



Challenges and Enablers for Private Sector Involvement in Delivery of Highway Public–Private Partnerships in the United States

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Abstract: Involvement of the private sector in financing and delivery of highway public–private partnerships (P3s) in the United States has experienced various limitations and challenges. The implementation of existing P3 project delivery frameworks by the public sector have neglected the private sector’s interests and have resulted in lack of alignment among public and private sector stakeholder institutions across P3 project planning, procurement, and administration. Further, the public sector’s variability in P3 program maturity and P3 implementation have entangled the emerging U.S. P3 market into a challenging environment. The purpose of this study is to determine and analyze the underpinnings of private sector involvement in U.S. P3s in the following areas: (1) the major issues and challenges faced by private sector stakeholders in the U.S. P3 market due to the variability in public agencies P3 project delivery process and (2) solutions and strategies for enhancing alignment of public and private sectors and standardizing the public sector’s P3 project delivery process. Following a comprehensive content analysis process, 25 P3 experts are identified and selected from organizations that are active in the U.S. P3 market. A structured and consistent interview protocol is utilized to conduct interviews and document the study results. Results indicate that among the identified challenges, regulatory uncertainty and inability of the private sector to be involved in predevelopment phases of transportation projects, lack of a programmatic approach for P3 project development in the public sector, significant transaction costs for P3 projects that involve private financing, and slow shift in mindset and required business processes in transitioning from conventional project delivery to P3 were recognized as primary issues hindering private sector involvement in highway P3s. Among the identified enablers, establishing a P3 program/unit with adequate project finance and procurement expertise, incorporating alternative funding and innovative financing considerations in the planning phase, allowing the use of factoring and asset-based financing methods, and utilizing appropriate performance bond vehicles were recognized as primary recommended opportunities for the U.S. P3 market. The outcome of this study can help state departments of transportation (DOTs), transportation planners, contractors, and financial institutions make more informed decisions when engaging in P3 arrangements. DOI: [10.1061/\(ASCE\)ME.1943-5479.0000493](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000493). © 2016 American Society of Civil Engineers.

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Introduction and Research Background

The maintenance and expansion of the aging U.S. transportation infrastructure, an essential component of the economy, faces significant funding and financing challenges. According to the report card for America’s infrastructure, investments in the nation’s highways would need to increase \$80 billion annually and reach an estimated \$170 billion between 2008 and 2028 (ASCE 2013). Governments at local, state, and federal levels are embracing private sector financing in the form of public–private partnerships in order to bridge funding gaps, leverage financial resources, and expedite

delivery of projects (Istrate and Puentes 2011; NSTIFC 2009). In fact, the Federal Highway Administration (FHWA) has established the Office of Innovative Program Delivery (IPD) in order to promote excellence in project finance and delivery and encourage state departments of transportation (DOTs) to efficiently and more extensively utilize P3s and project finance methods. Since 1989, 56 highway P3 projects worth \$46 billion were developed by state DOTs that involved private financing (PWF 2014). P3s involve contractual agreements between the public sector and a private sector entity (typically a consortium) that allow for greater private sector participation in design, construction, and financing of projects and may include operations and maintenance (FHWA 2015a). Because of the recent increase in the number of P3s procured in the United States and the complexity of the financing dimension of these projects, the focus of this study is on agreements that include a financing component, notably design-build-finance (DBF) and design-build-finance-operate-maintain (DBFOM) agreements.

Although the use of P3s in the highway sector is growing, evolution of the U.S. P3 market has not been without challenges. The recent history of failed P3s, such as the Indiana Toll Road, the Camino Columbia and SH-130 toll roads in Texas, and the Greenville Southern Connector in South Carolina, indicate that a variety of challenges can affect development of P3 projects from initiation to completion. A comprehensive review of recent P3 literature by Liu et al. (2014) shows that the project development

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process for P3s can be summarized into three major interrelated phases: (1) initiation and planning, (2) procurement, and (3) partnership management (EIB 2012). In the initiation and planning phase, perhaps the major issue faced by public and private stakeholders is the lack of adequate legal frameworks for investments across the United States (Angelidis and Xenidis 2009). Legal frameworks designate the laws for private sector involvement and project procurement across the states. Inefficiencies in these frameworks have negative impacts on private sector involvement in P3 projects and the P3 market, in general, mainly because of the autonomous legal and regulatory environment in each state (Garvin 2010). These legal inefficiencies have caused the private sector P3 teams to experience major project delays, project cancelations, and legal obstructions in delivery of P3 projects (Chan et al. 2011). The private sector P3 teams have experienced long lead times and poor front-end planning decision making because of improper management of organizational resources (Zhang 2005c).

In the procurement phase, the lack of transparency is among the major issues that has mainly affected private sector P3 teams. Mallet (2008) suggests that procurement transparency issues may lead to contract award protests and disputes. If these issues are not resolved, P3 agreements with the private sector can be under scrutiny because of negative public perception and local opposition. In addition to transparency challenges, a recent study by Rall et al. (2014) for the National Conference of State Legislators (NCSL) noted that more than 61% of state and local officials had no experience dealing with P3s and did not fully understand them. Existing public sector procurement practices impose substantial proposal development costs for the private sector participants, who are bidding on P3 projects (Ping Ho et al. 2015). The challenge for the private sector is the opportunity cost of lost time spent for proposals that have no further value.

Finally, in the partnership phase, private sector stakeholders are concerned with the lack of adequate contract management skills by the public sector. The transfer of responsibilities resulting from integration of design, construction, and operations and maintenance (O&M) services in P3s requires a more administrative role by the public sector as opposed to the hands-on active role utilized in traditional project delivery (Kraft and Molenaar 2014). Research conducted as part of the National Cooperative Highway Research Program (NCHRP) Reports 787 and 808 find that state DOTs are worried that with the transfer of roles and responsibilities, they are transferring the control over projects (Molenaar et al. 2015; Minchin et al. 2014). The challenge is that existing contract administration processes fail to accommodate the required shift in mindset of the agency project managers and staff. The private sector stakeholders expect a certain level of maturity in postaward contract administration during the partnership phase in order to establish sustained partnerships.

Recent studies on public sector's P3 state of practice have identified a significant degree of variability in P3 implementation by public agencies throughout the project development process (i.e., project initiation and planning, project procurement, and partnership management) (Soomro and Zhang 2015a; Martinez et al. 2013). The lack of standard approaches for P3 project delivery as well as public agencies' varying levels of maturity in P3 implementation have negative impacts on private sector's ability to deliver projects successfully (Ashuri and Mostaan 2015). A recent global survey of 67 high level executives in the private sector by Deloitte (2012) identified the U.S. P3 market as an emerging and challenging market, which does not offer a desirable and standard P3 model. Indeed, evolution of the U.S. P3 market has faced impediments in implementing true partnerships, where the service

delivery objectives of the government are aligned with the profit objectives of the private partners (Wang 2015; OECD 2008). There is a need for research to identify and analyze the major challenges and issues experienced by private sector participants in highway projects because of the impacts of autonomous public sector P3 practices in the United States. Furthermore, there is a need for research to evaluate and analyze improvement strategies that can standardize P3 project delivery and enhance partnership alignment between the public sector and private entities. The major stakeholders impacted by this research involve public sector agencies [i.e., state DOTs, state and national infrastructure banks, metropolitan planning organizations (MPOs), and permitting agencies] and private sector stakeholders (i.e., multinational development companies; contractors; investments banks; and procurement, financial, and legal advisors).

