pennsylvania
DEPARTMENT OF TRANSPORTATION

Art Suckewer Feb. 25, 2025
Wrought Iron Bridge Works
Response to PennDOTs rebuttal re: Skinners Falls Bridge

February 3, 2025

Wayne County
Damascus, PA
State Route 1002, Skinners Falls Bridge

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PennDOT in black
WIBW original proposal 1/25/2025 in black italic

Dear Art Suckewer:

Thank you for sharing your proposal regarding the Skinners Falls Bridge. The Skinners Falls Bridge and the Delaware River are considerably larger than the bridges and streams involved in the projects that you offer as examples. Furthermore, PennDOT is constrained by the emergency nature of this project. The public safety concern posed by the failure of the bridge must be addressed prior to the start of the recreational boating season, which typically starts on Memorial Day. As explained in more detail below, PennDOT has determined that your proposal cannot be implemented for a bridge of this size within the time available.

Please note that the proposal specifically addresses the claimed emergency and the cascading ramifications from said emergency. Setting aside that the measurement points, during the last three measurements, do not show changes outside the margin of error of the measurement techniques, nor do the changes show a pattern of movement consistent with imminent failure (the measurement changes since April 2024 are not reproducible nor do the changes correspond to an overall failure mode). Note: If the abutment is double layered interconnected stone masonry (I assume this has been checked and confirmed) then the progression of movement over the past 30 years makes more sense and the risk of imminent failure is minimal.

Tabling the extent of the emergency, the measurements taken since 1991 do show a steady deterioration of the NY abutment with no action beyond rudimentary patching. It is wise to address this deterioration properly. Preliminary stabilization can be done quickly and easily in a manner that addresses all safety concerns and does not impinge on recreational use of the river under the bridge. This can be easily done quickly; likely within the scope of the issued permits – meaning no filing delays and no local resistance.

While the bridge is larger than the Red Mill Road bridge (90’ using 15’ – 20’ tall falsework), it is not larger than other projects. A 30’ tall falsework supporting one end of a 130 ton span (weight based on PennDOT estimate) is not a complex matter and

would be erected on land. The primary support would be at L4. A support at L4 supporting the full weight of the NY end of the span would require a foot pad of 4'3" square to provide a ground loading of 25psi. Of course this load will be further reduced because it will be somewhat spread by a falsework of two interconnected, rigid, towers at L4 – L3 and L2 – L1. The L2 point will provide stability to the endpost (allowing the release of L0) through the compression diagonal. This will facilitate safely and correctly rebuilding of the abutment (preferably with hidden internal strengthening features) and replacing the bearings.

Importantly, the support structure would make it safe to place netting beneath the entire deck, protecting anyone passing beneath from potential debris without entering the water.

Although not contemplated in the original proposal, the falsework would allow for full restoration of the portion of the truss being supported. This method could be repeated with minor impingement of the river at opportune times for the entire structure.

PennDOT responses to your correspondence are provided below:

> *To address the emergency resulting from the failing abutment:*
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> *My suggestion is to create/erect a falsework of similar design to that used on Red Mill Road Bridge under the 1/4 - 1/3 of the NYS span which is over land above the low water mark, adjacent the abutment. The falsework would support the superstructure at the floorbeams and incorporate a hydraulic jacking feature at each attachment point. The falsework itself would rest on specialized bearing plates that do not require footings or significant ground disturbance. These features have significantly expedited permitting on previous projects.*
>
> *The bearing plates are of sufficient size to reduce the ground load sufficiently to not disturb possible ecological/archeological features below the ground surface and provide sufficient friction to minimize lateral motion once under load*.

PennDOT does not agree that a falsework system for a structure the size of the Skinners Falls Bridge over the Delaware River could rest on bearing plates without foundations. Falsework on the overbank area in the recommended locations would be in excess of 30' tall. This would require a multi-column system and stability bracing magnifying the potential hydraulic forces from river and ice flows. That would require deep foundations to protect the falsework from those hydraulic forces.
A falsework system of this magnitude could not be designed manufactured, permitted and installed prior to the start of the recreational boating season. Implementing the falsework system would require extensive agency coordination and permits prior to initiating construction. Placing falsework at individual panel points would require detailed analysis of the selected joint with consideration for pin and truss member deteriorated

conditions, and potential truss member stress reversals resulting from the modified support condition.

