



 **pennsylvania**  
DEPARTMENT OF TRANSPORTATION

**2019** RAPID BRIDGE  
REPLACEMENT PROJECT  
**LESSONS  
LEARNED  
REPORT**





# I. INTRODUCTION

The Pennsylvania Department of Transportation's (PennDOT) Rapid Bridge Replacement (RBR) project is a public-private partnership (P3) encompassing the design, construction, financing and life cycle maintenance of 558 replacement bridges. Plenary Walsh Keystone Partners (PWKP) was selected as the Development Entity (DE). The RBR project is the largest multi-asset, multi-location P3 project of its kind in the United States, replacing poor condition bridges statewide while minimizing impacts to the traveling public.

## Purpose

This document was developed by the PennDOT Office of Public-Private Transportation Partnerships (P3 Office) to summarize key lessons learned during the development, procurement, design and construction, and maintenance phases of the RBR project.

PennDOT focused its efforts on identifying what aspects of the project worked well, what RBR processes or procedures could be adapted for use in its regular capital program and what improvements or clarifications are needed to the project documents for future PennDOT P3 or alternative delivery projects.

Activities related to project delivery and management, schedule, cost, design, environmental, right-of-way, utilities, construction, and maintenance were reviewed to identify common themes that could be translated into future actions such as making changes to PennDOT standards and publications, making changes to contract language for future PennDOT P3 or alternative delivery projects, or making improvements to administrative processes such as project scoping or communication.

## Information Collection Methods

PennDOT gathered lessons learned data through a series of workshops that occurred toward the end of the design and construction phase. A variety of groups associated with the project provided feedback, including representatives from PennDOT's executive management team and P3 Office; PennDOT's subject matter experts in right-of-way, utilities, bridge and roadway design, construction, and maintenance; PennDOT's 11 Engineering Districts; and PennDOT's consultant support staff. Over 140 representatives were asked a series of questions and provided feedback regarding their experiences with the RBR project.

## II. PROJECT SUMMARY

Pennsylvania is among the nation's leaders in terms of state and local bridges (approximately 32,000), and miles of state and local roadways maintained (approximately 120,000). Because the RBR project was a statewide multi-location project, PennDOT and the DE had to accommodate some unique elements.



### Government and Organizational Structure

Pennsylvania's governmental structure and PennDOT's organization required the successful DE to coordinate with 67 counties that collectively form 11 PennDOT Engineering Districts, each with respective preferences regarding transportation infrastructure.



### Diverse Conditions Statewide

Some of the most diverse geography of any state, including mountains, valleys, numerous rivers and streams, and varying geology including karst conditions.



### Special Experimental Project-15 (SEP-15)

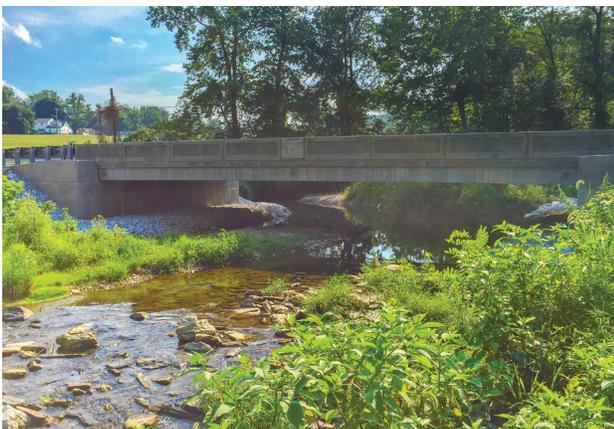
PennDOT obtained approval from the Federal Highway Administration (FHWA) to allow the responsibility for the development of the required National Environmental Policy Act (NEPA) documents to be transferred to the DE.



### Enabling Legislation

To utilize a P3 procurement, PennDOT leveraged legislation that allowed public entities to enter into agreements with private sector partners to finance the delivery and maintenance of transportation-related projects (Act 88 of 2012).

The RBR project focused on bridges of similar size and design (predominantly single-span bridges or culverts), which allowed the opportunity for similar designs and economies of scale, optimizing the ability to complete the design and construction of individual bridges more quickly. The project also included a 25-year maintenance term on each bridge, which began after each respective bridge was constructed and achieved final acceptance by PennDOT. PennDOT estimated that replacing the structures using conventional contract procedures would have taken eight to 12 years, while a P3 project could compress the schedule to approximately five years.