The main objectives of this study are twofold: (1) identification and analysis of the major issues and challenges faced by private sector stakeholders in the U.S. P3 market, due to the variability in public agencies P3 project delivery process and (2) identification and evaluation of solutions and strategies for enhancing alignment of public and private sectors and standardizing the public sector's P3 project delivery process in the United States. This study makes several intriguing contributions to the literature. First, by systematically analyzing the challenges, as experienced by private sector stakeholders, this study explores whether these issues are primary or secondary for the U.S. P3 market stakeholders and whether these issues are applicable at the international level as well. Further, by evaluating recommended strategies and enabling mechanisms this research aims to mitigate the knowledge gap and the lack of alignment between the public and private sectors in the U.S. P3 market. The findings are relevant for the U.S. P3 market but may also be useful for planners and policymakers in other countries. These challenges and opportunities were identified and validated through structured interviews with 25 P3 industry experts. The next section explains the methodology used to develop the structured interviews. The results and findings are described under two subsequent sections before conclusions are presented in the last section.

Research Methodology

In order to achieve the study objectives, a two-phase research methodology was employed: (1) identification of critical issues believed to have impact on the alignment of public and private sector in the P3 project delivery process and (2) structured interviews with P3 industry experts from diverse stakeholder organizations. Because of the unavailability of project performance data and diversity of issues affecting public and private sector alignment, this study employed exploratory research methods.

Fellows and Liu (2015) indicate that the objective of exploratory research is to gain understanding and collect information and data such that theories will emerge in response to the questions of questions of *what* and *why*. The synthesis of state of practice and discussion of critical issues led to the development of propositions (challenges/enablers) as to what are the challenges and enablers, why these issues affect public and private sector alignment, and how can P3 stakeholders adopt best practices in the U.S. P3 market. The methodology employed in this study lends itself to a major strength of exploratory methods, which is the ability to identify major issues or attributes associated with a particular research problem (Claxton et al. 1980). Fig. 1 presents the outline of the research methodology used in this study.



Fig. 1. Outline of the research methodology

Content Analysis Process

The content analysis process was used to perform a review of state of practice with respect to critical issues affecting alignment of public and private sector in the P3 project delivery process. The comprehensive literature review and content analysis resulted in identifying a set of critical issues believed to have an impact on the three phases of P3 project delivery process: planning, procurement, and partnership management. Table 1 lists categories of issues believed to have an impact on alignment of public and private sectors in P3 implementation. These issues identified in the literature review and content analysis formed the initial structure of the interviews.

Interview Protocol

The structured interview research method was employed to gain insight from P3 practitioners on issues identified in the content analysis process. The interviews engage the interviewees in active conversation and enable documentation of intriguing arguments on various aspects of implementing P3s in the United States, specifically major challenges and enabling mechanisms for alignment of public sector and private entities. The goal of the interview process was to engage subject matter experts on common themes affecting the state of practice in utilizing P3s, particularly project planning,

procurement, and partnership management. The interview protocol development involved the following steps:

1. Identify public sector P3 practice variability in the planning, procurement, and partnership phases;
2. Identify areas where public and private sector have faced alignment challenges;
3. Develop an interview template;
4. Pilot test interview template;
5. Identify a list of potential contacts from organizations active in the U.S. P3 market;
6. Diversify the pool of respondents to state DOTs, development companies, contractors, investment banks, consulting firms, and think tanks;
7. Contact potential interview respondents;
8. Conduct Interviews;
9. Analyze results and identify common themes; and
10. Discuss and conclude findings.

The interview questionnaire was designed considering critical issues identified during the content analysis process. The main outline of the structured interviews is presented in Fig. 2. The interview questionnaire required the respondents to begin with a description of the P3 decision-making process within their organization. Respondents were also required to describe the project screening, P3 policy and guidelines, and proposal development and procurement process in their organization. The second question required the respondents to explain the major challenges affecting alignment of public sector and private entities as well as issues affecting smooth P3 implementation in the United States. The critical issues identified during the content analysis were the major focus of the discussion henceforth. The third question required the respondents to then discuss potential enablers and recommended opportunities in areas identified in the content analysis process. Finally, the interview process was concluded by asking the respondents about the major components of the next generation of highway P3s in the United States. The interview outline was reviewed by industry experts and academics prior to distribution. The feedback from these individuals was incorporated in the interview structure. The interview structure was confined to the objectives of this study, particularly issues identified in the content analysis process. Nevertheless, the last question enabled diversion from the study objectives to identify and explore challenges and enablers affecting public and private sector alignment beyond the content analysis or the current state of practice. These diversions were further explored and analyzed and are presented either by directly quoting the respondent or by citing examples from the literature.

The interview pool consisted of organizations that have been involved in the U.S. P3 market. To begin, a potential list of respondents was developed by identifying firms that either have developed or procured P3 projects in the United States. The main sources of information included the FHWA Office of IPD project database, the Public Works Financing (PWF) newsletters and project database, American Road and Transportation Builders Association (ARTBA), and the Association for the Improvement of American Infrastructure (AIAI), which serves as a national proponent to facilitate education and legislation through targeted advocacy. This initial list of respondents was filtered to organizations that have procured or developed at least three highway P3 projects in the United States and at least one project in international markets. The survey request and template was distributed through emails to 75 respondents. A total of 25 structured interviews (24 phone and 1 in person) were conducted with P3 experts from organizations that are active in the U.S. P3 market. The interview pool within these organizations consisted of chief operating officers, vice presidents, and principal advisers, who either make strategic

Table 1. Summary of Critical Issues Affecting Public and Private Sector Alignment

Critical issues identified	Brief description of critical issues affecting P3s	Source
Project screening and pipeline	Mature markets have credible processes and policies for project selection, procurement, and delivery that are integrated in their P3 programs; a transparent and systematic project screening and selection process for public agencies is critical for the project planning phase.	VDOT (2016a), FDOT (2016), Caltrans (2013), Yuan et al. (2012), Ng et al. (2012), Texas Transportation Code (2011), and Abdel Aziz (2007)
P3 policy and guidelines	Good governance by public sector at the program level can attract private investors and result in project success; the government's perspective needs to shift from traditional regulatory stance to create a robust and dynamic outlook for a favorable investment and project development environment; P3 implementation framework should go beyond planning but extend to policy, development, procurement, and the whole lifecycle process.	Florida P3 Statutes (2016), VDOT (2016b), Liu et al. (2014), Caltrans (2013), Garvin (2010), TxDOT (2012), Li et al. (2005), and Zhang (2005c)
Leadership and executive support	The private sector can suffer particularly when the public sector fails to address the principal-agent problems (lack of agency/leadership accountability); public sector mismanagement for firm partnerships and long-term sustained relationships exists even in developed P3 markets.	Rwelamila et al. (2014), Papajohn et al. (2011), Chan et al. (2011), and Zhang (2005c)
Organizational structure of the agency	Political support, appropriate level of authority, and efficient approval process through a P3 unit is necessary for project success; successful and mature P3 programs have established a dedicated P3 unit/team with project planning, procurement, financing, and O&M expertise.	VDOT (2016b), Caltrans (2013), Chan et al. (2010), Garvin (2010), Yuan et al. (2009), and Abdel Aziz (2007);
Project procurement process	Poor procurement incentives, lack of coordination/communication, and lack of information/knowledge has resulted in problems for P3s; the public sector is interested in reducing financial burden and transfer risks. The private sector is interested in innovation and flexibility; the P3 procurement process should appeal reasonably to private sector interests and protect the needs of the public.	Soomro and Zhang (2015b), Yuan et al. (2012), Kwak et al. (2009), TxDOT (2008), Zhang (2005a), and Zhang (2005b)
Post-award contract administration	Diverging interests can jeopardize post-award administration (private sector intends to achieve return on investment and distribute profit to owners versus public sector aims to achieve policy goals, LOS, and performance); agencies face challenges in transferring certain responsibilities to the private sector because of the slow shift in mindset.	Molenaar et al. (2015), TxDOT (2015b), Minchin et al. (2014), Kraft and Molenaar (2014), and FDOT (2013a)
Project financing	Financial risk considerations are critical in partnership success. Financing risks should be allocated considering risk averseness and Information asymmetry. The diffusion of financing risks to subcontractors and insurance (surety) providers affects partnership success and hinders risk allocation.	VDOT (2015a), Yescombe (2014), Badu et al. (2013), Gomez and Vassallo (2013), Demirag et al. (2012), FHWA (2012), Demirag et al. (2011), and TxDOT (2007)
O&M services	Prescriptive project planning, design, and procurement specifications hinders implementing innovative solutions during the O&M phase. Lifecycle efficiencies during the O&M phase are among the major drivers for private sector investments in infrastructure that should be considered in project selection and planning.	Wang (2015), CBO (2012), Grimsey and Lewis (2007), and Yescombe (2007)

