

Accelerated Innovation Deployment (AID) Demonstration Project: Deploying Practical Solutions Using Lean Techniques and Knowledge Management

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Leni Oman

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Accelerated Innovation Deployment (AID) Demonstration Project

Deploying Practical Solutions Using Lean Techniques and Knowledge Management

FINAL Report

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Deploying Practical Solutions Using Lean Techniques and Knowledge Management (PS AID Project)

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I am deeply grateful for the encouragement, critical questions, and frank input from all the WSDOT employees that participated in this project. I hope you found value in the experience and that the recommendations and next steps will help address the opportunities and challenges you've raised.

This project was bold in concept and ambitious in scope and merely scratches the surface of what is possible to do when applying a systems view to organizational development. I hope it opens the door for more enterprise scale work.

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16. Abstract This report summarizes work done through the Washington State Department of Transportation (WSDOT) grant award for <i>Deploying Practical Solutions using Lean Techniques and Knowledge Management</i> . This project was funded through the Federal Highway Administration's Accelerating Innovation Deployment demonstration program. Activities included: developing a high level business process map and resource model; exploring opportunities to develop an enterprise architecture; assessing the current state and opportunities to improve alignment of roles, data and information with business needs; assessing opportunities to strengthen WSDOT's learning culture; evaluating and testing the use of vocabulary management to support search, navigation, and integration; and, testing the development of a knowledge book using the Method to Analyze and Structure Knowledge. The summary includes recommendations for each activity and the current status and next steps.					
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Table of Contents

INTRODUCTION.....	1
<i>Accelerated Innovation Deployment (AID) Demonstration grants</i>	<i>1</i>
<i>Report Scope and Organization</i>	<i>1</i>
Deploying Practical Solutions using Lean Techniques and Knowledge Management.....	2
Project Overview.....	2
Lessons Learned.....	2
PROJECT DETAILS	4
<i>Background.....</i>	<i>4</i>
Institutionalizing New Practices using Lean Methodologies	6
<i>What is it?.....</i>	<i>6</i>
<i>How was it developed?.....</i>	<i>6</i>
<i>How can we use it?.....</i>	<i>7</i>
<i>How can we measure the value?.....</i>	<i>8</i>
<i>Interim results.....</i>	<i>8</i>
<i>Feedback.....</i>	<i>9</i>
<i>What are the status and next steps?.....</i>	<i>10</i>
Resource Model	12
<i>What is it?.....</i>	<i>12</i>
<i>How was it developed?.....</i>	<i>12</i>
<i>How can we use it?.....</i>	<i>12</i>
<i>How can we measure the value?.....</i>	<i>12</i>
<i>What are the status and next steps?.....</i>	<i>13</i>
Enterprise Architecture: An Overview of Practice.....	14
<i>What is it?.....</i>	<i>14</i>
<i>How can we use it?.....</i>	<i>14</i>
<i>How can we measure the value?.....</i>	<i>14</i>
<i>What are the status and next steps?.....</i>	<i>14</i>
Improving Information Management for Practical Solutions at WSDOT	16
<i>What is it?.....</i>	<i>16</i>
<i>How can we use it?.....</i>	<i>16</i>
<i>How can we measure the value?.....</i>	<i>16</i>
<i>What are the status and next steps?.....</i>	<i>16</i>

Words Matter: Managing Vocabulary Resources to Support Productivity	19
<i>What is it?</i>	19
<i>How can we use it?</i>	19
<i>How can we measure the value?</i>	19
<i>What are the status and next steps?</i>	19
Strengthening WSDOT’s Learning Culture for Practical Solutions	21
<i>What is it?</i>	21
<i>How can we use it?</i>	21
<i>How can we measure the value?</i>	21
<i>What are the status and next steps?</i>	21
Sustainable Safety Knowledge Book	23
<i>What is it?</i>	23
<i>How can we use it?</i>	23
<i>How can we measure the value?</i>	23
<i>What are the status and next steps?</i>	23
WSDOT Manual Modernization: Vol. 1 Scoping and Vol. 2 Pilot	25
<i>How can we use it?</i>	25
Managing the Practical Solutions AID Project	27
APPENDIX A: TECHNOLOGY TRANSFER	28
APPENDIX B: SURVEYS	30
<i>Current State Multidisciplinary Engagement Survey Results (Before)</i>	30
REFERENCES	36

List of Figures

Figure 1. Practical Solutions Performance Framework.....	11
Figure 2 Enterprise Architecture View for WSDOT: The Layer Cake.....	15

INTRODUCTION

Accelerated Innovation Deployment (AID) Demonstration grants

The Federal Highway Administration (FHWA) Accelerated Innovation Deployment (AID) Demonstration grant program, which is administered through the FHWA Center for Accelerating Innovation (CAI), provides incentive funding and other resources for eligible entities to offset the risk of trying an innovation and to accelerate the implementation and adoption of that innovation in highway transportation. The AID program is one aspect of the multi-faceted Technology and Innovation Deployment Program (TIDP) approach, which provides funding and other resources to offset the risk of trying an innovation.

The AID Demonstration funds are available for any project eligible for assistance under title 23, United States Code. Projects eligible for funding shall include proven innovative practices or technologies such as those included in the EDC initiative. Innovations may include infrastructure and non-infrastructure strategies or activities, which the award recipient intends to implement and adopt as a significant improvement from their conventional practice.

Entities eligible to apply included State departments of transportation (DOT), Federal Land Management Agencies, and tribal governments as well as metropolitan planning organizations (MPOs) and local governments which applied through the State DOT as subrecipients.

Report Scope and Organization

This report documents the Washington State Department of Transportation (WSDOT) demonstration grant award for *Deploying Practical Solutions using Lean Techniques and Knowledge Management*. The report presents details relevant to the employed project innovation(s), the overarching TIDP goals, performance metrics measurement and analysis, lessons learned, and the status of activities related to adoption of lean and knowledge management practices as conventional practice by WSDOT. Technology transfer activities that took place to disseminate the project results are also discussed.

The project was conducted in eight tasks. Each task is reported in a separate section. Each section provides a brief summary of the following:

- What is it?
- How was it developed?
- How can we use it?
- How can we measure the value?
- What are the status and next steps?

More detailed information on each task is available in technical reports that are listed in the listed in the appendix on Technology Transfer.

Deploying Practical Solutions using Lean Techniques and Knowledge Management

Project Overview

The Washington State Department of Transportation (WSDOT) used funding from the AID Demonstration program to review and transform the project development lifecycle from Planning through Construction. We employed established lean methodology to identify opportunities to streamline processes and knowledge management practices on targeted capital projects to disseminate and institutionalize new practices. This project was carried out as part of a larger effort to deploy a Practical Solutions strategy. Funding from the AID grant allowed WSDOT to conduct interdisciplinary workshops and align knowledge resources to support new practices. This work aligns with the TIDP goals to accelerate the adoption of innovation in all aspects of highway transportation and promote new business practices in highway construction.

Both lean and knowledge management are proven in real-world applications in transportation agencies and private industry and have resulted in improved efficiency, productivity, and cost savings.

