



U.S. Department
of Transportation

Concept Design for an Online Information Source for Major Surface Transportation Projects: A Discussion Paper

June 2017



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Technical Report Documentation Page

1. Report No. FHWA-HIN-17-009	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Concept Design for an Online Information Source for Major Surface Transportation Projects: A Discussion Paper		5. Report Date June 2017	
		6. Performing Organization Code FHWA	
7. Author(s) Susan Binder, Benjamin Perez, Jagannath Mallela, and Suriyanarayanan Sadasivam		8. Performing Organization Report No. Cambridge Systematics WSP USA	
9. Performing Organization Name And Address Cambridge Systematics, Inc. 3 Bethesda Metro Center, Suite 1200 Bethesda, MD 20814 WSP USA One Penn Plaza New York, NY 10119		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No. DTHF61-13-D-00014	
12. Sponsoring Agency Name and Address United States Department of Transportation Federal Highway Administration Office of Innovative Program Delivery 1200 New Jersey Avenue, SE Washington, DC 20590		13. Type of Report and Period Covered Discussion Paper: August 2016 – June 2017	
		14. Sponsoring Agency Code	
15. Supplementary Notes Contracting Officer's Technical Representative: Patrick DeCorla-Souza, FHWA Office of Innovative Program Delivery			
16. Abstract This discussion paper explores the issues associated with compiling information on major surface transportation projects in a publicly accessible online information source or database to assist in establishing benchmarks on projects delivered conventionally and through Public-Private Partnerships (P3s). Information on projects delivered conventionally and through P3s for operating transportation facilities and those in various phases of development could also provide a resource for practitioners seeking to develop or implement similar projects.			
17. Key Words Public private partnerships, toll roads, concession arrangements, tax analysis, competitive neutrality adjustment, value for money		18. Distribution Statement No restrictions	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 57	22. Price N/A

Form DOT F 1700.7 (8-72)

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Executive Summary

Title IX of the Fixing America's Surface Transportation (FAST) Act of 2015 directs the National Surface Transportation and Innovative Finance Bureau (renamed the Build America Bureau by USDOT) establish procurement benchmarks to ensure accountable expenditure of federal assistance over the life cycle of projects. To the maximum extent possible, these benchmarks should:

- ▶ Establish maximum thresholds for acceptable project cost increases and delays in project delivery
- ▶ Establish methods for States to measure cost and delivery changes during the project lifecycle
- ▶ Be tailored to different types of project procurements including design-bid-build, design-build and public-private partnerships (as well as other alternative contracting methods such as Construction Manager/General Contractor, a.k.a. CM/GC)

The FAST Act also calls for the Bureau to work in coordination with the modal administrations, including the Federal Highway Administration, to collect project specific information and make it available on a publicly accessible Internet website.

This discussion paper explores the issues that would need to be considered to prepare a publicly accessible online information source or database that could be used to help establish benchmarks on major surface transportation projects delivered conventionally and through Public-Private Partnerships (P3s).

The interest in establishing an on-line repository of project procurement data reflects increasing interest in using public-private partnership (P3) concessions to implement and operate large and complex surface transportation improvements. The potential benefits and limitations of using the P3 concession approach are widely cited. However, little information is available to corroborate these claims. Data on the features and outcomes of P3 and non-P3 procurements could provide the basis for analyses that could shed light on both their strengths and weaknesses. Thus, a secondary purpose of the information source might be to provide a basis for substantiated conclusions about the appropriateness of different procurement strategies in constructing and operating transportation infrastructure under different conditions. Information on projects already implemented or in various phases of development could also provide a resource for practitioners seeking to develop or implement similar projects.

Potential data and information to be included in the information source were considered in terms of two tiers. Tier 1 would provide basic descriptive and outcome-related project data and would be populated to the greatest extent possible with information that has already been captured in existing data sets assembled by FHWA and other industry stakeholders. The Tier 1 information would be of interest to the primary target audience for the information source, namely state departments of transportation (DOTs), Metropolitan Planning Organizations (MPOs) and local transportation agencies that use or are contemplating the use of P3 project delivery.

The Tier 2 data would support more advanced research and analysis and would involve the collection of data that is not captured in existing repositories. This discussion paper identifies:

- ▶ A set of core questions, which would form the bases for such assessments and that the information source might address.



- ▶ Clearly defined data sets that could be used to conduct such assessments of the project performance outcomes of P3 and non-P3 projects.

The paper also identifies:

- ▶ The type of platforms and considerations for their design and management through which the information could be structured and made available
- ▶ Potential institutional structures and funding mechanisms to establish and maintain an information source.

As part of a vetting process, the discussion paper was reviewed by technical experts in academia, government and industry. FHWA also convened a daylong round table session attended by industry P3 experts, internal staff and the consulting team that prepared the discussion paper. The round table participants focused on the importance of the tradeoffs between the scale and depth of the information source, its utility, and the level of effort needed to establish and maintain it. While the information source could provide a first step in understanding project outcomes, the participants agreed that it would be most useful in informing higher-level public policy decisions on the use of different project delivery options.

The roundtable participants suggested the information source should initially focus on compiling the Tier 1 information. Although this information largely exists, it resides in disparate locations including the FHWA Office of Infrastructure's Major Projects Database, the FHWA Center for Innovative Finance Support website, and other FHWA and industry data sets. In order to confirm the availability of the information and evaluate the level of effort to collect and verify it, it was suggested that FHWA would benefit from conducting a pilot to collect Tier 1 level information for a small number of projects. This proof of concept effort would allow a better understanding of what information is available, and the extent of data gaps and consistency issues. A key task in such a pilot data collection effort would be to review as many candidate information sources as possible. It is expected that there will be inconsistencies from one data source to another. The pilot data collection effort could identify inconsistencies and develop strategies to verify information accuracy.

It was also suggested that FHWA and the Bureau could start the process by assembling information from FHWA's existing data on major projects. Once compiled, that information could be shared with state departments of transportation (DOTs) that do not have much experience with P3s. FHWA and the Bureau could then solicit their feedback on the value of the data to them. This would allow FHWA and the Bureau to gain an understanding of what such states would seek to learn when they are assessing project delivery options for major projects. While there are common issues in assessing project delivery options, there are always situations that are unique to individual state DOT policies, procedures and management direction. In many instances, procurement decisions cannot be informed fully by reviewing historical data, but also need an assessment of the specific issues involved. Working with the data already captured in the FHWA major project database would provide an opportunity to understand what type of information would be most helpful to state DOTs as they consider procurement options.

Given that roundtable participants suggested a focus on Tier 1 information as a start, Chapter 3 of the discussion paper identifies the candidate Tier 1 data metrics, together with the anticipated sources of that information. A description of the Tier 2 information has been retained in Appendix B of the discussion paper for potential use by other researchers.

Should a decision be made to begin efforts to put the information source in place, it is suggested that the efforts would benefit from oversight from a committee of thought leaders in the P3 and transportation policy arenas. It would be strategic to seek participation in such a committee from states that have recently passed P3 enabling legislation but that do not yet have hands-on P3 experience, together with representatives from larger MPOs.



These organizations would benefit from the information source as they consider new funding and financing options and make policy decisions guiding their strategic transportation plans.



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Acronyms and Abbreviations

AADT	Annual Average Daily Traffic
ATC	Alternative Technical Concepts
CM/GC	Construction Manager/General Contractor
CVS	Comma Separated Values
DB	Design-Build
DBB	Design-Bid-Build
DBE	Disadvantaged Business Enterprise
DBF	Design-Build-Finance
DBFOM	Design-Build-Finance-Operate-Maintain
DBOM	Design-Build-Operate-Maintain
DEIS	Draft Environmental Impact Statement
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMMA	Electronic Municipal Market Access
FAST Act	Fixing America's Surface Transportation Act
FASTLANE	Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
GIS	Geographic Information System
HPMS	Highway Performance Monitoring System
HTML	Hyper Text Markup Language
ITS	Intelligent Transportation System
MP&R	Maintenance Preservation and Renewal
MSRB	Municipal Securities Rulemaking Board
NBI	National Bridge Inventory
NCSL	National Conference of State Legislatures
NHS	National Highway System
O&M	Operations and Maintenance
P3	Public-Private Partnership
PAB	Private Activity Bond
PDF	Portable Document Format
PLA	Project Labor Agreement
RFI	Request for Information
RFP	Request for Proposals
RFQ	Request for Qualifications
RRIF	Railroad Rehabilitation & improvement Financing
TIFIA	Transportation Infrastructure Finance and Innovation Act
USDOT	United States Department of Transportation
VfM	Value for Money
VMT	Vehicle Miles Traveled
WAI	Web Accessibility Initiative



1 Online Information Source Structure and Purpose

1.1 Introduction

Title IX of the Fixing America's Surface Transportation (FAST) Act of 2015 calls for the establishment of a National Surface Transportation and Innovative Finance Bureau. In fulfillment of this mandate, the United States Department of Transportation (USDOT) established the Build America Bureau in July 2016. The FAST Act mandates the different functions the Bureau will serve. One of these is to promote best practices in project delivery for major projects receiving federal assistance. In order to accomplish this, the FAST Act calls for the Bureau to establish procurement benchmarks to ensure accountable expenditure of federal financial assistance over the life cycle of projects. The FAST Act requires that these benchmarks:

- ▶ Establish maximum thresholds for acceptable project cost increases and delays in project delivery
- ▶ Establish uniform methods for States to measure cost and delivery changes over the lifecycle of projects
- ▶ Be tailored to different types of project procurements including design-bid-build, design-build and public-private partnerships (as well as other alternative contracting methods such as Construction Manager/General Contractor a.k.a. CM/GC)

The FAST Act also requires that the Bureau work in coordination with the modal administrations, including the Federal Highway Administration, to collect project specific information and make it available on a publicly accessible Internet website. The purpose of this information source will be to address questions around the mandated benchmark development as well as to facilitate other information needs of the stakeholder community regarding various project delivery approaches.

The information source would compile data and descriptive information on major surface transportation projects delivered conventionally and through Public-Private Partnerships. Information on projects already implemented or in various phases of development could provide a resource for practitioners seeking to develop or implement similar projects. A secondary purpose of the information source might be to provide a basis for substantiated conclusions about the appropriateness of different procurement strategies in constructing and operating transportation infrastructure under different conditions.

1.2 Online Information Source Components

It is anticipated that the Information Source for Major Surface Transportation Projects will initially focus on major highway transportation projects ("major projects") that have been implemented in the recent past or are currently being implemented in the U.S. For the purpose of this paper, major projects are defined as highway projects of \$500 million or more in cost that use Federal financial assistance or those that use USDOT financing programs administered by its Build America Bureau. These projects are identified in Appendix A of this paper. It is anticipated that the information source could grow to include transit, rail, and marine and air transportation projects. Therefore, it is anticipated that the architecture of the information source will be designed to accommodate these future expansions.

The purpose of the proposed information source is twofold:

- ▶ **Provide project information for project delivery practitioners and others** who are involved in delivery of major transportation projects, and may have an interest in how other projects, similar to the ones under their consideration, have been delivered; or those who are involved in oversight of specific projects, including stakeholders, state and local managers, Federal officials from the various modal

administrations, as well as the USDOT's Build America Bureau. The Bureau has been charged by Congress to monitor and track against benchmarks all transportation projects that receive Federal financial support, including TIFIA, PAB and RRIF¹ credit assistance and discretionary grants under the FASTLANE program authorized by Congress in the FAST Act, i.e., all projects referenced in Section 9001 (d) (1) of the FAST Act. The type of project data required by this user group is similar to the information currently collected by FHWA's Office of Infrastructure for major highway projects.

- ▶ Provide more detailed project data for project delivery practitioners, policy makers, decision makers and academics that may have an interest in analytical studies of project delivery methods. For example, Value for Money studies require inputs such as expected impacts of various project delivery options on cost, delivery schedule, and quality of service; and studies seeking to perform comparisons of various project delivery options require reliable data on projects delivered using those options. The level of detail required for this purpose is much greater than that for the first purpose discussed above and the information is much more difficult to collect.

Addressing the information needs for the first purpose above could be relatively simple and straightforward. It could also be less costly to implement. For example, a library of documents from major projects (e.g., P3 agreements) could be developed, based on the needs of that audience. The beginning of such a library for highway projects already exists on the web site of FHWA's Office of Innovative Program Delivery. A database of major projects implemented since 2005 (albeit requiring a high level of curation) already exists for the project development, procurement and implementation phases of highway projects and is maintained by the FHWA Office of Infrastructure's Major Projects Team; it could be a source for data for this purpose. However, continuing curation of the data and addition of information on the operations and maintenance phase would be needed.

Comprehensively addressing the information needs for the second "analysis" purpose above would be resource-intensive and more challenging. For example, a comprehensive database has been developed by the University of Colorado for a single project, the Presidio Parkway project in San Francisco, CA, at a cost of approximately \$500,000. The data for this project could be used to populate the Information Source initially, with relatively little effort, but it would require a significant investment to include information for other highway projects at that level of detail. Therefore, it might be more practical to collect comprehensive data only for select projects and only when appropriate levels of funding are available, and collect readily available data for other projects at a much lower level of detail.

It is therefore recommended that the information source be organized in two tiers that correlate with its two purposes and related target audiences – Tier 1 (basic) for basic project information and Tier 2 (advanced) for more detailed analysis. The primary target audience for Tier 1 of the online information source is the public agencies that use or are contemplating the use of P3 delivery and are seeking information on similar projects implemented by others, including state DOTs and local transportation agencies. Tier 2 of the database could inform decision making on the appropriateness and use of P3 project delivery and provide detailed information (e.g., for input assumptions in value for money analysis) to support the decision making. The comprehensive nature of the Tier 2 information would enable broader assessments of the factors that contribute to successful projects outcomes for P3 and non-P3 projects.

The paper addresses, for each of the two purposes discussed above, the following: (1) information needs based on identified questions from each audience; (2) sources of information to answer the questions and populate the information source, along with related issues; (3) online platform configuration considerations; and (4) long-term maintenance issues.

¹ See the List of Acronyms and Abbreviations on p. iv.

The content of the information source could initially be focused on highway projects, and would depend on the level of resources available for development and maintenance. It is important to achieve useful products within whatever level of funding support is available. Thus, this paper proposes a strategy (outlined in Table 1 below) to address the needs of each purpose incrementally (with respect to highway projects) depending on level of funding.

Table 1. Recommended Information Source Tiered Structure

Purpose and Target Audience	Information Product	Highway Projects to be Included	Initial information to Build Upon
Tier 1 Project information for project delivery practitioners and others	Library and high-level “benchmark” data for project development, procurement and implementation to assist in project oversight and in decision making regarding future programs and policy development	All projects (irrespective of delivery method) since 2005 that are in the FHWA major projects database (projects using federal funding with a capital cost of \$500 million, or more)	FHWA Office of Innovative Program Delivery/ Center for Innovative Finance Support web site “library” and FHWA Office of Infrastructure major projects database
Tier 2 Detailed data for practitioners and academics	Detailed data on project development, procurement, implementation and operations for a full range of questions related to project development, delivery, operations and maintenance	All major projects (irrespective of delivery method) for which the required data is available and affordable within funding constraints, with the intent of obtaining data for a sufficient number of projects delivered under alternative delivery methods so that comparisons can be made (if possible) on a case study basis	Presidio Parkway

In order to make the information source as useful as possible, it will be necessary to define the data elements clearly. This would likely include the preparation of a data dictionary that provides concise definitions of all performance metrics included in the information source, bearing in mind that complicated data items would create difficulty in data collection. Whenever possible the information source should focus on observed data rather than information that is estimated or based on judgements.

This paper raises the issues that would need to be addressed if it were to be useful to its audience and worthwhile to its sponsors. The discussion paper identifies:

- ▶ A set of core questions that the Tier 2 database could answer
- ▶ Clearly defined information sets that could be used to assess the project performance outcomes of P3 and non-P3 projects
- ▶ Potential initial and continuing information sources
- ▶ The type of platform through which the information could be delivered efficiently
- ▶ Potential institutional structures and funding mechanisms for the ongoing maintenance and expansion of such an information source.

Based on the feedback received from industry stakeholders during the development of the discussion paper, a decision was made to first focus on compiling the Tier 1 information. Chapter 3 of the discussion paper therefore identifies the candidate Tier 1 data metrics together with the anticipated sources of that information. A discussion of the Tier 2 information has been retained in Appendix B of the discussion paper for use by other researchers.

