



The Wisconsin Department of Transportation (WisDOT) is managing a series of complex projects (left to right): the Zoo Interchange, I-94 E-W Corridor Replacement, and the Madison Beltline

Project Management Strategies for Complex Projects

The Five Dimensional Project Management Process: An Innovative Approach to Managing Complex Projects

Innovation is at the forefront as the Wisconsin Department of Transportation (WisDOT) explores a new method for managing complex projects. Moving beyond the standard, three-dimensional project management process focused on cost, schedule, and technical requirements, WisDOT is training their staff to use a **five-dimensional project management (5DPM)** approach that incorporates the dimensions of context and finance. With 5DPM, project managers become innovative problem solvers able to anticipate and prepare for challenges associated with complex transportation projects.

5DPM is the core of a product developed through the second Strategic Highway Research Program (SHRP2) called *Project Management Strategies for Complex Projects (R10)*. WisDOT staff learned about 5DPM during a demonstration workshop sponsored by the Federal Highway Administration (FHWA) to assist their staff with the replacement and reconfiguration of the I-94 E-W corridor in Milwaukee. Based on this experience, WisDOT intends to integrate 5DPM into the agency's project management and delivery process. Their first step was hosting a Train the Facilitator Training to help managers understand and apply the 5DPM approach.

This case study summarizes the 5DPM concepts and strategies, and describes how WisDOT participants applied them to actual projects. The FHWA encourages transportation agencies to innovatively plan for complex projects by integrating 5DPM into their project management and delivery process. Detailed tools, presentations, and other training resources are available in the [5DPM Train the Facilitator Workbook](#).

The Challenge: Managing Complex Projects Using the Three-Dimensional Project Management Process

Replacing a highway bridge that traverses prominent landmarks and neighborhoods while navigating uncertain financing. Upgrading a multimodal ferry terminal while maintaining access during construction and adhering to seasonal fish spawning windows. Complex projects like these may face indefinite financing, right of way, utility relocation and technical issues, and stakeholder scrutiny, among other challenges.

Regardless of size or type, complex projects have one thing in common: high degrees of uncertainty and unpredictability that may increase costs, add delays, and undermine public confidence. Managing complex projects using the three dimensions (cost, schedule, and technical requirements) is challenging. This approach revolves around static, sometimes stove-piped, interaction, which limits information and resources to address unexpected problems.

Complex projects require a more comprehensive approach that encourages team collaboration and communication, and adds formality to the consideration of external factors, such as the environment or public involvement, and financial issues that may impact project funding.



The SHRP2 Solution: Project Management Strategies for Complex Projects

Project Management Strategies for Complex Projects equips project managers with innovative solutions to address complex projects. It was the tenth research project in the SHRP2 Renewal Focus Area and is also known as Renewal 10 (R10). The R10 product guides project teams through 5DPM: cost, schedule, technical requirements, finance, and context, expanding on the three-dimensional process. 5DPM facilitates the integration of these factors into the overall project management process. Using R10's planning methods and execution tools, project teams 1) quantify the level of complexity in each of the five dimensions, 2) apply the planning methods to the most complex areas, and 3) develop action plans and identify execution tools to address complexities.

5DPM fosters dynamic interactions through early communication and collaboration by involving the entire project team and supporting partners from startup through construction. Building stronger partnerships sets the stage for effective project management, enabling teams to proactively identify project complexities, develop action plans to determine rational resource allocations, and guide project planning and implementation. The 5DPM process may be repeated periodically to continually manage complexity and re-allocate resources as necessary. A key benefit is that agencies can apply 5DPM to transportation projects of varying sizes and types.

The R10 WisDOT Train the Facilitator Training

During the Train the Facilitator Training, WisDOT staff applied *Project Management Strategies for Complex Projects*. FHWA hosted the Train the Facilitator Training in order to:

- Train project teams to implement the 5DPM approach on future complex projects
- Identify opportunities to incorporate 5DPM strategies into WisDOT's project management process
- Begin to establish an internal center of expertise on complex project management

The WisDOT participants learned about 5DPM strategies and how to begin integrating them into their organization. Then they applied 5DPM tools and methods to existing complex projects. Participants split up into three groups, each focused on an individual WisDOT project. One group explored the Madison Beltline project, which is outlined in the Project Snapshot. This case study uses the Madison Beltline project to explain the 5DPM exercises and their implementation benefits.



