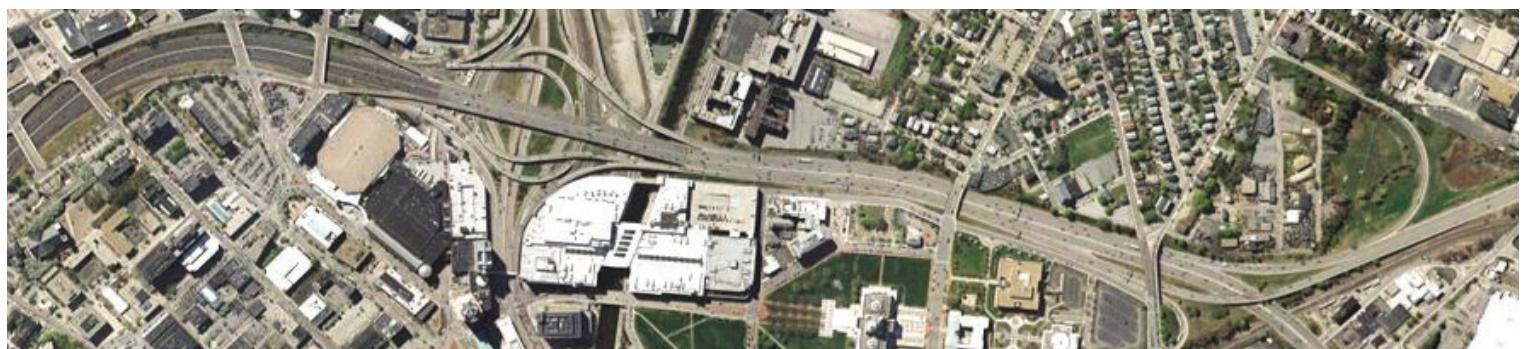


## Rhode Island Department of Transportation: Complex Bridge Replacement Management Case Study



An aerial image of the I-95 Northbound Viaduct Replacement site in Providence, RI.

### Project Management Strategies for Complex Projects: The I-95 Northbound Viaduct Replacement Project in Providence

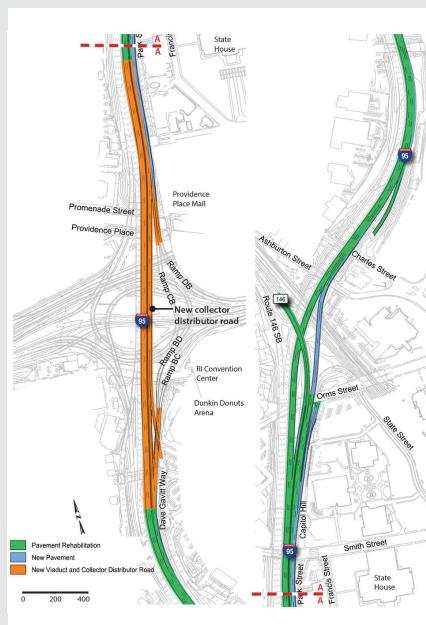
Complex highway projects face uncertain financing, right of way and technical issues, and stakeholder scrutiny, among other challenges. These issues often disrupt successful project implementation, including on-time and on-budget delivery, which may cause additional public inconvenience and dissatisfaction. Project teams that can effectively manage complex projects can minimize or avoid negative impacts.

The Rhode Island Department of Transportation (RIDOT) faces such challenges on a bridge replacement project located in downtown Providence (Figure 1 illustrates a Project Snapshot of the RIDOT I-95 Northbound Viaduct Replacement Project). RIDOT is using a product developed through the second Strategic Highway Research Program (SHRP2), called Project Management Strategies for Complex Projects, to help them deliver the project on time, within budget, and with minimal traffic disruption. The product provides a systematic and collaborative approach that goes beyond traditional project management methods, accelerates decision making, addresses complex issues, and expedites project delivery. RIDOT has already realized a number of benefits from using the product, and of most importance, the project is on track for a successful delivery.

Figure 1

### Project Snapshot: RIDOT I-95 Northbound Viaduct Replacement Project

- A bridge section of Interstate 95 through downtown Providence, RI
- 1,300 feet long
- Originally built in 1964
- Current traffic volume: 180,000–190,000 vehicles per day
- Current condition is poor, requiring bi-monthly inspections to assure structural integrity
- \$135M project budget
- Key project features: include new bridge structure, collector-distributor roadway, and pavement structure
- Design Bid Build delivery method
- Anticipated construction period: 2017-2021



### The SHRP2 Solution:

*Project Management Strategies for Complex Projects* was the tenth research project in the SHRP2 Renewal Focus Area and is also known as Renewal 10 (R10). The product guides project teams through five dimensions of project management (5DPM): cost, schedule, technical requirements, finance, and context, expanding on the traditional three-dimensional process (cost, schedule, technical requirements). Using R10's planning methods and execution tools, RIDOT (1) quantified the level of complexity in each of the five dimensions of the Northbound Viaduct Replacement project, (2) applied the planning methods to the most complex areas, and (3) developed action plans and identified potential execution tools to address complexities.