1.3 Organization of the discussion Paper

This discussion paper is organized into five chapters, including this introduction. The remainder of this chapter identifies core questions that the information source would be designed to address, for both Tier 1 and Tier 2 users, and the basic steps that would be involved in assembling the information source.

Chapter 2 of the discussion paper discusses the types of P3 and non-P3 projects that could be included in the online information source.

Chapter 3 describes a possible organizational structure for the online information source and makes recommendations on the different descriptive and performance metrics that could be included in Tier 1 of the online information source.

Chapter 4 of the discussion paper describes the types of on-line platforms that could be used to house and deliver the online information source, including technology options and the functionality of the information platform.

Chapter 5 discusses the long-term enhancement and maintenance of the information source, identifying different models for data management and alternative institutional structures and responsibilities.

Finally, Chapter 6 provides conclusions and recommended next steps.

Appendix A of the discussion paper identifies all Major Projects designated by FHWA since 2005.

Appendix B of the discussion paper includes a detailed matrix identifying potential Tier 2 performance metrics that could be considered for inclusion in the online information source.

1.4 Core Questions to be Addressed by the Information Source

At its best, the online information source is envisioned as enabling P3 stakeholders including departments of transportation, public policy and project procurement professionals, and academics to determine if and under what conditions the value propositions sought under P3 project delivery are borne out by the data. A logical first step in developing a framework for the information source is to identify the universe of overarching questions that the target audience could be seeking to answer concerning P3 project outcomes. Understanding these core questions would drive the structure and content of the information source and help identify what information and performance metrics would need to be included in it. It is recognized that there are tradeoffs between the ability to address “all” questions and the effort and cost to address them in a credible and useful fashion. For this discussion paper, the “universal” list of questions is considered in order to determine the functional implications for the information source and provide options for consideration by potential sponsors.

The information source could be designed to provide users with the information that they would need to address the following core questions:

Table 2. Core Questions (for Tier 1 and Tier 2 Combined)

1.	How do cost savings, efficiencies and other important outcomes of specific P3 projects compare to non- P3 projects? What project characteristics and external conditions have enabled P3 structures to achieve in cost savings, efficiencies and other important outcomes compared to non- P3 projects, e.g., risk transfer?
2.	What types of risk have been mitigated most appropriately by P3 and non-P3 project delivery techniques?
3.	How have the capital and operation and maintenance costs for P3 and non-P3 projects differed?
4.	How do estimated and actual costs evolve over the course of the development of P3 and non-P3 projects?
5.	How does project scope evolve over the course of development of P3 and non-P3 projects?
6.	At what stage of a project are costs reasonably known for P3 and non-P3 projects (cost-certainty)?
7.	How has schedule certainty differed between P3 and non-P3 projects?
8.	How do the costs of procuring and overseeing P3 and non-P3 projects differ for project sponsors?
9.	How do the operating and life cycle costs for P3 and non-P3 projects differ?
10.	How do the financing costs for P3 and non-P3 projects differ?
11.	How do the timeframes for the various phases in the development and implementation of P3 and non-P3 Projects differ?
12.	What types of design, finance, construction, and operating innovations have been fostered by P3 and non-P3 projects?
13.	How have design and construction quality differed between P3 and non-P3 projects?
14.	How have post-construction maintenance quality differed between P3 and non-P3 projects?
15.	How has post-construction service quality differed between P3 and non-P3 projects (e.g., customer satisfaction, facility condition, etc.)?
16.	How many claims, disputes and change orders have been experienced with P3 and non-P3 projects?
17.	What has been the level of local subcontractor and disadvantaged business enterprises involvement in the construction of P3 and non-P3 projects?
18.	What have been the labor rates for the design, construction and operation of P3 and non-P3 projects, and what share of the labor is from foreign countries?
19.	What issues have arisen from payment default and completion with P3 and non-P3 projects, especially for those that do not use traditional bonding methods?
20.	How have the outcomes of real toll and availability payment P3 concessions differed?
21.	What influence has P3 enabling legislation and agency policy had on the outcomes of P3 projects?

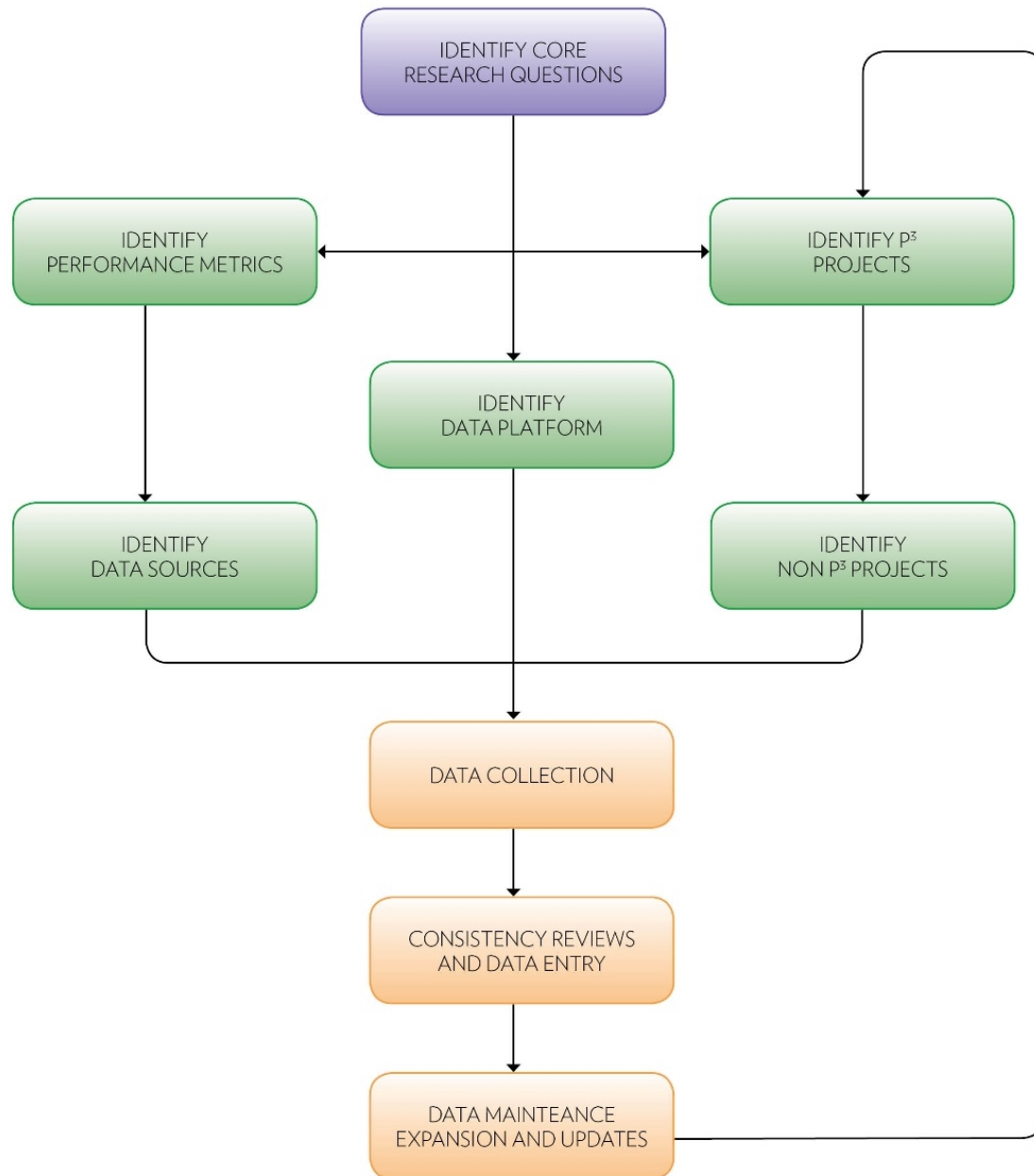
In order to ensure credible comparisons among projects, the data elements to be included in the information source would need to be defined as clearly as possible.

1.5 Steps in Assembling the Online Information Source

The possible steps involved in assembling the online information source are suggested in Figure 1. Based on the core questions, the projects to be included in the information source and the metrics that may be used to describe the projects and measure outcomes would be identified in tandem. As individual metrics are considered, information sources and an appropriate means of collection would also need to be considered. As the nature and scale of the information to be included in the information source comes into focus, options for

storing and accessing information would need to be assessed. The ultimate selection of a data platform would need to reflect user needs. Considerations should include on-line availability and the desired flexibility to search and query the information source and generate reports, as well as the ability to accommodate ongoing data updates and incorporate new projects over time. In order to maximize the usefulness of the information source to users, it will need to be as flexible as possible. It is envisioned that the information source would be available to users without any restrictions.

Figure 1. Online Information Source Assembly



Source: WSP | Parsons Brinckerhoff, 2017

Once these fundamentals have been established, data collection would begin. This would likely involve a variety of collection methods, with the data ultimately put into a spreadsheet environment from which it would be uploaded to the data platform. Careful quality review for consistency from project to project will be an essential element of the data collection process. Data quality assurance is discussed in greater detail in section 5.1.3 of this discussion paper. A trial data collection phase may be employed to determine whether the information provides sufficient value and reliability, as well as the cost and level of effort involved in assembling it.

Once the information source is populated and made available to users, the data maintenance and expansion phase would begin. During this period, additional performance data on the projects included in the information source would be added at regular intervals as they become available. Regular updates would be necessary to sustain the information source as circumstances change. The information source would also likely be expanded to include additional projects or project cohorts. If the initial iteration of the information source were to be prepared by a consultant, suitable arrangements would need to be made for the ongoing maintenance and operation of the information source. This would involve identifying funding sources to cover the ongoing cost and an institutional structure to oversee the process.

The different steps involved with the creation and ongoing operation of the online information source are addressed in the remainder of this discussion paper.



2 Identifying the Projects to be Included in the Online Information Source

The primary purpose of the online information source is to document the performance outcomes of P3 and non-P3 transportation projects to enable analyses across different procurement types. To facilitate such analyses, it would be ideal to begin the assembly of the information source by obtaining parallel information on projects of comparable size and levels of complexity, noting that in some cases individual projects may be implemented through a series of procurements over time.

In order to accomplish this, it is recommended that the information source focus on highway improvements that have been designated as Major Projects by FHWA. Since 2005, FHWA has required DOTs sponsoring highway projects with a total project cost of \$500 million or more to complete its Major Projects process in order to qualify to receive federal funding. Project owners must demonstrate that these projects have been carefully planned. The Major Projects process requires project sponsors to demonstrate that: 1) costs have been estimated as accurately and meticulously as possible; 2) risks have been carefully considered and mitigated; 3) funding requirements and strategies have been clearly defined; and 4) the implementation of the project has been carefully planned.

Through the different phases of project delivery, project owners are required to submit financial and project management plans and are subject to various FHWA review processes before Federal funding can be released for the project. The FHWA Major Project requirements include:

- ▶ Cost Estimate Review
- ▶ Financial Plan
- ▶ Project Management Plan

Using the different data collected through the major projects process, FHWA has assembled an [Active Project Status Report](#) identifying active major projects since 2005. These projects receive federal funding and have a capital cost of \$500 million or more. One-hundred-and-four of these projects were listed as active as of February 2017 and an additional 33 projects have been completed. Together, these projects represent the largest and most complex transportation improvements undertaken in the United States since 2005. They include design-bid-build procurements, design-build procurements and Design-Build-Finance-Operate-Maintain (DBFOM) P3 concession procurements. Work has not yet begun on some of the projects included in the Active Project Status Report. Therefore, the list should be reviewed to identify projects for which information on actual project outcomes may not yet be available. Some projects are being built using multiple procurements as funding becomes available.

A listing of the projects included in the FHWA Active Project Status Report is included in Appendix A of the discussion paper. General information on the three project types proposed to be included in the information source follows.

2.1 Design-Bid-Build Projects

Design-bid-build is the traditional delivery model that most DOTs have used to procure the vast majority of transportation projects in the United States. With this approach, DOTs enter into separate contracts for project design and project construction. Projects are designed to 100 percent completion as part of the design procurement. Qualified contractors then bid on the construction contract, with the project sponsor usually awarding the job to the bidder submitting the lowest cost bid. Once design-bid-build projects are completed,



their public sector sponsors are responsible for their ongoing maintenance and operation. Unlike P3 concessions, design-build procurements do not involve ongoing maintenance and operations needs. Therefore, to the extent possible, it would be useful for the information source to include data on asset condition for design-build projects.

2.2 Design-Build Projects

Design-build project delivery combines design and construction functions into a single contract, rather than as two independent services performed consecutively by separate entities. With design-build procurements, owners execute a single, fixed-price contract for both architectural/engineering services and construction. The design-build entity—also known as the “constructor”—may be a single firm, a consortium, joint venture or other organization assembled for a particular project. However, highway and transit design-build teams are almost exclusively contractor led. With design-build delivery, the design-builder assumes responsibility for completing a final design for projects and undertaking construction activities for a lump-sum price. As such, the design-builder also assumes the financial risks associated with possible cost overruns. Most design-build contracts also include penalties for schedule delays and bonuses for the early completion of construction. The project sponsor remains responsible for financing the project, and operates and maintains it after construction is complete. It should be noted that nearly all P3 concessions also utilize fixed-price design-build contracts.

Given that they are fixed price agreements, design-build contracts incentivize the design-builder to innovate and identify strategies to streamline construction costs. Project completion can also be accelerated by undertaking some design and construction activities concurrently rather than sequentially, as is the case with design-bid-build projects. This has the potential to result in further cost reductions by shielding projects from the risk of inflation and commodity cost escalations and accelerating project completion. Project designs are generally 10 to 30 percent complete at the time most design-build procurements are let, and design-build procurements contain comprehensive performance requirements that the bidder’s final design must meet. (The degree to which this is true may vary from project to project and state to state). This structure can provide the design-builder with the flexibility to innovate and find the most cost effective solutions both in terms of project design and construction techniques.

The award of design-build contracts is usually made on a best value basis that takes price, technical quality and the qualifications of the proposing teams into consideration. Under the right conditions, design-build procurements may result in cost reductions compared to the traditional design-bid-build approach and accelerate the completion of projects. Unlike P3 concessions, design-build procurements do not involve ongoing maintenance and operations needs. Therefore, to the extent possible, it would be useful for the information source to include data on asset condition for design-build projects.

2.3 P3 DBFOM Concession Projects

Under the right conditions, P3 procurements may be expected to provide project sponsors with the cost and acceleration benefits of design-build procurements and the added lifecycle benefits of the DBFOM approach. In addition, they are expected to transfer lifecycle performance risk to the private sector partner and provide owners with access to new sources of financing, including private sector equity and global commercial debt possibilities.

There is a great deal of variety in DBFOM arrangements in the United States, especially the degree to which financial responsibilities are actually transferred to the private sector. One commonality that cuts across all DBFOM projects is that they are financed by equity and debt leveraging revenue streams dedicated to the project.

While P3 project delivery has been the subject of extensive discussion among transportation and public policy professionals, the number of P3 projects that have been implemented in the United States is relatively small. As of December 2016 25 new-build highway and transit P3 projects have either opened to service or reached financial close in the United States. Two different revenue sources have been used to leverage financing for P3 concessions. The majority of existing P3 concessions use toll revenues to raise project financing. Since 2009, a growing number of P3 concessions have been financed using periodic availability payments paid by the project sponsor to the private partner. The financing raised from both of these revenue streams is also often supplemented by grants from project sponsors and other contributions, such as right-of-way or complementary construction projects. The two P3 concession models are discussed in further detail in the following sections.

2.3.1 Real Toll Concessions

DBFOM projects leveraging toll proceeds are commonly referred to as “real toll” concessions. To date, 14 real toll concession projects have opened to service or reached financial close in the United States. Two of these projects have since been purchased by the public sector. With these arrangements, the private sector partner has the right to collect toll revenues during the concession period but bears the risk that toll proceeds may not meet forecasted levels. It assumes the risk that the funds generated by the project will not be adequate to pay the underlying project debt and interest and make a fair return on its investments of time, expertise and equity. To protect the public sector interest in the event of robust revenue generation, some concession agreements can include a revenue-sharing provision between the private partner and public sector if revenues exceed certain specified thresholds. In some cases, minimum revenue guarantees to private partners are necessary in order for P3 projects to advance. These mechanisms can take the form of a Developer Ratio Adjustment Mechanism (DRAM), which is available to the private partner if toll revenues are insufficient to cover operational and/or debt service costs over specified periods of time.