“Major Challenges and Enabling Mechanisms for Private Sector Involvement in Highway Public-Private Partnerships” Interview Questionnaire:

- I. Describe the P3 decision-making process in your organization including:
 - i. *Project screening and pipeline development*
 - ii. *The strategic decision-making process/P3 policy and guidelines*
 - iii. *Proposal development and procurement*
- II. What are the major challenges to highway P3 project development in the U.S.?
 - i. *Describe major challenges experienced in P3 projects due to variation in P3 project delivery processes*
 - ii. *Describe issues affecting smooth P3 implementation by the public sector and private entities*
- III. What opportunities are available that can improve the current state-of-practice in P3 project delivery?
 - i. *Discuss recommended opportunities for aligning public and private sector expectations*
 - ii. *Discuss enabling mechanisms for enhancing P3 implementation by the public and private sector*
- IV. What are the major components of the next generation of highway P3s in the U.S.?

Fig. 2. Interview questionnaire template

decisions or provide high-level decision support in P3 projects. The average professional experience of the interviewees was in excess of 20 years. Each interview lasted between one to two hours. The interview transcripts were documented in a consistent manner in order to facilitate extraction and in-depth analysis of common themes.

After the completion of interviews, the scripts were recorded and compared using keywords from the content analysis critical issue categories. Following the analysis of interview results, the arguments made by the respondents were grouped into the following two areas: (1) major issues and challenges and (2) enabling mechanisms and recommended opportunities. In each area, various statements are discussed across the three phases of initiation and planning, procurement, and partnership. The discussions focus on why and how these statements are among the top issues impacting the U.S. P3 market. Further, the discussions explain whether these issues are primary or secondary for the U.S. P3 stakeholders, as well as if these issues are also observed at the international level. Wherever applicable, substantial evidence is provided on how these issues and challenges or enabling mechanisms and opportunities have the potential to hinder or enhance development of highway P3 projects.

P3 Development Major Issues and Challenges

The interviews with private sector P3 experts highlighted a variety of major issues and challenges, reported under six categories in Table 2. This section describes these major issues and challenges experienced by the private sector in further detail.

Legislative Issues and Challenges

Implementation of P3s is reliant upon enabling legislation that may or may not be available in every state. The interviewees noted that although the state statutes throughout the United States are positively changing towards authorizing P3s, inadequate legal frameworks and legislative interventions are still a major challenge for P3s. It is found out that private sector firms, prefer to avoid participating in P3 projects, particularly where there is lack of standard and well-established legal and statutory frameworks. The primary legislative challenges with noticeable impact on development of P3s were identified as follows:

- Legislative limitations and statutory interventions,
- Wide range of variability in states' enabling legislation, and
- Regulatory uncertainty and division of authority and control over projects.

Although legislative limitation and statutory interventions are often observed internationally as a major challenge, the variability in states' enabling legislation and regulatory uncertainty are a common pattern observed in the U.S. P3 market. Particularly, it is found out that P3 agreements in the United States often suffer from division of authority and control over projects on the public sector's side. The private sector is concerned with lack of control for the public sector authority in charge of P3 development and procurement.

Among the secondary challenges, two issues were highlighted during the interviews

- Inefficient legal and planning frameworks for private investment and
- Inability of the private sector to be involved in predevelopment phases of transportation projects.

It is determined that both these challenges are prominent issues for the U.S. P3 industry. Across the United States, state laws designate the legal frameworks for P3s, funding sources and financing

mechanisms allowed in P3, and authority to use private advisors. Several states still lack the alternative payment authorization under the state legislative frameworks, which is presumed to be a major challenge for the private sector participants in the United States. Hence, establishment of a uniform legal framework for P3s is critical for private sector participation in P3 projects. A survey of more than 100 P3 experts conducted by Martinez et al. (2013) for the Texas Transportation Institute (TTI) reports that over 60% of respondents considered the legal framework for development of P3s to be inadequate. Finally, state and federal statutes impede the private sector from direct involvement in certain components of the transportation planning process. The private sector participants of P3 projects are also concerned with the lack of flexibility in the transportation planning process. It is found that the existing project development practices by public agencies limit innovation and impose prescriptive criteria on private sector teams. This practice is counterintuitive because one of the major drivers for early private sector involvement in P3 projects is the ability to utilize flexibility and introduce innovation in project planning and design.

Agency-Related Issues and Challenges

Planning for major highway projects requires involvement of several public agencies, such as state DOTs, environmental permitting agencies, and MPOs that contribute to development of financially sound statewide transportation improvement programs (STIP) and transportation improvement plans (TIP). This study identified three primary challenges with respect to agency-related issues

- Lack of political stability and turbulent political conditions,
- Lack of a programmatic approach for P3 project development, and
- Failure of delegating decision-making authority to the responsible parties.

The interviewees emphasized the lack of political support for the project can result in project failure or project cancellation. Development of P3 projects is dependent upon the commitment and political will of the state officials and the legislature. The interviewees highlighted that some state DOTs may consider private financing as a one-time deal for fixing short-term funding shortfalls and bridging the funding gaps. It is found out that among these primary challenges, lack of a programmatic approach for P3 project development by the public sector is particularly observed in the U.S. market. In other developed markets, such as Canada, the United Kingdom, and Australia, the public sector has realized that the lack of a strategic approach in advancing P3 programs has negative impacts on future projects because the perceived success (or failure) of one project can contribute to the ability to move other projects forward (Regan et al. 2013). Finally, smooth implementation of P3 projects requires delegating the adequate level of decision-making authority to the parties responsible within state DOTs. Failure of delegating authority may result in long lead times for decision making and lack of decision-making consistency.

Among the secondary challenges, the following issues were notably highlighted by the interviewees:

- Lack of consistency in decision making by public agencies,
- Long lead times in decision making by state and federal agencies, and
- Administrative inefficiency and team building issues within public agencies.

It is found out that lack of commitment to a systematic and well-established framework for project selection and approval is a major concern, particularly for the private sector. Developed P3 markets have experienced that systematic and well-established framework