At the time of the grant submission, WSDOT was not routinely using lean or knowledge management practices. WSDOT intends to integrate these practices and the AID funding provided the necessary resources to demonstrate the value and initiate integration. Application of lean and knowledge management practices are anticipated to result in significant improvement to WSDOT's project development practice. Anticipated benefits include: streamlined workflow and better management of information management throughout the lifecycle of project development. It is anticipated that this will facilitate community engagement, mode choice consideration and integration, and strategic investments.

Lessons Learned

Through this project, the WSDOT gained valuable insights with regard to the innovative practices used. The following were some of the lessons learned:

- WSDOT is in a period of transformation with a number of broad organizational initiatives underway. An organizational change management plan would be beneficial to help coordinate priorities, sequence, resourcing, and connections amongst the initiatives to ensure timely delivery.
- Lean is most often perceived as a process improvement technique though it is an approach that can be more broadly applied to help evaluate organizational efficiency. The Practical Solutions AID project provided insight into the connections, questions, and possible improvement opportunities between and within business units that will support and help expedite development and implementation of Practical Solutions. This can help target priority work.
 - The State Route 527 Bus Rapid Transit Gap Analysis provided a case study in coordinating and communicating with constituents and customers across developing practical solutions. The project illustrated that WSDOT lacks an information system that

records and shares information and commitments across the business units involved in the Practical Solutions lifecycle. This task provided information to guide improvement.

- A project assessed the Interchange Justification Reports (IJR), Value Engineering (VE), and National Environmental Protection Act (NEPA) processes to identify opportunities to reduce rework, cost, and timing delays. The project identified the value of common definitions and clarifying responsibilities.
- The resource model provided a high level look at the organizational structure to support deployment of Practical Solutions. The emphasis on multimodal solutions, collaboration and integrated decision-making has disrupted established discipline-based patterns highlighting the need to clarify the roles of organizations integrated decision-making.
- There is room for improvement in WSDOT's approach to enterprise data and information management. Improving the efficiency of information collection, access, and compilation – and building confidence in existing information resources – will help WSDOT to maximize use of its limited budget and staff capacity. Given continued evolution of the Practical Solutions approach (and continued developments in technology), more agility on the part of WSDOTs information management functions will be required.
- Through this project we attempted to develop a knowledge book. The single consultant with the skill working in the United State was not available. An effort was made to conduct the work using the methodology. The product will be useful and many lessons were learned about the need to limit the scope of the knowledge book, work with a single expert, and how to craft the product. It would be valuable to do this work with a person trained in the methodology.
- Agency guidance documents tend to be discipline-based and the current information management practices limit the ability to search across these resources. The Practical Solutions AID project implemented vocabulary management strategies to enhance search and navigation across a subset of agency manuals. The results greatly improved access to information contained within the pilot site. The project provided information about the resources needed to develop and sustain this capability.

PROJECT DETAILS

Background

Transportation infrastructure investment decisions have wide-ranging implications for the long-term sustainability of our community, economy, and environment. The systems built over the last half a century have fueled strong economic growth, but those systems are in urgent need of repair and maintenance. By 2030 Washington State's population forecasts indicates Washington will grow by another two million people. This will place more pressure on the already overburdened transportation system. The past approach to transportation system investment is no longer affordable or sustainable.

In 2014, the Washington State Department of Transportation (WSDOT) initiated a new approach to the management and development of the multimodal transportation system. The new approach, called Practical Solutions, is a data-driven, multidisciplinary approach for making system stewardship and development decisions that focus on performance objectives and gaps, the context of the locale, the users of the system, and low cost effective solutions. Operations and transportation demand management (TDM) strategies are considered before a capital project is advanced.

WSDOT has used community input, considered low cost solutions, and strengthened multidisciplinary engagement for many years. Historically, this work has been conducted independently by modes and types of solutions. The Practical Solutions approach uses this experience and broadens the application to more formally consider the community and environmental context, and multimodal and lower cost solutions.

The AID project is part of a larger effort to develop and implement Practical Solutions. Activities already conducted with other fund sources include: establishing a vision, collecting best practices, and piloting efforts to apply Practical Solutions. Ongoing and future work on other fund sources includes integrating changes in procedure into manuals, piloting least cost planning practices, training staff on new practices, monitoring and reporting on performance, and integrating lessons learned.

To support the evolution and deployment of this practice, WSDOT applied for and received a grant award from the Federal Highway Administration (FHWA) Accelerated Innovation Deployment (AID) demonstration program for a project titled *Deploying Practical Solutions with Lean Techniques and Knowledge Management* (PS AID Project). The goals of the project were to employ lean methodology to streamline processes and knowledge management practices to disseminate and institutionalize new practices.

Lean methods provided a means to examine work flow processes and target improvements. Knowledge management practices mapped the knowledge and information needed to support the new processes and plan strategies for effective integration of new practices.

Colorado DOT and other transportation agencies have used lean methodology to improve and/or streamline processes. Lean is an organizational methodology designed to optimize the flow of products and services. Lean techniques seek to maximize value and minimize wasted effort and resources.

Virginia DOT and other transportation agencies have demonstrated the successful use of knowledge management to develop, disseminate and institutionalize new practices. Knowledge Management is a discipline that provides strategies and processes for identifying, capturing, structuring, and sharing an organization's knowledge. A 2013 Domestic Scan on Knowledge Management [NCHRP 20-68A (12-04)] highlighted several practices in use by state federal, state, and private companies.

Both practices support continual learning, improvement and innovation.

The Practical Solutions approach involves several business areas within WSDOT. This project took a broad view of the practice in order to assess the clarity and effectiveness of handoffs between functional stages. WSDOT worked with representatives from modes, Regions, and Divisions to gather information, evaluate the current state of practices and opportunities for improvement, and to vet recommendations.

The Practical Solutions AID Project allowed WSDOT to take a high-level, whole system view of the organizations and practices involved with management and development of the transportation system. Through this we were able to identify strengths, weaknesses, and opportunities for improvements. Much work remains to integrate and implement the recommendations of this project but this project has provided a better understanding of the current context and strategies to support continued evolution of the Practical Solutions approach.

Institutionalizing New Practices using Lean Methodologies

What is it?

This document provides an overview of the State of Washington's Lean Government Framework and describes the development of a high level WSDOT business process framework. It also provides information on targeted lean projects.

How was it developed?

The development of the business process map began with meetings on each functional stage of project development, goal setting, planning, programming, design/development, construction/implementation and operation. Participants included representatives from headquarters, regions, and modes. Information on the suppliers, inputs, processes, outputs, and customers (SIPOC) of each functional stage were documented at a high level along with questions, concerns, and opportunities about the implementation of Practical Solutions. This input that was summarized in a technical memo.

The material of the SIPOCs was used as the foundation for a workshop to develop a high-level business process map. Approximately 100 employees participated in a three-day workshop to review and refine current state process, identify gaps or other process issues, and define and outline an integrated future-state business process map. Representatives from each functional area provided a summary of the SIPOC for their area. Participants then rotated through each stage to ask question and offer comments and suggestions. This information was summarized into a high level business process map that was discussed with participants on the final day. Issues, questions, and opportunities were also collated into a single document for use.