The real toll concession model has been used to develop three greenfield toll roads in corridors that did not have highway facilities. Two real toll concessions have been used to develop water body crossings, and nine have developed priced managed lanes. This last group of real toll projects involve designated lanes within existing highway rights-of-way where the flow of traffic is managed by restricting vehicle eligibility, limiting facility access, and collecting variably priced tolls. Toll rates may vary in real time based on actual traffic conditions or according to a fixed schedule; this meters the flow of paying vehicles in order to maintain a desired level of service and predictable travel times on the priced managed lanes.

2.3.2 Availability Payment Concessions

A total of 11 P3 concession projects that have opened to service or reached financial close have been funded with availability payments made by the public sector sponsor to private development partners. The sponsor pledges availability payments to compensate the concessionaire for its role in designing, constructing, financing, operating, and maintaining the facility for a set time period during which it receives fixed annual payments, which may be indexed. Availability payments are often used for projects that are not tolled or in situations where the owner wishes to retain control over toll rates or if toll revenues are not expected to cover debt service costs. Owners make the availability payments to their private partners using public funds that are prioritized ahead of other needs throughout the concession period. Funds for the availability payments may be obtained from a revenue pledge or subject to appropriations. When they involve the construction of toll facilities, the public sponsor may apply the toll revenues to the cost of the availability payments.

The ongoing availability payments depend on the private partner meeting operational performance standards. If the private partner does not meet the required standards, the amount of the availability payment is reduced. Tiered regimes for non-compliance are typically used before payments are reduced.

The availability payment approach has been used to develop two transit projects, as well as tolled and non-tolled highways, managed lanes, major crossings, and a bridge replacement program.



3 Organizational Structure of the Online Information Source

The Online Information Source could be organized into different tables that together could comprise a relational database. Users would be able to search the relational database and assemble tailored reports to suit their research needs. The relational database would also provide the flexibility to accommodate the addition of new projects and data over time. It is envisioned that the information source would be able to accommodate a variety of file formats and that it could provide users with access to images, video, and project documents.

As demonstrated in Figure 2, the contents of the online information source could be organized into seven data tables. Three of these would provide descriptive information on the P3 and non-P3 projects, as well as information on the legislative contexts in which they have been implemented and information on the sponsoring agencies' policies and capacity. Given that legislative contexts are fluid, the legislative information included in the online information source should be date-stamped and updated on a regular basis. This will enable researchers to gain access to accurate information about legislative context at the time decisions were made. Many of the data elements would need clear instructions on how to interpret and synthesize data from disparate sources into the information source. The intent is that the information would enable users to make "apples to apples" comparisons among project cohorts of their own choice. The remaining four data tables would contain information on the performance outcomes of the projects.

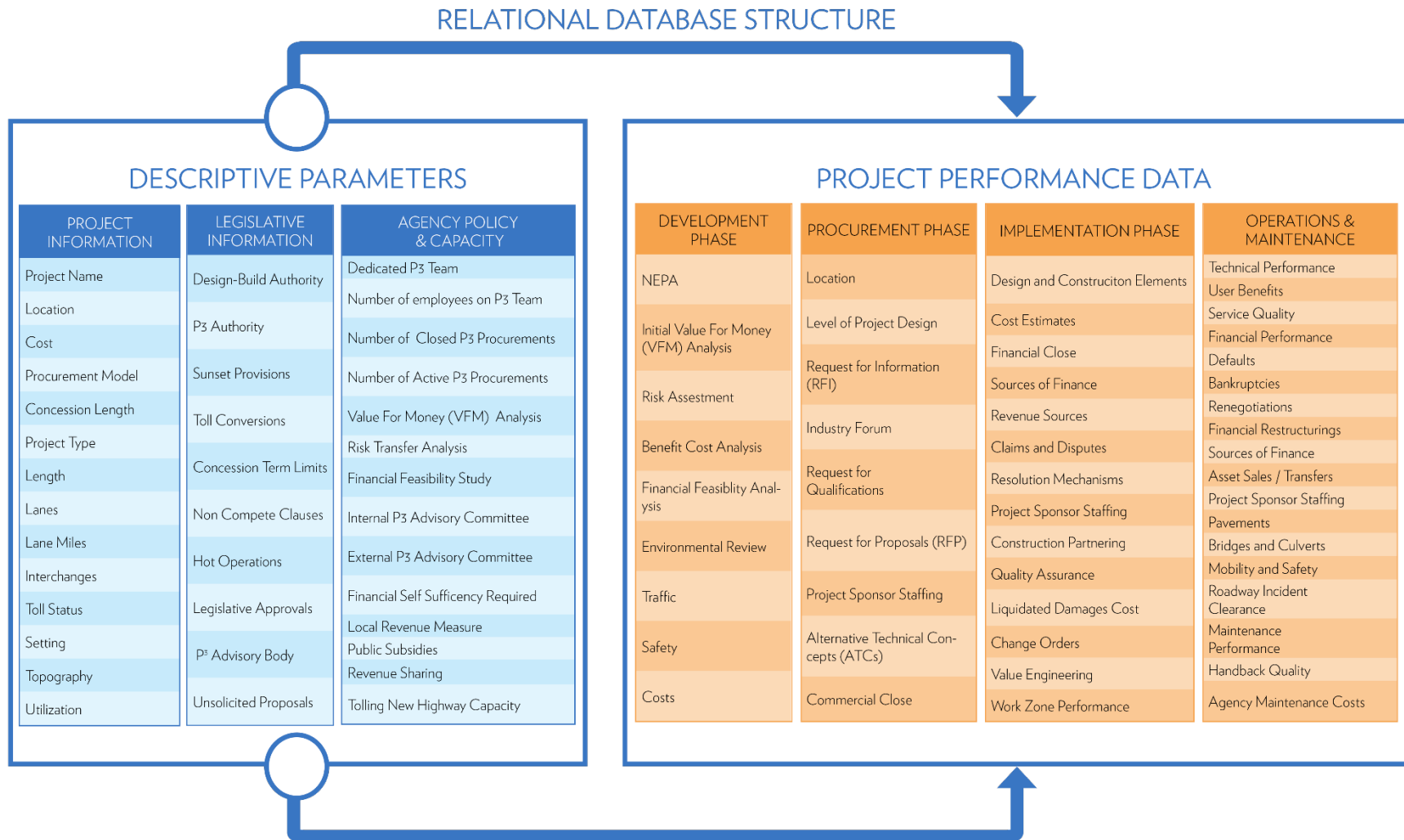
Using the approach described above, the data tables would provide the following types of information:

- ▶ **Project Information** – descriptive information on the project location, cost, procurement model, length, interchanges, project type, setting, toll status and utilization levels
- ▶ **Legislative Information** – descriptive information on statutory authorities under which the project was implemented
- ▶ **Agency Policy and Capacity** – descriptive information of local policies under which the project was implemented and the technical capabilities and size of its sponsoring agency
- ▶ **Project Development Phase** – data on the environmental approval process, technical feasibility, economic feasibility, financial feasibility and initial value for money (VfM) assessment, and retained public liabilities (financial risk analysis).
- ▶ **Procurement Phase** – data on the request for information (RFI), request for qualifications (RFQ), draft request for proposals (RFP), final RFP, proposers, alternative technical concepts (ATCs), award details, selected team, VfM assessment, project finance, P3 agreement, commercial close, and financial close.
- ▶ **Project Implementation Phase** – data regarding design and construction elements and costs.
- ▶ **Operations and Maintenance Phase** – data on performance standards, technical performance over time, service quality over time, facility condition, hand back quality at end of service life, maintenance costs.

Tier 1 of the information source would include all the information in the above categories that is needed for project oversight. Tier 2 would add the more detailed information for further analysis. Appendix B of this report contains a detailed discussion and a list of suggested performance metrics that could be included in each of the data tables, including the purpose of the data tables, their information requirements, and potential data sources.



Figure 2. Relational Database Structure



Source: WSP | Parsons Brinckerhoff, 2017

The remainder of this chapter identifies the information recommended for inclusion in Tier 1 of the online information source. Industry experts reviewing the discussion paper also suggested that rather than collecting all the Tier 1 information initially, it might be beneficial to collect the subset of Tier 1 metrics that are available in the FHWA Major Projects database. That information could be shared with state DOTs to provide FHWA and the Bureau with sense of its usefulness to State DOTs and, if warranted, modifications could be made to the data collection approach.

3.1 Project Information

The proposed data elements to describe the project information are presented in Table 3.

Table 3. Recommended Data Elements for Project Information Table

Data Element	Potential Data Source(s)
Project name	- Project profiles on the FHWA Center for Innovative Finance Support website - Major Projects Database - Project websites maintained by the project sponsor or P3 concessionaire - Public Works Financing database - FHWA Highway Performance Monitoring System (HPMS) - State DOT geographic information system (GIS) websites - Municipal Securities Rulemaking Board (MSRB) Electronic Municipal Market Access (EMMA) – Official Statements for debt issuance
Project location (city/county/region, state), project limits (latitude and longitude, and mileposts) and setting (urban, suburban, rural)	
Project topography (flat, rolling or mountainous)	
Total capital cost, including construction, financing, right-of-way, and utility relocations (some of which may be done under separate contracts) necessary for facility development	
Procurement model, including design-bid-build, design-build, and DBFOM real toll and availability payment concessions	
Concession period	
Project type, including greenfield highway, priced managed lane, bridge, tunnel, brownfield/asset monetization (long-term lease concession)	
Project length, number of lanes and lane-miles or span length and vertical clearance (for water crossings)	
Number of interchanges	
Toll status, i.e., tolled or non-tolled, and fixed vs. variable tolls	
Utilization, including annual average daily traffic (AADT) by year	
Roadway segments by type: on surface, elevated section, in trench, below ground in tunnel	
For highways, number of bridges and length of elevated structures or flyovers	

3.2 Legislative Information

The proposed data elements that capture the key legislative provisions are summarized in Table 4. Note that the information should reflect the status of legislation at the time the decision was made with regard to project delivery method. Amendments and changes to legislative authorities should also be captured, together with date stamps. This approach would provide researchers with a comprehensive understanding of the evolution of the state legal environments affecting the use of alternative project delivery strategies throughout the data collection period. Date-stamped information could also be included about past legislative changes and amendments.

Table 4. Recommended Data Elements Capturing Key Legislative Provisions

Data Element (reflecting status at the time project delivery method was selected)	Potential Data Source(s)
Whether design-build procurement is allowed	▪ NCSL's Private Partnerships for Transportation: A Toolkit for Legislatures ▪ NCSL's Transportation Funding and Finance Legislation Database ▪ FHWA's Alternative Contracting Methods Library ▪ InfraAmericas US Legislation database ▪ State DOT and legislative policy agency P3 enabling statute primers
Whether DBFOM concessions are allowed	
Year of enactment and sunset provisions	
Whether the legislation explicitly allows the conversion of existing free roads to toll roads	
Term limits on concession agreements	
Limitations on utilizing availability payment structures	
Whether non-compete clauses are restricted or prohibited	
Limitations on utilizing progress, milestone and completion payments	
Whether high occupancy toll operations or congestion pricing are allowed	
Whether legislative approvals are required to finance revenue bonds, levy user fees, implement innovative finance partnerships, or complete the project procurement process	
Whether creation of a P3 advisory body is required (this is different from a dedicated alternative delivery or P3 unit)	▪ NCSL's Private Partnerships for Transportation: A Toolkit for Legislatures ▪ NCSL's Transportation Funding and Finance Legislation Database ▪ FHWA's Alternative Contracting Methods Library ▪ InfraAmericas US Legislation database ▪ State DOT and legislative policy agency P3 enabling statute primers
Whether both solicited and unsolicited proposals are allowed, and under what conditions	
Whether proposal evaluation criteria are specified	
How the confidentiality of ATCs is addressed and whether the payment of stipends to unsuccessful proposers allows the agency to use the innovations in their proposals	
Whether the public agency is required to charge application fees for review of unsolicited proposals	
Whether authority is limited to specific projects or certain types of projects	
Information addressing the authority to set toll rates	
Whether the legislation allows the highway agency to issue toll revenue bonds	
Whether revenue sharing is explicitly allowed	

3.3 Agency Policy and Capacity

The proposed agency policy and capacity data elements that could be gathered are summarized in Table 5. Note that the information should reflect the status of agency policy and capacity at the time the decision was made with regard to project delivery method.

Table 5. Recommended Data Elements Describing Agency Policy and Capacity

Data Element (reflecting status at the time project delivery decision was made)	Potential Data Source(s)
Presence of a dedicated P3 or alternative project delivery team, including the number of full-time employees on the team	▪ Project profiles on the FHWA Center for Innovative Finance Support website ▪ Project sponsor's websites ▪ Local revenue measure websites ▪ P3 Concession Agreement
Number and status of past, current and future P3 procurements	
Overall size of the project sponsor's 5-10- year capital program and the percentage of the program dedicated to the project	
Whether financial feasibility and risk assessment studies were conducted using in-house personnel, with the help of private consultants, or solely using private consultants	
Availability of a P3 advisory committee	
Local revenue measures and policies on the use of the money they generate	
Whether public funding in the form of up-front subsidies or revenue guarantees may be used to support the development of toll facilities	
Financial self-sufficiency requirements for toll projects	
Whether revenue sharing or cross subsidies are allowed	
Local policies on tolling new highway capacity	
Local policies on tolling existing highway capacity	
Formal procedures for assessing new highway capacity for P3 feasibility	
Toll rate setting authority	
Toll rate setting flexibility	
Agency policies on the use of external advisers	

These data elements should be date stamped so that users can track changes over time. The data elements will be available at the same level of detail for both Tier 1 and Tier 2.

3.4 Project Development

The project development data elements for the Tier 1 level are summarized in Table 6.

Table 6. Recommended Data Elements Relating to Project Development

Data Element	Potential Data Source(s)
Environmental review milestone dates, specifically the following: ▪ Notice of Intent ▪ Draft Environmental Impact Assessment (DEIS) ▪ Final Environmental Impact Assessment (FEIS) ▪ Re-evaluation (if any) ▪ Record of Decision	▪ Project DEIS/FEIS reports ▪ Record of Decision documents
FEIS cost estimate, broken down by the following elements (<i>depending on the project delivery method</i>): ¹ ▪ Capital costs ▪ Financial costs ▪ Other costs	▪ Project DEIS/FEIS reports ▪ FHWA Major Projects Initial Financial Plan
Baseline Public Sector Comparator cost for P3 project evaluations only (<i>not available for all projects</i>) ▪ Toll facility: Estimated public upfront contribution (net of debt) if any (present value) ▪ Non-toll project: Public cost (present value)	▪ FHWA Major Projects Initial Financial Plan ▪ Sponsor and project websites (on public upfront contribution for toll facility and public costs) ▪ Procurement documents ▪ Procurement options analysis studies
P3 Alternative cost (not available for all projects) ▪ Toll facility (toll concession): Estimated public upfront contribution or concession fee expected from concessionaire (present value) ▪ Non-toll project (or Availability Payment concession): Public milestone and completion payments and availability payments (present values)	▪ FHWA Major Projects Initial Financial Plan ▪ Procurement options analysis studies

Note: (1) There is a diversity of conventions on how owner agencies present the breakdown of project cost items in the FEIS. Recognizing that the breakdown of project costs might not be consistent across agencies, it is suggested that three broad categories be included to capture capital, financial and other costs. The other cost category may include right-of-way, utility, engineering, contract administration and contingencies.

3.5 Project Procurement

Project procurement data elements to be included in the Tier 1 level are summarized in Table 7.