Unlike a modern bridge construction this truss is light weight (below 200 tons total, per span - 130 Tons per span according to PennDOT) thus falsework supporting four (4) floor beams taking the load off the NY abutment needs to support less than 100 tons. So, a 3' by 3' pad under each of the 8 verticals of the partial falsework would be below the 25 psi load normally considered permissible (Ideally greater size under L2 and L4 – second and 4th floor beam from the abutment). Using PennDOT's weight assessment, a 4'3" square pad under each leg of the falsework verticals at L4 would carry the entire NY abutment load with a 25 psi ground loading. Using a polymer, as simple as horse mat, attached to the underside of the pad would provide both ground conformance and traction sufficient to withstand most lateral forces.

Of course stability bracing would be necessary (horizontal spreaders and diagonal tension members) but the falsework's cross section would remain minimal, increasing any lateral forces from floodwaters, but only slightly. This would result in two reinforced 'towers' at L4 – L3 and L2 – L1 with interconnection between L3 and L2. The Red Mill Road withstood the break-up under flooding of 10 inch thick ice without distortion or dislocation. However, we would recommend cabling to an up-stream load (gabion baskets filled with stone placed slightly upstream, on-shore, to act as deflectors for flood debris and as anchors. Both the falsework and gabions would only be present during the period when work is occurring at that location.

The level of structure you are proposing is excessive – it would be needed for something like the Rt-22 truss, which is a multi-lane 540' span (see photos of its falsework used in its construction. That level of support is extreme overkill on the Skinner's Falls Bridge.

Furthermore, falsework buttressing of the abutment in the overland area would not address the safety concern posed by the deteriorating condition of the truss spans.

The proposal was focused on the expressed emergency. It would allow netting to be safely placed under the decking across the remainder of the bridge, addressing the concern raised regarding falling debris ahead of a full restoration. As work progressed, netting wouldn't be needed below the restored sections.

Furthermore, the partial falsework could be re-erected under other sections of the spans on a non-emergency basis to allow restoration to proceed during optimal times with minimal impingement of recreation.

> *The hydraulic jacks will allow adjustment and a gradual, minimal stress, unloading of the truss end bearings to safely facilitate abutment work.*

Our existing falsework components are available and can be quickly modified to accommodate the specifics of this bridge.

Falsework for the Skinners Falls Bridge would require much larger components than the example project. By comparison to the Cambria County project, the Skinners Falls Bridge span and height are two and a half times larger. The bridge is also twice as high over land. The Delaware River extends under approximately two-thirds of the New York span and three-quarters of the Pennsylvania span with variable channel depths up to 15 feet.

While addressed above, it is important to reiterate, while the falsework will be taller, the structural design will make it very stable without significant cross section exposure to flood flows and it will generally not carry significantly more weight than the Cambria County example. Note: this team also removed the Mead Ave. Bridge in District 1, which was of similar mass to Skinner's Falls and a more complex project but we feel the Cambria County example is more relevant due to methodology.

The support of the falsework will also provide adequate safety to deploy netting under the remainder bridge while the abutment is being restored.

Falsework would not suffice for safe deployment of netting under the bridge. The netting would need to be installed either from the deck of the bridge or from a causeway. Installing the netting from the deck would not be safe because of the critical condition of the superstructure. Installing the netting from a causeway would not be practicable because the causeway would need to be removed by start of the recreational boating season. PennDOT will need to access the netting each winter because the accumulation of ice on the netting during winter weather increases the dead load weight and horizontal wind load that the truss spans must be able to support. This means that the netting would need to be removed prior to each icing event. You have proposed a multi-year plan for restoring the superstructure. Removing the causeway before each recreational boating season and rebuilding it each winter would not be practicable and would have excessive ecological impacts.

No causeway is required. The superstructure is rated a 2 which is sufficient for access without heavy equipment – heavy equipment isn't required for the task. The netting could be either resistively heated or removed in the manner it was installed (from the deck – without heavy equipment) on a seasonal basis. It is assumed that with the abutment emergency resolved, the bridge's restoration could proceed (preferably in place using the partial falsework method) meaning less and less netting would be needed with each cycle,

Flood protection would be provided by a gabion-based deflection/mass system placed upstream (on-shore). Preferably, the falsework would be tied to it via cable.

A gabion-based deflection/mass system cannot substitute for deep foundations for the falsework. No such system could protect the falsework against all flood and ice events. A failure of the gabion-based system could cause of catastrophic failure of a falsework system without deep foundations.

The falsework would not be in place during winter (no ice events). Although not every flood can be protected against (please recall, the NY span of the Skinner's Falls Bridge was washed off the substructure during the October 1903 'Pumpkin Flood' then subsequently disassembled, repaired and re-erected) however, the proposed method (without gabions) withstood a severe flood with ice breakup during the Cambria County project. The example approach used no foundations and didn't disturb the environment nor the archeology. The gabions are simply providing increased flood safety.

