

NCHRP Project 20-123(09)  
Feasibility Study for a Platform to Capture Innovations from State  
Departments of Transportation

Final Report

Prepared for  
National Cooperative Highway Research Program

By  
Public Knowledge

SPECIAL NOTE: This report IS NOT an official publication of the National Cooperative Highway Research Program, Transportation Research Board, National Research Council, or The National Academies.

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## **Disclaimer**

The opinions and conclusions expressed or implied are those of the research agency that performed the research and are not necessarily those of the Transportation Research Board or its sponsoring agencies. This report has not been reviewed or accepted by the Transportation Research Board Executive Committee or the Governing Board of the National Research Council.

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# 1 Executive Summary

## Problem Statement

Departments of transportation (DOTs) nationwide use innovations to improve policies, streamline practices, and find creative solutions to better meet growing demands. Development and use of the innovations are siloed within individual DOTs. Using a platform to allow DOTs to share innovations could help DOTs improve across the nation. Public Knowledge® (PK) conducted a feasibility study and alternatives analysis for The National Cooperative Highway Research Program (NCHRP) on a platform to capture and share innovations between DOTs.

## Recommendation

We recommend moving forward and purchasing a new commercial-off-the-shelf (COTS) system to allow for innovation sharing between DOTs. The panel members who participated in the alternatives analysis voted in support of this decision.

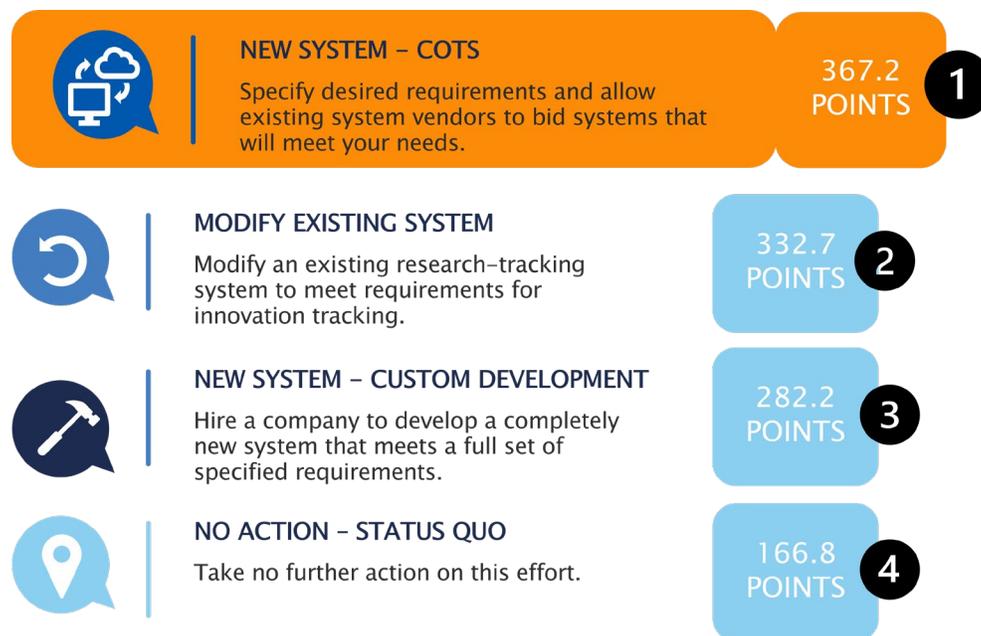


Figure 1. Alternative Scores

## Feasibility Findings

**Would people use a new system?** Potential users we surveyed are already researching innovations and seeking out peer input to solve the problems they face. Many indicate they are likely or very likely to use a new system if one is deployed. This behavior supports investing in a centralized system. No system is currently deployed across all or even most

DOTs. There is room to improve on existing technology by introducing a single place to search and record innovation data.

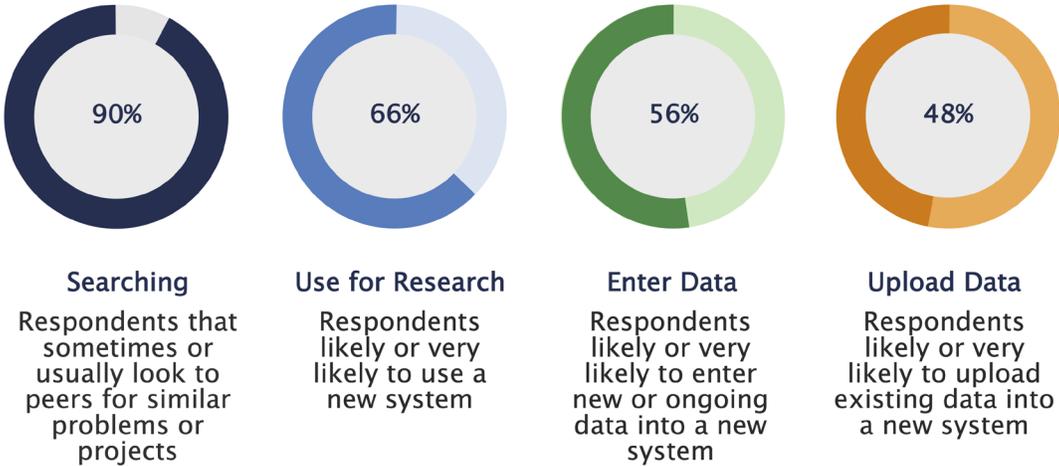


Figure 2. Likely System Use

Approach

Our approach to the work that led to these recommendations is based on the five tasks summarized below.



Figure 3. Research Approach

## 2 Project Overview

PK conducted a feasibility study for a platform to capture innovations from state departments of transportation. This report contains a summary of the approach and outcome of that project.

### 2.1 Project Purpose

The NCHRP researches problem areas that affect highway planning, design, construction, operation, and maintenance in the United States. DOTs nationwide use innovations to improve policies and practices and to find creative solutions to better meet growing demands, but development and use of the innovations are siloed within specific DOTs. NCHRP is considering a platform(s) to collect information and allow DOTs to retrieve the information. NCHRP contracted with PK to conduct a feasibility study for developing a new platform(s) or implementing an existing platform(s) to allow DOTs to share and retrieve information.

### 2.2 Project Outcomes and Recommendations

We recommend purchasing a new COTS system to allow for innovation sharing between DOTs. The panel members who participated in the alternatives analysis all support this decision.

The next effort should establish an innovation sharing system implementation project. The high-level steps should be:

- Identify a project owner and governance structure
- Secure funding
- Staff the project
- Develop user stories or gather requirements
- Procure, implement, and test a system
- Complete user outreach and training
- Establish a sustainable model for ongoing system operation

## RECOMMENDATION CATEGORIES

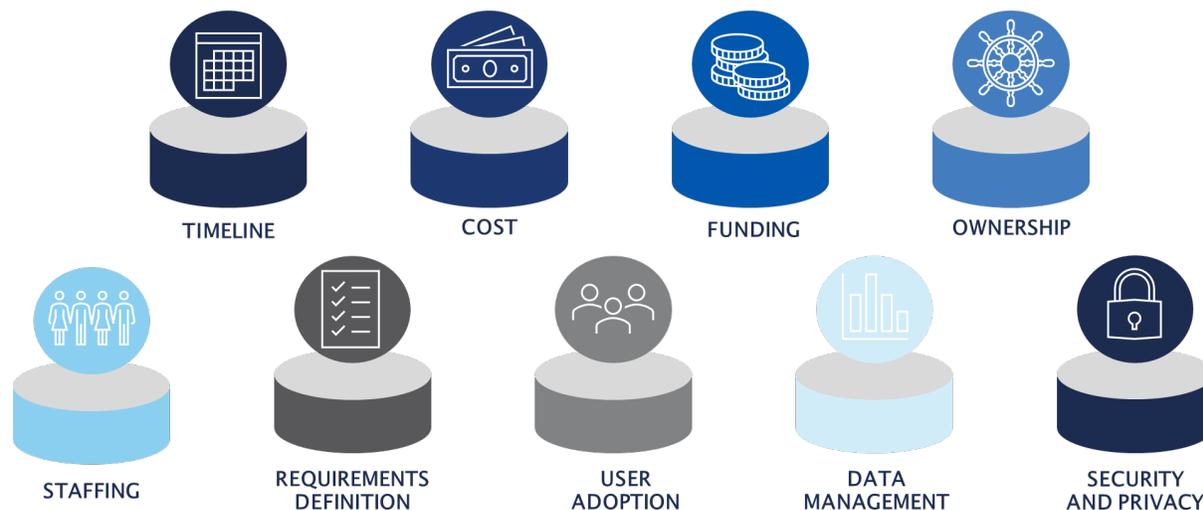


Figure 4. Recommendation Categories

Based on our experience with system implementation projects, we suggest the panel consider the recommendations below as they move forward with an innovation sharing solution. Recommendations are grouped into the categories shown in Figure 4.

### Timeline



- **Procurement Timeline.** Plan for a procurement to take three to six months depending on necessary contract approvals. Time spent in the procurement phase to accurately capture needs and wants will pay off in the implementation and operations phases.
- **Customization Timeline.** Plan time for some customization work to be completed by the vendor.
- **Implementation Timeline.** Plan for implementation to take anywhere from six to 18 months, depending on the level of customization, the vendor's approach, and how many features or modules are purchased.

### Cost

- **Vendor Staff Cost.** Determine a budget for non-vendor staff required to complete the project. Include project manager and business or data analyst positions.
- **Implementation Cost.** Determine a cost structure for implementation that considers how much to pay upfront for desired customizations. For example, some vendors will lower



implementation costs, but raise costs on operations to make up for any losses during implementation.

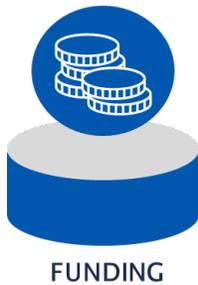
- **Offer Flexibility.** Give potential bidders flexibility on how to charge for ongoing operations. For example, some vendors may have a per user per month charge, while others may propose fixed monthly or yearly rates.
- **Plan to Negotiate.** Plan to negotiate pricing. Consider an invitation to negotiate or a Best and Final Offer (BAFO) approach to procurement. Enterprise-level pricing may be negotiable if government rates are not explicitly offered.
- **Published Pricing.** The table below shows published pricing for some systems. This is intended to help inform stakeholders about potential ongoing licensing costs but does not include all costs or systems. Additional information about potential costs can be found in Appendix E.

**Table 1. Sample System License Costs**

System (Module)	Published Price	User Caps
Wrike (Business)	\$24.80 per user per month	up to 200
IdeaScale (Evolve)	\$21,999+	Undefined
Aha! (Premium)	\$59 per user per month	Undefined
Confluence (Standard)	\$5–10 per user per month, depending on package	20,000

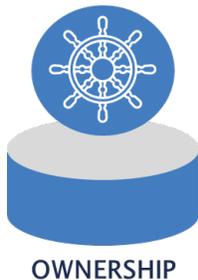
## Funding

- **Seek Federal Funding.** Consider identifying a grant or federal funding source to fund the new system fully or partially. Charging state DOT's access fees may limit participation and thus the value of the system.
- **Identify Strategic Partnerships.** Investigate partnering with The American Association of State Highway and Transportation Officials (AASHTO) and offering system access as a benefit of AASHTO membership.



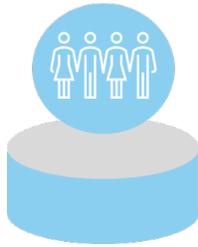
- **Evaluate Funding Models.** If user fees are necessary, consider a facilitated discussion and information gathering from the DOTs for their willingness to participate and to generate buy-in to the fee structure. Evaluate funding models in use for other efforts that distribute the cost of ownership between states.

## Ownership



- **Identify the System Owner.** Identify a clear system owner with input and buy-in from the panel and other project sponsors and stakeholders. The system owner will be responsible for facilitating funding and payment, providing implementation resources, defining requirements, and publishing a request for proposal (RFP). Consider the High Value Research system (HVR) model as an example, with many states logging in and the National Academy of Science (NAS) providing a resource and managing the vendor contract. Evaluate NAS and AASHTO as options for system owners.
- **Evaluate Ownership Options.** Evaluate the risks before assigning a single state as the owner of the system. Single-state ownership can be successful, but also can place unbalanced influence and burden on the selected state. It is possible this could lead to reduced system use and value over the long term if other organizations feel they do not have adequate influence on the system.
- **Create a Steering Committee.** Create a steering committee with membership from various stakeholder groups, such as state DOTs, NCHRP, AASHTO, and the Federal Highway Administration (FHWA). The committee should be tasked with making decisions about feature requests, system updates, and guiding any incentive efforts similar to HVR's Sweet 16. The steering committee should be engaged to provide input on requirements and scoring the RFP.
- **Draft a Charter.** Develop a steering committee charter to set clear guidelines and role expectations for the system owner and steering committee members.