Table 7. Recommended Data Elements Relating to Project Procurement

Data Element	Potential Data Source(s)
RFI issue and response dates	▪ Sponsor and Project websites
Number of submittals	▪ Sponsor and Project websites
RFQ issue, response and shortlisting dates	▪ Sponsor and Project websites
RFQ number of submittals and shortlisted proposers	▪ Sponsor and Project websites
RFQ evaluation criteria and scoring	▪ Sponsor and Project websites
Draft RFP issue, response and award dates	▪ Sponsor and Project websites
Number of draft RFPs issued for comment	▪ Sponsor and Project websites
Number of submittals in response to RFP	▪ Sponsor and Project websites
RFP evaluation criteria and scoring	▪ RFP documents available on Sponsor and Project websites
RFP requirements for local hiring	▪ RFP documents available on Sponsor and Project websites
RFP requirements for disadvantaged, minority, women, disabled veteran, and small business enterprises	▪ RFP documents available on Sponsor and Project websites
Amount and duration of coverage for all sureties and bonds	▪ RFP documents available on Sponsor and Project websites
Commercial close date (for P3 projects) or bid opening date (for non-P3 projects)	▪ Sponsor and Project websites ▪ FHWA Project Profiles ▪ Public Works Financing database
Engineer's cost estimate and date	▪ FHWA Major Projects Financial Plan
Engineer's schedule estimate (substantial completion dates of key milestones) and dates	▪ FHWA Major Projects Financial Plan
Commercial close award cost and date	▪ Winning bidder's bid/proposal submittal ▪ Annual updates to FHWA Major Projects Financial Plan ▪ Public Works Financing database
Winning bidder's schedule estimate (substantial completion dates of key milestones) and dates	▪ Winning bidder's bid/proposal submittal ▪ Annual updates to FHWA Major Projects Financial Plan
Number of subcontractors	▪ FHWA Project Profiles ▪ Annual updates to FHWA Major Projects Financial Plan ▪ Sponsor and Project websites
Total cost value of all implemented ATCs	▪ Annual updates to FHWA Major Projects Financial Plan
Net schedule savings of all implemented ATCs	▪ Annual updates to FHWA Major Projects Financial Plan
Project costs at financial close	▪ Center for Innovative Finance Support Website ▪ Public Works Finance ▪ Project websites
Sources of finance, including public sector investments, debt, private equity, bond premiums, and interest income	▪ FHWA Project Profiles ▪ Annual updates to FHWA Major Projects Financial Plan ▪ MSRB EMMA – Official Statements for debt issuance
Sources of revenue	▪ FHWA Major Projects Financial Plan ▪ MSRB EMMA – Official Statements for debt issuance



3.6 Project Implementation

Project implementation data elements to be included in the Tier 1 level are summarized in Table 8.

Table 8. Recommended Data Elements Relating to Project Implementation

Data Element	Potential Data Source(s)
Design Timeline: Design completion date, notice to proceed date, total design duration	FHWA Major Projects submittals– Project Management Plan and annual updates to Financial Plan
Construction start and completion dates, and total construction duration	FHWA Major Projects submittals– Project Management Plan and annual updates to Financial Plan
Design and construction costs (aggregation of cost items depending on the project delivery method and availability of reliable data)	- FHWA Major Projects submittals– Financial Plan and annual updates to Financial Plan - MSRB EMMA – Official Statements for debt issuance and Monthly Construction Progress Reports
Final contract time, including extensions granted by the agency, value engineering savings, and the number of days involving liquidated damages	FHWA Major Projects submittals– Project Management Plan and annual updates to Financial Plan
Cost items, including final contract costs, award costs, cost growth due to claims and change orders, value engineering savings, construction engineering costs, quality assurance costs, and liquidated damages costs. Any changes from prior entries should be noted.	- Annual updates to FHWA Major Projects Financial Plan - MSRB EMMA – Monthly Construction Progress Reports
Number of change orders, cost change due to change orders, schedule change due to change orders	- Annual updates to FHWA Major Projects Financial Plan and Project Management Plan - MSRB EMMA – Monthly Construction Progress Reports
Number of claims, total cost value of all resolved claims	- Annual updates to FHWA Major Projects Financial Plan and Project Management Plan - MSRB EMMA – Monthly Construction Progress Reports
Number of claims by the cause type (e.g., award related, right-of-way, third party, site-related, delay, schedule acceleration, quality, owner requested changes, plans and specifications, supply-chain, and others)	- Annual updates to FHWA Major Projects Financial Plan and Project Management Plan - MSRB EMMA – Monthly Construction Progress Reports
Number of claims settled by resolution type (i.e., project team review, agency review, arbitration and mediations, claims review board, and litigation)	- Annual updates to FHWA Major Projects Financial Plan and Project Management Plan - MSRB EMMA – Monthly Construction Progress Reports
Total cost value of all claims settled by resolution type and dates	- Annual updates to FHWA Major Projects Financial Plan and Project Management Plan - MSRB EMMA – Monthly Construction Progress Reports
Change orders by type (e.g., scope change, differing conditions, errors and omissions, force majeure and weather, right-of-way, environmental concerns, and others) and dates	- Annual updates to FHWA Major Projects Financial Plan and Project Management Plan - MSRB EMMA – Monthly Construction Progress Reports
Cost value of all approved value engineering proposals	- Annual updates to FHWA Major Projects Financial Plan and Project Management Plan - MSRB EMMA – Monthly Construction Progress Reports
Schedule savings of all approved value engineering proposals	- Annual updates to FHWA Major Projects Financial Plan and Project Management Plan - MSRB EMMA – Monthly Construction Progress Reports

3.7 Operations and Maintenance

Operations and maintenance data elements to be included in the Tier 1 level are summarized in Table 9.

Table 9. Recommended Data Elements Relating to Operations and Maintenance

Data Element	Potential Data Source(s) ³
Traffic related elements (to be collected every year): ▪ Annual average daily traffic (AADT) – HPMS Data Item 21 ▪ AADT of single-unit trucks and buses only – HPMS Data Item 22 ▪ AADT of combination trucks – HPMS Data Item 24 ▪ Peak hour single-unit truck and bus volume as a percentage of total AADT (sample sections only) – HPMS Data Item 23 ▪ Peak hour combination truck volume as a percentage of total AADT – HPMS Data Item 25 ▪ Design hour volume (30th largest hourly volume for a given calendar year) as a percentage of AADT – HPMS Data Item 26 ▪ Roadway capacity – HPMS Data Item 69 ▪ Number of through lanes – HPMS Data Item 7 ▪ Speed limit – HPMS Data Item 14 ▪ Bridge closure – detour length – NBI Data Item 19 ▪ Number of lanes on and under bridge – NBI Data Item 28 ▪ Year of reporting	▪ Highway Performance Monitoring System (HPMS)^{1, 2} ▪ National Bridge Inventory (NBI)¹
Pavement condition related elements (to be collected every year): ▪ International Roughness Index (IRI) – HPMS Data Item 47 ▪ Present Serviceability Rating (PSR) – HPMS Data Item 48 ▪ Rutting – HPMS Data Item 50 ▪ Faulting – HPMS Data Item 51 ▪ Cracking percent – HPMS Data Item 52 ▪ Cracking length – HPMS Data Item 53 ▪ Year of reporting	▪ Highway Performance Monitoring System (HPMS) or Agency Pavement Management System (through information requests)
Pavement structure related elements (available for sample sections only for pavement performance modeling purposes, and to be collected every year): ▪ Pavement surface type – HPMS Data Item 49 ▪ Year of last improvement – HPMS Data Item 54 ▪ Year of last construction – HPMS Data Item 55 ▪ Last overlay thickness – HPMS Data Item 56 ▪ Thickness (rigid pavements) – HPMS Data Item 57 (as applicable) ▪ Thickness (flexible pavements) – HPMS Data Item 58 (as applicable) ▪ Pavement base type – HPMS Data Item 59 ▪ Pavement thickness type – HPMS Data Item 60 ▪ Climate zone – HPMS Data Item 61 ▪ Soil type – HPMS Data Item 62 ▪ Year of reporting	▪ Highway Performance Monitoring System ▪ Agency Pavement Management System (through information requests)
Pavement condition thresholds (e.g. IRI, rutting, faulting, cracking and others) and handback criteria⁵	▪ RFP documents available on Sponsor and Project websites

Table 9. Recommended Data Elements Relating to Operations and Maintenance (continued)

Data Element	Potential Data Source(s) ³
Annual pavement maintenance, preservation and rehabilitation cost elements: ▪ Routine maintenance costs per mile ▪ Pavement preventive maintenance costs per mile ▪ Pavement minor rehabilitation costs per mile ▪ Pavement major rehabilitation costs per mile ▪ Pavement reconstruction costs per mile ▪ Year of cost estimate	▪ Agency Pavement Management Systems (through information requests and interviews) ▪ O&M financial reports to debt holders (for P3 projects only)⁴
Bridge condition related elements (to be collected every year): ▪ Condition rating of deck - NBI Data Item 58 ▪ Condition rating of superstructure - NBI Data Item 59 ▪ Condition rating of substructure - NBI Data Item 60 ▪ Condition rating of channel and channel protection - NBI Data Item 61 ▪ Condition rating of culverts - NBI Data Item 62 ▪ Inventory rating - NBI Data Item 66 ▪ Structural evaluation rating - NBI Data Item 67 ▪ Deck geometry rating - NBI Data Item 68 ▪ Vertical and horizontal under-clearances - NBI Data Item 69 ▪ Bridge posting - NBI Data Item 70 ▪ Waterway adequacy rating - NBI Data Item 71 ▪ Approach roadway alignment rating - NBI Data Item 72 ▪ Critical feature inspection - NBI Data Item 92 ▪ Scour criticality - NBI Data Item 113 ▪ Year of reporting	▪ National Bridge Inventory ▪ Agency Bridge Management System (through information requests)
Bridge structure related elements: ▪ Structure type - NBI Data Item 43 ▪ Structure type, approach spans - NBI Data Item 44 ▪ Deck structure type - NBI Data Item 107	▪ National Bridge Inventory ▪ Agency Bridge Management System
Bridge condition thresholds for decks, superstructure, substructure, channels and channel protections, culverts and other elements, and handback criteria⁵	▪ RFP documents available on Sponsor and Project websites
Annual bridge maintenance and improvement cost elements: ▪ Bridge inspection and routine maintenance costs ▪ Element repair, rehabilitation and replacement costs (by element type) ▪ Structural replacement costs (by bridge type) ▪ Year of cost estimate	▪ Agency Bridge Management System (through information requests and interviews) ▪ O&M financial reports to debt holders (for P3 projects only)⁴ ▪ National Bridge Inventory

Table 9. Recommended Data Elements Relating to Operations and Maintenance (continued)

Data Element	Potential Data Source(s) ³
Annual financial performance metrics (for toll projects): ▪ Annual revenue ▪ Revenues by source ▪ Toll collection costs ▪ Operating and maintenance costs ▪ Capital expenditures (rehabilitation and expansion) ▪ Net income before depreciation ▪ Profit or loss ▪ Toll rate per mile by vehicle type ▪ Debt service cover ratio ▪ Credit ratings at end of year ▪ Defaults ▪ Bond covenant violations	▪ Financial Statements ▪ MSRB EMMA – Quarterly O&M Reports
Roadway maintenance costs per mile (aggregated at corridor level) by year	▪ Agency Maintenance Management System (through information requests and interviews) ▪ O&M financial reports to debt holders⁴ ▪ MSRB EMMA – Quarterly O&M Reports

Notes:

1. Both HPMS and NBI databases are designed to support the assessment and reporting of highway and bridge performance at the system level. These databases are not designed to make asset management decisions at the asset level. Therefore, there may be some issues, such as data gaps, unavailability of recent data, or lack of precision, to facilitate a comprehensive life-cycle comparison of asset performance. The owner agency's pavement and bridge management systems typically maintain more recent and comprehensive data in readily-useable format. Therefore, information may be obtained directly from the agency's asset information systems through information requests.
2. Depending on the functional class and element type, the HPMS database may contain information for the full extent of the roadway segment or sample sections only. Similarly, depending on the element type, some element types may be reported as-is (with no further calculation) or using the most prevalent value, while others may be aggregated as weighted averages.
3. On most P3 projects, the P3 concessionaire is required to provide O&M reports on a monthly, quarterly or annual basis. The O&M reports are likely to include more recent and comprehensive data. Therefore, information may be obtained directly from the agency through information requests.
4. P3 concessionaires and toll road operators prepare and submit annual reports on financial performance to debt holders. These annual reports, which are available in the public domain, contain information about O&M expenditures for P3 projects only, with cost breakdowns or in aggregate.
5. Both the asset condition criteria and threshold values listed under performance requirements for P3 projects may differ among agencies. Similarly, the threshold values used for non-P3 projects may be different from those for P3 projects.

4 Online Information Platform

4.1 Introduction

The information source envisioned in this discussion paper is intended to provide the end user with hard data by project phase. At the same time, it will provide other “soft” information on the prevailing context in which projects are conceived and executed, e.g., specific language of the enabling legislation, the policy framework and its evolution during a project, institutional experience and capacity to administer projects of a similar type. It will take a concerted effort to design an information source capable of answering the core research questions identified in Chapter 1 of this report. Assembling the information source would require the collection, verification, analysis and synthesis of large amounts of data on major transportation projects. This section of the discussion paper discusses the optimal platform to disseminate the information.

The organization of data in the information source is expected to be *project-centric* with the potential to update information (e.g., performance data) throughout the project lifecycle. It is expected that the life cycle of projects included in the information source could extend over several decades. The types of data that are expected to be included in the information source would be collated from multiple sources and points of origin as they become available over time. Incentives may be needed to encourage project sponsors to share performance information. The information could include data tables with alphanumeric information, environmental documents, project documentation, maps, and images. Users should derive significant value from the ongoing longitudinal performance information that is added to the information source over time.

There are many models for handling project information of this type. A generic or customized document management system could be used, as could a relational database or some combination of these, e.g., a document-oriented database. The project-related data that the information source is expected to include would likely lend itself to being organized in a set of well-defined data tables (also referred to as structured data). To the extent that such information is available from project sponsors and other sources, additional project artifacts such as images, video, audio, documents, and emails (also referred to as unstructured data) could be included in the information source. Many different commercial vendors offer a variety of solutions for document management, document-oriented databases and relational databases. However, given that this tool would provide information that supports analysis and comparison within project phases and across projects, a relational database structure appears to be a pragmatic and prudent approach. This type of database would need to be able to support project-specific unstructured data as well as structured data. In addition, in order to deliver information in an efficient and user-friendly manner, the information source would require a custom front-end web application to upload and retrieve project information.

4.2 High-Level system Specifications

While the specific solution and attendant details of the relational database and platform to access the information source is beyond the scope of this paper, some high-level system specifications are provided here to guide the development of such a system. This online information platform would benefit from using non-proprietary software, databases and coding practices that apply current industry-standard versions of the software platform/language, which are not more than one major revision from the latest version. It would be preferable to avoid third party add-on libraries requiring royalties/fees. The goal should be to lower the cost of maintaining the software and database system over time. However, exceptions may need to be made when developing the software needed to implement the final requirements of the information source.

The system should use responsive design for multi-device display, and be compliant with Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794 (d)). It should support the usability/accessibility

design guidelines of the Web Accessibility Initiative (WAI) to provide information to users in an intuitive manner, including those accessing online content using assistive technologies. It is anticipated that most of the data included in the information source would be alphanumeric and, therefore, accessible to visually impaired users using assistive technologies. If the information source were hosted on a federal server, any source documents residing in the information source itself – including portable document format (PDF) files would need to be Section 508 compliant. This would require converting all PDF files to hyper text markup language (HTML) or modifying their format to create web-accessible PDF documents. Either option would likely be extremely resource intensive. The need to convert such documents would be avoided if they were to reside on non-federal servers which are accessed from the information source via hyperlink. A drawback is that links would likely need to be updated frequently as the non-federal sources update their sites. There is also some likelihood that valuable time-based historical information could be lost when these non-federal sites take down “outdated” information that is no longer needed by their stakeholders.

As discussed above, the system architecture could be based on a hybrid relational database and file management platform that enables access to the database from a front-end user interface that facilitates data queries, results display, and data export. The information source should provide users with the ability to export information in convenient and commonly used formats including Excel, comma separated values (CSV) and PDF formats, at a minimum. The platform must be user-friendly and intuitive. The integrated back-end platform and front-end user interface should support the following features/functions:

- ▶ **Search Filters:** Filters for generating data subsets. The filters could be organized to provide data subsets for user analysis to help address the “core questions” discussed in Chapter 1.
- ▶ **Search Results Display:** A user-friendly display table could provide a synopsis of records matching user-selected criteria, to include the record identifier, which serves as a link to a detailed record display.
- ▶ **Sortable Columns:** Results display table column headings could be toggled to display data in ascending and descending order.
- ▶ **Print-Friendly Pages:** The results display table should support a print-friendly page display.
- ▶ **Reporting:** Individual record details should be printable and templated PDF or MS Excel reports.
- ▶ **Data Upload Facility:** The information platform should support population of the online information source, which would include both manual data entry for individual records, and automated data entry via a secure, data import utility using pre-defined customized data templates.
- ▶ **Data Export:** The full data set and/or data subsets should be exportable in common software formats such as Microsoft Excel and CSV formats for additional analytics via other programs.
- ▶ **Online Help Menu | Tool Tips:** User aids should support use of the online system and provide explanations and/or clarifications, as needed, via tool tips. YouTube instructional videos, webinar trainings, user management, and comparison functions could also prove helpful.