Five capital projects were identified as resources for current practice in WSDOT's grant application. Information from these projects was used as resource material when developing project activities. However, it was difficult to use this information as baseline material because of the variations in documentation and the turnover in staff.

- SR 520 Westside completion
- I-90 Medical Lake Interchange - Reconstruction (VE completed 2013)
- I-90 Spokane Transit median flyer stop
- I 405/SR 167 Interchange- Direct Connector CEVP Update
- I 405 Renton to Bellevue CEVP update workshop

Following the workshop, the business process map was aligned with a performance framework that was also in development. Dubbed WSDOTs "Practical Solutions Performance Framework" this high-level process flow was reviewed, validated, and subsequently refined and adopted by agency leadership as a working model of the Practical Solutions lifecycle.

Specific opportunities to improve information flow and integration were identified within some business areas and recommended for early attention. The projects selected for phase 2 lean work included:

- 1) Clarifying Corridor Sketch products needed by Regional Planners. This was conducted through a series of interviews with the project sponsor and customers of the products.
- 2) A retrospective of the State Route 527 Bus Rapid Transit project to strengthen coordination and communication across the lifecycle. A project team developed the project scope and plan. Representatives from Community Transit and WSDOT convened to review the process steps and decisions made along the Practical Solutions lifecycle. PRR facilitated the workshop and prepared a technical report of the event.
- 3) Assessing the Interchange Justification Reports (IJR), Value Engineering (VE), and National Environmental Protection Act (NEPA) processes to identify opportunities to reduce rework, cost, and timing delays. A project team met and developed the project scope and plan. Background information on the three processes and project schedules were prepared. External project partners were interviewed and this information was compiled. A workshop was held with representatives from WSDOT headquarters and regions as well as staff from the Federal Highways Administration to review this information, analyze the gap, and identify root causes and potential countermeasures.

How can we use it?

The products of this work are being used in a variety of ways:

- The Practical Solutions Performance Framework is used to support discussion about improvement initiatives. It has helped identify pain points that need attention and is used to identify the stage(s) in discussion, related work, and sources of feedback information.
- The phase 2 lean products provided improvement information for the target activity. They also provided an opportunity to test lean methodologies and exposed a number of WSDOT employees to lean practice.
- The issues, questions, and opportunities are a source of information that can be used for continual improvement to support and expedite continuous development and deployment of the Practical Solutions approach.
- The Practical Solutions Performance Lifecycle and other products from this phase of the project were used in the subsequent activities of the Practical Solutions AID Project.

How can we measure the value?

WSDOT's proposes to use the following measures for the measurement of value.

- Estimated time savings and cost for managing and developing activities involved in the Practical Solutions Performance Framework.
- Reduction in the number of isolated information silos &/or reduction in number/size of siloed systems.
- Improved engagement practices and quality of decisions resulting in greater support and reduced rework.

FHWA is particularly interested in the five measures listed below. Further implementation of the Practical Solutions AID Project will most directly address items 2, 3, and 5.

1. Achieve a safer environment for the traveling public and workers
- 2. Reduce overall project delivery time and associated costs**
- 3. Reduce life cycle costs through producing a high-quality project**
4. Reduce impacts to the traveling public and project abutters
- 5. Satisfy the needs and desires of our customers**

Interim results

Use of Lean Techniques

WSDOT was at the very beginning of Lean deployment when the Practical Solutions AID project began. The project helped to amplify Lean and provided foundational information on lean practices for project participants.

Survey

A survey was distributed to the participants of the SIPOC meetings and workshop. The survey requested information about:

- Awareness of WSDOT expectations and process for the development and management of an integrated, multimodal transportation system and Practical Solutions.
- Engagement, participation, and support
- Skills for collaborating with others
- Authority to engage others
- Use of their input

Participants were also asked to rank activities in order of the greatest value to support multidisciplinary engagement. The list is organized with the highest priority at the top.

1. Clear management direction is a priority
2. I understand the contributions different business units have to offer

3. Project timelines that allow for broad communication
4. There are employees with the expertise you need and time to help you
5. Alignment of schedules and priorities between contributing work units
6. Agency guidance for project management
7. An expertise directory exists to help you find employees with the knowledge you need
8. A resource of best practices in multidisciplinary engagement
9. Training on project management
10. Other (see below)
11. Social media tools are available to help you communicate with other employees outside of meetings

The survey results can be found in the section on Surveys. A follow up survey is planned after the end of the Practical Solutions AID Project.

Feedback

Participants in the business process workshop commented that it was helpful to have a basic understanding of the overall process, why organizations needed products from them and how they were used. The Practical Solutions Performance Framework continues to be used to describe the overarching process. A survey was conducted before the business process workshop to gauge understanding of the process for deploying Practical Solutions. A survey was planned for one year later but project leadership recommended postponing the survey as Practical Solutions AID project products had not been distributed. A follow up survey will be conducted after this project has been completed.

It is difficult to quantify the value of the meetings and common framework. However, with the increase in multidisciplinary work, the Practical Solutions Performance Framework has been used to help clarify the functional stage in work is conducted and to further clarify the activities needed. Issues and opportunities discussed in the meetings and workshops are also incorporated into other improvement activities as feasible.

Lean is most often perceived as a process improvement technique though it is an approach that can be more broadly applied to help evaluate organizational efficiency.

The phase 2 lean work provided a training ground for conducting lean activities.

- The Corridor Sketch project provided information into the products needed by Regional Planners and other partner organizations. This information is helping to shape a corridor information resource.
- The State Route 527 Bus Rapid Transit Gap Analysis provided a case study in coordinating and communicating with constituents and customers across the Practical Solutions Performance Lifecycle. The project illustrated that WSDOT lacks an information system that records and shares information and commitments across the

business units involved in the Practical Solutions lifecycle and provides information to guide improvement.

- A project assessed the Interchange Justification Reports (IJR), Value Engineering (VE), and National Environmental Protection Act (NEPA) processes to identify opportunities to reduce rework, cost, and timing delays.

An attempt was made to use the schedules for the target capital projects as a basis for documenting the estimated time and cost savings. However the use of the reporting system varied across Regions and projects and the project schedule data did not provide adequate information to use as a baseline.

The project identified the value of common definitions, clarifying responsibilities, and assessing resources to support the process. At the completion of this project, the FHWA policy for Interchange Justification Reports was updated. The Development Division used the workshop input and policy change to update manuals to improve the alignment of processes.

What are the status and next steps?

Since the Practical Solutions AID Project was initiated, the WSDOT Lean Process Improvement Office (LPIO) has become well established. To date, 90 staff have been trained as green belts to lead Lean activities, and more than 135 Lean process improvement projects have been conducted. Several hundred employees have attended introductory Lean training.

In the future, the WSDOT LPIO will continue to train employees in Lean, improve the agency's processes, and strive toward a culture of continuous improvement throughout the agency.

The Practical Solutions AID project provided insight into the connections, questions, and possible improvement opportunities between and within business units that will support and help expedite development and implementation of Practical Solutions. This can help target priority work.