## Staffing



STAFFING

- **Identify Implementation Resources.** Assign or hire staff needed to support implementation. At a minimum, we recommend a project manager to oversee the procurement and implementation and an analyst to lead requirements drafting and traceability. You may consider working with a consultant or outside vendor to fill these roles. Plan for both the project manager and analyst to work half to full time through requirements gathering, procurement, and implementation.
- **Leverage Vendor Experience.** Minimize staffing burden in the implementation phase by leveraging vendor experience and staff to fill essential roles, including support. Write these activities into the RFP to get a clear picture of cost before contract negotiations.
- **Plan for Data Administration.** Consider hiring or appointing a data administrator or content moderator, or give a rotating assignment from the pool of interested state DOT staff users. The role of the content moderator is to curate posts and authorize submissions. The level of effort required for this position cannot accurately be estimated yet. Future decisions will influence the work required by this resource. For planning purposes, assume the effort will be full time initially as agencies upload historic data, then reduces to quarter time or less for ongoing effort.

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## Requirements Definition



REQUIREMENTS  
DEFINITION

- **Craft User Stories.** Consider avoiding traditional functional requirements in the procurement. Instead, focus on high level user stories that describe what users want to accomplish with the new system. Focusing on how people will use the system gives latitude to vendors to propose creative solutions and widens the pool of potential vendors. This will allow a wider range of COTS providers to respond to an RFP by creatively solving your problems instead of meeting strict requirements.
- **Utilize Existing Content.** Use the desired functionality discussed during the visioning and other sessions to create user stories for the procurement.
- **Prioritize System Needs.** Prioritize user stories with categories such as must have, should have, and could have. Must have priorities will determine the minimum viable product.

- **Estimate User Counts.** Consider estimating user counts and data volumes so vendors are bidding the work on the same baseline or assumptions, and the evaluation team can compare pricing. Work with the requirements development team to set these estimates and consider using the HVR system access volume as a data point.
- **Invite Vendor Demos.** The list of example systems in this report is not exhaustive. Consider inviting vendors to give system demos to the requirements drafting team to get a sense of what features and systems are available in the marketplace.
- **Create Comprehensive User Stories.** Consider including the following functional areas in user stories.
  - Security
  - Role-based access
  - Reporting
  - User support
  - System support and maintenance
  - Features

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## User Adoption

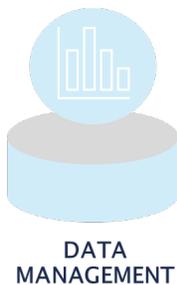


- **Prioritize Adoption.** Make user adoption a priority throughout the project. Keep in mind that system use will be voluntary and the system will not provide value if users do not use it. Seek ongoing user feedback and engagement.
- **Draft a Communication Plan.** Draft a communication plan that includes impacted stakeholders and schedule communications at appropriate intervals across multiple methods, including email and social media.
- **Communicate Early and Often.** Start communications with potential users early in the procurement process and provide quarterly updates until closer to training. Reference the user survey conducted in this project to highlight how user input contributed to the effort. For example, highlight key requested features such as searchability and ease of use.
- **Use Multiple Training Formats.** Make training available to users in multiple formats and times. Leverage the vendor to provide training. Include training in the requirements.

- **Incentivize Participation.** Establish a participation incentive that recognizes and awards innovations. Consider offering multiple award categories and recognizing agencies that are frequent contributors. The HVR Sweet Sixteen model is a starting point. Tailor this program to incentivize system participation and drive additional submissions so that users have a broad pool of fresh ideas to search.

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## Data Management



- **Develop Data Taxonomy.** Work with a transportation librarian to develop a taxonomy to classify innovations that will populate the system. Share the taxonomy with stakeholder groups and interested parties to increase buy-in.
- **Define a Data Model.** Define a data model that encourages high quality data submissions from end users. The model will need to be user friendly and clearly communicated to increase understanding, minimize support requests related to classifying data, and reduce instances of misclassified or unclassified submissions. Specify the threshold for submissions, including whether innovations must have been implemented or can simply be an idea from a contributor.
- **Include Innovation Rating.** Write RFP requirements for a feature that allows users to rate innovations. Over time the innovations database will become large and potentially hard to navigate. User scoring or a similar feature will allow users to search for innovations that have been evaluated by others, have been implemented by others, or are truly new with no other attempts or reviews.

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## Security and Privacy

- **Offer an API.** Define requirements for an application programming interface (API) for users that want to integrate existing systems.
- **Utilize National Security Standards.** Establish security requirements based on existing national standards, such as National Institute of Standards and Technology (NIST). Evaluate appropriate security needs for the type of data that will be included to prevent adding unnecessary cost for unneeded security measures.



- **Maximize Data Access.** Maximize user access to data. The vendor may recommend a variety of user roles with customized access restrictions, however these roles must be managed and maintained, which adds cost and effort. Consider allowing users to search across all innovations. Users may identify unconsidered use cases for existing solutions, and a broader search function will encourage this innovative thinking.

## 3 Project Approach

Our approach to this project was based on five tasks. The tasks are summarized in Figure 5 and described below the graphic. Sections 4 through 7 of this report provide greater detail on these tasks and the outcomes achieved.



Figure 5. Research Approach

### Task 1: Kickoff

In January 2021, we facilitated a kickoff meeting with members of the NCHRP research panel overseeing this work. The purpose of this meeting was to confirm the approach, discuss roles and responsibilities, and identify communication channels and progress reporting preferences.

### Task 2: Visioning Session

We facilitated a visioning session with NCHRP staff, research panel members, and other stakeholders in February 2021. The purpose of this meeting was to clarify needs and identify the information that we would collect through research and the stakeholder survey. Based on the feedback and input received during the Kickoff and Visioning Session, we revised our work timeline and approach to better meet the goals of the NCHRP panel.

### Task 3: Survey

We conducted a survey of panel members and other stakeholders in March 2021. Based on feedback from the visioning session, we invited participation from several disciplines at all state DOTs. The purpose of the survey was to gauge interest in accessing and contributing data to a solution that tracks innovations, identify existing systems to utilize as a solution or a model for a solution, and identify and prioritize solution features. We created interactive dashboards with annotated charts that allow panel members to drill down into the results and highlight key findings from the survey. Key findings were also highlighted in a presentation to the panel.

#### **Task 4: Research**

We researched systems and submitted a research report containing details on systems identified during the visioning and survey tasks of the project. We identified other systems for consideration during the research task, including COTS and software as a service (SaaS) innovation systems and a system used by another federal agency (Centers for Medicare & Medicaid Services or CMS) for collaboration and information sharing.

#### **Task 5: Feasibility**

We conducted an alternatives analysis facilitated session in May 2021 to assist the panel in determining which alternative is most favorable to meet the objectives of the project.

Alternatives were evaluated across seven criteria, including:

- Effort to implement
- Effort to maintain
- Cost to implement
- Cost to maintain
- Availability of requested features
- Adoptability
- Scalability

We then submitted an alternatives analysis report with a summary of the alternatives analysis session and recommendations to achieve the objective of the project.

Additional detail on these tasks can be found below in this report. After these tasks were complete, we created this report to capture the work that was done and the outcomes of each task and the effort overall.

## PK Team

We used a five-person team to conduct this work. The PK team members and their roles are below.

- Administrative Officer, Jen Vachon
- Principal Investigator, Adam Brown
- Transportation Subject Matter Expert, Nicole Alonzo
- Data Model Subject Matter Expert, Aaron Oldre
- Technical Subject Matter Expert, Greg Gamette

## 4 Task 2: Visioning

On February 11, 2021, PK facilitated a participative visioning session as part of this NCHRP Feasibility Study for a Platform to Capture Innovations from State Departments of Transportation. The 14 participants were asked to answer the four questions listed below.

- What do you want to see in place as a result of this project?
- What are some things in place that you are aware of that can be leveraged to achieve the vision?
- What challenges might we run into?
- What critical strategic actions can we take to address those priorities?

For each question, participants shared their responses. Participants then collectively grouped responses into clusters with related responses. Participants then identified which groups of responses were the highest priority for each question. Prioritization was not used to limit research, but rather to get an idea of session participants opinions and to encourage discussion during the session.

Sections 4.1 through 4.4 provide the cluster of responses participants identified as highest priority for each question. All responses to each question can be found in Appendix A of this report.

### 4.1 Question 1: Project Outcomes

Visioning session participants were asked what they want to see in place as a result of this project. Responses from the cluster of responses participants identified as highest priority are listed below.

- Less focused on data structure
- Reduces duplication of effort
- Real-time delivery of information. Fresh info
- Identification of research networks already in place
- A strategic approach to develop and advance the tool mentioned, with linkages and opportunities to connect with existing processes and systems, and recognized risks
- Cross-functional
- Needs to be implementable
- Concepts on data sharing platform for those that do not have one, but linking in tools folks already have (so, a cross talk tool)
- Connectivity identifiers
- Best-practice

- Integrated dashboard
- Ability to enter info from scratch or ingest existing data
- Self-populating, sustainable
- Well organized and updated innovation data base

## 4.2 Question 2: Tailwinds

Visioning session participants were asked what things are in place that can be leveraged to achieve the vision. Responses from the cluster of responses participants identified as highest priority are listed below.

- Groups exist and are forming with high interest
- Commonality of challenges
- Many states now have innovation leaders.
- Yes, good momentum amongst many state DOT's and within FHWA
- STIC's
- Lots of support for this to happen at federal, state and regional level
- Groups and committees exist which can be leveraged

## 4.3 Question 3: Headwinds

Visioning session participants were asked what challenges we might run into. Responses from the cluster of responses participants identified as highest priority are listed below.

- Complexity
- Variability by agency
- The burden of "ownership and maintenance" of the tool
- Broken record – who will maintain the system and how it is paid for
- Lack of implementation support

## 4.4 Question 4: Strategic Actions

Visioning session participants were asked what critical strategic actions we can take to address priorities. Responses from the cluster of responses participants identified as highest priority are listed below.

- Automated alerts? Would be nice to be able to opt in to alerts anytime someone from my own org submits.
- Sustainable and easy to use solution to spread innovative ideas at the federal, state, and regional level

- User must see this as this is the greatest thing ever!
- Platform cross talk (so existing systems don't have to change much)
- Compare and contrast of approaches for an innovation system
- Compatibility of systems
- Allowing enough flexibility in the design to use a wide net – the more rigid the requirements or definitions the more limiting on users

## 4.5 Survey Questions and Topics

During the final strategic priorities portion of the visioning session, participants shared thoughts on information that would be valuable to collect during the stakeholder survey. Input we collected on survey questions appear in the list below.

- Target survey participants since innovation exists in several agency divisions.
- Talk to DOT IT staff.
- Gauge level of interest with an innovation platform.
- Investigate what categories or types of innovation respondents would be interested in.
- Determine what information is necessary for respondents to know about an innovation to determine if they are interested in it.
- Ask whether respondents have an existing innovation program. Follow up with contact information.
- Ask whether respondents have a defined research or innovation implementation program.
- Identify existing taxonomy of fields that may be already in use.

## 5 Task 3: Survey

As part of our work on the Feasibility Study for a Platform to Capture Innovations from State Departments of Transportation, PK conducted a survey in March 2021. The survey purpose was to gain insight into the current state of innovations tracking, gauge interest in accessing and contributing data to a solution that tracks innovations, identify existing systems to utilize as a solution or a model for a solution, and identify and prioritize solution features. A copy of the survey can be found in Appendix B.

The survey was distributed to the NCHRP panel, the AASHTO Research Advisory Committee (RAC), the AASHTO Innovations Community of Practice (ICOP), and the Transportation Research Board (TRB) Research, Innovation, and Implementation Management Committee (RIIM). We also invited all survey recipients to pass the survey invitation on to anyone else they thought might have opinions to share.

A summary of key results and conclusions is below. Full results are available via an interactive dashboard available by clicking [here](https://analytics.zoho.com/open-view/1329313000015182983/f4617c295a3358dee14195f38ddb098b) or pasting the following link into a browser: <https://analytics.zoho.com/open-view/1329313000015182983/f4617c295a3358dee14195f38ddb098b>

### 5.1 Survey Key Findings

#### Conclusions

- Respondents are already researching innovations and seeking out peer input. This behavior supports investing in a centralized system.
- Respondents expressed willingness to adopt a new system either as users or data contributors, so the system data is likely sustainable.
- No system is currently deployed across all or even a majority of respondents, so there is room to improve on existing technology by introducing a single place to search and record innovation data.
- Sixty-six percent of respondents said they are likely or very likely to use a new system. Identifying a system that matches priority features and functionality and communicating widely about it may increase this percentage.

**Who Answered?** Responses received from 44 states, three national organizations, and two international respondents. Fifty of 104 respondents marked Research as their discipline.