4.3 Data management

The plan for populating the information source and establishing its governing structure will have a strong influence on the design of the final tool. For instance, if multiple partners handle data population, then role-based access and security will need to be built into the tool (e.g., administrator, super user, contributor, etc.). The complexity of the data management process will dictate the complexity of the underlying workflows and approvals processes. These decisions will need to be put into place prior to the actual population of the information source. Regardless of which method is used, the online system would benefit from a secure administration function that supports both system and data management. System management activities would

include functionality to generate additional search filters dynamically and record mapping criteria. Data management would support record add/edit/delete functions and mapping to search criteria.



5 Long-Term Enhancement & Maintenance of the Information Source

5.1 Data Lifecycle Attributes

Investment in the information source cannot be regarded as a one-time event. To remain a viable long-term resource for the industry, the information source requires a thoughtful and proactive approach to its management. This will ensure that the owning organization is able to manage the data resources according to appropriate levels of performance, protection, availability, and cost.

Establishing a high quality and high profile information source would require significant investment in order to provide relevant and useful information on project outcomes for P3 and non-P3 projects. It is envisioned that the process would include the following components:

- ▶ **Plan:** identification of the data that would be compiled and how the data would be managed and made accessible throughout its lifetime—the focus of this paper.
- ▶ **Describe:** data, data tables and other pertinent project information would be described thoroughly and accurately using the appropriate metadata standards—this could be the focus of a future effort that would develop and describe the web-based information source or an equivalent system for information dissemination.
- ▶ **Note:** for the purposes of illuminating the discussion of this paper, it is assumed that an online relational database would be the preferred choice to store and disseminate information. However, this presumption, does not in any way limit the applicability of the paper if other choices were made to store or disseminate information.
- ▶ **Collect:** data would be submitted to an appropriate long-term archive or a data center responsible for managing the online information source portal—discussed in this section of the paper.
- ▶ **Assure:** quality of the data would be verified by a clearinghouse or a data oversight board and then made available through a database server—discussed in this section of the discussion paper.
- ▶ **Analyze:** data would be used and analyzed by end users to achieve their research and business objectives, i.e., answer core questions.

Important aspects of the work flow would include the **Plan**, **Collect** and **Assure** phases, during which the planning, collection and quality assurance of the project-based information will occur prior to being entered into a database and made available to the public through the online portal. High-level specifications for the on-line portal are discussed in Chapter 4.

5.1.1 Data Management Plan

The data management plan will be a critical aspect of the information source. Planning for data management would involve answering several questions about how the data would be gathered and used to populate the information source. These questions include:

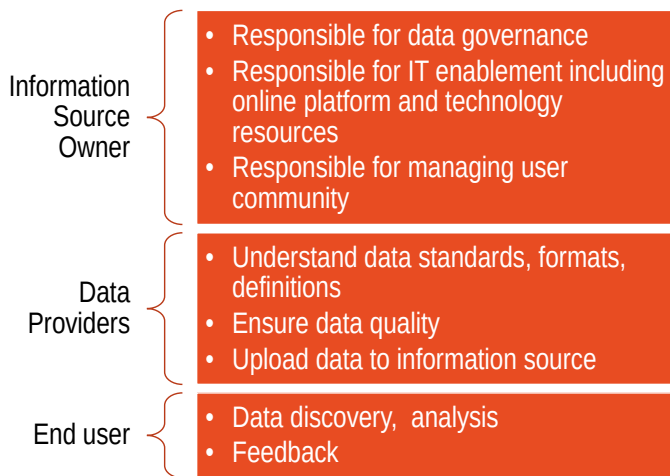
- ▶ Do the data already exist?
- ▶ How will the data be obtained or collected?
- ▶ What is the schedule and budget for data collection?
- ▶ How will the data be checked and certified?

- ▶ Can the data be made publicly available?
- ▶ How will the data be stored, accessed, and protected?

Questions regarding data availability are addressed in Chapter 3 of this discussion paper. The larger question underpinning the data management plan involves determining who would be responsible for data collection and the associated schedule and budgetary needs. While the information platform described in Chapter 4 suggests that import of data into the information source may be facilitated with the help of templates, the structure of the entity or entities responsible for collecting information and importing it into the information source could take three potential forms:

- ▶ Approach 1 -- Distributed Responsibility: As shown in Figure 3, this approach would assign responsibility for understanding the specific needs of the information source, collecting and reviewing the data for accuracy and then uploading the data to the online platform to a group of data providers. Clear and stringent data entry protocols would be necessary, even when the information can be expected to vary somewhat in completeness and quality. The information source owner would then accept, store, protect and make the data accessible to end users. The advantage of this approach is that it would assign the data review and population responsibilities to the data providers, who would be in the best position to serve in this function. For example, the data providers would be in charge of supplying quality data to the online source, and the information source owner would then be responsible for ensuring that the data is received and delivered to end users in a seamless fashion. However, a potential disadvantage of this approach could be that the data providers may not have a strong incentive to populate the information source with quality information and may not be fully attuned to the needs of end users of the information source. Additionally, the multiple providers may interpret the data input differently causing errors in entry. As a result, this approach could lead to a weaker information source.

Figure 3. Distributed Responsibility Data Management Plan



Source: WSP | Parsons Brinckerhoff, 2017

- ▶ Approach 2 -- Total Ownership: As shown in Figure 4, this approach would assign total ownership of the information source to a single entity that would be responsible for providing the IT infrastructure for the information platform, coordinating and gathering data from various sources, reviewing the data and uploading all relevant data to the information platform to making it available to the public. The information source owner would also be responsible for the lifecycle management of the online platform and the user base. The advantage of this approach would be that all activities would be undertaken by a

single entity that would be aware of the needs of the information source end users, as well as data and data quality requirements and the workings of the online platform. The disadvantage with this approach is that it could perhaps be more expensive than the other strategies due to the considerable resources that would need to be used to collect data from disparate agencies.

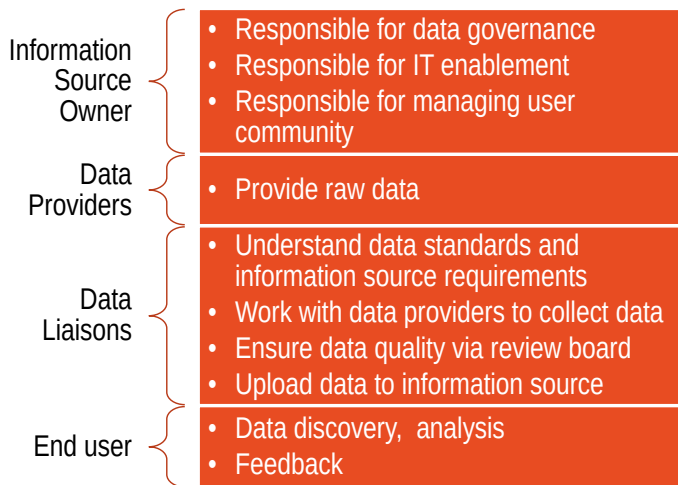
Figure 4. Total Ownership Data Management Plan



Source: WSP | Parsons Brinckerhoff, 2017

- ▶ Approach 3 -- Hybrid: This approach would adopt a hybrid structure, as shown in Figure 5, where one party would be responsible for providing the IT infrastructure to house the online platform and its ongoing management needs. Separate liaisons of the information source owner would work with data originators (including project sponsors) to collect raw information. This information would then be uploaded to the information source by the liaison. The data liaison, or possibly a third party expert or expert panel, would be responsible for quality review, curating the data, certifying the data, and releasing it for public use. The level of effort associated with data certification would vary and may require triangulation, which could be resource-intensive. The advantage of this approach is that the data originators would be responsible for providing raw information. However, the requirements of the information source would be communicated through a liaison, making it less of a burden on the data originators to align the final data submitted with the goals of the information source. In addition, since the data liaison / third party experts would be involved with quality review of the data, it further lowers the burden on the data originators to understand the quality requirements of the data set. Finally, the IT platform and its management would be left to a competent party that would not necessarily need to be involved with the technical aspects of the data. However, this approach would likely result in greater costs than Approach 1, but might incur lower costs than Approach 2.

Figure 5. Hybrid Data Management Plan



Source: WSP | Parsons Brinckerhoff, 2017

The selection of a final data management approach should involve careful deliberation of the pros and cons of each option considered. The requirements of the information platform (relational database and file management system), the data collection, quality reviews and maintenance strategies, and roles and responsibilities of the various parties involved will flow from the selected approach. In addition, given that the information for each project in the database will be developed over several years, the management of the database is a long-term activity. Therefore, data collection, population and quality assurance will be on-going, long-term activities involving multiple parties.

5.1.2 Data Collection

For the purposes of this paper, data collection is defined as a coordinated set of activities that begins with identifying the key points of contact at the data sources (identified in Chapter 3), making data requests, receiving and collating data, and moving it to the next step of quality assurance and upload. There are two types of data needed to complete the information source: 1) primary data, i.e., data that are available from the data sources in a form that can be readily consumed by the information source; and 2) data discovered through secondary research such as interviews, questionnaires, detailed project reviews and other specific information elicitation techniques. A majority of the data for Tier 2 is expected to fall in the latter category. Two types of actors will be needed to gather the necessary information, as discussed below.

Primary Data Providers: For an overwhelming set of the information needed to address the core questions, the primary data providers are project sponsors/owners. The USDOT and FHWA are also valuable sources of project information since they collect some of the desired information as part of their monitoring and oversight activities. In a few instances, for DB and P3 projects, the DB contractor or private partner are also responsible for generating and reporting some of the primary data elements. Examples of such data include legislative information, agency capacity and policy, asset condition and operational (performance) information. All data incorporated into the information source should undergo reliability tests (as explained below in section 5.1.3).

Secondary Data Providers (including Research): As noted above, a majority of the data elements for Tier 2 require research that is attuned to the needs of the information source. This would likely involve additional interviews with specific parties within the project owner/sponsor and the identification and review of key internal and published project documents. While project sponsors/owners or their contractors and private partners technically have access to their own information, they will need to re-analyze it in light of the

needs of the information source to make such data available in appropriate formats and with common metrics. Regulatory agencies such as the USDOT or FHWA routinely perform research on some data elements and have many datasets or project-specific reports that could provide helpful input to the information source. Other interested industry stakeholders might have similar information. However, it is expected that additional effort would be needed to research and mine the requisite information for the information source. Stringent protocols and reliability tests will be needed to maintain the quality of the data incorporated into the information source over time.

5.1.3 Data Quality Assurance

The online information source will include some data metrics that are robust and others that are more descriptive and may require judgement and interpretation by the team assembling and maintaining the information source. The information source could create an illusion of consistency by inappropriately including disparate data into binary or other constrained categories.

Data quality assurance is an ongoing activity lasting at least as long as the information source is active. Data quality assurance is required when data is uploaded to the information source. Two levels of quality assurance are recommended. The first step would be to validate the data fields being uploaded to the information source to ensure that they are consistent with the backend database in terms of units, maximum and minimum value, type of data (e.g., text or numbers), etc. This could be an automated process using a validation checker that could be made available as part of the online information platform described in chapter 4. Once the validation checks are completed, the data could be admitted into the database with lowest level of quality assurance certification attributed to it along with a version control. A data completeness check could also be incorporated as an automated process to review the number of expected fields to be completed at a given project stage versus the number of fields for which data is actually populated.

A second, more laborious and manual data checking process is also recommended to assure the usability and competency of the data. This review would entail ensuring that the data submitted for publication in the information source passes the test of reasonableness to be valuable to end users. Reasonableness checks could be performed on all aspects of the information submitted, but should focus mainly on the core questions that the information source is designed to address. The checks could encompass reviewing information on costs, schedule, financial performance, and quality (during design and construction and in-service). The intent would be to ensure that the reasonableness checks are directly related to the data fields being collected (or their derivatives) and that their coverage is comprehensive and encompasses the entire information source. It is possible that the information source assigns a confidence level to the data published using an arbitrarily selected, but well explained, rating scale.

Examples of questions to be asked to check the reasonableness of the submitted data could include:

- ▶ Is the total cost value of claims reasonable (e.g., are the costs greater than, say, 10 percent of the engineer's estimate of the project cost)?
- ▶ Are the net cost savings from all ATCs reasonable (e.g., are the cost savings greater than 25% of the total engineer's estimate of project costs)?
- ▶ Are the net schedule savings from ATCs reasonable (e.g., are the schedule savings greater than 25% of the engineer's estimate of the baseline duration)?
- ▶ Are the non-weather related incident clearance times greater than 24 hours for a single event?
- ▶ Is the average work zone queue length greater than typical queue lengths for this site?
- ▶ Is the value of non-conforming work accepted greater than a small percentage (e.g., 2 to 5 percent) of the total project cost?

If the answers to any of these questions (or other similar ones formulated during the review process) are questionable, secondary research, including formal outreach to the data sources to verify data accuracy, may be necessary. Triangulation and replication tests provide the highest degrees of reliability and validity. Any verification processes would be formalized through proper communication protocols, including feedback and data reconciliation reports during the operational phase. Any data that is reconciled would need to be updated and the “raw” data source cleansed, with appropriate versioning and re-certification steps occurring to ensure the quality of the new information.

5.2 Potential Institutional Structure and Responsibilities

The responsibilities for data collection will align with the approach chosen for the data management plan. If Approach 1 were chosen, the project data originators would become responsible for primary and secondary data collection as well as data completeness, accuracy and long-term population. The information source owner would provide the platform, data standards and IT enablement for uploading and use of the data. In Approach 2, data collection and quality would be the responsibility of an “outsourced” entity, which would work in cooperation with the information source owner to populate and maintain the online information source. In Approach 3, primary data collection would be assigned to the data originator, with secondary data collection outsourced, and the data quality assurance function would be housed with the information source owner along with the IT enablement function.

No matter which approach is selected, it will be important for the parties responsible for assembling the information source to engage with state and local project sponsors to obtain ongoing data updates. The information source would also benefit from a strong initial impetus focused on creating a robust online platform and creating a critical database of project-related information. This is important to understand the value proposition created by the information source, finalize details of the management plan, and attract agency participation and secure funding for the long-term sustenance of the information source. Initial seed funding for the information source could be provided through a pooled-fund study using state DOT research monies from multiple states, through the national cooperative highway research program, or by the U.S. Department of Transportation.

6 Conclusions and Next Steps

6.1 Conclusions

As part of the review of this discussion paper, FHWA convened a roundtable meeting on March 28, 2017 attended by industry P3 experts, USDOT staff and the consulting team that prepared the paper. The roundtable participants provided a number of recommendations on the conceptual design for an online information source. The participants focused on the importance of the tradeoffs between the scale and depth of the data included in the information source. Given that a greater level of complexity would require greater effort, the potential value of the additional information to users was considered. It was generally agreed that the information source would be most useful in informing higher-level public policy decisions.

The roundtable participants suggested that the information source should initially focus on compiling the Tier 1 information. Although this information largely exists, it resides in disparate locations including the FHWA Office of Infrastructure's Major Projects Database, the FHWA Center for Innovative Finance Support website, and other FHWA and industry data sets. In order to confirm the availability of the information and evaluate the level of effort to collect and verify it, it was suggested that FHWA would benefit from conducting a pilot to collect Tier 1 level information for a small number of projects. This proof of concept effort would allow a better understanding of what information is available, and the extent of data gaps and consistency issues. A key task in such a pilot data collection effort would be to review as many candidate information sources as possible. It is expected that there will be inconsistencies from one data source to another. The pilot data collection effort could identify inconsistencies and develop strategies to verify information accuracy.

