



U.S. Department of Transportation
Federal Highway Administration

Bridge Bundling Guidebook

*An Efficient and Effective Method for Maintaining
and Improving Bridge Assets*

ABC-UTC
Florida International University (FIU)

Webinar

October 17, 2019
1:00 pm – 2:00 pm (EDT)

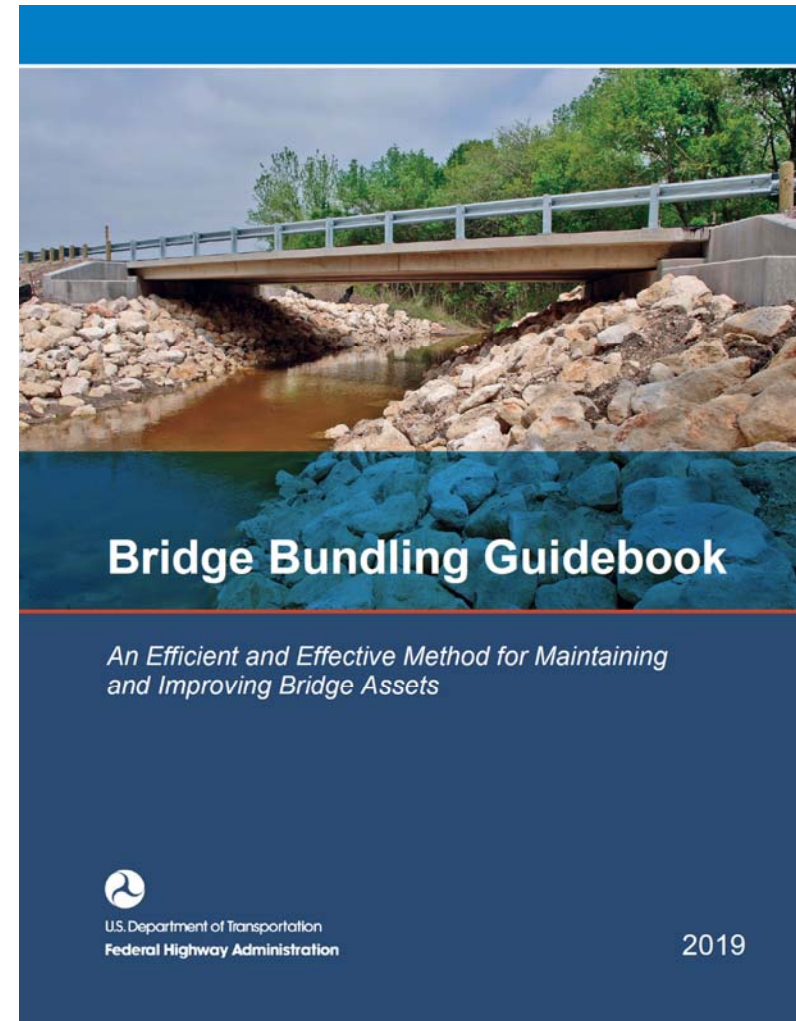
Romeo Garcia
FHWA, Bridge Construction Engineer

Dan D'Angelo, P.E.
ARA, Principal Civil Engineer

Barry Benton, P.E.
GPI, Vice President

Outline

1. Background
2. Bridge Bundling Guidebook
3. Appendices
4. Case Studies



1. Background

- Bridge Bundling Implementation Team
- Technical Work Group
- Agency Visits
- Definition



Technical Work Group (TWG)

- Justin Bruner, Pennsylvania Department of Transportation
- Aaron Butters, H.W. Lochner
- Brenda Crudele, New York State Department of Transportation
- Jon Fricker, Purdue University
- Gregg Hostetler, Infrastructure Engineers, LLC
- Travis Konda, HNTB
- Jim Kutz, McNees Wallace & Nurick, LLC
- Edward Minchin, University of Florida
- Keith Molenaar, University of Colorado
- Stan Rugis, Northampton County, Pennsylvania
- Andrea Stevenson, Ohio Department of Transportation
- Darlene Svilkos, Erie County, New York
- Mark Traynowicz, Nebraska Department of Transportation



Agency Visits (in-person)

- County Engineers Association of Ohio
- Georgia Department of Transportation
- Hall County, Nebraska
- Missouri Department of Transportation
- Nebraska Department of Transportation
- New York State Department of Transportation
- New York State Thruway Authority
- Ohio Department of Transportation
- Oregon Department of Transportation
- Pennsylvania Department of Transportation
- Sarpy County, Nebraska
- Saunders County, Nebraska
- South Carolina Department of Transportation



Definition

Bridge Bundling Project

“A defined set (or bundle) of bridges that are planned for preservation/preventive maintenance, rehabilitation, or replacement in a timely and efficient manner...”

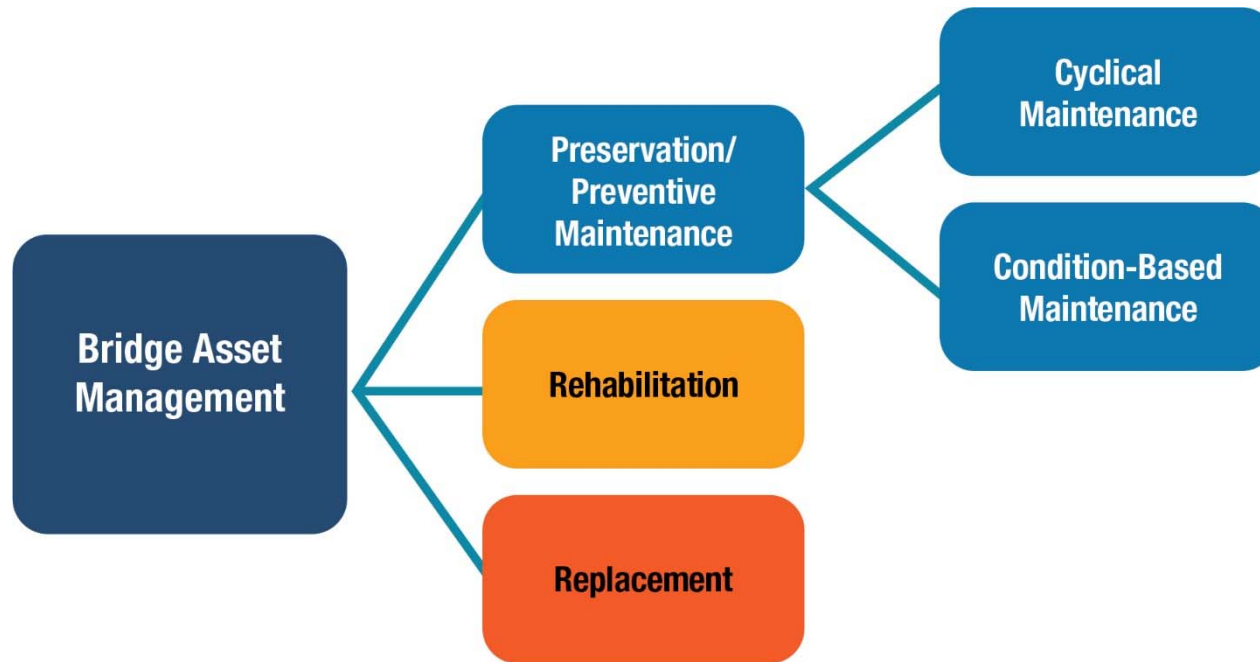
Bridge Bundling Program

“...a series of bridge bundling projects with the support of various funding options and/or partnerships that may include a program completion time frame.”