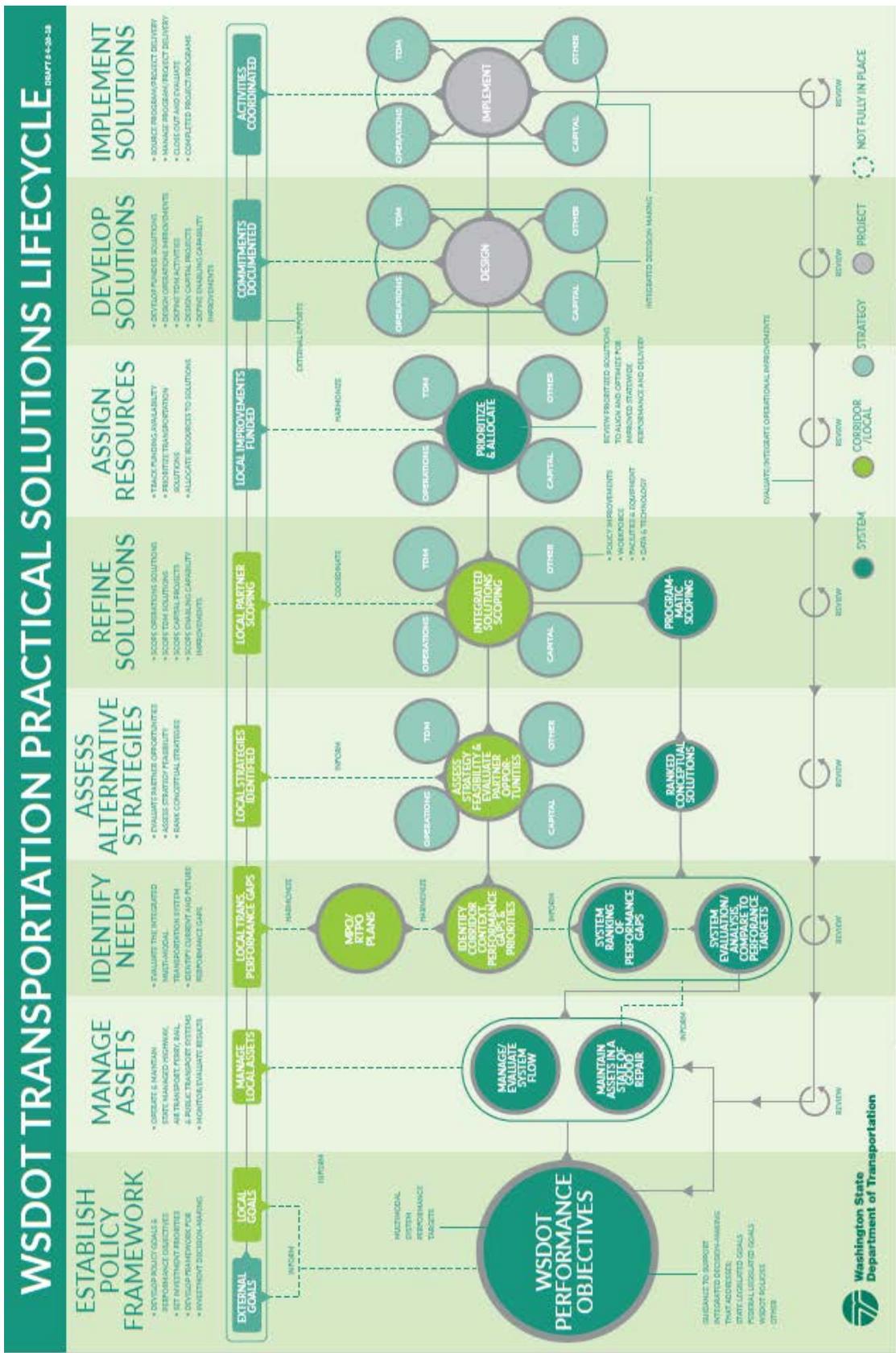


Figure 1. Practical Solutions Performance Framework

Resource Model

What is it?

The resource model analyzed each stage of the Practical Solutions life cycle to identify the activities conducted, the knowledge and information needed, and the information produced. It also identifies key roles played by groups internal to WSDOT as well as external organizations that participate in some way. Knowledge sources and products include documents, data sets, applications, and people.

How was it developed?

The materials developed through the business process mapping task were reviewed. Interviews were conducted with representatives from functional areas to address questions. This information was used to develop the resource model. Draft versions were reviewed by functional area representatives.

How can we use it?

The resource models can be used in several ways:

- They provide a high level look at current roles and responsibilities which helps us understand the *multidisciplinary engagement needs* of Practical Solutions and can inform efforts to build a *multimodal decision framework*.
- They provide insight into the common information needs across the different stages of the life cycle, which can inform development of a framework for meeting the information needs of individuals participating in each stage of the process.
- They provide a way to look at *handoffs* across the different stages. They help to answer the question: what information produced in one stage is needed within a downstream stage?

To maximize value of this product, WSDOT should establish a regular process to review and refine the resource models. This will ensure that they are kept current as roles and information resources evolve.

How can we measure the value?

The resource model serves as a foundation for improving the multimodal decision framework. Because WSDOT did not have a common business process across business units, it was not possible to estimate the amount of time required for each stage of the lifecycle. The project team attempted to use the project schedules for the sample capital projects but found a high degree of variability in the schedule details that were documented. Due to this, it was not possible to compare the project schedules and obtain a baseline.

As functional areas assess the roles and responsibilities, a sample timeline could be developed to serve as a baseline and monitored for improvement.

What are the status and next steps?

The resource model provided a high level look at the organizational structure to support deployment of Practical Solutions. The emphasis on collaboration and integrated decision-making has disrupted established patterns. Recommended actions are to:

- Update the decision framework for multimodal, multi-organizational decision framework and the roles and responsibilities to support that framework;
- Take steps to strengthen the handoffs between functional stages; and
- Consider conducting a capability assessment within functional areas to help identify and prioritize organizational development needs.

The resource model also provided insight about the data and information used and produced at each functional stage. This information was used in a separate task to assess opportunities to improve information management in support of the Practical Solutions approach. Status and next steps are included in the summary of that work on page 17.

Enterprise Architecture: An Overview of Practice

What is it?

This document introduces the practice of enterprise architecture (EA), which has been implemented by many organizations to better align their data, applications, technology and staff with organizational goals and objectives, and improve organizational agility. As illustrated in Figure 2, enterprise architecture is built out in layers that provide different viewpoints (typically including layers for goals and objectives, lines of business, people and knowledge, information and data, applications, and technology).

As WSDOT continues to advance the Practical Solutions approach, techniques from enterprise architecture can provide models for defining a desired future state and aligning workforce, data and information, and technology management in support of that future state. Resource Models provide the connective tissue across the different layers of an EA, defining resource needs (e.g. data, information, applications and people/skills) associated with different business capabilities. The top two tiers of a business function classification scheme were drafted based on the information commonly needed to deploy Practical Solutions. A business function classification scheme helps organize essential work of the department to align enterprise resources with business objectives and promotes cross-organizational connections.

How can we use it?

This overview document can be used to explain the concepts underlying EA and support future efforts to adopt EA practices at WSDOT.

How can we measure the value?

It is premature to assess the impact of implementing an enterprise architecture. Once the enterprise architecture is in place, the following metrics may be applied.