It was also suggested that FHWA and the Bureau could start the process by assembling information from FHWA's existing data on major projects. Once compiled, that information could be shared with state departments of transportation (DOTs) that do not have much experience with P3s. FHWA and the Bureau could then solicit their feedback on the value of the data to them. This would allow FHWA and the Bureau to gain an understanding of what such states would seek to learn when they are assessing project delivery options for major projects. While there are common issues in assessing project delivery options, there are always situations that are unique to individual state DOT policies, procedures and management direction. In many instances, procurement decisions cannot be informed fully by reviewing historical data, but also need an assessment of the specific issues involved. Working with the data already captured in the FHWA major project database would provide an opportunity to understand what type of information would be most helpful to state DOTs as they consider procurement options.

Should a decision be made to begin efforts to put the information source in place, it is suggested that the efforts would benefit from oversight from a committee of thought leaders in the P3 and transportation policy arenas. It would be strategic to seek participation in such a committee from states that have recently passed P3 enabling legislation but that do not yet have hands-on P3 experience, together with representatives from larger MPOs. These organizations would benefit from the information source as they consider new project delivery and funding and financing options and make policy decisions guiding their strategic transportation plans.

6.2 Next Steps

To advance the development of the online information source, further specification would be needed. In order to inform decision making moving forward, it will be important to develop an understanding of the level of effort associated with different options, the resources available to support the options, and the usefulness of the anticipated work products.



Appendix A: FHWA Major Projects

This appendix contains a list of the major projects included in FHWA's Active Project Status Report as of February 21, 2017. These projects use federal funding and have a capital cost of \$500 million or higher. These are the projects that would be included in the Online Information Source for Major Transportation Projects.

FHWA ACTIVE PROJECT STATUS REPORT PROJECTS

AL	Birmingham Northern Beltline
	CBD I-59 / I-20 Bridge Replacement
AK	Knik Arm Crossing
AZ	SR 202L South Mountain Freeway
	State Route 303: I-10 to US-60
CA	BART Seismic Retrofit System Wide
	Centennial Corridor Project
	Doyle Drive / Presidio Parkway Project
	Gerald Desmond Bridge Replacement
	I-405 Sepulveda Pass Widening and High Occupancy Vehicle Improvement
	I-405: SR-73 to I-605
	I-5 HOV North (SR-134 to SR-118)
	I-5 North Coast Corridor Project, San Diego County
	I-5 South Los Angeles County Widening Project
	I-80 / I-680 /SR-12 Interchange
	I-80/ San Francisco-Oakland Bay Bridge (East Span)
	I-805 Managed Lanes North Project
	Marin-Sonoma Narrows
	New Route CETAP Mid-County Parkway (MPC) Corridor
	SR-11 and Otay Mesa "East" Port of Entry
	SR-4 (East) Widening Project
	SR-46 Corridor Improvement Project
	SR-905 from I-805 to Otay Mesa Port of Entry
	SR-91 Corridor Improvement Project /HJOT Lanes Initial Project)
CO	I-70 East
	North I-25 ROD1, ROD2 and ROD3
CT	I-95 / New Haven Harbor Crossing
DE	US 301 Project, DE/MD Line to SR1
DC	South Capitol Street Corridor Project
FL	I-395 Reconstruction
	I-4 Ultimate W/ Managed (Tolled) Lanes (Moving-4-Ward)
	I-75/SR826 Managed Lanes
	I-95 Express (Phase 3)
	Miami Intermodal Center
	Pinellas County Gateway Expressway Project
	SR 249 - Wekiva Parkway
GA	Three Mile Pensacola Bay Bridge
	I-285/GA 400 Interchange Project
IL	Northwest Corridor Project (I-75-I-575)
	Circle Interchange
IN	Elgin-O'Hare Western Access
	O'Hare Con-RAC
IA	US 31 Hamilton County
KY	Council Bluffs Interstate System Improvements, Segments 1, 2 and 3
	I-74 Quad Cities Corridor Study
KY	Louisville Southern Indiana Ohio River Bridges Project
	US 68/KY80, Lane Between the Lakes, West of Cadiz, KY



FHWA ACTIVE PROJECT STATUS REPORT PROJECTS (continued)

MD	I-81 Improvement Project
MI	I-75
	I-94/Edsel Ford Freeway
MN	St. Croix River Crossing
MS	I-269 Corridor
NV	I-15 South
	I-15/Project NEON
NH	I-93 Reconstruction
NJ	Rt. I-295 & 42/I-76 Direct Connection
NY	Brooklyn Bridge Contract 6
	Goethals Bridge Replacement
	Kosciuszko Bridge Replacement, I-278 over Newtown Creek
	Route 347
	Tappan Zee Hudson River Crossing / New NY Bridge Project
	Willis Avenue Bridge
NC	I-77 Express Lanes from Exit 11 (I-277 Brookshire Freeway) to Exit 36 (NC 150)
	Monroe Expressway
OH	Brent Spence Bridge Corridor Project
	Cleveland Innerbelt
	I-70/71 Columbus Crossroads -- Phases 1-6
	I-75 (HAM-75-2.30), City of Cincinnati (Mill Creek Expressway)
	Portsmouth Bypass
OK	I-40 Crosstown
PA	Central Susquehanna Valley Transportation (CSVT)
	Commonwealth of PA Rapid Bridge Replacement Project
	I-95 Betsy Ross Interchange and Bridge Street Ramps Reconstruction
TX	Bergstrom Expressway - US 183 from US 290 to SH 71
	DFW Connector
	IH 35 (From IH37 to Schertz Parkway)
	IH 35E Managed Lanes (Dallas and Denton)
	Loop 12 / Interstate Highway 35E Corridor
	Midtown Express (SH 183 Managed Lanes Project)
	North Tarrant Express 3A & 3B (NTE 3A & 3B)
	Project Horseshoe IH-30/IH-35E
	SH 288
	SH 99 Grand Parkway, Segment H and I-1
	SH 99, The Grand Parkway (Segments F-1, F-2 and G)
	Southern Gateway Managed Lanes Project
	Trinity Parkway (from IH 35E/SH 83 to US 175/SH 310)
	U.S. 181 Harbor Bridge Project
	US 281 HOV expansion project
	US 290
VA	I-95 HOV/HOT Lanes, Northern Segment
	Midtown tunnel/Downtown Tunnel/Martin Luther King Extension Project
	Thimble Shoal Parallel Tunnel Project
	Transform 66, Outside the Beltway
WA	SR 520 - Pontoon Construction Project
	SR 520, I-5 to Medina: Bridge Replacement and HOV Project - Floating Bridge and Landings Stage
	SR 520, Medina to SR 202: Eastside Transit and HOV Project
	SR 99: Alaskan Way Viaduct Replacement Project
WV	WV Corridor H - Section 2, Kerens to Parsons Project
WI	I-39/90
	I-41 Reconstruction
	I-43 North-South (Silver Spring Drive - Wis 60)
	I-94 North-South
	Tri-County Freeway, USH 10/441
	Zoo Interchange (I-94/I-894/US-45)



FHWA COMPLETED ACTIVE PROJECT STATUS REPORT PROJECTS	
CA	Alameda Corridor
	I-15 Managed Lanes, SR-163 to SR-78
	I-215 San Bernardino North Corridor Project (from I-10 to I-210)
	SR-52 Extension
CO	I-25/I-225 Southeast Corridor (T-REX)
FL	(iROX) I-75 from GG Parkway to SR-80, D/B/Finance
	Connector - I-4 to Lee Roy Selmon Expressway
	I-595 Corridor Improvements
	Port of Miami Tunnel & Access Improvements (POMT)
	SR826/SR836 Interchange Reconstruction (Palmetto 5)
IN	Tampa Interstate System (TIS)
	I-465 Est Leg Reconstruction (Accelerate 456)
LA	I-69 SIU 3 Section 4
LA	I-10 Twin Span Structures
MD	Intercounty Connector
MA	Central Artery/ Ted Williams Tunnel
MN	I-35W St. Anthony Falls Bridge
MO	I-64 from Spoede Rd. to Sarah Street
	New Mississippi River Bridge
NC	Triangle Expressway, Western Wake Freeway
TX	Central Texas Turnpike
	Eastern Extension of the President George Bush Turnpike (SH 190)
	Katy Freeway Reconstruction
	IH 695 Managed Lanes
	North Tarrant Express 3A & 3B (NTE 3A & 3B)
	SH 130 Segments 5 & 6
	SH 161 - President George Bush Turnpike Western Extension
UT	Southwest Parkway (SH 121) - Chisolm Trail
	I-15 Corridor, Salt Lake County
VA	Capital Beltway High Occupancy Toll (HOT) Lanes
	I-95/I-395/I-495 Springfield Interchange
	I-95/Woodrow Wilson Bridge
WI	I-43/I-94/I794 Marquette Interchange



Appendix B: Purpose, Data Requirements and Potential Data Sources

There is increasing interest across the United States in bringing greater efficiency to the construction and operation of public transportation infrastructure. One set of strategies that has been advanced is to use public-private partnership (P3) concessions to implement and operate large and complex surface transportation improvements. Under the P3 concession approach, a private sector developer/investor raises the necessary financing to fund up-front capital construction costs by leveraging project revenues. These revenues are typically either in the form of user charges or periodic availability payments made by the public sector project sponsor, or some combination of the two. The private partner is responsible for designing and constructing the project, and then operating and/or maintaining it for a designated concession period in exchange for the right to receive the revenue during that time, either in user fees or payments from the project sponsor.

The potential benefits and limitations of using the P3 concession approach are widely cited; however, few data are available to corroborate these claims. The wide variety of specific conditions under which the P3 procurements are negotiated and operated have made comparisons between various types of P3 projects and conventional project delivery difficult to generalize. Study of the features of various P3 procurements could shed light on both their strengths and weaknesses. This information could form the basis for substantiated conclusions about the comparative advantage of different procurement strategies in installing and operating transportation infrastructure under different conditions.

Tier 2 of the Information Source is intended to fill that information void. Such a repository could provide source material that could improve the understanding by interested stakeholders in the collective experience with these approaches.

This Appendix provides further details to supplement Chapter 3, and in particular includes data elements proposed to be included in a Tier 2 database providing information on the financial and performance characteristics of P3 and non-P3 projects. The secondary audience for the information source (and the main audience for Tier 2 information) is expected to include researchers and transportation policy analysts who study alternative delivery methods and project performance. Private sector P3 developers and design-builders may also benefit from being able to evaluate other projects and gain contextual understanding of the issues that public agencies are interested in tracking. The Tier 2 information could also be useful to other transportation stakeholders with an interest in P3 and alternative project delivery methods. The information source is expected to provide quantifiable information on project outcomes for select projects for which more detailed data is available, allowing policy analysts and researchers to assess whether P3 projects delivered benefits and efficiencies compared to non-P3 projects for those specific projects and, if so, under what conditions.

B.1 Project Information

B.1.1 Purpose

The recommended data elements under this category are primarily identifiers and descriptors that serve to define individual projects within the database. The proposed data elements describe the project name, project type, geographic location and functional class, project length, cost and delivery method. However, some data elements have direct influence on the project outcomes, and thus, serve a purpose beyond providing descriptions. For instance, attributes such as the project type (e.g., greenfield vs brownfield) or toll status (e.g., fixed vs variable), are likely to have different cost outcomes and risk profiles.

B.1.2 Information Requirements

The proposed data elements to describe the project information are listed in Chapter 3.

These data elements would be available at the same level of detail for both the Tier 1 and Tier 2 of the information source.

It should be noted that a project might be procured under multiple contracts using different procurement types. If this is the case, the online information source should have the flexibility to assess each contract or procurement type individually, as well as the capability to aggregate information on individual contracts to provide information on the entire project. There are challenges associated with accomplishing this.

B.1.3 Potential Data Sources

The primary sources of data include the FHWA Center for Innovative Finance Support website and project websites maintained by project sponsors. These websites include key project information, location and project limits, purpose and need of the project, procurement information, and schematics of the project concept. The FHWA Center for Innovative Finance Support website maintains project profiles that include key information, such as project description, cost, funding structure, and project delivery method, for each P3 project. The Center's Reports on P3 projects also supplement the information available on individual project profile websites. If additional information is necessary to allow quantification of project footprints and components, it could be obtained from project sponsors or design documents.

Another notable source of project-specific information is the FHWA's Highway Performance Monitoring System (HPMS) database. HPMS provides inventory information in greater detail for all public roads that are eligible for Federal-aid highway funds, albeit at different degrees for roadways categorized under National Highway System (NHS) vs. non-National Highway System facilities. The HPMS provides project-specific information that includes, but is not limited to, the route number, functional class, speed limit, number of lanes, traffic volume, percent trucks, toll status, etc. No potential challenges are expected in gathering the proposed data elements. Information from such databases would need to be reviewed to determine if the information is structured in such a way that it could be quantified within a project's limits.

For projects financed with tax-exempt debt, the Municipal Securities Rulemaking Board's Electronic Municipal Market Access (EMMA) website is an additional information source. The EMMA website contains continuing disclosure reports and regular updates from bond issuers providing a wealth of information.

B.2 Legislative Information

B.2.1 Purpose

The recommended set of data elements captures the key provisions of the State's P3 legislation to supplement the project description information. As of January 1, 2016, thirty-three states as well as the District of Columbia and Puerto Rico have enacted P3 legislation with full or limited authority. Forty-eight states – all but Iowa and Oklahoma – have passed enabling legislation allowing design-build procurements. Many key provisions of the P3 or design-build legislation, including the authorization, time limits, governance, financing and proposal administration, vary from state to state, as the legislation of each state is tailored to reflect the specific objectives of the state. P3 authorization legislation may provide blanket authority to implement P3s, authority for a limited group of pilot projects, or project specific approval.

Given that P3 legislation varies from state by state, the data structure should be flexible, and to the extent possible avoid personal judgement, focusing instead on observable data. In addition, since legislative developments are often fluid, all information will need to be date stamped in order for information source users to determine what authorities were in place at the time different project development decision were made. Key provisions in P3 authorization legislation reflect the political and regulatory environment and the fiscal policies under which the P3 projects are conceived, procured and executed. Capturing the key legislative

provisions at the time that projects were procured is essential in order for information source users to be able to make meaningful comparison of P3 and non-P3 project outcomes across states.

B.2.2 Information Requirements

The proposed data elements that capture the key legislative provisions are included in Chapter 3.

These data elements would be available at the same level of detail for both Tier 1 and Tier 2. Note that the information should reflect the status of legislation at the time the decision was made with regard to project delivery method.

B.2.3 Potential Data Sources

The primary source of data includes the project delivery/procurement websites of individual public agencies. However, the National Conference of State Legislatures (NCSL) reports serve as a single source to access this information with relative ease. The key NCSL reports include the following:

- ▶ NCSL's *Private Partnerships for Transportation: A Toolkit for Legislatures* – Also referred to as the NCSL's P3 Toolkit, the report provides a comprehensive categorization and analysis of the transportation P3 enabling statutes of State agencies.
- ▶ NCSL's *Transportation Funding and Finance Legislation Database* – This database tracks legislation from all 50 states and provides information on P3 related legislative bills considered since 2009.
- ▶ FHWA's Alternative Contracting Methods Library, an online source maintained by the Office of Program Administration, provides online information on DB enabling statutes.

B.3 Agency Capacity & Policy

B.3.1 Purpose

The proposed set of data elements captures the sponsoring agency's organizational capacity, past experience, advisory and analytical capabilities, as well as the key policies relating to project procurement. The primary intent of capturing this information is to supplement the legislative information to evaluate the maturity of the agency's procurement experience and practices. In addition, some of the proposed attributes may profoundly shape the bidders' perceptions of procurement risks, which are in turn reflected in their bid prices. This data table could also capture project objectives such as economic development or congestion relief. Information on policy goals and objectives could be programmatic applying to groups of projects developed by an individual project sponsor, or they may vary from project to project. The information source should make that distinction. The point is to capture data regarding policy goals and objectives. For example, was the intent of the owner to minimize toll rates, have maximum flexibility for future toll rates facility improvements, minimize upfront public subsidy/maximize project scope, minimize expected project costs, or involve local proposers, etc.

B.3.2 Information Requirements

The proposed data elements, that could be at the same level of detail for both the Tier 1 and Tier 2 levels of the information source, are included in Chapter 3.

These metrics should be date-stamped so that users can track changes over time. Note that the initial information should reflect the status of agency policy and capacity at the time the decision was made with regard to project delivery method.