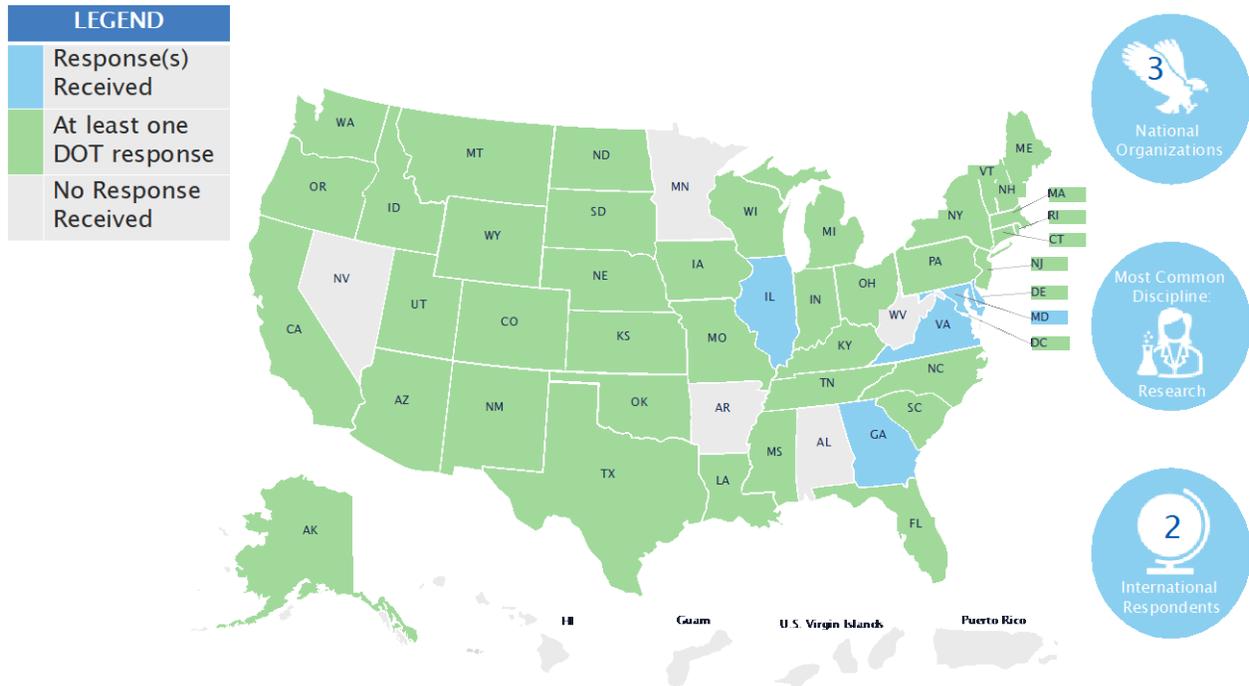


Figure 6. Who Answered

**What is in place now?** Slightly more than half of respondents are already tracking innovations, and 84 percent of them are willing to share data to a new system.

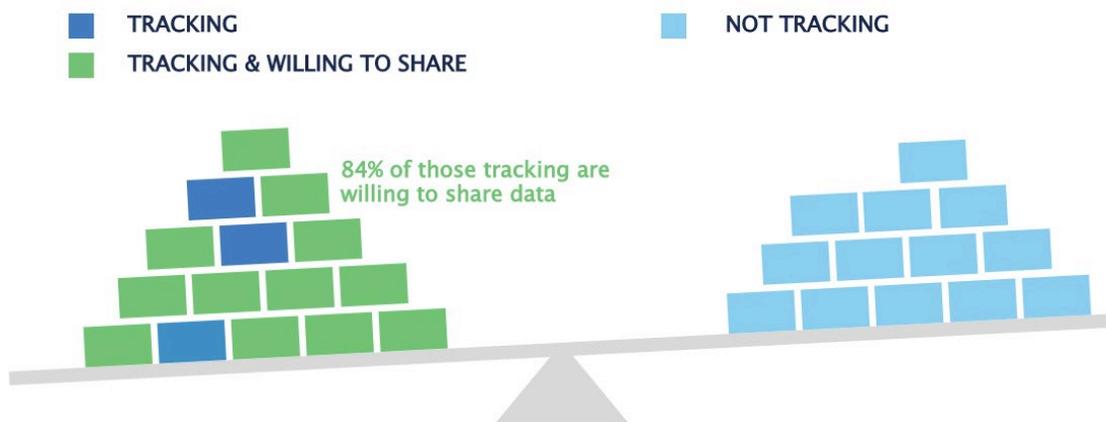


Figure 7. In Place Now

**What tools are in use?** Respondents listed the tools they are using now to conduct research on innovations. Very few respondents are using custom tools.

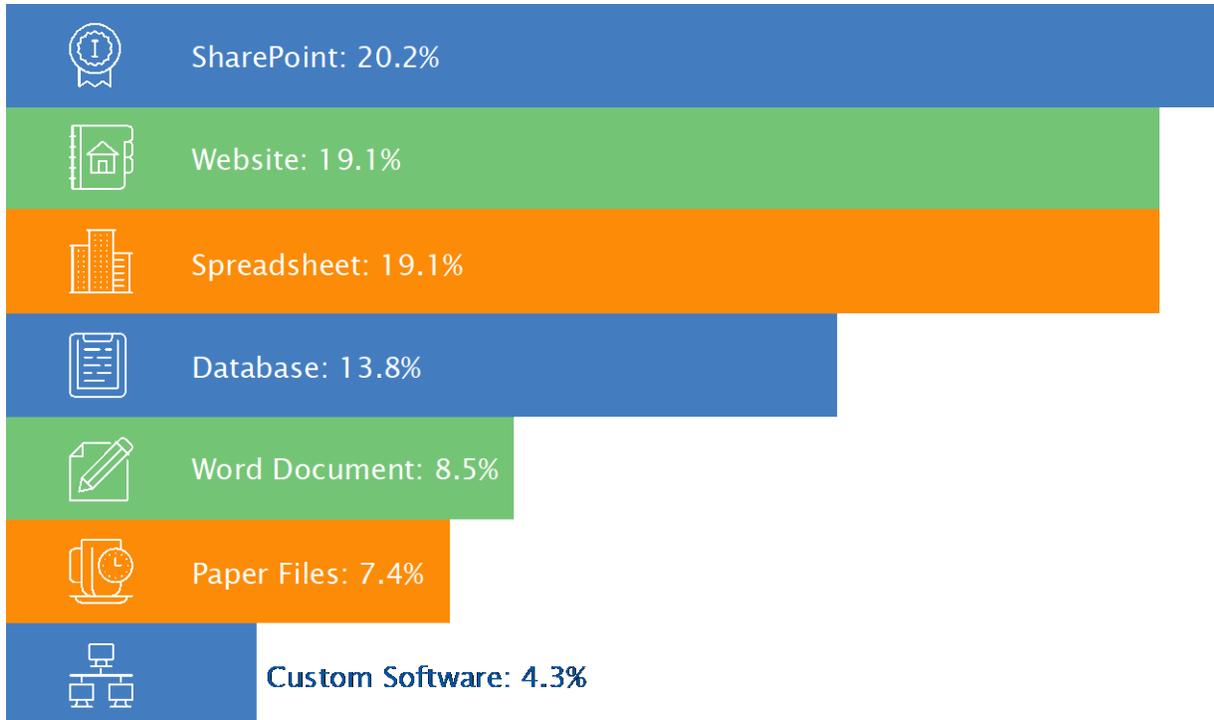


Figure 8. Tools in Use

**Would people use a new system?** Respondents are already researching problems they face, and many are likely or very likely to use a new system if one is deployed.

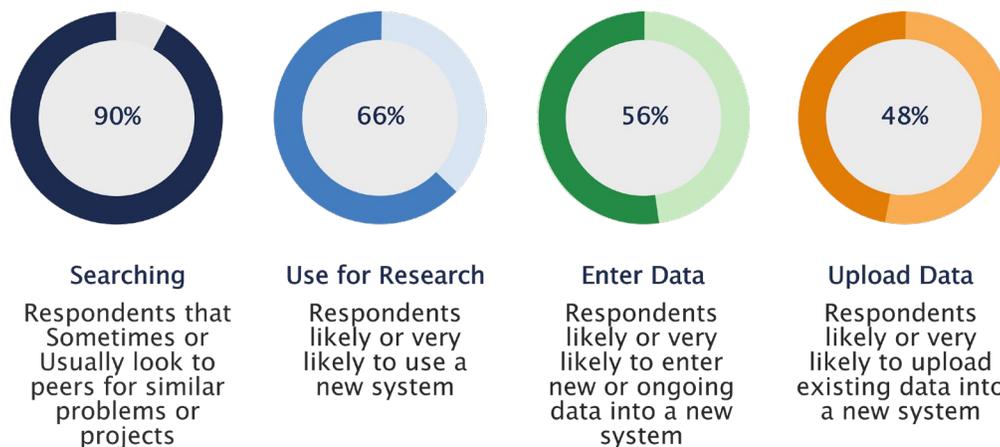


Figure 9. Likely System Use

What would encourage adoption? Top features and information respondents want are listed below in order of popularity:

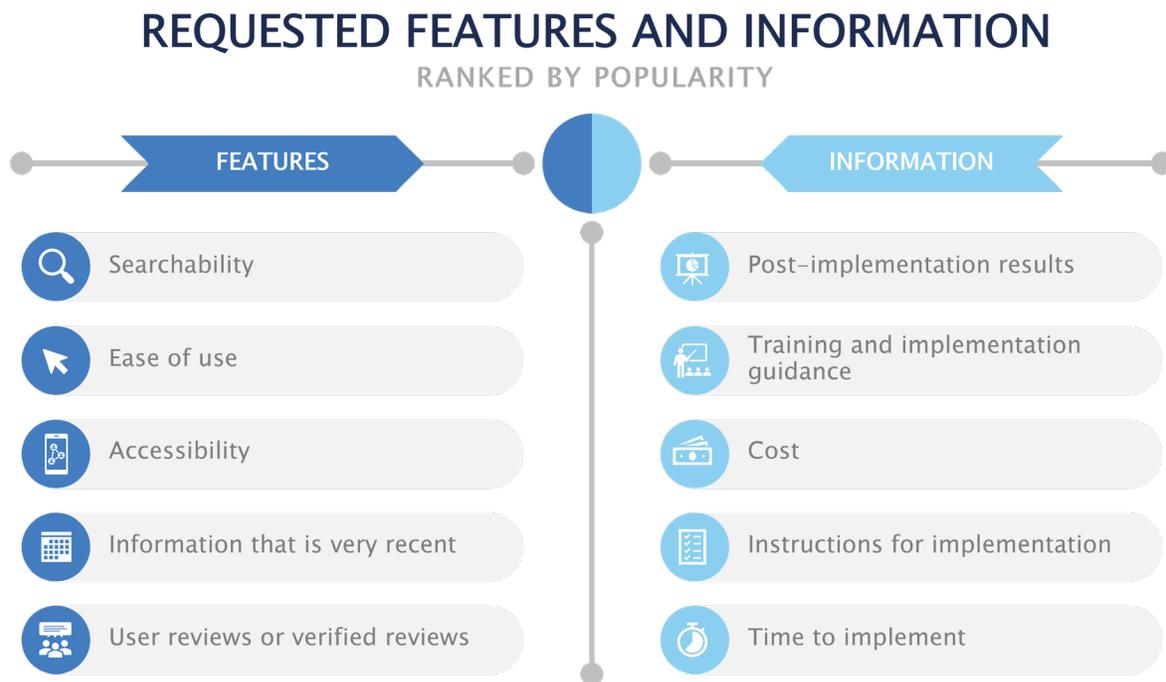


Figure 10. Requested Features

## 6 Task 4: Research

As part of our work on the Feasibility Study for a Platform to Capture Innovations from State Departments of Transportation, PK researched systems that may facilitate innovation tracking or sharing. This research provides insight into what systems are commercially available or currently in use and whether they may help innovation sharing between DOTs.

### 6.1 Research Approach

Our approach to the research task began with creating a list of research criteria, outlined in Appendix C. This criteria consisted of thirty-four details to investigate about each system we would research. We then compiled a list of systems to investigate. We identified systems to research from four sources:

1. Systems identified by the panel as potential candidates for reusing and repurposing to capture and share innovation. Example: High Value Research (HVR), a system created by iEngineering on behalf of NCHRP.
2. Systems shared by respondents during the survey phase of the project. Examples: eCAMMS system used by Pennsylvania (PennDOT) and Confluence by Atlassian used by Washington D.C. (DDOT).
3. Systems used by other government agencies for collaboration. Example: The zONE system used by Centers of Medicare and Medicaid Services (CMS).
4. Systems used to capture ideas and innovation in other industries, created by software as a service (SaaS) vendors. Example: Bright Idea and Hype Innovation.

We reviewed each system and captured information for the research criteria such as costs, features, and developer information. We summarized the research of each system in a system description and key considerations found in Appendix D of this report.

### 6.2 Systems Researched

The following table provides a brief description of each system researched and the rationale for including it in the research. This list is illustrative of the types of solution options available. It is not exhaustive, and we encourage the panel to consider other solutions that may be identified during any future procurement.