Source: FHWA Bridge Bundling Guidebook



2. Bridge Bundling Guidebook



Bridge Action Categories

Source: FHWA

Bridge Bundling = ABC?

Bridge bundling lends itself very well to ABC at two levels:

- Macro-level (or Program Level) – Allows owners to accelerate improvements to their bridge program by bundling bridges, funding, permitting, etc.
- Micro-level (or Project Level) – Facilitates faster bridge construction through scale, efficiency and sequence of construction



Guidebook Content includes:



Federal legislation



Noteworthy practices from agencies, including case studies



Other resources from agencies or professional organizations

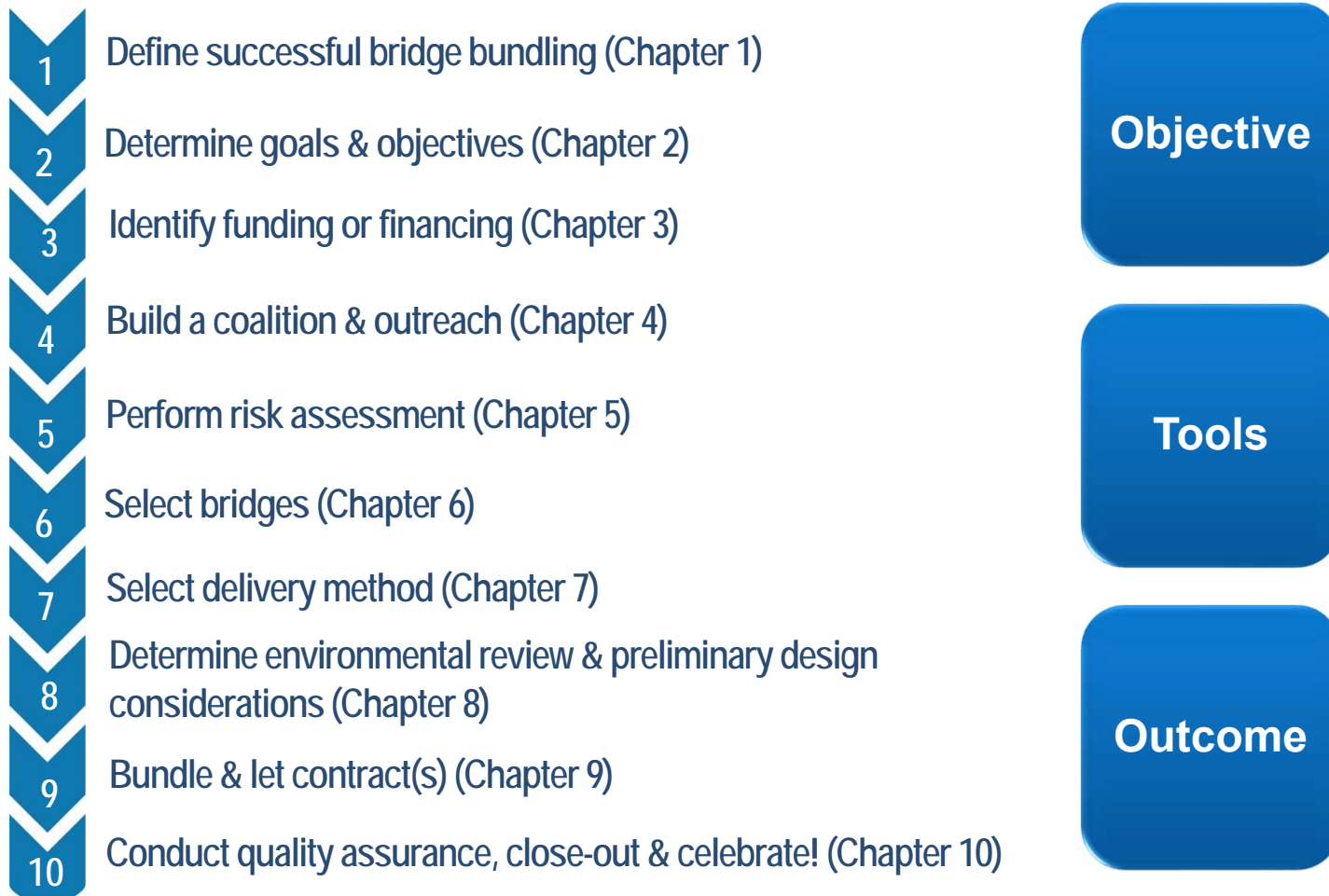


Federal guidance



Video clip from State or local agency representative offering his or her perspective

Bridge Bundling “How-to”



Introduction: Defining Success



Objective:

- To be able to define a successful bridge bundling project or program

Tools:

- Definition
- Case studies
- List of lessons learned

Outcome:

- Improved understanding of the range of successful bridge bundling projects and programs



Successful Bridge Bundling

Bridge bundling has been used successfully to:

- Achieve performance targets
- Complete preservation/preventive maintenance actions
- Rehabilitate bridges
- Replace bridges
- Achieve economies of scale
- Reduce cost
- Accelerate project schedules
- Deploy innovation



Lessons Learned

It is best when bridge bundling is used for:

- Locations with no, or minimal, ROW acquisitions
- Locations with minimal environmental constraints
- Locations where hydraulic analysis is completed in advance
- Locations with sufficient advance geotechnical information



Why Bundle Bridges? Goals and Objectives



Objective:

- To establish goals and objectives for a bridge bundling project or program

Tools:

- Case studies
- List of common goals, benefits, and objectives
- Research studies
- Work types, bridge asset management

Outcome:

- Documented project goals and objectives



Goals and Objectives

1. Achieve performance goals
2. Save time
3. Save design costs
4. Save construction costs
5. Take advantage of economies of scale
6. Take advantage of available funding
7. Take advantage of financing
8. Deploy innovation
9. Expedite project delivery
10. Utilize alternative contracting methods
11. Coordinate construction staging – reduce public disruption



Goals and Objectives (cont.)

