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MEMORANDUM

To: Dale Doughty, Commissioner
From: Jeffrey S. Folsom, P.E. Assistant Director, Project Development
William A. Pulver, P.E. Chief Engineer
Subject: **Old Town, Llewellyn Estes Bridges – Structural Failure and Recommended Path Forward**
Date: September 22, 2026
cc:

Background

The Llewellyn Estes Bridges project in Old Town involves replacement of two existing bridges on Stillwater Avenue over the Stillwater River. In April 2022 bids for the construction of conventional replacement bridges came in approximately double the funds available. After rejecting those bids, the Department decided to pursue a grant for additional funding to utilize fiber-reinforced polymer (FRP) composite tub girders. This composite tub girder technology was developed by the University of Maine Advanced Structures and Composites Center and the Old Town bridges provided an opportunity to further the development of corrosion-resistant structural beam technology by incorporating the girders into a multi-span continuous deck configuration in close proximity to the University. The composite tub girders used for this project were designed and manufactured by Basalt International of Winterport, Maine Basalt International acquired the Maine-based assets of Advanced Infrastructure Technologies (AIT) during AIT's bankruptcy. AIT had previously designed and fabricated composite tub girders for two MaineDOT bridges in Hampden. The general contractor for the Old Town project is Reed and Reed, Inc. of Woolwich, Maine.

On August 13, 2026, a structural failure occurred during deck concrete placement on Span #1 of the new northerly bridge (Bridge #2), resulting in the failure of multiple composite tub girders. One worker sustained a fractured ankle and two others sustained minor injuries. The new bridge was not open to traffic at the time of the incident.

The purpose of this memorandum is to summarize the information and evaluations completed to date, describe the current status of the project, discuss relevant factors associated with the failure, and recommend a path forward for completing the project.

Immediate Efforts

Immediately following the incident, MaineDOT formed a response team to ensure information was collected to assist in determining the cause of the failed span and the status of the other constructed elements of Bridge #2; and, in parallel, to evaluate options to complete the bridge replacement project.

The specific cause of the failure remains unknown, and the condition of the failed span and remaining Bridge #2 elements have warranted a cautious, thoughtful approach to investigation inspection, data collection, site cleanup and demolition. The safety of workers is paramount.

Collection of Information

MaineDOT initiated a comprehensive effort to establish an objective factual record of the event, preserve relevant physical evidence, determine the factors that contributed to the failure, and evaluate the condition of the remaining bridge components.

MaineDOT has collected and reviewed eyewitness accounts, photographs, video, design documentation, fabrication inspection reports, construction documentation and other relevant information. This information has been made available to the project partners and technical experts involved in the investigation.

Additional data collection following the event included drone photography and video, LiDAR surveys of the collapsed and adjacent spans, GPR inspection of the adjacent span deck, and arms reach inspection by MaineDOT, FHWA, and project partners. Additional inspection and documentation are anticipated as part of the demolition and removal of the failed structure to be completed this fall.

MaineDOT has also held initial and follow-up meetings with the project partners, and the FHWA Turner-Fairbank Highway Research Center to review the available information, identify potential causes of the failure, and determine what engineering analysis can be conducted to identify the specific cause or contributing factors of the Span 1 collapse. More than a month after the incident, it is clear that this technical investigation will take significant analytical effort and time.

Current Status

Prior to the incident, the project was on schedule for opening to traffic in September of 2027 with a final project completion in Summer of 2028. The impact of the failure on the overall project schedule is not yet fully determined; however, a significant delay is anticipated.

At this point, two key decisions represent the project critical path. The first is authorization to proceed with demolition and removal of the failed structure. The Department is expecting the contractor's final demolition plan for review in the coming days, with significant clean up and demolition starting as soon as specialized equipment can be mobilized to the site. The second is determining the appropriate technical and construction approach for completing the project.

The purpose of this memorandum is, in part, to establish the recommended path forward so that design and construction activities can proceed and delay and additional cost can be minimized.

Initiation and Progression of Failure

Eyewitness accounts obtained following the incident consistently indicated that the failure initiated along the upstream side of the bridge and progressed across the width of the structure. Subsequent review of security camera footage confirmed this general sequence.

Visual inspection of the failed girders, together with the available video evidence, suggests that a local buckling failure initiated in the upper portion of the girder section. This likely occurred in Girder #1, the upstream exterior beam. Upon failure of Girder #1, load was shed to the adjacent girders through formwork supports and bracing connections thus leading to a cascading failure across the width of the bridge.

The precise failure mechanism and the factors that led to buckling of the top portion of the girder remain subject to ongoing engineering evaluation. It is important to point out that multiple contributing factors may exist.

Construction Procedures

MaineDOT reviewed the Contractor's approved submittals for deck forming and concrete placement, together with eyewitness accounts from Contractor personnel, MaineDOT inspection staff, and other observers.

The contractor and its personnel involved in the work have significant experience in forming and placing concrete bridge decks on steel and precast concrete girders. Based on the information reviewed to date the erection of the deck formwork, supplemental bracing, installation and operation of the finishing machine, and placement of concrete were performed generally in conformance with the contract plans, specifications, and approved submittals.