Table 2. Summary of Major Issues and Challenges

Issue category		Major issues/challenges	Relative importance	Applicability	
Project initiation and planning	Legislative issues and challenges	Legislative limitations and statutory interventions in P3s	Primary	Int. and U.S.	
		Wide range of variation in states' enabling legislations	Primary	U.S.	
		Regulatory uncertainty and division of authority and control over projects	Primary	U.S.	
		Inability of the private sector to be involved in predevelopment phases of transportation projects	Secondary	U.S.	
	Agency-related issues and challenges	Inefficient legal and planning frameworks for private investment		Secondary	U.S.
			Lack of political stability and turbulent political conditions	Primary	Int. and U.S.
			Lack of a programmatic approach for P3 project development	Primary	U.S.
		Failure of delegating decision-making authority to the responsible parties		Primary	Int. and U.S.
			Conventional transportation planning and programming challenges	Secondary	U.S.
			Lack of consistency in decision making by public agencies	Secondary	Int. and U.S.
			Long lead times in decision making by state and federal agencies	Secondary	Int. and U.S.
			Administrative inefficiency and team building issues within public agencies	Secondary	Int. and U.S.
			Bureaucratic and inefficient transportation procurement processes	Secondary	U.S.
Project procurement	Project readiness and project cancelation	Public opposition and tenure of elected officials to proceed with controversial projects	Primary	Int. and U.S.	
		Major National Environmental Policy Act (NEPA), right-of-way (ROW), and other critical permitting risks that must be resolved prior to soliciting bids	Primary	Int. and U.S.	
		Lack of public sector determination to build the project in a specific timetable	Secondary	U.S.	
	Transaction costs recoverability and opportunity for innovation	Arbitrary government interference in procurement of mega projects	Secondary	U.S.	
		Significant transaction costs for projects that involve private financing	Primary	Int. and U.S.	
		Lower transaction cost recoverability for DBF projects compared to DBFOM projects	Primary	Int. and U.S.	
		Limited opportunity for innovation in DBF projects compared to DBFOM projects	Secondary	Int. and U.S.	
Partnership management	Balance sheet and surety-contractor issues	Limited opportunity for innovation due to lack of performance-based procurement criteria	Secondary	U.S.	
		Contractor bankruptcy risks and limited capabilities of sureties to support failed projects	Primary	U.S.	
	Post-award project administration issues	Negative impact of private sector financing on contractors' balance sheet	Primary	Int. and U.S.	
		Slow shift in mindset and required business processes in transitioning from conventional project delivery to P3	Primary	Int. and U.S.	
		Difficulty in conducting timely acceptance and testing functions in the context of fast-track project delivery	Primary	U.S.	
	Unnecessarily strict design oversight by public agencies in P3 projects	Secondary	U.S.		

for project selection is critical to maintain the public position once a project is approved for P3 (Gomez and Vassallo 2013). With respect to long lead times in decision making and significant delays in the project development process, this study discovered that particularly at the procurement phase and prior to financial close, private sector participants experience significant financial risks (i.e., interest rate risks or currency exchange risks). It is found out that project delays may be due to long lead times for making critical decisions or may be a result of lead times for coordination between the public agency and other permitting agencies. The long lead times in decision making and administrative inefficiencies are also observed in P3 projects across the world (Badu et al. 2013).

However, with respect to secondary challenges observed in the U.S. P3 market in particular, two challenges were highlighted during the interviews

- Conventional transportation planning and programming challenges and
- Bureaucratic and inefficient transportation procurement processes.

During the interviews, it was discovered that consideration of alternative funding sources and innovative financing mechanisms in both long-term and short-term planning horizons for P3 projects is a major challenge for public agencies in the U.S. It is a hindrance to acquire approval for fiscally constrained TIP and STIP and utilize innovative financing mechanisms on P3 projects. It is found out that incorporating a 5- to 7-year short-term financing plan for a DBF project under the deferred payment mechanism

into a 4- or 5-year STIP is a significant challenge for state DOTs. Further, tolling and availability payment considerations for DBFOM projects at early stages of concept development were mentioned as major challenges because the project cost estimates and risk profiles are simply at preliminary levels. The interviewees mentioned significant challenges with respect to interagency coordinating among state DOTs, environmental agencies, and the FHWA division in each respective state at the project planning phase. Finally, several interviewees noted that they have experienced difficulty during the procurement process of P3 projects in the past. It is found out that these difficulties are mainly related to clarity and transparency of the procurement process, such as the shortlisting criteria, number of shortlisted teams, award criteria, and scoring justification. Particularly with respect to P3 projects, procurement can be a time-consuming and challenging process that involves several other parties besides the entities in charge of design and construction services. These agency-related challenges have the potential to become deal-breaker issues for the private sector because they can obstruct planning and procurement of P3 projects or impede P3 agreements.

Project Readiness and Project Cancelation

Project readiness and realistic schedules for project milestones are critical for project success. During the interviews with P3 experts, two primary issues were noted with respect to project readiness that can be considered as deal-breaker issues in P3 projects

- Public opposition and tenure of elected officials to proceed with controversial projects and
- Major National Environmental Policy Act (NEPA), right-of-way (ROW), and other critical permitting risks that must be resolved prior to soliciting bids.

A review of both the U.S. and international literature shows that these primary challenges affect the global P3 market (Soomro and Zhang 2015b). Public opposition and tenure and steadiness of political officials are among the major barriers that can disrupt project development and even result in project cancellations. The interviewees noted that major project risks, such as environmental, ROW, utilities, and other critical permitting risks can also result in significant schedule delays/risks, which may be wholly or in part left with the private sector. Therefore, it is necessary for the public sector to ensure that these risks are mitigated, dealt with, and/or properly transferred prior to project advertisement.

In terms of secondary challenges, which are observed in the U.S. P3 market in particular, the following were highlighted during the interviews:

- Lack of public sector determination to build the project in a specific timetable and
- Arbitrary government interference in procurement of mega projects.

The interviewees mentioned project cancellation as a major challenge for private sector participants of P3 projects. It is discovered that the authority to enter into various forms of private financing agreements, such as DBF and DBFOM, does not necessarily provide assurance for the private sector that projects will not be canceled or significantly delayed because of legal and political setbacks. The interviewees mentioned that the negative effects of terminating contracts during the procurement period goes beyond the main players (e.g., design-build teams and developers). In fact, it is found out that project cancellation has cascading negative effects on all secondary parties involved in the P3 and private financing market (e.g., lenders; various advisors to developers and lenders, such as technical, financial, and legal advisors; and subcontractors). An example is the \$1.4 Billion “U.S. Route 460” P3 project in Virginia, where the project was canceled after reaching an agreement with the developer (VDOT 2015b). The major issue is the opportunity cost of the lost time spent for bid preparation and the significant expenses for the project teams bidding on the canceled project.

Transaction Costs Recoverability and Opportunity for Innovation

Procurement of P3 projects, especially mega projects, involves significant legal and contractual challenges as well as high transaction costs. These costs can be as high as 3% of the project value (Dudkin and Väililä 2005). Transaction costs include a variety of expenditures, such as preparing a bidding document; traffic and revenue analysis (T&R); financial structuring; legal, technical, and financial advisory; cost estimating; drawing up a contract; administering the contract; and dealing with any deviations from contract conditions (Li et al. 2013). Two primary issues were found out during the interviews with P3 experts

- Significant transaction costs for projects that involve private financing and
- Lower transaction cost recoverability for DBF projects compared to DBFOM projects.

Several interviewees stated that “procurement of smaller P3 projects (typically less than \$200 million), where several contract parties are involved and transaction costs are high, neither improves

the competition nor is economically feasible.” It is found out that investors and developers attempt to recover transaction costs during the project’s life cycle. The major challenge discovered is the issue of project size and recoverability of transaction costs for bidders. One interviewee mentioned that “there is not much difference between transaction costs of a \$500 million DBF/DBFOM project and those of a \$1 billion DBF/DBFOM project.” It is discovered that because of significant transaction costs, private financing is not attractive for small- to medium-sized projects. Some of the interviewees specified \$200M as a minimum threshold for project size that most major firms would seriously consider for bidding. Finally, it is worth noting that transaction cost issues are a global challenge for P3 projects. The P3 market is a competitive environment. Throughout the interviews, it was discovered that contractors and infrastructure developers often have to strive and differentiate themselves in the market through offering unique innovative solutions to the owners. Further, it is found out that design and construction innovations can become the differentiating factor and make one proposal surface from the competition pool.

The secondary challenges in this area discovered during the interviews are as follows:

- Limited opportunity for innovation in DBF projects compared to DBFOM projects and
- Limited opportunity for innovation because of a lack of performance-based procurement criteria.

It is discovered that the real value of innovation becomes prominent, particularly during the O&M phase of P3 projects. Hence, limited opportunity for innovation can be a major issue for the private sector to pursue a DBF project as opposed to a DBFOM concession. This challenge also affects projects internationally. On the other hand, with respect to the U.S. P3 market, it is discovered that prescriptive specifications, in lieu of performance-based criteria, significantly affect the private sector’s ability to introduce innovation in projects. The interviews highlighted the private sector’s frustration with respect to prescriptive specifications and the lack of familiarity in the public sector when it comes to incorporating innovative design and construction solutions or alternative technical concepts (ATCs). The challenge reveals itself particularly when the performance-based criteria or the alternatives have not been used by the agency before or if they have not previously been used in the United States.