## Developing & Achieving Project Goals

### Preliminary project goals included:

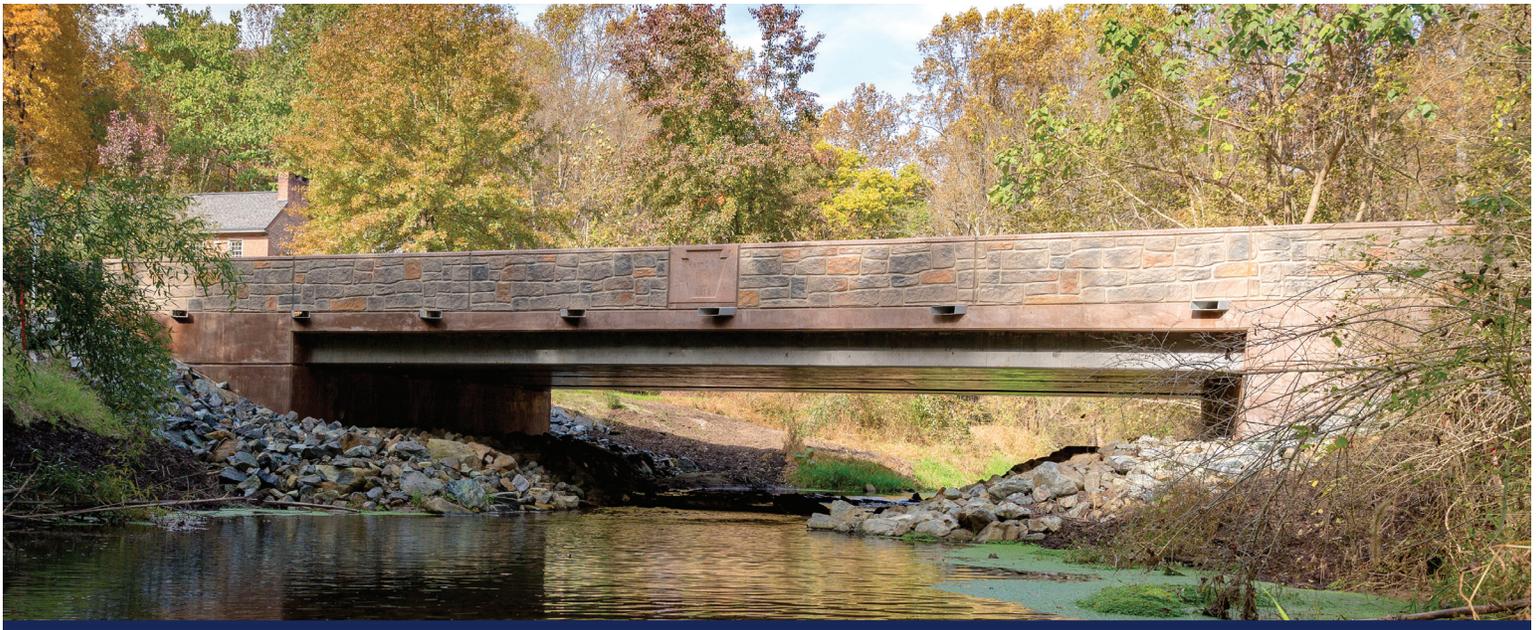
- ✓ Accelerate replacement of poor condition bridges
- ✓ Utilize high-quality, cost-effective and sustainable alternative technical solutions
- ✓ Minimize the duration of public inconvenience during construction and maintenance of each replacement bridge
- ✓ Minimize impact to the environment while ensuring safety
- ✓ Improve system connectivity and mobility for commerce
- ✓ Undertake all work on a whole-life management basis to ensure that each replacement bridge is handed back to PennDOT in a suitable condition upon completion of the maintenance phase

### APPROACH TO DEVELOPING & ACHIEVING GOALS



PennDOT set the requirements and provided guidance and suggestions, but left the decision-making on how to achieve the required outcome to the DE. Ultimately, the delivery of the bridges was the responsibility of the DE.

