AASHTO Innovation Initiative

[Proposed] Nomination of Innovation Ready for Implementation

Sponsor

Nominations must be submitted by an AASHTO member DOT willing to help promote the innovation. If selected, the sponsoring DOT will be asked to promote the innovation to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative.

1. Sponsoring DOT (State): Utah

2. Name and Title: Reuel Alder, Enterprise Risk Manager

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Innovation Description (10 points)

The term "innovation" may include processes, products, techniques, procedures, and practices.

3. Name of the innovation:

UDOT Natural Hazard Risk Management

4. Please describe the innovation.

Make use of existing hazard data and roadway network geometry to identify and prioritize natural hazard risks.

5. What is the existing baseline practice that the innovation intends to replace/improve?

FHWA baseline: Risk = Consequence * Probability

RAMCAP baseline: Risk = (Owner Cost + User Cost) * Vulnerability * Probability

UDOT approach: Vulnerability = Severity/Condition. Where Condition is the condition of the asset.

Evaluate risk for all assets assuming the assets are in good condition. Additional analysis to consider asset conditions can be performed once high risk locations are identified. This reduces the solution complexity by holding one variable constant.

Severity and Probability are dependent variables. When one is known the other is known.

Evaluate all risk for a fixed probability. This provides a relative risk value to prioritize risks. For example FEMA floodplain maps show where all 100 year flood events will occur and a GIS map identifies the intersection of floods and assets.

Prioritize risk with respect to criticality factors and/or a return on a return on investment (ROI) ratio of Risk/Owner Cost. This relative ROI assumes that if we could eliminate all risk we would not want to expend more than the replacement cost of the asset.

6. What problems associated with the baseline practice does the innovation propose to solve?

Vulnerability factors are difficult to quantify and are subjective. By decomposing Vulnerability into Severity/Condition and holding condition and probability constant we are able to prioritize risk locations of interest.

7. Briefly describe the history of its development.

RAMCAP analysis of portions of I-15 and US 40 using RAMCAP process and vulnerability terms.

8. What resources—such as technical specifications, training materials, and user guides—have you developed to assist with the deployment effort? If appropriate, please attach or provide weblinks to reports, videos, photographs, diagrams, or other images illustrating the appearance or functionality of the innovation (if electronic, please provide a separate file). Please list your attachments or weblinks here.

Process documentation

FY22 Process Update

Statewide Natural Hazard Risk Map

Attach photographs, diagrams, or other images here. If images are of larger resolution size, please provide as separate files.

State of Development (40 points)

Innovations must be successfully deployed in at least one State DOT. The AII selection process will favor innovations that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.

9. How ready is this innovation for implementation in an operational environment? Please select from the following options. Please describe.

☐ Prototype is fully functional and yet to be piloted

x Prototype has been piloted successfully in an operational environment

☐ Technology has been deployed multiple times in an operational environment

☐ Technology is ready for full-scale implementation

Technology has been deployed multiple times in an operational environment

10. What additional development is necessary to enable implementation of the innovation for routine use?

Regular data updates

11. Are other organizations using, currently developing, or have they shown interest in this innovation or of similar technology?? ☐ Yes X No

No

If so, please list organization names and contacts. Please identify the source of this information.

Organization	Name	Phone	Email
Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.
Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.
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Potential Payoff (30 points)

Payoff is defined as the combination of broad applicability and significant benefit or advantage over baseline practice .

12. How does the innovation meet customer or stakeholder needs in your State DOT or other organizations that have used it?

We can validate risks with the institutional knowledge of maintenance staff and add risks not found in our existing data sets to fill the gaps in our knowledge

Maintenance can prioritize efforts to evaluate asset conditions based on risk

Designers can apply risk values in trade off studies

13. Identify the top three benefit types your DOT has realized from using this innovation. Describe the type and scale of benefits of using this innovation over baseline practice. Provide additional information, if available, using quantitative metrics, to describe the benefits.

Benefit Types	Please describe:
Efficiency	It is far more efficient to identify and prioritize risks using a model based approach rather than attempting to compute an accurate value of risk before identifying areas of concern.
Visual identification of risks	GISD map provides easy identification of locations of concern.
Choose an item.	

Provide any additional description, if necessary:

Click or tap here to enter text.

14 How broadly might this innovation be deployed for other applications? in the transportation industry (including other disciplines of a DOT, other transportation modes, and private industry)?

Risk prioritization may be applied in planning, design, construction, and maintenance. In the planning process we are looking for high risks where we should consider increasing the robustness of an asset to withstand a hazard event. In design we may consider the best place to invest limited funds to limit loss. In construction, minimizing risk reduces our construction costs. In maintenance we know which assets to inspect first and what frequency to minimize losses. Where robustness is not a good option we can plan

for a more rapid response to reduce the impact to the public which will reduce user costs and minimize risk.

Market Readiness (20 points)

The AII selection process will favor innovations that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.

15. What specific actions would another organization need to take along each of the following dimensions to adopt this innovation?

Check boxes that apply	Dimensions	Please describe:
x	Gaining executive leadership support	Risk impacts the entire enterprise and needs the support of executive leadership
x	Communicating benefits	The benefit of a risk priority system is knowing where to focus our effort to reduce risk and improve resiliency. Focusing on critical points will maximize the return on investment.
x	Overcoming funding constraints	Literature on preparing for and responding to risk, tells us that for every $1 invested in risk reduction reduces the cost of damage by $6
x	Acquiring in-house capabilities	A statewide map of natural hazard risks enables in-house staff to improve robustness where appropriate, plan for a rapid response, and increase redundancy where needed. In addition maintenance actions may be prioritized to apply more emphasis on high risk locations.
x	Addressing legal issues (if applicable) (e.g., liability and intellectual property)	What we have developed is open to the public. There are no legal or liability issues..
x	Resolving conflicts with existing national/state regulations and standards	What we have done is in support of national goals to manage risk.
x	Other challenges	Risks are identified using available national data sources. However the data is not

		complete. The challenge is to gather institutional knowledge to fill the data gaps, to collect asset conditions which affect risk, and to identify mitigation solutions not found in data sources.

16. Please provide details of cost, effort, and length of time expended to deploy the innovation in your organization.

Cost: Our cost over a 4 year period exceeded $4 million.

Level of Effort: 1 UDOT staff and 3 support contractors

Time: 4 years to develop

17. To what extent might implementation of this innovation require the involvement of third parties, including vendors, contractors, and consultants? If so, please describe. List the type of expertise required for implementation.

 Cost estimating expertise is needed to calculate the replacement cost of assets.

GIS expertise is needed to include natural hazard data on a GIS map, overlay it with the roadway network, and perform risk calculations.

Facilitators to help capture the institutional knowledge of maintenance staff, validate the risks on the map, add risk not found in the available data, add asset condition data and identify mitigation strategies

Risk Analysis Process

Following is the step by step process to analyze risk at a project location for solutions development and concept development projects.

1. Locate project area

- The search bar in the upper left can be used to search by highway number.
- Enter the highway number and the route will be highlighted in teal blue.
- Mileposts are displayed in green.
- Zoom into the project area of the

Route Search

Great Salt Lake

20mi

powered by esri