12. Start construction of multiple bridges simultaneously
13. Maintain bridges in good and fair condition
14. Improve bridges in fair condition to good condition
15. Reduce bridges in poor condition
16. Improve locally owned bridge conditions
17. Improve surrounding land value, economic benefits
18. Partner with other agencies to achieve efficiencies
19. Create jobs in the construction industry
20. Increase pool of bridge contractors in a geographic area
21. Create opportunities for small and disadvantaged businesses
22. Create on-the-job training opportunities



Other Considerations

- Worst first
- Limiting competition
- Bonding capacity
- Financing cost
- Mutually dependent
- State procurement restrictions
- Funding – annual program impact
- Local industry capacity
- Agency capacity
- Federal fund use



Case Study: NY Works Accelerated Bridge Program

- Years: 2012-2013
- Cost: \$135M(DBB), \$84M (DB)
- Goals
 - Reduce bridge decks in poor condition
 - Jobs (2012 & 2013)
- 116 bridge decks over 2 years (81 DBB, 35 DB)
- Bundled to maximize efficiency
- Flexibility in contracts
- Contractors gained efficiency through repetition

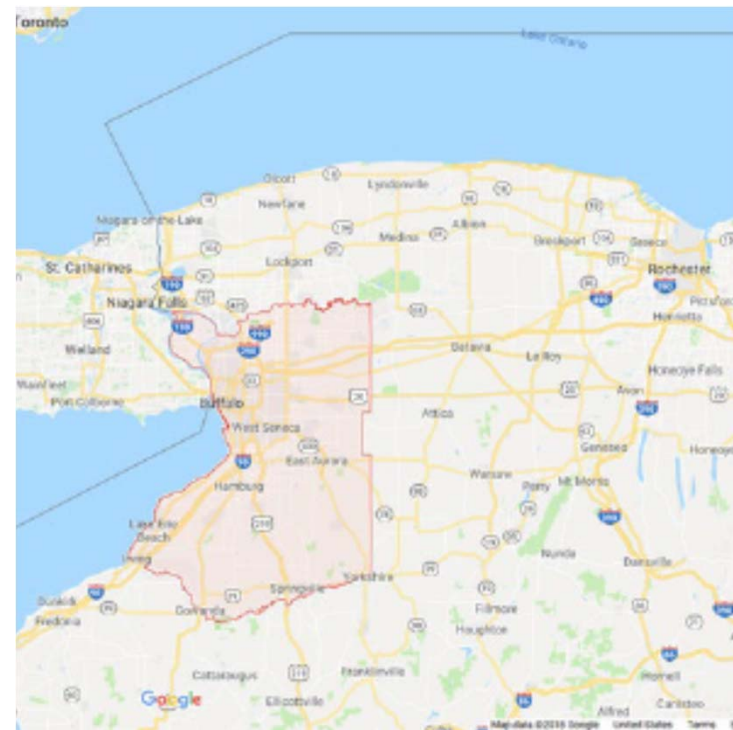


Source Fort Miller Co., Inc NY



Case Study: Erie County Preventative Maintenance Bridge Bundling Program

- Years: Ongoing
- Cost: \$1M-1.5M/year
- Goals
 - Extend service life
 - Maximize funding
- \$1M steel repairs (every 2 years)
- \$1M deck repairs (every 2 years)
- \$250K bridge washing (every 2 years)
- \$200K deck sealing (every year)



The original map is the copyright property of Google® Earth™ and can be accessed from <https://www.google.com/earth>.



Funding or Financing Strategies



Objective:

- To identify funding sources or a finance strategy

Tools:

- Table of available funding options
- Table of financing strategies
- Federal funding programs

Outcome:

- Documented funding sources or financing strategy



Chapter 3 Outline

- 3.1 Funding Approaches
- 3.2 Funding Challenges
- 3.3 Existing Revenue Generators
- 3.4 Federal Funding Programs
- 3.5 Federal-aid Complexities
- 3.6 Federal-aid Management Tools
- 3.7 Potential New Revenue Sources—Value Capture
- 3.8 Innovative Finance Strategies
- 3.9 Tolling and Pricing Revenue
- 3.10 Public-Private Partnership
- 3.11 Summary

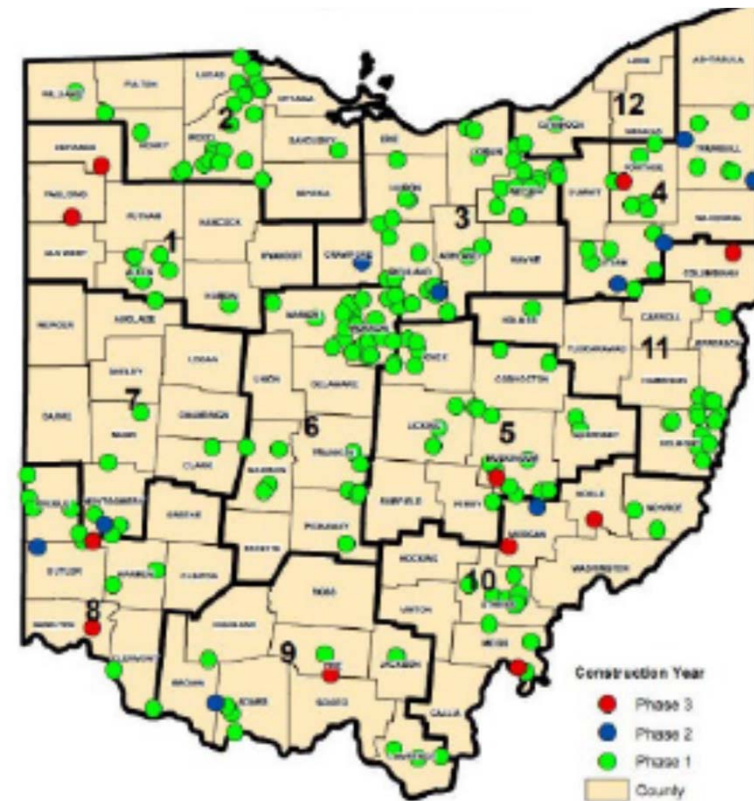


FUNDING STRATEGIES	FINANCING STRATEGIES
<ul style="list-style-type: none"> ● State and Local Funds ● Federal-aid Highway Program <ul style="list-style-type: none"> ○ National Highway Performance Program ○ Surface Transportation Block Grant Program ○ National Highway Freight Program ● Highway Infrastructure Program <p>Potential New Revenue Sources</p> <ul style="list-style-type: none"> ● Value Capture <p>Federal-aid Cash Management Tools</p> <ul style="list-style-type: none"> ● Advance Construction ● Partial Conversion of Advance Construction ● Tapered Match ● Soft Match <p>Revenue Streams</p> <ul style="list-style-type: none"> ● Federal Motor Fuel Taxes ● State Motor Fuel Taxes ● Alternative Fuel Taxes ● Fees–Tolling and Pricing ● Traditional Funding Strategies 	<ul style="list-style-type: none"> ● General Obligation Bonds ● Revenue Bonds ● GARVEE Bonds ● State Infrastructure Banks ● Federal Credit Assistance–TIFIA ● Private Activity Bonds Program ● Section 129 Loans ● Public-Private Partnerships (DBF, DBOM, DBFOM) ● Railroad Rehabilitation and Improvement Financing Program



