Advanced Project Bundling

A Reference for Getting Started





U.S. Department of Transportation
Federal Highway Administration

Every Day Counts
Innovation for a Nation on the Move

FOREWORD

As the amount of U.S. transportation infrastructure in need of attention continues to increase, agencies can save resources and time by bundling two or more projects into a single contract. Bundling can also help agencies meet other strategic objectives, such as rapidly addressing system performance needs (e.g., poor-condition bridges, maintaining a state of good repair) and creating opportunities for local economies. It is not a one-size-fits-all solution—each agency must establish its own goals for its bundling program.

Several State and local public agencies already utilize project bundling; however, because project bundling practices and methods are not yet standardized, the Federal Highway Administration (FHWA) sought to identify tools and techniques to assist agencies in implementing project bundling successfully for all funding sources.

The development of this reference on *Advanced Project Bundling* was guided by the FHWA Every Day Counts Project Bundling Implementation Team to supplement the 2019 *Bridge Bundling Guidebook* and is based on interviews, case studies, and lessons learned from practicing agencies. It offers information, tools, and methods to help State and local agencies save procurement time, leverage design expertise, achieve cost savings, incorporate measurable innovations and risk reductions, and build momentum for maintaining critical infrastructure assets.

This document was created through contract number 693JJ319D000031, order number 693JJ320F000047. The contract included the convening of a Technical Work Group (TWG) with members representing State departments of transportation, local public agencies, Tribal Nations, academia, contractors, and legal and engineering consultants. In addition, the contract resulted in in-person interviews with agency staff who have had success in delivering bundled projects at the State and local level. The input and guidance from the TWG and the FHWA Project Bundling Implementation Team were invaluable in creating this reference.

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. FHWA-RC-21-0008	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Advanced Project Bundling: A Reference for Getting Started		5. Report Date December 2021 6. Performing Organization Code: HIN-1
7. Author(s) Daniel D'Angelo, Applied Research Associates, Inc. Douglas Gransberg, Gransberg & Associates, Inc. Barry Benton, Greenman-Pedersen, Inc. Rob McCleary, Greenman-Pedersen, Inc. Romeo Garcia, Federal Highway Administration David Unkefer, Federal Highway Administration		8. Performing Organization Report No.
9. Performing Organization Name and Address Federal Highway Administration Office of Infrastructure 1200 New Jersey Ave, S.E. Washington, DC 20590		10. Work Unit No. 11. Contract or Grant No. **693JJ3119D000031-693JJ320F000047**
12. Sponsoring Agency Name and Address Federal Highway Administration Office of Policy and Governmental Affairs 1200 New Jersey Ave, S.E. Washington, DC 20590		13. Type of Report and Period Covered Final Report, February 2020 – January 2021 14. Sponsoring Agency Code HPL-1
15. Supplementary Notes Input and guidance on the development of *Advanced Project Bundling* was provided by a Technical Working Group of industry subject matter experts and the Federal Highway Administration Project Bundling Implementation Team.		
16. Abstract Advanced project bundling is done strategically and systematically and often aims to accomplish an agency's program-level objectives, such as reducing the number of poor bridges or better accomplishing pavement management. Benefits include faster delivery of transportation benefits, while saving time, money, and overall effort through leveraging economies of scale. This document provides information for State departments of transportation, local public agencies, and Tribal Nations to consider advanced project bundling for all funding sources. Topics covered include why advanced project bundling should be considered; advanced project bundling practices; organizational self-assessment; getting started with planning, budgeting, and funding; and creating agency business rules, processes, and procedures for consistently selecting effectively bundled projects. The document includes case studies, tools for agencies, and checklists.		
17. Key Words Bundling, Bridge, Pavement, Project Delivery, Rehabilitation, Strategic Delivery, Preservation, Funding, Financing, Alternative Contracting Methods, Innovations, Risk Management.	18. Distribution Statement No restrictions. This document is available to the public through the Federal Highway Administration website.	

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 155	22. Price Free download.

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

ACKNOWLEDGMENTS

The Federal Highway Administration would like to express appreciation to the members of the Project Bundling Technical Work Group and acknowledges this *Advanced Project Bundling* reference guide would not be possible without their input and guidance:

Neil Adams, Illinois Department of Transportation
John Boyle, Source Contractors, LLC
Michael Copp, Illinois Department of Transportation
Brenda Crudele, New York State Department of Transportation
Peter Davich, Minnesota Department of Transportation
Chris Day, Ontario County, NY
David Deutsawe, Pueblo of Acoma
Louis Feagans, Indiana Department of Transportation
Jon Fricker, Purdue University
Matt Girard, Plenary Group
Chris Harper, Colorado State University
Gregg Hostetler, CONSOR Engineers, LLC
Tony Hunley, Stantec Consulting Services, Inc.
Darrell Kaminski, University at Buffalo, the State University of New York
Bijan Khaleghi, Washington State Department of Transportation
Chris McCray, Pawnee Nation
Royce Meredith, Kentucky Transportation Cabinet
Ryan Mitchell, Michigan Department of Transportation
Keith Molenaar, University of Colorado Boulder
Lorraine Moyle, Florida Department of Transportation
Jim Nichols, Nevada Local Technical Assistance Program Center
David Orr, Cornell University Local Roads Program, New York State Local Technical Assistance Program Center
Lyndsay Quist, Indiana Department of Transportation
James Ranger, Michigan Department of Transportation
Stephane Seck-Birhame, Illinois Department of Transportation
Andrea Stevenson, Ohio Department of Transportation
Darlene Svilokos, Erie County, NY
Sui Tan, Metropolitan Transportation Commission, San Francisco, CA
Daniel Tran, University of Kansas
Mark Traynowicz, Nebraska Department of Transportation
Kenny Voss, Missouri Department of Transportation

The FHWA would also like to acknowledge the following agencies and associations for providing the project bundling case study information used throughout this guide:

Delaware Department of Transportation
Indiana Department of Transportation
Iowa Department of Transportation
Kentucky Transportation Cabinet
New York State Department of Transportation
City of Oakwood, Georgia
Scenic Hudson, Inc.

Cover photo sources (left to right): Pueblo of Acoma Tribe, Pueblo of Acoma Tribe, Delaware Department of Transportation, Federal Highway Administration, Federal Highway Administration

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LIST OF ACRONYMS AND ABBREVIATIONS

5DPM	five-dimensional project management
AADT	annual average daily traffic
ADT	average daily traffic
ACM	alternative contracting methods
AGC	Associated General Contractors
ARRA	American Recovery and Reinvestment Act
ATC	alternative technical concepts
BBG	Bridge Bundling Guidebook
CEI	construction engineering and inspection
CFR	Code of Federal Regulations
CHBP	Competitive Highway Bridge Program
CM/GC	construction manager/general contractor
D-B-B	design-bid-build
D-B	design-build
DBE	Disadvantaged Business Enterprise
DelDOT	Delaware Department of Transportation
DOT	department of transportation
EDC	Every Day Counts
FAST Act	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
GMP	guaranteed maximum price
HBP	Highway Bridge Program
HRAP	Hudson River Access Plan
IDIQ	indefinite delivery/indefinite quantity
IGA	intergovernmental agreement
INDOT	Indiana Department of Transportation
KYTC	Kentucky Transportation Cabinet
LPA	local public agency
LRTP	long-range transportation plan
MOT	maintenance of traffic
NEPA	National Environmental Policy Act
P3	public-private partnership
QA	quality assurance

RFP	request for proposals
ROW	right-of-way
SR	State Route
STIP	statewide transportation improvement program
SHRP2	Second Strategic Highway Research Program
TAMP	transportation asset management plan
TIP	transportation improvement program
U.S.C.	United States Code

Sources *(left to right)*: Pueblo of Acoma Tribe, Pueblo of Acoma Tribe, Delaware Department of Transportation, Federal Highway Administration, Federal Highway Administration

EXECUTIVE SUMMARY

Project bundling—the awarding of a single contract for several preservation, rehabilitation, or replacement projects—can save agencies cost and time (Qiao, Fricker, & Labi, 2018) (Qiao Y. J., 2019) and offers a comprehensive and accelerated delivery solution for addressing strategic program goals. It streamlines planning, design, contracting, and construction; allows agencies to capitalize on economies of scale to increase efficiency; and supports greater collaboration during project delivery. This document will assist agencies in planning and implementing project bundling throughout their programming and project development process.

The Federal Highway Administration's (FHWA) Every Day Counts (EDC) program selected project bundling as an EDC round 5 (EDC-5) initiative because it has a proven track record of success. The advanced form of bundling promoted during EDC takes traditional bundling practices and associated benefits to a new level of effectiveness.

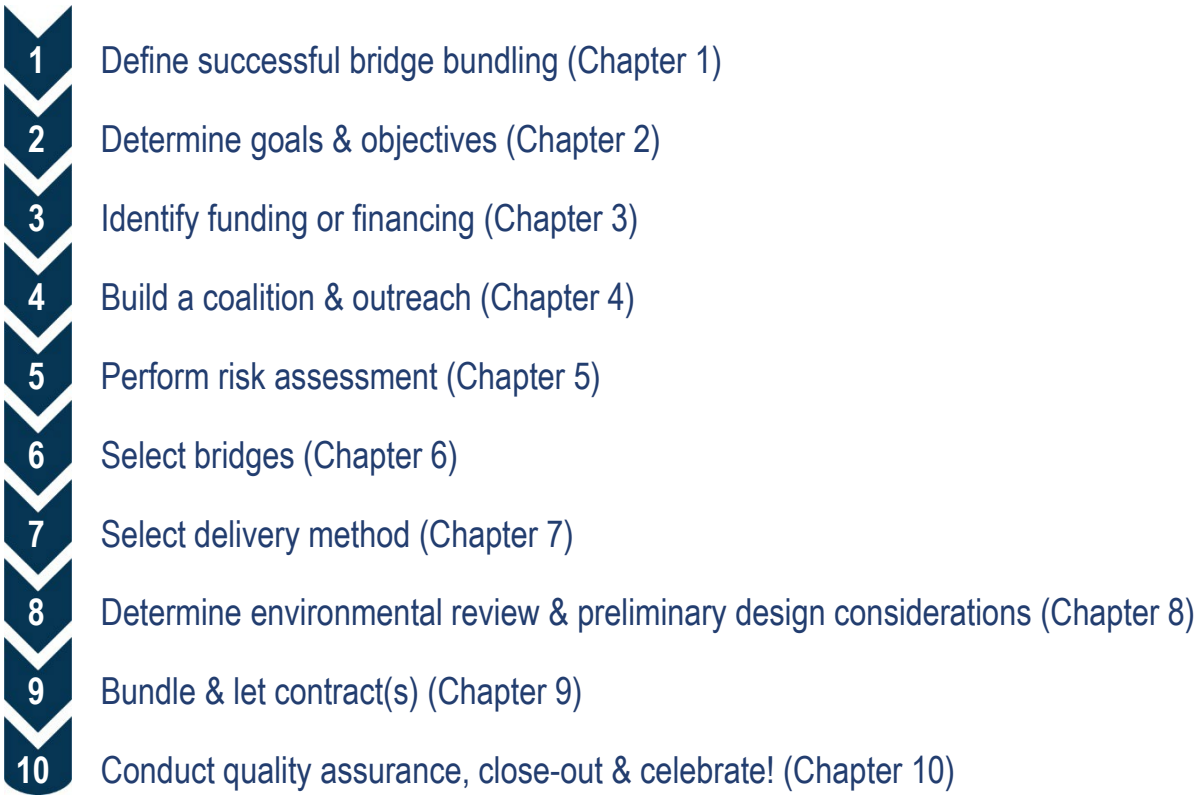
FHWA collected examples of effective practices from agencies nationwide and recent research to produce the *Bridge Bundling Guidebook* (BBG) (FHWA, 2019). This reference document on Advanced Project Bundling supplements the BBG with additional information on bundle creation and process details.

Figure 1 outlines the 10 steps involved in implementing and delivering a project bundle. This document focuses on step 3 (identifying funding and programming) and step 6 (selecting projects), based on recent research and a variety of effective practices nationwide for optimizing the benefits of bundling for various project work types.

Appendix A highlights results from several bundling projects and programs where design savings were as much as 50 percent and construction savings as much as 15 percent.

The **Indiana Department of Transportation** (INDOT) has established "business rules" and a scoring system for evaluating projects to bundle. INDOT recognizes that the way projects are scoped, packaged, and delivered can greatly influence bid prices, user impacts, and the agency's level of effort during procurement and delivery. Efficiencies and direct cost savings may be generated through logical groupings of projects. See Appendix G for INDOT's business rules.

The summary presentation in Appendix H provides an overview of this document for agency use in sharing the content for educational and marketing purposes.



Source: FHWA

Figure 1. How-to steps for bundling as listed in FHWA's *Bridge Bundling Guide*.

CHAPTER 1. THE BASIS FOR ADVANCED PROJECT BUNDLING

Project bundling is not new to many State and local transportation agencies. Agencies bundle projects into single contracts for many reasons:

- Making a single contract large enough to increase competition among qualified contractors, subcontractors, or designers.
- Reducing long-term disruption to the traveling public.
- Optimizing the use of available funding by leveraging economies of scale.
- Accelerating the planning, design, and construction of transportation improvements.
- Building political capital (e.g., accelerating or getting projects "off the books").
- Optimizing construction schedules and reducing contractor mobilization costs.
- Supplementing agency staff through use of contractors or consultants. Achieving national goals and performance management measures (23 United States Code [U.S.C.] § 150).
- Addressing transportation asset management plan objectives (23 U.S.C. § 119).
- Bringing innovation and risk reduction to projects and/or programs.

Bundling also supports the national goal of reducing project delivery delays.[1] For example, Yuba County, CA, bundled 4 years of road repairs into one contract completed in a single summer. While the primary objective of the bundled contract was to minimize disruption to the road network, Yuba County also saved about $4 million. In this case, the bundled project delivery was both faster and cheaper. The project, titled "Tomorrow's Paving Today," won a 2020 Outstanding Local Streets and Roads Project Award by the California State Association of Counties, the League of California Cities, and the County Engineers Association of California.

This document is intended to help agencies improve construction program delivery and address system performance issues, such as poor-condition bridges and pavements or safety hot spots, more rapidly and strategically. It provides information on making the business case for project bundling (Chapter 4), as well as the process for identifying projects that are good candidates for bundling (Chapter 5). A tool for estimating the potential cost and schedule impacts of bundling versus completing a set of projects one at a time is provided to assist the decision process (Chapter 5). Appendix A offers case studies, Appendix D provides a policy and process checklist, and Appendix E includes a checklist for assessing and managing risks associated with bundling and a methodology to collect and evaluate project performance to cover the full life cycle of bundled project delivery.

[1] 23 U.S.C § 150(b). Federal Highway Administration, Transportation Performance Management, National Goals.

1.1 Project Bundling Methods

Project bundling, as part of round five of the Federal Highway Administration (FHWA) Every Day Counts program (EDC-5), is a logical follow-on to the publication of the *Bridge Bundling Guidebook* (BBG). The BBG, shown in Figure 2, contains fundamental, high-level information on bundling based on general project delivery concepts and requirements. This document augments the BBG by providing a concise reference with more specific how-tos for getting started.

FHWA's promotion of project bundling as part of EDC follows Congress' inclusion of bridge bundling in the Fixing America's Surface Transportation Act (FAST Act), Public Law 114-94 (2015). Congress added a "Bundling of Bridge Projects" provision in 23 U.S.C. § 144(j), encouraging States to bundle multiple bridge projects to save on project cost and delivery time.

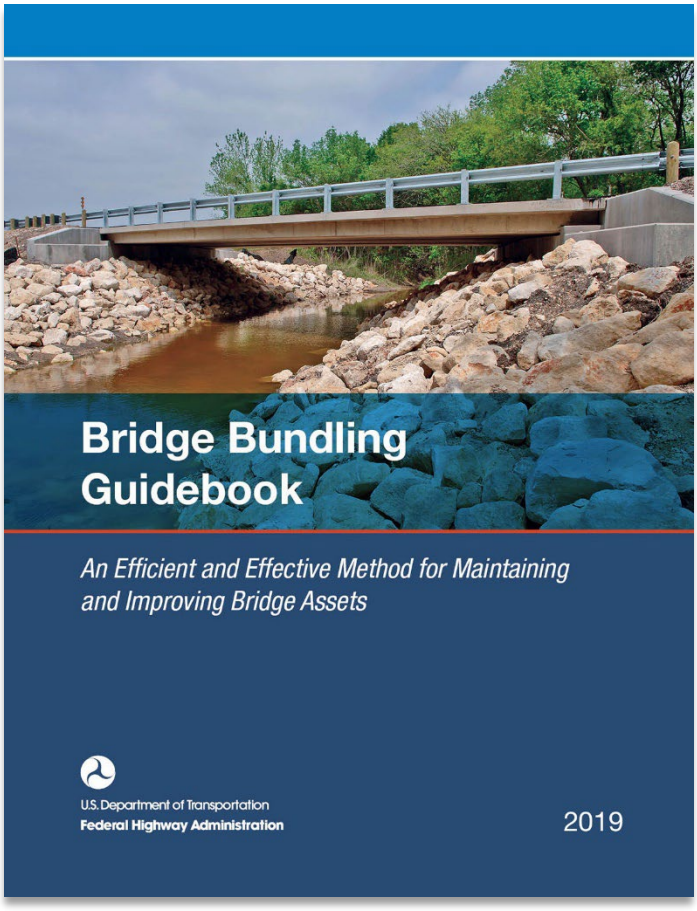


Figure 2. The FHWA *Bridge Bundling Guidebook* contains fundamental information applicable to bundling projects of all types, not just bridges. It is available for free download.

Figure 3 illustrates the two common methods agencies use to create a project bundle. The first method is by analyzing individual projects. This can be accomplished in two ways: 1) by reviewing existing programmed projects for opportunities to bundle or 2) as a routine business process, identifying bundled projects for programming on an agency's capital program.

The second method is by special initiative and includes two approaches: 1) using bundling to deliver a special funded program for a specific purpose or 2) using bundling to justify or make the case for an initiative to secure additional funding. Examples of this type of funding are in the American Recovery and Reinvestment Act (ARRA) of 2009, Public Law 111-5; funding allocated for specific local infrastructure improvements such as the Competitive Highway Bridge Program (CHBP); and emergency funding for the restoration of service after a natural disaster. This type of funding could be a single authorization like the New York Works Accelerated Bridge Improvement Program or an annual set-aside like the New York State Department of Transportation's Preventive Maintenance Bridge Bundling Program.

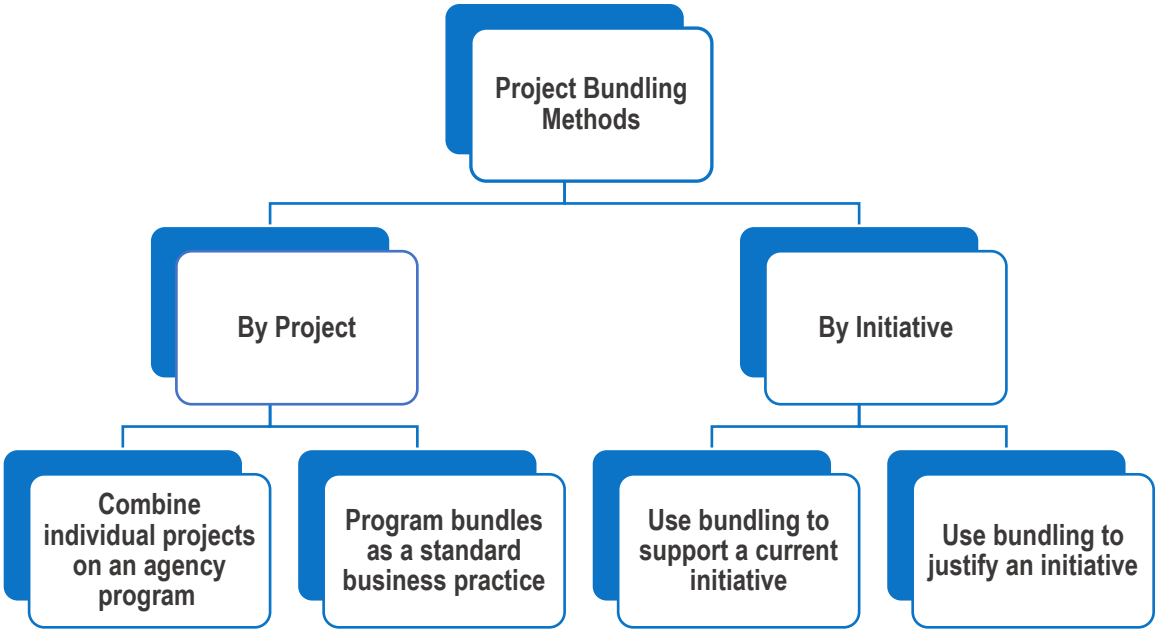
Both methods have their advantages—one benefits individual projects by combining them strategically; the other achieves a specific initiative or helps justify funding for a specific need through more efficient practices.

This document focuses on the first method, which employs bundling as a routine, institutionalized process. However, the steps in the routine approach can be directly applied to bundled contracts that arise as a result of specially funded infrastructure improvement programs.

Criteria for identifying candidate projects for bundling are discussed later in this chapter. Chapter 5 offers advice for determining the size of a given bundle.

The **Indiana Department of Transportation** (INDOT) examined the effects of contract size and other factors on the cost savings achieved by bundling. Researchers used 9 years of data from 1,997 bridge projects delivered via 715 INDOT contracts. The results confirmed and documented the benefits of bundling and produced models INDOT can use to select the most appropriate projects to bundle in the future.

Bridging Kentucky is a Kentucky Transportation Cabinet (KYTC) program to manage the rehabilitation or replacement of State, county, and municipal bridges throughout the Commonwealth. Bridges are bundled by location and project type. Most bundles are bid as traditional design-bid-build projects and are kept small with 2 to 13 bridges per bundle to ensure they are inclusive of smaller contractors. Bundle time frames are long enough to allow the bridges to be constructed in series, not requiring multiple crews to do the work.



Source: FHWA

Figure 3. How to create a bundle.

1.2 The Business Case for Project Bundling

Most public transportation agencies have used project bundling to some degree. However, this usage tends to be the exception rather than the rule. The goal of the EDC-5 project bundling initiative was to help make bundling a routine agency business process. Ideally, agencies would have rules for assessing projects for potential benefit by bundled delivery. Then, when the decision to bundle is made, repackage or program the individual projects into optimally sized bundled contracts. This document provides information on how to employ this approach and how to include project bundles in a statewide transportation improvement program (STIP).

Case studies provided in the BBG and in Appendix A of this document demonstrate the benefits of advanced project bundling and validate the business case for its implementation. Project bundling can be an essential tool in an agency's project delivery toolbox. Bundling provides an approach for delivery of transportation improvements to accomplish program and performance goals faster, more effectively, and strategically.

As of February 2021, KYTC's Bridging Kentucky program had helped 87 of Kentucky's 120 counties restore at least one bridge. More than 260 critical structures have been rehabilitated, repaired, or replaced so far. Significant cost savings were used to advance 120 additional bridge projects.

Project delivery methods are not necessarily a constraint on bundling; an agency may use whatever method is most appropriate of the methods they have available. In fact, project bundling has been applied successfully in all project delivery methods, and alternative contracting methods (ACM) beyond design-bid-build (D-B-B) often act to enhance bundling with the inherent integration of design and construction. See BBG Chapter 7 for details on using

bundling with project delivery methods including design-build (D-B), construction manager/general contractor (CM/GC), indefinite delivery/indefinite quantity (IDIQ), and public-private partnerships (P3).

A comprehensive study completed by the Indiana Department of Transportation (INDOT) in 2018 compared bundled contracts to individual projects in a sample that covered 10 years' worth of construction and nearly 8,800 projects (Qiao, Fricker, & Labi, 2018). Within that population, there were over 1,300 bundled contracts consisting of nearly 7,000 projects. The stand-alone sample had roughly 3,500 contracts. The population covered the full gamut of typical transportation projects from bridges and roads to traffic and utility projects. The study found the following general benefits of bundling:

- Economies of scale resulted in a reduction in unit costs as project size increased.
- Bundling resulted in a reduction in per project cost in bridge and road projects.
- Competition was maximized when two to four related projects were included in the bundle.
- Maintenance of traffic costs were reduced on bundled projects of all types, with roadway projects experiencing the most benefit in this area.

Another key finding of the INDOT study was there was a functional limit to the number of projects included in a bundle where the benefits either reached a point of diminishing return or declined. This phenomenon will be discussed in more detail in the next chapter. However, it led INDOT to develop business rules for bundling more strategically during early project programming, which institutionalizes the process to allow for greater economies of scale throughout project development and delivery.

Results from **INDOT's bundled contracts study**:

- Bundled projects saved from 8% to 27% compared to engineers' estimates.
- Program savings enabled $20 million in additional projects to be programmed.

(Qiao, Fricker, & Labi, 2018)

The lessons learned from the INDOT study support the objective of this document, which is to provide a systematic method for evaluating project bundling on a strategic basis. This document will assist agencies in determining the appropriate number and types of projects that comprise the final bundled contract scope of work.

CHAPTER 2. ADVANCED PROJECT BUNDLING PRACTICES

This chapter collates existing information, such as the BBG, to describe processes used to deliver bundled projects. Agencies can customize these example processes quickly to get started with bundling. These processes can be used for both programs with dedicated funding and those funded from traditional sources. The chapter also provides a set of effective practices identified in the literature to assist an agency in developing its own bundled project development and delivery process. Lastly, it summarizes the collective lessons learned from both successful and unsuccessful bundled projects.

2.1 Existing Resources

The FHWA BBG is the most recent and directly applicable resource for developing a high-level bundling process, whether it be for bridges or for non-bridge projects. The following chapters of the BBG can be directly related to non-bridge bundling contracts. This document builds on these chapters with more detailed process examples, without repeating the BBG herein.

- Chapter 3: Funding or Financing Strategies covers the currently available options for Federal-aid funding. It includes a discussion on the applicability of P3 delivery and tolling to generate necessary revenue.

- Chapter 4: Coalition Building and Outreach provides information on gaining stakeholder support for bundling.

- Chapter 7: Project Delivery and Procurement Method Selection furnishes the fundamental information necessary to place the decision in the bundling context. As previously mentioned, project delivery method selection is not necessarily a constraint to bundling but rather an integral step in the bundled project development and delivery process.

- Chapter 8: Environmental Review and Preliminary Design describes bundling issues associated with the environmental review and clearance process, permitting, preliminary design, right-of-way (ROW), and third parties (utilities). In addition, it includes issues unique to bridges, such as hydrology and hydraulics and geotechnical conditions.

- Chapter 9: Contract Bundling and Letting provides information on procuring bundled projects.

- Chapter 10: Quality Assurance, Close-out, and Celebration highlights specific issues related to quality assurance and the close-out of bundled projects.

Appendix F in this document lists other resources applicable to bundled contracts.

INDOT's study (Qiao, Fricker, & Labi, 2018) is the most comprehensive analysis of bundling to date, and its findings are considered authoritative. The study categorized bundled projects into the following six work types:

- Bridge – 2,936 projects in 8 subcategories ranging from new bridge to miscellaneous bridge rehabilitation and repair.
- Road – 2,966 projects in 12 subcategories ranging from new road construction to intersection improvements.
- Traffic – 970 projects in 6 subcategories ranging from intelligent transportation systems to lighting.
- Small structure – 769 projects in 3 subcategories ranging from pipe lining to maintenance and repair.
- Utility – 60 projects in 2 subcategories: railroad work and utility relocations.
- Miscellaneous – 569 projects in 5 subcategories ranging from demolition to paths, sidewalks, and curb ramps.

Table 1 summarizes the major findings for the work types on the factors analyzed in the study. The following are examples of each type shown in the table:

- Road: new road construction, added travel lanes, rehabilitation, and repair.
- Traffic: intelligent transportation systems, signing, traffic signals, lighting.
- Small Structure: pipes, culverts.
- Bridges: new, replacement, superstructure replacement, deck replacement, widening, deck overlay, thin deck overlay, rehabilitation, and repair.
- Utility: railroad work, utility relocation.
- Miscellaneous: demolition, channel and ditch work.

Table 1. Bundling project trends.

Evaluated Factor	Road	Traffic	Small Structure	Bridges	Utility	Miscellaneous
Economy of Scale	Unit cost decreases as contract size increases.	Unit cost decreases as contract size increases.	No statistically significant finding	Unit cost decreases as contract size increases.	No statistically significant finding.	No statistically significant finding.
Economy of Bundling	No statistically significant finding.	No statistically significant finding.	Unit cost decreases as contract size increases.	Unit cost decreases as contract size increases.	No statistically significant finding.	Unit cost decreases as contract size increases.
Economy of Competition	No statistically significant finding	Unit cost decreases as number of bidders increases	Unit cost decreases as number of bidders increases	Unit cost decreases as number of bidders increases for most types	No statistically significant finding	Unit cost decreases as number of bidders increases
Project Similarity	Project unit cost decreases as similarity increases	Project unit cost decreases as similarity increases	Project unit cost decreases as similarity increases	Project unit cost decreases as similarity increases	Project unit cost decreases as similarity increases	Project unit cost decreases as similarity increases
Bundle Size	New construction: project unit cost increases as size increases to an optimal point where it reverses	Traffic signals: project unit cost decreases as size increases to an optimal point where it reverses	New construction: project unit cost decreases as size increases	All bridge types: project unit cost decreases as size increases	No statistically significant finding	Project unit cost decreases as size increases
Bundle Size	Most other types: project unit cost decreases as size increases to an optimal point where it reverses	Pavement marking, guard rail, etc.: project unit cost decreases as size increases to an optimal point where it reverses	Pipe lining: project unit cost decreases as size increases to an optimal point where it reverses			

These findings provide agencies with justification for investing the time and resources to develop a structured, formal, and strategic approach to project bundling strategy. To consistently maximize bundling benefits, an agency can develop bundling policies and processes (or bundling guidance and implementation documents) that incorporate the practices outlined in Table 2 through Table 7. The process described in Chapter 3 and Appendix D (Project Bundling Policy

and Process Checklist) of this document can serve as the starting point for agency development and institutionalization of its bundling policy and process.

2.2 Effective Practices

Effective bundling practices can be grouped into six categories: policy, stakeholder communication, funding and financing, environmental permits, utility coordination and ROW, and contracting. Table 2 through Table 7 describe the practices in each category, as well as the ACM appropriate for each practice.

Table 2. Policy practices.

No.	Practice	Description/Benefits	ACM
1	Making the bundling decision early during planning	Developing bundles as early as practical accrues economy of scale benefits throughout the project development process.	All
2	Determining optimum bundle size	According to the INDOT study, there is a point at which increasing the size of the bundle decreases the potential benefits. (Qiao, Fricker, & Labi, 2018) (Qiao Y. J., 2019)	All
3	Limiting bundle by work type	Using a lesser number of similar pay items maximizes economies of scale and achieves a reduction in unit prices.	All
4	Limiting bundle by geographic proximity	Restricting the geographic distribution of the projects in a bundle reduces the complexity of construction management and allows close coordination of activities such as maintenance of traffic. However, artificially limiting close projects by district or county boundaries may prevent realizing some benefits.	All

Table 3. Stakeholder communication practices.

No.	Practice	Description/Benefits	ACM
5	Performing industry outreach	Industry is concerned that increasing the total contract amount by adding projects to a bundle will decrease the ability of small businesses to compete. Thus, industry outreach to articulate the agency's rationale for bundling and to detail measures to include small businesses has been found to be prudent. Industry outreach includes reviewing its capacity to meet the demands associated with the size and pace of project bundles, including the capacity of fabricators and the capacity of review agencies to process permits.	All
6	Performing stakeholder outreach	Bundles can increase the impact of a single contract on third-party stakeholders such as utility owners and their capacity to relocate their facilities. Outreach to impacted stakeholders provides a means to attain a mutual understanding of the scope and early buy-in.	All
7	Engaging in local partnering	Bundling has been found to be ideal for local public agencies to partner on with State departments of transportation and with each other to deliver projects.	All

Table 4. Funding and finance practices.

No.	Practice	Description/Benefits	ACM
8	Identifying Federal-aid eligible work types	Understanding Federal-aid eligible work types allows for more efficient bundles if non-eligible and eligible work types are not combined.	All
9	Using innovative financing	Bundling allows agencies to maximize the use of all types of available funding. FHWA's Center for Innovative Finance Support aids with alternative financing, including State Infrastructure Banks, Grant Anticipation Revenue Vehicles, and private activity bonds. Additional programs like the EDC-5 value capture initiative and private financing through P3 delivery are also applicable to bundling.	All
10	Using State funding only	Excluding projects that use Federal-aid funds from bundles eliminates certain Federal requirements.	All

Table 5. Environmental permit practices.

No.	Practice	Description/Benefits	ACM
11	Bundling to reduce the number of permit actions	If the bundling decision is made early enough, a single permit transaction can be made for all projects in the bundled contract, greatly reducing the transaction costs and time associated with National Environmental Policy Act clearance and other permitting actions for situations without a programmatic permit or agreement in place.	All
12	Receiving programmatic permits	Bundling programs have received programmatic permits that are limited by project activity type (e.g., stream crossing, wetland fill, culvert, bridge, or widening) and the resource (e.g., wetland, stream, species, historical/cultural resource) being impacted as a result of the project. Examples include the U.S. Army Corps of Engineers Nationwide Permits and other existing resource agency transportation programmatic permits.	All
13	Assigning permitting tasks to industry	Several options exist for transferring some of the permitting activity to the winning contractor. These range from requiring the contractor to assist in preparing the permit applications to making it the contractor's responsibility in D-B and P3 contracts. Environmental commitments such as monitoring and mitigation can also be assigned to D-B and P3 contracts.	D-B, P3

Table 6. Utility coordination and ROW practices.