Table 2. List of Systems Researched

System Name	Description
RPPM (Research Program and Project Management for Transportation)	<ul style="list-style-type: none"> <li>Originally built on SharePoint, but has since been transitioned to WordPress</li> <li>Repository of research program and project management documents, events, and links</li> <li>Allows for collaboration between researchers</li> </ul>
HVR (High Value Research)	<ul style="list-style-type: none"> <li>Maintained and managed by NCHRP</li> <li>Collects high value research project submissions from all DOTs</li> <li>Developed by iEngineering with whom NCHRP has a contract through 2024</li> </ul>
APEL (AASHTO Product Evaluation List website)	<ul style="list-style-type: none"> <li>Nine DOTs have proprietary information listed</li> <li>Provides a repository consisting of findings from the evaluation and testing of new, innovative, and proprietary products and materials</li> </ul>
EU Compass	<ul style="list-style-type: none"> <li>Developed as part of the EU lifelong learning program</li> <li>Custom built for an EU project over ten years ago</li> <li>Does not appear to be supported anymore</li> </ul>
Saba Cloud Activity Stream – UDOT Ideas Portal	<ul style="list-style-type: none"> <li>Used by Utah DOT as a hub for recording and sharing innovative practices</li> </ul>
Confluence by Atlassian	<ul style="list-style-type: none"> <li>Used by Washington D.C. (DDOT) to build a knowledge base for documentation and product requirements</li> </ul>
eCAMMS	<ul style="list-style-type: none"> <li>Web-based business and partner-accessible system</li> <li>Used by Pennsylvania (PennDOT) to search and track test results and approved materials</li> </ul>
ArcGIS	<ul style="list-style-type: none"> <li>Used by Michigan and New Hampshire to geolocate innovations within their respective DOTs</li> </ul>

System Name	Description
	<ul style="list-style-type: none"> <li>• PK research identified ArcGIS as a potential feature of a system rather than a full-featured product</li> </ul>
CMS zONE	<ul style="list-style-type: none"> <li>• Used by Centers of Medicare and Medicaid Services to collaborate with states</li> <li>• Allows participants to share documents and comment on document history</li> <li>• Allows broad sharing of information between Centers of Medicare and Medicaid Services and state agencies</li> </ul>
Bright Idea	<ul style="list-style-type: none"> <li>• Used by companies to track ideas from inception to completion and analyze return on investment (ROI)</li> <li>• Licensed on a per user per month basis</li> </ul>
Plan Box	<ul style="list-style-type: none"> <li>• Used for agile innovation management and portfolio management</li> <li>• Primarily focused on agile project management methodologies</li> <li>• Licensed on a per user per month basis</li> </ul>
Hype Innovation	<ul style="list-style-type: none"> <li>• Used for idea and innovation management to determine which opportunities are aligned with strategic initiatives</li> <li>• Licensed on a per user per month basis</li> </ul>
SharePoint	<ul style="list-style-type: none"> <li>• Ubiquitous document sharing and management solution developed by Microsoft</li> <li>• Familiar to users in the DOT community</li> </ul>
Custom Development	<ul style="list-style-type: none"> <li>• Would allow NCHRP to create a tool customized to requirements identified by the panel</li> <li>• Custom development may be based on existing system, e.g., HVR</li> </ul>

## 7 Task 5: Alternatives Analysis

As part of our work on the Feasibility Study for a Platform to Capture Innovations from State Departments of Transportation, PK facilitated an alternatives analysis session with NCHRP panel members in May of 2021.

### 7.1 Alternatives Analysis Approach

Alternatives analysis is a technique used to evaluate options to select the most favorable or most likely to achieve a desired outcome. An alternatives analysis provides quantitative scores to a qualitative decision using a consistent, logic-based approach. Our steps to perform an alternatives analysis are shown in Figure 11 below and detailed below the graphic.



Figure 11. Alternatives Analysis Steps

1. **Visioning:** The group shares expectations on what they will achieve through the process, and reaches consensus on what progress will have been made when the group's time together is concluded.
2. **Define Criteria:** The group agrees on which factors are important to the decision being made, such as cost, effort, or time to implement.
3. **Define Alternatives:** The group agrees to limit consideration of alternatives only to those that are reasonably likely to meet the goals of the project. A no-action alternative is considered as well, to ensure the benefits are sufficient to justify the associated cost of the other alternatives.
4. **Review and Confirm Alternatives and Criteria:** This step is important to build consensus around the criteria and alternatives, which ensures the group will accept

the outcome of the alternatives analysis. The group weights the criteria and makes sure all members have a comfortable understanding of each alternative, including its pros and cons.

5. **Assess Alternatives using Criteria:** The group works to evaluate each alternative independently, on its own merits, by scoring each of the criteria for each alternative. Scores are awarded using a consistent scale for each criteria on the first alternative, then scoring is repeated for each subsequent alternative. This consistent approach generates qualitative data for decision support.
6. **Summarize and Confirm Results:** The group reviews the summary scoring and agrees to support the highest scoring alternative.

## 7.2 Facilitated Session

We facilitated an Alternatives Analysis session with the NCHRP Panel in May 2021. The session focused on the last three steps in the process, since the previous steps had been completed in prior sessions.



Figure 12. Facilitated Session Steps

### Assumptions

The panel agreed that the outcome of the session would be a system type rather than a recommendation to adopt a specific system platform or vendor. The four system types considered, called alternatives, are detailed in Section 7.4 below. The panel also agreed to consider each alternative independently on its own merits against the evaluation criteria rather than comparing each alternative against each other. The evaluation criteria are detailed in Section 7.3, which follows.

## 7.3 The Evaluation Criteria

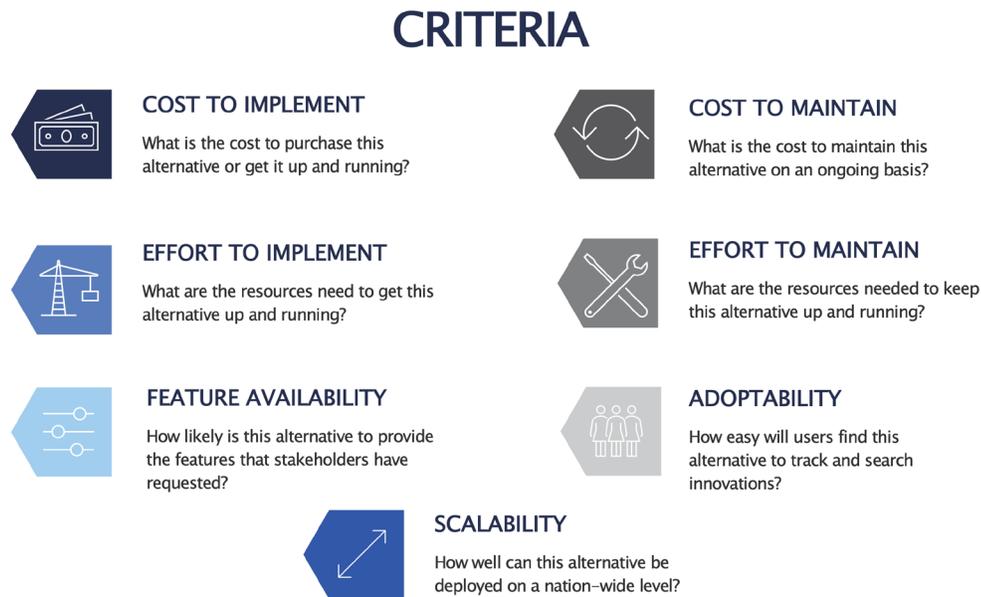


Figure 13. Evaluation Criteria

We developed the list of evaluation criteria from panel and stakeholder survey input. We identified the areas that the panel wanted to consider when deciding how and whether the effort should proceed, and incorporated comments received during the survey. The result included seven criteria that were used to evaluate each alternative.

- **Cost to Implement.** Most systems have an upfront cost to design, develop, or configure, and deploy either in a cloud or on-premises environment. This criteria considers how much upfront cost is required to get from idea to live for a given alternative.
- **Cost to Maintain.** Ongoing system costs will require budgeting and payment throughout the system life. This may include system maintenance, production environment maintenance and upgrades, and ongoing licensing fees. This criteria considers the ongoing expense to maintain a system once it is deployed.
- **Effort to Implement.** Even vendor-hosted systems require input from the user team or owner to define requirements, configure, and test. This criteria evaluates the effort required from the panel or system owner to define needs and document requirements, configure the system, and test the solution once it is deployed.
- **Effort to Maintain.** Ongoing system maintenance may fall mostly to the vendor for some systems, or may fall completely on the owner for on-premises deployments.

This criteria evaluates the level of effort to keep a system up and going once it is in place.

- **Feature Availability.** Features are what make the system useful, or the functionality that encourages adoption. This criteria evaluates how well each alternative delivers the desired features and functionality that will make the system meet user needs.
- **Adoptability.** Adoptability refers to how likely users are to introduce the system to their existing work flows, and modify current behaviors to continue use. Many factors contribute to this, including how user friendly a system is, how familiar some users may be with the software, or how much value the user sees from using the system. This criteria evaluates how adoptable the alternative will be or can be made to be through requirements drafting.
- **Scalability.** The panel is seeking a system that allows cooperation from state DOTs across the nation, which makes solutions scalability an important consideration for whichever alternative is selected. Some solutions may work very well within a single DOT, but may not be built to scale nation-wide. This criteria evaluates whether alternatives can be deployed to all state DOTs and other stakeholders.

During the facilitated session, panel members were given the list of criteria and asked to distribute 100 points between the list to demonstrate how important each criteria is relative to the others. These distributions were averaged and the resulting scores were used to weight criteria based on importance when calculating the final weighted scores. Criteria weights are shown in the graphic below.

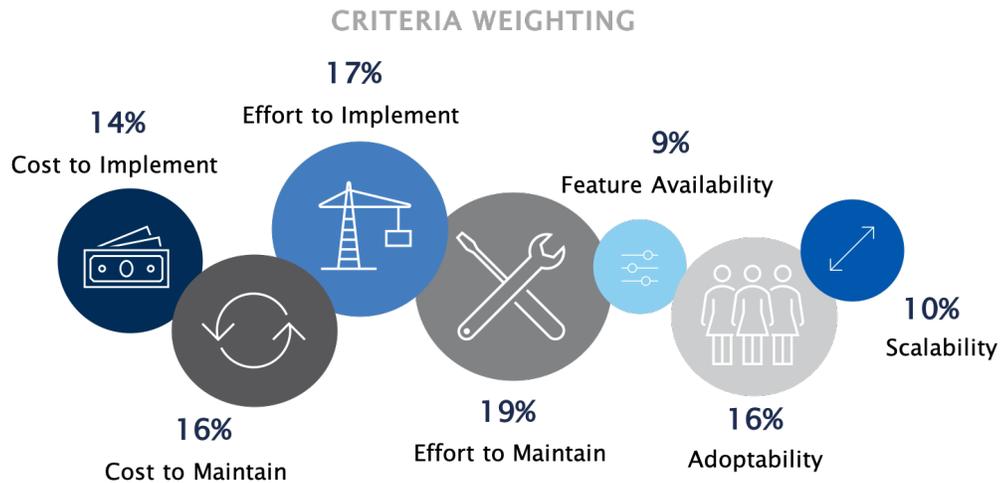


Figure 14. Criteria Weighting

## 7.4 The Four Alternatives



## ALTERNATIVES

Figure 15. The Four Alternatives

The panel considered four alternatives during the facilitated session. These alternatives were selected as a result of PK research and stakeholder input via survey. The suggested and researched platform options fell into three major categories, and a no-action alternative was also considered in the evaluation. This section of the report contains the information the panel used to evaluate each alternative, including a summary of information about the alternative and a consideration of the pros and cons for each criteria.

Panel members were invited to consider each alternative independently, and score each alternative using the criteria without consideration for how the alternative might compare to other alternatives. This ensures a full evaluation of each alternative instead of asking the panel to pick the best alternative out of a list. Each alternative was scored after the review was presented. Unweighted alternative scores are presented in this section following each alternative summary.

## 7.4.1 Alternative 1: Custom Development

**Overview:** To procure a new custom developed system, the buyer will identify all desired functionality, features, workflows, and use cases and hire someone to create a new system that meets all unique, specific requirements. The buyer will either deploy in a local server environment or purchase remote hosting.

**Cost Information:** Software developer time runs \$75 to \$175 per hour depending on platform and complexity. Typical small development projects run \$50,000 to \$500,000. Maintenance packages will be billed annually. Hosting and environmental support are not usually included.