Case Study: Ohio Bridge Partnership Program

- Years: 2014-2017
- Cost: \$110M
- Goal: Replace 200 locally owned bridges in 3 years
- Grant Anticipation Revenue Vehicle (GARVEE) bonds to pay for 80%
- Toll credits for 20% (No local match)
- Small bundles
- Replaced 210 bridges due to cost savings



Source ODOT



Coalition Building and Outreach



Objective:

- To identify a project implementation team and develop an internal and external outreach plan

Tools:

- Example communication plan
- Tables of communication topics

Outcome:

- Communication plan



Example Communication Plan

ORGANIZATION OR INDIVIDUAL	CONTENT	FREQUENCY	MEDIUM	SOURCE	RESPONSIBILITY
Commissioner/ Agency Head	Progress Report	Weekly	E-mail	Management Team	Project Manager
Construction Industry Association	Project Overview	Monthly	In-person (agency meeting)	Project Manager	Project Manager
Legislature	Benefits, Risks	Once	In-person (committee meeting)	Project Management Plan, Risk Management Plan	Commissioner
Procurement Team	Risk Allocation	Bi-weekly	Risk Report on File Sharing Site	Risk Management Plan	Risk Manager



Stakeholders

1. Internal
2. Industry
3. Control agencies
4. External/public
5. Elected officials
6. Financial market



Case Study: Bridging Kentucky

- Years: 2019-2024
- Cost: \$700M
- Goals: To rehab, repair, or replace 1,000 critical bridges in 6 years
- Large Project Team
 - Directed by KYTC
 - 21 Consultant Firms
 - Deep Expertise in key areas
 - Working alongside KYTC



Source KYTC



Risk Assessment



Objective:

- To formally identify initial project risks (threats and opportunities)

Tools:

- Risk process overview
- List of potential threats and opportunities
- List of potential risk responses

Outcome:

- Project risk management plan
- Project risk register



Threats and Opportunities

POTENTIAL BRIDGE BUNDLING RISKS (THREATS AND OPPORTUNITIES) – PARTIAL LIST	
THREAT (T) OR OPPORTUNITY (O)	POTENTIAL RESPONSE
Unclear goals and objectives (T)	<ul style="list-style-type: none"> • Get stakeholder input. • Document.
Project delivery method not clear (T)	<ul style="list-style-type: none"> • Utilize project delivery selection tool (risk-based).
Accelerated delivery/schedule constraints (T)	<ul style="list-style-type: none"> • Use CM/GC delivery method. • Use D-B delivery method. • Use ATC process. • Use incentives/disincentive clauses. • Use A+B bidding (D-B-B). • Use schedule as a selection criterion (best value procurement).
Utility/Third-Party conflicts (T)	<ul style="list-style-type: none"> • 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.



Bridge Selection



Objective:

- To identify bridge selection criteria and candidate bridges

Tools:

- Bridge selection matrix
- Table of contract sizes
- Table of contract durations

Outcome:

- List of candidate bridges for bundling



Number of Bridges per Contract Bundle

AGENCY	FUNDING SOURCE	D-B-B	IDIQ ¹	CM/GC	D-B	P3
Delaware DOT	Federal – State	2-20	22	-	28	-
Erie County, NY	Federal – Local	3-25	-	-	-	-
Georgia DOT	State	-	-	-	5-7	-
Missouri DOT	Federal reimbursement bonds	2-10	-	-	554	-
Nebraska DOT	SIB – Local	2-7	-	-	-	-
New York State DOT	Federal – State	2-19	6-200	-	6-16	-
Northampton County, PA	Private – Local	-	-	-	-	33
Ohio DOT	GARVEE bonds	2-3	-	-	2-6	-
Oregon DOT	State	-	-	3	-	-
Osceola County, FL ²	Local	-	-	13	-	-
Pennsylvania DOT	State, Private – Federal	7-18	-	-	-	558
South Carolina DOT	Federal – State	3-5	-	-	3-13	-
RANGE	-	2-25	6-200	3-13	2-554	33-558



Bridge Bundling Contract Durations (years)

AGENCY	D-B-B	IDIQ	CM/GC	D-B	P3
Delaware DOT	-	3, 5	-	-	-
Erie County, NY	2	-	-	-	-
Georgia DOT	-	-	-	3	-
Missouri DOT	3	-	-	5	-
Nebraska DOT	1-2	-	-	-	-
New York State DOT	1, 2	1, 2, 3	-	2	-
Northampton County, PA	-	-	-	-	12+10
Ohio DOT	-	-	-	3	-
Oregon DOT	-	-	7	-	-
Osceola County, FL	-	-	7	-	-
Pennsylvania DOT	2	-	-	-	25
South Carolina DOT	-	-	-	varies	-
RANGE	1-3	1-5	7	2-5	10-25