No.	Practice	Description/Benefits	ACM
14	Negotiating consolidated utility agreements	In bundles limited by proximity, it may be possible to negotiate a consolidated utility agreement in advance of advertising the bundled project.	All
15	Assigning utility coordination to industry	The construction sequence of work is highly dependent on utility coordination. Assigning this to the contractor gives it full control of the sequence of work for completing individual projects in the bundle.	CM/GC, D-B, P3, IDIQ
16	Staging ROW acquisition sequence	The sequence of bundled contracts can be phased around ROW availability, with work starting as necessary parcels become available.	All

No.	Practice	Description/Benefits	ACM
17	Using IDIQ to stage ROW, permits, and/or utilities	IDIQ allows individual task orders to be released for construction as ROW, permits, and/or utilities issues are resolved without the pressure of fixed contract start and completion dates.	IDIQ
18	Assigning ROW tasks to industry	Several options exist for transferring some of the ROW activity to the winning contractor. These range from requiring the contractor to merely identify required parcels to making it the contractor's responsibility in D-B and P3 contracts.	D-B, P3

Table 7. Contracting practices.

No.	Practice	Description/Benefits	ACM
19	Using ACMs (i.e., something other than traditional D-B-B)	ACMs accrue documented benefits associated with accelerating schedule and enhancing constructability on bundled projects. They also permit the shift of certain risks to industry. (Note: For Federal-aid projects, agencies should work with their FHWA Division Office to determine Federal-aid eligibility of project procurement and scope of work.)	CM/GC, D-B, P3, IDIQ
20	Using Alternative Technical Concepts (ATCs)	ATCs allow industry input to the final design during procurement, as well as an opportunity to get approval of potential innovations before contract award on bundled projects.	All
21	Coordinating construction staging	Since bundled projects are composed of a series of projects, it is important to coordinate the construction sequence and mobilization as part of the contract.	All
22	Coordinating Maintenance of Traffic (MOT) plans	Since bundled projects are composed of a series of projects, it is important to coordinate the MOT through the area in which construction will occur.	All
23	Applying progressive guaranteed maximum price (GMP)	Progressive GMP allows the construction cost for each project in the bundle to be determined as its individual design is completed and reduces the need for contingencies.	CM/GC, D-B
24	Using open-ended contracts (on-call contracts)	Open-ended contracts permit agencies the flexibility to bundle projects in accordance with available funding. In addition, open-ended contracts can become logical vehicles to rapidly respond to emergency requirements without the need for a separate procurement.	All
25	Using IDIQ contracts	IDIQ contracts permit agencies the flexibility to bundle projects in accordance with available funding. IDIQ delivery presumes multiple task orders that can easily become projects in an overall bundle. In addition, IDIQ contracts can become logical vehicles to rapidly respond to condition-based maintenance repairs without the need for a separate procurement.	IDIQ

2.3 Lessons Learned

The 25 effective practices discussed in Table 2 through Table 7 encapsulate the implementation of lessons learned in project bundling. Of those, the following nine practices are considered most effective because they were successfully applied by five or more public agencies. This is not an exhaustive list. Agencies may have additional practices fitting for their individual situations.

- Making the bundling decision early during planning.
- Determining optimum bundle size.
- Limiting bundle by work type.
- Limiting bundle by geographic proximity.
- Performing stakeholder outreach.
- Engaging in local partnering.
- Assigning utility coordination to industry.
- Using ACMs.
- Coordinating construction staging.

Establishing policy and processes greatly influences the potential success of bundled projects and an agency's ability to consistently realize the benefits. Conducting stakeholder outreach and partnering with local entities are effective for creating a robust and programmatic approach that extends the benefits throughout an agency's transportation system management. Other practices, depending on the ACM, allow contractors to optimize the project's sequence and to leverage their creativity through early contractor involvement in the design and delivery of bundled projects. It is important to note that there are exceptions to the lessons learned. To illustrate, some local public agencies (LPAs) do not limit the bundles to work type. Rather, they bundle their entire capital improvement programs, based on strategic bundling principles, capitalizing on innovation, risk reduction, and economy of scale.

CHAPTER 3. INITIAL IMPLEMENTATION STEPS

This chapter provides information that can help agencies establish a project bundling process or formalize an existing practice by developing guidance documents that incorporate the effective practices identified in the previous chapter.

Bundling can reduce the number of transactions required (e.g., procurements, permits, contracts, designs, professional agreements) to deliver the total scope of a capital transportation program, with a commensurate reduction in total program delivery time and cost. However, this benefit is diluted if an agency's bundling business processes are cluttered with unnecessary internal oversight and approval steps. Appendix D offers a project bundling policy and process checklist.

3.1 Leadership Vision and Goals for Bundling

It is important that an agency's leadership define, in enough detail, what their overall program strategic vision is, as well as their project bundling goals and objectives. This is followed by creating and tracking actionable steps toward achieving these goals and objectives, while being able to pre-define success. As mentioned, success is best defined prior to kicking off project bundling, i.e., what is the desired end state and what does success of a bundling program truly look like? Furthermore, these goals and objectives should be connected or aligned with other agency and stakeholder goals.

For additional details on goals, see Chapter 1 (Defining Success) and Chapter 2 (Goals and Objectives) of the BBG.

3.2 Organizational Self-Assessment Tool

FHWA created a self-assessment tool for agencies to evaluate their current project bundling practices, identify improvement opportunities, and create an action plan for advancing their practices. Figure 4 shows the practices included in the tool (see Section 2.2 for descriptions). The self-assessment provides the opportunity for an agency to rate its capability (or maturity) on each practice within each project development stage (planning, programming, preliminary engineering, final engineering, construction, and operations and maintenance) and makes an overall assessment of organizational capability. The resulting report provides a list of practices that could be implemented or improved to advance an organization's project bundling capability.

Practice #	Practice
1	Early bundling decision during planning/programming
2	Determine optimum bundle size
3	Limit bundle by work type
4	Limit bundle by geographic proximity
5	Outreach – industry
6	Outreach – stakeholders
7	Local partnering
8	Identify Federal-aid eligible work types
9	Use innovative finance
10	Use State funding only
11	Bundle to reduce number of permit actions
12	Programmatic permit
13	Assign permitting tasks to industry
14	Consolidated utility agreement
15	Assign utility coordination to industry
16	Stage ROW acquisition sequence
17	Use IDIQ to stage ROW/permits/utilities
18	Assign ROW tasks to industry
19	Use ACM
20	Use ATC
21	Coordinate construction staging
22	Coordinate MOT
23	Progressive GMP
24	Open-end contract
25	IDIQ contracts

Source: FHWA

Figure 4. Agency project bundling self-assessment tool practices for evaluation.

Additional project bundling practices that are not currently part of the self-assessment tool, but that an agency may also want to consider, include the following:

- **Standardized design** – Repeatable design details and similar designs can reduce overall engineering and construction costs.

- **Budget control** – The flexibility to match budget by adding or removing project locations can help avoid delays by including only project locations that are ready for letting.

- **Preliminary engineering cost** – Project bundles are not subject to FHWA's 10-year rule; so if a State is developing a bundle, then needs to drop project locations (due to budget or other factors), the preliminary engineering costs for those locations would not be subject to it.

The definitions in Table 8 are consistent with the FHWA EDC-5 definitions for the first five capability levels. A sixth level has been added to indicate a maturity level that uses performance metrics and lessons learned to make revisions and achieve continuous improvement.

Table 8. Organizational self-assessment tool capability definitions.

Capability Level Criteria			
Level	**Description**	**EDC definition**	**Definition applied specifically to bundling**
1	Not Implementing	The agency is not pursuing innovation anywhere and is not interested in pursuing innovation.	Project bundling is not considered.
2	Development Stage	The agency is collecting guidance and best practices, building support with partners and stakeholders, and developing an implementation process.	No formal policy, process, or tools. Ad hoc approach to project bundling is applied when required.
3	Demonstration Stage	The agency is testing and piloting the innovation.	Basic project bundling process and tools are repeatedly used but not standardized. Approach varies from project to project.
4	Assessment Stage	The agency is assessing the performance of and process for carrying out the innovation and making adjustments to prepare for full deployment.	Draft organizational standard process for developing project bundling strategy is documented. Supporting methods, tools, and staff training are being assessed.
5	Institutionalized	The agency has adopted the innovation as a standard process or practice and regularly uses it on projects.	Organizational standard process for developing project bundling strategy is documented. Supporting methods, tools, and staff training are established and documented.
6	Optimized	– not applicable –	Lessons learned and best practices are applied for continuous improvement. Performance metrics have been established to enable quantitative feedback.

This tool serves to lead the agency through the assessment of its maturity for the practices it selected in each stage of project development and delivery and automatically consolidates the input to produce the matrix shown in Figure 5.

Reference	Practice #	Practice	Planning	Program	Prelim. Eng.	Final Eng.	Constr.	O&M	Capability for Each Practice
Table 2	1	Early bundling decision during planning/programming	3	1					1
	2	Determine optimum bundle size		2	2	2			2
	3	Limit bundle by work type		4	4	4			4
	4	Limit bundle by geographic proximity		4	4				4
Table 3	5	Outreach – industry		2	3				2
	6	Outreach – stakeholders		2	3				2
	7	Local partnering		1	1				1
Table 4	8	Identify Federal-aid eligible work types	5	4	5	5			4
	10	Use State funding only	4	4					4
Table 5	11	Bundle to reduce number of permit actions		3	4				3
Table 6	14	Consolidated utility agreement			3	4			3
	16	Stage ROW acquisition sequence		3	3	4			3
	17	Use IDIQ to stage ROW/permits/utilities			3	4			3
	18	Assign ROW tasks to industry			3	4			3
Table 7	19	Use ACM		4	4	5	5	5	4
	20	Use ATC				5	5		5
	21	Coordinate construction staging			5	5	5		5
	22	Coordinate MOT			5	5	5		5
	25	Use IDIQ for emergency contracts				5	5		5
									Overall Capability Level
									4

Source: FHWA

Figure 5. Example capability assessment result review sheet.

The tool will also generate a report that lists the practices applicable to the agency with its current capability, or maturity, level. The purpose of the report is to stimulate dialogue within the agency regarding the value of institutionalizing and optimizing practices. For those practices the

agency wishes to improve, a goal is set for a higher maturity level and action steps can then be identified to help reach that level.

Figure 6 shows seven practices (practice numbers 1, 2, 5, 6, 7, 11, and 14) the example agency wishes to improve. For example, it shows for practice 2 (determining optimal bundle sizes) the agency rated itself as in the development stage (maturity level 2) with a desired goal of being in the assessment stage (maturity level 4). This agency could then take a critical look at whether its project development process should include a step for analyzing bundle sizes for optimal benefits. The agency has identified an action to create a draft policy and process for determining optimal bundle sizes and a second action for asset managers to pilot the process.

Practice #	Practice	Maturity	Maturity Level Goal[1]	Action Plan to Raise Capability Level[2]
1	Early bundling decision during planning/ programming	1	4	1. Develop a draft policy & process (business rules) to provide guidance on including bundling program development. 2. Coordinate with asset managers for piloting process, refine as necessary, adopt.
2	Determine optimum bundle size	2	4	1. Develop a draft policy & process (business rules) for determining optimum bundles sizes. 2. Coordinate with asset managers for piloting process, refine as necessary, adopt.
5	Outreach – industry	2	3	Formalize an outreach plan template for industry input on potential bundled projects.
6	Outreach – stakeholders	2	3	Formalize an outreach process for internal stakeholders to provide input on potential bundled projects.
7	Local partnering	1	3	1. Identify one or more local public agencies with which to pilot a bundled project. 2. Local Public Project Group informs local agencies on benefits of bundling; identify pilot project between local agencies.
11	Bundle to reduce number of permit actions	3	4	1. Consider permit actions in bundling decision. 2. Consider bundling permit actions independently from bundled projects.
14	Consolidated utility agreement	3	4	Pilot one overall agreement for a bundled project (as opposed to individual location permits).

[1] The tool does not automatically populate these columns; the user enters desired capability level and action steps to reach that level.

[2] Please see the FHWA Project Bundling Resource Database for examples and tools to assist in developing agency action plans.

Source: FHWA

Figure 6. Example of organizational self-assessment tool maturity improvement report.

3.3 Change Management – First Steps

When deploying any innovation, or process improvement, thinking and acting in terms of change management increases the probability of success. The following list highlights important steps agencies can choose to take in the change management process related to project bundling:

Appoint a champion. The champion acts as a facilitator. He or she creates a work plan, acts as a single point of contact for assembling the necessary input data, facilitates the issues that must be addressed, and identifies agency stakeholders who should be included in developing the project bundling program or practice. The best champion is a senior manager with the necessary authority to initiate implementation activities and keep them moving to fruition. Some agencies have hired consultant support to assist the champion and internal staff with the more intensive efforts of getting a bundling program or practice started, such as outlining foundational policies and processes and creating guidance materials.

Initiate a pilot project or program with an objective to establish published processes. Agencies with robust project bundling practices, such as INDOT and the Oregon DOT (ODOT), started with a pilot program. Pilot projects provide an opportunity to establish and test project performance metrics and capture lessons learned. Once the pilot is complete, the agency can evaluate the results and make the necessary adjustments to enhance the performance of future bundled projects. It can also draft the necessary policy and procedural documents to institutionalize project bundling within the agency's overall program. Those documents are assessed and revised over subsequent sets of bundled projects to adequately transfer the requisite knowledge to practitioners with no project bundling experience to be able to successfully undertake a bundled project for the first time.

Mosaic is a tool developed by the **Oregon DOT** for use in transportation planning in collaboration with local, regional, and statewide stakeholders. It provides planning-level analysis by comparing groups of transportation investments (bundles) to one another.

Implement training. The last element of a successful implementation strategy is training. Once the practice or program has become institutionalized, creating training can provide consistency in the application of the newly developed program procedures. Some agencies have developed training on two levels. The first is for working-level project managers and their support staff. The content of this training is focused on the details of project development and delivery. The second is for managers and support staff above the working level and focuses on policy, funding, and other appropriate topics that provide a consistent understanding of the newly implemented program or practice.

Pursue continuous improvement. Once the bundling practice or program has been implemented, its performance can be measured and outcomes can be assessed to determine if the practice or program is meeting its expected objectives. Lessons learned from specific bundled projects can be assembled and used to fine-tune the agency's policies and business practices to enhance the performance of future bundled projects.

3.4 Organizational and Workforce Considerations

Bundling projects offers opportunities to manage employee and consultant resources more effectively, but also may require new business processes and approaches for staffing. This can be either an advantage or a disadvantage. On the one hand, consolidating several projects into a single contract can reduce the number of transactions required to develop and award the contract. If the projects are in the same proximity, it may make the ability to conduct a single permitting action for the bundle or obtain a programmatic permit for a series of bundled projects possible. On the other hand, construction engineering and inspection (CEI) duties may become more frequent and complex as simultaneous projects are being built in different locations. Additionally, the number of review actions for submittals, tests, etc., may increase, which may create staffing challenges for design and materials lab personnel. Consultants may be hired to address peak staffing needs. However, consolidating CEI may enable more efficient and uniform training of CEI staff and increase the ease of delivering a consistently administered program, versus using numerous CEI firms that could have different administration and inspection standards and/or techniques.

A second consideration is whether the agency is centrally organized or decentralized with self-supporting districts or regions. If project bundle contracts involve multiple districts or regions, project bundling responsibility may reside with the central office, increasing the intensity of required reviews and testing. Decentralized agencies may share responsibilities or defer to one district or region to take the lead; coordination and communication should developed. Prior agency experiences suggest that centralizing administration can be more efficient in consistently delivering successful bundling programs across regions and districts.

CHAPTER 4. GETTING STARTED: PLANNING AND FUNDING

4.1 Transportation Planning Process

This chapter deals with evaluation and selection of projects that would benefit from a bundling approach. Evaluation of projects for bundling should be done early in the transportation planning process. That process includes developing a long-range transportation plan (LRTP) and a STIP. These fit with an agency's programming and budgeting processes, where bundling considerations should begin. The Federal Government requires completion of these planning activities to use Federal funding (23 CFR §§ 450.216, 450.218). The STIP is a programming document that must list the following:

As a continually evolving document, the STIP offers opportunities for inclusion of project bundling.

- All projects programmed for Federal funds.
- All regionally significant projects (from an air quality perspective), regardless of funding source.
- State-funded projects, for information purposes.

The STIP process offers a valuable opportunity to consider project bundling because it includes many of the same stakeholders that need to be involved in bundling decisions. It also includes the actual decision-making process that results in which projects are funded and advanced through the preliminary engineering, ROW, and construction phases.

While the STIP is only required to be updated once every 4 years (23 CFR § 450.104), many States routinely update their document more frequently. As a continually evolving document, the STIP offers opportunities for inclusion of new projects and project bundles.

4.2 Transportation Planning with Project Bundling in Mind

Ideally, from a planning perspective, the decision of what projects are suitable for bundling and how to bundle them would occur before those projects are listed in the STIP. Changes to projects already listed are possible through modifications and amendments, but those processes can result in project schedule delays, which could otherwise be avoided by pre-STIP planning with project bundling in mind. Pre-STIP planning expands opportunities to assemble project bundles that may result in greater program benefits:

- Enhanced strategic long-term outlook.
- Increased cost-effectiveness in use of limited resources.
- Reduced traffic disruptions.
- Reduced project delivery delays.

- Improved highway system reliability as projects are completed more comprehensively.
- Increased opportunities for innovations and economies of scale with reduced risk to the owner.

Many of the best candidate projects for bundling fall within system preservation programs for safety, bridges, and pavements. As such, bundling program implementation should draw from agency strategic goals for asset management and performance management, which would, in part, drive the candidate projects and bundling decisions. Additionally, many system preservation-type projects are exempt from being listed individually in the STIP. This affords even more flexibility in choosing projects to include in a bundle and their funding schedules.

A sound planning strategy for project bundling is to review the STIP, or a capital improvement plan or local government transportation improvement program (TIP), for opportunities to combine individual projects into a bundle (review existing agency program for opportunities to bundle, as described in Chapter 1). For federally funded projects, 23 CFR § 450.218(j) allows grouping of projects that are not of appropriate scale for individual identification in a given program year. For further examples of the types of projects that are not required to be listed individually in the STIP, see Appendix B.

Grouping of projects provides flexibility in project selection and bundling opportunities.

Once groups are formed, they are usually listed in the STIP as a program such as bridge preservation or intersection safety. Provided the overall scope and funding of a grouping remains unchanged, revisions to the projects rolled up into that grouping will not trigger an administrative process such as a STIP modification or amendment. Each such grouping is typically assigned to an agency official to manage the agency's budget and develop a work plan (i.e., list of projects to be pursued under the grouping during each budget cycle). That agency official is generally afforded the flexibility to mix and match projects under that grouping in ways that offer the most cost-effective strategy for preserving and improving the transportation network. This also offers the opportunity to bundle individual projects within the grouping. Ideally, the work plan would include project bundling as one of the tools available to help deliver the goals of the grouping.

One word of caution: Grouping a sufficient number of small projects together can create a project that becomes large enough to merit individual identification in the STIP. It may also trigger the need for a financial plan and/or value engineering study. Even though those types of requirements may complicate project delivery, the bundling approach may still be the best option.

The case study in Appendix A on DelDOT's I–95 rehabilitation project provides one such example. Made up of 17 bridge rehabilitations and pavement resurfacing on 3.5 centerline miles of interstate, in aggregate this project bundle amounted to an estimated $165 million. None of the 17 bridges or resurfacing segments alone, or even if bundled in groups of 2 to 4 projects, would

have been significant enough to warrant individual listing, a financial plan, or a value engineering study. But combined, they amounted to over 30 percent of DelDOT's annual capital program, which is a significant project and warrants all those additional steps in the process. The decision to bundle was determined to be the best option, although it limited programming flexibility, because one coordinated maintenance of traffic plan reduced the overall time of construction and traffic disruptions.

4.3 Incorporation of Appropriate Data into the Bundling Strategy

A great number of ways and strategies can be used to bundle projects. In addition, LPA bundling strategies for capital improvement projects may differ in nature from those of State DOTs. The INDOT study (Qiao, Fricker, & Labi, 2018) found that patterns exist that can be used as a guide to identify candidate projects and support bundling and scheduling decisions. Agencies can use the lessons learned from this work, as well as internal lessons learned, the case studies included in this document, and the BBG to refine future bundling decisions.

Data sources that define the operational conditions of the transportation system can help in determining which projects offer the best bunding opportunities. This data may include the numbers and types of traffic crashes, congestion and delays, anticipated asset service lives, current infrastructure condition ratings, and previous maintenance investment levels, as well as predicted future condition ratings based on future investment strategies. These types of datasets are available across multiple operational business units within each State DOT and are often summarized in their transportation asset management plan (TAMP).

Project bundling offers a way to implement LRTP, TAMP, and STIP goals and objectives.

Each TAMP includes investment strategies leading to a program of projects that would make progress toward achieving State DOT targets for asset condition and performance of the National Highway System and toward the national goals identified in 23 U.S.C. § 150(b). Incorporating the TAMP data and strategies into the project bundling decision-making process is an important element for success. Alignment of the LRTP, TAMP, and STIP should improve coordination between the maintenance, preservation, and capital improvement programs. Project bundling offers a way to implement the goals and objectives of all three.

4.4 Business Processes

Project bundling programs should adjust the following business processes to assess whether bundling brings value for a given situation and, if so, what actions should be taken to realize the potential benefits.

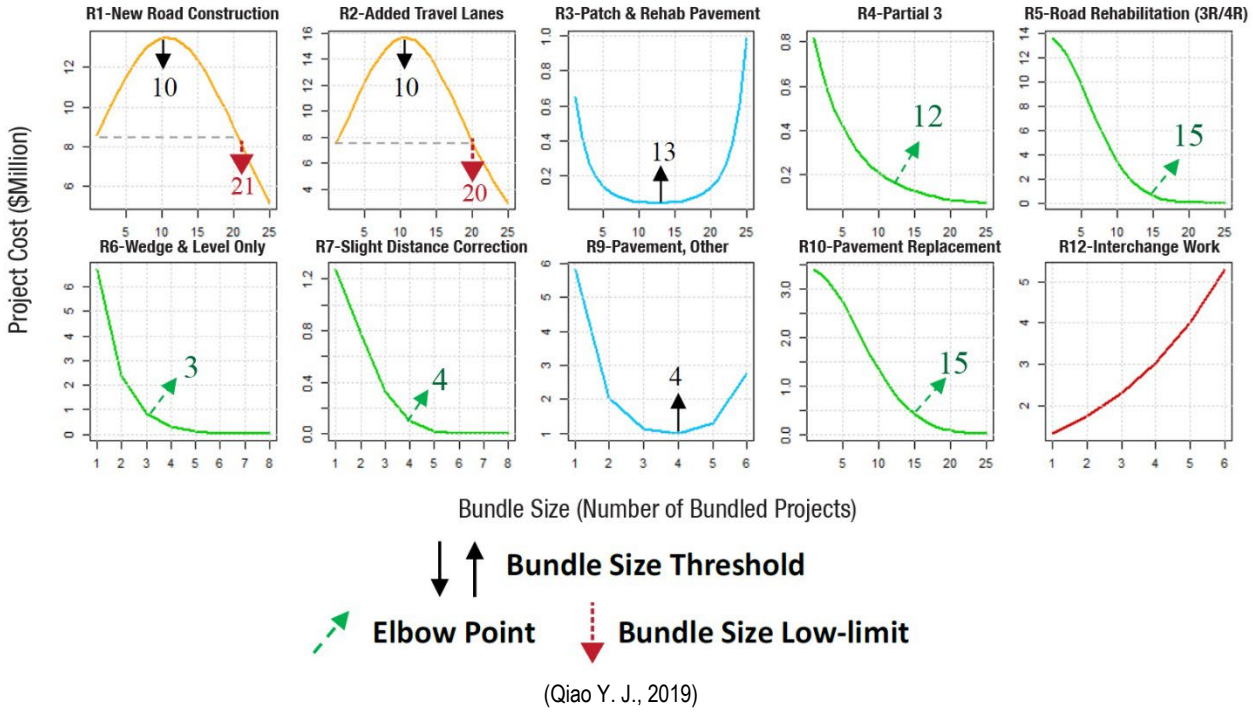
- Evaluate available funding and determine whether bundling will create additional value for money.
- Assess the potential projects for inclusion.

- Determine any constraints, such as limiting the total number of projects or value in a bundled contract.
- Assess the impact of bundle size on the local construction industry.
- Evaluate the alignment of project bundling with the agency's goals.

4.4.1 Funding Evaluation

Research shows that bundling can reduce the average per project cost, as well as transaction costs for the agency. It is important to note that depending on project type, this is not always the case. Additionally, for some work types, the cost increases as the number of projects increases to an inflection point where the trend is reduced. The opposite is true for other work types (Qiao Y. J., 2019).

Figure 7 comes from a comprehensive study of INDOT's bundling program and illustrates this phenomenon.



(Qiao Y. J., 2019)

Figure 7. Effects of bundle size on project cost for road work types.

Figure 7 shows that bundling the new road construction and added travel lanes work types increased the per project cost until the bundles involved 10 to 20 projects. On the other hand, the pavement rehabilitation and pavement-other work types experienced the opposite trend. Except for interchange work, the other road work types decreased in cost as the number of projects increased, reaching a point of diminishing incremental savings at certain bundle sizes.

Thus, to evaluate the impact of bundling on available funding, cost models can be developed with which to conduct the analysis. The document from which Figure 7 was drawn provides a methodology for developing those models using multiple regression techniques (Qiao Y. J., 2019). Assuming the presence of the necessary cost models, the agency can then conduct a series of what-if scenarios and determine the optimum sizes for each bundle that lead to the optimum use of available funding.

Chapter 5 provides a tool for a high-level analysis of project bundle size that does not require the development of specific agency work type cost models.

4.4.2 Bundle Considerations

Maximizing bundling benefits means carefully selecting candidate projects using two primary considerations:

- Work type or asset classes – bridge, highway, culvert, sign, signal, guardrail, pedestrian facilities, etc.

- Proximity – geographic location and dispersion, corridor.

Work type and proximity constraints can have a combined impact on the ability of a given bundle to achieve the expected value for money. While a bundle of projects of similar work type and in proximity is typically ideal, it is not always possible, or proximity may not be a constraint. Therefore, one approach is to consider first constraining the bundle by work type, assessing the impact on project costs. Then, taking the same projects, re-bundle them based on proximity and determine which alternative provides the greatest benefit. Also, for certain LPAs, projects being spread across large areas may be an advantage for using bundling due to economies of scale, ease in logistical planning, and spreading out mobilization and demobilization while utilizing the team's power of critical thinking in strategic delivery.

4.4.3 Competition Considerations

Once a bundle of projects is selected, the agency should determine availability of qualified, experienced contractors. An agency may look at bonding capacity, which is often readily available via the bidders list, to assess the level of potential competition for a specific bundle size. While this analysis involves a great deal of professional judgment, the following considerations should be included:

- Creating bigger bundles will attract larger contractors but can reduce competition among smaller contractors (although some large project bundles rely on many smaller contractors to work on multiple sites simultaneously).

- Developing bundled contracts with bid alternates for different-sized bundles provides some flexibility with respect to bonding capacity constraints.

- Increasing the number of projects in a bundle decreases agency transaction cost.

- Keeping bundles homogenous by work type reduces the amount of subcontracting and may reduce the price as well as increase competition among subcontractors in each trade.

- Allowing enough time to construct bundled projects in series instead of multiple projects at one time can increase competition from smaller contractors with a limited workforce.

4.5 Examples of Bundling Opportunities

Appendix A includes the following eight examples of project bundles used by State DOTs and LPAs to optimize limited transportation dollars to preserve and enhance their transportation networks:

1. Bridging Kentucky – Statewide Bridge Bundling Program
2. DelDOT I–95 Pavement and Bridge Bundle
3. Indiana DOT Project Bundling Program
4. Indiana DOT Pavement Project Bundle R-37841
5. Iowa Competitive Highway Bridge Program (CHBP)
6. Iowa Competitive Highway Bridge Program (CHBP) – Bridge Bundle #16 Scott and Jackson County
7. Oakwood, Georgia – Multi-city Pavement Bundling
8. Historic Hudson Valley Steel Truss Bridges, New York State

The BBG includes the following 17 project bundling case studies:

1. DelDOT Culvert Replacement Bridge Bundling Program
2. DelDOT Preventive Maintenance Bridge Bundling Program
3. Erie County (New York) Preventive Maintenance Bridge Bundling Program
4. Georgia DOT Design-Build Bridge Replacement Program
5. Larimer County Road 43 (Colorado) Emergency Project Bridge Bundling
6. Missouri DOT Safe & Sound Bridge Improvement Program
7. Nebraska DOT County Bridge Match Program
8. New York Works Accelerated Bridge Program
9. Northampton County (Pennsylvania) Public-Private Partnership
10. New York State DOT Region 1 Preventive Maintenance Bridge Bundling Program
11. Ohio Bridge Partnership Program
12. Oregon DOT I–5 Willamette River CM/GC Bridge Bundle
13. Oregon Transportation Investment Act III State Bridge Delivery Program
14. Osceola County (Florida) Roadway and Bridge Bundling Program
15. Pennsylvania DOT Local Bridge Bundling Program
16. Pennsylvania DOT Rapid Bridge Replacement Program
17. South Carolina DOT Letter Packages Bridge Bundling Program

These case studies offer examples of flexibility during the project development phase to add and delete locations, adjust funding levels, and make schedule changes to meet changing needs and conditions. The contracts often define several project locations as part of the request for proposals (RFP) but offer the flexibility to add locations during construction.

ACMs like IDIQ offer the opportunity to enhance bundling. IDIQ contracts are procured without known locations at the time of bid. Procurement is made from a list of pay items. The quantities shown in the RFP are for comparison of bids only. IDIQ allows the project location identification and bundling decisions to occur simultaneously with the procurement, which can speed overall project delivery. The bundling decision typically is based on similarity of work and geography. These types of contracts tend to avoid locations that would require acquisition of property rights, environmental permits, utility impacts, and railroad involvement, as those processes extend the time of project development considerably.

CHAPTER 5. PROCESS AND PROCEDURES FOR SELECTING BUNDLED PROJECTS

The advanced project bundling process shown in Figure 8 draws from the BBG, which applies the bundled project development flowchart shown in Figure 9. This chapter will discuss the application of Step 6. The major difference in developing bridge versus non-bridge bundles is the great diversity of project types. Table 9, which is taken from the INDOT bundling study (Qiao Y. J., 2019), provides an example of how to classify project work types.

Many agencies will already have their own classification system that can be used to provide a structure for the work types available for project bundling. The important point is that the agency adopts a standard classification system that allows it to assemble cost, project attributes, and performance databases that can be used to provide input for the cost models necessary to determine the optimum bundle size for each project type. While there will be an initial investment of resources to build the various cost models, that investment will accrue returns in the long term. It will provide an objective foundation on which bundle composition decisions can be made.

Source: FHWA

Figure 8. BBG process flowchart.

Table 9. Project type classification (Qiao Y. J., 2019).

Category	Code	Project Type
Road	R1	New Road Construction
	R2	Added Travel Lanes
	R3	Patch & Rehab Pavement
	R4	Partial 3
	R5	Road Rehabilitation (3R/4R)
	R6	Wedge & Level Only
	R7	Sight Distance Correction
	R8	Shoulder Rehab & Repair
	R9	Pavement, Other
	R10	Pavement Replacement
	R11	Intersection Improvement
	R12	Interchange Work
Utility	U1	Railroad Work
	U2	Utility Relocation
Traffic	T1	Intelligent Transportation Systems
	T2	Signing
	T3	Traffic Signals
	T4	Pavement Markings
	T5	Guard Rail, Cable Barrier & Wall
	T6	Lighting
Small Structures	S1	Pipe Lining
	S2	Small Structure Installation
	S3	Small Structure Maintenance & Repair
Miscellaneous	M1	Demolition
	M2	Channel and Ditch Work
	M3	Stormwater Improvements
	M4	Slide Correction
	M5	Paths, Sidewalks & Curb Ramps

5.1 Project Bundling Process

The project bundling process typically follows the sequence of steps shown in Figure 9:

Step 1 – Consider project bundling. A decision is made to consider project bundling.

Step 1A – Complete organizational self-assessment. As shown on the left side of Figure 9, an agency can perform a self-assessment of its current bundling business practices to identify practices for improvement and create an improvement plan.

Step 1B – List bundling candidate projects. The agency starts by listing the set of projects that are candidates for bundling.