- Data and information resources align with organizational priorities and decision-making practices.
- Repetitive tasks are digitized.
- There is improved clarity about and access to authoritative information sources (using before and after surveys).

What are the status and next steps?

Establishing an enterprise architecture and enterprise information architecture would help align workforce and knowledge needs, information and data, applications and technology with organizational objectives and business practices.

Recommendations are to:

- Establish an Enterprise Architecture lead at WSDOT (also included under the Information Management recommendations);
- Vet and finalize the top tiers of the draft business function classification for Practical Solutions, and

- Develop an implementation strategy to build out additional tiers.

In addition, WSDOT has recently established an Enterprise Technology Board and is in the process of developing a governance approach for data and information. It is anticipated that the information developed by the Practical Solutions AID project will provide input for the performance objectives of both groups.

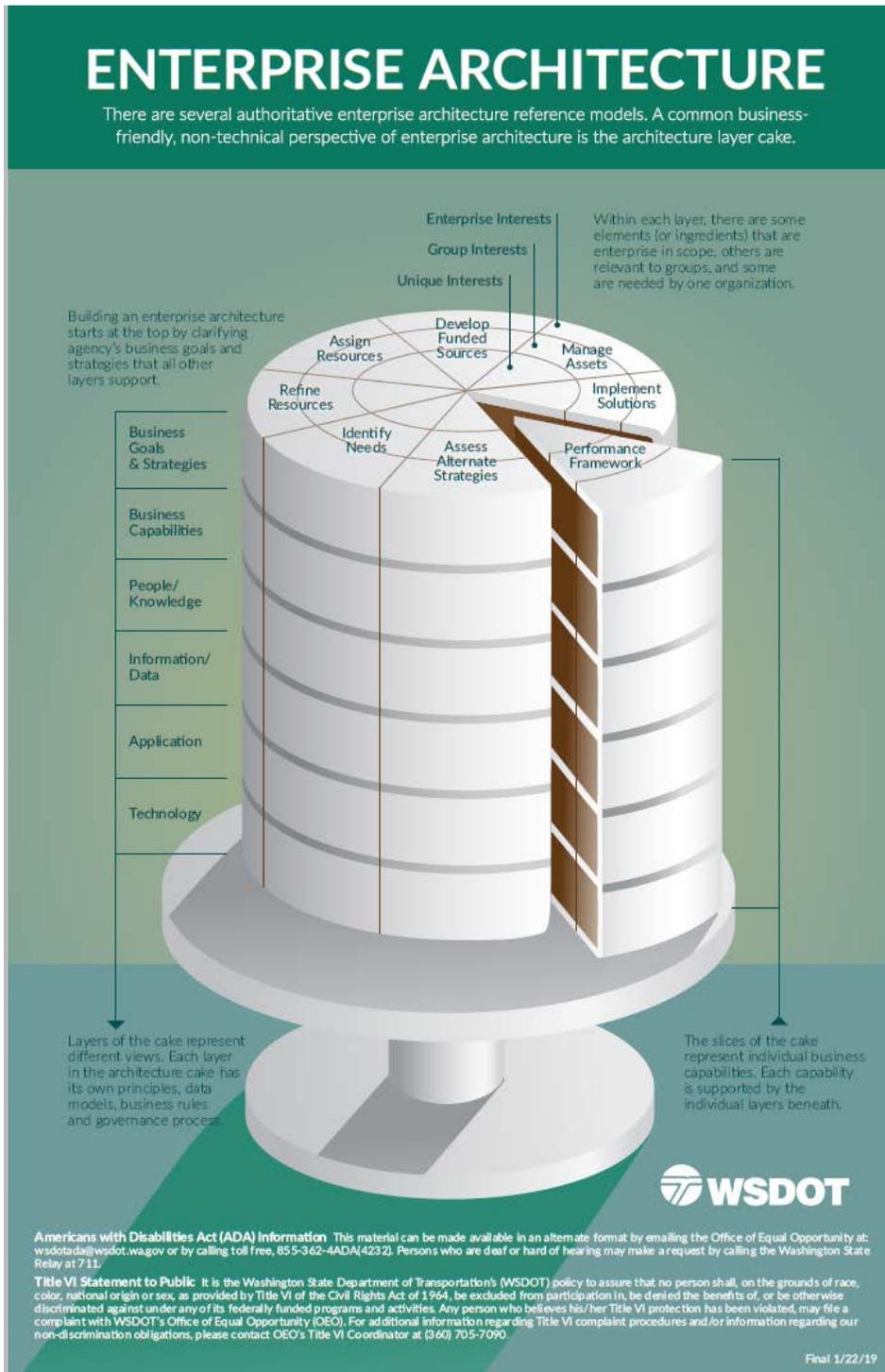


Figure 2 Enterprise Architecture View for WSDOT: The Layer Cake

Improving Information Management for Practical Solutions at WSDOT

What is it?

This document presents objectives and recommendations for improvements to information and data management at WSDOT. Common information needs were identified based on the resource models. The current state of information management was assessed based on structured interviews with WSDOT information managers. These interviews were used to identify gaps in current practice and formulate recommendations for improvement.

How can we use it?

The current state assessment can be used to build awareness of strengths and opportunities for improvement. The recommendations can guide development of specific improvement actions that will provide a stronger foundation for Practical Solutions.

How can we measure the value?

It is premature to assess the impact of the implementation of the information management recommendations. It is anticipated that the new Enterprise Technology Board and anticipated data and information governance group will review the information developed by the Practical Solutions AID project and consider the recommendations when developing the performance objectives of both groups.

- Number of knowledge domains developed. These groups will assess adequacy of current process, data, and information.
- There is a reduction in the number of isolated information silos &/or reduction in number/size of siloed systems.
- There is improved findability and access of data and information, improving productivity (using before and after user tests).
- There is timely integration of new data and information uses.
- Employees have the tools needed for collaboration eliminating rouge practices.

What are the status and next steps?

There is room for improvement in WSDOT's approach to enterprise data and information management. Improvements to efficiencies in information collection, access, and compilation – and building confidence in existing information resources – will help WSDOT to maximize use of its limited budget and staff capacity. Given continued evolution of the Practical Solutions approach (and continued developments in technology), more agility on the part of WSDOTs information management functions will be required.

Four objectives were identified to guide future improvements and are described below.

1. Build and Maintain a Common Pool of Information

WSDOT employees need access to a common pool of authoritative information resources from a variety of internal and external sources supporting:

1. Understanding of agency policy and guidance;
2. Understanding of transportation system context, performance and needs;
3. Understanding of available solutions and their likely costs and effectiveness; and
4. Engagement and collaboration.

Recommendations to achieve this objective include clearly articulating information needs, documenting existing shared information assets and identifying gaps, and enhancing enterprise information access tools.

2. Maximize Use of Available Information Resources

WSDOT needs to stretch its available budget and staff resources by maximizing use of available information. Each data set that is collected; each report that is compiled; each map that is created represents an investment in staff time. This investment should be maximized by making sure that information created can be found and re-used.

Achieving this objective requires three strategies: (1) leveraging information produced by one business function for use in other business functions, (2) ensuring confidence and trust in available information resources, and (3) improving discovery of and access to relevant information.