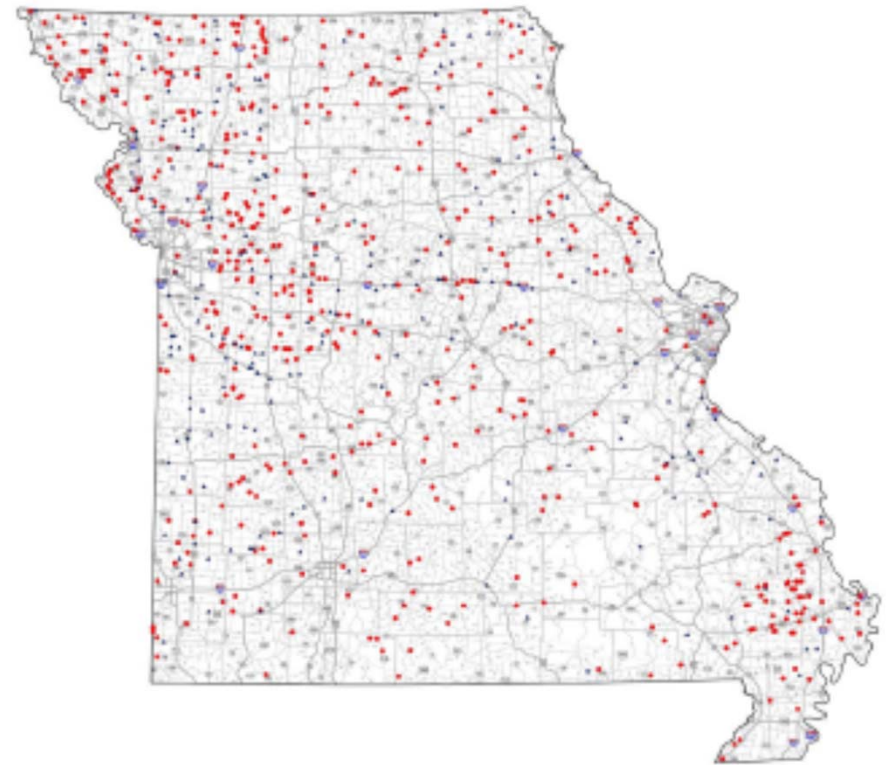
Bridge Selection/Screening Criteria

- Geographic location and proximity
- Road type, geometry, traffic, and work zone control
- Bridge size
- Similar bridge types
- Similar work types
- Environmental permitting
- Hydrology and hydraulics
- Geotechnical conditions
- Utilities/Third parties
- Right-of-Way
- Railroads



Case Study: MoDOT Safe & Sound Bridge Improvement Plan

- Years: 2009-2012
- Cost: \$685M (Total)
\$487M(DB), \$198M (DBB)
- Goal: 802 bridges in 4 years
- 42 Days Avg. road closure
- Selection Criteria
 - State owned
 - Poor condition
 - Limited or no RW needs
 - Small bridges (147' avg)
 - Available detour route
 - Low-volume road
 - No RR or Historic bridges
 - Minimum Env. Permits



Source MoDOT



Select Delivery Method



Objective:

- To identify the most appropriate project delivery and procurement method

Tools:

- Comparison tables of project delivery & procurement methods

Outcome:

- Selected project delivery & procurement method

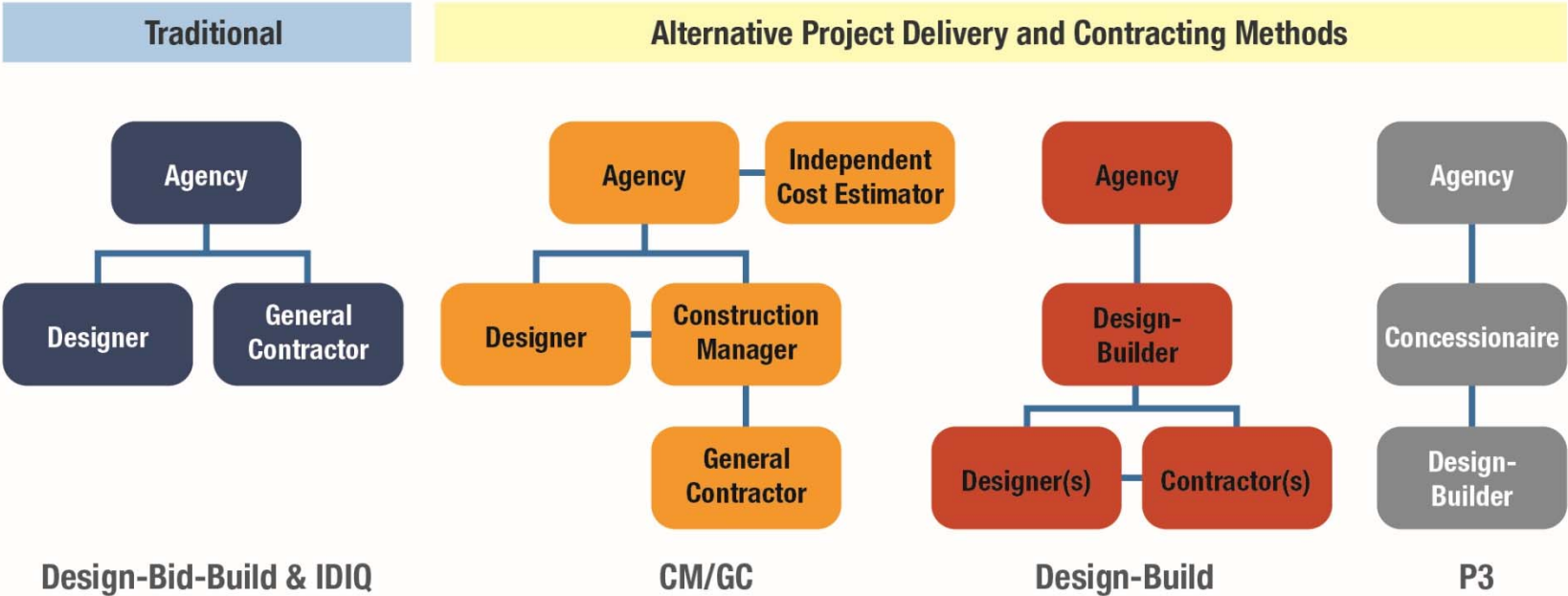


Chapter 7 Outline

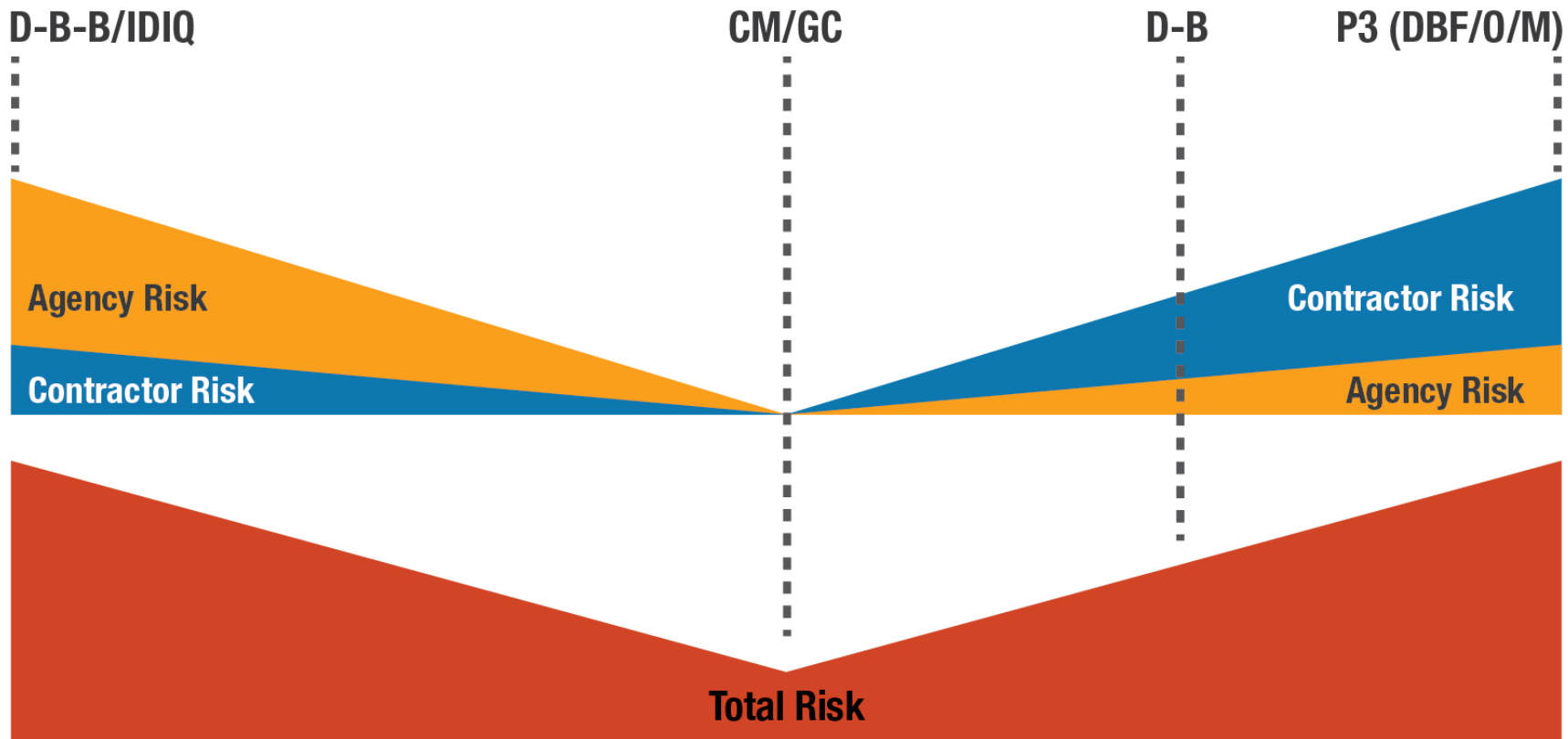
- 7.1 Project Delivery Methods
- 7.2 Risk-Based Project Delivery Method Selection
- 7.3 Design-Bid-Build (D-B-B)
- 7.4 Indefinite Delivery/Indefinite Quantity (IDIQ)
- 7.5 Construction Manager/General Contractor (CM/GC)
- 7.6 Design-Build (D-B)
- 7.7 Public-Private Partnership (P3)
- 7.8 Procurement Methods
- 7.9 Summary



Project Delivery Methods



Risk Allocation by Project Delivery Method



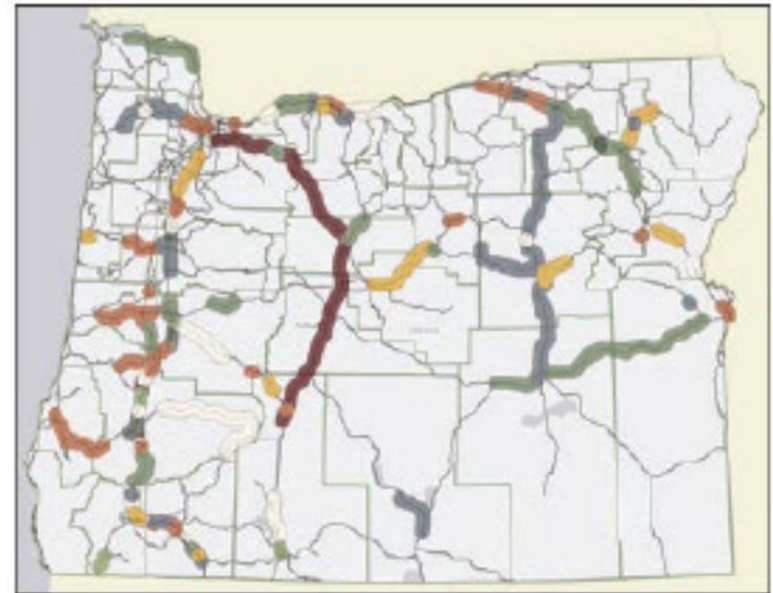
Summary of Project Delivery Methods

CATEGORIES	D-B-B	IDIQ	CM/GC	D-B	P3
Program Goals	<ul style="list-style-type: none"> • Agency retains design risks • Traditional delivery • Maintain control of final product 	<ul style="list-style-type: none"> • Quick response for unknown needs • Improve asset management 	<ul style="list-style-type: none"> • Risk allocation to party best to handle • Contractor innovation • Bundle bridges with complex components 	<ul style="list-style-type: none"> • Transfer risks to contractor • Increase capacity of bridge program • Contractor Innovation 	<ul style="list-style-type: none"> • Transfer risk to concessionaire • Operations, long-term maintenance • Contractor Innovation
Project Characteristics	<ul style="list-style-type: none"> • Similar bridge types • Simple designs • Third-party Issues resolved before advertisement 	<ul style="list-style-type: none"> • Preservations • Preventative maintenance • Culvert replacements • Predictable but not yet determined work 	<ul style="list-style-type: none"> • Bridges that owners might avoid in a bridge bundle due to complexities • Significant third-party involvement • "Out of the box" thinking required 	<ul style="list-style-type: none"> • Simple bridges for time savings • Complex bridges for innovation • Limited third-party involvement (ROW, Environmental, Utilities, Railroads, etc.) 	<ul style="list-style-type: none"> • Simple bridges for time savings • Complex bridges for innovation • Limited third-party involvement (ROW, Utilities, Environmental, Railroads, etc.) • Bridge maintenance • Variety of work types
Procurement Methods	<ul style="list-style-type: none"> • Low Bid • Best Value 	<ul style="list-style-type: none"> • Low Bid 	<ul style="list-style-type: none"> • QBS • GMP 	<ul style="list-style-type: none"> • Best Value • QBS • Low Bid 	<ul style="list-style-type: none"> • Best Value • QBS



Case Study: Oregon Trans. Inv. Act (TIA) III State Bridge Delivery Program

- Years: 2004-2014
- Cost: \$1.3B
- Goal: To repair or replace 271 bridges due to load rating analysis
- Bundled by corridor
- 96 Bundles (2-13 bridges)
- Formal program-level risk analysis up front
- Risk assessment for each bridge performed
- Delivery Method Chosen
 - 85 D-B-B, 10 D-B, 1 CM/GC



Source Oregon DOT



Environmental Review & Preliminary Design



Objective:

- To identify environmental clearance & permitting issues and preliminary design issues

Tools:

- Lists of potential issues
- Case studies
- Noteworthy practices

Outcome:

- Identification of environmental & preliminary design issues to address



Environmental Review and Clearance

- Threatened or endangered species (and their habitats)
- Migratory birds
- US Army Corps of Engineers Section 408 authorizations
- Cultural resources (archeological or historic)
- Public parklands
- Floodplains and wetlands
- Noise levels, water quality, and air quality
- Human health and safety
- Social and economic impacts on communities
- Federal aid: Categorical Exclusions, Environmental Assessments, Environmental Impact Statements



Environmental Permitting

- Communicate early with other agencies.
- Have open communication with other agencies.
- Be flexible within the constructs of existing laws and regulations.