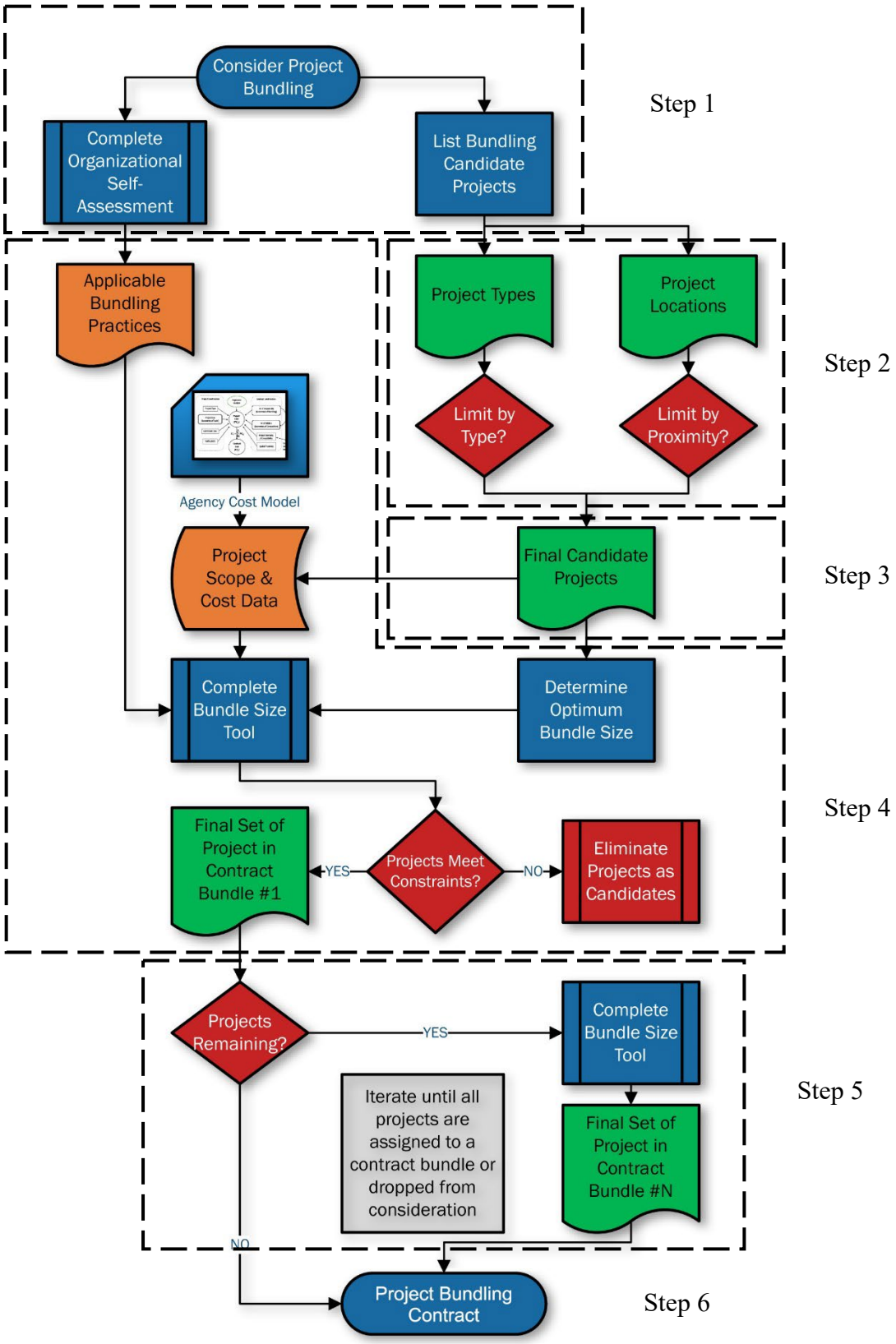
Step 2 – Determine constraints by work type and proximity. Next, the agency decides if the composition of the bundle will be constrained by work type, project location, or both.

Step 3 – Determine final candidate projects. Once work type and proximity constraints are determined, a list of final candidate projects remains, and the agency can then move forward and determine optimum bundle size.

Step 4 – Determine optimum bundle size. This step can be completed quantitatively in a framework developed by Qiao (Qiao Y. J., 2019) or, if the necessary agency data and cost models are not available, qualitatively using the project screening criteria shown in Table 12. In either case, the desired result is to determine an optimized bundle containing a specific number of projects that will define the total scope of work for a single contract.

Step 5 – Iterate. If candidate projects remain, the agency repeats the process as many times as necessary and develops additional bundled contracts until all candidate projects are either assigned to a given bundle or dropped from the analysis.

Step 6 – Establish project bundling program. The process for arriving at the final composition of each bundled contract and its overall contract scope of work will result in the agency's bundling practice.



Source: FHWA

Figure 9. Project bundling development flowchart.

The Figure 9 process relies on the classification of project types and a set of individual project input data. In general, the following are the data needed to develop optimized project bundles:

- Project type.
- Project location.
- Project scope.
- Project cost.

A bundle contract can be delivered using the traditional D-B-B delivery method or using an ACM; as such, the delivery method should also be considered in determining bundle size. Chapter 7 of the BBG provides information on selecting the appropriate delivery method based on project goals and objectives and associated risks.

5.1.1 Optimum Bundle Size Tool

An agency-specific optimum bundle size tool can be created by using the agency's unit cost models for each work type[1] and the algorithm developed by the INDOT research study to produce the graphs shown in Figure 7, or by using the framework developed by Qiao (Qiao Y. J., 2019). The agency will need to choose whether to develop the regression analysis shown in the framework or use the simplified version discussed below based on its actual pay item unit costs and its own project scope information.

The **Indiana Department of Transportation** (INDOT) has established "business rules" and a scoring system for evaluating projects to bundle. INDOT recognizes that the way projects are scoped, packaged, and delivered can greatly influence bid prices, user impacts, and the agency's level of effort during procurement and delivery. Efficiencies and direct cost savings may be generated through logical groupings of projects. See Appendix G for INDOT's business rules.

5.1.2 Agency Data Requirements

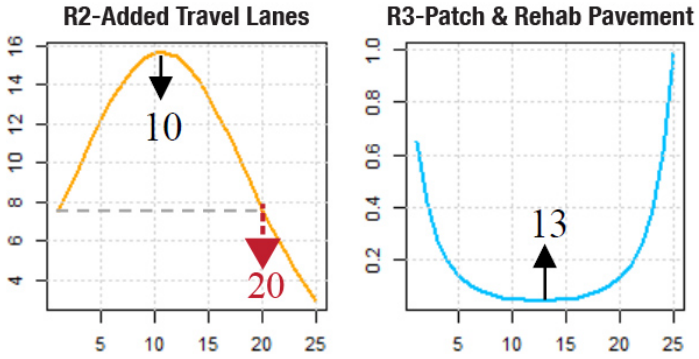
The requirements for historical data will be driven by the level of complexity found in agency cost models. Remember the purpose of this process is ***not*** to create a final cost estimate for the bundled contract but rather to determine the number of projects that will be included in each bundle. The use of the Pareto principle is typically applied to top-down cost models (Gardner, Gransberg, & Jeon, 2016). Research has shown that 80 percent of the value is found in 20 percent of the pay items in a typical State DOT highway project (Gransberg & Riemer, 2009). Therefore, the first step in developing the cost model input data for each category of work type that are candidates for bundling is to determine those pay items where approximately 80 percent of the cost resides and develop a list of items, quantities, and unit prices. If desired, the agency

[1] "The average unit cost for a given project type is the project award amount divided by the project size (i.e., the deck area, project length, number of lanes). The unit cost is expressed as $ per square foot, $ per lane mile, $ per mile depending on the project type." (Qiao, 2019, p. 132)

can then compute a multiplier to mark up the top-down number to account for the minor items that make up the remaining 20 percent of the cost.

5.1.3 Simplified Determination of Optimum Bundle Size

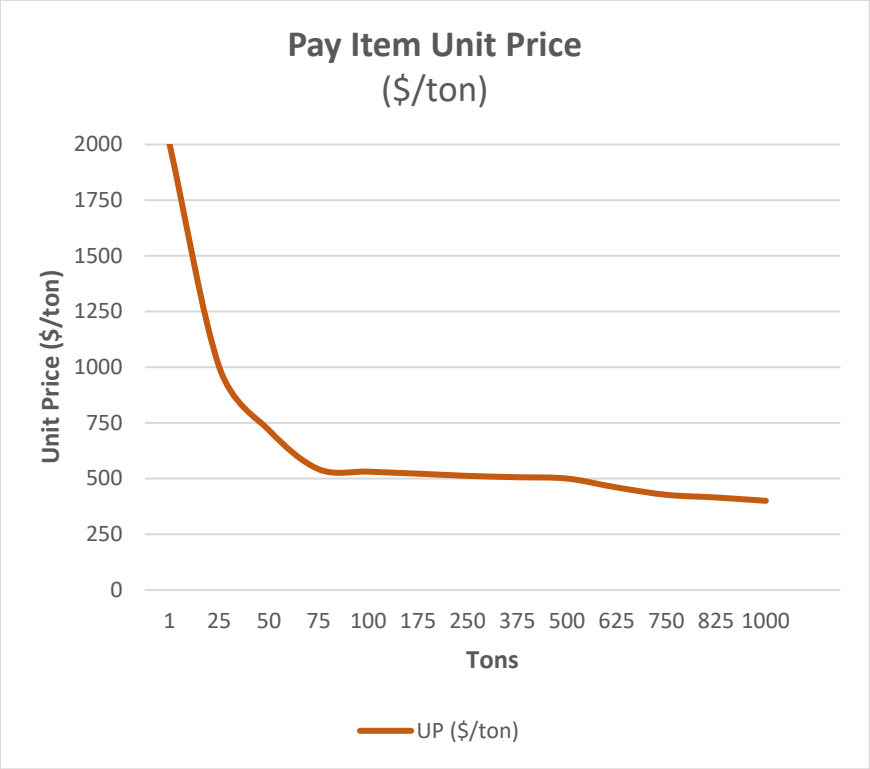
The reason it is important to do an analysis of optimum bundle size is illustrated in Figure 10, which is an extract from Figure 7 in Chapter 4. The INDOT bundling study showed that the relationship between the number of projects in a bundled contract and the value added through economies of scale is not linear. The graphs shown in Figure 10 both reverse their trend as the number of projects in a bundled contract increases. Therefore, to assist agencies in checking a proposed bundled contract for this issue, the following example is provided as a simplified approach to determining optimum bundle size.



Source: (Qiao Y. J., 2019)

Figure 10. Extract from Figure 7.

The below approach is based on checking the incremental increase in savings realized by increasing total quantities of work for similar pay items as bundled contract size increases and determining if the incremental savings trend reverses. Note that this only approximates the sophisticated algorithms used to generate the curves shown in Figure 7 and Figure 10. Thus, the method should only be used for trend analysis and not considered a reliable estimate of actual savings realized by bundling. Nevertheless, it does not require the development of regression-based cost models—it only requires the agency to have the quantities of work and estimated unit prices for each pay item used in the analysis. It also requires that there be a way to extrapolate the unit prices for each item for higher quantities of work. Figure 11 is an example of a hypothetical pay item measured and paid in tons. The data necessary to generate this curve should be easily obtained from agency historical bid tabulations.



Source: FHWA

Figure 11. Hypothetical pay item unit price extrapolation curve.

The following example involves determining the optimum number of projects in a single bundled contract. Five similar projects were chosen as candidates for bundling using the screening criteria shown in Table 12 (see section 5.1.4 Project Selection) for an explanation of the use of screening criteria). An analysis of the bid form and an engineer's estimate for each project were executed to identify the following:

- Similar pay items between projects.
- Pay items representing roughly 80 percent of the value in each project's total cost (Pareto principle).

The analysis found that three pay items should be included: 1) mobilization (lump sum [LS]), 2) Pay Item 1 (tons [TN]), and 3) Pay Item 2 (cubic yards [CY]). Table 10 is a summary of the bid form and engineer's estimated unit prices and extended totals.

Table 10. Example project data.

Project #	Quantity Mobilization	$/LS	#1 Qty (TN)	#1 $/TN	#1 Ext	#2 Qty (CY)	#2 $/CY	#2 Ext	Total
1	1	$40,420	400	$507	$202,800	100	$25	$2,500	$245,720
2	1	$25,420	200	$514	$102,800	100	$25	$2,500	$130,720
3	1	$17,965	100	$531	$53,100	600	$16	$9,600	$80,665
4	1	$16,098	75	$542	$40,650	400	$21	$8,400	$65,148
5	1	$15,378	50	$717	$35,850	100	$25	$2,500	$53,728

Table 11 shows the results of the analysis of bundle size trend as the number of projects in the contract increases. The analysis consists of incrementally increasing the number of projects in the proposed contract and solving for the incremental change in the potential savings accrued through economy of scale found by increasing the total quantities of work in a single contract.

Table 11. Example optimum bundle size analysis.

Bundled Contract #	Projects in Contract	Mobilization	$/LS	#1 TN	#1 $/TN	#2 CY	#2 $/CY	Bundled Contract Total Cost	Individual Project Total Cost	Savings	# Projects in Contract	Increment of Savings
*A	1,2	1	$65,840	600	$435	200	$22	$331,240	$376,440	$45,200	2	$45,200
B	1,2,3	1	$83,805	700	$429	800	$15	$396,105	$457,105	$61,000	3	$15,800
C	1,2,3,4	1	$99,903	775	$427	1200	$13	$446,428	$522,253	$75,825	4	$14,825
D	1,2,3,4,5	1	$115,281	825	$422	1300	$12	$479,031	$575,981	$96,950	5	$21,125

Note: *Row A indicates the optimum bundle size, as noted in the preceding paragraph.

The following steps were taken to arrive at the output:

1. List the projects in order of descending estimated cost, as shown in Table 10.
2. **Iteration #1:** As shown in Table 11, combine the first two projects in the list and compute the total quantities of work for each pay item.
3. Using the pay item unit price curves developed for the analysis (Figure 11) , determine the appropriate unit price for the combined quantities of work and extend those quantities and new unit prices to estimate the cost of Bundled Contract A with Projects #1 and #2.
4. Compute the total estimated cost if delivered individually from Table 10 and subtract the estimated bundled cost to find the savings.
5. **Iteration #2:** Repeat steps 2 through 4 for Bundled Contract B with Projects #1, #2, and #3.
6. Subtract the estimated savings of Contract A from Contract B to yield the incremental savings attributed to a three-project contract versus a two-project contract.
7. **Iterations #3 and #4:** Repeat until Table 11 is complete.

Before proceeding, it is extremely important to emphasize that the incremental analysis is merely a mechanism to look for the inflection point where the trend reverses and is ***not a decision criterion that seeks the maximum total amount of savings****. As shown in Table 11 for this example, total savings continues to increase as more projects are added to the bundle.*

Table 11 shows that the incremental savings goes down from two to four projects and then reverses when a fifth project is added. Thus, the maximum incremental savings is achieved in Contract A (two projects), whereas the maximum total savings is reached in Contract D (five projects). The agency should use this to inform its final decision rather than treat it as the only correct answer. Other factors such as geographic dispersion, limitations on inspection staff, and contractor availability may indicate a better overall value than the two discussed in this simple example, which merely provides a starting point for the ultimate bundle size decision. To achieve a precise optimal solution, the agency would have to invest in the development of a data-driven tool using business analytics, as was done in the INDOT bundling study.

5.1.4 Project Selection

Section 6.3 in the BBG contains a detailed discussion of project screening and selection criteria for bridges. When looking at bundling of non-bridge projects, the bridge-specific criteria should be deleted and replaced with criteria specific to the work type under analysis. Table 12 is a revision of Table 17 in the BBG to illustrate a more general application. Note that because of the broad potential for bundling among work types, Table 12 is not comprehensive. Nevertheless, it can be used as a model for developing project screening criteria for work types not shown in its contents.

Table 12. Project bundling screening criteria.

Screening Criteria	Discussion
Geographic Location and Proximity	Projects in the same geographic area and proximity can reduce mobilization costs and inspection costs.
Road Type, Geometry, Traffic, and Work Zone Control	Similar road types and similar traffic volumes can result in construction efficiencies through similar work zone control setup.
Project Size	Bundling projects of similar size results in fewer complications.
Similar Project Types	Bundling similar project types results in fewer complications and less need for different designs and construction means and methods.
Similar Work Types	Bundle by similar work types: • Preservation activities • Rehabilitation activities • Replacements The projects in the bundle should use the same unit pay items of work as much as possible.
Similar Risk Profiles	Including projects with divergent risk profiles will reduce competition and may impact the potential to accrue benefits from bundling.
Similar Benefits from Alternative Contracting Methods	Not all projects will benefit from ACM delivery. Thus, bundles that can benefit from early contractor involvement, innovations found in ATCs, eligibility for private funding, etc., are desired.
Environmental Permitting	Location-specific studies may be necessary but may allow for a streamlined process if bundled.
Hydrology and Hydraulics	Advance analysis results in contracts with less risk to the contractor, resulting in lower cost.

Screening Criteria	Discussion
Geotechnical Conditions	More advanced work and more data reduce contractor risk, resulting in lower cost.
Utilities/Third Parties	Minimizing bundling projects with utilities (or securing utility agreements in advance) will reduce construction risks.
Right-of-Way	ROW is often a key consideration. Locations where the work can be completed within the existing ROW will reduce risks.
Railroads	Risk typically remains with the agency. If risk is transferred by contract, it may result in additional cost or time delays. Projects involving railroads should generally be avoided if possible.

5.1.5 Bundling Decision Documentation

Once the final set of bundles is determined, it is important to capture the rationale and any quantitative criteria used to make the final decision. This information will be compared with actual project performance using metrics established for the bundles. The comparison provides a mechanism to adjust the cost models and the decision process for future bundles. It also assists in capturing lessons learned to further improve the agency's project bundling program. Additionally, it is a tremendous help in creating a success story, which assists in anchoring project bundling in the culture of the agency.

CHAPTER 6. FINAL STEPS FOR MOST EFFECTIVE BUNDLING

Bundling targets a defined set of project types that are planned for preservation/preventive maintenance, rehabilitation, or replacement/reconstruction in a timely and efficient manner through a series of contracts with the support of various funding options and/or partnerships and may include a program or project completion time frame. The likely benefits of bundling may include better risk allocation, cost savings (economies of scale), expedited procurement (faster construction start), earlier completion, technical innovation, increased service life of assets, coordinated construction staging, reduced burden on agency staff, and funding and financing innovation. Ultimately, early consideration of potential benefits of bundling as part of the routine project development process is a key success factor. Additionally, having a bundling process in place positions an agency to rapidly take advantage of special funding opportunities like ARRA.

Effective project bundling starts with developing a program vision, while also describing the project goals and objectives, an iterative process that is modified as detailed information becomes available. With the goals identified, a guiding coalition can be established, and a project manager selected. Moving forward, the process is dependent on understanding the opportunities and threats to achieving the goals and objectives.

An initial risk assessment should be conducted, resulting in a risk register (see Appendix E) that should be updated through the life of the project. Preparing a communication plan outlining stakeholder (internal and external) engagement is beneficial. Identifying the necessary or available funds (existing budgets, new Federal or State sources, or seeking private equity through a P3 arrangement) is obviously critical to placing a limit on the scope of work. Technical issues need to be addressed, including project selection criteria, design standards to be met, ROW needs, the environmental approval process, and third-party coordination.

Based on an updated risk analysis, a project delivery or contracting method (e.g., D-B-B, IDIQ, CM/GC, D-B, or P3) is selected. The procurement methodology is also determined (low bid, best value, or qualifications-based selection). Consideration should be given to incorporating the ATC process in the procurement. How quality assurance (QA) will be conducted and civil rights requirements met are incorporated into the contract documents. Disadvantaged Business Enterprise (DBE) program requirements apply, and setting a DBE contracting goal should be considered, if the bundled project is Federally funded (regulations can be found in 49 CFR part 26). Whether the bundled project is in one general location or dispersed throughout the State, goal setting is determined by analyzing the subcontracting opportunities, project market area, and availability of DBEs to perform the type of work. If the bundled work is dispersed throughout the State, the sponsor may want to consider setting an overall goal, with sub-goals for each region. As the post-award activities commence and progress, an updated risk assessment can help an agency determine where its resources can best be used. Finally, closing-out the project and capturing lessons learned for future projects is vital to continuous improvement and optimization of the bundling program.

The BBG chapters (or steps) 7 through 10 provide processes and tools applicable to all work types for selecting a project delivery method and conducting environmental review and preliminary design, contract management, and construction quality assurance. The objectives, tools, and expected outcomes for these chapters are described in Table 13.

To assist agencies in developing an action plan for creating a project bundling policy and process, a simple checklist by project development phase is included in Appendix D.

Finally, Appendix F includes information on additional reference material to assist agencies and others in the development of project bundling projects, programs, and initiatives. This database includes resources in five categories: case studies, programs, bundle contracts, reference documents, and research studies.

Table 13. *Bridge Bundling Guidebook* Steps 7–10.

Process Steps	Objective	Tools	Outcome
Step 7. Select delivery method (Chapter 7)	To identify the most appropriate project delivery and procurement method.	Comparison tables of project delivery and procurement methods. Project Delivery Selection Tool.	Selected project delivery and procurement method.
Step 8. Determine environmental review & preliminary design considerations (Chapter 8)	To identify environmental clearance and permitting issues and preliminary design issues.	List of potential issues. Case studies. Noteworthy practices.	Identification of environmental and preliminary design issues to address.
Step 9. Bundle & let contract(s) (Chapter 9)	To identify roles and responsibilities for contract creation and management.	Responsibility matrix. Civil rights and Disadvantaged Business Enterprise table. Sample contract documents.	Project management plan.
Step 10. Conduct quality assurance, close-out & celebrate! (Chapter 10)	To understand the issues to consider and options available for quality assurance.	List of items to consider. Comparison tables of quality assurance options.	Quality assurance plans.
	To celebrate the project successes and capture lessons learned.	List of close-out and celebration items to consider. Implementation checklist.	Celebration actions. Close-out actions.

Next Steps – Additional Resources

Complementing this reference document, FHWA-sponsored webinars on the following topics and more are available on demand from the FHWA Center for Innovative Finance Support website:

- Advanced Project Bundling: Examples Beyond Bridges
- Moving Towards Advanced Project Bundling: Key Characteristics of Lead Agencies
- Advancing Project Bundling: Making the Business Case
- Project Bundling for Local Public Agencies
- Advancing Project Bundling: How-to
- Advancing Project Bundling: Overcoming Hurdles
- A Strategic Approach to Project Bundling: What Does Success Look Like?
- Project Bundling: The Business Process

In addition, FHWA is producing a series of how-to briefs. The purpose of these briefs is to address key challenges that impede implementation of advanced project bundling practices. These 10- to 12-page briefs are meant to help practitioners have a deeper understanding of how to implement detailed practices or consider better approaches and processes. The briefs will cover the following topics:

- Creating a State-local project bundling program.
- When to bundle: How to identify projects – an asset management approach.
- Project bundling frequently asked questions (FAQs).
- Overcoming roadblocks (hurdles) to institutionalizing or adopting project bundling.

APPENDIX A. CASE STUDIES

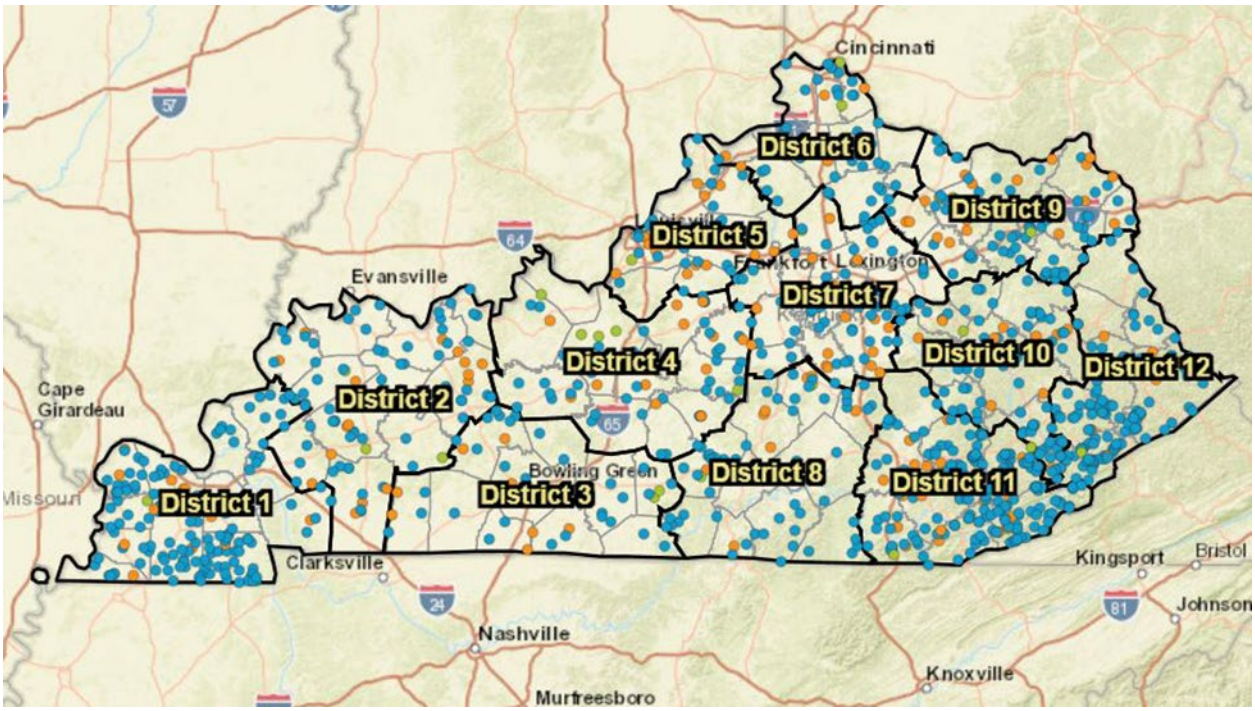
Bridging Kentucky – Statewide Bridge Bundling Program

Agency Name:	Kentucky Transportation Cabinet (KYTC)
Location:	Statewide
Project Delivery Method:	Design-bid-build (D-B-B), design-build (D-B)
Procurement Method:	Low bid, best value
Total Project Cost:	More than $700 million over 6 years (2019 – 2024)
Funding Source:	Federal and State (80/20)
Construction Schedule:	2019 – 2024
Project Description:	Like many States, Kentucky has struggled to keep up with needed maintenance and replacement of infrastructure due to limited revenues for transportation. Bridging Kentucky is a KYTC program to manage the rehabilitation or replacement of State, county, and municipal bridges throughout the Commonwealth. Figure 12 shows the distribution of bridges in the program and Table 14 provides a summary. With a focus on improved safety and mobility, the Bridging Kentucky program team has evaluated more than 1,100 structures in all of Kentucky's 120 counties and identified more than 1,000 bridges meeting the program's criteria. They are continuing to monitor and evaluate bridges to prioritize needs. The program is addressing bridges with the most pressing needs over 6 years (2019 – 2024). To make an immediate impact, the focus is on rehabilitation of bridges first, restoring them quickly with structural improvements that will add decades to their life. Bridges that are too deteriorated to be restored will be replaced. KYTC is bundling bridges by location and project type. Most bundles are being bid as traditional D-B-B projects and are kept small with 2 to 13 bridges per bundle to ensure they are inclusive of smaller contractors. Time frames for bundles are adequate to allow the bridges to be constructed in series so that multiple crews are not required to do the work. Consultants are also being used to complete designs in bundles. KYTC is also replacing 106 bridges in a large D-B bundle. These bridges are in 21 Eastern Kentucky counties. "This design-build project addresses a significant need to improve structures in Eastern Kentucky," said Adam Knuckles, KYTC's project

manager for the Eastern Kentucky D-B project. "This is a heavy concentration of bridges in a part of the State with limited transportation options. By having one team plan and complete construction of all these bridges, we expect improved coordination and reduced impacts on travelers during construction."

KYTC has a program manager for the Bridging Kentucky program and has also acquired the services of a consultant program manager to assist with managing the bundles.

Project Website: https://bridgingkentucky.com/bridges/



Source: Kentucky Transportation Cabinet

Figure 12. Map of Bridging Kentucky project locations.

Table 14. Bridging Kentucky program summary.

PROGRAM DETAILS	DESCRIPTION
Program Goals	The goal for bundling contracts is to reduce the number of bridges in poor condition as quickly as possible.
Bridge Selection Criteria	Bridge length over 20 feet and in poor condition.
Delivery and Procurement Method	D-B-B low bid and D-B best value
Funding Sources/Financing Strategy	Federal and State (80/20)
Environmental, Right-of-Way, and Utility Considerations	Completed by KYTC before advertisement. Some locations do not have environmental, right-of-way, or utility involvement.
Program Risks	D-B-B Bundles: Typical D-B-B contract. Risk on the owner. D-B Contract: Risk is primarily on the contractor.
Owner Management/Quality Assurance	D-B-B Bundles: Typical D-B-B contract. D-B Contract: Quality assurance/quality control and construction inspection are the responsibility of the D-B team.
Stakeholder Communication	Communication is the same as any other project. For the D-B contract, the D-B team is responsible for communication with the affected community.

DelDOT I–95 Pavement and Bridge Bundle

Agency Name:	Delaware Department of Transportation (DelDOT)
Location:	City of Wilmington, New Castle County
Project Delivery Method:	Construction manager/general contractor (CM/GC)
Procurement Method:	Guaranteed maximum price
Total Project Cost:	$165 million (budgeted)
Funding Source:	Federal and State (80/20)
Construction Schedule:	Spring 2021 – Summer 2023
Project Description:	DelDOT's Rehabilitation of I–95 from I–495 to North of the Brandywine River Bridge Project included rehabilitating 19 bridges and 3.5 centerline miles of interstate highway with a current annual average daily traffic (AADT) of about 100,000. This predominantly four-lane corridor runs through Wilmington and is a major commuter route into the city. Built in the 1960s, the interstate is now over 50 years old and in need of significant repairs. There is deterioration of all structural elements of both the elevated and at-grade portions of the highway. Bridge bearings, expansion joints, and decks need replacement. Supporting columns and abutments need repairs. Replacement of all concrete barriers, guardrails, sign structures, signage, and lighting assets are necessary given their age and condition. Necessary improvements include reconfiguration of the I–95 Southbound on-ramps from 2nd and Jackson Streets to eliminate documented high crash locations caused by a merge on the ramps followed by an acceleration lane of inadequate length. DelDOT's initial identification of work necessary to keep I–95 through Wilmington in a state of good repair came predominantly from comparing its asset condition inspections to performance goals for various asset inventories and its safety goals. Pursued as stand-alone projects, the work would have required 19 bridge rehabilitation projects, at least 1 major pavement rehabilitation project that would include guardrail replacements, at least 1 sign structure replacement project, at least 1 roadway lighting replacement project, and 1 ramp reconstruction project. That adds up to 23 separate projects all identified as urgent needs. Several were already funded through their respective programs in the DelDOT STIP: bridge preservation, intersection safety, and pavement rehabilitation. The ramp reconstruction, sign structures,

and lighting replacements were unfunded. See Table 15 for a project summary.

Simultaneous identification of the 23 separate projects made bundling the obvious choice to complete this work, as it was not feasible to procure the work separately. Bidding the 23 projects separately would have resulted in overlapping maintenance of traffic (MOT) setups, conflicting construction phasing, exposure to contractor delay claims, extreme disruption to traffic, and community backlash. The deteriorated condition of the various assets also made it impossible to spread the work out over time to avoid these impacts. Given the scope of the repairs needed, the urgency to complete them within 5 years, and the potential for impact on commuters and the city of Wilmington, DelDOT decided to address the rehabilitation of the corridor as one bundled project.

Given the size of the bundle, it now required listing in the statewide transportation improvement program (STIP). Except for the ramp reconfiguration, none of the other 22 projects would have warranted listing if built as a stand-alone project because each was of limited scope focused on preserving or replacing existing assets. When bundled, however, they amounted to a $165 million project consuming over 30 percent of DelDOT's annual capital program, which becomes a significant project worthy of listing. It also warranted a value engineering study and development of a financial plan. These requirements added complexity to project development, but bundling was still deemed the best path forward.

Citizens understood quickly what a bundled project meant to their daily commute and potential impact on Wilmington businesses. To gain their support, DelDOT developed a comprehensive public outreach strategy including a community advisory group, a webpage, public workshops, project videos with three-dimensional animated visualizations of the construction phasing and timing, and a community liaison assigned to handle questions and complaints during construction. DelDOT emphasized it was making data-driven decisions based on the preservation strategies in its asset management plans, which optimize the use of tax dollars. The agency also collected origin-destination data and off-site turning movement counts and predicted logical diversion routes through the city during construction, all to minimize community impacts.

Several mitigation projects were performed in advance of the main I–95 rehabilitation, including improving capacity at predicted bottlenecks along diversion routes and paving the predicted traffic

diversion routes. Mitigation strategies included monitoring traffic and pavement conditions during construction on the diversion routes with the understanding that DelDOT would rehabilitate those routes damaged by increased traffic once the project was complete.

DelDOT's public outreach strategy included sharing the key goals of the project early and often. Promising to make repairs that extended the service life of the corridor another 30 years and improving the operational efficiency of the highway were major selling points. The agency also promised to limit long-term lane closures during construction on I–95 to a maximum of 2 years while maintaining at least one lane in each direction at all times, with the potential exception of major traffic phase shifts. Maintaining access in and out of the city was a major element of gaining community support for the project.