B.3.3 Potential Data Sources

The FHWA Center for Innovative Finance Support tracks policy initiatives influencing highway development in all states and identifies them in its project profiles and other technical reports. This information could be

supplemented from project sponsor websites, which could also serve as important information sources. These websites include key information on P3 statutes and rules, P3 manuals of instruction, a summary of past, current and future P3 projects, and the organizational structure. Furthermore, if needed, any missing information might be addressed through selective questionnaire interviews/information requests with the project sponsor, or possibly fieldwork.

B.4 Project Development

B.4.1 Purpose

The primary objective of the project development phase is to develop a preferable project concept with an appropriate level of design that is ready for procurement. The project concept establishes a baseline for proposers to build on. The level of detail of the designs prepared by project sponsors depends on the project delivery method. It is typically five to 30 percent for P3 and design-build projects and 100 percent for design-bid-build projects. The project development data included in the online information source is needed to establish a baseline for performance, cost, schedule and risk outcomes that will be compared to those of the final design and actual performance. For instance, this could include comparisons of the net benefits of the base concept with net benefits of the final design, for P3 and non-P3 projects. This would provide an indication of the level of value the private sector has introduced for P3 projects relative to non-P3 projects.

The project sponsor's preferred concept is typically selected from a set of reasonable alternatives using an alternatives analysis. Considering that P3 projects typically involve an environmental impact statement (EIS) or environmental assessment (EA), all reasonable alternatives, including the no-build option, are evaluated during the environmental review process. Much of this information is typically contained in EIS or EA reports. Technical reports, which are ancillary to EIS/ EA reports, also summarize the findings of special studies undertaken to assess existing operational and environmental conditions and potential future changes expected during and after project implementation. In addition, some states have additional environmental requirements that must be addressed.

The review of alternatives begins with the identification of the purpose and need for the project and a set of reasonable project alternatives. These are then assessed for cost, future traffic demand, existing and future operational conditions, engineering factors (primarily mobility and safety), and the analysis of environmental impacts. This process culminates in the selection of a preferred design concept that reflects the economic worth and the trade-offs between the different project benefits, costs and impacts. Project sponsors also often undertake financial feasibility analysis to assess available funding options and public investment needs.

Some of the most important issues arising during the project development stage include the quality of traffic forecasts at a given point in project development, project-specific environmental impacts, and agency-specific environmental requirements. Collectively, these factors have a profound influence on the project risk profile, innovation potential, and cost outcomes. These issues also shape the selection of the preferred alternative.

The identification of potential risks and risk mitigation strategies is another critical activity that typically occurs during the project development phase of major projects. The risk analysis records contain detailed information about the project risks, risk mitigation plans, and risk allocation strategies. This information is usually summarized in a risk register. While it would be ideal to capture all pertinent information from risk assessments in the online information source, key metrics would include risk-adjusted estimates of project costs and schedule. These provide an indication of the completeness of the agency's risk analysis exercise and the private sector's ability to reduce project cost and schedule risks further. This information would be helpful in validating the assumptions made in the Value for Money (VfM) analysis. Two key considerations when trying to obtain this information would include: Is this information documented and compiled such that it can be accessed, and would the owners of the information be willing to share it for inclusion in the information source?

B.4.2 Information Requirements

Tier 1 data is discussed in Chapter 3. Data on the project development phase for the Tier 2 level of information would focus on the following considerations:

- ▶ A summary of the findings of the environmental review process, such as the level of review, impacts and commitments, which would provide an indication of the complexity and constraints of the project. The environmental review and alternative analysis reports could be archived for future reference, in lieu of resource-intensive data mining efforts.
- ▶ Pre-construction and forecasted traffic demand summaries would provide a baseline for developing designs and assessing whole life asset and operational performance. Any inaccuracies in traffic forecasting, as measured by the differences between forecasted and actual data, may result in substantial downstream financial and performance risks. Given the private sector's opportunities for recalibration of the agency-provided forecasted data, this information will help to explain the differences in whole life performance management between P3 and non-P3 projects. Recognizing the challenges in extracting pre-construction and post-construction forecasted traffic demand summaries, these reports can also be archived for future reference.
- ▶ Risk analysis summaries provide insights on the agency's understanding of the planned project. The summaries typically include a register of all identified risks, risk-adjusted cost and schedule estimates, and the top twenty percent risks by severity of cost and schedule impacts. The risk-adjusted cost and schedule estimates, including the contingencies, form the basis for the sponsor's engineering cost estimate. In conjunction with the final contract cost and time, this information will provide insights on how well the project was implemented. It should be noted that it could be time consuming to develop an understanding of the different risks that actually arise on individual projects. This would likely require a careful review of project construction reports. However, it may be possible to standardize collection of this information over time. In addition, various versions of risk analysis summaries can be archived for future reference.
- ▶ Cost, revenue and user-benefit estimates from the Benefit-Cost and Value for Money analyses provide information to evaluate the assumptions made by the project sponsor. The benefits may include monetized forms of travel time savings, crash rate reduction, change in emissions, fuel and non-fuel vehicle operating costs. Note that the FHWA P3-VALUE 2.0 tool allows users to estimate user benefits and calculate benefit-cost ratios.

The project development data included in the online information source will include core metrics that will be necessary to establish a baseline against which later project outcomes could be compared. There is also additional information that it may be helpful to have in order to develop a more comprehensive understanding of project outcomes. If it is practicable to do so, this information should also be collected. However, if the level of effort to collect it is onerous, or if the data is unavailable or unreliable, a decision may be made not to pursue this information, or only include it when it can be easily obtained. When appropriate, the project development metrics should also be date stamped so that users can understand the sequence in which different analyses were made and how certain metrics may have changed and evolved over time.

A list of data elements to be included in Tier 1 are provided in Chapter 3. Tier 2 data are summarized below.

- ▶ Tier 2 Level of Information:
 - Percent contingency included in the pre-bid cost estimate
 - Pre-bid final schedule included in the pre-bid schedule estimate
 - Schedule contingency incorporated in the pre-bid schedule estimate



- Financial feasibility analysis data including: date of analysis, project revenue, debt capacity, lifecycle operating cost estimate and available public funding
- Benefit cost ratios for P3, design-build and design-bid-build projects
- Pre-construction traffic and operational data, including AADT, percent trucks, free-flow speed, peak hour volumes, transit ridership
- Pre-construction crash rates (by fatalities, injuries and property damage) and possibly incident rate, incident management practices and performance.
- Risk assessment – risk assessment date, number and type of risks in risk register, baseline cost before risk assessment, baseline schedule before risk assessment, total cost value of unmitigated risks, net schedule change due to unmitigated risks, total cost value of mitigated risks, net schedule change due to mitigated risks
- Post-construction forecasted traffic and operational data, including AADT (average weekday and weekend volumes), percent trucks by truck class, free-flow speed, peak hour volumes, transit ridership
- Post-construction forecasted crash rates (by fatalities, injuries and property damage) and possibly incident rate, incident management practices and performance
- Pre-construction costs by cost type (e.g., utilities, right-of-way, scoping, surveying, environmental review, planning, public involvement, etc.)
- Environmental impacts and commitments by impact type (e.g., right-of-way, ecological, flood plains, Section 4(f), Section 6(f), farmlands, coastal areas, hazardous materials, noise, air quality, archaeological and historical properties)

B.4.3 Potential Data Sources and Challenges

The primary sources of project-development information for Tier 2 include the following:

- ▶ **Project-specific environmental review (EIS and/or EA) reports and ancillary technical reports** – These reports are typically available on project websites. It should be noted that these reports are often extensive and not easily perused for the kind of detailed information that would be of use in the online information source.
- ▶ **Project sponsor's internal project development documents, including risk register, VfM, benefit-cost and financial feasibility reports** – The project sponsor's internal documents may include summaries of internal analytical exercises, such as risk assessment and financial analysis, undertaken to support the project development process. Internal documents may or may not be available for public scrutiny, depending on the arrangements and requirements for transparency. It may be difficult to obtain these types of internal records and some project sponsors may object to making the information openly available to users.

In addition, missing information could be supplemented through questionnaires, interviews, or specific information requests to project sponsors. While environmental review and technical reports contain a wealth of information relating to pre-bid project development, extracting this information with reasonable quality checks may be a laborious and resource-consuming exercise for project sponsors. Moreover, they may not prefer to reveal some sensitive information, such as those available in risk or financial analyses.

Standardizing the data on project development will likely be challenging, as different agencies may use a variety of reporting or analysis format. Standardizing the data would help to minimize the subjectivity of subsequent analyses performed by users.

B.5 Project Procurement

B.5.1 Purpose

Analysts could use project procurement data included in the online information source to evaluate and compare efficiency and effectiveness of the procurement of P3 and non-P3 projects. Process efficiency is a reflection of the maturity of a public agency's procurement practices, while the effectiveness is an indicator of the "value" that the agency locks in at the procurement stage. The efficiency of the procurement process is evaluated in terms of resource expenditure, including stipends paid to qualified proposers, and the duration of procurements.

The effectiveness of the procurement process may be assessed by comparing actual project costs and schedules with pre-bid estimates. Additional effectiveness parameters include market maturity, competitiveness and responsiveness, the level of pre-bid engagement between the project sponsor and proposers, private sector efficiency, value capture through alternative technical concepts, and the evolution of the project design concept over the procurement period.

B.5.2 Information Requirements

Information would likely focus on data elements that are captured, derived and aggregated at the conclusion of the procurement process. Data elements that could be readily captured for the Tier 1 level are included in Chapter 3.

More detailed information for the Tier 2 level may include the following data elements:

- ▶ Procurement costs of the project sponsor, including total stipends paid to all qualified proposers, are a key component of the project's whole life costs. This information may be difficult to disaggregate from agency costs and would depend on the accounting approach used.
- ▶ RFQ/ RFP evaluation criteria provide information on stated priorities of procurement as well as the established goals of the project.
- ▶ The winning bidder's proposal provide subcontractor-related information, including the number of equity and non-equity partners, primary role of each subcontractor (i.e., engineering design, construction, operations, maintenance), company-related information of each subcontractor (e.g., company size in terms of number of employees, total revenue), and the presence of subcontractors (i.e., local/regional/national/global).
- ▶ The project sponsor's RFQ/RFP and the winning bidder's proposal provides information on disadvantaged business enterprise (DBE) goals, the number of DBEs, status of DBEs (e.g. women owned, minority owned), the DBE goal proposed by the winner proposer, and the DBE performance of subcontractors.
- ▶ Surety, bonding requirements and letters of credit (e.g., bond amount, duration of coverage, and costs, if available) for bid bonds, performance bonds, payment bonds, and O&M bonds.
- ▶ Labor and wage related information, such as whether the project sponsor requires labor wages to be paid at prevailing minimum or union rates in accordance with the federal Davis-Bacon Act or equivalent State Acts; whether the project sponsor has signed a project labor agreement (PLA) with unionized labor organizations, and if positive, the applicability and scope of the PLA on the project; and whether the labor requirements are applicable for highway maintenance workers as well.
- ▶ The ATCs offer insights on the efficiency potential of the private sector. In addition, gathering information on ATCs is important as a measure of innovation. However, it may be time consuming, as well as subjective, to quantify the value of these proposals and determine whether they actually achieved the

desired benefit in the long term. The collective value of cost and schedule savings achieved through the implementation of ATCs, which is typically derived at the conclusion of the procurement process, would be deemed adequate for use in the Tier 1 level. It should also be noted that capturing the benefits of any design optimization undertaken by the private sector outside the purview of the ATC process would be challenging. The number of proposed, approved and implemented ATCs and their total value categorized by value type (i.e., cost, schedule, asset quality, work zone, operational quality) can be captured for the Tier 2 level.

- ▶ The RFP addenda issued to provide additional clarifications, such as to address errors and omissions, can be used to evaluate the efficiency of the procurement process. The RFP addenda issued due to ATCs and scope changes reveal how the project concept evolved with interaction with the private sector during the procurement process.
- ▶ The metrics based on the comparison of award outcomes with those of the agency's pre-bid estimates are an indicator of how the project costs and schedule evolved over the course of project development. These metrics also serve as aggregated indicators of value of money and private sector efficiencies locked in the contract.
- ▶ The information on pre-RFQ meetings with the industry and stipends reflect the project sponsor's initiatives to boost competition.
- ▶ The number of RFP meetings, including those for ATCs, indicates the level of communication between the project sponsor and proposers and may also indicate a lack of clarity in the RFP.

As with other project phases, certain data metrics would be essential in tracking procurement issues, and are listed as Tier 1 data in Chapter 3. Other desirable procurement information could also be included in Tier 2 of the information source if it could be obtained without excessive effort.

- ▶ Tier 2 Level of Information:
 - Total stipends
 - Percent costs set aside for DBE by the winning proposer
 - Amount and duration of coverage for all sureties and bonds
 - Key contractual provisions, relating to change in law, non-compete, non-discriminatory specification change, latent defects, force majeure.
 - Number of subcontractors
 - RFQ and RFP evaluation criteria and scoring
 - Number of RFP addenda by purpose
 - FTE Hours to oversee procurement
 - Number and cost of advisory contracts to support the procurement process
 - Total number of proposed/approved/implemented ATCs by winning and non-winning proposers
 - Number of conditionally approved ATCs requiring design waivers, exceptions and changes in environmental review and permitting
 - Number of proposed/approved/implemented ATCs claiming value by value type (i.e. cost, schedule savings, asset quality, operational performance and work zone disruptions)

B.5.3 Potential Data Sources and Challenges

Potential data sources include:

- ▶ Sponsor and project website
- ▶ Agency's published and internal procurement documents
- ▶ Proposers' procurement submittals
- ▶ Sponsor interview/survey

Some of the data elements, such as RFQ/RFP dates, number of submittals, evaluation criteria and scoring and award value, are readily available in the public domain on agency or project websites. Other items, such as stipends, the reasons for issuing RFP addenda and ATCs are typically available from sponsoring agencies in the form of proposer submittals, decision notifications and contract administration documents. It should be noted that the ATC related information is often redacted or requires further quantification and validation of the claims relating to cost, schedule and operational benefits.

While most of this information should be gathered with relative ease, there are potential challenges:

- ▶ **Non-availability of information:** Depending on the sophistication of the sponsoring agencies' documentation practices, some information, such as staffing hours, reasons for RFP addenda, or value propositions of various ATCs may not be available. Basin information on ATCs is generally available, but obtaining richer information requires effort and the willingness of the holder to share the information. Impacts may not be well quantified, and ensuring comparability across different jurisdictions will be challenging given different methods of quantification.
- ▶ **Inconsistencies:** Reconciling differences in reporting and terminology among state and regional and local stakeholders can be challenging.
- ▶ **Higher level of effort:** Though some data elements reside with sponsoring agencies in internal documents and submittals, the information may not be readily available. Sponsors may have to undertake a separate effort to extract information from internal documents.
- ▶ **Data confidentiality:** Project sponsors may prefer not to reveal some sensitive information, such as those available in price proposals and those related to ATCs, for valid reasons; however, agencies may select to mask critical information for reporting purposes. For example, sponsors may use an aggregation of total cost savings from ATCs without revealing the specific source, or provide a high-level description of reasons without revealing the specific details.
- ▶ **Data quality:** The value propositions made in ATC submittals are those claimed by the proposers, and are sometimes exaggerated. Without independent verification by the agency, the accuracy of any claims of ATC cost savings cannot be assured. Data quality also includes other several dimensions.

B.6 Project Implementation

B.6.1 Purpose

Analysts would use the project implementation data included in the online information source to evaluate how implementation is managed and to compare specific performance outcomes for P3 and non-P3 projects. The information gathering exercise could focus primarily on “quantifiable” performance outcomes of the design and construction tasks in terms of schedule, cost, quality, and work zone performance. In addition to these quantitative measures, qualitative factors that influence the outcomes of the implementation phase could be captured as well. These include the level of integration among project phases, the level of partnering between

parties, and the influence of earlier project development stages. These issues, however, are not easily measured.

The different project delivery options forge different levels of integration among the design, construction, finance, operational and maintenance phases of projects. In a traditional design-bid-build environment, design and construction are completed independently and operating and maintenance costs may not be tracked separately. However, with P3 delivery the private sector partner is responsible for the integrated completion of project design, construction and ongoing maintenance and operations. This has the potential to generate opportunities for efficiency gains in terms of cost, schedule and lifecycle performance. This level of integration may result in a smoother implementation process with fewer change orders, claims and disputes. In addition, the certainty of the whole life cost of maintaining the facility is likely to change with the project delivery method.