### Representative Activities

- Requirements gathering and review
- RFP drafting and proposal scoring
- Vendor validation of requirements
- System design and development
- Configuration and implementation
- Testing
- Training and launch

### Example Systems

- RPPM
- APEL
- EU Compass
- HVR
- eCAMMS (PennDOT)
- zONE

## Pros and Cons

Table 3. Pros and Cons of Alternative One: Custom Development

	Pros	Cons
Cost to Implement	A competitive RFP can be used to increase pricing competition	Potential for significant upfront cost for developer time, project staff, and hosting environment
Cost to Maintain	Contract can be structured to share risk with vendor through quality-based performance standards	Cost for future feature enhancements, security patches, and environment maintenance
Effort to Implement	Based on the contract structure and scope, could mitigate resource effort through contractor staffing	Panel and stakeholder time commitment for requirements elicitation and testing. System projects are complex and fraught with risk
Effort to Maintain	Panel can set feature prioritization and own all data	Time commitment for data curation
Feature Availability	System will be innovation-focused from inception, increases sharing of innovations, all features possible	Features will need to be identified, documented, and developed
Adoptability	Ease of use can be written in as a requirement	New system for all users
Scalability	Scalability can be written in as a requirement	Panel or eventual system owner will have to scale environment as system use or features increase

### Unweighted Scores

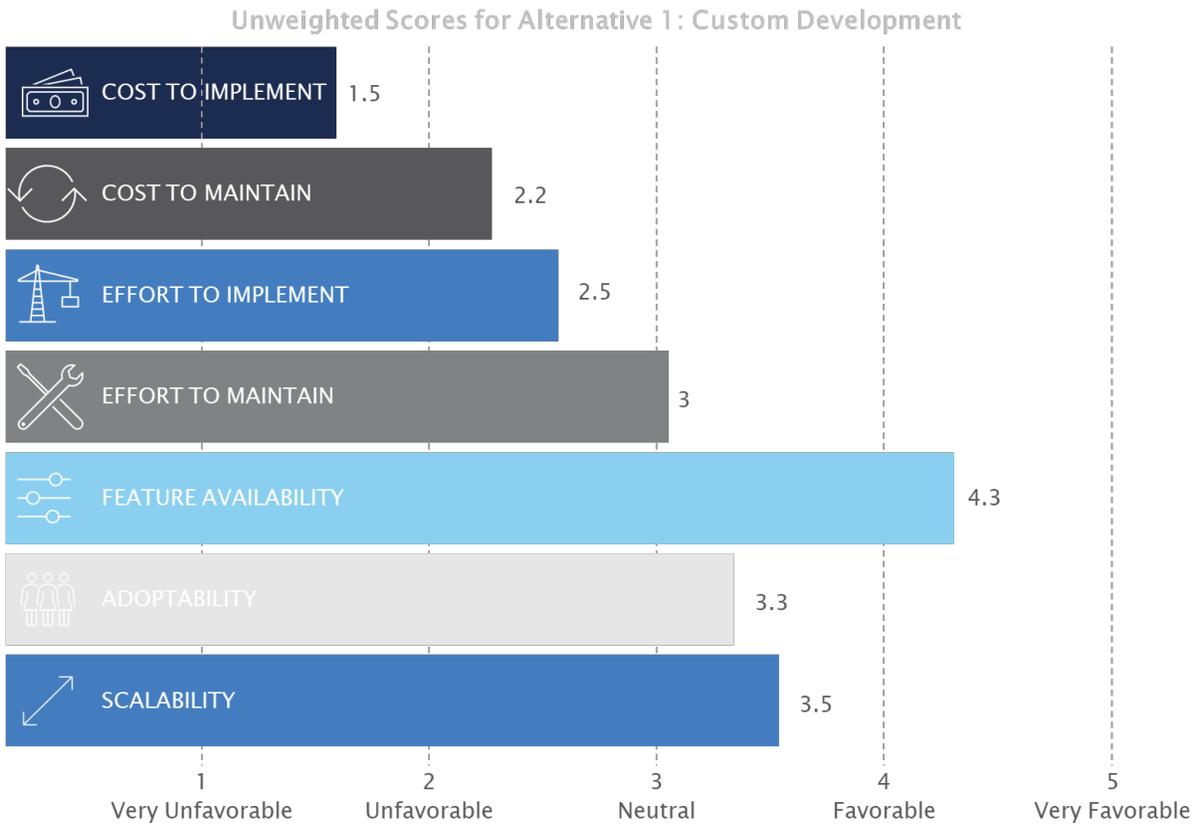


Figure 16. Alternative One Scoring

## 7.4.2 Alternative 2: COTS

**Overview:** To procure a new commercial-off-the-shelf (COTS) system, the buyer will develop a list of features and functionality and convert it to RFP requirements. An RFP will call for proposals to meet the requirements, and the buyer will select a system. The vendor will include hosting and system maintenance. Contracts will run multiple years and include licensing and user support.

**Cost Information:** Expect to pay an implementation cost for a large-scale deployment, followed by either an annual maintenance fee or a per user per month fee depending on the system and vendor. Monthly fee estimates land between \$200 – \$3500 per month.

### Representative Activities

- Requirements gathering and review
- RFP drafting and proposal scoring
- Vendor validation of requirements
- System Configuration
- Testing
- Training and launch

### Example Systems

- IdeaBox
- Saba People Cloud (Utah Idea Stream)
- Confluence
- ArcGIS
- Bright Idea
- Plan Box
- HYPE Innovation
- SharePoint

## Pros and Cons

Table 4. Pros and Cons of Alternative Two: COTS

	Pros	Cons
<b>Cost to Implement</b>	A competitive RFP can be used to identify the most advantageous system from multiple vendors	High cost up front for configuration and implementation
<b>Cost to Maintain</b>	User fee will cover all maintenance in price	A per user, per month cost will likely be required, which may be hard to budget for
<b>Effort to Implement</b>	A cloud hosted system will require less input than a custom development solution	Panel and stakeholder time commitment for requirements documentation and system configuration will still be somewhat high
<b>Effort to Maintain</b>	All system patches and maintenance will be handled by the vendor, and may include data curation	Time commitment for data curation
<b>Feature Availability</b>	Features can be set and prioritized during the RFP process, will increase innovation sharing	No exact match for features desired or focused on transportation innovation. Customization of COTS is expensive
<b>Adoptability</b>	Established systems typically come with training and support resources	Will be a new system for all users
<b>Scalability</b>	Cloud environments are scalable by definition	None

Unweighted Scores

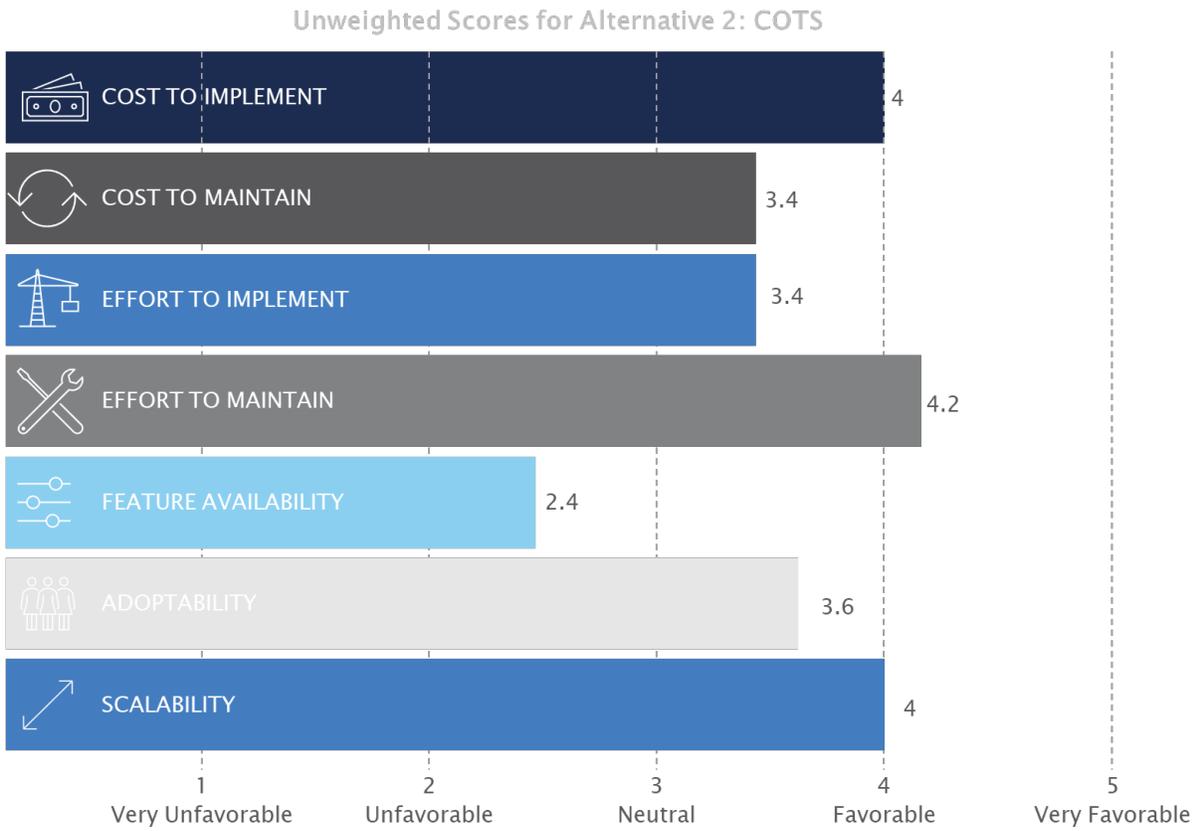


Figure 17. Alternative Two Scoring

### 7.4.3 Alternative 3: Modify Existing System

**Overview:** To modify an existing system for a new use, the buyer will identify an existing system and contract with a vendor to make modifications, or copy the system into a new instance and modify that instance for a different use.

**Cost Information:** Expect to pay for design and implementation from the development vendor, but at a reduced cost compared to custom development, especially if the vendor developed the initial system. May incur additional cost for hosting and support, depending on the existing system setup.

#### Representative Activities

- System identification
- Requirements gathering and review
- Gap analysis
- Vendor solutioning
- System design and development
- Testing
- Training and launch

#### Potential Candidates for System Reuse

- Utah Idea Stream
- HVR
- RPPM
- APEL
- zONE

## Pros and Cons

Table 5. Pros and Cons of Alternative Three: Existing System Modification

	Pros	Cons
Cost to Implement	Initial cost will be less if system has some or most desired functionality	Costs related to custom development to modify existing system or reuse existing code, or expand hosting environment
Cost to Maintain	You can likely tag on to the existing system contract for economies of scale	Contractor may request new payment model that increases maintenance costs, upon contract renewal or new contract award
Effort to Implement	Can focus only on additional development needs, reducing time to gather requirements and test	Will still need to support requirements development and testing
Effort to Maintain	You can likely utilize the team or vendor maintaining the existing system	Time commitment for data curation
Feature Availability	Any feature requested can likely be developed, will increase innovation sharing	Features will need to be identified, documented, and developed
Adoptability	Ease of use can be written in as a requirement, and users may already have familiarity with existing system	Modifications or enhancements may require a learning period before becoming fully adopted
Scalability	Existing system may already be in nationwide use	Environment may need expanded if user count increases dramatically

### Unweighted Scores

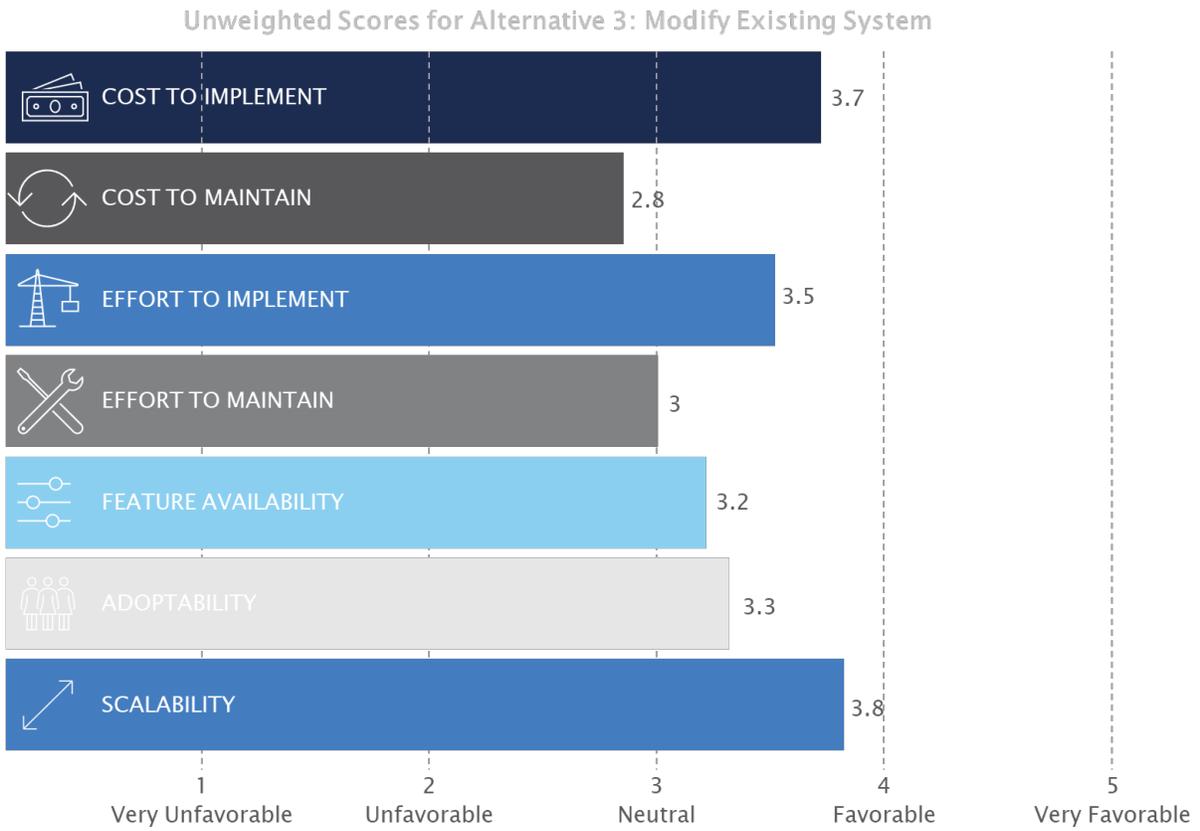


Figure 18. Alternative Three Scoring

### 7.4.4 Alternative 4: No Action

**Overview:** The panel would take no further action to implement a system to track and share innovations between DOTs.

**Cost Information:** No additional cost would be incurred under this option.

**Representative Activities**

- Conclude research and alternatives analysis
- No further action

**Pros and Cons**

**Table 6. Pros and Cons of Alternative Four: No Action**

	Pros	Cons
<b>Cost to Implement</b>	No implementation cost	None
<b>Cost to Maintain</b>	Existing costs are known and already paid by state DOTs	None
<b>Effort to Implement</b>	No implementation resources	None
<b>Effort to Maintain</b>	Existing resources re known and already in place for each DOT	DOT staff will still conduct disparate searches with mixed results
<b>Feature Availability</b>	None	No new functionality or features available, no increase to sharing of innovations
<b>Adoptability</b>	None	No system available for all users to adopt, disparate systems and training methods with no interconnectivity
<b>Scalability</b>	None	No single DOT system emerged as scalable to other states or systems as deployed