Another major obstacle to bundling came from the Delaware contracting community. A project of the size and scope in the proposed bundle was largely beyond the bonding capacity of many local road and bridge builders. Politically influential, these stakeholders made a case to divide the work into smaller contracts they could compete for and, in turn, support the local economy by creating and/or sustaining jobs for construction workers, material suppliers, and the many other businesses that service the industry. DelDOT was able to break out major portions of the work such as the ramp reconstruction (which included 2 of the 19 bridges), the sign structure replacements, the diversion route paving, and the intersection improvement projects on the diversion routes that eliminated bottlenecks in advance of the I–95 work. These breakout projects were possible while still preserving the goal of keeping the I–95 MOT together under the control of one contract. It took considerable negotiation and several iterations of potential breakouts, with proposals offered by each side. In the end, a solution was found that minimized the potential impacts as stated above.

Figure 13 provides a map of the project area. Bundling so much work into one corridor project required a comprehensive look at the optimum means and methods for construction. Designers worked diligently on a plan but had to make assumptions as to how a contractor would build the project. They realized early on that the form of procurement had the potential to significantly improve the chances of project success, especially those methods that involve the contractor during the design phase. The decision to use the CM/GC procurement method gave the project team the benefit of contractor input into development of the construction phasing

plans and the contractual mechanisms that would encourage minimization of major traffic disruptions. The CM/GC contractor's role became one of offering strategies to minimize traffic congestion and proposing ways to complete the project faster than what would otherwise be proposed in a conventional design-bid-build procurement. The contractor was also expected to play a significant role in the public outreach efforts during design and through the construction phase.

Project Website: DelDOT Projects Portal

Original Photo: © 2020 Google® (see Acknowledgments section). Source: FHWA

Figure 13. DelDOT project limits map.

Table 15. DelDOT I–95 pavement and bridge bundle summary.

PROGRAM DETAILS	DESCRIPTION
Program Goals	The goal is to extend the service life of the existing asset by 30 years with minimal disruption to the affected community.
Project Selection Criteria	Projects in close proximity. Similar items of work. Overlapping MOT without project bundling. Reduced total costs. Reduced time to deliver the improved asset.
Delivery and Procurement Method	CM/GC, guaranteed maximum price
Funding Sources/Financing Strategy	Federal and State (80/20)
Environmental, Right-of-Way, and Utility Considerations	Completed by DelDOT before advertisement.
Program Risks	Typical construction phase risk to owner and contractor is reduced via CM/GC by having the builder at the table during the design phase. Risk of community impacts and political backlash is reduced by project bundling approach. Other types of risk are unchanged.
Owner Management/Quality Assurance	Contractor involved in design review. Inspection performed by DelDOT.
Stakeholder Communication	This project is using enhanced communication tactics to remain in constant contact with the affected community, including forming a community advisory group and requiring contractor participation through the construction phase.
Primary Obstacle to Bundling and How It Was Overcome	The primary obstacles were caused by the size of the bundled project, which generated concerns over the potential impacts to commuter traffic into and through Wilmington as well as the perception that local contractors would be cut out of the work. The CM/GC procurement method was used as a key component of overcoming concerns regarding construction phasing and disruption to traffic. Developing prerequisite projects built in advance of the I–95 work, as well as breaking out portions of the work itself, overcame the concerns raised by the local contracting community because it carved out contracts of significant value within their bonding capacity and ability to compete.

INDOT Project Bundling Program

Agency Name:	Indiana Department of Transportation (INDOT)
Location:	Statewide
Project Delivery Method:	Design-bid-build (D-B-B)
Procurement Method:	Low bid
Total Project Cost:	N/A – Entire program is evaluated
Funding Source:	Federal/State
Construction Schedule:	N/A – Entire program is evaluated
Project Description:	INDOT examined the effects of contract size and other factors on the cost savings that can be achieved by bundling. Researchers used 9 years of data from 1,997 bridge projects delivered via 715 INDOT contracts. The results confirmed and documented the benefits of bundling and produced models INDOT can use to select the most appropriate projects to bundle in the future. The INDOT study investigated several factors affecting project bundling costs, including project size, bundle size, bidding market conditions, and the degree to which bundled projects were similar. Its bundling efforts have saved the agency over 7 percent when compared to historical non-bundled pricing. The following is an abridged version of the researchers' findings. **ECONOMIES OF SCALE:** A decline in unit costs as project size increased was documented for all project types analyzed. This was true for both single- and multiple-project contracts. **ECONOMIES OF BUNDLING:** A reduction in cost per project as bundle size grew was found for all bridge project types and for most traffic, small structure, and miscellaneous project types. However, for road project types, a reduction in project cost due to bundling was found for four certain types of road projects, but not others. The conclusion was that similar road work project types can benefit from bundling. **ECONOMIES OF COMPETITION:** Having more bidders lowers costs for most bridge projects, but larger contracts can discourage small firms from bidding. This can lead to less competition and, therefore, higher unit costs. Researchers modeled the relationship between market competition and contract size using both deterministic and probabilistic methods. According to

the probabilistic model, the average number of bidders tends to be highest when two to four projects are bundled.

PROJECT SIMILARITY: The degree to which projects within a bundle are similar was identified as an important factor for reducing project cost, especially for road work. Researchers measured project similarity using statistical models based on the pay items included in the contract. They verified that project types in the same work category are better candidates for bundling compared to projects in different work categories. Also, bundling projects with different road classification affected success. Mixing interstate with non-interstate work did not result in as much savings as projects of all interstate or all non-interstate. Proximity also played a major factor as projects more than 25 to 30 miles apart resulted in limited to no savings.

MAINTENANCE OF TRAFFIC (MOT) COST: MOT can be a major component of project cost. The study found that project bundling could generally reduce MOT cost for most road, traffic, bridge, and small structure work types. Of all work categories, road work was found to benefit the most from project bundling in terms of MOT cost savings.

FUTURE STRATEGIES: INDOT's past project bundles were frequently based on combinations of work categories, such as bridges with road work, traffic with road work, bridges with traffic and road work, and bridges with small structures work. Commonly combined project types included intersection improvements with traffic signals, new bridges with new road construction, and bridge replacement with bridge deck overlay.

The study's recommendations for future bundling strategies included using the statistical models developed to identify projects most suitable for combining into multiple-project contracts. In addition, patterns found in the study can be used to guide the number of projects selected for multiple-project bundles. For other examples, see Table 16 and Figure 14.

The findings can also be used as a guide to support project scheduling decisions. For example, a certain collection of individual projects may yield significant cost savings for INDOT, but the locations of the projects may create unacceptable disruptions in traffic.

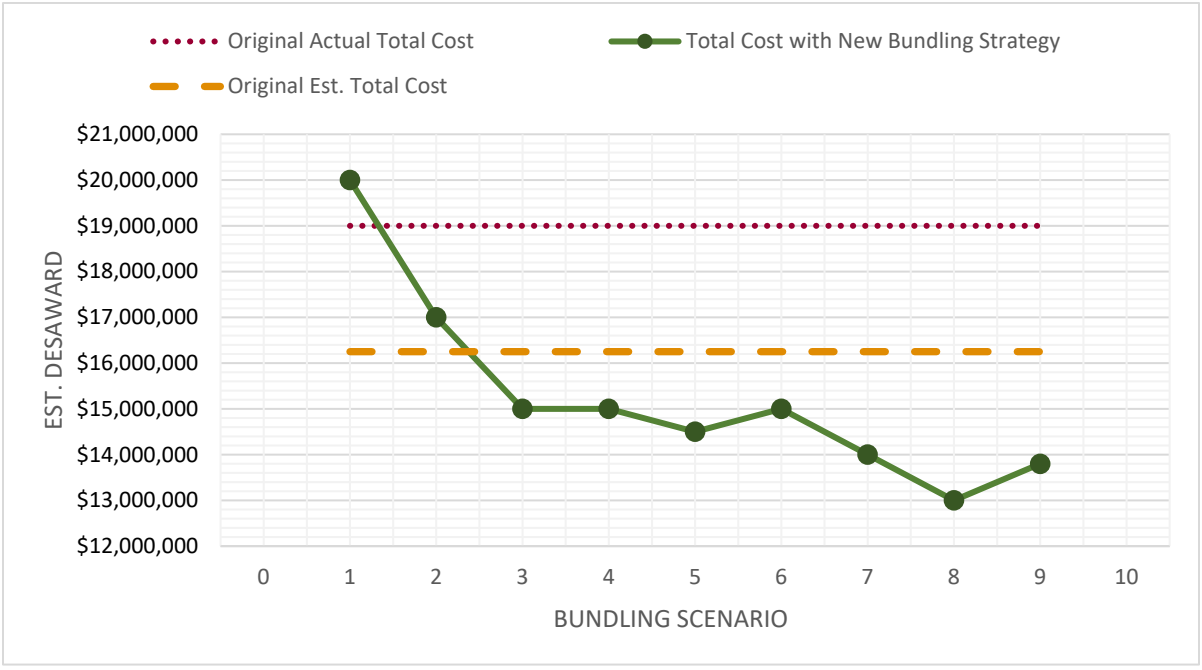
INDOT has developed business rules for bundling more strategically during early project programming. This institutionalizes the process to allow for greater economies of scale

throughout project delivery. As INDOT bundles more projects, the related databases will continue to grow, as well as evidence concerning which bundles saved money and which did not.

Project Study Website: https://docs.lib.purdue.edu/jtrp/1674/

Table 16. Example of INDOT bundling optimization for 19 projects.

Scenario	Number of Projects	Estimated Number of Bids	Estimate of Project Award
1. All Projects Unbundled as Separate Contracts	19	13 each	$20,117,716
2. Four Contracts Bundled Randomly	3+3+6+6	9+9+7+7	$17,177,400
3. Four Contracts Bundled by Project Similarity	3+3+7+6	9+9+6+7	$15,061,743
4. Three Contracts Bundled Randomly	6+7+6	7+6+7	$15,193,676
5. Three Contracts Bundled by Project Similarity	6+7+6	7+6+7	$14,481,562
6. Two Contracts Bundled Randomly (unbalanced)	6+13	7+4	$14,985,185
7. Two Contracts Bundled Randomly (balanced)	10+9	5+5	$14,195,652
8. Two Contracts Bundled by Project Similarity	6+13	7+4	$13,041,827
9. Bundle All Projects into One Contract	19	2	$13,677,940



Source: Indiana DOT

Figure 14. Effects of bundle contract size and other factors on cost savings.

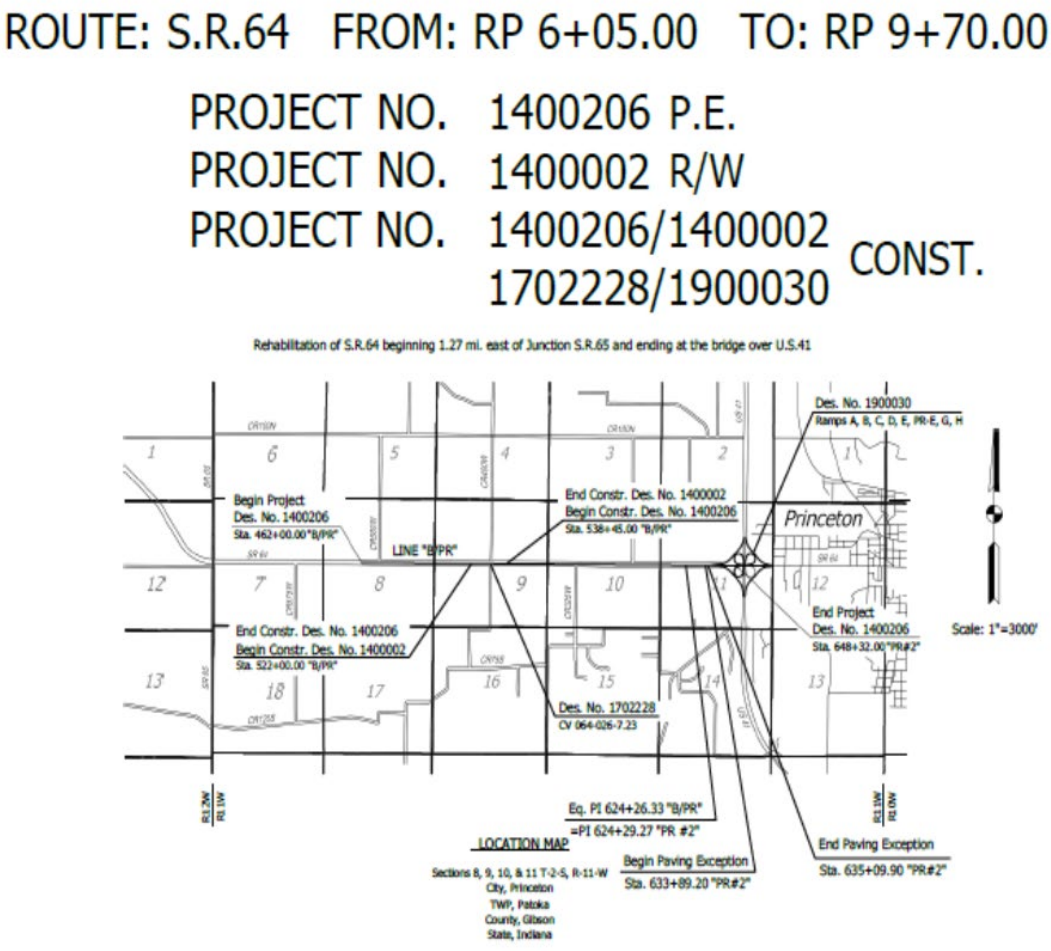
INDOT Pavement Project Bundle R-37841

Agency Name:	Indiana Department of Transportation (INDOT)
Location:	State Route (SR) 64 from 1.29 miles east of west junction SR 65 to 2.38 miles west junction U.S. Highway 41
Project Delivery Method:	Design-bid-build (D-B-B)
Procurement Method:	Low bid
Total Project Cost:	$7,451,703.72
Funding Source:	Federal/State
Construction Schedule:	Intermediate completion date of 11/30/2020, with final construction completion date of 06/05/2021.
Project Description:	INDOT project bundle R-37841 is a part of its efforts to bundle projects effectively at the programmatic level. For this bundled contract, which is in Gibson County, IN, on SR 64 near the town of Princeton, the projects were combined based on location to prevent working in the same area multiple times. Instead, work types including adding auxiliary, acceleration, and deceleration lanes; performing hot-mix asphalt overlays (structural and preventive maintenance); and replacing small structures and drains were all combined under one contract. The cost savings for this project are primarily attributed to economies of scale with the additional work in one contract in the same vicinity and efficiencies of work with combined phasing of the work and maintenance of traffic (MOT) setups. In addition to cost savings, there were time savings in construction duration in the area. The work was completed in two construction seasons (2019 and 2020), compared to an anticipated completion date of 2022 with letting separate contracts. Letting the work in separate contracts would have required additional coordination with potentially multiple contractors or letting the work in sequence. Individually, each of these projects was being developed with the D-B-B methodology, so INDOT combined the contracts and let them as one D-B-B contract. Design-build was not considered. Two specific crossroads along SR 64 were part of the bundle. Project number 1900030 involved work on the U.S. 41/SR 64 loops and ramps apart from the SR 64 eastbound to U.S. 41

northbound loop, which was completed previously using an indefinite delivery/indefinite quantity contract for its repairs. The other, project number 1400002 on SR 64 and County Road 400, was a traffic safety intersection improvement. This project involved adding turn lanes to prevent or at least lessen crashes at this location. See project map in Figure 15 and a summary in Table 17.

INDOT has developed business rules for bundling more strategically during early project programming. This institutionalizes the process to allow for greater economies of scale throughout project delivery. As INDOT bundles more projects, the related databases will continue to grow, as well as evidence concerning which bundles saved money and which did not.

Project Website: N/A



Source: Indiana DOT

Figure 15. Pavement projects bundled based on location.

Table 17. INDOT pavement project Bundle R-37841 summary.

PROGRAM DETAILS	DESCRIPTION
Program Goals	The program goal is to bundle projects strategically and optimally to reduce costs and increase the amount of work that can be completed within the budget.
Project Selection Criteria	Geographical location of work.
Delivery and Procurement Method	D-B-B, low bid
Funding Sources/Financing Strategy	State and Federal
Environmental, Right-of-Way, and Utility Considerations	Environmental, right-of-way, and utility coordination were completed before advertisement.
Program Risks	Typical D-B-B contract. Risk on the owner.
Owner Management/Quality Assurance	Typical D-B-B contract. Construction inspection performed by INDOT.
Stakeholder Communication	INDOT worked with its contractor community to build support for the program. Both INDOT and the local public agency involved conducted stakeholder communication at the project level.
Primary Obstacle to Bundling and How It Was Overcome	The primary obstacle to INDOT as it progressed the program was to demonstrate positive results and continue to improve it. Through research and data analysis, INDOT found ways to optimize bundles to maximize savings, proving that bundling saves money and allowing it to complete more projects. INDOT conducted a significant amount of communication and negotiation with stakeholders on the phasing of the project, specifically coal mines, a power-generating station, and the city of Princeton.

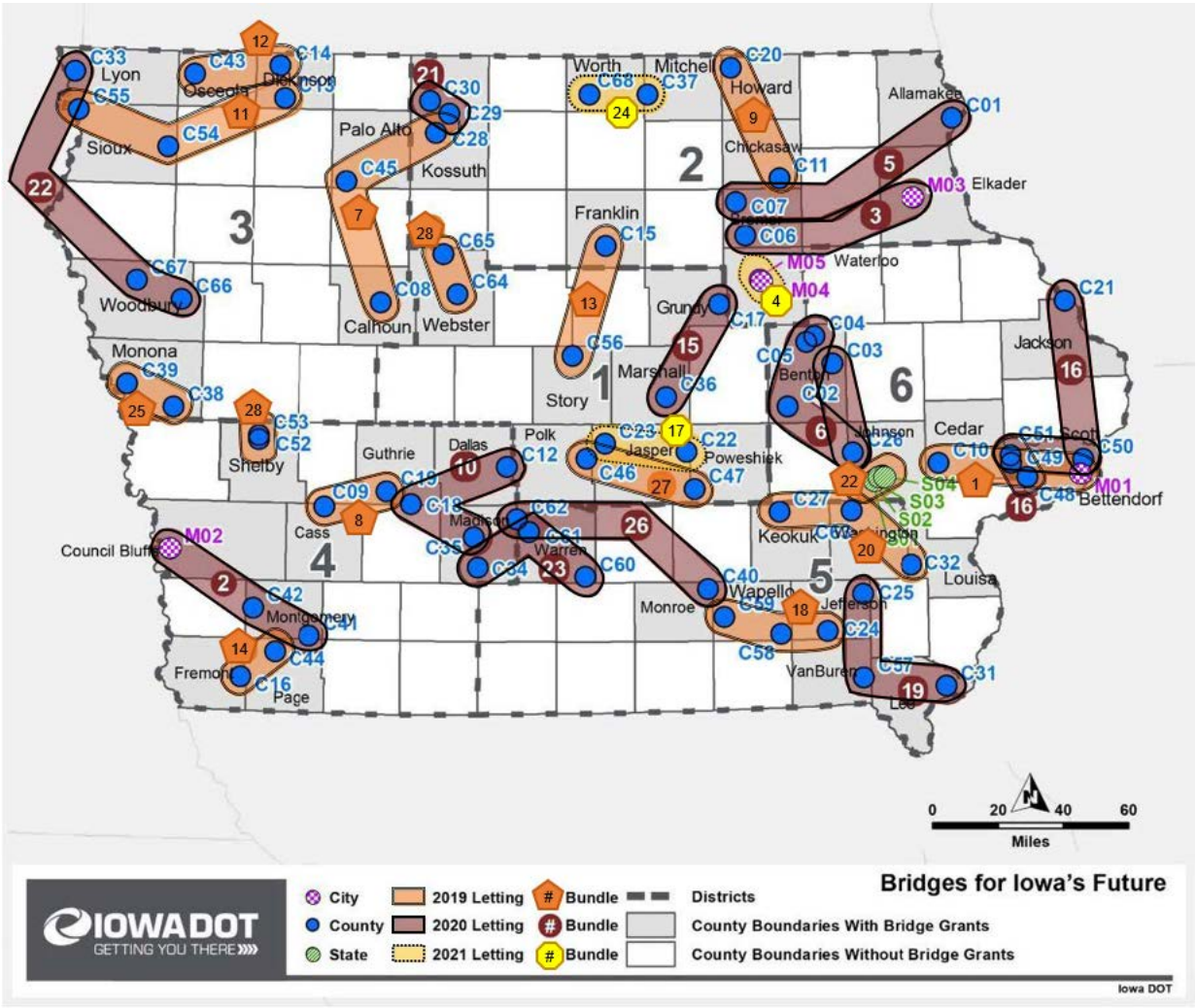
Iowa Competitive Highway Bridge Program (CHBP)

Agency Name:	Iowa Department of Transportation (Iowa DOT)
Location:	Statewide
Project Delivery Method:	Design-bid-build (D-B-B)
Procurement Method:	Low bid
Total Project Cost:	$61.2 million ($33.4 million from FHWA CHBP Award)
Funding Source:	CHBP award plus Federal-aid swap, resulting in net zero for local public agencies (LPAs).
Construction Schedule:	Project letting schedule is January 2020 through September 2021 (a CHBP grant deadline).
Project Description:	In 2018, Iowa reported having 4,675 bridges in poor condition. Of these, 4,632 were on the county and city system. The State's LPAs had struggled to maintain their bridge inventory due to a lack of resources. When FHWA introduced the CHBP, which set aside $225 million to replace and rehabilitate bridges in 25 rural States (defined as less than 100 people per square mile), it required candidate projects to demonstrate cost savings through bundling two or more bridges (83 FR 45176). Although Iowa DOT had been reluctant to use bundling in the past, the agency applied to the CHBP seeking $45.9 million (75 percent of the $61.2 million construction cost) and was granted $33.4 million, the largest award to any State. Iowa DOT's Local Systems Bureau is leading the bundling effort, which involves a coalition of 50 agencies. The program, which has garnered letters of support from over 25 stakeholders, including politicians, contracting associations, county associations, and planning commissions, is bundling 77 bridges in 30 contracts of 2 to 5 bridges each. Of the 77 bridges, 4 are State owned, 68 are county owned (45 different counties), and 5 are municipal bridges (4 cities). Table 18 provides a program summary. Bridges were chosen for the program using data-driven analysis. To be selected, bridges had to be in poor condition, have an average daily traffic (ADT) count of 100 or more, be less than 150-feet long, be previously programmed, and go through a National Environmental Policy Act (NEPA) prescreening. The emphasis of

these criteria was on selecting priority bridges with project readiness.

Bridges are bundled by geographic proximity, bridge type, and year they will reach construction. As shown on the map in Figure 16, some bundles stretch across as many as three agencies. Iowa DOT has agreements with all participants. The agencies determine the contracting authority for each bundle. Designs are completed by the local agency, but the Iowa Standard Bridge Plans are used where possible, which includes most county bridges. Contracts are bundled and procured by Iowa DOT, and construction is administered by each agency, with the contracting authority being the lead agency.

Project website: https://iowadot.gov/local_systems/



Source: Iowa DOT

Figure 16. Iowa DOT bundled bridges for its CHBP program by proximity, bridge type, and expected year of completion.

Table 18. Iowa Competitive Highway Bridge Program summary.

PROGRAM DETAILS	DESCRIPTION
Program Goals	The goal for bridge bundling contracts is to qualify for CHBP funding and reduce the number of bridges in poor condition as quickly as possible.
Project Selection Criteria	Selected bridges met the following criteria: • Over 100 ADT • Less than 150 feet long • Poor condition • Previously programmed (project readiness) • National Environmental Policy Act prescreening (project readiness)
Delivery and Procurement Method	D-B-B, low bid

Funding Sources/Financing Strategy	Total cost of program is $61.2 million ($33.4 million from FHWA CHBP award). Funding used CHBP award plus Federal-aid swap for net ***zero*** for LPAs.
Environmental, Right-of-Way, and Utility Considerations	Environmental, right-of-way, and utility coordination is completed before advertisement.
Program Risks	Typical D-B-B contract. Risk on the owner.
Owner Management/Quality Assurance	Small D-B-B Bundles: Typical D-B-B contract. Construction inspection performed by each LPA bridge owner.
Stakeholder Communication	Iowa DOT sought a coalition of stakeholder support before applying for the CHBP funds. Its Local Systems Bureau is leading the coordination of over 50 agencies. LPAs are conducting stakeholder communication at the project level.
Primary Obstacle to Bundling and How It Was Overcome	The bundling program includes 77 bridges with 50 different owners. Coordination among LPAs was imperative. Iowa DOT took the lead for the program, organizing the bundles and executing agreements with each LPA, but the participants of each bundle decided among themselves who would be the lead contracting agency. Quality control for each bridge within the project fell to the LPA responsible for that bridge. Using Iowa DOT bridge standards helped with consistency in the program.

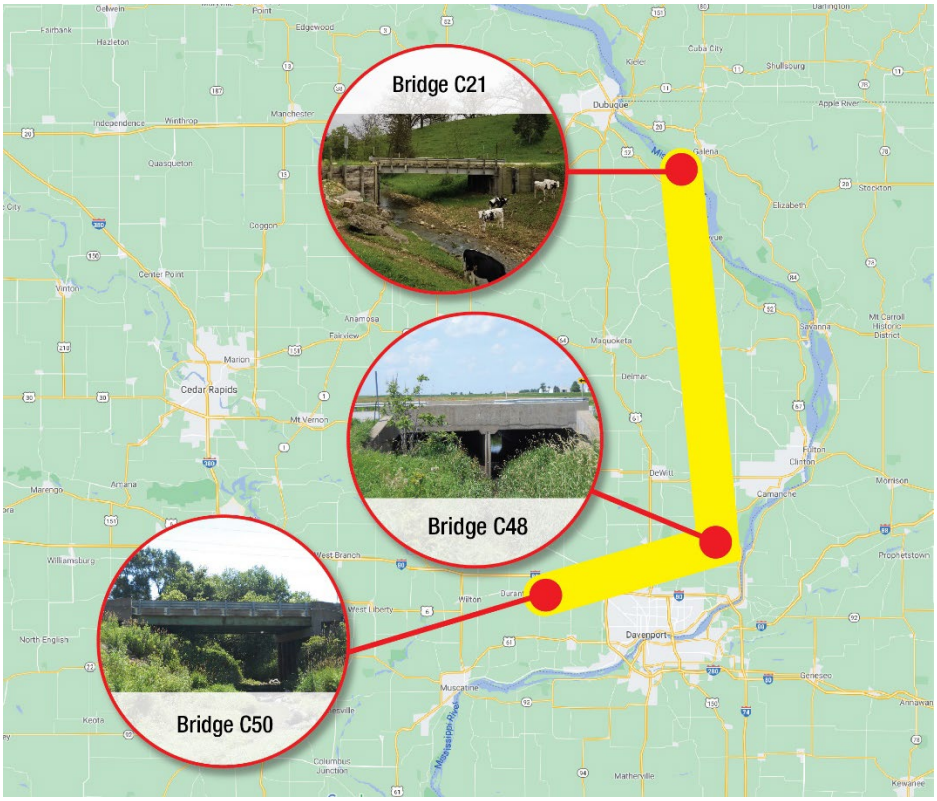
Iowa Competitive Highway Bridge Program (CHBP) – Bridge Bundle #16 Scott and Jackson Counties

Agency Name:	Scott County (Contracting Authority), Jackson County
Location:	Scott and Jackson Counties
Project Delivery Method:	Design-bid-build (D-B-B)
Procurement Method:	Low bid
Total Project Cost:	$1,264,026.56 apparent low bid
Funding Source:	CHBP award plus Federal-aid swap of Highway Bridge Program (HBP) funds for net ***zero*** for LPAs.
Construction Schedule:	Jackson County (Bridge C21) – Late start date 8/17/2020, 45 working days Scott County (Bridge C48) – Late start date 8/16/2021, 45 working days Scott County (Bridge C50) – Late start date 8/23/2021, 40 working days
Project Description:	This bridge bundle project is identified as Bundle #16 in the Iowa CHBP. All projects in the CHBP were bundled based on geographic proximity, bridge type, and year the project was to be completed. The projects in Bundle #16 are all box culverts in close geographic proximity. Table 19 provides a project summary. As shown in Figure 17, the three bridges in the bundle stretch across two counties in eastern Iowa. Scott County and Jackson County are partners in this project, with Scott County acting as the contracting authority as owner of two of the three bridge replacements in the bundle. Each agency will inspect its own project(s). Iowa DOT reviewed all plans and was involved in project development through letting. It also let the project and concurred with the award. Jackson County's project is a twin 14 × 8 × 66-foot reinforced concrete box culvert with a 30-degree skew on an unpaved road (Bridge C21). Scott County's projects are a twin 12 × 6 × 88-foot reinforced concrete box culvert with a 0-degree skew on a paved road (Bridge C48) and a single 10 × 8 × 86-foot reinforced concrete box culvert with a 15-degree skew on a paved road (Bridge C50).

Iowa DOT worked with the Associated General Contractors (AGC) of Iowa to have the most flexible contract periods possible. Late start dates were listed in the contract, but the contractor could begin work any time before that date. With the late start dates as far as a year away, contractors have the flexibility to use one crew or multiple crews, depending on their workload. Once they mobilize to a site, the clock begins and they still only have 40 to 45 working days to complete the work, thus protecting the contracting authority and traveling public from a bridge being torn out and allowed to sit without a crew working on it for multiple days or even an entire summer.

Bids were at 123 percent of the Engineer's Estimate but were still awarded based on guidance in an Iowa DOT instructional memorandum to LPAs. The higher prices are not thought to be due to bundling, but may be a result of several factors, including the slightly higher than normal amount of work, speculation of material prices due to the contract time extending into 2021, and uncertainty about the COVID-19 pandemic (bids were received in April 2020).

Project Website: N/A



Original image/map: © 2020 Google® (see Acknowledgments section). Photo and label source: Iowa DOT

Figure 17. Map of Iowa CHBP Bridge Bundle #16.

Table 19. Iowa Competitive Highway Bridge Program Bundle #16 summary.

PROGRAM DETAILS	DESCRIPTION
Program Goals	The goal for bridge bundling contracts is to qualify for the CHBP funding and reduce the number of bridges in poor condition as quickly as possible.
Project Selection Criteria	Meet the requirements for the Iowa CHBP Bundling Program • Over 100 in average daily traffic • Less than 150 feet long • Poor condition • Previously programmed (project readiness) • National Environmental Policy Act pre-screening (project readiness) For this bundle, bridge replacements are all concrete culverts in close proximity (Scott and Jackson Counties).
Delivery and Procurement Method	D-B-B, low bid
Funding Sources/Financing Strategy	$1,264,026.56 apparent low bid Funding used CHBP award plus Federal-aid swap for net ***zero*** for LPAs.
Environmental, Right-of-Way, and Utility Considerations	Environmental, right-of-way, and utility coordination is completed before advertisement.
Program Risks	Typical D-B-B contract. Risk on the owner. Timing for this contract gives flexibility to the contractor to lower the risk in bidding multiple bridges.
Owner Management/Quality Assurance	Small D-B-B bundles: Typical D-B-B contract. Construction inspection performed by each LPA bridge owner (Scott and Jackson Counties).
Stakeholder Communication	Iowa DOT sought a coalition of stakeholder support before applying for the CHBP funds. Its Local Systems Bureau is leading the coordination of over 50 agencies. LPAs are conducting stakeholder communication on a project level.
Primary Obstacle to Bundling and How It Was Overcome	The bundling program included 77 bridges with 50 different owners. Coordination among LPAs was imperative. Iowa DOT took the lead for the program, organizing the bundles and executing agreements with each LPA, but the participants of each bundle decided among themselves who would be the lead contracting agency. For this bundle, the lead agency is Scott County as the owner of two of the three bridges. Quality control for each bridge within the project fell to the LPA responsible for that bridge. Using Iowa DOT bridge standards helped with consistency in the program.

City of Oakwood, Georgia, Multi-City Pavement Bundling

Agency Name:	City of Oakwood
Location:	Oakwood, GA
Project Delivery Method:	Design-bid-build (D-B-B)
Procurement Method:	Low bid
Total Project Cost:	Combined project cost is $713,000. (Projects costs vary from year to year depending on participation.) $430,000 annually (Oakwood's budget for paving – not the combined amount.)
Funding Source:	1) State – Local Maintenance & Improvement Grant Program formula based plus a 30-percent match. 2) State/Local – Special Purpose Local Option Sales Tax 3) Oakwood General Fund
Construction Schedule:	N/A – This is an annual program.
Project Description:	The city of Oakwood, GA, owns and maintains roadway pavements that have a gross replacement value exceeding $21 million. To protect this investment, the city has a maintenance program that costs around 2 percent of the replacement value annually, or approximately $430,000. Like other small municipalities, it faces contracting challenges that result from low bid quantities, including low contractor bid participation (one to three contractors) and limited access to alternative paving methods (e.g., in-place recycling). As such, Oakwood set out to create a larger program by partnering with other small municipalities to bundle road projects, increasing material quantities to attract a higher number of contractors to compete for the work. The goals of this program are as follows: • Reduce costs of maintaining the pavement system. • Expand methods of treatment (e.g., in-place recycling). • Assist other municipalities with project selection and treatment. • Provide a single entity to issue task orders and receive billing. • Establish a realistic project plan that meets everyone's funding needs.