Balance Sheet and Surety-Contractor Relationship

The role of sureties and their guarantee of contractors’ performance through issuing performance bonds is prominent in highway projects. However, when it comes to P3 projects and private sector financing, this issue has not been thoroughly investigated in the academic literature (Cui et al. 2004). During the interviews, it was discovered that a variety of factors are considered in contractors’ assessment by sureties: experience and expertise, ability to work in the region that the project is located, current work in progress, overall management, balance sheet, and payment record of obligations.

The primary challenges discovered during the interviews are as follows:

- Contractor bankruptcy risks and limited capabilities of sureties to support failed projects and
- Negative impact of private sector financing on contractors’ balance sheet,

Because DBF and DBFOM projects involve some form of private financing, challenges and possible disputes can arise over the role of equity holders in case of contractor’s default. In other words, contractor bankruptcy represents additional risks for the sureties simply because the sureties are not in a position to finance a failed

DBF or DBFOM project. This challenge is particularly relevant to the U.S. P3 market due to the Miller Act (*U.S. Code Title 40 2016*), which protects government owners and subcontractors in case of the prime contractor default. The other major challenge that affects P3 projects globally is that most contractors cannot simply afford using a large portion of their equity in projects that require private financing. It is found out that this practice negatively affects their balance sheet and subsequently hurts their bonding capacity on other projects. As mentioned by the interviewees, contractors are especially concerned when a significant amount of debt is shown on their balance sheet. This issue is even more critical for publicly-traded firms because it adversely impacts their share values. Further, small- or medium-sizes contractors may not have the adequate bonding capacity to satisfy the surety's requirement in terms of solid balance sheets.

Post-Award Contract Administration Issues

P3 projects involve significant transfer of responsibilities to the private sector. Agencies and contractors that have used design-bid-build as their primary project delivery method inherently have difficulty transitioning to DB, DBF, or DBFOM, and this manifests itself in contract administration. This study identified the following two primary challenges in this area:

- Slow shift in mindset and required business processes in transitioning from conventional project delivery to P3 and
- Difficulty in conducting timely acceptance and testing functions in the context of fast-track project delivery.

The primary challenge is that the change in roles and responsibilities for conducting preconstruction services, design management, and quality assurance may be interpreted as a quality threat for the agency. The interviewees noted that the main challenge is the slow shift in the agency's culture and its business processes that are vital for the success of P3 projects. With respect to the U.S. P3 market, it is found out that public agencies often fail to conduct timely acceptance and testing functions in the context of fast-track project delivery. Hence, private sector developers experience significant delays in the review processes by the public agencies. Finally, unnecessarily strict design oversight by public agencies in P3 projects results in major hindrances to the private sector. Lengthy review periods and prescriptive design specifications imposed by some agencies hinder implementation of innovation solutions in the post-award phase. One interviewee mentioned that "managing innovation in P3 projects is a daunting task; hence, prescriptive design specifications and enforcement of unnecessarily strict design oversight by public agencies poses major challenges to post-award P3 project management."

P3 Development Enabling Mechanisms and Recommended Opportunities

The interviews with P3 industry experts highlighted a variety of enabling mechanisms and recommended opportunities that were analyzed by the authors and are reported under seven categories in Table 3. This section describes these enabling mechanisms and opportunities recommended by P3 experts in further detail.

P3 Program Organization

Among the 35 state DOTs authorized to use private financing for P3s, several have experimented with only one or two projects, and some have established mature private financing programs. It is identified that P3 program organization attributes as a significant enabling mechanism for P3s development, procurement, and

delivery. Particularly, allocating a P3 program/unit with adequate project finance and procurement expertise is identified as a primary recommended opportunity. Several interviewees noted that establishing a dedicated group or program with adequate organizational resources can significantly contribute to reduction of lead times during project development and procurement. According to the interviewees, a dedicated P3 program ensures that the public sector's project teams have the required project finance and procurement expertise and access to necessary organizational resources to successfully accomplish project objectives. In developed P3 markets, such as Australia, Canada, and the U.K., national and regional P3 units have the resources and the authority to engage with the private sector in P3 projects. The U.S. highway sector lags behind these developed markets in organizing the required resources for P3 units (*Garvin 2010*).

It is discovered that P3 project planning by the public sector requires expertise in multiple fields. The interviews highlighted the fact that in absence of organizational resources, agencies may face lack of leadership and expertise that need to be deployed on P3 projects. *Rwelamila et al. (2015)* notes that this situation may impact the organization's ability to deliver its duties. The challenge associated with this strategy is sustaining the P3 program through series of P3 projects. In other words, the P3 program would require a flow of P3 projects in order to exist. However, several state DOTs have decided to experiment with a P3 taskforce at first and then incorporate a full-fledged P3 program.

The recommended opportunities for P3 program organization that were discovered to be secondary are as follows:

- Delegating authority to the P3 program decision makers and
- Sharing a single point of contact with the private sector stakeholders and well-established history of excellence in project development.

Several state DOTs, such as California, Florida, Texas, and Virginia, have dedicated innovative program delivery/public-private partnership units for development and procurement of P3 projects. The common feature among these P3 programs that was highlighted during the interviews is adequacy of organizational resources and delegation of authority to the decision-making party. For instance, the Virginia DOT (VDOT) has established the Office of Public-Private Transportation Act (PPTA), dedicated to P3 projects primarily concerned with prioritization, selection, development, and procurement of all P3 projects, including DBF projects (*VDOT 2016b*). Similarly, Texas DOT (TxDOT) has established the Strategic Projects Division dedicated to procurement of various types of P3 projects, including DBF and DBFOM, under the Comprehensive Development Agreements (CDAs) (*TxDOT 2015a*). A list of projects that are appropriate for CDA must be presented to the Texas legislatures along with the summary of technical and budgetary reviews prior to project selection. Although VDOT has a centralized approach to innovative project delivery, TxDOT has a project-centered CDA process, partially because of the massive size of its projects. Both state DOTs have enjoyed specialized resources needed to effectively conduct innovative project delivery using private financing. Finally, it is discovered that sharing a single point of contact with the private sector stakeholders and well-established history of excellence in project development mitigates the risks for the P3 industry.

Transportation Project Planning and Programming

Long-range transportation planning (LRTP) is the foundation for development of regional transportation plans. Long-range planning involves establishing the transportation vision and goals for a region, and its outcome is a broad-based consensus and support for