### Unweighted Scores

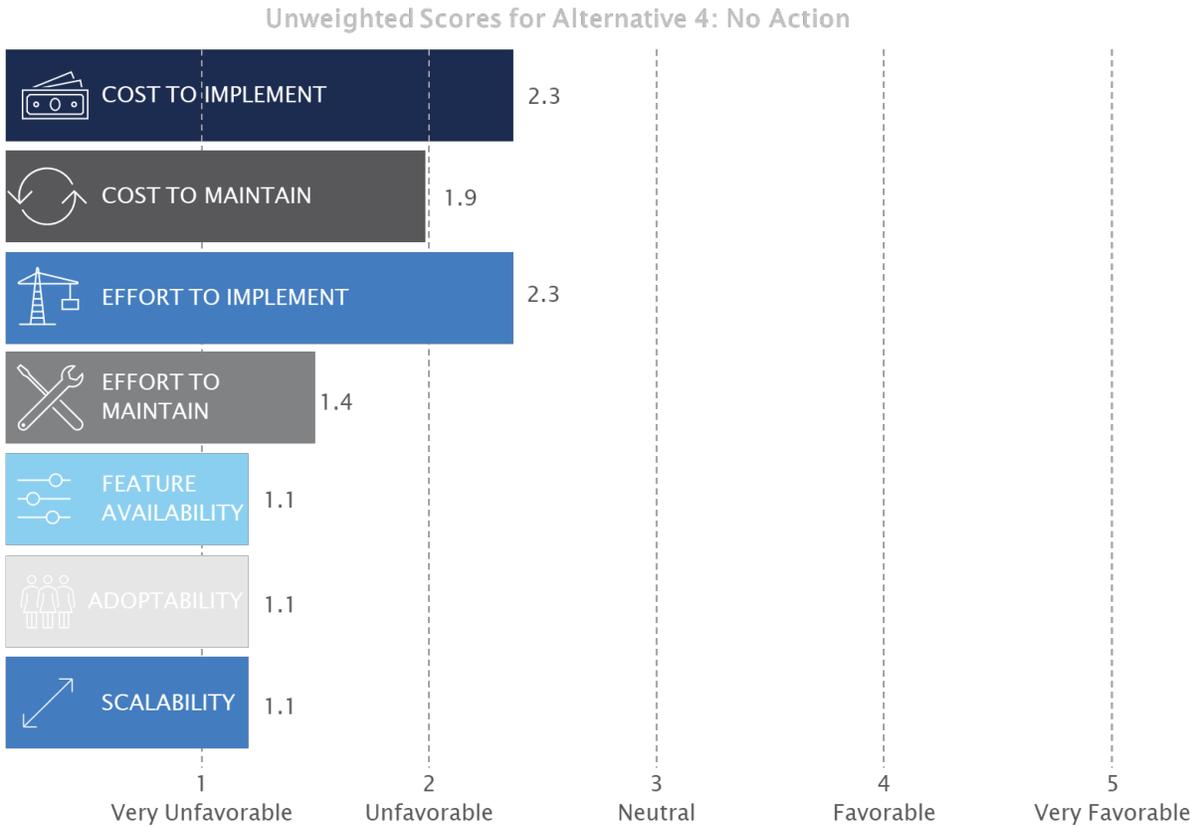


Figure 19. Alternative Four Scoring

## 7.5 Results

Once the panel reviewed all alternatives and provided scores for each criteria, PK compiled the scores and multiplied the average criteria score by the criteria weight. We then summed the scores for each alternative to arrive at a weighted score for each alternative. Purchasing a new COTS system is the selected alternative. The final weighted scores are reflected in the graphic below.

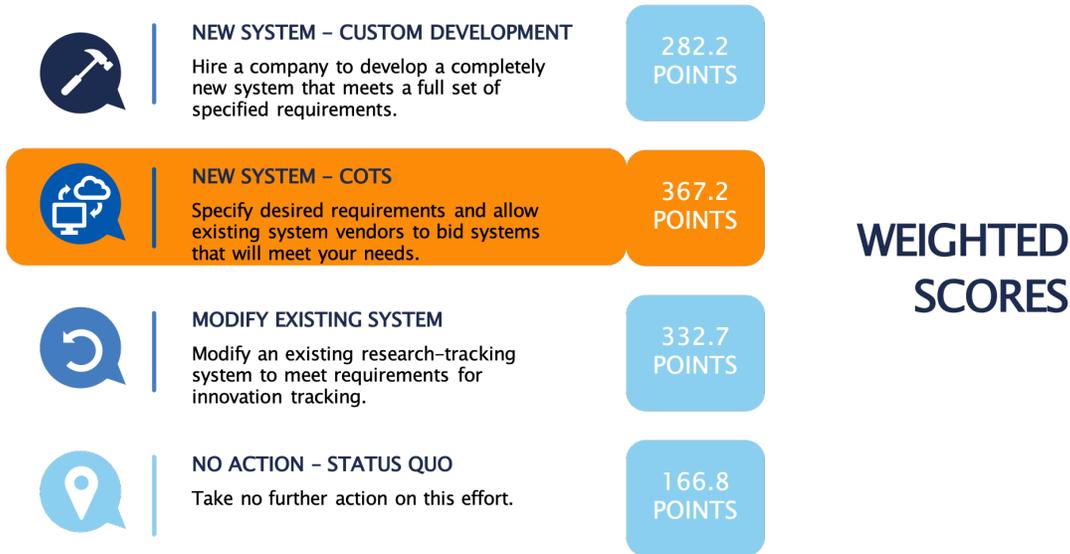


Figure 20. Scoring Summary

Scoring detail, including the score for each criteria for every alternative, can be found in the table below.

### CALCULATED ALTERNATIVE SCORES

	Cost to implement	Cost to Maintain	Effort to Implement	Effort to Maintain	Feature Availability	Adoptability	Scalability	Total Score <i>Sum(Scores x weights)</i>
Weights	14	16	17	19	9	16	10	
New System: Custom Development	1.5	2.2	2.5	3	4.3	3.3	3.5	282.2
New System: COTS	4	3.4	3.4	4.2	2.4	3.6	4	367.2
Modify Existing System	3.7	2.8	3.5	3	3.2	3.3	3.8	332.7
No Action	2.3	1.9	2.3	1.4	1.1	1.1	1.1	166.8

Figure 21. Scoring Detail

The panel reviewed and discussed the scores and confirmed the validity of the results. Each panel member present agreed to recommend adopting the selected alternative.



# Appendix A. Visioning Session Results

We asked visioning session participants four questions. After sharing their responses, participants collectively grouped all responses into clusters of related responses. Participants then identified which cluster of responses was the highest priority for each question. The tables below show all responses visioning session participants provided to each of the four questions. The responses are presented in the clusters assigned by vision session participants. Clusters of responses that participants identified as highest priority are indicated with “\*Priority.”

## Question 1: Project Outcomes

Visioning session participants were asked what they want to see in place as a result of this project. Their responses are in the table below.

Table 7. What do you want to see in place as a result of this project?

Cluster	Responses
One	<ul style="list-style-type: none"> <li>• Realistic options for an innovation sharing platform</li> <li>• Concepts toward a marketing strategy</li> <li>• Path forward for an end product</li> <li>• Cost estimation for development, then to sustain</li> <li>• Who will maintain</li> </ul>
Two	<ul style="list-style-type: none"> <li>• Don't overload participants with responsibilities beyond their capacity</li> <li>• Individuals post their innovations</li> <li>• Collaborative site</li> <li>• Encourage user data entry</li> <li>• Easy to use for any customer (research folks, operations folks, states, locals, etc.)</li> <li>• Has to be something people want to use</li> <li>• Well organized, easily searchable tool</li> <li>• Latest solutions to the top</li> <li>• Comprehensive platform</li> </ul>
Three (*Priority)	<ul style="list-style-type: none"> <li>• Less focused on data structure</li> <li>• Reduces duplication of effort.</li> <li>• Real-time delivery of information. Fresh info</li> <li>• Identification of research networks already in place</li> </ul>



Table 7. What do you want to see in place as a result of this project?

Cluster	Responses
	<ul style="list-style-type: none"> <li>• A strategic approach to develop and advance the tool mentioned, with linkages and opportunities to connect with existing processes and systems, and recognized risks</li> <li>• Cross-functional</li> <li>• Needs to be implementable</li> <li>• Concepts on data sharing platform for those that do not have one, but linking in tools folks already have (so, a cross talk tool)</li> <li>• Connectivity identifiers</li> <li>• Best-practice</li> <li>• Integrated dashboard</li> <li>• Ability to enter info from scratch or ingest existing data</li> <li>• Self-populating, sustainable</li> <li>• Well organized and updated innovation data base</li> </ul>
Four	<ul style="list-style-type: none"> <li>• Open for users to search but closed for data entry</li> <li>• Metrics and triggers to keep things from slipping</li> <li>• Differentiation between "new approach" vs. solid best practice or standard</li> <li>• Categorization of innovations</li> <li>• HVR-like model that incorporates best of the best and coupled national awards.</li> <li>• User experience rating system</li> <li>• Potential for integrating section for untested ideas or problems needing solved vs. something already in place and tested (idea vs. implemented innovation)</li> <li>• Reporting mechanism</li> </ul>
Five	<ul style="list-style-type: none"> <li>• Means to communicate the value of the effort, and the uses as it is deployed</li> </ul>



## Question 2: Tailwinds

Visioning session participants were asked what things are in place that can be leveraged to achieve the vision. Their responses are in the table below.

**Table 8. What are some things in place that you are aware of that can be leveraged to achieve the vision?**

Cluster	Responses
One	<ul style="list-style-type: none"> <li>• Knowledge management tools and AI evolving</li> <li>• Opportunity to make this platform the authoritative collection system.</li> <li>• Looking at other successful collection models, like HVR</li> <li>• Modifying existing systems (RPPM and HVR)</li> </ul>
Two (*Priority)	<ul style="list-style-type: none"> <li>• Groups exist and are forming with high interest</li> <li>• Commonality of challenges</li> <li>• Many states now have innovation leaders.</li> <li>• Yes, good momentum amongst many state DOT's and within FHWA</li> <li>• STIC's</li> <li>• Lots of support for this to happen at federal, state and regional level</li> <li>• Groups and committees exist which can be leveraged</li> </ul>
Three	<ul style="list-style-type: none"> <li>• Funding streams are out there – estimate \$250M per year – for innovation deployment (though not so easy to navigate)</li> <li>• Every Day Counts</li> <li>• Pooled fund studies like No Boundaries</li> <li>• A lot of info is available already</li> <li>• Many tools exist, but multiple formats and complexities – so want to make the cross talk easy, not forcing someone to scrap their tool</li> </ul>
Four	<ul style="list-style-type: none"> <li>• Like opening a channel for private sector inclusion</li> <li>• Possible innovation platforms in private sector –the 3M's</li> <li>• Tech to comb through and extract info from disparate data sources is getting better every day</li> <li>• Technology advancement</li> <li>• Rapid pace of change driving system adoption and innovation</li> </ul>



**Table 8. What are some things in place that you are aware of that can be leveraged to achieve the vision?**

Cluster	Responses
	<ul style="list-style-type: none"><li>• Information exists but poorly shared due to nowhere to house easily and collaboratively</li><li>• "Hot topic" = innovation from leaders everywhere</li></ul>



### Question 3: Headwinds

Visioning session participants were asked what challenges we might run into. Their responses are in the table below.

Table 9. What challenges might we run into?

Cluster	Responses
One	<ul style="list-style-type: none"> <li>• Keeping up with rapid changes</li> <li>• Finding consensus among the DOTs on what types of innovation are important – everyone is at different levels of innovation.</li> <li>• Overcoming past failures –"I tried that once...."</li> <li>• Multiple and sometime conflicting approaches finding a solution</li> <li>• Showing ROI from this venture</li> <li>• Shifting or varying priorities</li> <li>• Lack of clear purpose or benefit to effort</li> <li>• Defining and aligning everyone on "what is innovation" to capture</li> </ul>
Two	<ul style="list-style-type: none"> <li>• Failure to recognize the value innovations bring</li> <li>• Human nature to do your own thing, use you own tool (change management) – though the leaders involved in all of this have innovative drive</li> <li>• Incorrect incentive or level of effort participation barriers.</li> <li>• Fracturing other collection efforts (creating more duplication)</li> </ul>
Three (*Priority)	<ul style="list-style-type: none"> <li>• Complexity</li> <li>• Variability by agency</li> <li>• The burden of "ownership and maintenance" of the tool</li> <li>• Broken record – who will maintain the system and how it is paid for</li> <li>• Lack of implementation support</li> </ul>
Four	<ul style="list-style-type: none"> <li>• Engaging all DOT's</li> <li>• Resourcing</li> <li>• Not all DOTs have identified Innovation leads</li> <li>• No spare capacity to participate.</li> </ul>
Five	<ul style="list-style-type: none"> <li>• Data becoming stale</li> <li>• Differentiating between tactical innovations from large research innovations</li> </ul>



**Table 9. What challenges might we run into?**

Cluster	Responses
	<ul style="list-style-type: none"><li>• Who will maintain the data</li><li>• Ability to identify all the different locations of existing information</li><li>• Difficulty of different technologies talking together</li><li>• Data governance issues</li></ul>



## Question 4: Strategic Actions

Visioning session participants were asked what critical strategic actions we can take to address priorities. Their responses are in the table below.