Also, long term access for installation and maintenance of an upstream gabion-based system would require a right-of-way agreement for a multi-year temporary construction easement that would add project complexity and delay work to install the falsework increasing the time period that the safety concerns are not addressed.

The falsework and accompanying gabions are temporary, only in place during the restoration of a given section (generally in place for months, certainly not years). The longest being during the abutment rebuild (assuming extensive and historically correct work is performed – quicker if only the minimum required is done).

> *Responsibility transfer:*
>
> *One of the dilemmas being faced by PennDOT is that this is more of a historic preservation project than an infrastructure improvement. However, as this is part of an interstate agreement, its removal creates it's own headaches. By transferring the long-term responsibility for the bridge to the NPS (I believe they oversee the Roebling Aqueduct / bridge) or another local organization in a carefully structured agreement, the bridge's care would better align responsibility and purpose for what is a historic artifact. Also, the transfer of ownership/ responsibility/liability may allow funds from a different source to be used to fund the restoration.*

PennDOT is willing to discuss transfer to any entity willing to take ownership. However, PennDOT has not received indication that NPS is in favor of taking ownership of the structure. Transfer would require legislative action.

I hope you are sincere with this statement. I look forward to assisting with this as I strongly believe that this bridge is adequate for this crossing and don't believe it is in PennDOT's best interest to be in the business of overseeing the restoration of historic bridges.

Restoration:

Assuming there is buy-in, the falsework approach could be implemented to safely and (relatively) cost effectively restore the entire substructure and superstructure.

Using the partial falsework approach, the bridge could be fully restored with a small crew over several years; minimizing risk, cost, environmental and cultural impacts. Techniques similar to those used in Indiana and Michigan would be implemented in order to fully restore the bridge in a manner that will meet both AASHTO and Secretary of the Interior standards. For the restoration, I would recommend the participation of Jim Barker PE (or his associates) as he is the technical editor of the NPS historic bridge restoration guide.

Rehabilitation requires complete disassembly of the bridge. The disassembly is necessary to allow the cleaning between all faying surfaces and galvanization of the members for future protection, in addition to the replacement of all pins with new shouldered pins.

This is incorrect. I can provide examples of similar bridges that required more extensive work and were restored in place (Brooks Bridge in Indiana is an example). With falsework, items like replacing all of the pins is straightforward (unlike the method recently utilized on the New Hope – Lambertville Bridge pin replacement). Modern paint (exceeding PennDOT spec.) is available that is a more practical and attractive solution to surface protection than galvanization.

Also, while lower cord pins frequently show deterioration, most other pins are pristine (the 1888 Cambria County bridge was a full disassembly and when inspected, the upper pins showed NO deterioration – machining marks and shop stamps were still clearly visible) – are the non lower cord pins known to be in poor condition?

Dismantling the truss and replacing truss members would require a temporary support system supported on deep foundations and necessitate the installation of causeways within the Delaware River. The causeways are necessary because of the span length to perform the installation of the temporary supports and facilitate in place truss rehabilitation. As determined throughout the course of the in-depth inspection, several pins on the bridge have defects including broken pin sleeves and section loss to the pins themselves. The presence of extensive pack rust and corrosion at connections throughout the structure has deteriorated the pins creating a danger of members being “pushed off” the pins which could result in bridge collapse.

PennDOT’s own estimates set the span weight at 130 tons – this isn’t heavy. Erecting the falsework for the restoration portion (mid-stream / mid-span) requires ingenuity and creativity, not brute force. It will be done without heavy equipment and causeways.

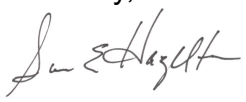
Almost every bridge we have restored has pack rust – this isn't difficult to correct by those with extensive experience in the art of historic bridge restoration. While all of the issues need to be corrected, none of this requires full disassembly. This is the reason for using partial falsework. By supporting around the section being worked on, the panel point can be fully unloaded (even in Baltimore truss).

As previously mentioned, the work to address the safety concerns need to be completed before the start of the recreational boating season. A multiple-year in-place restoration would cause several problems. Having the falsework under the entire bridge for multiple years would close the river to all recreational use. Ice flows could cause damage to the falsework. The necessary permits are based on timeframes that allow the river to be used for recreation.

There seems to be a misunderstanding on how the falsework will be used. It will only be partial (never more than a fraction of one span) and only be in place during the restoration of a particular section (months – not years). Thus risk and disturbance to recreation will be minimal.

Thank you again for sharing your thoughts regarding Skinners Falls Bridge. Should you require any additional information, please contact me at 570.963.3015 or at shazelton@pa.gov.

Sincerely,



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