Although Oakwood is the lead agency, each participating municipality provides its list of roads to be included in the project with information on length and width of the roadways, work descriptions, and maps of the locations. Oakwood requests that each participant make their own assessments of the pavement conditions, but it has assisted some in the past, including making a recommendation for treatment. Once this information is submitted, Oakwood provides the participants with estimated bid quantities and asks that they verify and agree that the treatment method is correct, that the patching needs are clearly marked, that the asphalt type and thickness are correct, and that the type of stripping and lengths are correct. Once quantities have been tabulated, Oakwood provides each participant with an estimated cost based on the previous year's line-item bid prices. After all individual projects are approved and submitted, they are combined into one bid document. Figure 18 shows a roadway that was improved as part of the bundling program. Table 20 provides a project summary.

The pavement bundling program has resulted in higher contractor participation (increasing from one to three up to five to seven), access to alternative paving methods that usually require a minimum of 40,000 square yards to be cost effective, and better pricing. The following is an example of quantities driving pricing:

- Variable depth milling of 400 square yards in a solo project – bid amount $17.50 per square yard.
- Variable depth milling of 9,300 square yards in a joint project – bid amount $3.75 per square yard.

Some line items in bids are not as extreme as the example provided, however, quantifying cost savings is difficult as materials cost and current work demands have increased every year.

Throughout the process, communication has been the key to success when multiple agencies are involved. Having a simple intergovernmental agreement (IGA) is also helpful. Also, all participants work to ensure that they provide accurate information and that they understand the issuing of task orders and the billing process. Oakwood additionally recommends that the contractor verify all quantities and work prior to beginning.

Due to the success of the program, Oakwood is currently working with its county to expand it. The city wants to include the words "and or other local municipalities" in the county's bid packages so that smaller municipalities can benefit from the county's line item bid prices meeting State and Federal bid requirements.

Project Website: N/A

Source: City of Oakwood

Figure 18. Oakwood paving project before and after resurfacing and safety improvements.

Table 20. City of Oakwood multi-city pavement bundling program summary.

PROGRAM DETAILS	DESCRIPTION
Program Goals	The goal was to create a larger program by partnering with other small municipalities to bundle road projects, increasing material quantities to attract a higher number of contractors to compete for the work, lower costs, and expand methods of treatment.
Project Selection Criteria	Locations are chosen based on pavement condition assessments.
Delivery and Procurement Method	D-B-B contract: low bid
Funding Sources/Financing Strategy	1) State – Local Maintenance & Improvement Grant Program formula based plus a 30-percent match 2) State/Local – Special Purpose Local Option Sales Tax 3) Oakwood General Fund
Environmental, Right-of-Way, and Utility Considerations	Pavement rehabilitation projects typically do not have third-party involvement. If necessary, it is completed by municipalities before advertisement.
Program Risks	Owner risk is typical for D-B-B projects. Roadway resurfacing is primarily low risk.
Owner Management/Quality Assurance	Quality assurance, quality control, and construction inspection are the responsibility of each municipality.
Stakeholder Communication	Each municipality is responsible for communication with the affected community.
Primary Obstacle to Bundling and How It Was Overcome	The city of Oakwood did not have enough projects on its own to make a sizable bundle. By partnering with nearby municipalities, it was able to create bundled projects large enough to take advantage of economies of scale and expand the available methods of treatment.

Historic Hudson Valley Steel Truss Bridges, New York State

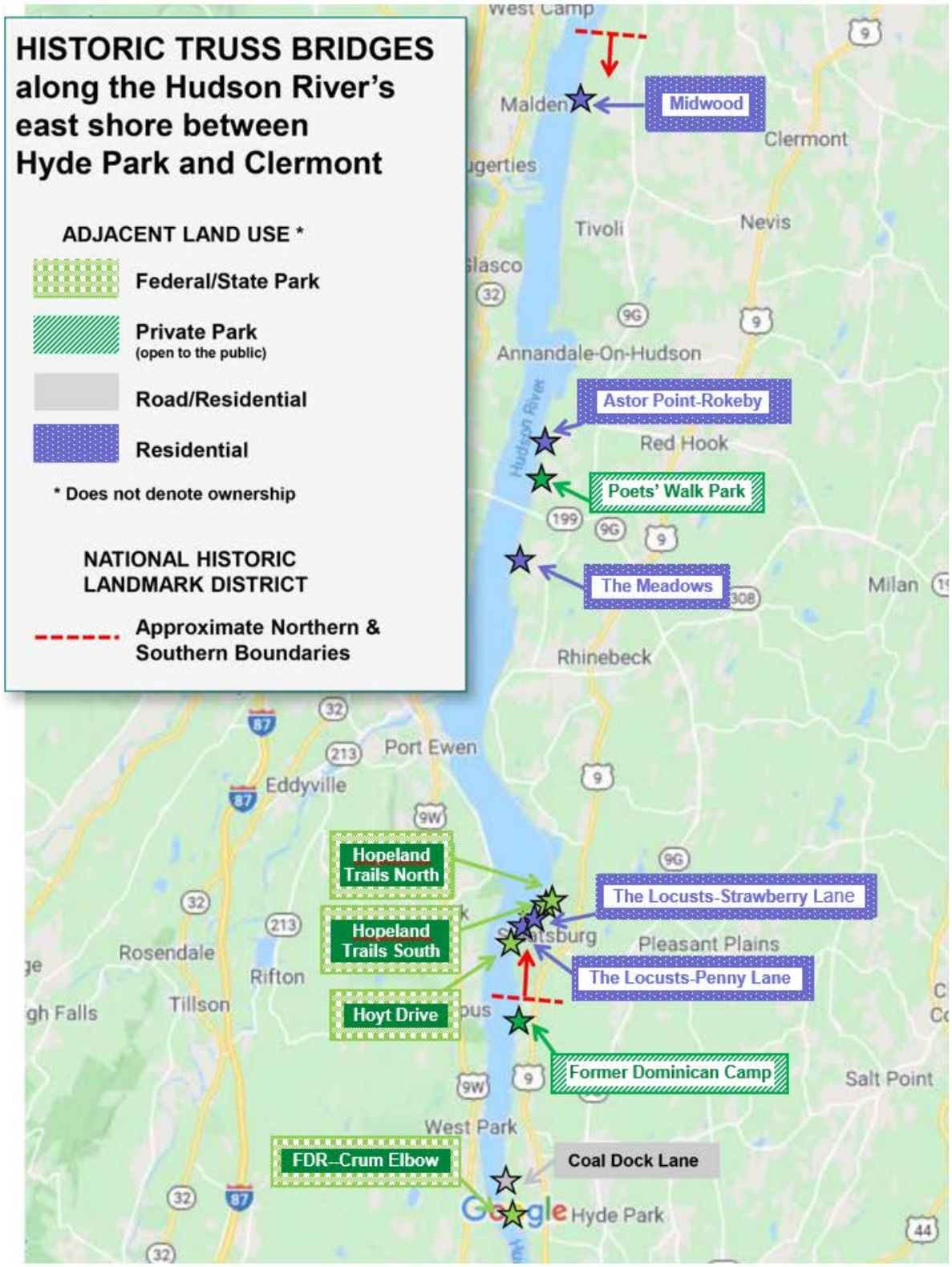
Agency Name:	Scenic Hudson, Inc.
Location:	Dutchess and Columbia Counties, NY
Project Delivery Method:	Construction manager/general contractor (CM/GC) anticipated
Procurement Method:	Best value
Total Project Cost:	$6 million – $7 million
Funding Source:	Mixture of public and private grants and funds
Construction Schedule:	Summer 2021 – Fall 2022
Project Description:	The project consists of 12 historic steel pony and through truss bridges built at the turn of the 20th century along a 27-mile river/rail corridor between Hyde Park, NY, (Dutchess County) and Clermont (Columbia County), NY. The map in Figure 19 shows the locations of all 12 bridges, and Figure 20 and Figure 21 provide images of two. Table 21 provides a program summary. In March 2020, Scenic Hudson, Inc. issued the 2020 Hudson River Access Plan (HRAP). The plan provided recommendations to improve river access for pedestrians and cyclists on the east side of the Hudson River between Poughkeepsie, NY, and Rensselaer, NY, where CSX owns and Amtrak operates a rail line that severely limits the public from accessing the Hudson River shoreline. Pursuant to the HRAP's recommendations, the bundled bridge project will protect and repair these 12 historic steel truss bridges, which span Amtrak's Empire Corridor between Hyde Park and Clermont. Nine of the bridges are within the Hudson River National Historic Landmark District, and another is located adjacent to the Franklin D. Roosevelt National Historic Site, a National Historic Landmark. All are critically threatened with removal due to lack of maintenance. From a civil engineering perspective, to have a collection of steel truss bridges of this age is extremely rare and is part of the State's industrial age history. Once preserved under this bundled bridge project, the bridges will serve both as tangible examples of New York State's industrial design excellence and key access points for residents across the region to reach and experience the Hudson River. The 12 bridges are ideal for bundling, as they were all designed and constructed in the same time period and have similar lengths (80 to 100 feet) and design details, except for one through truss.

The needs of all the bridges are the same: new wood decks, steel repairs where water has collected over the years, and new safety appurtenances for safe passage of pedestrians and bicyclists. Some of the bridges need maintenance and emergency vehicle accommodation as well. Common repair details for all 12 bridges will be developed whenever possible. Individually, each bridge would be considered a small bridge project, but collectively, they create an ideal opportunity for economies of scale and innovative delivery, particularly considering that the bridges span two Amtrak tracks where speeds are between 75 and 90 miles per hour.

CM/GC, an alternative contracting method, is being considered for numerous reasons. The steel repair and restoration details for each bridge are similar, which will enable the owner and contractor to agree on typical repair details and develop a unit cost for each repair—this avoids the need to inspect bridges over high-speed trains twice (once for design, and again during construction).

Speed of design and construction is very important to all stakeholders working to try to save this unique collection of bridges before it is too late. Several stakeholders were involved in the 2009 adaptive reuse and reconstruction of the Poughkeepsie Railroad Bridge into Walkway Over the Hudson State Historic Park. Attracting over 600,000 annual visits, the award-winning "Walkway" is 1.25-mile-long cantilever truss bridge 4 miles south of the Crum Elbow-Franklin D. Roosevelt truss bridge. Crum Elbow is where Henry Hudson moored his ship, the Halfmoon, and came ashore in 1609. For the Walkway project, the owner/designer/contractor worked together from the early stages and agreed on repair details and unit costs. The same approach is proposed for the 12 bridges. A CM/GC approach would simplify the paperwork for all parties.

Project Website: N/A



Original image/map © 2020 Google® (see Acknowledgments section). Project labels and map key source: Scenic Hudson, Inc.

Figure 19. Locations of the 12 historic truss bridges bundled for repair.

Figure 20. Through truss bridge at the former Dominican Camp.

Figure 21. Pony truss bridge at the Franklin D. Roosevelt National Historic Site.

Table 21. Hudson Valley historic steel truss bridges program summary.

PROGRAM DETAILS	DESCRIPTION
Program Goals	The goals of this bundling project include: Saving and preserving a rare assemblage of 12 historic truss bridges. Utilizing bundling for cost efficiency. Minimizing impact to train operations. Enhancing access to the Hudson River for pedestrians and cyclists (six of the bridges are in public parks). By bundling, the project team is also able to optimize the funds being provided by multiple sources.
Project Selection Criteria	The bridges were selected due to their commonality (original design, age, historic significance, condition, and location) as identified in Scenic Hudson's 2020 Hudson River Access Plan and the 2021 Historic Steel Truss Bridges Cultural Resource Survey.
Delivery and Procurement Method	CM/GC project delivery method (anticipated) Best-value procurement method (anticipated)
Funding Sources/Financing Strategy	Total cost is estimated to be $6 million–$7 million. Funding sources will be a combination of private and public funds, as the bridges are located on a mix of Federal, State, public, and private lands, and many will connect to extensive trail networks.
Environmental, Cultural, Right-of-Way, and Utility Considerations	The Historic Steel Truss Bridges Cultural Resource Survey was conducted from fall 2020 to January 2021 in accordance with the New York State Office of Parks, Recreation and Historic Preservation and National Park Service standards. The survey was funded by the Preservation League of New York State and Scenic Hudson, Inc. Preserve New York is a signature grant program of the New York State Council on the Arts and the Preservation League of New York State (via support from the governor and the State legislature). It is anticipated that minimal environmental, right-of-way, or utility issues will be encountered.
Program Risks	While there is considerable public support and enthusiasm to restore these 12 bridges, determining the responsible party for ownership and maintenance of these bridges and their components remains a challenge due to changing railroad ownership since the bridges were originally built.
Owner Management/Quality Assurance	Consultant services.
Stakeholder Communication	Stakeholder coordination and communication started under the 2020 Hudson River Access Plan. Communication and coordination continued with a project-specific, 1-day charette in November 2021 with FHWA bundled bridge program experts in attendance. The communication process during construction will be part of the bundle contract(s).
Primary Obstacle to Bundling and How It Was Overcome	An array of owners—private, public, and not-for-profit—and uncertain ownership and maintenance responsibilities were an obstacle to bundling. Project proponents addressed this obstacle under the theory that the "whole is greater than the sum of its parts." All parties share a common desire to preserve these historic bridges. Scenic Hudson, a not-for-profit environmental organization that preserves, protects, and revitalizes land and communities in the Hudson River Valley of New York has facilitated the first step in this process, the development of a cultural resource survey. It is anticipated that due to Scenic Hudson's reputation in the region, stakeholders and interested parties will be rallied to take subsequent steps to save the bridges.

APPENDIX B. PROJECT GROUPINGS BY TYPE IN TRANSPORTATION IMPROVEMENT PROGRAMS

A sound planning strategy for project bundling is to review a statewide transportation improvement program (STIP), transportation improvement program (TIP), or capital improvement plan for opportunities to combine individual projects into a bundle (reviewing an agency's existing program for opportunities to bundle, as described in Chapter 1). For federally funded projects, 23 CFR § 450.218(j) allows grouping of projects that are not of appropriate scale for individual identification in a given program year. They may be grouped by function, work type, and/or geographic area using the applicable classifications under 23 CFR § 771.117(c) and (d) and/or 40 CFR part 93. Commonly known as the "c" and "d" lists, they include 43 cases in which projects are eligible for a categorical exclusion under the National Environmental Policy Act (NEPA) and, accordingly, may be grouped in the STIP. Examples of projects that may be grouped and represented as one line item in the STIP include pavement resurfacings, bridge rehabilitations, and safety improvements.

The following list is from 40 CFR § 93.126 – Exempt projects:

Safety

Railroad/highway crossing.
Projects that correct, improve, or eliminate a hazardous location or feature.
Safer non-Federal-aid system roads.
Shoulder improvements.
Increasing sight distance.
Highway Safety Improvement Program implementation.
Traffic control devices and operating assistance other than signalization projects.
Railroad/highway crossing warning devices.
Guardrails, median barriers, crash cushions.
Pavement resurfacing and/or rehabilitation.
Pavement marking.
Emergency relief (23 U.S.C. § 125)
Fencing.
Skid treatments.
Safety roadside rest areas.
Adding medians.
Truck climbing lanes outside the urbanized area.
Lighting improvements.
Widening narrow pavements or reconstructing bridges (no additional travel lanes).
Emergency truck pullovers.

Mass Transit

Operating assistance to transit agencies.
Purchase of support vehicles.

Rehabilitation of transit vehicles.
Purchase of office, shop, and operating equipment for existing facilities.
Purchase of operating equipment for vehicles (e.g., radios, fareboxes, lifts, etc.).
Construction or renovation of power, signal, and communications systems.
Construction of small passenger shelters and information kiosks.
Reconstruction or renovation of transit buildings and structures (e.g., rail or bus buildings, storage and maintenance facilities, stations, terminals, and ancillary structures).
Rehabilitation or reconstruction of track structures, track, and track bed in existing rights-of-way.
Purchase of new buses and rail cars to replace existing vehicles or for minor expansions of the fleet.
Construction of new bus or rail storage/maintenance facilities categorically excluded in 23 CFR part 771.

Air Quality

Continuation of ridesharing and van-pooling promotion activities at current levels.
Bicycle and pedestrian facilities.

Other – Specific activities that do not involve or lead directly to construction, such as:

Planning and technical studies.
Grants for training and research programs.
Planning activities conducted pursuant to titles 23 and 49 U.S.C.
Federal-aid systems revisions.
Engineering to assess social, economic, and environmental effects of the proposed action or alternatives to that action.
Noise attenuation.
Emergency or hardship advance land acquisitions (23 CFR § 710.503).
Acquisition of scenic easements.
Plantings, landscaping, etc.
Sign removal.
Directional and informational signs.
Transportation enhancement activities (except rehabilitation and operation of historic transportation buildings, structures, or facilities).
Repair of damage caused by natural disasters, civil unrest, or terrorist acts, except projects involving substantial functional, locational, or capacity changes.

APPENDIX C. ORGANIZATIONAL SELF-ASSESSMENT

Source: FHWA

Figure 22. Cover page of the Project Bundling Organizational Self-Assessment Tool.

APPENDIX D. PROJECT BUNDLING POLICY AND PROCESS CHECKLIST

Project Bundling Policy & Process Checklist			
Agency: Date:			
Brief description of goals and objectives for creating a project bundling policy and process:			
	Activity	Considerations	Action Steps
Policy Statement			
	Agency policy statement	• When to consider bundling • Priority • Reasons why, goals to achieve • Organization ownership • Work types	
Process			
	Planning process	• Early bundle development • Identify funding • Financing options • Work types • Geographic boundaries	
	Programing process	• STIP/TIP • Outreach • Alternative contracting method considerations	
	Environmental process	• Programmatic permits • Bundling applications • Outreach • Risk analysis	
	Preliminary design process	• Alternative contracting method considerations • Third-party coordination	

		• Outreach • Risk analysis	
	Final design process	• Bundling permits • Risk analysis • Work zone control	
	Construction process	• Staffing procedure • Risk analysis	
	Close-out, lessons-learned	• Feedback • Performance metrics • Policy and procedure improvements	

APPENDIX E. PROJECT BUNDLING RISK MANAGEMENT

In the project bundling context, risks include both threats to achieving project goals and opportunities to enhance them. Investing the resources to identify and assess those project-specific risks lays the foundation for a proactive project management plan and improves the likelihood of a successful project. Research has shown that both individual and organizational assessments of risk are fundamentally a function of perception (Murphy & Gardoni, 2006).

Risk and Risk Management Defined

Risk: the positive or negative effects of uncertainty or variability on agency objectives.

Risk Management: the cultures, processes, and structures directed toward the effective management of potential opportunities and threats.

(FHWA, 2012)

Classic risk perception theory maintains the magnitude of a given risk is a function of its potential impact and the intensity of the observers' fear of the given risk's impact (Castro-Nova et al., 2018). Fear of potential consequences is directly proportional to the level of uncertainty associated with the consequences' frequency of occurrence. The ability to gauge uncertainty is directly related to each analyst's experience with the specific risk. Thus, an expert familiar with a specific risk will perceive its potential impact differently than a non-expert, especially in terms of its manner and magnitude. For example, as experience with a new process increases, the perception of its risk decreases. In the current context, an agency, such as the Indiana Department of Transportation (INDOT), that is experienced with bundling will perceive the risk associated with the approach in a much different fashion than an agency that has never used it.

Formal risk assessment or risk analysis is often reserved for large, complex projects where the commitment of time and resources appears to justify the effort. However, once an agency has developed a risk register template and a standardized process for applying it, the resource demand drops to the point where it may prove cost-effective to perform risk analysis more routinely.

Formal risk analyses do not need to be data-driven, quantitative efforts. Qualitative risk analyses are usually enough to assess many of the types of projects what would become part of a bundle. Figure 23 provides an example of a risk matrix that can be used to conduct a formal qualitative risk analysis. In this case, the ranges shown in the figure would be used to assess the risks identified in the risk register. The result would be consolidated and used to develop a risk management plan for the bundled contract.

Representative Cost Impact Assessment Matrix						
		Cost Consequence				
		5	4	3	2	1
Probability	Scale	>25%	10% - 25%	3% - 10%	1% - 3%	<1%
	5 - > 70%	High	High	High	Medium	Low
	4 - 40% - 70%	High	High	Medium	Medium	Low
	3 - 20% - 40%	High	Medium	Medium	Low	Low
	2 - 5% - 20%	Medium	Medium	Low	Low	Low
	1 - 0% - 5%	Low	Low	Low	Low	Low

Representative Schedule Impact Assessment Matrix						
		Schedule Consequence				
		5	4	3	2	1
Probability	Scale	>365 days	120-365 days	30 - 120 days	7 - 30 days	<7 days
	5 - > 70%	High	High	High	Medium	Low
	4 - 40% - 70%	High	High	Medium	Medium	Low
	3 - 20% - 40%	High	Medium	Medium	Low	Low
	2 - 5% - 20%	Medium	Medium	Low	Low	Low
	1 - 0% - 5%	Low	Low	Low	Low	Low

Source: FHWA

Figure 23. Qualitative risk analysis example.

Project Bundling Risk Assessment Process

Risk identification and assessment starts in planning and carries through the life of the project. As risks are addressed or are not realized, they can be retired, making the project's risk register a living document. The assessment of risk should be made at every major project decision, starting with planning and carrying through programming, the environmental process, the project candidate selection process, and selection of a project delivery method and a procurement method, which are essentially risk allocation decisions. Risks should be assigned to the party in the best position to manage that risk. The agency can also approach this process looking for ways to share rather than shed risk, with the objective of increased cost and schedule certainty as early as practical. The traditional hard bid mentality of risk-shedding merely results in higher costs, delays, decreased quality, or disputes.

Both qualitative and quantitative formal risk analyses also serve as a communications tool with the project team and stakeholders. Risk assessments structure the dialogue necessary to determine the areas on which agencies can invest limited resources to achieve the greatest overall benefit to the bundled project. The process can be structured by first categorizing the risks that must be assessed by the source of the risk and then assigning specific risk to the appropriate category. A common set of general risk categories is as follows:

- Environmental risks
- Third-party risks
- Utility, right-of-way, and real estate risks

- Organizational risks
- External risks
- Geotechnical and hazmat risks
- Design risks
- Procurement risks
- Construction risks
- Operations and maintenance risks

Table 22 through Table 31 contain common high-level risks associated with each category, a potential response, and applicable practice from Table 2 through Table 7.

Table 22. Environmental risks.

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Delay in review of environmental documentation	T	• Educate. • Consider programmatic agreements. • Early coordination. • Bundle coordination. • Avoid.	11, 12, 13
Challenge in appropriate environmental documentation	T	• Educate. • Early coordination. • Bundle coordination. • Avoid.	11, 12, 13
Defined and non-defined hazardous waste	T	• Educate. • Early coordination. • Bundle coordination. • Avoid.	11, 12, 13
Environmental regulation changes	T	• Early coordination. • Develop plan to minimize impact.	11, 12, 13
Environmental impact statement required	T	• Early coordination. • Bundle coordination.	11, 12, 13
National Environmental Policy Act/ Section 404 permit merger process required	T	• Early coordination. • Bundle coordination. • Employ the five-dimensional project management (5DPM) guide, available from the second Strategic Highway Research Program (SHRP2 R10).	11, 12, 13
Environmental analysis on new alignments required	T	• Early coordination. • Bundle coordination.	11, 12, 13

Table 23. Third-party risks.

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Coordination with other projects	T/O	• Educate. • Early coordination. • Bundle coordination. • Leverage internal resources.	1, 2, 4, 22
Coordination with other government agencies	T/O	• Early coordination. • Employ the 5DPM guide (SHRP2 R10). • Share resources where possible. • Develop a communication plan. • Secure local funding.	1, 4, 6, 7
Unforeseen delays due to third-party during planning, programming, or design	T	• Early coordination. • Employ the 5DPM guide (SHRP2 R10). • Avoid.	1, 2, 3, 4, 6, 7
Third-party delays during construction	T	• Educate. • Sequence work to minimize impact. • Bundle coordination. • Develop a communication plan.	6, 17, 21, 22,
Railroad involvement	T	• Owner assumes risks. • Early coordination (see SHRP2 R16: Railroad-DOT Mitigation Strategies). • Clearly assign responsibility in procurement/contract documents. • Utilize the "3 Cs": coordination, cooperation, and communication. • Avoid locations with railroad involvement.	5, 16, 21

Table 24. Utility and/or right-of-way risks.

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Unforeseen delays due to utility owner	T	• Owner assumes risks. • Clearly assign responsibility in procurement/contract documents. • Utilize the "3 Cs": coordination, cooperation, and communication. • Relocate utilities in advance of procurement. • Avoid locations with unknown utility information. • Implement SHRP2 R01A, R01B, R15B: Improving Coordination with Utilities.	13, 14, 15, 17
Unexpected utilities encountered during construction	T	• Owner assumes risks. • Clearly assign responsibility in procurement/contract documents. • Utilize the "3 Cs": coordination, cooperation, and communication. • Relocate utilities in advance of procurement. • Avoid locations with unknown utility information. • Implement SHRP2 R01A, R01B, R15B.	13, 14, 15, 17
Objections to right-of-way (ROW) appraisal take more time and/or money	T	• Owner assumes risks. • Early coordination. • Establish management reserve for ROW.	16, 17, 18
Acquisition ROW problems	T	• Owner assumes risks. • Early coordination. • Establish management reserve for ROW.	16, 17, 18
Difficult or additional condemnation	T	• Owner assumes risks. • Early coordination. • Establish management reserve for ROW.	16, 17, 18
Additional ROW purchase due to alignment change	T	• Owner assumes risks. • Early coordination. • Establish management reserve for ROW. • Avoid.	16, 17, 18

Table 25. Organizational risks.

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Inexperienced staff assigned	T	• Conduct training. • Develop a communication plan. • Outsource.	1, 3, 4, 17, 19
Loss of critical staff at crucial point in the project	T/O	• Create a succession plan. • Conduct cross-training. • Hire experienced replacements. • Outsource.	3, 4
Functional units not available or overloaded	T	• Conduct training. • Develop a communication plan. • Outsource.	2, 3, 4, 14, 15, 16, 18,
Lack of coordination/ communication	T	• Conduct training. • Develop a coordination/communication plan.	1
Internal red tape causes delay in getting approvals, decisions	T	• Educate. • Early coordination. • Bundle coordination. • Obtain waiver from unnecessary internal transactions for bundled projects.	10, 12, 14

Table 26. External risks.

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Elected officials buy-in	O	• Educate. • Demonstrate need. • Develop a communication plan. • Secure funding.	1, 3, 4, 5, 6
Stakeholders request late changes	T	• Educate. • Develop a communication plan.	3, 4, 6, 7, 19, 24
Local communities pose objections	T	• Educate. • Demonstrate need. • Develop a communication plan.	3, 4, 6, 7
Community relations	O	• Educate. • Develop a communication plan.	3, 4, 6, 7
Inadequate external communications	T	• Develop a communication plan.	1, 3, 4, 6, 7

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Conformance with regulations/ guidelines/ design criteria	T	• Educate. • Early coordination. • Bundle coordination. • Clearly assign responsibility in procurement/contract documents.	3, 4, 6, 7, 8, 11,12, 25
Intergovernmental agreements and jurisdiction	O	• Educate. • Early coordination. • Bundle coordination.	3, 4, 6, 7
Public-private partnership (P3) concessionaire bankruptcy	O	• Establish rigorous financial vetting in procurement. • Early coordination. • Bundle coordination. • Establish concession financial monitoring program during operations and maintenance phase.	2, 5, 19,20, 23

Table 27. Geotechnical and hazardous materials risk.

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Unexpected geotechnical issues	T	• Owner assumes risks. • Conduct geotechnical investigations in advance. • Conduct geotechnical investigations during procurement (to save time). • Assign risk to design-builder. • Provide all available data and previous studies as part of procurement. • Employ GeoTechTools (SHRP2 R02). • Avoid locations with unknown geotechnical information.	1, 3, 4, 14, 19, 20, 21, 23
Hazardous waste site analysis incomplete or in error	T	• Owner assumes risks. • Conduct hazardous materials (hazmat) investigations in advance. • Provide all available data and previous studies as part of procurement. • Employ GeoTechTools (SHRP2 R02). • Avoid locations with unknown hazmat information.	1, 3, 4, 14, 19, 20, 21, 23

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Adverse groundwater conditions	T	• Owner assumes risks. • Conduct geotechnical investigations in advance. • Conduct geotechnical investigations during procurement (to save time). • Assign risk to design-builder. • Provide all available data and previous studies as part of procurement. • Employ GeoTechTools (SHRP2 R02) • Avoid locations with unknown geotechnical information.	1, 3, 4, 14, 19, 20, 21, 23

Table 28. Design risks.

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Design is incomplete/ Design exceptions	T	• Early coordination. • Bundle coordination. • Employ the 5DPM guide (SHRP2 R10) • Use design-build (D-B) project delivery method. • Use construction manager/general contractor (CM/GC) project delivery method. • Use P3 project delivery method. • Use indefinite delivery/indefinite quantity (IDIQ) project delivery method. • Incorporate an alternative technical concepts (ATC) process	1, 2, 3, 4, 8, 19, 20
Scope definition is poor or incomplete	T	• Early coordination. • Bundle coordination.	1, 2, 3, 4,
Pressure to deliver project on an accelerated schedule	T	• Early coordination. • Bundle coordination. • Employ the 5DPM guide (SHRP2 R10). • Use D-B project delivery method. • Use CM/GC project delivery method. • Incorporate ATC process.	1, 2, 3, 4, 8, 15, 18 19, 20, 22, 23

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Constructability of design issues	T/O	• Early coordination. • Bundle coordination. • Use D-B project delivery method. • Use CM/GC project delivery method. • Use P3 project delivery method. • Use IDIQ project delivery method. • Incorporate ATC process.	1, 2, 3, 4, 8, 15, 18 19, 20, 22, 23
Project complexity—scope, schedule, objectives, cost, and deliverables—is not clearly understood	T	• Early coordination. • Bundle coordination. • Employ the 5DPM guide (SHRP2 R10) • Use D-B project delivery method. • Use CM/GC project delivery method. • Incorporate ATC process.	1, 2, 3, 4, 8, 15, 18 19, 20, 22, 23
Innovation desired	T/O	• Incorporate ATC process. • Use D-B project delivery method. • Use CM/GC project delivery method. • Use best-value procurement (establish evaluation criteria). • Consider FHWA Every Day Counts initiatives. • Consider SHRP2 products.	1, 2, 3, 4, 8, 15, 18 19, 20, 22, 23

Table 29. Procurement risks.

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Inadequate competition	T	• Early coordination. • Bundle coordination. • Industry coordination.	1, 2, 3, 4, 5,12
Project delivery method unclear	T/O	• Utilize project delivery selection tool (risk-based).	17, 19, 20
Accelerated delivery/ schedule constraints	T/O	• Use CM/GC delivery method. • Use D-B delivery method. • Use ATC process. • Use incentives/disincentive clauses. • Use A+B bidding (design-bid-build). • Use schedule as a selection criterion (best value procurement).	17, 19, 20

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Third-party delays during construction	T	• Owner assumes risks. • Clearly assign responsibility in procurement/contract documents. • Utilize the "3 Cs": coordination, cooperation, and communication. • Relocate utilities in advance of procurement. • Avoid locations with unknown utility information. • Implement SHRP2 R01A, R01B, R15B.	3, 4, 6, 7, 8, 11,12
Fixed budget	T	• Use D-B project delivery method. • Use CM/GC project delivery method. • Using maximum price, request proposal responder to identify amount of work that can be done within this budget.	
Insufficient budget	T	• Owner assumes risks. • Consider P3 financing. • Issue revenue bonds or Grant Anticipation Revenue Vehicle bonds. • Obtain Federal credit assistance (State Infrastructure Banks or Transportation Infrastructure Finance and Innovation Act program). • Modify/reduce scope. • Use guaranteed maximum price. • Ask for innovation.	17, 19, 20
Disadvantaged Business Enterprise Program	T/O	• Educate. • Outreach activities. • Appropriate project or location-specific goals.	1, 2, 3, 4, 5, 6, 17, 24, 25

Table 30. Construction risks.

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Pressure to deliver project on an accelerated schedule.	T/O	• Use D-B project delivery method. • Use CM/GC project delivery method. • Use fixed-schedule request for proposals to identify amount of work that can be done within a fixed period.	1, 2, 3, 4, 5, 6, 13, 18, 19, 20, 21, 22

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Inaccurate contract time estimates	T	• Early coordination. • Bundle coordination. • Use D-B project delivery method. • Use CM/GC project delivery method. • Use P3 project delivery method. • Use IDIQ project delivery method. • Incorporate ATC process.	1, 2, 3, 4, 5, 6, 19, 20,
Unclear contract documents	T	• Early coordination. • Bundle coordination. • Clearly assign risk responsibility in procurement/contract documents. • Contract boilerplate specific to bundled projects.	5, 6, 7
Problem with construction sequencing, staging, and/or phasing	T	• Early coordination. • Bundle coordination. • Use D-B project delivery method. • Use CM/GC project delivery method. • Use P3 project delivery method. • Incorporate ATC process.	1, 2, 3, 4, 5, 6, 13, 18, 19, 20, 21, 22
Maintenance of traffic/ work zone traffic control	T	• Early coordination. • Bundle coordination. • Clearly assign risk responsibility in procurement/contract documents. • Use D-B project delivery method. • Use CM/GC project delivery method. • Use P3 project delivery method. • Incorporate ATC process.	1, 2, 3, 4, 5, 6, 13, 18, 19, 20, 21, 22

Table 31. Operations and maintenance risks.