Table 10. What critical strategic actions can we take to address those priorities?

Cluster	Responses
One	<ul style="list-style-type: none"> <li>• Think we need to determine the volume of participation we are envisioning. UDOT is averaging 100+ innovation success stories per year. Is it realistic that we would individually submit all 100? Without automation, I don't think this is practical.</li> <li>• Must be easy to use but still have enough details to be useful</li> <li>• Measuring success (of the system once implemented)</li> </ul>
Two	<ul style="list-style-type: none"> <li>• Consider engagement mechanism – opt in, subscription, open library, scope of participants to include or invite (federal, state, local, private?)</li> <li>• Incentivizing participation (awards tie-in).</li> <li>• Determine who will enter information</li> </ul>
Three (*Priority)	<ul style="list-style-type: none"> <li>• Automated alerts? Would be nice to be able to opt in to alerts anytime someone from my own org submits.</li> <li>• Sustainable and easy to use solution to spread innovative ideas at the federal, state, and regional level</li> <li>• User must see this as this is the greatest thing ever!</li> <li>• Platform cross talk (so existing systems don't have to change much)</li> <li>• Compare and contrast of approaches for an innovation system</li> <li>• Compatibility of systems</li> <li>• Allowing enough flexibility in the design to use a wide net – the more rigid the requirements or definitions the more limiting on users</li> </ul>
Four	<ul style="list-style-type: none"> <li>• Strategic Priority: Need to understand that innovations can result from research, but don't need to.</li> <li>• Defining "what is" innovation</li> <li>• Research work vs. homegrown tactical innovations</li> <li>• Not necessarily as a strategic priority, but the TRB AJE35 committee is working on defining innovation.</li> </ul>



**Table 10. What critical strategic actions can we take to address those priorities?**

Cluster	Responses
Five	<ul style="list-style-type: none"> <li>• Need to know what platforms are already in use and the breadth of their use.</li> <li>• Check existing AASHTO platforms: APEL for example</li> <li>• Are there off the shelf solutions</li> <li>• Check existing RAC platforms: RPPM &amp; HVR</li> </ul>

**Table 11. What critical strategic actions can we take to address those priorities?**

Cluster	Responses
One	<ul style="list-style-type: none"> <li>• Think we need to determine the volume of participation we are envisioning. UDOT is averaging 100+ innovation success stories per year. Is it realistic that we would individually submit all 100? Without automation, I don't think this is practical.</li> <li>• Must be easy to use but still have enough details to be useful</li> <li>• Measuring success (of the system once implemented)</li> </ul>
Two	<ul style="list-style-type: none"> <li>• Consider engagement mechanism – opt in, subscription, open library, scope of participants to include or invite (federal, state, local, private?)</li> <li>• Incentivizing participation (awards tie-in).</li> <li>• Determine who will enter information</li> </ul>
Three (*Priority)	<ul style="list-style-type: none"> <li>• Automated alerts? Would be nice to be able to opt in to alerts anytime someone from my own org submits.</li> <li>• Sustainable and easy to use solution to spread innovative ideas at the federal, state, and regional level</li> <li>• User must see this as this is the greatest thing ever!</li> <li>• Platform cross talk (so existing systems don't have to change much)</li> <li>• Compare and contrast of approaches for an innovation system</li> <li>• Compatibility of systems</li> <li>• Allowing enough flexibility in the design to use a wide net – the more rigid the requirements or definitions the more limiting on users</li> </ul>
Four	<ul style="list-style-type: none"> <li>• Strategic Priority: Need to understand that innovations can result from research, but don't need to.</li> <li>• Defining "what is" innovation</li> </ul>



**Table 10. What critical strategic actions can we take to address those priorities?**

Cluster	Responses
	<ul style="list-style-type: none"><li>• Research work vs. homegrown tactical innovations</li><li>• Not necessarily as a strategic priority, but the TRB AJE35 committee is working on defining innovation.</li></ul>
Five	<ul style="list-style-type: none"><li>• Need to know what platforms are already in use and the breadth of their use.</li><li>• Check existing AASHTO platforms: APEL for example</li><li>• Are there off the shelf solutions</li><li>• Check existing RAC platforms: RPPM &amp; HVR</li></ul>



# Appendix B. Survey

**Thank you for participating in the research survey. In this section, please share some information about yourself.**

1. In which state is your employer located? If you work for a national organization, please select "national organization"

2. Which of the below categories best describes your work discipline?

- Engineering
- Maintenance
- IT
- Planning
- Project Management
- Leadership
- Innovation Champion
- Research
- Finance/Budget
- Other (please specify)

3. Please select your organization type

- State DOT
- Federal DOT
- Local or State Government (Not DOT)
- Other (please specify)
- Private Sector
- University or Education Organization



**The aim of this research project is to investigate the feasibility of a single database or tracking tool that can be used by all transportation agencies to track and share innovations. In this section we will ask about any technology you have in place that might be similar or related.**

4. Does your agency currently track innovations identified during projects or initiatives?

Yes

No



**5. What system or tool do you primarily utilize to track innovations?**

- Database
- Spreadsheet
- Word Document
- Paper Files
- Website
- SharePoint
- Custom Software
- Other (please specify)

**6. Please provide the name and brand of the tool or software you identified to track innovations in the previous question.**

**7. Would you be willing to share the innovation data in your tracking system with other DOTs or transportation organizations?**

- Yes
- No



**In this section we will ask about how you might use an innovation tracking database if one were to be deployed.**

8. When solving problems or working on projects for your agency, how often do you or your peers check to see how others have approached similar problems or projects?

- Usually
- Sometimes
- Rarely
- Never

9. Where do you look for shared knowledge on innovation? (Select all that apply)

- Internet search
- My agency's website or tool
- Another agency's website or tool
- National transportation organization site (i.e. AASTHO or FHWA)
- University research department
- Other (please specify)

10. If a single system existed that consolidated innovations from transportation organizations, how likely are you to use it?

- Very likely
- Likely
- Neither likely nor unlikely
- Unlikely
- Very unlikely

11. If a single system existed that consolidated innovations from transportation organizations, how likely are you to import or upload your existing (already gathered) innovation tracking data into that system?

- Very likely
- Likely
- Neither likely nor unlikely
- Unlikely
- Very unlikely



12. If a single system existed that consolidated innovations from transportation organizations, how likely are you to input or enter innovation data into the system going forward?

- Very likely
- Likely
- Neither likely nor unlikely
- Unlikely
- Very unlikely

13. When researching innovation, how important is each of the following types of information?

	Not important at all	Minimally important	Somewhat important	Very important
Cost	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time to implement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Return on investment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maturity of method or technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Instructions for implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Post-implementation results	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Complexity or difficulty of implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contact information of innovation originator	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ratings and reviews from others who have tried the innovation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Research papers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Standard operating procedures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Training and implementation guidance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



14. How important would each of the following features be to you in an innovation tracking system?

	Not important at all	Minimally important	Somewhat important	Very important
Featured/Highlighted Innovations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
User Review/Verified Reviews	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Message Boards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Comment Sections	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ranking/Rating System	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alerts of notifications when new items are submitted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Searchability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Classification System	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ease of Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Privacy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accessibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information that is very recent or fresh	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. How likely would you be to use each of the following types of training on how to use a new innovation tracking system?

	Not likely at all	Minimally likely	Somewhat likely	Very likely
PDF manuals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interactive tutorial	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Video training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Live demonstration webinar with QA session	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



**Thank you for participating in the research survey. In this section, please share some information about yourself.**

16. Please share some information about yourself.

Your name

Organization you are representing

Your title

Please provide your email address if you are willing to provide additional clarifying information.

17. Do you have any additional comments for the survey collection team?



## Appendix C. Research Criteria

PK identified research criteria to compare systems and evaluate feasibility for the alternatives analysis. This is a comprehensive list of research criteria. Due to the proprietary nature of products researched, information for all criteria was not available for all products.

Table 12. Research Criteria

Research Criteria	Source	Description
System Name	General	Common name of the system
Latest system version	General	The latest version number of the system
Latest version release date	General	Release date of the latest version
Initial release date	General	When the system was first released
Developer Name	General	Name of entity that develops and supports the system
Product URL	General	Web link of the software
License cost	General	Licensing cost, if COTS product – either fixed annual or per user per month
Support cost	General	Support cost for maintaining the system – either yearly or monthly
Development stack	General	The development system used to create the software, e.g., .Net, Java, other
Underlying database	General	Back-end database used to support the system
Application type	General	Whether solution is server/client, web-based (either locally installed or cloud based/SAAS)



Research Criteria	Source	Description
Web browser support	General	If web-based, what browsers are supported – both desktop and mobile
Current users	General	If the system is already in use, names of current users of the system who may be willing for additional conversations about the solution, e.g., states or other entities that are using the solution
Application primary function	General	The application's original purpose. While the solution may not be written to "capture innovation", it may be extensible to do so based on its original design
Alternate uses of application	General	Any other ways the application is used beyond its primary function.
COTS?	General	Is the solution considered commercial off the shelf (COTS)? I.e., implementable with minimal DDI.
Level of automation in surfacing information	Visioning	How automated is the tool at surfacing information? Does it have an AI component to find related content that may be interesting to user?
Easy to use	Visioning	Is the user interface easy to navigate with minimal training?
Incentives for users	Visioning	Does the system have incentives to encourage participation from users?
Flexible design	Visioning	How flexible is the design, especially if adapting a system designed for another entity?
Taxonomy	Visioning	Does the solution have an extensible taxonomy that allows users to create



Research Criteria	Source	Description
		different topical areas for streamlined information retrieval?
Uploading	Survey	Does the system allow existing data to be uploaded in an end-user supported way? I.e., it does not require a data analyst to perform ETL on data.
Featured/Highlighted innovations	Survey	Indicate whether the solution has this or similar feature
User Review/Verified Reviews	Survey	Indicate whether the solution has this or similar feature
Message Board	Survey	Indicate whether the solution has this or similar feature
Comment Sections	Survey	Indicate whether the solution has this or similar feature
Ranking/Rating System	Survey	Indicate whether the solution has this or similar feature
Alerts or notifications when new items are submitted	Survey	Indicate whether the solution has this or similar feature
Searchability	Survey	Indicate whether the solution has this or similar feature
Classification System	Survey	Indicate whether the solution has this or similar feature
Ease of use	Survey	Indicate whether the solution has this or similar feature
Privacy	Survey	Indicate whether the solution has this or similar feature
Accessibility	Survey	Indicate whether the solution has this or similar feature



Research Criteria	Source	Description
Information that is very recent or fresh	Survey	Indicate whether the solution has this or similar feature



## Appendix D. Research Results

This section includes information about each system Public Knowledge researched. The information on each system includes:

- **System name**
- **Source.** Indicates which stage of the project identified the system for further research. For example, the RPPM system was identified by the panel during the visioning session.
- **Alternatives analysis classification.** Identifies which of the four alternatives analysis categories the solution would fall into if implemented. The four alternatives are:
  - No action
  - Custom development
  - Commercial off the shelf (COTS)
  - Modify existing system
- **Key Considerations.** Contains the most important information on how the system fits into the innovation solution strategy.
- **System Description.** Contains a brief description of the system, including features that may be relevant to the innovation solution.

### System 1 – RPPM (Research Program and Project Management for Transportation)

**Source:** Identified by Panel during Visioning

**Alternatives Analysis Classification:** Modify existing system, custom development

#### Key Considerations

This system may be an option if Modify Existing System is selected. While research focused, it has the most user-friendly interface and robust search capabilities of the research-based systems we reviewed. Collaboration and rating features would need to be added to meet panel and stakeholder needs.

#### System Description

RPPM is a repository for research information. It is meant to be a one-stop shop for everything related to the research program and project management. RPPM also allows



collaboration to leverage the work of others. It provides value for State DOT researchers regardless of AASHTO affiliation role.

RPPM is a custom website developed originally in SharePoint and now hosted in WordPress. Despite the focus on research instead of innovation, the RPPM system offers a number of features that are important to the panel and surveyed stakeholders. There are multiple types of documents available, a robust search interface, and a page devoted to collaboration agreements. No collaboration features are present in the system, such as rating and commenting on information, and there is no login requirement to search information. RPPM is funded by the NCHRP admin fund and developed by iEngineering who also develops the HVR system.

## **System 2 – HVR (High Value Research)**

**Source:** Identified by panel during Visioning

**Alternatives Analysis Classification:** Modify existing system

### **Key Considerations:**

HVR presents an opportunity to leverage existing infrastructure for a cost-effective solution. Some additional development would be required to make the system work for innovations tracking and research, but this is worth investigating if Modify Existing System is selected as the preferred alternative.