Table 3. Summary of Enabling Mechanisms and Recommended Opportunities

Issues category	Enabling mechanisms/recommended opportunities		Relative importance	Applicability
Project initiation and planning	P3 program organization	Allocating P3 program/unit with adequate project finance and procurement expertise	Primary	U.S.
		Delegating authority to the P3 program decision makers	Secondary	Int. and U.S.
		Sharing single point of contact with the private sector stakeholders and well-established history of excellence in project development	Secondary	Int. and U.S.
	Transportation project planning	Incorporating alternative funding and innovative financing considerations in the transportation planning process	Primary	U.S.
Utilizing private sector expertise in NEPA analysis and ROW acquisition		Secondary	U.S.	
Educating policy decision makers, legislatures, and other stakeholders about P3s		Secondary	Int. and U.S.	
Project procurement	Development of project portfolios	Developing project portfolios to reduce transaction costs for both public and private sectors	Primary	Int. and U.S.
		Outsourcing a portfolio of projects to reduce administrative costs/burden for the public and private sector	Secondary	Int. and U.S.
	Account receivable purchase agreements	Expediting cash reimbursements to permit the contractor with compensating subcontractors and maintaining strong balance sheet	Primary	Int. and U.S.
		Utilizing factoring to reduce cash balance volatility for contractors and enabling investments across a portfolio as opposed to individual projects	Secondary	Int. and U.S.
	Asset-based financing and securitization	Utilizing factoring to reduce financial risk exposure of both the developers and banks	Secondary	Int. and U.S.
		Utilizing conduit bond issuing entities (e.g., local governments) to issue private activity bonds (PABs)	Primary	U.S.
Partnership management	Surety, payment, and performance bonds	Utilizing escrow accounts mechanism to indirectly involve banks in the financing process of P3 projects	Secondary	U.S.
		Utilizing an appropriate performance bond to protect both public and private sector's interests during the construction phase of the project	Primary	U.S.
	O&M services and commitment to a quality management plan	Providing balance sheet support and adequate P3 considerations for developers of P3 projects	Secondary	Int. and U.S.
		Bundling O&M services as a separate contract to encourage the development of innovative design and construction solutions	Primary	Int. and U.S.
		Requiring and evaluating a QMP in the RFQ and RFP process to ensure that the project has sufficient quality in case of contractor default	Primary	U.S.

the transportation strategies and project concepts that are recommended (Grant et al. 2013). Following the LRTP, the programming phase is undertaken that results in development and adoption of TIP and STIP, which combines regional TIPs.

The primary enabling mechanism discovered throughout the interviews involves incorporating alternative funding sources and innovative financing mechanisms consideration in the development of the TIP and the STIP. Several interviewees stated that the conventional long-range statewide transportation planning process lacks proper alignment with alternative funding and innovative financing project development needs. The interviewees noted that consistency at the planning and budgeting phase and consideration of alternative funding sources and innovative financing mechanisms can contribute greatly to market predictability for the private sector. This issue is identified to be a major enabler in the U.S. market, mainly because of the fact that the transportation planning and project development process in most state DOTs is aligned with the traditional pay-as-you-go financing mechanism (FHWA 2007).

The secondary recommended opportunities for transportation planning were determined as follows:

- Utilizing private sector expertise in NEPA analysis and ROW acquisition and
- Educating policy decision makers, legislatures, and other stakeholders about private financing and P3s.

The interviewees mentioned that involving financial institutions at the early stage of project development contributes to a robust project financing framework. Although there are concerns with respect to early private sector involvement, especially during the predevelopment stages, this strategy has been tried before on a number of major DBFOM projects. Early private sector involvement often

includes one or a combination of the following approaches: (1) predevelopment agreement between the state DOT and a developer, (2) unsolicited proposal from a developer, and (3) industry outreach and informal involvement in the planning phase. To overcome the procedural challenges with respect to private sector involvement in the predevelopment phases, state DOTs have the option to apply for waivers under the FHWA special experimental project No. 15 (SEP-15) program, which allows for deviations in contracting; compliance with environmental requirements, right-of-way acquisition, project finance, and other transportation project planning requirements (FHWA 2014a). This secondary recommended opportunity is applicable for the U.S. P3 projects because project delivery in most state DOTs is aligned with the conventional design-bid-build project delivery system, and private sector involvement in NEPA analysis and ROW acquisition is still a major challenge for most agencies (NEPA).

The other secondary recommended opportunity in planning for transportation projects is the capacity to report and educate decision makers at the legislative and executive levels regarding P3s. It is discovered that informing the policy decision makers regarding the potential benefits and possible issues related to private sector involvement in private financing can result in political stability and consistency in decision making. Interviewees highlighted the importance of state DOTs' P3 project development and planning maturity and transparency in sending the proper signals for investors that P3 projects are real. Several interviewees mentioned that "... risks associated with tenure and stability of elected officials and political will of the authorities can undermine planning efforts and send negative signal to investors." In fact, Rall et al. (2014) note that at the global level, educating policy decision

makers is among the best practices for enhancing P3 project planning and development.

Development of Project Portfolios

The primary issues discovered during the interviews is that the development of project portfolios has the potential to reduce transaction costs for both public and private sectors. The interviewees noted that bundling of small projects into a P3 project portfolio results in eliminating the transaction costs of individual projects and reducing the administrative costs for both public and private sectors. Bundling projects into a program results in significant transaction cost savings for the bidders and reduces procurement costs for the state DOT, which has been previously experimented by the Missouri DOT's "Safe and Sound Program" for replacement of 800 bridges (FHWA 2015b). Furthermore, bundling projects can save significant administrative costs, particularly when state DOTs decide to outsource both design and construction to the private sector. Finally, P3s can substantially reduce rework and change requirements for individual projects as opposed to conventional design-bid-build projects.

The secondary recommended opportunity in this area is found out to involve outsourcing a portfolio of projects to reduce administrative costs/burden for the public and private sector. Outsourcing a program or portfolio of projects can reduce state DOTs' responsibilities and transfer risks, traditionally retained by the owner to the private sector. A P3 project portfolio encourages competition and generates interest in the P3 market that can result in significant cost savings for the project. The Pennsylvania DOT (PennDOT) decided to utilize private financing resources and accelerated bridge construction for replacement of 614 structurally deficient bridges through a P3 project portfolio as part of the "Rapid Bridge Replacement Project" designed to address over 4,000 bridges in the state (Barnes and Cho 2014). The P3 contract involves an availability payment agreement to design, construct, finance, and maintain the bridges at a prescribed level of performance and condition for 25–35 years (PennDOT 2015).

Accounts Receivable Purchase Agreements or Factoring Design and Construction Invoices

Accounts receivable purchase agreement or factoring is a globally accepted method of raising capital for short-term financing needs. Factoring involves selling a firm's accounts receivable along with the collection risks to a financial institution (i.e., bank), also known as the factor, at a discount or for a prescribed fee plus interest (Chen and Chen 2012). With approximately \$10 trillion worth of accounts receivable on financial statements of U.S. companies, factoring is employed by several industries, such as retail, manufacturing, and production (Katz 2011). However, the construction industry has not yet extensively employed factoring for accounts receivable or invoices of major highway construction contracts.

The primary enabling mechanism discovered during the interviews with P3 experts involves expediting cash reimbursements to permit the contractor with compensating subcontractors and maintaining strong balance sheet. During the interviews, one upper level executive stated that "the ability to sell receivables or construction invoices (accounts receivable purchase agreements) by the developer/contractor increases cash availability and ensures that bank's credit facilities are not counted as debt on the developer/contractor balance sheets." Factoring of construction invoices requires flawless coordination between the agency, the factor (i.e., bank or other financial institution), and the private entity (i.e., the project developer) for the benefit of the project, regardless

of the factor's recourse rights against the developer/contractor or the agency.

Two secondary enabling mechanisms were discovered as follows:

- Utilizing factoring to reduce cash balance volatility for contractors and enabling investments across a portfolio as opposed to individual projects and
- Utilizing factoring to reduce financial risk exposure of both the developers and banks.

The interviewees noted that expedited cash reimbursements permit the contractor to compensate subcontractors and maintain a strong balance sheet. Further, interviewees noted that factoring can reduce contractors' dependency on bank loans as a financing method and level the playing field for small- and medium-sized contractors. As part of the factoring agreement, the bank, in return, may provide the developer, and in some instances, the involved subcontractors with loan discounts. Factoring of construction invoices are dependent upon approval of the agency, which are subject to quality assurance/quality control and independent verification of the quality of the delivered work items. If approved, the contractor can then seek immediate cash reimbursements from the bank. Fig. 3 presents the structure of a P3 agreement that allows factoring of invoices.