Specific recommendations include strengthening version management and records management, continuing to implement processes for documenting and passing along information across the transportation development life cycle, establishing an enterprise architecture lead at WSDOT, and establishing a common business glossary of terms.

3. Provide the Agility Needed to Respond to a Changing Environment

Information needs, sources and solutions are continually changing. It is more important than ever to shift away from addressing information management needs through separate, single purpose systems that are not easy to adapt to new needs and require specialized IT staff resources to maintain. WSDOT currently has over 370 distinct applications (excluding those that are not managed by IT) and over 60 engineering publications that support the Practical Solutions life cycle.

Recommendations to achieve this objective include identifying opportunities to consolidate content and applications, creating self-service information and analysis solutions, pursuing hosted and other software-as-a-service solutions as appropriate, and addressing training needs. These activities will require an enterprise perspective and an organizational commitment to working across divisions.

4. Facilitate Collaboration and Learning

The Practical Solutions approach has been defined at a high level, and business processes are evolving. Fully realizing the vision for Practical Solutions will necessarily involve considerable collaboration and learning as people continue translating principles and concepts into practice. It will be important for successful practices and lessons learned to be disseminated to ensure a process of continual improvement. Learning Culture recommendations address this point (see below).

Words Matter: Managing Vocabulary Resources to Support Productivity

What is it?

This document examines WSDOT practices for developing, applying, and maintaining metadata, taxonomies, glossaries, and thesauri. These are collectively called vocabulary management for the purposes of this report. These vocabulary resources support search, navigation, and filtering of data and information. Current practices for managing these resources were analyzed for their ability to support multidisciplinary engagement throughout the Practical Solutions life cycle. This information was used to identify strengths and weaknesses and develop recommendations.

How can we use it?

The descriptions of metadata, taxonomies, glossaries and thesauri can help to establish a common understanding of these resources and their value. The recommendations provide a direction for continued work on enhancing vocabulary resources in support of Practical Solutions.

How can we measure the value?

- There is improved findability and access of data and information, improving productivity (using before and after user tests).

The Manual Modernization task provided some feedback on this metric and that information is reported in the section on that project.

What are the status and next steps?

WSDOT has made significant progress in clarifying vocabulary management needs and strategies for improving search and navigation of information and data resources. The report provides recommendations to strengthen practices in support of Practical Solutions and employee productivity. Recommendations for implementation include:

- Endorsing the role of the Vocabulary Team to support and manage term governance;
- Publishing the metadata framework;
- Developing strategies to integrate metadata management;
- Developing and implementing strategies for taxonomy development and integration;
- Publishing the WSDOT glossary; and
- Managing improvements, and development and management of a WSDOT Thesaurus.

Implementing these strategies will improve the ability to search and navigate information resources and therefore optimize the use of the agency's information and data investments.

Several of the recommendations are being applied in the pilot project to modernize engineering manual management. The project will test the ability to search across the content of several manuals. This work is reported on page 26.

Strengthening WSDOT's Learning Culture for Practical Solutions

What is it?

This document explores the current state of WSDOT's learning culture and identified opportunities to strengthen learning in order to support the continued integration and evolution of practices.

How can we use it?

The recommendations can guide future efforts to build a learning culture at WSDOT that will help the agency adapt to the Practical Solutions approach.

How can we measure the value?

Outreach activities have been conducted by the Human Resources & Safety Division to encourage and strengthen WSDOT's learning culture. As we continue to this work, the following measures can be used to monitor progress.

- Number of outreach activities to encourage learning and fostering a learning culture in group activities.
- Recognition of and support for learning in practice.
- Increased opportunities for learning within employee work plans.
- Timely adoption of new procedures, less need to revisit decisions, faster decision-making
- The number of communities of practice established to discuss, share, and improve practices.
- Number of feedback loops established to support continuous improvement.
- Action taken on lessons learned

What are the status and next steps?

The Practical Solutions approach will continue to evolve, and employee and stakeholder input is essential to identify needs for improvement and feasible solutions. WSDOT has a rich history of innovation but there is considerable opportunity for improvement. Key findings from the review identified four elements to strengthen a learning culture:

- Development of a shared vision and strategy for learning to clearly articulate the future direction and guide learning priorities.
- Strengthening the leadership commitment to learning and change management from espoused values to lived values.
- Providing opportunities for learning through activities such as scheduling time to reflect and capture lessons learned.

- Adoption of methods and tools supporting learning such as building skills and experience for facilitation and coaching to help people learn how to talk about failed activities in a productive way.
- Create and maintain Practical Solutions learning resources including a single “home base” for resources, piloting a moderated online discussion forum, and piloting an online expertise directory.

Sustainable Safety Knowledge Book

What is it?

This task includes production of a Knowledge Book using the Method to Analyze and Structure Knowledge (MASK) and a guide for development of a future Knowledge Books. Crash Analysis was selected as the topic for the Knowledge Book. The Knowledge Book provides an overview of the following elements of Crash Analysis:

- History
- Evolution
- Content Types
- Process
- Phenomena
- Know How

How can we use it?

The Crash Analysis Knowledge Book will be used by employees to understand the basis and context of roadway crash analysis. It helps retain institutional knowledge on the practice to support continued evolution.

Further work has been done to build out more elements of WSDOT's Sustainable Safety Program. This work serves as a prototype that may be adopted by other organizations and has the potential to align with WSDOT's training activities and manual production.

How can we measure the value?

Measurement of the value of this product is premature as the Knowledge Book has not been finalized and shared. Metrics that will apply include:

- The number of uses of the content
- Active management of the content to maintain currency
- The number of additional modules developed for Safety
- The number of additional Knowledge Books developed.

What are the status and next steps?

Lessons learned through this pilot project area summarized in the report titled *Creating a Knowledge Book for WSDOT: Lessons and Future Directions*. The recommendations for continuing the development of knowledge books has been used to guide our continued work.

Version 1 of the Knowledge Book was produced through the Practical Solutions AID Project. Since the product was delivered, work has been conducted on Version 2 that emphasizes visual navigation of the crash analysis content. It also became apparent that information was needed on the evolution of highway safety policy and performance management. Further work on the

crash analysis book is postponed and a separate knowledge book on the WSDOT Sustainable Safety Program is in development. Other elements of the Safety Program have also been identified for future development.

WSDOT Manual Modernization: Vol. 1 Scoping and Vol. 2 Pilot

What is it?

This task resulted in a report documenting the business requirements to support the production, publication, and use of engineering manual content. A lean workshop was conducted to assess the opportunities to streamline the design manual update process. A pilot site was also developed that demonstrates improved search and navigation of manual content across eight engineering manuals.

How can we use it?

The business requirements can be used to evaluate software as the information architecture continues to evolve. The lean workshop recommendations can be implemented to streamline the Design Manual update process. The pilot site can be used to demonstrate the value of modernizing manual access and help inform decisions about funding production of this site. The pilot site also demonstrates the value of investing in vocabulary management.

How can we measure the value?

