Office of Research and Implementation

FFY2027 Request for Proposals

Reference SPR Item # 2508

Research Problem Statement Title:

Bridge Deck Evaluation

Problem Statement:

Oklahoma DOT conducts statewide pavement condition data collection annually for Pavement Management System (PMS) reporting and Highway Performance Monitoring System (HPMS) submittal. These collections include high-resolution 2D surface imagery and 3D range data across the state highway network. However, in current practice, these PMS datasets are used exclusively for roadway pavement condition assessment, and the data acquired over bridge decks and approach/departure slabs are not incorporated into PMS data delivery or bridge evaluation workflows. As a result, ODOT is not fully leveraging this large volume of existing data sets that could directly support bridge deck condition assessment and bridge management activities within the Bridge Division at ODOT. At present, bridge deck condition surveys remain labor-intensive, depend on windshield inspections or lane closures, and may not detect early-stage deterioration that is likely visible in the ODOT PMS surface condition data.

Proposed Research:

The separation between pavement management and bridge inspection workflows has prevented PMS data from being utilized within bridge management systems. Although ODOT receives and archives the raw 2D intensity imagery and 3D range data from each annual survey, there is currently no established process or analytical tool to extract bridge-relevant surface condition indicators—such as cracking, scaling, spalling, potholes, delamination signatures, joint deterioration, or approach slab settlement. These features are essential for accurate and timely bridge deck evaluation, yet they remain underutilized due to the lack of an integration framework and automated detection methods. Oklahoma has approximately 7,000 bridges, including about 3,700 with decks, making traditional manual survey approaches time-consuming and resource intensive. Automating condition feature extraction from existing PMS datasets offers a scalable, cost-effective solution with substantial statewide impact. Utilizing the existing annual PMS 2D/3D roadway surface data for bridge deck evaluation would provide significant benefits.

Suggested Tasks (to include but not limited to):

The proposed research will include, but is not limited to, the following tasks:

- Review current ODOT bridge inspection and condition rating practices to establish data requirements and integration points.
- Evaluate the available PMS 2D surface imagery and 3D range datasets and identify bridge-relevant distress and surface condition indicators.
- Develop automated, multimodal feature detection algorithms to identify deck distress (e.g., cracking, spalling, scaling, joint distress, and approach slab settlement).

- Design and implement a software viewer interface that integrates with existing Bridge Division workflows and asset management systems.
- Validate the methodology using a representative sample of bridges, then scale and implement the approach statewide for all bridge decks.
- Deliver the software tool, user documentation, and training, ensuring successful transfer and long-term operational adoption.

This project leverages data already collected annually at highway speed, so as to enable more frequent, objective, and cost-effective monitoring of bridge deck conditions across the state.

Implementation:

Implementation of this solution would primarily affect inspection and asset management procedures, rather than structural design requirements. The following documents and workflows may be updated to incorporate PMS-derived surface condition data:

- Oklahoma Bridge Inspection Manual – to include procedural guidance for using supplemental 2D/3D surface data during bridge deck assessments.
- Bridge Management and Rating Workflows – to integrate PMS-based distress indicators into routine condition rating and evaluation practices.
- Maintenance Prioritization and Preservation Programming Processes – to support data-driven decision-making based on more frequent and consistent condition information.
- Asset Management Reporting Systems (including AASHTOWare BrM) – to enable storage, visualization, and interpretation of PMS-derived bridge condition metrics.

Benefits:

Utilizing the existing annual PMS 2D/3D roadway surface data for bridge deck evaluation would provide several significant benefits:

- Reduce field inspection labor and minimize possible lane closure requirements, decreasing worker exposure and improving safety for both crews and the traveling public.
- Enable more frequent and consistent assessments at little or no additional data collection cost, allowing earlier identification of deck deterioration and emerging defects.
- Improve the accuracy and objectivity of bridge condition ratings, supporting more effective prioritization of maintenance, rehabilitation, and preservation investments.
- Establish a uniform, statewide dataset to monitor condition trends, deterioration progression, roadway-to-bridge transitions, and dynamic impact factor effects.
- Maximize the value of data already being collected, reducing redundancy and improving return on investment across pavement and bridge asset management workflows.

Deliverables:

All projects require the submission of the following reports:

- Monthly Progress Reports
- Multi-Year Projects require a Year-end Annual Report
- Copies of the project Draft Final Report in Microsoft Word and ADA accessible Adobe Acrobat .pdf electronic formats
- Copies of the project Final Report in Microsoft Word and ADA accessible Adobe Acrobat .pdf electronic formats

The Year-end Annual Report, Draft Final Report, Final Report and Color Article should be submitted to satisfy all federal and state requirements pertaining to the accessibility of documents including but not limited to:

- Oklahoma State Statute 62 § 41.5e and the Americans with Disabilities Act (ADA) of 1990, 42 USC 12.01 et seq.

The PI must also participate in the following project meetings:

- New project initiation meeting
- Semi-annual project meeting
- Close-out project meeting
- Continuing project meeting

Estimated completion time twenty-four (24) months.