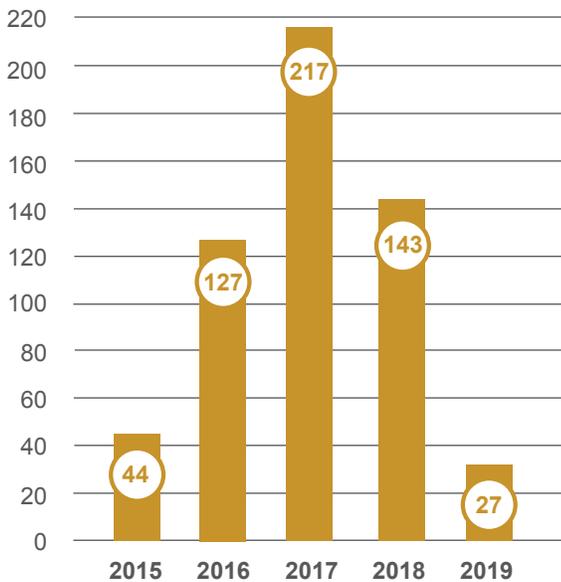




## What was the Result?



## Bridges Constructed by Year



## Noteworthy Statistics

**5,251** Design Items Reviewed by Districts

**27,325** Project Document Submissions Processed by PennDOT Team

**558** NEPA Approvals

**99** Section 4(f) Resources

**80** Section 106 Resources

**457** General Permits (GP-11)

**1,709** Utility Relocations

**80** Joint Permit Applications

**1,808** Right-of-Way Acquisitions

# III. PROJECT SUCCESSES

The following were considered project successes:

- ✓ 558 poor condition bridges were replaced. The majority were replaced in an expedited timeframe with minimal impacts to the traveling public and PennDOT's traditional highway and bridge delivery program.
- ✓ Experience gained from coordination of utility relocations is being used to modernize PennDOT's utility management system and coordinate activity statewide.
- ✓ PennDOT staff gained additional alternative project delivery experience within and outside their normal areas of expertise and were able to implement these items into the standard program.
- ✓ Innovations
  - Use of **polyester polymer concrete** overlay on all bridge decks was installed to protect decks from the infiltration of deicing salts, provide extended useful life in a single application (as opposed to three epoxy applications) and reduce long-term maintenance costs.
  - Use of **Bridge-In-A-Backpack™**, also known as a Composite Arch Bridge System, accelerated bridge construction time and reduced life cycle costs.
  - Use of **folded steel plate girder** design, which utilized cold-bent steel plates to form an innovative girder shape that provides strength with lighter weight.
- ✓ Utilization of SEP-15 allowed the DE to develop the NEPA documents in a streamlined, efficient manner. PennDOT hopes the overall success of the process will aid in updates to federal regulations.
- ✓ Tools were developed to manage right-of-way acquisitions in a streamlined, centralized manner which will be utilized in PennDOT's regular program.
- ✓ Implemented processes to ensure all design submissions were automated and set up tracking processes that can be utilized on future projects.



*Bridge-In-A-Backpack™, JV-135 and JV-136, Union County, PA*

## IV. LESSONS LEARNED

All projects bring with them an opportunity to learn. The RBR project is no different, and due to the alternative delivery vehicle used to procure a private partner, as well as the project's size (558 individual locations spanning the entire state of Pennsylvania), it provided extensive opportunities for PennDOT to experience new ways of managing and coordinating projects; to learn or adapt processes to expedite project development and improve communication internally and externally; and to gain a better understanding of how performance-based contracting works.

### PennDOT Procurement Process & Asset Selection

Preliminary project development and the utilization of an alternative delivery method for a project of this size was new to PennDOT. Some key lessons that PennDOT learned related to the asset selection and procurement process for the RBR project were:



#### Asset Selection

- Ensure all teams utilize the same consistent criteria for selecting assets.
- Use a multi-discipline approach to develop selection criteria.
- Consider complexities beyond design and construction (utility, permitting, right-of-way, traffic impacts) when selecting assets.



#### Asset Categorization and Prioritization

- If developing a multi-asset project, identify or categorize the assets based on complexity, and include contract language to ensure the most complex elements are addressed early in the project to minimize schedule impacts.





### Risk Allocation

- Perform a risk assessment during contract development to understand what the risks are and which party (PennDOT or DE) is best equipped to manage them in a cost efficient and expeditious manner.
- Clearly outline the responsibilities of both PennDOT and the DE in the contract documents to ensure clarity.
- Effectively consider and evaluate the increased PennDOT, stakeholder, and outside agency demands and risks associated with DE innovations.



### Exercise Patience

- Ensure ample time is set aside for thorough project scoping, documentation and review by subject matter experts.
- Understand that coordination among various stakeholders to develop the project scope and performance requirements may initially result in conflicting opinions.