WisDOT staff attends a 1.5 day Train the Facilitator Training in Milwaukee, Wisconsin

THE WisDOT TRAIN THE FACILITATOR TRAINING TIMELINE



1 Mapping the Project's Complexity

Understanding the project's complexity in terms of the five dimensions lays the foundation for the 5DPM process.

Creating a 5DPM complexity map benefits the project team in the following ways:

- Allows the project team to identify and discuss critical project issues at an earlier stage
- Highlights the complexity dimension(s) that most affect the project's success
- Facilitates process of resource allocation to address project complexities and maximize potential for project success
- Offers the ability to track project performance by dimension over time

The Madison Beltline group identified critical success 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 12,435. This graph, shown in Figure 1, 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 90) – Specific factors that make context the most complex dimension include:
 - The need for local acceptance, particularly from bike and transit advocates
 - Navigating environmental limitations during construction: wetlands, an arboretum, and lakes that intersect or surround the Beltline
 - The challenges of maintaining capacity while rebuilding the Beltline
- **Finance** (Complexity Score of 85) – Specific factors that make finance the second most complex dimension include:
 - The need to secure the project's placement in the State's legislature to be funded by 2022 to begin construction by 2025. If the project isn't funded in time, WisDOT would have to delay completing the project design and beginning construction on the project.

Resources to Help You Train Your Staff in Project Management Strategies for Complex Projects (R10)

- The **5DPM Train the Facilitator Workbook** is available on the [GoSHRP2 Website](#)
- The R10 product's **guidebook and other materials** are available on the Transportation Research Board website: <http://www.trb.org/Main/Blurbs/167482.aspx>

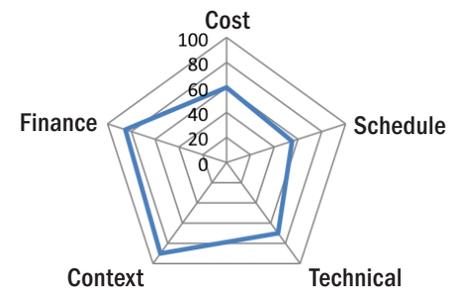
To learn more, visit <http://www.fhwa.dot.gov/GoShrp2/Solutions/Renewal/R10> or contact:

- Carlos F. Figueroa, P.E. (FHWA Office of Innovative Program Delivery) at carlos.figueroa@dot.gov
- Keith Platte, P.E. (AASHTO) at kplatte@aaashto.org

Figure 1

2015 Complexity Map Madison Beltline Project

Area = 12,435



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

“ The 5DPM process has numerous benefits. The complexity map is a useful visual tool. The success factors and targeted action plans allow you to see where you need to focus. The gap analysis tool helped WisDOT understand their unique challenges. ”

– Michael Treazise, WisDOT

Project Snapshot: The Madison Beltline Project

- Principal artery and multilane urban freeway originally constructed in the 1950s in southwest Wisconsin in Dane County
- Up to 112,000 vehicles per day travel on the Madison Beltline
- Dane County’s population is expected to add 120,000 residents between 2010 and 2040 with no capacity on the Beltline to serve this growth
- Bridges and pavement are aging and deteriorating. Ramps and shoulders do not meet current design standards.
- Key project features: replacement of existing facility, improvements to bicycle and pedestrian facilities
- Planning and Environment Linkages (PEL) and National Environmental Policy Act (NEPA) studies to be completed by 2020 before proposing recommendations to Transportation Projects Commission for funding of final design and construction
- Anticipated construction to begin by 2025



Up to 112,000 vehicles travel per day on the Madison Beltline through neighborhoods, natural areas, and business districts

2 Exploring 5DPM Planning Methods for Managing Complexity

Once the Madison Beltline group identified the project complexities and developed the complexity map, it applied the **5DPM planning methods** listed in the table below (the 5DPM planning methods are described in detail in the [R10 guidebook](#)). For the purpose of the training, the group applied the 5DPM planning methods to each of the most complex dimensions (context and finance). The group first identified the critical project success factors. In practice, this step alerts project teams to potential issues. The project team then outlined the next steps to meet the objectives of the critical project success factors.