Early measures on this task include the following:

- The development of business requirements for manual production, publication and use have helped evaluate the functionality of available software and led to a decision not to pursue new software at this time.
- The lean workshop on updating the Design Manual has resulted in changes to the process that are anticipated to save time.
- Feedback on the pilot site has been positive. Some employees continue to use the site to find the manual content needed for their work and state that it is a time saver. One employee noted that it reduced the time to address questions from 20 minutes to one to five minutes.

Longer term measures include:

- Monitoring the time saved in the Design Manual update process.
- If the pilot site moves to production, monitoring use of the site.
- Number of terms integrated into WSDOT's vocabulary management practices.

What are the status and next steps?

The pilot site is currently active and employees are using the site to help find manual content. The project recommends a phased approach for continued development.

1. Bring pilot into WSDOT's environment and update existing content. Develop a proposal for a production site. Work is underway to import the site and a proposal for developing a production site are in development.
2. Implement as production site within WSDOT's environment – with expanded set of manuals
3. Establish update and maintenance processes
4. Implement continuous improvements to manual content consistency, linkages and development processes
5. In the longer term (3-5 years), consolidate manual content using a common framework and shift management of original content to a single source publishing system.

Improvements identified in the Design Manual Update Process Lean workshop are being implemented. "Just do it" activities have been assigned to the appropriate organization. Near term, midterm, and long term activities have also been assigned and work is underway to implement the strategies.

Managing the Practical Solutions AID Project

What is it?

WSDOT is in a period of transformation with a number of broad organizational initiatives underway. While there was significant participation in Practical Solutions AID project events but the process for discussing and prioritizing activities was challenging due to changing organization, the competition for time, and lack of synchronicity between activities. This technical memo summarizes the practices used to manage the project and proposes recommendations for future initiatives.

How can we use it?

The recommendations can be used to guide organizational development and/or projects that require multidisciplinary engagement.

How can we measure the value?

If the recommendations are implemented, the following measures could be used to measure the value of the practice.

- A workforce who knows what's expected of them and the resources to meet those expectations.
- A list of ongoing improvement needs/opportunities to apply improved practices to other applications.
- Level of engagement by employees needed for the project
- Timely product delivery and dissemination
- Integration of products into practice.
- Lack of rework for the project.

What are the status and next steps?

The technical report on practices used in the AID project is in development. This will include a report on practices used to develop and manage the project, the challenges and opportunities encountered, and the engagement and outreach activities used. It will include recommendations for managing future projects of this nature.

APPENDIX A: TECHNOLOGY TRANSFER

Reports

This report and supporting documentation are available in the following documents.

- WA-RD 895.1 [Deploying Practical Solutions using Lean Techniques and Knowledge Management: Report to FHWA](#) (this report)
- WA-RD 895.2 [Institutionalizing New Practices using Lean Methodologies](#)
- WA-RD 895.3 [Strengthening a Learning Culture for Practical Solutions](#)
- WA-RD 896.1 [Improving Knowledge and Information Management for Practical Solutions at WSDOT: Executive Summary](#)
- WA-RD 896.2 [Resource Models for Practical Solutions at WSDOT](#)
- WA-RD 896.3 [Improving Information Management for Practical Solutions at WSDOT](#)
- WA-RD 896.4 [Enterprise Information Architecture: An Overview](#)
- WA-RD 896.5 [Words Matter: Managing Vocabulary Resources to Support Productivity](#)
- WA-RD 896.6 [WSDOT Manual Modernization: Scoping](#)
- WA-RD 896.7 [WSDOT Manual Modernization: Pilot](#)
- WA-RD 897.1 [Creating a Knowledge Book for WSDOT: Lessons and Future Directions](#)

Presentations

Aspects of the Practical Solutions AID project were provided through the presentations listed below. Additional presentations are planned following the completion of this project.

- Transportation Research Board Annual Meeting
Overview of the Practical Solutions AID Project. Task Force on Knowledge Management. January 16, 2019.
Future of Work: A Human Resource and Knowledge Management Perspective, January 15, 2019. Session 1576 Today's Teen, Tomorrow's Transportation Professional: Adapting and Preparing for the Future of Work.
WSDOT Data Governance. Statewide Transportation Data and Information Systems Committee. January 14, 2019.
Leaning Forward: Knowledge and Information Management for a Nimble Organization. January 9, 2018. Session 661 Tools for the Zombie Apocalypse: Avoiding Brain Drain in Transportation.

Building a Business Process for the New Paradigm. Session 255 Transportation Transformation. January 11, 2016.

Manual Modernization: Improving the User Experience. Details pending. January 2020.

- 2019 AASHTO Agency Administration Conference. *Aligning Information Resources with Business Needs.* May 7, 2019.
- FHWA State Safety Data Capabilities Peer Exchange
 - Updating the Alignment of Business Needs and Organizational Resources.* Data Integration Peer Exchange, WSDOT, November 14, 2019
 - Data Management and Data Integration, AL DOT, June 2019
- Conference on Performance and Data in Transportation Decision Making. September 2019
 - Improving Data Governance for Decision-Making
- Chief Data Officer Peer Exchange, September 18-19, 2019
- Michigan DOT Knowledge Management discussion, October 2019

Webinars

- *Leaning Forward: Knowledge and Information Management for a Nimble Organization.* July 13, 2018. Hosted by TRB Task Force on Knowledge Management.

Websites

- Manual Modernization website: <http://wsdot2.iknow.us/>

APPENDIX B: SURVEYS

Current State Multidisciplinary Engagement Survey Results (Before)

A survey was conducted in October 2015 of the WSDOT employees invited to the lean meetings and workshop conducted. The questions focused on knowledge of the Practical Solutions approach and business roles, multidisciplinary engagement, and activities to support multidisciplinary engagement.

1. I am confident that I know the WSDOT expectations and process for development and management of an integrated, multimodal transportation system.
 - 51% somewhat or strongly agree
 - 49% somewhat or strongly disagree
2. I am confident that other participants share a common understanding of this process.
 - 67% somewhat or strongly disagree
 - 33% somewhat or strongly agree
3. There is a shared understanding of Practical Solutions vision and goals for WSDOT's transportation system development and management process.
 - 58% somewhat agree
 - 42% somewhat or strongly disagree
4. It is clear how the activities in the process in which I engage lead to a decision(s).
 - 60% somewhat or strongly disagree
 - 40% somewhat or strongly agree
5. I am engaged at the appropriate stages to contribute my knowledge and expertise.
 - 54% somewhat or strongly agree
 - 46% strongly or somewhat disagree
6. I feel empowered to contribute and actively contribute.
 - Feel empowered to contribute*
 - 67% somewhat or strongly agree
 - 33% somewhat or strongly disagree
 - Actively contribute*
 - 84% somewhat or strongly agree
 - 16% somewhat or strongly disagree

7. I think my contributions are used and valued.

Contributions are used

- 66% somewhat or strongly agree
- 34% somewhat or strongly disagree

Contributions are valued

- 71% somewhat or strongly agree
- 29% somewhat or strongly disagree

8. Participants are willing to share their ideas, resources, influence and power to fulfill the goal.

Ideas

- 85% somewhat or strongly agree
- 15% somewhat or strongly disagree

Resources

- 58% somewhat or strongly agree
- 42% somewhat or strongly disagree

Influence

- 65% somewhat or strongly agree
- 35% somewhat or strongly disagree

Power

- 54% somewhat or strongly agree
- 36% somewhat or strongly disagree

9. The other participants and I have the necessary skills for collaborating.

I have the skills

- 94% somewhat or strongly agree
- 6% somewhat or strongly disagree

Others have the skills

- 78% somewhat or strongly agree
- 22% somewhat or strongly disagree

10. I have the ability to involve other employees from my discipline and other disciplines if I think they are needed in the process.