A financial structure that resembles factoring was used on the "Texas SH 183 Managed Lanes" project (TxDOT 2015c). The comprehensive development agreement issued by Texas DOT includes a deferred design and construction cost component (worth \$200 million) that can be sold to credited financial institutions under a factoring agreement (TxDOT 2015a). Similarly, Georgia DOT used a factoring agreement for development of two major DBF projects, notably the "Northwest Corridor (NWC)" and the "I-285/SR-400 Improvements" projects worth, \$834 million and \$679 million, respectively (FHWA 2015c; GDOT 2015). Although the former project includes only a \$200 million financing component, the latter project involves a \$445 million gap financing to be repaid in six years following substantial completion in 2019. The recommended opportunities discovered in this area have the potential to enhance the P3 industry's financing capabilities in U.S. as well as at the global level.

Asset-Based Financing and Securitization

Asset-based financing and securitization methods involve raising funds either through a financial institution or in the bond market using the future project revenues (Fabozzi and Nahlik 2012). These funds (i.e., bond proceeds or loans) are considered debt, and therefore, limit the issuing entity's (i.e., either the state or the project company) debt capacity. During the interviews, it was found that utilizing conduit bond issuing entities (e.g., local governments) to issue private activity bonds (PABs) can serve as an enabling mechanism for financing P3s. The U.S. P3 market has significantly benefited from PABs, and therefore, this mechanism is particularly discussed in the U.S. context.

In DBF agreements, where projects do not have a source of revenue, such as tolls or availability payments, asset-based financing or securitization may seem inappropriate. It is found out that using the deferred payment mechanism and through a conduit bond issuer, state DOTs can pledge bond repayments and deliver projects using proceeds from municipal bonds. The proceeds of these bonds can be used by the developer in a nondebt form. Compared to the typical bank loans or government-backed loans this form of debt is considered low risk. Repayment of these bonds are backed by future state funding (using deferred payment mechanism), and they are considered relatively low risk compared to bonds backed by toll

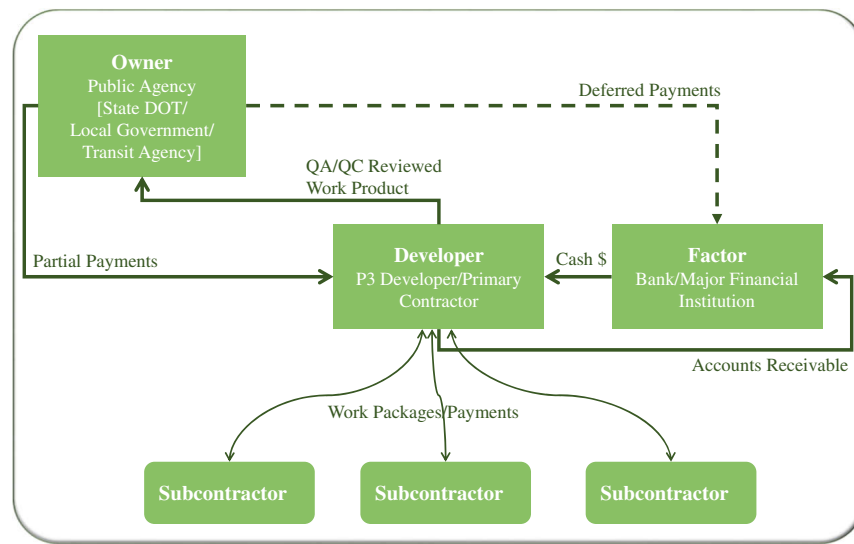


Fig. 3. Structure of a P3 contract with factoring agreement

proceeds. One interviewee mentioned that “the U.S. bond rating agencies and investment banking needs to be familiarized with asset-based financing mechanisms.” The Florida DOT (FDOT) in collaboration with a local public entity (i.e., Florida Municipal Loan Council) utilized a similar financing structure on two design-build-finance contracts, the SR 9B project and I-95 (from SR 406 to SR 44) improvements (FDOT 2013b). The financing portion of the DBF agreement involved using the proceeds of bonds issued by a local public entity (i.e., conduit bond issuer) for design and construction costs without recourse against the joint ventures. The Florida DOT retained the payment responsibility for the bonds. However, the major drawback of this approach is the lack of flexibility in project prioritization in future years because of debt-like obligations of the state DOT.

The interviewees mentioned that the authority to use alternative payment mechanisms (i.e., the deferred payment method, reimbursement of payment certificates, or availability payments) is essential for planning and development of projects that include a private financing component. However, in some states, the state DOT may not have the ability to directly pay the lenders for payment certificates. For instance, the Florida statutes prohibit FDOT from reimbursement (for payment certificates) of a party other than the contractor, who has performed the work (FDOT 2015). This statutory constraint may limit the use of factoring agreements in DBF or DBFOM projects. An innovative strategy to overcome the indirect payment barrier, which was discovered during the interviews, is to utilize escrow accounts for making all payments to an escrow account (or a lock-box) controlled by the lender (FDOT 2015). FDOT has utilized the escrow accounts approach on some of its DBF projects in order to solve the issue of direct contractor reimbursement.

The escrow accounts method requires establishment of an escrow account that is directly managed by the lenders and used for making deposits by the state DOT, as depicted in Fig. 4. The agency reimburses the account for the completed portions of the work and then the lenders can have the flexibility to use the funds in the account based on the agreement with the contractor. One interviewee noted that although this approach solves the issue of indirect lender reimbursement, when compared to the factoring method, it may pose additional risks to the contractor. If the state DOT decides to tie reimbursements to substantial completion, the lenders may

exercise set-off rights against the funds in the account in case of contractor default. Therefore, the private sector prefers to utilize the escrow accounts method combined with a fixed schedule of repayment (i.e., not tied to the final project completion). Similar to PABs, it appears that this secondary recommended opportunity is applicable in the U.S. context.

Surety, Payment, and Performance Bonds

The importance of surety bond requirements for federal-aid public works projects under the Miller Act of 1935 (U.S. Code Title 40 2016) has been widely accepted by state DOTs and private developers and contractors. Surety payment and performance bonds protect the public sector, subcontractors, and suppliers in highway project developments. In major DBF and DBFOM projects, where significant private sector financing is involved, the risks are even higher for the state DOT because contractor’s default means lack of funding for project’s continuation because the private sector partially finances the project. However, Kraft et al. (2014) notes that use of performance bonds that cover 100% of the project value for contracts over \$250 million may not be a reasonable alternative. One primary enabling mechanism discovered during the interviews involves utilizing an appropriate performance bond to protect both public and private sector’s interests during the construction phase of major P3 projects, where the risk of default is generally the highest among all other phases of a project. P3 projects in the United States can substantially benefit from appropriate performance bonds as a critical requirement that protect the stakeholder’s financial interest during the construction phase of DBF and DBFOM projects (SFAA 2015). It is found out that performance bonds for DBF and DBFOM projects are, to some extent, different from regular construction projects because an additional liquidity component and parent company guarantees are often requested by the lenders in P3 projects to secure potential delay damages.

The secondary recommended opportunity in this area involves providing balance sheet support and adequate P3 considerations for developers of P3 projects. Particularly, it is discovered that in the United States, the surety industry is typically hesitant to issue bonds for small- or medium-sized firms (Bayraktar et al. 2004; Cui et al. 2004). Appropriate guarantees from parent companies provide the public sector, lenders, suppliers, and subcontractors with the

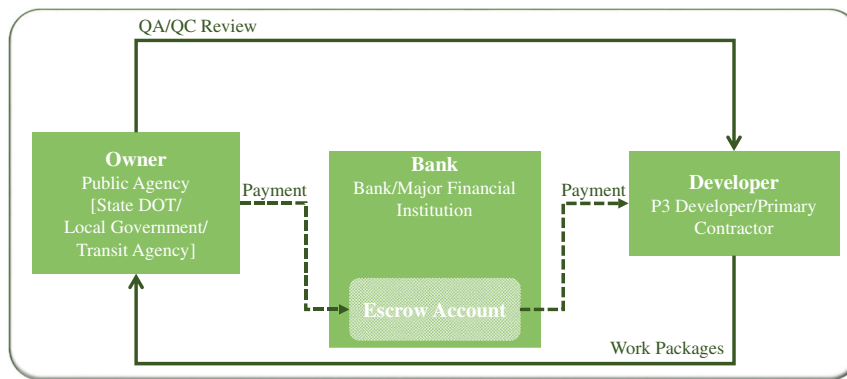


Fig. 4. Structure of a DBF contract with escrow accounts

third-party assurance that the contractor is capable of performing the work. Further, it is found out that in case of project delays that may extend several months, the traditional performance bond does not provide adequate capacity to address potential delay damages. Hence, a liquidity component, which serves as an additional guarantee for lenders and investors, should accompany developers' performance bond for DBF or DBFOM projects.