Since project implementation represents the culmination of earlier development phases, any errors or omissions by the project sponsor in the pre-bid project development and procurement phases may trigger inefficiencies including change orders, claims and disputes during project implementation. As the level of integration increases, the likelihood of such inefficiencies is generally expected to decrease, resulting in better performance outcomes. The information source could enable researchers to explore the influences of earlier stages on outcomes as projects are implemented.

B.6.2 Information Requirements

The intent should be to capture meaningful milestones rather than simply assembling a library of project design and project control documents. The information source would focus on the aspects of the implementation phase identified below:

- ▶ The timeline of design and construction phases will be used to establish schedule performance. Basic schedule information, including key milestones, start and end dates, and notice to proceed, can be obtained from the readily available sources, while additional details, such as schedule extension grants, liquidated damages, and schedule related incentives and disincentives would require more effort.
- ▶ Primary construction methods: cut-and-cover, deep bore tunneling, etc.
- ▶ All pertinent cost components, including design, construction, value engineering savings, additional costs due to change orders and delays, construction administration and quality assurance. This information can be used to establish final contract costs. The readily available sources could provide aggregated costs, while the disaggregated costs will typically require more research. However, the availability of reliable disaggregated costs for design and construction may be challenging for design-build and P3 projects. The cost data obtained from private sector sources may require validation by the project sponsor.
- ▶ Information relating to project financing and revenue sources, including financing sources such as TIFIA loans, GARVEE bonds, private activity bonds, commercial debt, shareholder equity, tolls, availability, progress, milestone and completion payments, value capture techniques, and local revenue measures,
- ▶ Quality assurance information, including frequency and value of non-conforming work, as well as the as-built asset quality, will be used to evaluate quality outcomes of the project. These data elements are typically available in the advanced sources.
- ▶ Work zone configuration, closure schedule and performance measures may be used to evaluate work zone performance in terms of work zone road user costs. This data element involves a separate computation effort using the following inputs: number of lanes opened and closed, lane widths, work zone length, traffic volume passing through the work zone, traffic volume on detour, hourly traffic demand, traffic composition, travel speed, closure times, closure duration, and unit costs for travel time and vehicle



operating costs. Many agencies also include the estimated cost of crashes that occurred due to work zone related reasons in the user cost computations. The data elements required to estimate work zone road user costs may require significant data mining efforts.

- ▶ Total value, in terms of cost savings and net schedule savings, from all value engineering proposals may be used as a measure of private sector efficiencies gained during design and construction.
- ▶ Information on sponsor-initiated change orders and private sector claims may be used to provide insight on how the processes and risks were managed prior to and during implementation. Change orders and claims also influence cost and schedule performance outcomes.
- ▶ Details on the settlement of claims, which can be derived from research, may provide an indication of the nature of the relationship between the project sponsor and its private sector partners and the cost of managing the claims. Typically, claims settled at the project-level require less time and resources than those that go to arbitration and litigation. Similarly, the number and complexity of claims tend to correlate with the project type and project delivery method. More complex projects also introduce a greater likelihood for claims. However, the project delivery method and level of integration between the project development phases may mitigate this potential.
- ▶ Construction partnering sessions may provide an indication of the level of communication between the project sponsor and private sector and may result in lower opportunities for claims.

A list of data elements to be included in Tier 1 is presented in Chapter 3 and Tier 2 data elements are summarized below.

- ▶ Tier 2 Information:
 - Work zone performance attributes, including vehicle miles traveled through work zone, closure periods, cumulative delay, posted travel speeds, average travel speeds, crash rates by crash type, vehicle miles traveled through detours, and road user complaints.
 - Approved value engineering proposals, including number of proposals, total cost value and net schedule savings.
 - Non-conformance of work, including number of instances, value of work accepted as-is, value of work accepted after corrective work, and value of work that required rework.
 - Asset quality indicators after construction, including percent within limits for pavements, bridge rating factors.
 - Number and total duration of construction partnering workshops.
 - Quality assurance non-conformance instances
 - Payments withheld due to con-conformance
 - Value of non-conformance work corrections
 - Schedule change due to change orders

B.6.3 Potential Data Sources and Challenges

The best sources of information on project implementation are project-specific post-construction evaluation reports prepared by project sponsors using project construction and contract administration records. Most project sponsors maintain an electronic document management system where a variety of project documents reside, including quality management plans, change orders, acceptance records, non-conformance reports, project-closeout reports, time extension approvals, liquidated damages, and value engineering details. The sponsor's documentation may also include information on construction partnering sessions, summaries of

claims and follow-up actions, decision summaries on settled claims, and implementation costs. It is possible the project sponsors may not wish to share certain information externally, so it will be important to demonstrate the benefits of doing so to these agencies.

Finance-related information is available in the project profiles and other reporting prepared by the FHWA Center for Innovative Finance Support and financial plans and the updates submitted to FHWA's Major Projects Team. For projects financed with bonds, an additional source of information is the Municipal Securities Rulemaking Board's Electronic Municipal Market Access (EMMA) website, which contains reports and regular updates from bond issuers. Discrepancies between these different data sources are common and would need to be resolved.

It is expected that most, if not all of the additional data elements identified for the Tier 2 level will not be included in project sponsor reporting. Accessing this data may require significant effort and may involve asking project sponsors to extract information from their internal records. In addition, some records, such as claims or quality assurance, may be subject to version-control issues. Robust quality control measures may be needed to ensure data accuracy. Such efforts could be challenging, time consuming and costly.

B.7 Operations and Maintenance

B.7.1 Purpose

As projects move into the operations and maintenance phase, the online information source would provide information on the quality with which service is being provided. Service quality might be assessed using asset conditions by type, implementation of maintenance, preservation and renewal (MP&R) actions, asset life-expectancy and life-cycle costs accrued over the analysis period. Beyond asset condition, additional attributes of service quality include the level of user charges and operating expenses. Researchers may be interested in comparing these types of efficiency measures between P3 and non-P3 projects. Note that the data collection period should be asset-specific but long enough to include at least one major rehabilitation event. Recognizing the need to keep the data collection period similar for all P3 and non-P3 projects, the average duration of the P3 projects included in the information source could also be used for non-P3 projects.

This information could be utilized to evaluate: i) whether projects are maintained in a state of good repair; ii) the effectiveness of managing various asset types in terms of optimizing the applications of MP&R actions to minimize life-cycle costs; iii) the efficiencies of intervention actions to repair deficiencies and restore to acceptable conditions within the contractually stipulated curing period (counterfactual equivalents may not be available for non-P3 projects); iv) conditions and residual asset design life at the end of the concession or analysis period; and v) loss of revenue or monetized aggregation of work zone delay costs when the facility needed more frequent repairs due to inadequate maintenance and repair actions.

The online information source could use performance and level of service attributes relating to maintenance quality and operational performance to evaluate service quality. This could be reported in terms of timeliness of maintenance actions, maintenance adequacy, user satisfaction, mobility, safety and incident clearance. Various performance indicators of service quality can also be monetized and aggregated in terms of user costs.

Information on the financial performance of P3 and other revenue generating projects could also be included in the information source. This could also include information on any financial distress or events due to defaults, bankruptcies, and restructuring, as well as renegotiations of tariffs/tolls/availability payments. Such occurrences would also provide an indication of financial, market-related, forecasting and political risks.

Facility performance in the "use" phase is a direct outcome of decisions made during the project development phases. The decisions made during procurement, design and construction phases will have a substantial impact on the net financial, asset and operational performance of transportation projects. For example, the level of construction quality committed to during procurement or achieved during construction influences future asset

performance. The appropriateness of design decisions, such as design deviations, or the impact of design flaws on operational performance also influence asset performance, as do the validity of future costs for maintenance and rehabilitation estimated at the time of procurement. The robustness of traffic forecasting during the pre-bid phase affects future financial performance. Researchers could use the online information source to highlight the connections between the project development decisions and service delivery outcomes.

B.7.2 Information Requirements

Information capture would focus on the attributes of the operations and maintenance phase discussed below:

- ▶ Condition indicators would be required to describe the overall quality of the roadway assets. Reporting from readily available sources can include primary roadway assets, specifically pavements and bridges, for Tier 1, while the Tier 2 level can include ancillary assets, such as signs, ITS devices, pavement markings, lighting and culverts. The asset condition information may include composite condition rating or nationally reported asset condition measures at the Tier 1 level or detailed measurements of distresses and deficiencies of individual asset components at the Tier 2 level. The condition indicators of the primary roadway assets include:
 - For pavements, the nationally reported condition measures, which include international roughness index, faulting, cracking and rutting, can be gathered from readily available sources, while, agency-specific pavement condition indices as well as individual condition measurements, including friction and potholes, can be reported using the research.
 - National Bridge Inventory (NBI) Condition Ratings for: Decks (Item 58), Superstructure (Item 59) and Substructure (Item 60), which are reported nationally can be used at the Tier 1 level, while other ratings, Channel and Channel Protection (Item 61), Scour Criticality (Item 113) and deficiencies, such as in rails, bearings, painting, drainage systems, approach slabs, expansion joints, surfaces and sidewalks, and fender systems can be reported at the Tier 2 level.

The ancillary assets may use a simple index or detailed measurements, such as condition rating for culverts, replacement age or retro-reflectivity for signs and pavement markings, illuminance for roadway lighting, and mean time between failures for Intelligent Transportation Systems (ITS) devices.

- ▶ When condition indicators fail to satisfy performance thresholds, the responsible party is required to undertake follow-up actions to address the deficiencies. Follow-up actions may include scheduled applications of MP&R actions to prevent further deterioration or corrective actions to repair deficiencies. Data elements would include performance thresholds, curing periods, type of repair actions undertaken, non-availability of lanes, repair costs, and non-compliance points. Researchers could use this information to compare the efficiency of the asset maintenance process between P3 and non-P3 projects.
- ▶ Performance thresholds can be readily captured at the Tier 1 level from the procurement documents of P3 projects. The performance thresholds for non-P3 projects, which could differ from those for P3 projects, can be captured from the agency's MP&R decision matrices.
- ▶ Curing periods are more appropriate for the Tier 2 level of information. While this information can be captured using readily available sources from the procurement documents of P3 projects, the curing periods do not generally apply for non-P3 projects. An equivalent metric for non-P3 projects would involve a resource-intensive exercise of identifying time lapses between the reporting of deficiencies and the date of follow-up actions.
- ▶ Asset conditions measured at the end of the analysis period could serve as a proxy for handback conditions for non-P3 projects. The nationally reported asset conditions can be gathered from readily available sources, while detailed measurements can be obtained based on research. The ability to capture this

information would depend on whether project sponsors keep data of this sort on a mile-post to mile-post basis, since this information would be needed to align with project boundaries for non-P3 projects.

- ▶ The effectiveness of roadway maintenance activities could be evaluated for the Tier 2 level using maintenance level of service (LOS), or maintenance performance ratings. Specifically for P3 projects, indicators, such as non-compliance points, number of instances when maintenance fails to achieve contractually stipulated thresholds, etc., could also be captured to assess the timeliness and quality of maintenance activities. Capturing similar information may be challenging for non-P3 projects, as most agencies may not track the timeliness performance of maintenance activities. More than half of State DOTs utilize maintenance management systems that capture needs identification, scheduling and tracking of maintenance activities. This is especially true in large, high-growth states that have sponsored the majority of P3 projects undertaken to date in the U.S. The metrics derived from these systems, in conjunction with maintenance LOS and percent backlog, can give some indication of the timeliness of maintenance activities for non-P3 projects. Other measures, such as user satisfaction ratings and safety performance, could serve as surrogate metrics to evaluate the quality of maintenance activities. A similar approach could be used to determine the quality of incident clearance as well.
- ▶ Mobility and safety performance indicators are more appropriate for the Tier 2 level of information. Such indicators may include the number of crashes by crash severity type, transit ridership on the highway improvement corridor, free-flow speeds, travel times, and vehicle miles travelled to provide insight on operational performance of the facilities.
- ▶ The role of the private sector is not restricted to P3 projects alone. Some project sponsors may use performance-based maintenance contracts. Participation of the private sector in maintenance of non-P3 projects could also be included in the information source.
- ▶ All pertinent cost components, including those for roadway maintenance, asset preservation, and data collection costs, would be used to establish life-cycle costs. The historic per-mile cost estimates could be included in the Tier 1 level of information, while detailed estimates of unit costs or real expenditures could be included in Tier 2.

A list of data elements to be included for Tier 1 is presented in Chapter 3. Tier 2 data elements are summarized below.

- ▶ Tier 2 Information:
 - Life expectancy of newly constructed or rehabilitated assets (by asset type). This data element involves computation of life expectancy using performance forecasting of asset condition ratings.
 - Lifecycle costs (by asset type)
 - MP&R action history (by asset type and year)
 - Budget required and allocated (if available)
 - Curing period (by asset type) – for P3 projects only
 - Whether restored within curing period (by asset type and year)
 - Lane closure or non-availability (by asset type and year)
 - Non-compliance points (by asset type and year) – for P3 projects only
 - User costs if condition exceeds thresholds (by asset type and year). This data element involves the computation of work zone user costs as well as non-work zone travel costs due to travel time, crashes, emissions, and fuel costs. Note that FHWA's Highway Cost Allocation Study provides guidance on computing external non-work zone costs to road users.
 - Maintenance level of service (by year)



- Crash rates by crash severity type (by year)
- Handback condition (by asset type) or the condition at the end of analysis period
- Mobility metrics by vehicle type (auto, single unit trucks, combination trucks and buses)
- Number of incidents by cause (e.g., weather, crash, medical, law-enforcement), statistical summary of incident clearance and response times, and occurrence of secondary crashes
- Number of snowy/icy/flooding conditions, traffic volume during weather event, time for traffic volume to return to normal conditions
- Maintenance performance rating and deficiency threshold (by maintenance type)
- Mobility performance, including free-flow speed, percent congested conditions, travel time reliability, volume-to-capacity ratio, percent lane-mile-hour non availability (by year)
- Transit ridership, to the extent that it is easily measured or tracked within project boundaries
- Number of incidents, average incident response and clearance times (by year), performance threshold for incident response and clearance
- Incident clearance costs
- Number of customer complaints
- FTE hours to monitor performance

B.7.3 Potential Data Sources and Challenges

Regardless of the delivery method, many project sponsors monitor the performance of transportation facilities through condition surveys, field surveys and output from intelligent transportation systems. With P3 projects, private partners may be responsible for monitoring facility performance. These performance monitoring efforts would provide the most online source of information on the performance of the P3 and non-P3 projects included in the online information source.

The Tier 1 level of information can be readily generated from the FHWA's national HPMS and NBI databases as well as project procurement documents. Owner agencies are likely to possess cost per mile estimates of various MP&R activities for pavements and bridges. Additional sources of operating costs and financial information include the EMMA continuing disclosure reports, FHWA Major Projects financial plan updates, and possibly borrowers' annual TIFIA financial plan reports.

For the Tier 2 level, the asset-related information may be generated from the automated systems used to monitor the condition of pavements, bridges and ancillary assets. Other potential data sources for asset-related attributes include:

- ▶ The concessionaire's lane closure requests, submitted to the public agency for approval, containing information on the type and timing of MP&R activities
- ▶ Procurement documents containing information on performance thresholds, curing periods, handback requirements, calculation of non-compliance points, and associated payment adjustments.
- ▶ The public agency's unit costs for various asset and non-asset maintenance activities.
- ▶ The concessionaire's description of the asset maintenance plan in its technical proposal.

Potential data sources for compiling information on mobility, incident clearance and safety include internal sponsor records, reports submitted by private partners, and mobility metrics derived from ITS data. Third-party sources may also have mobility data and public agencies often analyze such information for planning purposes.

There will likely be significant challenges in assembling the recommended performance information, as the range of performance data suggested may not be readily available from project sponsors. Project sponsors may have to dedicate substantial resources to collect, check, analyze, summarize and report the recommended data elements. This may also involve collecting information from a variety of existing internal sources and private partners. There may be difficulties in obtaining information from private partners particularly for those data elements not identified in the P3 agreement for reporting. There may also be a need for a significant amount of post-processing to derive usable metrics from the raw data, if this information is not already available as a part of the project sponsor's standard performance reporting practices or within the contractual obligations of their private partners.