- 76% somewhat or strongly agree
- 24% somewhat or strongly disagree

11. There are clear roles, responsibilities and expectations of participants.

Clear roles

- 43% somewhat or strongly agree
- 57% somewhat or strongly disagree

Clear responsibilities

- 39% somewhat or strongly agree
- 61% somewhat or strongly disagree

Clear expectations

- 39% somewhat or strongly agree
- 61% somewhat or strongly disagree

12. Participants feel safe enough to say what they think and feel.

- 60% somewhat or strongly agree
- 40% somewhat or strongly disagree

13. Participants were asked rank the following in order of value to support multidisciplinary engagement. The list is organized with the highest priority at the top.

1. Clear management direction is a priority
2. I understand the contributions different business units have to offer
3. Project timelines that allow for broad communication
4. There are employees with the expertise you need and time to help you
5. Alignment of schedules and priorities between contributing work units
6. Agency guidance for project management
7. An expertise directory exists to help you find employees with the knowledge you need
8. A resource of best practices in multidisciplinary engagement
9. Training on project management
10. Other (see below)
11. Social media tools are available to help you communicate with other employees outside of meetings

14. Feedback received on 'Other' organized by topic

- A. Clarify roles, responsibilities, expectations, shared goals
 - Clarifying roles, responsibilities and expectations
 - We lack a clear decision-making process and structure that can resolve issues and over-ride isolated opposition.
 - A clear sharing of the roles / responsibilities related to Practical Solutions.
 - There doesn't seem to be much of a connection between assignments and resources. If WSDOT executives have a strategy for engagement with external partners they have kept it a secret.
 - Clear agency wide expectations and adherence of all business units to those expectations.

- Many of the agency's divisions, offices and regions pursue independent goals. It would be a different organization if we all worked toward clear, measurable goals together; and understood the process steps that lead to decisions. (The rating system in question 13 isn't clear; I rated the item high IF an improvement in the area would help me; not that it currently helps me.)

B. Funding

- Funding available for multidisciplinary engagement
- Funding for multi-disciplinary engagement in planning process.
- adequate funding for multidisciplinary engagement at appropriate times

C. Executive Participation

- Executive Leadership Team (Assistant Secretary Level) engagement in the process. Hands on leadership with the flag in one hand and the pen in the other. The tone of engagement is set at the top of an organization. A 15 minute endorsement is nice, but being at the table for the entire discussion to lead the change first hand is what's needed to demonstrate that an issue is important. Culturally importance is measured by how much time to spend at the table, not the words you state.

D. Experts/Peer Assists

- Other means "Peer Review" teams or experts to advise
- A mentor or outside WSDOT contacts.

E. Levels of Authority/Communication between Functions

- When teams have both support and approval authority there is a problem with expediting delivery. Many times the delivery team is forced to guess what they are thinking. Or to guess what they aren't thinking because they haven't reviewed a submittal yet. Then when they do finally review the submittal so much other work has been completed that it is too late to change. Sometimes it feels like they simply find some little thing to fix just to buy them time because they haven't done their work. This could be because they are too busy. More authority needs to be pushed down to those who have the information to make decisions.

15. Other comments or suggestions related to multidisciplinary engagement

- Assistant Secretaries and Division Directors need to be included in consideration of multidisciplinary engagement. They are important models for behavior as well as facilitators of the time, priorities and resource allocation that enable multidisciplinary engagement.
- Executive Leadership Team (Assistant Secretary Level) engagement in the process. Hands on leadership with the flag in one hand and the pen in the other. The tone of engagement is set at the top of an organization. A 15 minute endorsement is nice, but being at the table for the entire discussion to lead the change first hand is what's

needed to demonstrate that an issue is important. Culturally importance is measured by how much time to spend at the table, not the words you state.

- The draft multidisciplinary engagement principles sound wonderful but they must have been written by somebody from a different agency. In my experience WSDOT executives have demonstrated very little support for that approach. Decisions seem to come out of an echo chamber in HQ. I have seen no openness to suggestions for revision or improvement. Attempts to bring data and useful facts to such discussions has produced only frustration. Adherence to ideological principles seems to be what matters.
- WSDOT still has silo's
- We are still a long way off from understanding how to implement practical solutions. There is a big step from understanding the conceptual process and implementing with our local partners and stakeholders.
- We shouldn't be talking about Multi Model Projects only. We should be talking about all assets and the priorities of these assets.
- Multidisciplinary engagement has been a key task in every WSDOT project since the Nickel and TPA programs started. It was emphasized in the Managing Project Delivery training when initiating and planning the projects. The task now is to engage the local stakeholders in more detail in the early Planning stages (corridor sketches).
- I don't think the problem is that WSDOT projects are multi-disciplinary, they have been for a long time. A much greater problem is that the decision makers in HQ don't know what they are doing. The direction from HQ often seems to be unconnected with reality. For example they love least-cost planning, but if we really applied it to transportation plans (ours and others) we would discover it doesn't support the desired projects. Internal multi-disciplinary engagement doesn't solve that problem, especially when HQ isn't interested in hearing about it.
- In addition to multi-disciplinary, inter-regional engagement during is critical to successful project delivery.
- Even when multidisciplinary engagement is with WSDOT personnel, it can be time consuming to prepare for such meetings. It becomes even more complicated when WSDOT engages in multidisciplinary issues with MPO/RPTO's. And even more complicated and time consuming if meeting with local agencies, tribes, and public.
- It would also be helpful to have executives prioritize these multidisciplinary engagements since it is possible that the same resources will be needed for multiple projects.
- Limit your time with general probes on how people feel about everything. Pick a specific process and work on it. Learn it. Make meaningful improvements. Show progress. Demonstrate success. Build on that.

- WE have yet to take the position and definition of multidisciplinary to include folks / functions in the agency that includes: Budget, accounting, maintenance and others. Most of the focus has been on the "engineering and planning" disciplines
- WSDOT runs on "charge numbers". We don't "value" work that has not been budgeted and we don't budget multidisciplinary work. Decisions that are made with our partners and customers early in the project development (or program development) process, are not valued by disciplines later due to their lack of involvement and ownership of the products. Chicken/egg problem. Project management plans need to be done at each step in the process and the ability must be availed to those managers throughout the process to obtain the necessary expertise needed to successfully move forward toward practical solutions.
- All support teams need to feel the same urgency for delivery that the delivery teams feel.

REFERENCES

References are provided in the technical reports cited in the Appendix on Technology Transfer.

Americans with Disabilities Act (ADA) Information:

This material can be made available in an alternate format by emailing the Office of Equal Opportunity at wsdotada@wsdot.wa.gov or by calling toll free, 855-362-4ADA(4232). Persons who are deaf or hard of hearing may make a request by calling the Washington State Relay at 711.

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