A key benefit of this product is that project managers can apply it to highway projects of varying sizes and types. This characteristic allows project managers to proactively and effectively identify project complexities and develop action plans to determine rational resource allocations and guide project planning and implementation. Furthermore, the 5DPM process may be repeated periodically throughout the project lifecycle to continually monitor complexity and re-allocate resources as necessary.

## The R10 Rhode Island Demonstration Workshop

Members of RIDOT's Northbound Viaduct Replacement project team applied Project Management Strategies for Complex Projects during a demonstration workshop. The Federal Highway Administration (FHWA) provided the workshop in order to:

- Showcase the product and provide assistance to RIDOT in applying the product's concepts and methods
- Facilitate project team communication and identify project complexities
- Identify opportunities to implement complex project management strategies in the delivery of the RIDOT highway program

The RIDOT team perceived the R10 workshop as an opportunity to learn skills that would help them plan for and address potential issues earlier in the project development process. They also wanted to compare their experience using the product on the Northbound Viaduct project with their experience applying typical management practices on the related Southbound Viaduct replacement project (under construction and scheduled for completion in 2017).

### TIMELINE OF THE RIDOT WORKSHOP PROCESS



#### ① Mapping the Project's Complexity

Like most complex projects, the Northbound Viaduct Replacement project is influenced by many factors that can affect project success. Following the R10 process, the RIDOT team identified these factors within each of the **five dimensions of project management (5DPM)**: cost, schedule, technical, finance, and context. Then they quantified the level of complexity for each dimension on a scale of 0 to 100, with 100 representing the greatest possible complexity and 50 representing an average level. The team plotted each dimension's relative level of complexity on a pentagon-shaped graph that provided an overall complexity area rating of 17,057. This graph, shown in Figure 2, is a tool to visualize the 5DPM complexity as determined by the project team.

A maximum possible rating area is 24,000 (if all five dimensions are rated 100) and an average rating area is 6,000 (if all five dimensions are rated 50). The team identified the following dimensions as significantly more complex.

- **Context** (Complexity Score of 95) – Specific factors that make context the most complex project dimension include:
  - Avoiding or minimizing negative impacts to downtown Providence's economic activity during project construction
  - A required property easement with a neighboring AMTRAK facility
  - Close proximity to the Rhode Island State Capitol and visibility to politicians
  - Close proximity to residents and businesses, including several hotels that may be affected by construction noise
- **Finance** (Complexity Score of 90) – While the project has been included in the Rhode Island State budget and may receive federal aid funding, including a potential FHWA TIGER grant pending RIDOT's application and award before contract advertisement, a number of factors make finance a complex dimension:
  - State funding could change due to alternate political priorities
  - The project's estimate was recently increased to include needed preservation improvements on infrastructure connecting to the Viaduct

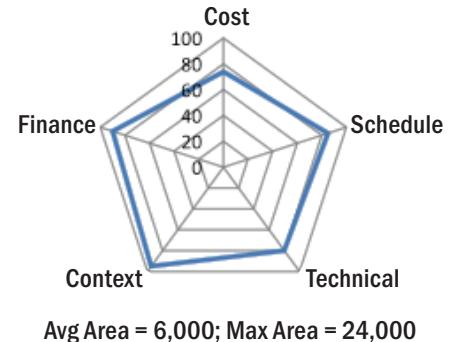
The 5DPM method illustrated in this case study can be applied numerous times—as a benchmark starting before a project's implementation—and periodically throughout the project's development stages. By identifying the greatest complexity at various points in time, project managers are empowered to allocate resources to the most complex project dimension at that particular time.

Figure 2

#### 2015 Complexity Map I-95

#### NB Viaduct

Area = 17,057



Avg Area = 6,000; Max Area = 24,000

### Resources to Help You Use Project Management Strategies for Complex Projects (R10)

- A demonstration workshop enables State and local transportation personnel to realize the product benefits first-hand by applying it to a real project.
- Workshop facilitator **training materials** educate interested agency staff and colleagues about the R10 process through a workshop or meeting environment. Through the training, staff learns the skill set to apply the product to future projects.
- The project team receives a summary report after the workshop, which outlines the **action plans and execution tools** to manage project complexities.
- The **product's guidebook and other materials** are available on the Transportation Research Board website: <http://www.trb.org/Main/Blurbs/167482.aspx>