O&M Services and Commitment to a Quality Management Plan

There are various O&M issues associated with DBF projects that may result in lack of proper incentives for the contractors to incorporate innovation and lifecycle cost efficiencies in the project. Considering the significant highway expenditures on maintenance, incorporating the O&M services in project delivery may result in efficiencies in procurement and lifecycle cost savings. Agencies may feel uncomfortable or may be limited by the statute of the state to engage in long-term DBFOM projects. In this regard, the primary enabling mechanism that was discovered during interviews involves bundling O&M services as a separate contract to encourage the development of innovative design and construction solutions. At the international level, Albalade and Xenidis (2009) suggest that P3 agreements with flexible terms or flexible scope have been experimented. Research shows that such flexibilities provide an additional layer of security for both the public and private sector (Ferreira da Cruz and Marques 2014).

A flexible O&M component ensures the public sector that facility operations are assigned to the responsible and responsive bidder. A possible solution in these circumstances might be signing a separate O&M contract with the same development team on the DBF project. The public sector can still hold the right to collect tolls and manage any long-term financing transactions related to the project. The project development team, however, has an added incentive to build high-quality product, knowing the opportunity available to take the charge of operating and maintaining the facility. In fact, some developers specified their interest in this hybrid model because they do not have to maintain a long-term financing position in the project because their involvement in private financing will be short-term according to the financing requirements of the DBF contract.

In P3 projects, project quality assurance and quality control (QA/QC) responsibilities during design and construction as well as O&M are ultimately the responsibility of the developer, mainly because the design and construction components of these projects are contracted under design-build requirements. Although state DOTs can transfer the responsibility of QA/QC to the P3 developer's

design-build team, the responsibility for acceptance does not change in design-build contracts [23 CFR 637.207(b) 2016]. The interviewees noted that it is critical to properly administer quality acceptance procedures and achieve accepted levels of quality on design-build projects that have the QA/QC responsibilities transferred to the design-build team. Hence, with respect to QA/QC commitment, the primary enabling mechanism involves requiring and evaluating a quality management plan (QMP) in the request for qualifications (RFQ) and request for proposals (RFP) process to ensure that the project has sufficient quality in case of contractor default.

This recommended best practice ensures the public sector of adequate contractual mechanisms for safeguarding the project quality. Particularly in the United States, agencies have started to shift towards a more administrative and oversight role as opposed to the hands-on approach in managing QA/QC responsibilities for P3 projects (Kraft and Molenaar 2014). One of the interviewees indicated that "state DOTs need to ensure that the contractor complies with the proposed quality management plan so that they (state DOT) are prepared for the worst-case scenario. Incentives for project quality are not adequate, particularly in DBF projects that do not have an O&M component. State DOTs have to be prepared for contractor's default so that they (state DOT) can take over the project that has an acceptable performance and level of service."

Conclusions

It is anticipated that private sector involvement in financing U.S. highway projects in the form of P3s will continue to grow in the future. This study investigates major issues and challenges as experienced by private sector participants in highway projects because of the impacts of autonomous public sector P3 practices in the United States. It is concluded that the public agencies' varying levels of maturity in P3 implementation has negative impacts on private sector's ability to deliver projects successfully. It is also recognized that the challenges and limitations of P3 project development are common among the participants of the highway P3 market. Among the identified challenges, regulatory uncertainty and inability of the private sector to be involved in predevelopment phases of transportation projects, lack of a programmatic approach for P3 project development in the public sector, significant transaction costs for P3 projects that involve private financing, and slow shift in mindset and required business processes in transitioning from conventional project delivery to P3 were recognized as primary issues hindering private sector involvement in highway P3s.

It is concluded that the project initiation and planning challenges result in autonomous P3 practices across the states and escalate variability among state DOTs project delivery processes. Further, these challenges are likely to escalate political instability and result in project cancellations or push down the funding and financing challenges to developers and contractors. These challenges, as highlighted by the interviewees, are a major source of risk for private sector participants and can discourage investors and competitors from involvement in high-risk and turbulent markets (i.e., states with turbulent market conditions or politically instable) in favor of more developed markets (i.e., states with mature P3 programs). With respect to project procurement challenges, it is concluded that program-level success and good governance also represents itself in the project procurement for selection of a successful partner. Further, it is recognized that project readiness challenges coupled with transaction cost recoverability issues impede matching project procurement and risk management requirements with the industry's interests and appeals. Finally, it is concluded that balance-sheet and surety contractor challenges, as well as post-award administration issues, negatively affect the partnership phase, where the project transitions from procurement to execution. Hence, the identified challenges at the partnership phase can jeopardize team-building efforts and actual execution of design and construction solutions within an integrated process.

Following interviews with the P3 industry experts, this study identifies and evaluates improvement strategies that can standardize P3 project delivery and enhance partnership alignment between the public sector and private entities. Among the identified enablers, establishing a P3 program/unit with adequate project finance and procurement expertise, incorporating alternative funding and innovative financing considerations in the planning phase, allowing the use of factoring and asset-based financing methods, and utilizing appropriate performance bond vehicles were recognized as primary recommended opportunities for the U.S. P3 market.

It is concluded that although several state DOTs are still experimenting with P3, Florida, Texas, and Virginia state DOTs have established mature P3 programs. In fact, involvement of mature P3 programs in these state DOTs has expanded beyond the procurement phase and includes project selection, TIP/STIP planning, traffic and revenue studies, financial structuring, and administration of P3 projects. However, as the P3 market becomes increasingly competitive, it becomes prominent for the public sector to alleviate uncertainty in the P3 market and establish robust project delivery framework for P3 implementation at the initiation and planning phase. With respect to the procurement phase, it is concluded that enabling mechanisms that tend to mitigate the impacts of high transaction costs and cash flow volatility have the potential to incentivize private sector developers and investors. It is also concluded that state DOTs' role in enhancing the P3 market in their states and delivery of critical projects by involving regional entities (e.g., cities and counties) in asset-based financing and securitization should not be underestimated in project procurement. Finally, it is concluded that the P3 partnership in the United States can significantly benefit from novel surety vehicles, which include liquidity components and parent company guarantees, as well as better quality management planning specifications in partnership management. It is recognized that dedicated performance bonding requirements and post-award contract administration processes of P3s can pave the way for the next generation of P3s in the United States.

The focus of this study was limited to P3s procured in the United States with a financing component, which primarily include DBF and DBFOM agreements. Although the focus is on highway P3s, other transportation modes, as well as other infrastructure

sectors, can benefit from the findings of this study. This work is expected to contribute to the professional community of civil engineering and management by providing intriguing arguments from the standpoint of private sector stakeholders in the P3 market. The outcome of this study can help state DOTs, transportation planners, contractors, and financial institutions make more informed decisions when engaging in P3 arrangements. Future research is required to conduct a similar study for international P3 projects and compare the results to the U.S. market to see how owners and private sector stakeholders have overcome barriers to delivery of P3s. Further research is required to evaluate the performance and maturity scale of the P3 market in the United States in comparison with other developed countries as well as transitional markets. Finally, future research could focus on quantitative analysis of asset-based financing mechanisms and their economic effectiveness for P3 projects.

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