Preliminary Design

- Right-of-Way
- Utilities – Third Parties
- Hydrology & Hydraulics
- Geotechnical Conditions
- Railroads



Case Study: DeIDOT Culvert Replacement Bundling Program

- Years: 2006-Present
- Cost: \$1M-\$3M/Year
- Goal: Replace hundreds of culverts in poor condition
- Bundled using D-B-B, IDIQ, and DB
- Environmental permitting handled differently for each method



Bundle and Let Contracts



Objective:

- To identify roles & responsibilities for contract creation & management

Tools:

- Responsibility matrix
- Civil Rights & DBE table
- Sample contract documents

Outcome:

- Project management plan



Chapter 9 Outline

- 9.1 Roles & Responsibilities
- 9.2 Project Delivery Methods
- 9.3 Project Management Plan
- 9.4 Civil Rights & Disadvantaged Business Enterprise (DBE) Considerations
- 9.5 Design and Construction Considerations
- 9.6 Summary

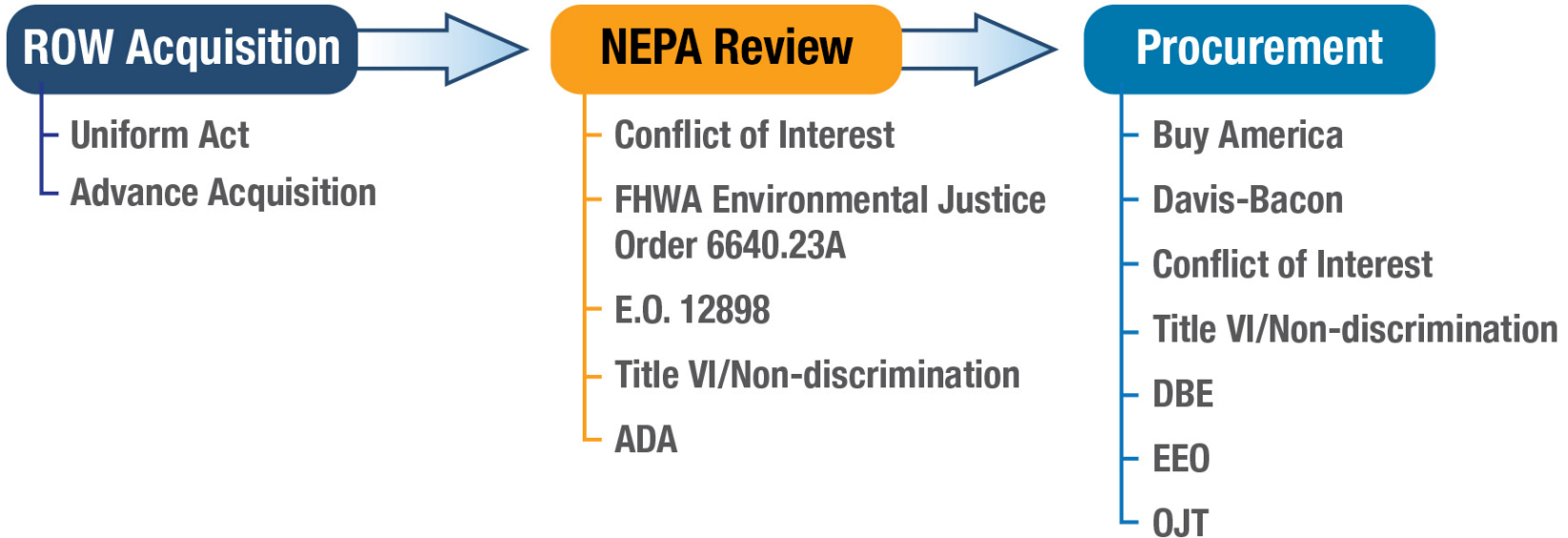


Responsible, Accountable, Consulted, and Informed (RACI) Matrix

SAMPLE BRIDGE BUNDLING PROJECT RACI MATRIX							
CATEGORIES	EXECUTIVE SPONSOR	PROJECT MANAGER	RISK MANAGER	BRIDGE ASSET ENGINEER	PROGRAM PLANNING DIRECTOR	DESIGN ENGINEER	CONSTRUCTION ENGINEER
Establish Goals & Objectives	Responsible	Accountable	Consulted	Informed	-	-	-
Funding	Accountable	Accountable	-	Informed	Responsible	-	-
Project Management Plan	Informed	Responsible	Consulted	Consulted	Consulted	Consulted	Consulted
Risk Management Plan	Informed	Accountable	Responsible	Consulted	Consulted	Consulted	Consulted
Communication Management Plan	Informed	Responsible	Consulted	-	-	-	-
Bridge Selection Criteria	-	Accountable	Informed	Responsible	-	Informed	Informed
Procurement Management	-	Accountable	Consulted	-	-	-	-
Stakeholder Engagement	Informed	Accountable	Consulted	-	Consulted	-	Consulted