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Required service life not achieved—early rehabilitation required	T	• Implement a robust quality control/quality assurance program during construction. • Implement preventive maintenance program during the operational life cycle of the investment (design-build-finance-maintain or design-build-finance-operate-maintain with hand-back criteria).	1, 3, 6, 9, 19, 24, 25

Risk	Threat/ Opportunity	Potential Response	Applicable Practice #
Maintenance activity exceeds estimates	T	• Use an asset management tool based on historical work order and cost data during the planning phase.	1, 2, 3, 19, 24, 25
Concessionaire fails to achieve hand-back criteria	T	• Implement a monitoring program during the operational life cycle of the investment to include condition ratings and deterioration tracking. • Provide annual reporting of observed asset conditions and maintenance activities performed. • Set up payment structure with substantial final payment at hand-back.	1, 9, 19, 24, 25
Toll revenue fails to meet minimums	T	• Update traffic projections at each stage of project development and design. • Conduct and update the toll avoidance study at each stage of project development and design. • Build enough cushion into the project financial plan to accommodate a pessimistic toll revenue prediction. • Take full advantage of design elements that reduce operating costs (e.g., all-electronic tolling, jointless bridges with integral abutments, minimal landscaping/reduced maintenance landscaping).	1, 9, 19, 24, 25

Risk Summary

Formal qualitative or quantitative risk analysis creates an environment for the identification of threats to, and opportunities for, achieving an agency's goals and objectives. Its outcome will be a risk management plan and an initial project or program risk register. The risk analysis is not a one-time activity. To bring about its potential benefits, it should be a continuous effort throughout the life of the project or program. Therefore, the initial risk register should be updated regularly and serve as a communication tool as the project or program progresses and is refined.

APPENDIX F. ADDITIONAL RESOURCES – DATABASE

As part of its Every Day Counts round five (EDC-5) project bundling innovation initiative, FHWA has prepared a database of resources to assist agencies in improving their project bundling practices. The database captures project bundling-related information, including "how, why, and by what means," to assist agencies and others in developing bundled projects and project bundling programs and initiatives. It is divided into five categories: case studies, programs, contracts, references, and research.

Contracts
The contracts component provides a summary of actual project bundling contracts with links to contract documents.

Programs
The program component provides a summary of agencies that have project bundling programs or initiatives and links to their websites.

References
The reference component includes project bundling-related advice and lessons learned from FHWA, State departments of transportation, local agencies, and others

Research
The research component provides a summary of project bundling-related academic and agency-sponsored research.

How to Use
Tabs can be searched by key words and sorted by columns or by project bundling practice. (The 25 practices are defined in FHWA's Project Bundling Self-Assessment tool. The Reference tab provides a link to the tool.)

This database is available at
https://www.fhwa.dot.gov/ipd/alternative_project_delivery/defined/bundled_facilities/

APPENDIX G. INDIANA DEPARTMENT OF TRANSPORTATION PROJECT BUNDLING BUSINESS RULES (DRAFT)

The Indiana Department of Transportation (INDOT) developed the following document that contains a set of draft business rules for bundling more strategically during early project programming. The document is included here in its entirety with INDOT's permission.

Augmented Call for Projects Business Rules

I. Augmented CFP Process Overview

1.0 Generating and Accounting for Efficiency in Capital Programing

The Indiana Department of Transportation (the "Department" or "INDOT") recognizes that the way projects are scoped, packaged, and delivered can greatly influence bid prices, user impacts, and the Department's level of effort during procurement and delivery. Efficiencies and direct cost savings may be generated through logical groupings of projects ("bundled projects" or "project bundle") and, where appropriate, using innovative delivery models.

Leveraging its prior experience, lessons learned from peer State Departments of Transportation nationwide, and targeted outreach with local and national designers, contractors, and developers, the Department identified specific sources of value, associated value drivers, and potential cost savings resulting from project bundling and innovative delivery.

Potential cost savings that may be realized thought the bundling process stem primarily from the following sources:

- Economies of scale
- Standardization of design and construction means and methods
- Shared resources including management, workforce, equipment, and plants and facilities
- Crew and equipment scheduling
- Efficiencies in contractor overhead
- Schedule acceleration
- Efficiencies in the environmental approval and permitting processes
- Cost effective MOT
- INDOT administrative savings in contract letting and administration

Recognizing the value such bundling can create, the Department augmented its Call for Project ("CFP") process to drive efficiencies in project scoping and delivery. Specifically, the Department's objectives for the Augmented CFP are to:

- Generate value through implementing logical groupings of projects
- Create objective criteria for evaluating the potential value-add of project groupings while maintaining the integrity of the pre-existing CFP process
- Increase the efficiency of the procurement process due to fewer bid packages, and project management due to fewer contracts to manage.

Cost efficiencies can be generated by bundling projects of the same/similar type in a single procurement. The magnitude of such efficiencies depends on the makeup of the bundle and the ability of designers and contractors to replicate elements of the work, in planning, approvals, permitting, design, and construction.

1 **Portfolio Bundle:** A Portfolio Bundle is a grouping of projects of the same asset type (e.g. bridge projects). The primary drivers for cost efficiencies for a Portfolio Bundle are similarities in asset type and work type enabling schedule acceleration, standardization in design and construction means and methods, and uniform project management techniques applied across a larger pool of projects. The size of the bundle, the geographic distribution of the individual projects within the bundle and other criteria also influence the potential for

cost efficiency. While the overall bundle creation process is independent of the asset type, specific criteria for separate asset classes must be considered. Therefore, separate business rules are provided in the augmented CFP process for:

i. Bridge and Large Culvert Portfolio Bundle
ii. Road Portfolio Bundle

2 **Corridor Bundle:** A Corridor Bundle is a grouping of project of the same or different asset types within the same corridor forming a generally continuous work zone. Such grouping may limit the impacts to users stemming from recurring interventions within a given corridor spanning multiple years. Cost efficiencies for a Corridor Bundle are geographic proximity and the complimentary nature of work types. These similarities increase the ability to accelerate delivery, increase productivity of labor and equipment, increase efficiency of coordination with outside entities, decrease mobilization/ demobilization and staging cost, and implement complementary management of traffic (MOT) procedures across a larger pool of projects (while potentially reducing user impacts).

Note that a bundle of projects can be evaluated as a Portfolio Bundle or Corridor Bundle, but not both since these categories are mutually exclusive.

The Augmented CFP adds a Bundle Efficiency factor that is scored separately from Cost Effectiveness, Condition, and Other factors (traffic, truck volume, road functional class, and system) that were part of the CFP Business Rules prior to 2016. The CFP process in place before 2016 remains in place without modification and is augmented by the Bundle Efficiency factor as described in the business rules herein. The addition of the Bundle Efficiency factor results in a direct point allocation impacting the ranking of a project bundle as part of the CFP.

2.0 Scoring Principles

2.1 Augmented CFP Scoring Process

Under the Augmented CFP, the maximum score for an individual project is 120 points and the total maximum score for a project bundle is 115 points, broken down as follows:

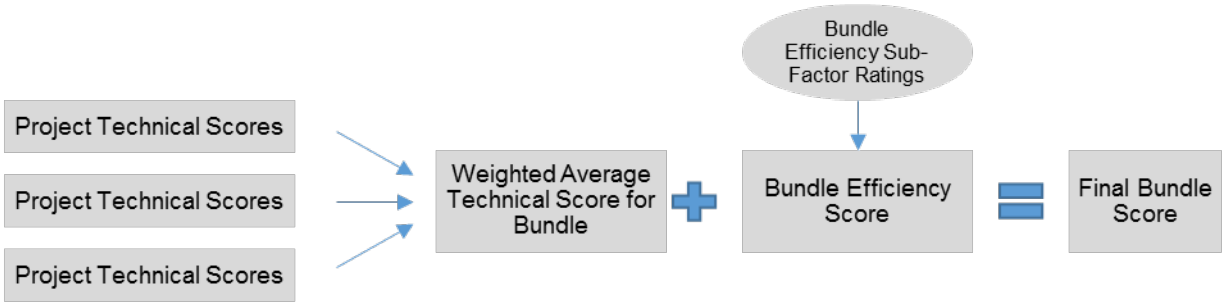
Description	Individual Project	Project Bundle
Technical Score (maximum of 100 points)	100	100
Bundle Efficiency Factor (maximum of 15 points)	n/a	15
Supplemental Score (maximum of 20 points)[1]	20	n/a
Total	**120**	**115**

The allocation of the 100 technical points for Road and Bridge/Culvert projects remains unchanged. For project bundles, the representative technical score is a weighted average of the

[1] Individual projects receiving outside agency funding are eligible for scoring under "supplemental score"; however, they cannot be bundled with other projects.

individual projects' technical scores, based on the estimated dollar value of each individual project.

The particular bundle's Bundle Efficiency (either Portfolio or Corridor) score is calculated and added to the weighted average technical score. The final bundle score is ranked against other individual projects and bundles in the CFP. The chart below displays the process for scoring a project bundle.



As further explained in Section I.3 below, if a given project bundle is not selected as part of the Augmented CFP process, the bundle will be eliminated, and the CFP list will be re-sorted with the individual projects listed separately. The individual projects then have the potential to be selected based on their individual technical merit.

2.2. Rating and Scoring Bundle Efficiency Factor

A Bundle Efficiency factor is calculated for each project bundle. The bundle type will determine the sub-factors that are scored to estimate value creation. These sub-factors are listed in the table below:

List of Efficiency Sub-Factors by Bundle Type		
Bridge Portfolio Bundle	Road Portfolio Bundle	Corridor Bundle
Homogeneity of bridge types	Homogeneity of pavement types	Bundle composition
Homogeneity of work types	Homogeneity of work types	Geographic concentration
Size of bundle	Size of bundle	Similarity of site conditions
Geographic concentration	Geographic concentration	Flexibility of contracting in scheduling / sequencing
Similarity of site conditions	Similarity of site conditions	Cost effectiveness of MOT
Flexibility of contracting in scheduling / sequencing	Flexibility of contracting in scheduling / sequencing	Reduced user impact
Cost effectiveness of MOT	Cost effectiveness of MOT	
Reduced user impact	Reduced user impact	

For each of the sub-factors, a simple rating system of “High”, “Medium”, or “Low/Neutral” (and in some instances “N/A”, “Negative Medium”, or “Negative High”) is used to assess the particular bundle’s attributes. Furthermore, while the sub-factors are scored individually, the synergies between or among sub-factors should also be taken into account when scoring.

Specific guidance on what constitutes a “High”, “Medium”, or “Low/Neutral” score and how to account for synergies are provided in Sections II to IV. However, it should be recognized that this guidance only provides general principles and that the specifics of each project bundle should be carefully reviewed in light of these general principles.

The qualitative rating for each sub-factor is converted to a numerical value using a simple scale:

- Most sub-factors use a three-point scale where a “High” rating is assigned a value of 2, a “Medium” rating is assigned a value of 1, and “Low/Neutral” rating is assigned a value of 0.
- Some sub-factors may not be applicable or cannot be scored with the available information, in which case the rating “N/A” should be selected, corresponding to a value of 0.
- Three sub-factors (Similarity of site conditions, Cost effectiveness of MOT and User impacts) may result in negative impacts. These sub-factors are converted using a five-point scale where a “High” rating is assigned a value of 2, a “Medium” rating is assigned a value of 1, a “Low/Neutral” rating is assigned a value of 0, a “Negative Medium” rating is assigned a value of -1, and “Negative High” rating is assigned a value of -2.

To illustrate this scoring mechanism, if a Bundle Efficiency factor has six sub-factors and a project is rated with two “High,” three “Medium” and one “Low/Neutral”, the total points for the Bundle Efficiency factor would be:

[(2 x 2 + 3 x 1 + 1 x 0) / (2 x 6)] x [15 maximum points for the Bundle Efficiency factor] = 8.75 points

In addition, the estimated cost savings for a bundled project is estimated based on the percentage of points earned for a bundle, the estimated capital cost of the bundled project, and a benchmark for estimated maximum cost savings. The benchmarks for maximum cost savings are based on market sounding efforts conducted in early 2016. Cost savings are estimated to be in the 8% to 9% range, reflecting the sample means of participant feedback.

For example, using the illustrative bundle above:

[(2 x 2 + 3 x 1 + 1 x 0) / (2 x 6)] x [Capital cost of bundled project (i.e., $5m)] x [Maximum cost savings (8.8%)] = $256,667 estimated cost savings generated by bundling the projects

Note that the points related to the reduced user impacts sub-factor are not included in the calculation of estimated cost savings, as these are economic costs of the asset user as opposed to cost savings to INDOT.

3.0 Augmented CFP Process

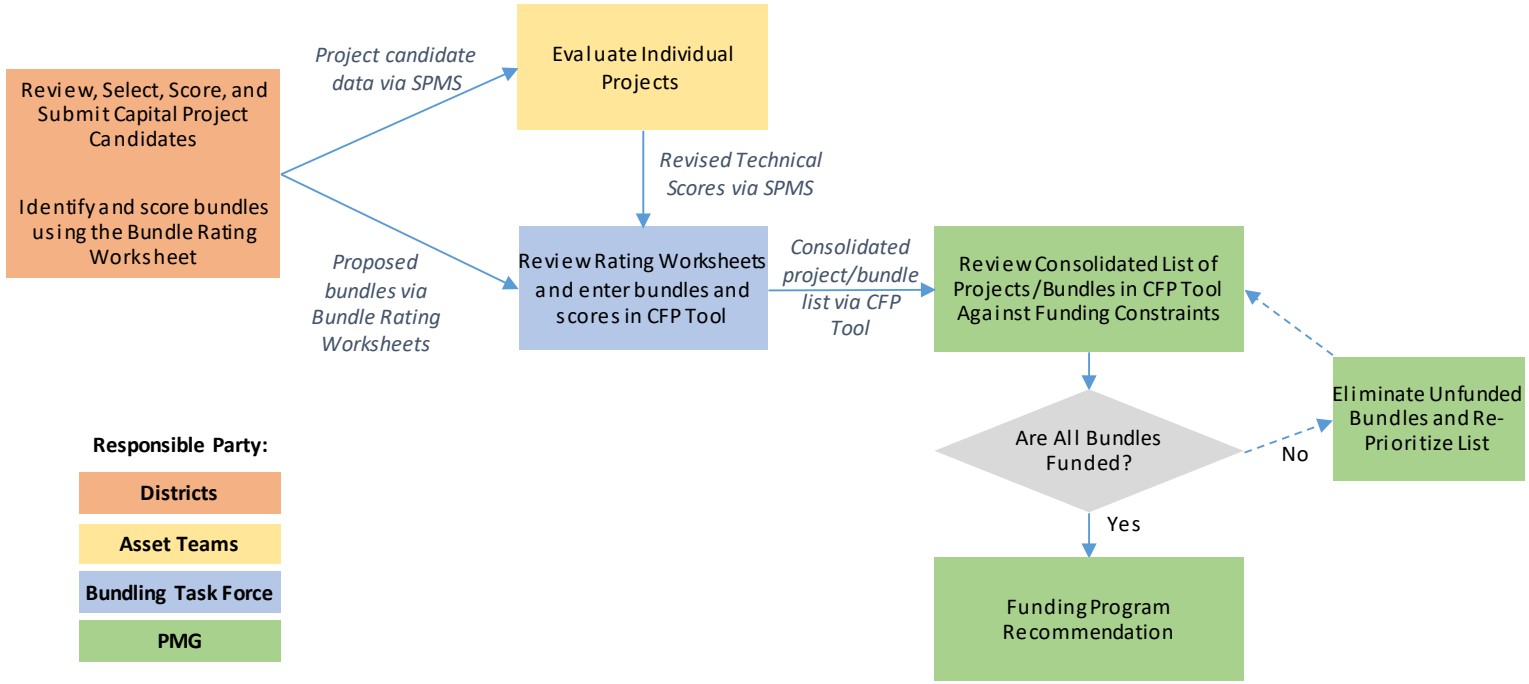
This section outlines the augmented CFP process and the key responsibilities of the Districts, the Asset Teams, the Bundling Task Force and Project Management Group (PMG). The Bundling Task Force is a newly created group formed for the purpose of creating and evaluating bundles as part of the augmented CFP process. The group will be comprised of 8-9 individuals

as follows: 2 from the PMG; 1 from the Pavement Asset Team; 1 from the Bridge Asset Team; 1 from the Mobility Team; 1-2 from Capital Programming; and 2 System Assessment Managers.

The process for the Districts starts the same as the prior CFP process, except that the Districts will receive a list of potential projects for programing consideration from PMG at the start of the Call. This list of projects will be based on data from dTIMs. The Districts will consider these and other projects for programing and then submit their projects into SPMS. Once the Districts submit their individual projects into the Call, there will be a second step whereby the Districts and the Bundling Task Force will evaluate projects for potential bundling. The Districts will complete and submit to the Bundling Task Force a Bundle Rating Worksheet for each proposed Portfolio or Corridor Bundle within their district.

The diagram below displays key steps in the augmented CFP process.

Overview of Augmented CFP Process



The following table provides more detail regarding specific responsibilities for each party with respect to the augmented CFP process. As noted in the flowchart above and indicated below, bundle validation occurs throughout the process and involves the Districts, the Bundling Task Force, and PMG. If at any step a bundle is eliminated, the bundle should be removed from the CFP Scoring Tool so that the individual projects may be considered on a standalone basis.

Overview of Existing and New Responsibilities Under CFP Process

Group	Districts	Asset Teams	Bundling Task Force	PMG
Condensed Existing Responsibilities	• field assessments and scoping projects • scoring individual projects for CFP submission	• reviewing individual project scores submitted by the Districts	• n/a	• prioritizing projects and making a funding recommendation
New Responsibilities Under Augmented CFP Process	• reviewing and validation through inspection, the list of proposed projects/project bundles sent by PMG • Identifying corridor and portfolio bundles within respective District • assigning a preliminary rating and justification for each Bundle Efficiency sub-factor using the Bundle Rating Worksheet • submitting first the list of individual projects or the Asset Teams, and second, the Bundle Rating Worksheets to Bundling Task Force	• revising individual project technical scores if a business case is mad and sending the revised scores to the Bundling Task Force	• reviewing, amending, and/or eliminating Portfolio or Corridor Bundles identified by Districts • identifying cross-district Bundles • creating and scoring Bundles in the CFP Scoring Tool ("Tool"), with reference to the Bundle Rating Worksheets submitted by the Districts • updating the Tool with revised technical scores provided by the Asset Team • submitting Tool to PMG, which will include a list of all scored individual projects and Bundles ranked in order from highest to lowest	• providing Districts with a proposed list of projects/project bundles for consideration in the current CFP • reviewing the Tool and revising the prioritization of any projects, if applicable • determining how many projects on the prioritized list can be funded given the budget • elimination any Bundles that cannot be funded and re-prioritizing the list • proposing a final project funding recommendation for bundles and individual projects • flagging any project that is over $15m and submitting it for additional evaluation under the Design-Build Screening Process

4.0 Bundle Rating Worksheet and CFP Scoring Tool

When proposing and assigning preliminary ratings for bundles, the Districts should use the Excel-based Bundle Rating Worksheet, which includes data fields for:

1. District name
   - Select from drop-down list
2. Bundle type
   - Select from drop-down list
3. Bundle Number
   - Select from drop-down list
4. List of bundled project IDs
   - Manually input individual project DES numbers for projects included in the bundle
5. Bundle size
   - Manually input the aggregate project cost of all individual projects in the bundle
6. Overall bundle justification
   - Qualitative description of the merits of the bundle, especially in regards to factors that are not captured in the individual sub-factor ratings. Consideration should be given to the following: what is the goal of bundling the projects; why are these projects being chosen to go together and how will it achieve the goal; relevant project scoping details.
7. Qualitative rating for each sub-factor
   - Selected from drop-down list (high, medium, low/neutral, etc.)
8. Rating justification for each sub-factor
   - Short description of important considerations which led to the rating selection
9. List of attachments
   - Any reviews, pictures, designs, etc. that support the bundling decision

Districts will fill out a Bundle Rating Worksheet for each of the proposed bundles and submit them to the Bundling Task Force. An example of a completed Bundle Rating Worksheet is provided in Appendix B to these Business Rules.

The preliminary rating for each sub-factor should be determined using the Scoring Guidelines in Sections II through IV. The Bundling Task Force will review the Bundle Rating Worksheets and use the CFP Scoring Tool to create and score the bundles to be ranked as part of the CFP. As part of its review process of the information submitted by the Districts, the Bundling Task Force should consider any bundles that should be adjusted, turned into a Corridor Bundle, and/or combined across multiple Districts. In addition, the Bundling Task Force will need to update the CFP Scoring Tool for any changes in project technical scores that come from the Asset Teams.

Once the Bundling Task Force has scored all of the bundles, the CFP Scoring Tool will be sent to PMG to be used for the final prioritization and funding recommendation. PMG may eliminate bundles that are not going to be funded and enable the individual projects to be considered for funding. Both the Bundling Task Force and PMG should refer to the Appendix for more guidance on how to use the CFP Scoring Tool.

II. Business Rules – Bridge and Large Culvert Portfolio Bundle Efficiencies

1.0 Scoring Overview

1.1 Introduction

This section sets forth the business rules for determining Bundle Efficiency, as part of the Augmented Call for Projects ("CFP") and Business Rules for Bridge and Large Culvert Asset Program.

Each proposed Bridge Portfolio Bundle is to be evaluated against the specific criteria presented in this Section II to derive an overall Bundle Efficiency score. The points allocated for Bundle Efficiency are *in addition to* the 100 points allocated for the Technical Score. The maximum available Bundle Efficiency points are 15.

A given bundle cannot be evaluated as a Road Portfolio Bundle and a Bridge Portfolio Bundle, with the exception of bridge deck work and concrete pavement work that may be combined in a single Road Portfolio bundle, provided that the work type is the same. With respect to Road Portfolio Bundles, see the scoring guidelines provided in Section III. If a variety of roadway projects and bridge projects are considered as part of the same bundle based on geographic proximity, please refer to Section IV addressing corridor continuity efficiencies.

2.0 Bundle Efficiency Scoring Guidelines

2.1 Creating Optimal Bundles

Cost savings that can be derived through the bundling process are dependent upon the makeup of the bundle. There are several key considerations in determining how projects should be grouped together to create an 'optimal' bundle, but the overarching principle is the **ability to replicate elements of the work**, in planning, approvals, permitting, design, and construction. With respect to Bridge Portfolio Bundles, the following guidelines should aid in the bundle identification process. See additional details in the scoring guidelines in Section II.2.2.

Factor	Efficiencies are driven by…
Bridge or Culvert types	The homogeneity of the structures in the portfolio: • Similar roadway type (e.g. principal arterials, minor arterial roads, collector roads, local roads) • Similar level of traffic (i.e. AADT, percentage heavy vehicles) • Similar transportation system • Similar structural systems (e.g. arch vs. truss vs. beam, abutment types, pile/bent types, decking, simple beam vs. continuous beam system vs. box culvert systems, and beam types - adjacent box beams vs. spread box beams vs. bulb T beams vs. steel I beams) • Bridge geometry (e.g. width, length, number of spans, curvature, height) • Similar materials (e.g. concrete, steel, or masonry) • Similar type of crossing and approaches (e.g. waterway, highway overpass, railroad overpass) • Similar age of existing bridges (compared to useful life)

Factor	Efficiencies are driven by…
Work types	The homogeneity of work type: • Either replacement or rehabilitation, not both • Rehabilitation work focusing on single elements (e.g. deck or piles, etc.) and/or similar type of issues (e.g. rust, scouring, etc.) (refer to INDOT work type classification)
Project size	• The efficiencies from standardization are magnified with larger bundles through economies of scale. • Project size should also be large enough to attract contractors with sufficient level of sophistication to address the coordination and management challenges of geographically dispersed projects and realize the intended efficiencies.
Geographic distribution	• Tighter geographic concentration of projects within a bundle; however highly concentrated bundles can be problematic from a traffic management perspective, so maintenance of traffic (MOT) during construction should also be considered. • Efficiencies can still be generated with geographically dispersed assets so long as local or regional clusters (groupings of projects in a concentrated area) can be identified, provided such clusters are sufficiently large to support it. • When fabrication or prefabrication is required or may be cost effective, proximity to plants and ability to minimize transport.
Site conditions	Similarity of site conditions: • Simpler site conditions are generally better for individual projects as well as bundles • Known site conditions are generally better for individual projects as well as bundles • Either rural or urbanized area or small urbanized area • Similar level of environmental impact • Similar level of complexity in utility relocation • Similar approaches and slopes • Similar geotechnical conditions • Similar hydraulic adequacy (if applicable) • Similar type of crossing (e.g. waterway, highway overpass, railroad overpass) • For complex sites, if the same type of complexity is present in all/most sites in the bundle, the issues can be addressed systematically and efficiently
Flexibility in scheduling / sequencing	The ability and flexibility of the contractor to sequence and schedule the work, such as flexibility, drives productivity, design planning, and resource allocation during construction.
Maintenance of traffic	The ability of the contractor to create an integrated approach to maintenance of traffic (MOT) through increased planning and coordination to reduce MOT costs and minimize impacts on user mobility and user costs.

Factor	Efficiencies are driven by…
User impact	Depending on the situation, a combined approach to MOT may result in cost savings; in other cases, minimizing user impact in the delivery of project bundle may require increased MOT spending. While related, MOT and user impact are assessed separately: • MOT has a direct cost impact on the project • User costs are an externality and minimizing user impact is always an objective for the Department

2.2 Scoring Guidelines

Accordingly, the Bundle Efficiency factor for Bridge Portfolio Bundles is determined by evaluating the following eight sub-factors:

1 Homogeneity of structure types
2 Homogeneity of work types
3 Project size
4 Geographic concentration
5 Similarity of site conditions
6 Flexibility in scheduling/sequencing
7 Cost-effectiveness of MOT
8 User impacts

For each of the sub-factors, the user should select a rating of “High”, “Medium”, “Low/Neutral”, “N/A”, or in some cases “Negative Medium” or “Negative High”, depending on the particular project bundle’s attributes. The remainder of this section provides general guidance on what constitutes a “High”, “Medium”, or “Low/Neutral” (or even “Negative”) score. However, it should be recognized that this guidance only provides general principles and that the specifics of each project bundle should be carefully reviewed in light of these general principles.

Furthermore, while the sub-factors are scored individually, the synergies between or among factors should be taken into account when scoring. For instance, the ability to drive efficiencies though standardization of design is dependent not only on the homogeneity of the bridge types in the portfolio, but just as importantly the homogeneity of work types and the size of the bundle. This concept is further explained below as each sub-factor scoring is presented.

The scores will automatically calculate in the CFP Scoring Tool based on the ratings selected. Below are guidelines for the selection of an appropriate rating for each sub-factor.

2.2.1 Homogeneity of structure types

This criteria evaluates the extent to which there is a sufficiently large number of similar bridge or culvert types in the bundle to enable standardization of design and construction means and methods. This criteria is to be considered in light of the overall size of the bundle and the homogeneity of the work program. The extent to which the following criteria are similar should be considered when assessing the homogeneity of structure types:

- Roadway type and level of traffic
- Transportation system

- Structural systems
- Bridge geometry
- Materials
- Type of crossing and approaches

Rating Category	Guidance
High	• The structures **are all or almost all** on roadways of similar class and the level of traffic is generally consistent on all structures in the portfolio • The portfolio can be divided in **no more than *three* transportation systems or structural systems or structural elements requiring work** and there are **at least *five* structures per category** • Structures in the portfolio have **similar geometric characteristics** (total length or length of spans for simple beam systems, width, height) • **All the structures are of the same material for the work type** • The **types of crossings are generally similar** or there are a large enough number of structures in each category of crossing to employ standardized construction methods and approaches to MOT
Medium	• The structures may be on roadways with different classification and level of traffic, but there are **at least three** structures **per roadway type** • The portfolio can be divided in **no more than *five* transportation systems or structural systems or bridge elements requiring work** and there are **at least *five* structures per category** • Structures in the portfolio have **similar geometric characteristics** (total length or length of spans for simple beam systems, width, height) • Structures may be of different material, but the **structures in each transportation system or structural system are of the same material for the work type** • The types of crossing may differ, but they present the **same level of complexity**
Low	Bundle does not meet the guidance for “High” or “Medium” above.

If the bundle scores “Low/Neutral” on this criteria, the projects in the bundle should be revised to achieve at least a “Medium” rating; or the projects in the bundle should be submitted individually and evaluated on their respective technical scores. Refer to Creating Optimal Bundles for further guidance on how to revise the bundle. Below are two examples of bundles that may achieve a High or Medium rating, respectively.

Examples:

1 A bundle scoring High on the homogeneity of bridge type sub-factor may include 20 bridges with the following characteristics:

- 12 simple beam bridges and 8 large box culverts
- Crossings over small waterways
- Two lane bridges with spans not exceeding 35 feet

- Minor arterial or collector roads
- Concrete or steel girders
- Work types include concrete barrier repairs and deck overlays

2 A bundle scoring Medium on the homogeneity of bridge type sub-factor may include 20 bridges with the following characteristics:

- 10 simple beam bridges, 5 continuous bean bridges, and 5 large box culverts
- Crossings over small waterways
- 18 bridges are two-lane bridges, 2 are four lane-bridges, with spans from 30 to 60 ft
- 17 bridges on minor arterial or collector roads, three bridges on principal arterials
- Concrete bridges
- All bridges require full replacement

2.2.2 Homogeneity of work types

This criteria evaluates the extent to which the program of work is sufficiently consistent to enable standardization of design and construction means and methods. This criteria is to be considered in light of the overall size of the bundle. To the extent the program of work involves replacement, homogeneity in structure type is paramount. Some rehabilitation activities require, *de facto*, consistency in some aspects of the bridge type: for instance, rust remediation and painting only applies to steel girders. This is self-evident. Other rehabilitation activities, such as crack sealing of the bridge deck, are mostly independent of the bridge type.

The work program should focus either on replacement (full structure replacement or replacement of the same element across the portfolio) or on rehabilitation work, **not both**.

For a classification of work type, follow INDOT's standard work type classification guidelines.

Rating Category	**Guidance**
High	The program of work generally consists of either one of the following: • Full structure replacement **and** the bundle scores High on the homogeneity of structure types criteria, or • Replacement or rehabilitation of ***one to three* elements** of the same type across the portfolio
Medium	The program of work generally consists of either one of the following: • Full structure replacement **and** the bundle scores at least Medium on the homogeneity of structure types criteria, or • Replacement or rehabilitation of ***three to five* elements** of the same type across the portfolio
Low	The program of work contains replacement and rehabilitation work or generally does not meet the guidance for "High" or "Medium."

If the bundle scores "Low/Neutral" on this criteria, the projects in the bundle should be revised to achieve at least a "Medium" rating; or the projects in the bundle should be submitted individually and evaluated on their respective technical scores. Refer to Creating Optimal Bundles for further guidance on how to revise the bundle. Below are three examples of bundles that may achieve a High or Medium rating, respectively.

Examples:

1 A bundle scoring High on the homogeneity of work type sub-factor may include 20 bridges with the following characteristics:

- 12 simple beam bridges and 8 large box culverts
- Crossings over small waterways
- Two-lane bridges with spans not exceeding 35 feet
- Minor arterial or collector roads
- Concrete or steel girders
- Work types include deck overlays on all bridges and rust remediation and bearing on all 12 simple beam bridges

2 A bundle scoring High on the homogeneity of work type sub-factor may include 20 bridges with the following characteristics:

- 13 simple beam bridges, 7 continuous beam bridges
- Crossings over small waterways
- Two-lane bridges with spans from 30 to 60 ft
- 12 bridges on minor arterial or collector roads, 8 bridges on principal arterials
- Concrete bridges
- Full replacement

3 A bundle scoring Medium on the homogeneity of bridge type sub-factor may include 20 bridges with the following characteristics:

- 13 simple beam bridges, 7 continuous bean bridges
- Crossings over small waterways
- 18 bridges are two-lane bridges, 2 are four-lane bridges, with spans from 30 to 60 ft
- 17 bridges on minor arterial or collector roads, 3 bridges on principal arterials
- Concrete and steel girders
- Work types include concrete barrier rehabilitation/partial replacement on 9 bridges, deck overlays on all bridges, rust remediation on 6 bridges, bearing replacements on 12 bridges, and slope stabilization on 4 bridges

2.2.3 Size of bundle

In addition to the number of projects required for High or Medium rating discussed in the homogeneity of bridge type and homogeneity of work type sub-factors, a total dollar value for the size of the bundle also needs to be considered. The size of the bundle for purposes of the Call for Projects process is equal to the sum of the total construction cost/contract value of all projects within the bundle.

The size of the bundled project can impact the level of efficiencies achieved in different ways. On one hand, larger projects can better leverage efficiencies from standardization through economies of scale. However, the size of the total project may also impact the local market participants. Larger projects (over $30 million) have the potential to generate a similar level or even greater level of competition by attracting larger regional or national players but may limit

the ability of smaller, local contractors to bid as prime. Nevertheless, local contractors would be essential in the delivery of such larger projects.