To learn more, visit <http://www.fhwa.dot.gov/GoShrp2/Solutions/Renewal/R10> or contact:

- **Carlos F. Figueroa, P.E.** (FHWA Office of Innovative Program Delivery) at [carlos.figueroa@dot.gov](mailto:carlos.figueroa@dot.gov)
- **Keith Platte, P.E.** (AASHTO) at [kplatte@aashto.org](mailto:kplatte@aashto.org)

**“**We already use a lot of these strategies, but what we are learning here today is how to put them in the right order and get to them earlier. I will be able to take these materials back to my desk and use them as a resource for future projects. **”**

- Samuel Hawkes,  
RIDOT Project Planning Team



Members of the RIDOT project team discuss the I-95 Northbound Viaduct project during the R10 workshop.

The workshop program provides a collaborative environment to promote team communication and decision making. Successful workshops involve representatives from each of the project areas, such as environmental, structural, and construction engineers, to ensure the team addresses all areas of project complexity.

## 2 Exploring Five Methods for Managing Complexity

Once the RIDOT team identified the project complexities and developed the complexity map, it applied the **five R10 methods** to better manage the project.

Method	Examples of Team Insights
Define critical project success factors	<ul style="list-style-type: none"><li>Minimize disruption during construction.</li><li>Secure State and Federal funding in time to advertise the project.</li></ul>
Assemble project team	<ul style="list-style-type: none"><li>While the current RIDOT project team composition is adequate, additional members may be needed if a different project delivery method is selected.</li></ul>
Select project arrangements	<ul style="list-style-type: none"><li>The current construction on the I-95 Southbound Viaduct project provides a good opportunity to compare project management lessons learned on this project versus the 5DPM approach on the I-95 Northbound Viaduct project.</li><li>Consider a comprehensive risk assessment and a public involvement plan before and during construction.</li></ul>
Prepare early cost model and finance plan	<ul style="list-style-type: none"><li>Funding is slated for the project but this could change. The team needs to explore contingency options to avoid potential delays.</li></ul>
Develop project action plans	<ul style="list-style-type: none"><li>Eight action plans were identified as a result of this process to successfully manage project complexities. Figure 3 on page 4 illustrates the process of identifying an action plan following the 5DPM approach.</li></ul>

## 3 Applying Project Execution Tools and Action Plans

Next, the RIDOT team developed action plans to manage the identified areas of complexity. They considered each of the **13 R10 project execution tools** listed below and selected (►) 8 for specific action plans.

- 1. Incentivize Critical Project Outcomes
- 2. Develop Dispute Resolution Plan
- 3. Perform Comprehensive Risk Analysis
- 4. Identify Critical Permit Issues
- 5. Evaluate Applications of Off-Site Fabrication
- 6. Determine Required Level of Involvement in ROW/Utilities
- 7. Determine Work Package/Sequence
- 8. Design to Budget
- 9. Co-Locate Team
- 10. Establish Flexible Design Criteria
- 11. Evaluate Flexible Financing
- 12. Develop Finance Expenditure Model
- 13. Establish Public Involvement Plan

Figure 3 on page 4 outlines the 5DPM process for developing action plans.

Figure 3

## The Development of a 5DPM Action Plan for RIDOT

Figure 3 illustrates the development of one of RIDOT's eight action plans.



**“**We have a strong team that is open to new ideas. When I learned about this product as part of the (SHRP2) Implementation Assistance Program, I knew we would get a lot out of it. Plus we have an opportunity to compare our results on the Northbound project to the Southbound. **”**

- Will Hernandez, RIDOT Managing Engineer



### Next Steps

FHWA will provide the following support:

- Detailed training on the R10 execution tools
- Funding for additional RIDOT training to build capacity on managing complex projects
- Assistance in developing and institutionalizing a RIDOT project management policy that incorporates 5DPM

### Implementation Benefits

RIDOT will continue to use R10 as it delivers the Northbound Providence Viaduct Replacement project. However, the project team has already benefited from the product by:

- Conducting an in-depth self-assessment to determine opportunities to improve the agency's complex project management maturity and capability in all phases of project development
- Identifying potential alternative sources of project funding
- Developing an action plan to receive contractor constructability input earlier in the design process
- Leveraging existing stakeholder relationships established during the Providence Southbound Viaduct project

### Implementing SHRP2

The second Strategic Highway Research Program (SHRP2) is a national partnership of the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the Transportation Research Board. Together, these partners conducted research and are deploying resulting products to help the transportation community enhance the productivity, boost the efficiency, increase the safety, and improve the reliability of the Nation's highway system.



The Rhode Island Department of Transportation applied Strategies for Managing Complex Projects on the Providence Northbound Viaduct project as part of the **SHRP2 Implementation Assistance Program**.