### **System Description**

The HVR system was discussed during the kickoff and visioning sessions as a potential system that could be adapted to capture innovation, ideally as a separate system. HVR allows state DOTs to submit research projects for consideration in an annual competition of the best research in transportation. HVR contains many similar features desired in the innovation system, but currently has a more limited scope of capturing pure research as opposed to a system that would capture any innovation.

HVR is funded by the NCHRP admin fund and all states support it indirectly via contributions to NCHRP. The HVR system was developed by iEngineering and they continue to provide the infrastructure to support the application. HVR was recently migrated to a new architecture so maintenance costs were higher in the most recent year as a result – around \$36,000. In a typical year, the application costs around \$14,000 to maintain. HVR was implemented in 2010 and has been continuously maintained.

## **System 3 – APEL (AASHTO Product Evaluation List website)**

**Source:** Identified by Panel during Visioning



**Alternatives Analysis Classification:** Modify existing system, custom development

### **Key Considerations**

APEL may be a candidate if Modify Existing System is selected as the preferred alternative, however additional development considerations may be needed as the system does not currently have login and credentialing.

### **System Description**

APEL is a data repository with information on innovations related to product and material testing. The site allows vendors and states to submit innovative products for testing and evaluation. Results are available for the general public to search and review without a login. The search feature includes some filtering on category, brand, and year.

## **System 4 – EU Compass**

**Source:** Identified by survey respondent

**Alternatives Analysis Classification:** Modify existing system, custom development

### **Key Considerations**

Compass has not been updated since 2011 and may not be a viable option for the NCHRP innovation project. However, some Compass features align with the innovation project. For example, Compass has topical areas that capture information, including a summary description along with classifications for the topic areas.

### **System Description**

The EU Compass system was identified as a potential option by one of the survey respondents. The Compass project was funded by the European Union (EU) and developed in 2008 with the purpose of supporting teachers in developing science and mathematics lessons. It allows users to create topical guides that can be utilized by other educators, including attachable resources and topic labels to group concepts. There is also a user forum to provide community features, however due to the system no longer being developed, the user community has not contributed since 2011.

## **System 5 – Saba Cloud Activity Stream – UDOT Ideas Portal**

**Source:** Identified by survey respondent

**Alternatives Analysis Classification:** Modify existing system, COTS

### **Key Considerations**



The UDOT Ideas Portal mirrors the concept the panel is searching for in a nationwide innovation sharing application. If Modify Existing System is selected as the preferred alternative, the panel could cross reference high-level requirements with features currently provided by the UDOT Ideas Portal. With necessary modification and hosting changes, the Ideas Portal could potentially be evaluated as a nationwide innovation solution.

### **System Description**

The Ideas Portal allows UDOT employees and authorized external users to document and share innovative ideas across the organization. Users can create innovation records with attached images and tags to categorize the innovation. The social features of the application allow users to favorite, comment, and share innovations with other users. Ideas Portal is built on the Saba Cloud learning management system. Saba was recently acquired by Cornerstone OnDemand. Pricing information is not publicly available.

## **System 6 – Confluence by Atlassian**

**Source:** Identified by survey respondent

**Alternatives Analysis Classification:** COTS

### **Key Considerations**

Confluence does have some features identified for the innovation solution, e.g., pages for documenting innovations and labels for categorizing and classifying information. However, due to its focus on the software development process, Confluence may not be a viable long-term choice for the innovation solution.

### **System Description**

Confluence by Atlassian was identified by a survey respondent. It is used by Washington D.C. (DDOT). The Atlassian suite of tools, including Confluence, Jira, Trello, and BitBucket, are geared towards managing Agile development projects. Confluence can be used for general knowledge sharing but information is structured around projects. Content within Confluence is centered around spaces, including team spaces, software project spaces, documentation spaces, knowledge base spaces, and personal spaces.

Confluence does allow for flexible implementation models, including cloud-based to self-hosted server. Off the shelf licensing is between \$5 and \$10 per month per user. Atlassian also offers enterprise licensing, allowing for deeper integration into an organization's security framework.

## **System 7 – eCAMMS**

**Source:** Identified by survey respondent



**Alternatives Analysis Classification:** Modify existing system, custom development

### **Key Considerations**

eCAMMS is not directly relevant to the NCHRP innovation project due to the type of information collected. However, there are some similarities as eCAMMS and the innovation solution are meant to capture classes of information (e.g., testing results for eCAMMS versus innovations for the new solution) and share it with interested parties. PK recommends the eventual project manager leading the innovation solution project review eCAMMS to glean user interaction (UI) and user experience (UX) information that may be helpful in developing requirements.

### **System Description**

eCAMMS, used by Pennsylvania (PennDOT), was another system identified by a survey respondent. eCAMMS is used to manage Pennsylvania's materials testing and approval process. Pennsylvania implemented the eCAMMS web-based software to streamline the testing process and provide construction contractors information on product and suppliers who have been approved by PennDOT. It is also used to share test results with contractors.

## **System 8 – ArcGIS**

**Source:** Identified by survey respondent

**Alternatives Analysis Classification:** COTS

### **Key Considerations**

ArcGIS is a unique tracking system that allows mapping of information. This may be a desirable feature in a future system, but by itself will not offer the full range of features the panel is interested in.

### **Brief Description**

During the survey, Michigan and New Hampshire identified in-house ArcGIS systems used to track innovation. Both applications were built using ArcGIS data tables to visualize innovations across the states by geolocation. We reviewed the systems and determined ArcGIS or geolocation are features of a solution, not an actual product. The panel may want to consider adopting features from ArcGIS that allows innovations to be geolocated and visualized via a map. Otherwise, the ArcGIS systems were missing critical features required for the innovation system, such as user management and sharing or community features.

## **System 9 – zONE: Opportunity to Network and Engage**

**Source:** Identified by Public Knowledge



**Alternatives Analysis Classification:** Modify existing system, custom development

### **Key Considerations**

zONE provides a powerful information sharing environment that supports thousands of users and is currently used by CMS. If Modify Existing System is selected as the preferred alternative, adapting zONE could be explored further though other existing transportation systems may be preferable as a starting point.

### **System Description**

The Opportunity to Network and Engage (zONE) system is used by the federal agency Centers of Medicare and Medicaid Services (CMS) within the federal Department of Health and Human Services (HHS). zONE is a social platform for state employees, contractors, and others who work with CMS to share information, documents, resources, and best practices. zONE allows users to subscribe to information channels that interest them and are topical to their work. As information objects are changed or commented on, zONE will send automated updates to all subscribers, allowing users to stay informed on the topic or interest.

## **System 10 – Bright Idea**

**Source:** Identified by Public Knowledge

**Alternatives Analysis Classification:** COTS

### **Key Considerations**

Bright Idea would provide a basic platform for sharing ideas but appears to lack the search, comment, rating, and information sharing features that the panel and stakeholders care about.

### **System Description**

Bright Idea's Idea Box is a software as a service (SaaS) platform designed for a single company or entity to track ideas from inception to completion and analyze return on investment (ROI). The Idea Box process follows a five-step process for capturing and implementing ideas:

7. Announcing the Idea Box to a team
8. Soliciting ideas from the team
9. Rating the ideas
10. Implementing the idea



## 11. Recognizing the team success

Bright Idea is geared towards capturing an idea then working to implement it rather than providing an idea and sharing it with a broader audience outside the innovator's organization. Pricing information is not readily available from the vendor.

## System 11 – Plan Box

**Source:** Identified by Public Knowledge

**Alternatives Analysis Classification:** COTS

### Key Considerations

Plan box is focused primarily on organizations looking to build innovation management programs. Some workflow concepts from the solution may be helpful to explore when documenting requirements for the innovation solution. Otherwise, Plan Box does not meet the current needs of the panel.

### System Description

Like Bright Idea, Plan Box is a SaaS product that provides a platform for capturing ideas and providing collaboration tools to promote ideas strategically aligned with an organization's goals. The tool is designed to help organizations develop innovation metrics and reports. Plan Box also provides consulting services for agile work management and change management. Plan Box starts at \$6 per month per user for up to 250 users, with discounts for higher volumes.

## System 12 – Hype Innovation

**Source:** Identified by Public Knowledge

**Alternatives Analysis Classification:** COTS

### Key Considerations

HYPE Innovation provides a good example of what is possible in the general innovation tracking marketplace, as it has the collaboration and interaction features important to stakeholders. If a SaaS solution is the preferred alternative, a vendor like this may consider responding to an eventual request for proposal (RFP).

### System Description

HYPE Innovation is a SaaS product that allows companies to gather ideas on specific topics to ensure idea generation is captured for strategic initiatives. Ideas are grouped by campaigns, and specific ideas can be selected for a development pipeline. Since it is a



proprietary system with direct contracting, no cost or platform information is publicly available.

## System 13 – SharePoint

**Source:** Identified by Public Knowledge

**Alternatives Analysis Classification:** COTS

### Key Considerations

SharePoint could be customized to provide a basic innovation sharing platform. Some of the sophisticated features desired by the panel and other stakeholders may not be feasible in SharePoint. As a system built on SharePoint matures, it may need to be migrated to another development stack, e.g., RPPM which was originally built on SharePoint was later migrated to WordPress.

### System Description

SharePoint is Microsoft’s web-based collaboration software currently used by many departments of transportation to facilitate document sharing and collaboration for users of Microsoft Office software. SharePoint’s primary purpose is for content and document management. It allows users to customize the site with domain-specific properties centered around document storage and collaboration. It is not purpose-built to capture transportation-related innovation but could be partially customized to provide some features identified by the panel and other stakeholders.

## Custom Development

**Source:** Identified by Public Knowledge

**Alternatives Analysis Classification:** New system, custom development

### Key Considerations

Custom development is an option if other alternatives are deemed infeasible by the panel.

### System Description

A custom development contract would allow NCHRP to create a purpose-built application, covering all requirements identified by the panel and other stakeholders. This option would require the development of a request for proposal (RFP) to solicit bids for the work from a qualified developer that could create the solution. The cost of this solution would vary based on requirements and scope.



## Appendix E. Potential Costs

Below are potential cost ranges for a COTS system purchase and implementation. Assumptions, if any, and factors that may influence the cost are noted in each area. Totals are provided only as ballpark estimates. For each area, the Low, Medium, or High option could be selected independently of other options, resulting in a blend of costs, and a total somewhere between the LOW and HIGH total overall.

**Procurement** includes efforts to define system needs, document them, advertise, and evaluate respondents. Factors that may impact this cost include how detailed the requirements are, how many proposers respond, and complexity of the evaluation process.

Table 13. Procurement Cost Estimates

	LOW	MEDIUM	HIGH
Set Requirements	\$10,000	\$30,000	\$40,000
Draft RFP	\$15,000	\$20,000	\$30,000
Facilitate Selection	\$10,000	\$15,000	\$25,000
<b>POTENTIAL PROCUREMENT COST RANGE</b>	<b>\$35,000</b>	<b>\$65,000</b>	<b>\$95,000</b>

Related assumptions: None

**Implementation** includes all costs associated with taking the system from contract signing to go live. This includes licensing, configuration, and project staff. Factors that may influence this cost include using a contract project manager, amount of custom configuration, and licensing model selection. The complexity of the system and level of configuration will dictate how long the implementation takes. More complex implementations will require more senior staff to participate for a longer duration.

Table 14. Implementation Cost Estimates

	LOW	MEDIUM	HIGH
Configuration	\$20,000	\$30,000	\$50,000
Initial Licensing	\$6,000	\$60,000	\$360,000
Project Manager	\$24,000	\$72,000	\$144,000



Table 14. Implementation Cost Estimates

	LOW	MEDIUM	HIGH
Business Analyst	\$24,000	\$72,000	\$144,000
POTENTIAL IMPLEMENTATION COST RANGE	\$74,000	\$234,000	\$698,000

Related Assumptions

- 100 users at \$5/month
- 200 users at \$25/month
- 500 users at \$59/month
- \$100/hour at 40 hours a month for 6 months
- \$150/hour at 40 hours a month for 12 months
- \$200/hour at 40 hours a month for 18 months

One-Time costs are the sum of procurement costs and implementation costs from above.

Table 15. One-Time Cost Estimates

	LOW	MEDIUM	HIGH
POTENTIAL IMPLEMENTATION COST RANGE	\$74,000	\$234,000	\$698,000
POTENTIAL PROCUREMENT COST RANGE	\$35,000	\$65,000	\$95,000
POTENTIAL TOTAL ONE TIME COST RANGE	\$109,000	\$299,000	\$793,000

Operations and Maintenance costs will recur annually per the vendor contract. Factors that influence this cost are number of users, negotiated licensing models, and services included. Data and System Administrator costs may be included in some licensing packages, or a higher level of data administration and oversight may be preferred.



**Table 16. Maintenance and Operation Cost Estimates**

	LOW	MEDIUM	HIGH
Annual Licensing	\$6,000	\$60,000	\$360,000
Data and System Administration	\$0 (included)	\$30,000	\$60,000
<b>POTENTIAL RECURRING COST RANGE</b>	<b>\$6,000</b>	<b>\$90,000</b>	<b>\$420,000</b>

Related Assumptions

- 100 users at \$5/month
- 200 users at \$25/month
- 500 users at \$60/month
- Assumes negotiated contract fee at flat rate