92,95]		
Public Partners	Regulatory	• National Environmental Policy Act (NEPA)
	Financing	
	Design Build	• Areas within preliminary ROW Plan •Hurricane level 3 or higher disrupting construction
	Operations & Maintenance	• Revenue risk
Shared	Regulatory	
	Financing	
	Design Build	• Force Majeure for events not covered by insurance or performance specifications • Geotechnical risks related with construction • Agreements, schedules and relocation of utilities
	Operations & Maintenance	• Force Majeure for events not covered by insurance or performance specifications • Inflation during the Operating Period • Traffic exceeding specified levels
Private Partner	Regulatory	• Obtaining Federal, State and Local Permits
	Financing	• Appropriation risk for Const. Milestone Payments and Avail. Payments • Equity and debt funding (financial close, interest rate and currency risk)
	Design Build	• Areas outside preliminary ROW Plan • Highway and structure design • Highway and structure constructions –including relevant cost and scheduling risks • Hurricane level 2 or below • Impacts on vehicle traffic and POM operations beyond agreed levels • Impact to adjacent communities during construction above agreed levels • Unforeseen increases in material costs and labor
	Operations & Maintenance	• Meeting availability and O&M criteria•Return O&M Segments in specified condition when concession ends

Official Data Sources	
Project webpage	http://www.portofmiamitunnel.com/
FDOT webpage	http://www.fdotmiamidade.com/current-projects/north-miami-dade/port-of-miami-tunnel.html
FHWA webpage	https://www.fhwa.dot.gov/ipd/project_profiles/fl_port_miami_tunnel.aspx

I-95 HOV/HOT Lanes

Location	
State	Virginia
County	Fairfax, Prince William, Stafford

Participants	
Public-Sector Agencies	Virginia Department of Transportation (VDOT)
Special Purpose Vehicle (SPV)	95 Express Lanes LLC
Private-Sector Partners	Fluor Enterprises, Inc., Transurban DRIVe

Contract Characteristics	
Contract Type	DBFOM –Design, Build, Finance, Operate, Maintain
Infrastructure Type	Highway
Infrastructure Details	The agreement involves the construction of additional lanes, the conversion from HOV lanes to reversible lanes, and the conversion from HOV to HOT lanes. It is divided in four components: 8.3 miles of new construction - two-lane reversible; 7.0 miles of two-lane HOV conversion - two-lane reversible; 11.9 miles of two-lane HOV conversion - three-lane reversible; 2.2 miles of two-lane HOV conversion - three-lane reversible. It includes 7 new bridges and new exits and entries to the highway.
Unsolicited Proposal	Yes
Financial Close	July 2012
Duration	73 years of O&M

Financial Characteristics[150]	
Equity	$ 280.4 million
TIFIA Loan	$ 300.0 million
TIFIA capitalized interest	$ 6.5 million
Private Activity Bonds	$ 252.6 million
VDOT Grant	$ 82.6 million
Interest Earnings	$ 0.6 million
Total	$ 922.7 million

Funding Characteristics	
Funding	Demand risk
Managed Lanes	Yes
Toll Type	Dynamic Variable: Rate varies based on current traffic conditions

Procurement event	
2003	Unsolicited proposal from Clark Construction, Shirley Contracting and Koch Performance Roads.
October 2004	VDOT review
October 2006	Interim Agreement signed
September 2009	Deferred
February 2011	Original length of the motorway is shortened 15% due to opposition and a lawsuit from Arlington county
March 2012	Early works
July 2012	Commercial close
July 2012	Financial close
July 2012	Construction starts
April 2014	Transurban purchases Fluor's interest
December 2014	Open to traffic
November 2015	Agreement reached to extend motorway 2 more miles into Stafford
November 2015	Agreement reached to extend motorway 8 more miles into Arlington
December 2016	Arlington County approves replacement of HOV by HOT, creating the I-395 northern extension of the HOT lanes.
August 9, 2017	Groundbreaking for I-395 extension.

Risk Allocation		
VDOT	Regulatory	• Local county approvals • Long range transportation plan • National Environmental Policy Act (NEPA)
	Financing	• Interest rate and spread risk
	Design Build	
	Operations and Maintenance	• Snow and ice removal
Shared	Regulatory	• Unknown hazardous materials remediation
	Financing	
	Design Build	• Force majeure event
	Operations and Maintenance	• Policing the HOT lanes • Revenue shared after a minimum rate-of-return targets are met
Private Partner	Regulatory	• Water quality permitting; technical documentation to support design changes
	Financing	• Debt repayment • Equity • TIFIA financing • Revenue
	Design Build	• Detailed design • Design build cost • Construction schedule • Project completion • Tolling technology • System performance • Construction management • DBE/SWAM • Material cost escalation • Mitigation of some hazardous materials
	Operations and Maintenance	• Revenue risk (toll revenue insufficient for debt service), including higher than forecast HOV3/transit use of HOT lanes • Operating performance and meeting required standards from VDOT/FHWA• Operating costs for HOT lanes • Roadside assistance • Routine and preventative maintenance • Major maintenance • Tolling system operation, upgrades • Toll enforcement • Changes in interstate highways standards

Official Data Sources	
Project webpage	https://www.expresslanes.com/
VDOT webpage	http://www.p3virginia.org/projects/95-express-lanes/
FHWA webpage	https://www.fhwa.dot.gov/ipd/project_profiles/va_i95.aspx

Presidio Parkway Phase II

Location	
State	California
County	San Francisco

Participants	
Public-Sector Agencies	California Department of Transportation (Caltrans); San Francisco County Transportation Authority (SFCTA)
Special Purpose Vehicle (SPV)	Golden Link Concessionaire, LLC
Private-Sector Partners	HOCHTIEF PPP Solutions North America, Meridiam Infrastructure