### Performance Criteria Development

- Create a multi-discipline team to determine the performance criteria required for the project.
- Understand that the contract instrument used for procurement in P3 projects may be entirely different than those used on traditional contracts. Undocumented preferences, applicable standards or procedures must be specifically written into the contract to ensure they will be followed.
- Exemptions or rewrites of portions of existing design manuals, specifications, or standards may need to be incorporated into project documents to ensure clarity on the contract documents and standards and specifications.
- Establish criteria for non-compliance in design, construction and management activities that have reasonable cure periods and penalties to ensure the best outcome for safety, quality and schedule.
- Ensure that contract language specifically outlines roles, responsibilities and expectations for all key personnel on the project.
- Clearly define quality criteria and expectations, including quality control roles responsibilities, qualifications, and expectations for construction inspection and acceptance (include forms to be used, photo documentation protocols, etc.).
- Retain responsibilities of managing the Construction Quality Acceptance Firm (CQAF).



## Post-Procurement (Administration and Management)

Once the DE was selected, meetings occurred to help integrate and familiarize the DE and PennDOT teams with each other to ensure all parties clearly understood the project goals and requirements. As the project progressed, it was clear that some additional coordination and changes to the project setup would have helped with project understanding and communication.

The following summarize key lessons learned regarding the RBR project's management and administration:

### 1. PennDOT and DE Shared Requirements

- ▶ Allow adequate time for project setup
  - Develop thorough project management plans that clearly outline the roles and responsibilities of all team members
  - Adhere to timeframes to submit and approve key project manuals (design and construction quality, project management) so that they are in place before the project fully commences
  - Establish design submission and Requests for Information (RFI) protocol as soon as possible
  - Utilize and have in place a single document management system for the entire project. Determine authorized users, work flow, etc. as soon as possible so that all project documentation is captured from the project onset
  - Mandate co-location of DE and owner staff





## 2. DE Performance

- ▶ Require analysis of complex/high-risk activities and development of a schedule that can be monitored from project start
- ▶ Develop sufficient timeframes for design submissions and resubmissions
- ▶ Ensure DE fully understands the importance of its role in public outreach and coordination with public and government stakeholders during all phases of the project
- ▶ Ensure that all DE team members are fully engaged and have clearly identified roles

## 3. PennDOT Requirements for Project Management

- ▶ Clearly define roles and responsibilities of the PennDOT project team
- ▶ Clearly communicate expectations of PennDOT personnel who are providing direct or indirect support of the project, particularly regarding the differences of a P3 or Design-Build contract versus a typical DOT project
- ▶ Establish a process to capture lessons learned early in the project

## 4. Design and Construction Phases

- ▶ Ensure thorough Quality Control process is in place prior to start of construction
- ▶ Quality Control and Assurance
  - Establish process to issue, track and resolve non-compliance events from project onset
  - Establish quality assurance/audit processes early in the project
  - Establish escalation processes for design, construction and commercial issues that are not being resolved at the lowest levels to prevent schedule slippage
- ▶ Consider the use of a Partnering Professional to assist the PennDOT and DE teams with conflict resolution

- Require the successful DE to perform field views with multiple discipline representatives prior to design (should be outlined as a Request for Proposal [RFP] requirement)
- Establish reasonable time allowances for both owner review of submissions and contractor allowance to resubmit
- Ensure DE develops a project schedule that includes reasonable timeframes, consistent with contract language, for multiple design submissions (including approval time) and other contract-specified activities such as advance utility notifications or right-of-way acquisition times

#### 5. Maintenance Phase (when applicable)

- ▶ Establish process to issue, track and resolve project issues from project onset
- ▶ Establish handback procedures and criteria early in the project
- ▶ Develop and update a maintenance management manual early in the project that includes roles and responsibilities, emergency response, notifications, and reporting requirements and frequency

## V. BEST PRACTICES

Based on the lessons learned, some of the best practices identified that are critical to the success of future P3 projects include:



- ✓ Commitment to communication at all levels
- ✓ Appropriate risk allocation
- ✓ Proper balance of performance and prescriptive requirements
  - Maximizes proposer flexibility
  - Allows for more innovation
- ✓ Project-specific business plan
- ✓ Develop issues resolution process
- ✓ Audits for project performance
- ✓ Early and constant coordination with outside agencies

Learn more about transportation P3s in Pennsylvania at [www.p3.pa.gov](http://www.p3.pa.gov)