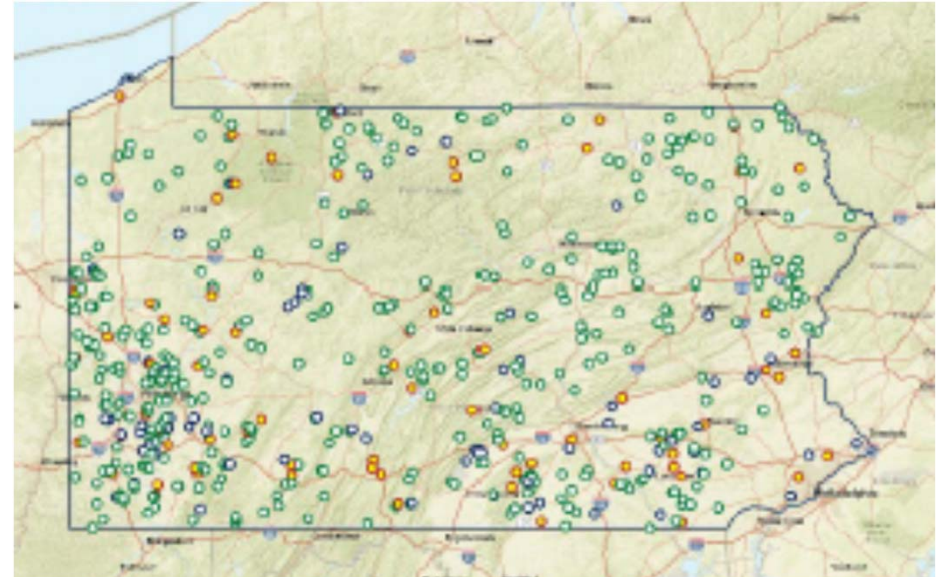


Key Civil Rights & Other Applicable Federal Requirements by Phase



Case Study: PennDOT Rapid Bridge Replacement Program

- Years: 2015-2018
- Cost: \$899M
- Goal: Replace 558 bridges in poor condition
- P3 procurement (DBFM)
- Consultant Program Manager
- Private partner set the NEPA impact footprint through Special Experimental Program 15
- Participated in utility coordination
- Outreach program to educate DBEs about program



Source PennDOT



QA, Close-out, and Celebration



Objective:

- To understand the issues to consider & options available for quality assurance

Tools:

- List of items to consider
- Comparison tables of quality assurance options

Outcome:

- Quality assurance plan



QA: Control and Acceptance

A construction QA program consists of the following core elements:

- Agency acceptance.
- Independent assurance.
- Dispute resolution.
- Personal qualification.
- Laboratory accreditation/qualification.



Image source: FHWA



Bridge Bundling Quality Assurance Options

BRIDGE BUNDLING QUALITY ASSURANCE OPTIONS		
PROJECT DELIVERY METHOD	AGENCY OVERSIGHT & ACCEPTANCE OPTIONS	QUALITY CONTROL OPTIONS
D-B-B & IDIQ	<ul style="list-style-type: none"> • By agency in-house staff. • By agency representative (outsourced to consultant). 	<ul style="list-style-type: none"> • Contractor QC staff are independent of construction staff.
CM/GC	<ul style="list-style-type: none"> • By agency in-house staff. • By agency representative (outsourced to consultant). 	<ul style="list-style-type: none"> • Same as D-B-B.
D-B & P3	<ul style="list-style-type: none"> • By agency in-house staff. • By agency representative (outsourced to consultant). 	<ul style="list-style-type: none"> • D-B QC staff are independent of construction staff. • Design-builder employs an independent testing firm. • Agency responsible for verification testing.



Close-out & Celebrate!

- Marketing
- Bridge Asset Management
- Risk Management
- Lessons Learned
- Share
- Plan



Summary – “How to”

- 1 Define successful bridge bundling (Chapter 1)
- 2 Determine goals & objectives (Chapter 2)
- 3 Identify funding or financing (Chapter 3)
- 4 Build a coalition & outreach (Chapter 4)
- 5 Perform risk assessment (Chapter 5)
- 6 Select bridges (Chapter 6)
- 7 Select delivery method (Chapter 7)
- 8 Determine environmental review & preliminary design considerations (Chapter 8)
- 9 Bundle & let contract(s) (Chapter 9)
- 10 Conduct quality assurance, close-out & celebrate! (Chapter 10)



3. Appendices

- A. Bridge Bundling Process Flow Chart
- B. Bridge Bundling Implementation Checklist
- C. Case Studies
- D. National Bridge Condition and Bridge Asset Management
- E. Finance Mechanisms
- F. Risk Management Process Overview
- G. Bridge Selection Matrix
- H. Alternative Contracting Methods
- I. Alternative Technical Concepts
- J. Sample Contract Documents
- K. Other Bridge-Related Innovation
- L-1. Research: Capital Program Cost Optimization through Contract Aggregation Process
- L-2. Research: Quantification of Cost, Benefits, and Risks associated with ACMs and Accelerated Performance Specifications



4. Case Studies

Bundling scope of work for

- Preservation/Preventive maintenance
- Rehabilitation
- Replacement/New

Bundled bridges by

- State owners
- Local owners
- Combined owners
(State & Local)

Funding and financing by

- Federal funds
- State funds
- Local funds
- Private sector



Case Studies

Project Delivery by

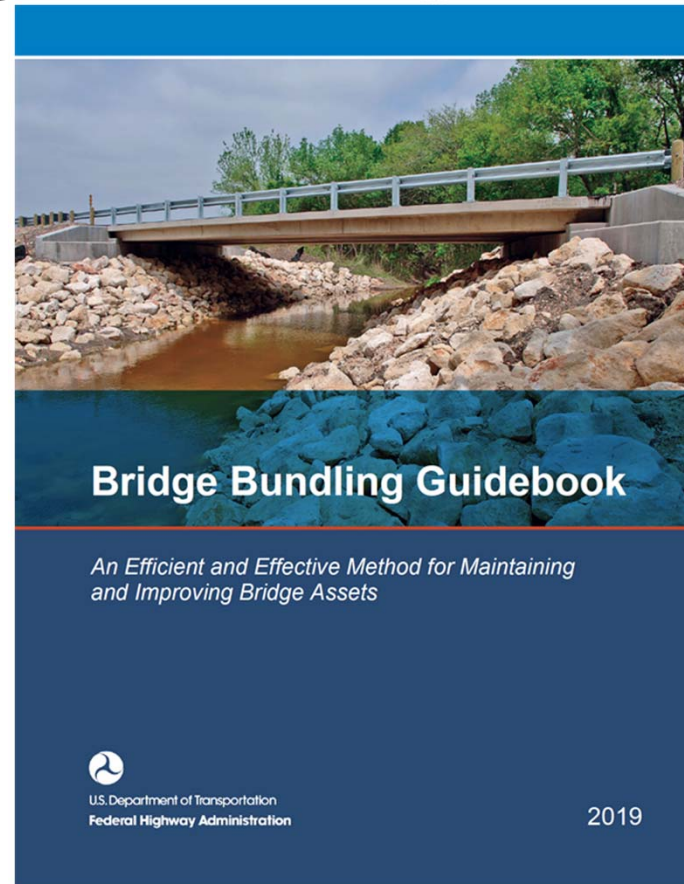
- Design-Bid-Build
- Indefinite Delivery/Indefinite Quantity
- Construction Manager/General Contractor
- Design-Build
- Public-Private Partnerships (Design-Build-Finance)

Procurement by

- Low Bid
- Best Value
- Qualifications-Based Selection



Bridge Bundling Guidebook



https://www.fhwa.dot.gov/ipd/alternative_project_delivery/defined/bundled_facilities/



U.S. Department of Transportation
Federal Highway Administration

Bridge Bundling Guidebook

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