Note that projects or bundles above $15 million should be screened for Design-Build (DB) and larger projects or bundles (above $75 million) could be considered as candidates to go through the innovative delivery project screening process, depending on the results of the initial DB screening.

Rating Category	Guidance - Bridges
High	Bundled project size **greater than $20 million for replacements, greater than $10 million for rehabilitation, or greater than $3 million for preventative maintenance. The number of projects/locations should be 10 or greater.**
Medium	Bundled project size between **$10 million and $20 million for replacements, between $5 million and $10 million for rehabilitation, or between $1 million and $3 million for preventative maintenance. The number of projects/locations should be 5 or greater.**
Low	Bundle does not meet the guidance for “High” or “Medium” above.

Rating Category	Guidance - Culverts
High	**The number of projects/locations should be 7 or greater.**
Medium	**The number of projects/locations should be 4 or greater.**
Low	Bundle does not meet the guidance for “High” or “Medium” above.

2.2.4 Geographic concentration

Tighter geographic concentration can have a beneficial impact on the ability to achieve efficiencies by facilitating crew and equipment scheduling/staging, shared facilities such as laydown areas or plants, overhead efficiency opportunities, and potentially more efficient MOT. Depending on the homogeneity of structure types and work types, the lack of proximity to existing plants can present substantial efficiency opportunities for a geographically concentrated bundle. In this scenario, the cost of setting up temporary materials or prefabrication plants can be spread across a larger set of projects if coordinated properly.

A more focused geographic concentration can also bolster potential bid competition as some contractors may not be able to bid on a very geographically dispersed project. Efficiencies can still be generated with geographically dispersed assets so long as local or regional clusters can be identified.

Rating Category	Guidance
High	Projects within the bundle or within individual clusters are within a **30 mile radius, up to three clusters**
Medium	Projects within the bundle or within individual clusters are within **30 to 60 miles, up to five clusters**
Low	Bundle does not meet the guidance for “High” or “Medium” above.

2.2.5 Similarity of site conditions

This criteria evaluates the extent to which site conditions are sufficiently similar to implement standardized processes to environmental approvals and permitting, as well as standardized design and construction methods.

In general, simpler site conditions with well-defined area of impact and limited impacts can lead to expedited environmental approvals under Categorical Exclusions, or accelerated delivery schedule thought a request for variance from 23 CFR 636.109(b)(6) and (7) regarding the involvement of a developer and consultants in preparing documentation required under NEPA under "Special Experimental Project Number 15" (SEP-15).[1] Similarly, the permitting process can be greatly simplified or even standardized for simple, common site conditions.

While simpler, more common, and known site conditions are more favorable in general (for individual projects and for bundles of projects alike), more complex site conditions may also present opportunities for efficiencies, so long as the type of complexity is present in all/most sites in the bundle. In such cases, the issues can be addressed systematically and therefore efficiently. For instance, overpasses over a Class I railroad typically require extensive coordination with the railroad and lengthy approval and design review, and construction coordination processes. If similar bridges crossing the same rail line can be put together in the same bundle, those processes may be standardized, leading to schedule acceleration and efficiency gains.

In assessing site conditions, the similarity of site conditions is therefore as important a driver of efficiency as the absence of conditions requiring special solutions customized to the site.

The extent to which the following criteria are similar should be considered in assessing the simplicity and/or similarity of site conditions:

- Level of environmental impact
- Level of complexity in utility relocation
- Approaches and slopes
- Geotechnical conditions
- Hydraulic adequacy (if applicable)
- Type of crossing (e.g. waterway, highway overpass, railroad overpass)

Rating Category	Guidance
High	All project sites are **generally favorable** (i.e., known site issues, if any, are very manageable) and the site conditions and design parameters across projects are **relatively similar; or site conditions are uniformly complex**
Medium	There are some variations in site conditions and design parameters amongst the various project sites – **some with minor or complex issues** and **others that are generally favorable**
Low	There are a **variety of different site conditions** and design parameters among the various project sites

[1] Such a variance was granted to the Pennsylvania Department of Transport by the Federal Highway Administration for the Rapid Bridge Replacement Project involving the replacement of 558 bridges statewide.

Rating Category	Guidance
Negative Medium	The **complexity and dissimilarity** of the site conditions and/or design parameters is viewed as potentially causing slight or moderate cost increases or delays to the project bundle when compared to individual projects
Negative High	The **complexity and dissimilarity** of the site conditions and/or design parameters is viewed as potentially causing significant cost increases or delays to the project bundle when compared to individual projects

If the bundle scores “Negative Medium” or “Negative High” on this criteria, the projects in the bundle should be reconsidered in light of the other criteria to achieve at least a “Low/Neutral” (and preferably a “Medium”) rating. A bundle may be submitted with a “Negative” rating with additional justification and flagged to the Bundling Task Force for additional review. Refer to Creating Optimal Bundles for further guidance on how to revise the bundle.

Below are three examples of bundles that may achieve a High or Medium rating, respectively.

Examples:

1 A bundle scoring High on the similarity of site condition sub-factor may include 10 bridges with the following site conditions:

- Four-lane bridges with spans varying from 60 to 100 ft
- Urban areas
- Limited environmental impacts with likely Categorical Exclusions (CE1 or CE2)
- Principal arterials crossing principal arterials
- Wet and dry unities, mostly well known
- 6 out of 10 sites have good geological information
- All bridges require full replacement

2 A bundle scoring High on the similarity of site condition sub-factor may include 12 bridges with the following site conditions:

- Two-lane bridges with spans varying from 60 to 100 ft
- 10 bridges are in small urbanized areas, one in rural area, one in urbanized area
- Minor arterial or collector roads
- All bridges crossing the same Class I railroad require full replacements

3 A bundle scoring Medium on the similarity of site condition sub-factor may include 12 bridges with the following site conditions:

- Four-lane bridges with spans varying from 60 to 100 ft
- Small urbanized areas and urban areas
- Most bridges have limited environmental impacts with likely Categorical Exclusions (CE1 or CE2) but two bridges may have environmental justice impacts and one may impact a flood zone
- Principal arterials crossing principal arterials
- Wet and dry unities, mostly well known

- 5 bridges have geotechnical information but show some disparity in substrates requiring different approaches to foundation work; the other do not have geotechnical information available
- 6 bridges require full replacement, 6 bridges are widenings with some rehabilitation work

2.2.6 Flexibility of contracting in scheduling / sequencing

This criteria assesses the ability of a contractor to determine the optimal sequencing of the work to fit its construction means and methods and optimize the use of its resources.

Rating Category	Guidance
High	Overall, the schedule does not require a significant level **of acceleration**. The schedule provides the contractor the **greatest level of flexibility** in sequencing work, by only imposing a final milestone for delivery. For large bundles, one or two additional milestones corresponding to clearly separated clusters may be acceptable. Limitations on durations of closures or detours do not exceed what is commonly accepted for similar structure types and work types.
Medium	Overall, the schedule **requires a reasonable level of acceleration**. The schedule provides the contractor **a fair amount of flexibility** in sequencing work by only imposing few intermediate milestones, most of which correspond to clearly separated clusters. Limitations on durations of closures or detours do not exceed what is commonly accepted for similar structure types and work types.
Low	Overall the schedule is aggressive and/or requires prescribed intermediate milestones for most bridges. Some bridges may require shorter closure or detour duration than what is commonly accepted for similar structure types and work types.

2.2.7 Cost effectiveness of MOT and user impact

These two criteria assess the ability of the contractor to create an integrated approach to maintenance of traffic (MOT) through increased planning and coordination to reduce MOT costs and minimize impacts on user mobility and user costs. The two criteria are scored separately as the former has a direct, monetary impact on the project costs and the later a macroeconomic impact. However, these two criteria are discussed together given their interrelationship.

Maintenance of traffic:

Rating Category	Guidance
High	MOT costs for the bundle are expected to be **reduced** compared to the MOT costs for individual projects by **30% or more**.
Medium	MOT costs for the bundle are expected to be **reduced** compared to the MOT costs for individual projects by **10% to 30%.**
“Low/Neutral”	MOT costs for the bundle are expected to be **sensibly the same** as the MOT costs for individual projects
Negative Medium	MOT costs for the bundle are expected to be **increased** compared to the MOT costs for individual projects by **10% to 30%.**
Negative High	MOT costs for the bundle are expected to be **increased** compared to the MOT costs for individual projects by **30% or more.**

User impact:

Rating Category	**Guidance**
High	User impacts for the bundle are expected to be **reduced significantly** compared to the impacts created by each project individually.
Medium	User impacts for the bundle are expected to be **reduced somewhat** compared to the impacts created by each project individually.
“Low/Neutral”	User impacts for the bundle are expected to be **sensibly the same** as the impacts created by each project individually.
Negative Medium	User impacts for the bundle are expected to **increase somewhat** compared to the impacts created by each project individually.
Negative High	User impacts for the bundle are expected to **increase significantly** compared to the impacts created by each project individually.

III. Business Rules – Road Portfolio Efficiencies

1.0 Scoring Overview

1.1 Introduction

This section sets forth the business rules for determining Bundle Efficiency, as part of the Augmented Call for Projects ("CFP") and Business Rules for the Road Program.

Each proposed Road Portfolio Bundle is to be evaluated against the specific criteria presented in this Section III to derive an overall Bundle Efficiency score. The points allocated for Bundle Efficiency are *in addition to* the 100 points allocated for the Technical Score. The maximum available Bundle Efficiency points are 15.

A given bundle cannot be evaluated as a Road Portfolio Bundle and a Bridge Portfolio Bundle, with the exception of bridge deck work and concrete pavement work that may be combined in a single Road Portfolio bundle, provided that the work type is the same. If a variety of roadway projects and bridge projects are considered as part of the same bundle based on geographic proximity, please refer to Section IV addressing corridor continuity efficiencies.

2.0 Bundle Efficiency Scoring Guidelines

2.1 Creating Optimal Bundles

Cost savings that can be derived through the bundling process are dependent upon the makeup of the bundle. There are several key considerations in determining how projects should be grouped together to create an 'optimal' bundle, but the overarching principle is the **ability to replicate elements of the work**, in planning, approvals, permitting, design, and construction. With respect to Road Portfolio Bundles, the following guidelines should aid in the bundle identification process. See additional details in the scoring guidelines in Section III.2.2.

While the bundles described here are for pavement, rigid pavement work may also be bundled with bridge deck work and scored as a single bundle, so long as the work on bridge deck is of the same nature as the pavement work.

Road Bundling Considerations	
Factor	**Efficiencies are driven by…**
Roadway type	The homogeneity of the roadway type in the portfolio: • Similar pavement materials being disturbed by the work • Similar roadway type (e.g. principal arterials, minor arterial roads, collector roads, local roads) • Similar level of traffic (e.g. AADT, percentage heavy vehicles, cumulative traffic loading) • Age of existing pavement (compared to useful life) • Similar design parameters for new or rehabilitated pavement (design life, pavement material strength factors, serviceability, design speed, etc.)

Road Bundling Considerations	
Factor	**Efficiencies are driven by…**
Work types	The homogeneity of work type may be evaluated by the extent to which the work involves one or more categories below: 1. Pavement Preservation a. Thin Asphalt Overlay b. MicroStation c. HMA Thin Overlay d. HMA Overlay, Preventative Maintenance e. Concrete Pavement Preservation / Restoration 2. HMA Overlay, 2-Lift 3. Thin Concrete Overlay 4. Concrete Restoration with Overlay a. Concrete Overlay b. Thin Concrete Overlay c. HMA Overlay 5. HMA Overlay, Structural a. HMA, 3-Lift b. Full Depth Reclamation c. Concrete Overlay 6. Pavement Replacement - New a. Full Depth Reclamation b. Concrete c. HMA 7. Pavement Reconstruction a. Full Depth Reclamation b. Concrete Rubblization w/ HMA Overlay c. Concrete Crack-n-Seat w/ HMA Overlay The work program is considered homogenous if it consists entirely or almost entirely of one of the above work types. In addition, the factors below may serve to further guide the evaluation of the homogeneity of work types: • Overall similarity of the activities involved (e.g. need to correct existing roadway geometry, consistent depth of milling, work on drainage system, work on safety devices, etc.) • For rehabilitation work, similar type of deficiencies calling for similar type of design solutions and treatment (e.g. age of existing pavement, type of cracking, rutting, roughness, spalling, slab cracking, differential settlements, base erosion, etc.) • For full-depth bituminous pavement, e.g. crack sealing, depth of milling, material types and thickness of overlay • For concrete pavement, e.g. crack sealing, spalling repair, joint repair, diamond grinding, slab replacement, join sealing • For bituminous overlay on concrete pavement, e.g. crack sealing, slab replacement, diamond grinding, crack and seat, material types and thickness of overlay • Similar design parameters for new or rehabilitated pavement (e.g. design life, pavement material strength factors, serviceability, design speed, etc.) • Similar work required on non-pavement elements, e.g. cut and fill slopes, barriers, retaining walls, safety devices, etc. • Similar level of damage to the pavement

Road Bundling Considerations	
Factor	**Efficiencies are driven by…**
Project size	• The efficiencies from standardization are magnified with larger bundles through economies of scale. • Project size should also be large enough to attract contractors with sufficient level of sophistication to address the coordination and management challenges of geographically dispersed projects and realize the intended efficiencies.
Geographic distribution	• Tighter geographic concentration of projects within a bundle; however, highly concentrated bundles can be problematic from a traffic management perspective, so maintenance of traffic (MOT) during construction should also be considered. • Efficiencies can still be generated with geographically dispersed assets so long as local or regional clusters can be identified and provided such clusters are sufficiently large to support it. • Proximity to plants (concrete or asphalt, as applicable). • Whether existing or mobile plants are used, the geographical distribution of the bundle (and clusters within the bundle if applicable) needs to maximize the use of plant capacity to the greatest extent possible.
Site conditions	Similarity of site conditions: • Simpler site conditions are generally better, for individual projects as well as bundles • Known site conditions are generally better, for individual projects as well as bundles • Either rural, or urbanized area, or small urbanized area • Similar roadway type (e.g. principal arterials, minor arterial roads, collector roads, local roads) • Similar roadway geometry (horizontal and vertical alignments, stopping sight distance, vertical clearance under bridges, slopes, shoulder width and type) • Site conditions may be less favorable if significant, localized improvements to roadway geometry are required • Smaller number of ingress/egress/private access requiring different treatment and transitions • Similar level of environmental impact • Similar level of complexity in utility relocation • Similar type of and level of impact on safety devices • Similar geotechnical conditions (and subgrade, base, subsurface course) • For complex sites, if the same type of complexity is present in a large proportion of the sites in the bundle, the issues can be addressed systematically and efficiently
Flexibility in scheduling/ sequencing	The ability and flexibility of the contractor to sequence and schedule the work, as such flexibility drives productivity, design planning, and resource allocation during construction (including plant utilization)
Maintenance of traffic	The ability of the contractor to create an integrated approach to maintenance of traffic (MOT) through increased planning and coordination to reduce MOT costs and minimize impacts on user mobility and user costs.

Road Bundling Considerations	
Factor	**Efficiencies are driven by…**
User impact	Depending on the situation, a combined approach to MOT may result in cost savings; in other cases, minimizing user impacts in the delivery of project bundle may require increased MOT spending. While related, MOT and user impact are assessed separately: • MOT has a direct cost impact on the project • User costs are an externality and minimizing user impact is always an objective for the Department

2.2 Scoring Guidelines

Accordingly, the Bundle Efficiency factor for Road Portfolio Bundles is determined by evaluating the following eight sub-factors:

1 Homogeneity of roadway type
2 Homogeneity of work types
3 Project size
4 Geographic concentration
5 Similarity of site conditions
6 Flexibility in scheduling/sequencing
7 Cost-effectiveness of MOT
8 User impacts

For each of the sub-factors, the user should select a rating of “High”, “Medium”, “Low/Neutral”, “N/A”, or in some cases “Negative Medium” or “Negative High”, depending on the particular project bundle’s attributes. The remainder of this section provides general guidance on what constitutes a “High”, “Medium”, or “Low/Neutral” (or even “Negative”) score. However, it should be recognized that this guidance only provides general principles and that the specifics of each project bundle should be carefully reviewed in light of these general principles.

Furthermore, while the sub-factors are scored individually, the synergies between or among factors should be taken into account when scoring. For instance, the ability to drive efficiencies though standardization of design is dependent not only on the homogeneity of the pavement types in the portfolio, but just as importantly the homogeneity of work types, overall roadway geometry and the size of the bundle. This concept is further explained below as each sub-factor scoring is presented.

The scores will automatically calculate in the CFP Scoring Tool based on the ratings selected. Below are guidelines for the selection of an appropriate rating for each sub-factor.

2.2.1 Homogeneity of roadway type

This criteria evaluates the extent to which the types of roadway in the bundle are sufficiently similar to justify being grouped together into a single procurement and the overall size of the bundle is large enough to enable standardization of design and construction means and methods. This criteria is to be considered in light of the overall size of the bundle and the homogeneity of the work program. The extent to which the following criteria are similar should be considered when assessing the homogeneity of roadway type:

- Type of materials being disturbed by the work

- Roadway types
- Traffic level
- Pavement age

Rating Category	Guidance
High	• **Greater than 80% of the total lane miles of treatment are comprised of the same material types** • The sections of pavement **are all or almost all** on roadways of similar type (i.e., urban vs rural) and the level of traffic is generally consistent on all sections leading to similar pavement design parameters • The sections of pavement approximately of the same age compared to the remaining useful life
Medium	• **50% - 80% of the total lane miles of treatment are comprised of the same material types** • The sections of pavement **are almost all** on roadways of similar type (i.e., urban vs rural) and the level of traffic is generally consistent on all sections leading to similar pavement design parameters • The sections of pavement are approximately of the same age compared to the remaining useful life
Low	Bundle does not meet the guidance for “High” or “Medium” above.

If the bundle scores “Low/Neutral” on this criteria, the projects in the bundle should be revised to achieve at least a “Medium” rating; or the projects in the bundle should be submitted individually and evaluated on their respective technical scores. Refer to Creating Optimal Bundles for further guidance on how to revise the bundle. If the bundle scores “Low/Neutral” on this criteria, the projects in the bundle should be revised to achieve at least a “Medium” rating; or the projects in the bundle should be submitted individually and evaluated on their respective technical scores. Refer to Creating Optimal Bundles for further guidance on how to revise the bundle. Below are two examples of bundles that may achieve a High or Medium rating, respectively.

Examples:

2.2.2 Homogeneity of work types

This criteria evaluates the extent to which the program of work is sufficiently consistent to enable standardization of design and construction means and methods. This criteria is to be considered in light of the overall size of the bundle.

Homogeneity in material types for the work type is paramount. For some rehabilitation activities requiring specialized equipment, the type of equipment drives the ability to create efficiencies and should be considered in the scoring. In other words, other things being equal, it will be more efficient to bundle pavement sections into a single contract when the materials being put in place are sensibly the same on all sections, the processes used to perform the work are similar, and the type of equipment required are the same.

For a classification of work type, follow INDOT’s standard work type classification guidelines.

The homogeneity of work type may be evaluated by the extent to which the work involves one or more categories below. Generally, for a given type of material used in the work, the work type is considered homogeneous if all of the work falls within only one of the subcategories (or category if there is no subcategory) as identified below.

1. Pavement Preservation
   a) HMA Preservation
   b) Concrete Preservation
2. HMA Overlay, 2-Lift
3. Thin Concrete Overlay
4. Concrete Restoration with Overlay
   a) Concrete Overlay
   b) HMA Overlay
5. HMA Overlay, Structural
   a) HMA, 3-Lift
   b) Asphalt Recycling
   c) Concrete Overlay
6. Pavement Replacement/Reconstruction
   a) Full Depth Reclamation
   b) Concrete
   c) HMA
   d) Concrete Rubblization w/ HMA Overlay
   e) Concrete Crack-n-Seat w/ HMA Overlay

Rating Category	Guidance
High	The materials used in the work are ***the same type, and*** The work program consists ***entirely or almost entirely*** of only one of the work type subcategory (or category, if no subcategory) listed above
Medium	The materials used in the work are ***nearly the same, and*** The work program consists of more than one work type category that are logically combined.
Low	Bundle does not meet the guidance for “High” or “Medium” above.

If the bundle scores “Low/Neutral” on this criteria, the projects in the bundle should be reconsidered to achieve at least a “Medium” rating. A bundle may be submitted with a “Low/Neutral” rating with additional justification and flagged to the Bundling Task Force for additional review or the projects in the bundle may be submitted individually and evaluated on their respective technical scores. Refer to Creating Optimal Bundles for further guidance on how to revise the bundle. Below are three examples of bundles that may achieve a High or Medium rating, respectively. Below are three examples of bundles that may achieve a High or Medium rating, respectively.

Examples:

2.2.3 Size of bundle

In addition to the number of projects required for High or Medium rating discussed in the homogeneity of pavement type and homogeneity of work type sub-factors, a total dollar value for the size of the bundle also needs to be considered. The size of the bundle for purposes of the Call for Projects process is equal to the sum of the total construction cost/contract value of all projects within the bundle.

The size of the bundled project can impact the level of efficiencies achieved in different ways. On one hand, larger projects can better leverage efficiencies from standardization through economies of scale. However, the size of the total project may also impact the local market participants. Larger projects (over $30 million) have the potential to generate a similar level or even greater level of competition by attracting larger regional or national players but may limit the ability of smaller, local contractors to bid as prime. Nevertheless, local contractors would be essential in the delivery of such larger projects. As discussed in Appendix A, Section 3.2, the impact of bundle size on market competition should also be carefully considered throughout the process. While greater bundle size is assumed to improve competition, the size of the bundle should always be compared to market capacity and the ability of the market to generate competitive pressure.

Note that projects or bundles above $15 million should be screened for Design-Build (DB) and larger projects or bundles (above $75 million) could be considered as candidates to go through the innovative delivery project screening process, depending on the results of the initial DB screening.

Rating Category	**Guidance**
High	Bundled project size **greater than $20 million for replacements**, or **greater than $10 million for rehabilitation**
Medium	Bundled project size **between $10 million and $20 million for replacements**, or **between $5 million and $10 million for rehabilitation**
Low	Bundled project size **under $10 million for replacements**, or **under $5 for rehabilitation**

2.2.4 Geographic concentration

Tighter geographic concentration can have a beneficial impact on the ability to achieve efficiencies by facilitating crew and equipment scheduling/staging, shared facilities such as laydown areas or plants, overhead efficiency opportunities, and potentially more efficient MOT. Depending on the homogeneity of pavement types and work types, the lack of proximity to existing plants can present substantial efficiency opportunities for a geographically concentrated bundle. In this scenario, the cost of setting up temporary material plants can be spread across a larger set of projects if coordinated properly.

A more focused geographic concentration can also bolster potential bid competition as some contractors may not be able to bid on a very geographically dispersed project. Efficiencies can still be generated with geographically dispersed assets so long as local or regional road segment clusters can be identified. Note that very tight geographic concentration of projects could actually result in complicated MOT and more adverse user impacts, which could counter-balance some of the other efficiencies achieved. However, MOT and user impact is its own

criteria and should be carefully evaluated and scored separately as opposed to being factored into the rating for Geographic Concentration.

Similar to Bridge Portfolio Bundles, geographic concentration for Road Portfolio Bundles can be measured in terms of project clusters that fall within a certain radius as shown in the table below.

Rating Category	Guidance
High	• Projects within the bundle or within individual road segments are within a 15 mile radius, up to three road segments, or
Medium	• Projects within the bundle or within individual road segments are within 15 to 30 miles, up to five road segments, or
Low	Bundle does not meet the guidance for “High” or “Medium” above.

2.2.5 Similarity of site conditions

This criteria evaluates the extent to which site conditions are sufficiently similar to implement standardized processes to environmental approvals and permitting, as well as standardized design and construction methods.

In general, simpler site conditions with well-defined area of impact and limited impacts can lead to expedited environmental approvals under Categorical Exclusions. Similarly, the permitting process can be greatly simplified or even standardized for simple, common site conditions.

While simpler, more common, and known site conditions are more favorable in general (for individual projects and for bundles of projects alike), more complex site conditions may also present opportunities for efficiencies, so long as the type of complexity is present in all/most sites in the bundle. In such cases, the issues can be addressed systematically and therefore efficiently. For instance, small urban projects that share ADA, traffic signals, drainage, utility and safety features may be grouped together.

In assessing site conditions, the similarity of site conditions is therefore as important a driver of efficiency as the absence of conditions requiring special solutions customized to the site.

The extent to which the following criteria are similar should be considered in assessing the simplicity and/or similarity of site conditions:

- Similar roadway geometry
- Level of environmental impact
- Level of complexity in utility relocation
- Geotechnical conditions
- Type of and level of impact on safety devices

Rating Category	Guidance
High	All project sites are **generally favorable** (i.e., known site issues, if any, are very manageable) and the site conditions and design parameters across projects are **relatively similar; or site conditions are uniformly complex**
Medium	There are some variations in site conditions and design parameters amongst the various project sites – **some with minor or complex issues and others that are generally favorable**

Rating Category	Guidance
Low	There is a **variety of different site conditions and design parameters** among the various project sites
Negative Medium	The **complexity and dissimilarity** of the site conditions and/or design parameters is viewed as potentially causing slight or moderate cost increases or delays to the project bundle
Negative High	The **complexity and dissimilarity** of the site conditions and/or design parameters is viewed as potentially causing significant cost increases or delays to the project bundle

If the bundle scores “Negative” on this criteria, the projects in the bundle should be reconsidered in light of the other criteria to achieve at least a “Low/Neutral” (and preferably a “Medium”) rating. A bundle may be submitted with a “Negative” rating with additional justification and flagged to the Bundling Task Force for additional review. Refer to Creating Optimal Bundles for further guidance on how to revise the bundle.

Below are three examples of bundles that may achieve a High or Medium rating, respectively.

Examples:

1 A bundle scoring High on the similarity of site condition sub-factor may exhibit the following site conditions:

- Urban areas
- Four-lane divided highway (principal arterials)
- Limited environmental impacts with likely Categorical Exclusions (CE1 or CE2)
- Mostly well-known utilities
- Concrete pavement
- Work involves crack sealing, spalling repair, joint repair, and slab replacement

2 A bundle scoring High on the similarity of site condition sub-factor may exhibit the following site conditions:

- Mostly rural areas with a small portion of the bundle in small urbanized areas
- Two-lane minor arterial or collector roads
- Limited environmental impacts with likely Categorical Exclusions (CE1 or CE2)
- Bituminous pavement
- All pavement sections surface treatment with limited mill and fill

3 A bundle scoring Medium on the similarity of site condition sub-factor may exhibit the following site conditions:

- Work allocated evenly across small urbanized areas and urban areas
- Two-lane and four-lane principal arterials and minor arterial roads
- Most sections have limited environmental impacts with likely Categorical Exclusions (CE1 or CE2) but two work may have environmental justice areas in at least two locations and may require small realignment
- Impacts on private driveways in multiple locations in urban areas
- Mostly well-known in small urbanized areas, more patchy information in urban areas

- Bituminous pavement
- All pavement sections require full mill and fill and other surface treatment

2.2.6 Flexibility of contracting in scheduling / sequencing

This criteria assesses the ability of a contractor to determine the optimal sequencing of the work to fit its construction means and methods and optimize the use of its resources.

Rating Category	Guidance
High	Overall, the schedule imposes a **limited amount of acceleration**. The schedule provides the contractor the **greatest level of flexibility** in sequencing work, by only imposing a final milestone for delivery. For large bundles, one or two additional milestones corresponding to clearly separated clusters may be acceptable. Limitations on durations of closures or detours do not exceed what is commonly accepted for similar pavement types and work types.
Medium	Overall, the schedule **requires a reasonable level of acceleration**. The schedule provides the contractor **a fair amount of flexibility** in sequencing work, by only imposing few intermediate milestones, most of which correspond to clearly separated clusters. Limitations on durations of closures or detours do not exceed what is commonly accepted for similar pavement types and work types.
Low	Overall the schedule is aggressive and/or requires prescribed intermediate milestones for most pavement sections. Some sections may require shorter closure or detour duration than what is commonly accepted for similar pavement types and work types.

2.2.7 Cost effectiveness of MOT and user impact

These two criteria assess the ability of the contractor to create an integrated approach to maintenance of traffic (MOT) through increased planning and coordination to reduce MOT costs and minimize impacts on user mobility and user costs. The two criteria are scored separately as the former has a direct, monetary impact on the project costs and the later a macroeconomic impact. However, these two criteria are discussed together given their interrelationship.

Maintenance of traffic:

Rating Category	Guidance
High	MOT costs for the bundle are expected to be **reduced** compared to the MOT costs for individual projects by **30% or more**.
Medium	MOT costs for the bundle are expected to be **reduced** compared to the MOT costs for individual projects by **10% to 30%.**
“Low/Neutral”	MOT costs for the bundle are expected to be **sensibly the same** as the MOT costs for individual projects
Negative Medium	MOT costs for the bundle are expected to be **increased** compared to the MOT costs for individual projects by **10% to 30%.**
Negative High	MOT costs for the bundle are expected to be **increased** compared to the MOT costs for individual projects by **30% or more.**

User impact:

Rating Category	**Guidance**
High	User impacts for the bundle are expected to be **reduced significantly** compared to the impacts created by each project individually.
Medium	User impacts for the bundle are expected to be **reduced somewhat** compared to the impacts created by each project individually.
“Low/Neutral”	User impacts for the bundle are expected to be **sensibly the same** as the impacts created by each project individually.
Negative Medium	User impacts for the bundle are expected to **increase somewhat** compared to the impacts created by each project individually.
Negative High	User impacts for the bundle are expected to **increase significantly** compared to the impacts created by each project individually.

IV. Business Rules – Corridor Continuity Efficiencies

1.0 Scoring Overview

1.1 Introduction

This section sets forth the business rules for determining Corridor Continuity Efficiency, as part of the Augmented Call for Projects ("CFP").

Each proposed Corridor Bundle is to be evaluated against the specific criteria presented in this Section IV to derive an overall Bundle Efficiency score. The points allocated for Bundle Efficiency are *in addition to* the 100 points allocated for the Technical Score. The maximum available Bundle Efficiency points are 15.

2.0 Bundle Efficiency Scoring Guidelines

2.1 Creating Optimal Bundles

Cost savings that can be derived through the bundling process are dependent upon the makeup of the bundle. However, given that a Corridor Bundle, by definition, involves a variety of asset classes and work types, the homogeneity of asset and work types criteria do not apply. Instead, there is increased reliance on efficiencies gained through closer geographic proximity, more efficient MOT, and reduced user impact.

The key differentiating concept with Corridor Bundles is the notion of **corridor continuity:** an 'optimal' Corridor Bundle is one where **all the projects that are part of the bundle are within a single corridor, forming a generally continuous work zone**. While the asset types and work types within a corridor bundle may vary widely, **cost savings can be generated if opportunities exist to manage and coordinate the delivery of the work more efficiently when projects are grouped rather than delivered individually**. The composition of the bundle, which encompasses the size of the bundle, the complexity of the work and the compatibility of the work types being grouped together, needs to be considered carefully. The example below illustrates this point:

- A fairly large corridor bundle with a smaller number of asset classes and work types may be fairly simple to manage but could provide opportunities for standardization in the delivery of the work, fewer mobilizations and demobilizations, shared staging areas, etc., and therefore create efficiencies.
- A large "fence-to-fence" contract involving a large number of assets within a corridor (e.g. pavement, bridges, lighting, traffic lights, safety devises, drainage systems, signs, etc.) may present significant coordination challenges, which may be efficiently handled by a sophisticated contractor.

Such grouping may also provide opportunities to decrease the impact on users stemming from recurring interventions within a given corridor spanning multiple years.

Because both bridge and road assets may be considered for inclusion in a Corridor Bundle, there are two approaches to creating a bundle within a corridor:

1. Supplementing an already proposed portfolio bundle (i.e., a tightly concentrated road bundle) with projects from another asset group that enhance the continuity and linearity of the bundle

2. Bundling standalone projects that are likely to achieve the desired Corridor Bundle results

Districts can propose a Corridor Bundle by submitting the Bundle Rating Worksheet to the Bundling Task Force. The Bundling Task Force may revise/supplement the proposed Corridor Bundle and can also supplement a proposed Portfolio Bundle to form a Corridor Bundle. Finally, the Bundling Task Force can create a new Corridor Bundle comprised of individual projects.

With respect to Corridor Bundles, the following guidelines should aid in the bundle identification process. See additional details in the scoring guidelines in Section IV.2.2.

Corridor Bundling Considerations	
Factor	**Efficiencies are driven by…**

Bundle composition	The composition of the bundle and overall size and complexity need to be considered carefully. The following bundle compositions generally provide opportunities for efficiencies (in decreasing order):
	• Larger projects with a high level of complexity, providing opportunities for improved coordination and phasing of the work
	  • If specialty contractors are required, the work for such contractors is large enough to generate competition
	• Larger projects with low level of complexity, providing efficiencies for standardization in delivery of the work
	  • The need for specialty contractors is generally limited
	• Smaller projects with low level of complexity generally provide fewer opportunities for cost efficiencies but may have great potential to lower user impacts
	• Small and complex projects are usually better handled on a standalone basis by specialty contractors rather than grouped with other, simpler projects
	
	In addition, the following should be taken into consideration:
	• The efficiencies from standardization are generally magnified with larger bundles through economies of scale
	• For complex projects, project size should be large enough to attract contractors with sufficient level of sophistication to address the coordination and management challenges of the work

Geographic distribution	• Tighter geographic concentration of projects within a bundle is generally better • However, highly concentrated projects can be problematic from a traffic management perspective, so maintenance of traffic (MOT) during construction should also be considered. • Proximity to plants (concrete or asphalt, as applicable) • Whether existing or mobile plants are used, the geographical distribution of the bundle needs to maximize the use of plant capacity to the greatest extent possible.