5DPM Planning Methods	Examples of Team Insights
Define critical project success factors	<ul style="list-style-type: none"> • Context Dimension: Obtain bike and transit group acceptance of the preferred National Environmental Policy Act (NEPA) project alternative. • Finance Dimension: Secure the project’s placement in the State’s legislature budget and its enumeration in 2022 in order to begin construction in 2025.
Assemble project team	<ul style="list-style-type: none"> • Hire two public involvement specialists to communicate and engage with stakeholders before and during construction.
Select project arrangements	<ul style="list-style-type: none"> • Execute a consultant contract to hire the public involvement specialists to lead the public involvement process.
Prepare early cost model and finance plan	<p>The team mapped the project’s cash inflow and outflow and identified secured and unsecured funding sources. After the exercise, the team:</p> <ul style="list-style-type: none"> • Determined that there appears to be sufficient funding for the Beltline study. The remaining funding will depend on its inclusion in the State legislature budget and if it is funded by 2022 to begin construction in 2025. If this doesn’t happen, WisDOT will need to begin identifying other project funding sources or the project will be delayed until it is completely funded.
Develop project action plans	<ul style="list-style-type: none"> • The team developed one action plan to successfully manage project complexities within the context dimension. Figure 2 on page 4 illustrates the process of identifying an action plan following the 5DPM approach.

3 Applying 5DPM Project Execution Tools and Action Plans

The Madison Beltline group developed one action plan to manage the project complexities within the context dimension. The action plan formally establishes ideas, resources, and a schedule to address potential project speedbumps. The group considered each of the **13 R10 project execution tools** listed below and selected (▶) one tool. For an actual project, more than one would likely be used.

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

Figure 2

The Development of a 5DPM Action Plan for WisDOT

Figure 2 illustrates the development of one WisDOT 5DPM action plan.



“ If we do a better job defining complexity within complex projects, we can start building confidence within WisDOT and in the legislature, municipalities, and general public. 5DPM helps you document project data and funding by mapping out a well-defined process and clearly identifying next steps. ” – Larry Jones, WisDOT

R10 Self-Assessment Survey

Before completing the training exercises, WisDOT participants reviewed the [R10 Self-Assessment Survey](#). This tool is recommended for periodic assessment of an organization's maturity and level of formal documentation relative to the 5DPM approach. An agency rates its maturity and level of formal documentation based on 1–5 levels, with level 5 representing a strong sense of teamwork and formal documentation and level 1 representing an initial level of organizational maturity. The survey results are displayed on a color-coded map of organizational maturity that includes specifics about where opportunity for additional maturity and formality should be considered. When conducting the R10 Self-Assessment Survey, agencies should involve representatives from all areas within the organization to ensure a variety of perspectives and obtain comprehensive results.

Next Steps

WisDOT will take steps to incorporate 5DPM into its agency-wide project management process, beginning with a review of its Facilities Development Manual and Mega Project Guidelines.



Implementation Benefits

WisDOT plans to use the 5DPM process for a variety of complex projects. Agencies that adopt the 5DPM approach can benefit from:

- Identifying and anticipating potential issues early throughout the design and construction process to help project teams bolster public confidence and adhere to a proposed budget and schedule
- Acknowledging the need to establish a reliable funding stream by identifying resources earlier in the process
- Improving the project management process from startup through construction by building strong partnerships to promote and facilitate team collaboration and communication
- Identifying opportunities to improve the organizational project management maturity and capability in all phases of project development



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 productivity, boost efficiency, increase safety, and improve the reliability of the Nation's highway system.

The Wisconsin Department of Transportation applied *Project Management Strategies for Complex Projects (R10)* on various complex projects as part of a Train the Facilitator Training under the [SHRP2 Implementation Assistance Program](#).