In addition to the failure experienced on Span #1, it is notable that there were other incidents of the girders behaving differently than predicted. During placement of Span #2, there were reports of settling and concern over higher than predicted deflections during concrete placement. This required adjustment to the deck finishing machine to maintain required deck thickness over the interior girders. However, the adjustments to the finishing machine did not appreciably alter the thickness of concrete placed over the deck.

Failure Analysis – Potential Causes and Contributing Factors

The information gathered to date indicates that the composite girders were analyzed for construction-stage loading, including the weight of fresh concrete and an assumed construction live load representing formwork, equipment, personnel, and other construction-related loads.

Based on discussions with the girder designer and manufacturer, the analytical model indicated a substantial margin against failure under the assumed construction loading, with a reported factor of safety of approximately four.

The observed failure therefore requires further examination of why the actual behavior of the girders differed materially from that predicted by the analytical model.

Our review of construction records, inspection information, placed concrete quantities, and observed construction procedures indicate that the girders were subjected to loading generally consistent with the assumptions used in the design analysis.

Given that the applied loads were generally consistent with the assumptions used in the analysis, the discrepancy between the predicted and observed behavior requires further evaluation of the design process, analytical assumptions, fabrication procedures, connections, and other factors that may have influenced the performance of the girders.

These efforts should be approached as a deliberate effort to better understand and verify the behavior of the technology rather than as a means of simply reproducing the observed failure. The work will require additional thorough analysis, physical testing, and time to complete properly.

As we believe the failure originated as a buckling failure in the top portion of the beam, the Department has identified key aspects related to the top flange of the girder that require further study. In particular, the bracing condition of the top flange requires further evaluation, including the contribution of the top cover plate, the strength of the connection at the interface, and the capacity required of that connection. The investigation should also evaluate the manufacturing, testing, and quality control parameters necessary to reliably achieve the required capacity, as well as the sensitivity of the girder to changes in flange geometry resulting from applied point loads or manufacturing tolerances in flange width and thickness.

The factors identified above are not intended to represent a complete list. As the investigation progresses, additional factors may become apparent and will be evaluated as appropriate to determine the cause and contributing factors of the failure and to assess the condition and future use of the remaining composite girders.

Recommended Course of Action

The Department has considered the available options for replacement of the permanent bridge structure, including continued use of the composite girder system or substitution of the superstructures with conventional materials.

While additional engineering work could potentially identify a means of completing the project using the existing composite girders, that approach presents significant uncertainty regarding both the required design, bracing and construction procedure modifications and the time necessary to complete the necessary analysis, testing, and verification. The condition of the remaining girders and substructure components on the adjacent spans of Bridge #2, given the

observed damage to the deck and suspected compromise of Span 2, would also require additional evaluation before they could be subjected to further construction loading.

The consequences of continued uncertainty are significant. Project delay will result in both direct project costs and indirect costs associated with the continued use of the temporary bridge and impacts to the traveling public. Additionally, given the serious and extraordinary nature of the span collapse during construction, the Department must move forward with a project that assures the full confidence of our project partners, construction personnel, and the public.

A conventional superstructure provides a more predictable and timely means of completing the project. The Department has evaluated conventional replacement alternatives including steel girders and precast prestressed girders and determined that a steel superstructure provides advantages in terms of structural geometry, weight, constructability, and availability of materials For this reason, we recommend proceeding with a conventional steel replacement superstructure for both Stillwater Avenue bridges.

The Department has re-engaged design consultant WSP, who designed all aspects of the project except those specific to composite girders, and Reed & Reed Inc. to evaluate the conventional steel option under a Construction Manager/General Contractor (CM/GC) contractual arrangement. If approved, MaineDOT would also engage an independent cost estimator to assist the Department in establishing and negotiating a construction contract with Reed & Reed for the conventional option.

This approach will allow the Department to proceed with development of a conventional replacement structure while the remaining technical investigatory efforts continue. It also provides a more predictable path toward completion of the project while preserving the Department's ability to fully evaluate the causes and contributing factors associated with the August 13 failure.

In summary,

1) The investigation into the specific cause of the span failure is ongoing and expected to take a significant amount of time and complex engineering analysis.

2) We recommend immediately proceeding with completion of the Llewellen Estes bridge project utilizing conventional steel superstructures for both bridges for the following reasons:
    a. It will take a significant and unknown amount of time to determine the specific cause of the failure, and to design and fully test a solution to our satisfaction.
    b. With respect to Bridge #2, the parties agree that Span #2 is damaged and compromised and must be removed; and if Span #1 and Span #2 are replaced with conventional materials, so should Span #3.
    c. The girders for Bridge #1, while shorter, carry the same design, fabrication and material properties as Bridge #2. We do not believe it is prudent to utilize the

composite tub girders on Bridge #1 until such time that a specific cause of the failure of Span #1 on Bridge #2 is identified and a solution is designed and fully tested.

d. Given the design of the substructure elements already in place, a steel girder system is the most reliable and expeditious option available.
e. We recommend that the Department proceed with a predictable path forward to completing the project to minimize delay costs and provide the communities and the public with a new bridge as expeditiously as possible.

Methodology Approved

Dale F. Doughty
Commissioner

22 Sept 26
Date