Corridor Bundling Considerations	
Factor	**Efficiencies are driven by…**
Site conditions	Similarity of site conditions: • Simpler site conditions are generally better, for individual projects as well as bundles • Known site conditions are generally better, for individual projects as well as bundles • Either rural, or urbanized area, or small urbanized area • Similar roadway type (e.g. principal arterials, minor arterial roads, collector roads, local roads) • Similar roadway geometry (horizontal and vertical alignments, stopping sight distance, vertical clearance under bridges, slopes, shoulder width and type) • Site conditions may be less favorable if significant, localized improvements to roadway geometry are required • Smaller number of ingress/egress/private access requiring different treatment and transitions • Similar level of environmental impact • Similar level of complexity in utility relocation • Similar type of and level of impact on safety devices • Similar geotechnical conditions (and subgrade, base, subsurface course) • For complex sites, if the same type of complexity is present in a large proportion of the sites in the bundle, the issues can be addressed systematically and efficiently
Flexibility in scheduling / sequencing	The ability and flexibility of the contractor to sequence and schedule the work, as such flexibility drives productivity, design planning, and resource allocation during construction (including plant utilization)
Maintenance of traffic **User impact**	The ability of the contractor to create an integrated approach to maintenance of traffic (MOT) through increased planning and coordination to reduce MOT costs and minimize impacts on user mobility and user costs. Depending on the situation, a combined approach to MOT may result in cost savings; in other cases, minimizing user impacts in the delivery of project bundle may require increased MOT spending. While related, MOT and user impact are assessed separately: • MOT has a direct cost impact on the project • User costs are an externality and minimizing user impact is always an objective for the Department

2.2 Scoring Guidelines

When assessing Corridor Bundles, the following criteria should be considered:

1 Bundle composition
2 Geographic concentration
3 Similarity of site conditions
4 Flexibility in scheduling/sequencing
5 Cost-effectiveness of MOT
6 User impacts

For each of the sub-factors, the user should select a rating of “High”, “Medium”, “Low/Neutral”, “N/A”, or in some cases “Negative Medium” or “Negative High”, depending on the particular project bundle’s attributes. The remainder of this section provides general guidance on what constitutes a “High”, “Medium”, or “Low/Neutral” (or even “Negative”) score. However, it should be recognized that this guidance only provides general principles and that the specifics of each project bundle should be carefully reviewed in light of these general principles. Furthermore, while the sub-factors are scored individually, the synergies between or among factors should be taken into account when scoring.

The scores will automatically calculate in the CFP Scoring Tool based on the ratings selected. Below are guidelines for the selection of an appropriate rating for each sub-factor.

2.2.1 Bundle composition

While the asset types and work types within a corridor bundle may vary widely, efficiencies in corridor bundling stem from the opportunities to improve the management and coordination of the delivery of the work when projects are grouped rather than delivered individually. Therefore, the overall size of the bundle, the types of work that are grouped together, and the complexity of the bundled project need to be considered together. In general:

- Larger projects with a high level of complexity provide opportunities for improved coordination and phasing of the work
- Larger projects with low level of complexity provide opportunities for efficiencies through standardization in delivery of the work
- Smaller projects with low level of complexity generally provide fewer opportunities for cost efficiencies but may have great potential to lower user impacts
- Small and complex projects are usually better handled on a standalone basis by specialty contractors rather than grouped with other, simpler projects

Corridor projects with a high level of complexity include, for example, those involving: major interchanges with several levels; coordination with multiple utilities; tunnel work; railroads (Class 1 in particular); long corridors and therefore more difficult logistics; pre-fabrication requirements; a large number of specialty contractors required to do the work.

With respect to the bundle composition, the following may be considered:

Bundle Composition	**Guidance**
High	• The bundle includes more than 5 asset classes and/or more than 5 work types and is greater than $20m in total size
Medium	• The bundle includes more than 3 asset classes and/or more than 3 work types and is greater than $10m in total size
Low	Bundle does not meet the guidance for “High” or “Medium” above.

Generally, bundles scoring “Low/Neutral” should only be considered if additional benefits can be achieved such as accelerated delivery and lower user impact. A bundle may be submitted with a “Low/Neutral” rating with additional justification and flagged to the Bundling Task Force for additional review.

2.2.2 Geographic concentration

Tighter geographic concentration can have a beneficial impact on the ability to achieve efficiencies by facilitating crew and equipment scheduling/staging, limiting mobilization/demobilization, increasing shared facilities such as laydown areas or plants, and creating overhead efficiency opportunities and potentially more efficient MOT.

The lack of proximity to existing plants can present substantial efficiency opportunities for a geographically concentrated bundles. In this scenario, the cost of setting up temporary material plants can be spread across a larger set of projects if coordinated properly. Conversely, the distance from a plant becomes more important the smaller the project is, as it becomes more difficult to justify the cost of a temporary plant. Accordingly, for small and medium sized projects, the distance from the plant should be carefully considered when creating a bundle.

There are some nuances with respect to geographic concentration in a Corridor Bundle. By definition, all of the work contemplated is within a single corridor, however efficiencies with respect to MOT and mobilization/de-mobilization will likely be maximized if the individual projects within the corridor are close to each other. On the other hand, there is a possibility that MOT in a tightly concentrated Corridor Bundle could be more complicated and expensive and also have a negative impact on users (albeit for a shorter period of time if the bundling allows for accelerated delivery). However, there is a separate criteria for evaluating MOT and user impact, so while certainly an important consideration, this should be addressed when assigning a rating for that category as opposed to this one.

Finally, differences among counties in their labor practices should be taken into consideration when creating a Corridor bundle.

Geographic concentration for Corridor Bundles can be measured in terms of project clusters that fall within a certain radius or may be evaluated in terms of linearity and continuity. A long stretch of projects on a single route may present significant efficiency opportunities, similar to a tight cluster of multiple routes. Rating guidance for both of these concepts is provided below.

Rating Category	**Guidance**
High	• Projects within the bundle or within individual clusters are within a 15 mile radius, up to three clusters, or • The work zone occupies approximately ¾ of the length of the corridor section requiring work
Medium	• Projects within the bundle or within individual clusters are within 15 to 30 miles, up to five clusters, or • The work zone occupies approximately ½ to ¾ of the length of the corridor section requiring work
Low	Bundle does not meet the guidance for “High” or “Medium” above.

2.2.3 Similarity of site conditions

This criteria evaluates the extent to which site conditions are sufficiently similar to implement standardized processes to environmental approvals and permitting, as well as standardized design and construction methods.

In general, simpler site conditions with well-defined area of impact and limited impacts can lead to expedited environmental approvals under Categorical Exclusions. Similarly, the permitting process can be greatly simplified or even standardized for simple, common site conditions.

While simpler, more common, and known site conditions are more favorable in general (for individual projects and for bundles of projects alike), more complex site conditions may also present opportunities for efficiencies, so long as the type of complexity is present in all/most sites in the bundle. In such cases, the issues can be addressed systematically and therefore efficiently.

In assessing site conditions, the similarity of site conditions is therefore as important a driver of efficiency as the absence of conditions requiring special solutions customized to the site.

The extent to which the following criteria are similar should be considered in assessing the simplicity and/or similarity of site conditions:

- Similar type of area
- Similar roadway type
- Level of environmental impact
- Level of complexity in utility relocation
- Geotechnical conditions
- Type of and level of impact on safety devices

Rating Category	**Guidance**
High	All project sites are **generally favorable** (i.e., known site issues, if any, are very manageable) and the site conditions across projects are **relatively similar; or site conditions are uniformly complex**
Medium	There are some variations in site conditions amongst the various project sites – **some with minor or complex issues and others that are generally favorable**
Low	There is a **variety of different site conditions** among the various project sites
Negative Medium	The **complexity and dissimilarity** of the site conditions is viewed as potentially causing slight or moderate cost increases or delays to the project bundle
Negative High	The **complexity and dissimilarity** of the site conditions is viewed as potentially causing significant cost increases or delays to the project bundle

If the bundle scores “Negative” on this criteria, the projects in the bundle should be reconsidered in light of the other criteria to achieve at least a “Low/Neutral” (and preferably a “Medium”) rating. Refer to Creating Optimal Bundles for further guidance on how to revise the bundle.

2.2.4 Flexibility of contracting in scheduling / sequencing

This criteria assesses the ability of a contractor to determine the optimal sequencing of the work to fit its construction means and methods and optimize the use of its resources.

Rating Category	Guidance
High	Overall, the schedule imposes a **limited amount of acceleration**. The schedule provides the contractor the **greatest level of flexibility** in sequencing work, by only imposing a final milestone for delivery. For large bundles, one or two additional milestones corresponding to clearly separated clusters may be acceptable. Limitations on durations of closures or detours do not exceed what is commonly accepted for similar pavement/bridge types and work types.
Medium	Overall, the schedule **requires a reasonable level of acceleration**. The schedule provides the contractor **a fair amount of flexibility** in sequencing work, by only imposing few intermediate milestones, most of which correspond to clearly separated clusters. Limitations on durations of closures or detours do not exceed what is commonly accepted for similar pavement/bridge types and work types.
Low	Overall the schedule is aggressive and/or requires prescribed intermediate milestones for most of the work. Some pavement sections/bridges may require shorter closure or detour duration than what is commonly accepted for similar pavement/bridge types and work types.

2.2.5 Maintenance of traffic and user impact

These two criteria assess the ability of the contractor to create an integrated approach to maintenance of traffic (MOT) through increased planning and coordination to reduce MOT costs and minimize impacts on user mobility and user costs. The two criteria are scored separately as the former has a direct, monetary impact on the project costs and the later a macroeconomic impact. However, these two criteria are discussed together given their interrelationship.

Maintenance of traffic:

Rating Category	Guidance
High	MOT costs for the bundle are expected to be **reduced** compared to the MOT costs for individual projects by **30% or more**.
Medium	MOT costs for the bundle are expected to be **reduced** compared to the MOT costs for individual projects by **10% to 30%.**
“Low/Neutral”	MOT costs for the bundle are expected to be **sensibly the same** as the MOT costs for individual projects
Negative Medium	MOT costs for the bundle are expected to be **increased** compared to the MOT costs for individual projects by **10% to 30%.**
Negative High	MOT costs for the bundle are expected to be **increased** compared to the MOT costs for individual projects by **30% or more**.

User impact:

Rating Category	**Guidance**
High	User impacts for the bundle are expected to be **reduced significantly** compared to the impacts created by each project individually.
Medium	User impacts for the bundle are expected to be **reduced somewhat** compared to the impacts created by each project individually.
“Low/Neutral”	User impacts for the bundle are expected to be **sensibly the same** as the impacts created by each project individually.
Negative Medium	User impacts for the bundle are expected to **increase somewhat** compared to the impacts created by each project individually.
Negative High	User impacts for the bundle are expected to **increase significantly** compared to the impacts created by each project individually.

Appendix A: Guidelines for Using the CFP Scoring Tool

1.0 Overview of the CFP Scoring Tool

The CFP Scoring Tool (the "Tool") will be used by the Bundling Task Force to score Bundle Efficiency and by PMG to prioritize projects and make a funding recommendation. The Tool begins with a gray Parameters tab, which is not to be manipulated by the users, and is followed by a Legend tab that describes the layout of the Tool. The Tool then contains 4 main sections, denoted by black colored section header tabs. There are 7 yellow "user input tabs", which require user input and manipulation, and 3 blue "output tabs" that present data for review and analysis. The structure of the Tool is as follows:

- Project Data Import Section – contains three user input tabs (Data Import, Revised Tech Score, and Supplemental Score)
- Bundle Creation Section – contains one user input tab (Bundle Creation)
- Scoring Section - contains three user input tabs (Road Portfolio, Bridge Portfolio, Corridor Bundle)
- Output Tables Section – contains three output tabs (Bundle Detail, Bundle Scoring Overview, Reprioritized Project List)

The tabs that are to be manipulated and/or viewed by the users of the Tool are described below.

1. *Data Import:* This is the first tab that the user will use and is where the detailed project data from the Detailed Call Report will be imported thereby setting up the Tool for use. It is important that the user pastes a data set that is in the standard format for the Tool. All data fields in the raw data need to match the order and content of the column headers in the Tool. Otherwise the project information will not correctly appear in the rest of the Tool.

2. *Revised Tech Score:* This tab allows Technical Scores to be updated throughout the bundle scoring process by pasting the updated technical scores, along with the project ID into this tab. This tab is to be used by the Bundling Task Force if it receives revised technical scores for individual projects from the Asset Teams. Appropriate functioning of the Tool requires that the revised score data set match the format in the Tool (i.e. two columns of data: project ID in column A, revised technical score in column B). The user must click the "Refresh" button once the data has been pasted into the columns in order for the data set in the Data Import tab to be updated.

3. *Supplemental Score:* This tab allows Supplemental Scores to be added during the bundle scoring process by manually entering the Project ID and corresponding Supplemental Score. This tab is to be used by *PMG* if a Supplemental Score is warranted based on availability of *outside agency funding*.

4. *Bundle Creation:* This tab allows the user to create bundles by assigning individual projects to a specific bundle. The tab contains the relevant information required to assist the user in determining which individual projects will be bundled together. The data in this tab can be filtered and sorted for analysis purposes. Projects can be also be removed from a bundle when appropriate by removing the bundle assignment selection.

5. *Road Portfolio:* This is the scoring tab for Road bundles and need only be used by the Bundling Task Force. This is where the Bundle Efficiency score will be calculated for the Road bundles.

6. *Bridge Portfolio:* This is the scoring tab for Bridge/Culvert bundles and need only be used by the Bundling Task Force. This is where the Bundle Efficiency score will be calculated for the Bridge/Culvert bundles.

7. *Corridor Bundle:* This is the scoring tab for Corridor bundles and need only be used by the Bundling Task Force. This is where the Bundle Efficiency score will be calculated for the Corridor bundles.

8. *Bundle Detail:* The Bundle Detail tab is an output tab that displays the composition of the selected bundles, the weighted average technical score for each bundle, and the aggregate bundle cost. The “Refresh” button on this tab must be clicked anytime that changes are made to the Bundle Creation tab in order for the output table to be updated.

9. *Bundle Scoring Overview:* The Bundle Scoring Overview tab is an output tab that displays the Adjusted Bundle Scores by adding the new Bundle Efficiency score to the weighted average technical score of each bundle. The “Refresh” button on this tab must be clicked anytime that changes are made to the Bundle Creation tab in order for the output table to be updated.

10. *Reprioritized Project List:* The Reprioritized Project List tab is an output tab that aggregates all of the individual projects and project bundles and displays them in ranked order by Final Project Bundle Score, in order from the highest to the lowest score. The “Refresh” button on this tab must be clicked anytime that changes are made to the Bundle Creation tab in order for the output table to be updated.

2.0 Using the CFP Scoring Tool

The following steps outline how the Tool is used to score project bundles:

1. *Data Import:* The Bundling Task Force will receive a report from the Finance Department that will contain the project data that needs to be imported into the Tool (the “Detailed Call Report”). The user of the Tool must copy and paste the Detailed Call Report data into the ***Data Import tab***, ensuring that the column headings are identical and in the same order before doing so. As the workbook is currently structured, raw data entry is limited to 5000 rows. Users should refrain from modifying the data contained in the ***Data Import*** tab (i.e. filtering and sorting data with tables) once the data has been imported into the tab.

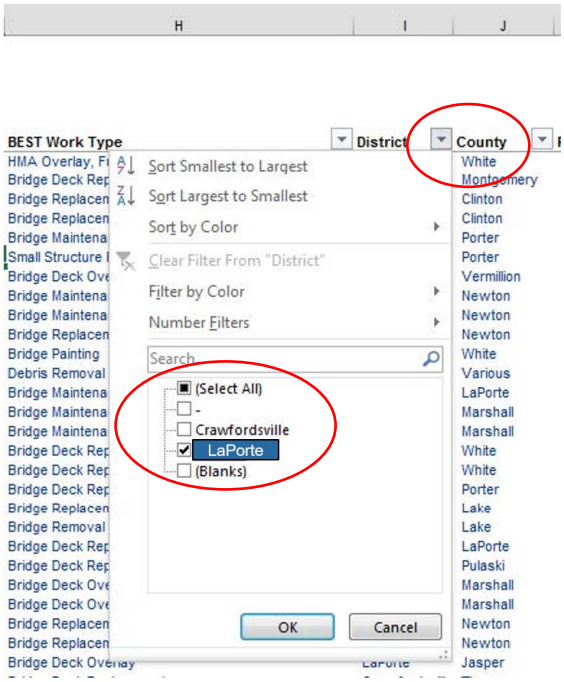
2. *Revised Tech Score:* If any individual project technical scores have been revised by the Asset Team, the Bundling Task Force will receive an additional report that will contain the project ID and revised technical scores (the “Revised Score Report”). The user of the Tool must copy and paste the Revised Score Report data into the ***Revised Tech Score*** tab, ensuring that the column headings are identical and in the same order before doing so. Users should refrain from modifying the data contained in the ***Revised Tech Score*** tab (i.e. filtering and sorting data with tables) once the data has been imported into the tab.

3. *Supplemental Score:* If an individual project is eligible for a Supplemental Score due to availability of outside funding for the project, PMG will manually enter the Project ID and corresponding Supplemental Score on this tab. Validation functionality on this tab allows the user to enter only Project IDs that are included in the Data Import tab, and Supplemental Scores between 0 and 20. The third column of this tab also notifies the user if a Project ID is included in a bundle.

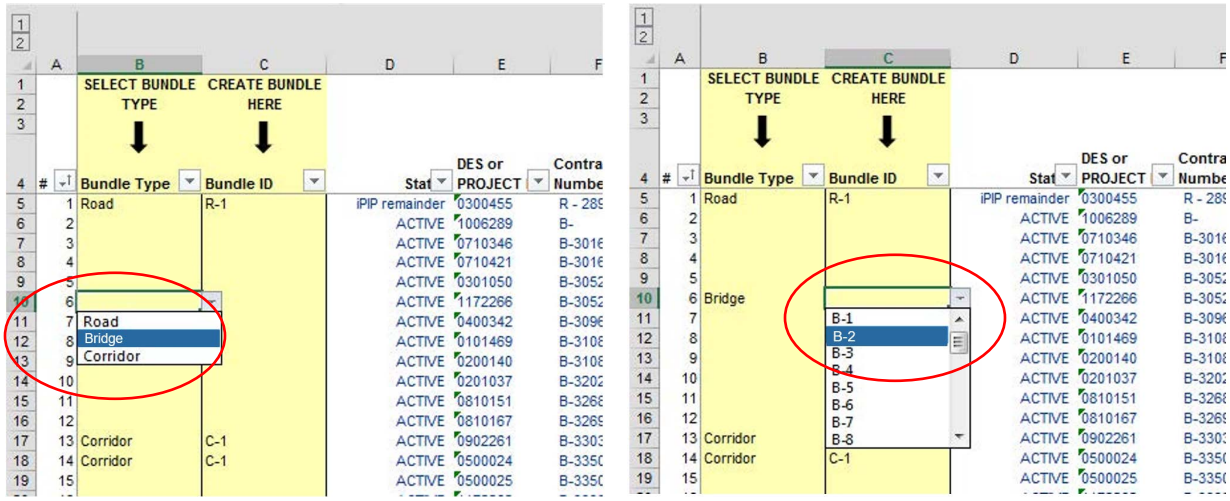
   Each Supplemental Score is automatically added to the respective project's technical score and is reflected on the Reprioritized Project List tab. Note: Projects that receive a Supplemental Score should not be bundled; if a project receives a Supplemental Score and is marked as bundled, it should be removed from the bundle on the Bundle Creation tab.

4. *Bundle Creation:* The ***Bundle Creation*** tab is used to assign specific projects to a bundle. The tab is automatically populated with the data from the ***Data Import*** tab. Projects can be sorted using the drop-down feature at the top of each column and filters can also be used to aid in data analysis. The filter in Column G (Pavement or Bridge) can be used to isolate a certain asset type.

   The user should analyze the data in the tab against the guidelines in the Business Rules for creating optimal bundles and identify individual projects to be bundled together. In doing so, the Bundling Task Force should reference the Bundle Rating Worksheets submitted by the Districts to determine if any of the proposed bundles should be incorporated and/or modified.



   Once projects are identified for bundling, the user should go to Column B (Bundle Type) to select the type of bundle (Bridge, Road, Corridor) from the drop-down box. This should be done for each project that will comprise the bundle. Next, the user should go to Column C (Bundle ID) and assign a Bundle ID to each individual project in a given bundle. All projects that are assigned the same Bundle ID will be aggregated for scoring purposes. The Tool allows for the creation of up to 30 different bundles for each bundle type: Road (R-1 through R-30), Bridge (B-1 through B-30), and Corridor (C-1 through C-30). All bundles that will be put forth for scoring should be created in this tab.



Only the cells in Columns B and C should be manipulated by the user of the Tool. Once bundles are created, a weighted average technical score for the bundle will automatically be calculated in Column M. Each assigned bundle will be set up for scoring in the subsequent tabs.

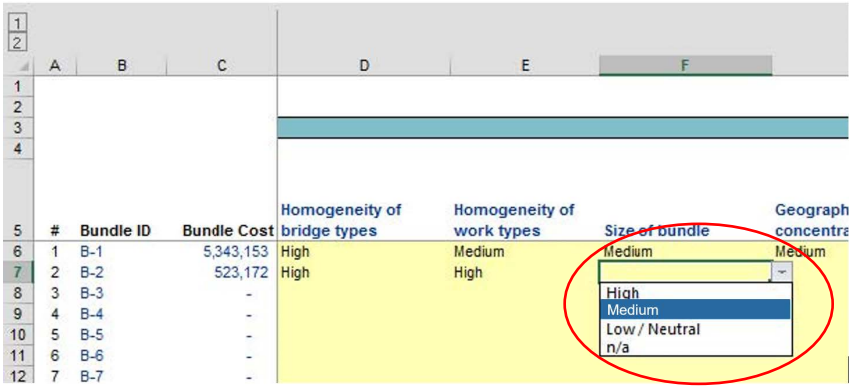
Note: The Bundle Detail tab provides the user with summary data regarding the makeup up of the selected bundles.

5. *Bundle Efficiency Scoring:* The user should next proceed to the relevant scoring tab, depending on the type of bundle being scored, as follows:

    - Road Portfolio
    - Bridge Portfolio
    - Corridor Bundle

    These scoring tabs set forth the sub-factors that are scored for each project bundle, each of which is defined in the Scoring Guidelines section of the relevant Business Rules. For Road and Bridge bundles, the sub-factors are in Columns D – K; for Corridor bundles the sub-factors are in Columns D – I. The user should only manipulate cells highlighted in yellow on this tab.

    For each bundled project, the user should select a rating from the drop-down box for each of the sub-factors. In doing so, the Bundling Task Force should reference the Bundle Rating Worksheets submitted by the Districts to assess whether the preliminary suggested ratings should be carried forward.



There are five potential ratings that can be assigned for a sub-factor. These ratings and the associated number of points for each are as follows:

Rating	Applicable Number of Points
High	2
Medium	1
Low/Neutral or N/A	0
Negative*	-1
Negative High*	-2

**Not applicable for all sub-factors.*

Once the ratings are selected, the Bundle Efficiency score for each bundled project will be automatically calculated in Column S and will flow through into the Bundle Scoring Overview tab. An overview of how the qualitative sub-factor ratings are converted into points and ultimately a Bundle Efficiency score is provided below:

	Homogeneity of bridge types	Homogeneity of work types	Size of bundle	Geographic concentration	Similarity of site conditions	Flexibility of contracting in scheduling / sequencing	Cost effectiveness of MOT	Reduced user impacts
Efficiency Rating:	High	Medium	High	High	High	High	Medium	Negative High
Efficiency Points:	2	1	2	2	2	2	1	-2

Column in Tool:	Q	R	S	T
Calculation:				(Q/R) * S
	Efficiency Points	**Maximum Efficiency Points**	**Maximum Score**	***Efficiency Score***
	10	16	10	*6.25*

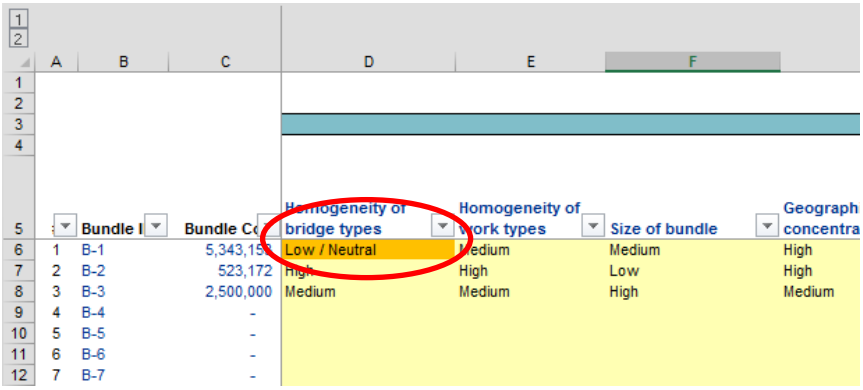
3.0 Additional Bundling Task Force Scoring Considerations

3.1 Bundle Review and Validation

When reviewing proposed project bundles and Bundle Efficiency scores, the Bundling Task Force should carefully consider the merits of each bundle. Bundles that score below certain thresholds for any of the criteria may lack the key attributes that result in a successful bundle. The table below provides key thresholds for each of the criteria. If a bundle scores at or below these levels, the bundle composition should be reevaluated or the bundle could be considered for elimination altogether. As is the case throughout the CFP process, exceptions may arise when a specific business case is made.

Key Efficiency Criteria Rating Thresholds	
Criteria	**Rating Threshold (triggers re-evaluation)**
Homogeneity of pavement/bridge/asset types (for Portfolio Bundle)	Low
Homogeneity of work types (for Portfolio Bundle)	Low
Geographic concentration (for Corridor Bundle only)	Low
Similarity of site conditions	Negative
User Impact	Negative

The bundle scoring tabs include validation functionality that highlight ratings at or below the applicable thresholds. The graphic below shows an example of a rating that is highlighted in orange, indicating that bundle re-evaluation is necessary:



	A	B	C	D	E	F
5		Bundle I	Bundle Co	Homogeneity of bridge types	Homogeneity of work types	Size of bundle	Geograph concentra
6	1	B-1	5,343,15	Low / Neutral	Medium	Medium	High
7	2	B-2	523,172	High	High	Low	High
8	3	B-3	2,500,000	Medium	Medium	High	Medium
9	4	B-4	-				
10	5	B-5	-				
11	6	B-6	-				
12	7	B-7	-				

3.2 Competition and Market Capacity

Attracting a competitive pool of bidders that are all capable of executing the project bundle is critical to realizing potential cost savings. Competition and capacity for any given bundle are driven by a variety of factors, many of which are incorporated/captured in the Bundle Efficiency scoring process. The factors are outlined below:

a. Complexity and diversity of the projects within the bundle

   i. A bundle that contains projects that require broad capabilities (i.e. corridor bundle with disparate complex projects) may attract fewer small/local contractors that may be more specialized. On the other hand, it would likely attract larger contractors, potentially those from other states.

b. Size of bundle

    i. As previously noted, bundles that are over $30m will attract larger regional or national players; however, it may limit local contractors from participating in the project as a prime contractor.

c. Geographic concentration

    i. Local contractors may be limited in their ability to bid on a bundle that is more geographically dispersed.

d. Bundle prioritization

    i. The market may have limited capacity to bid on the last remaining bundles at the end of a letting cycle.

    ii. The evaluation of this component of competition is not directly scored in the process. It is inherently one of the last adjustments to bundle priority because it is driven by priority.

These factors should be considered throughout the process. If, during the bundle review and validation, a proposed bundle is unlikely to generate sufficient competition based on any of these factors, it should be reconsidered. For example, a high priority project (based on condition) may be included in a bundle that has overall low priority (based on score). Since this bundle may or may not generate sufficient bids, it may make sense to remove the high priority project or eliminate the entire bundle.

3.3 PMG Delivery Model Assessment

While Delivery Model Efficiency will not be scored as part of the CFP process, an important step in the process will be for PMG to assess whether any of the projects selected for funding under the augmented CFP could be suitable candidates for alternative delivery models such as Low Bid Design-Build, Best Value Design-Build or even a Design-Build-Finance-Maintain. As such, once the CFP project prioritization and selection process is completed, PMG will be responsible for identifying any project that is over $15 million and putting it through the Design-Build Screening Process. This process entails answering a checklist of questions for a given project, resulting in a score between 20 and 60 points. A delivery model is preliminarily assigned based on the score, the project size and certain qualitative factors such as the need for INDOT to retain design or construction control. PMG should refer to the Design-Build Screening Process chapter within the Public-Private Partnership Implementation Guide for detailed instructions on the screening process.

Throughout this process, PMG will work in coordination with the Innovative Delivery Team. In particular, projects that score “High” (greater than 47 points) in the Design-Build Screening Process and meet a minimum size threshold of $50 million will be sent to the Innovative Delivery Team for P3 screening under the Public-Private Partnership Implementation Guide.

Appendix B: Example Bundle Rating Worksheet

INDOT Call for Projects - Bundle Rating Worksheet (Portfolio Bundle)

Instructions: Fill out one Bundle Rating Worksheet for each proposed bundle by entering requested information into the yellow shaded boxes. For the Bundle Number, start with "B-1" for the first proposed bridge bundle or "R-1" for the first road bundle. Fill out a separate Bundle Rating Worksheet for each additional bundle. Refer to Business Rules for guidance.

District:	Crawfordsville
Bundle Type:	Bridge
Bundle Number:	B-1

DES #s of projects in bundle: *(manually enter)*					
	1005682	1296949			
	1005681	1500644			
	1006281				
	1006282				

Bundle Size (prior to efficiencies): *(manually enter)*	$ 25,355,748

Overall justification for bundle *(manually enter)* [consider the following: what is the goal of bundling the projects; why are these projects being chosen to go together and how will it achieve the goal; relevant project scoping details]	The bundled projects are very similar in nature and are located along a relatively short stretch of Interstate 65 in Tippecanoe County. While several of the projects are very high in priority, the remaining projects can be sequenced to increase MOT and staging efficiencies.

Bundle Efficiency Preliminary Rating		
Criteria	**Proposed Rating**	**Rating Justification *(manually enter)***
Homogeneity of bridge types	High	All bridges are classified as interstate. The bridges are similar in design and are located on Interstate 65. The bridges at the Wabash River crossing are slightly different in design from the other bridges.
Homogeneity of work types	High	All projects require the same work type: Bridge Deck Replacement
Size of bundle	High	Engineer's estimate for the work totals $25.4 million
Geographic concentration	Medium	The projects are located along a 30 mile stretch of Interstate 65
Similarity of site conditions	High	There are some variations in site conditions amongst the project sites. The northbound and southbound crossings at the Wabash River present site conditions that are more complex than the other projects, but conditions are believed to be generally favorable.
Flexibility of contracting in scheduling / sequencing	High	Given the high priority of work at the Lauramie Creek crossing, there is somewhat less flexibility in scheduling. The priority of the projects still allows them to be completed in sequential geographic order.

Bundle Efficiency Preliminary Rating		
Criteria	**Proposed Rating**	**Rating Justification *(manually enter)***
Cost effectiveness of MOT	High	Modest savings in MOT are expected at the Wabash River and Lauramie Creek sites as MOT can be coordinated and leveraged for traffic in both directions.
User impact	Negative High	There is limited anticipated impact on users.
Bundle Efficiency Score (out of 15)	**10.313**	

Attachments:	

INDOT Call for Projects - Bundle Rating Worksheet (Corridor Bundle)					
-	-	-	-	-	-
Instructions: Fill out one Bundle Rating Worksheet for each proposed bundle by entering requested information into the yellow shaded boxes. For the Bundle Number, start with "C-1" for the first proposed corridor bundle. Fill out a separate Bundle Rating Worksheet for each additional bundle. Refer to Business Rules for guidance.					
	-	-	-	-	-
District:					
Bundle Type:	Corridor				
Bundle ID:	-				
DES #s of projects in bundle:					
(manually enter)					

Bundle Size (prior to efficiencies):	$ -				
(manually enter)					
Overall justification for bundle *(manually enter)* [consider the following: what is the goal of bundling the projects; why are these projects being chosen to go together and how will it achieve the goal; relevant project scoping details]					

Bundle Efficiency Preliminary Rating		
Criteria	**Proposed Rating**	**Rating Justification *(manually enter)***
Bundle composition		
Geographic concentration		
Similarity of site conditions		
Flexibility of contracting in scheduling / sequencing		
Cost effectiveness of MOT		

Bundle Efficiency Preliminary Rating					
Criteria	**Proposed Rating**	**Rating Justification *(manually enter)***			
User impact					
Bundle Efficiency Score (out of 15)	**-**				
Attachments:					

APPENDIX H. SUMMARY PRESENTATION

PENDING

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