Contract Characteristics	
Contract Type	DBFOM –Design, Build, Finance, Operate, Maintain
Infrastructure Type	Motorway
Infrastructure Details	A 1.6 mile six-lane segment on Route 101, from the Golden Gate Bridge Toll Plaza to Broderick Street. It includes two tunnels, one viaduct, and the demolition of previous structures. It includes the landscaping from Phase I.
Unsolicited Proposal	No
Financial Close	June 2012
Duration	30 years after construction

Financial Characteristics[150]	
Equity	$ 43.0 million
Parent company contribution	$2.6 million
TIFIA Loans (Tranches A and B)	$150.0 million
TIFIA capitalized interest	$2.5 million
Bank loan	$166.6 million
Total	$ 364.7 million

Funding Characteristics	
Funding	Availability payment
Managed Lanes	No
Toll Type	No

Procurement event	
February 2010	RFQ issued
April 2010	Teams short-listed
July 2010	RFP issued
October 2010	Preferred bidder selected
January 2011	Commercial close
June 2012	Financial close
June 2012	Construction starts
July 2015	Opens to traffic
June 2017	As of June 2017, pending Landscaping

Risk Allocation[140,173]		
Caltrans & SFCTA	Regulatory	• Coordination with other entities, particularly Presidio Trust
	Financing	
	Design Build	• Costs linked to unidentified hazardous materials, natural resources, and cultural resources • Site access during the construction phase of previous stages
	Operations and Maintenance	• Seismic risk
Shared	Regulatory	
	Financing	
	Design Build	• Mitigation of some hazardous materials
	Operations and Maintenance	• Debt repayment
Private Partner	Regulatory	
	Financing	
	Design Build	• Design and build cost • Construction schedule • Project completion • Construction management • Costs linked to design errors and omissions •The cost of overruns increases from 15% to the private sector in a DBB contract to a 100%, or labor and material costs • Operating performance and meeting required standards • Maintenance of traffic during construction. • Unidentified geotechnical risks
	Operations and Maintenance	• Meeting availability and O&M criteria• Major maintenance •Appropriation risk of revenue to pay the availability payments

Official Data Sources	
Project webpage	http://www.presidioparkway.org/
SFCTA webpage	http://www.sfcta.org/presidio-parkway-home
FHWA webpage	https://www.fhwa.dot.gov/ipd/project_profiles/ca_presidio.aspx

LBJ TEXpress (IH 635 Managed Lanes)

Location	
State	Texas
County	Dallas

Participants	
Public-Sector Agencies	Texas Department of Transportation
Special Purpose Vehicle (SPV)	LBJ Infrastructure Group
Private-Sector Partners	Cintra, S.A.; Meridiam Infrastructure Finance; Dallas Police and Fire Pension System; Ferrovial Agroman, S.A.; W.W. Webber, Inc.; Bridgefarmer & Associates, Inc.

Contract Characteristics	
Contract Type	DBOFM – Design, Build, Operate, Finance, Maintain
Infrastructure Type	Highway/Managed Lanes
Infrastructure Details	Project relieves congestion north of Dallas on LBJ Freeway (IH 635) by adding 13 miles of managed lanes. This includes six subsurface lanes on IH 635 between I-35E and US 75, and four lanes on the outside of the highway. Six elevated managed lanes are also built on I-35E from Loop 12 to the LBJ interchange. Tolls for first 6 months after opening will be fixed, then will adjust according to traffic conditions. HOV-2 users receive a 50 % discount during peak hours.
Unsolicited Proposal	No
Financial Close	2010
Duration	48 years of O&M

Financial Characteristics	
Equity	$ 682 million
TIFIA Loan	$ 850 million
Private Activity Bonds	$ 606 million
Public Funds	$ 490 million
Toll Revenues During Construction	$ 17 million
Total	$ 2,645 million

Source: [150]

Funding Characteristics	
Funding	Demand risk, with State contributions
Managed Lanes	Yes
Toll Type	Dynamic Variable: Rate varies based on current traffic conditions.

Procurement event	
May 2005	RFQ issued
September 2005	Deadline to submit qualifications.
November 2005	Four teams shortlisted
October2006	RFP issued
February 2009	Selection of best value proposal
September 2009	Commercial close (CDA executed)
June 2010	Financial close
December 2010	Construction starts
September 2015	Open to traffic -substantial completion
December 2015	Final acceptance

Risk Allocation		
TxDOT	Regulatory	• Finding of No Significant Impact (FONSI) granted before RFQ. • Environmental re-examinations introduced by changes in design held FONSI.
	Financing	• State contribution
	Design Build	
	Operations and Maintenance	
Shared	Regulatory	
	Financing	
	Design Build	• Force majeure event
	Operations and Maintenance	• Revenue shared after a minimum rate-of-return targets are met
Private Partner	Regulatory	
	Financing	• Debt repayment • Equity • TIFIA financing • Revenue
	Design Build	• Design build cost • ROW acquisitions required for highway construction • Project completion • Tolling technology • Construction management • DBE/SWAM
	Operations and Maintenance	• Revenue risk (toll revenue insufficient for debt service), including higher than forecast HOV2/transit use of managed lanes • Operating performance and meeting required standards from TxDOT/FHWA• Operating costs for managed lanes • Major maintenance

Official Data Sources	
Project webpage	http://www.lbjtexpress.com/
TxDOT webpage	http://www.txdot.gov/business/partnerships/current-cda/635-lbj-cda/newlbj/overview.html (page was available at the beginning of the project but it no longer is)
FHWA webpage	https://www.fhwa.dot.gov/ipd/project_profiles/tx_lbj635.aspx