



# Rehabilitation of the Robert Prowse Memorial Bridge for the City of Keene, NH

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## PROJECT BACKGROUND

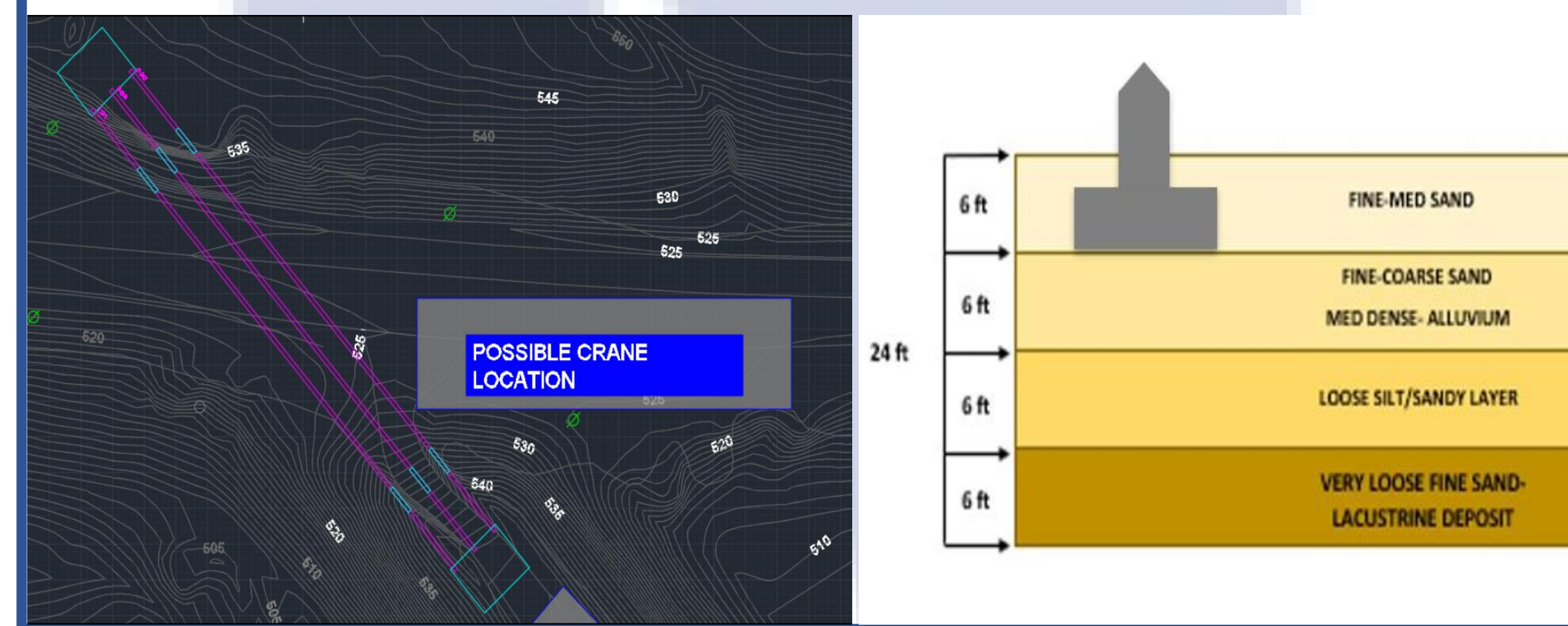
- Previously named the Ash Street Bridge.
- Currently located in Londonderry, NH.
- Designed and constructed in 1962 by famous bridge engineer Robert J Prowse.
- Made history for being the first continuously welded steel frame bridge in the U.S.
- Deconstructed in 2014 for the reconstruction and widening project for 20 miles on I-93.
- Prowse Bridge famous for having large longitudinal stiffeners on the outside girders that serve mainly as aesthetic purpose.
- The historical significance is one of many highlights on the reasoning behind rehabilitating the Prowse bridge.
- This project involves doing a soil analysis, erection procedure, transportation research, and cost analysis all while maintaining historic integrity.



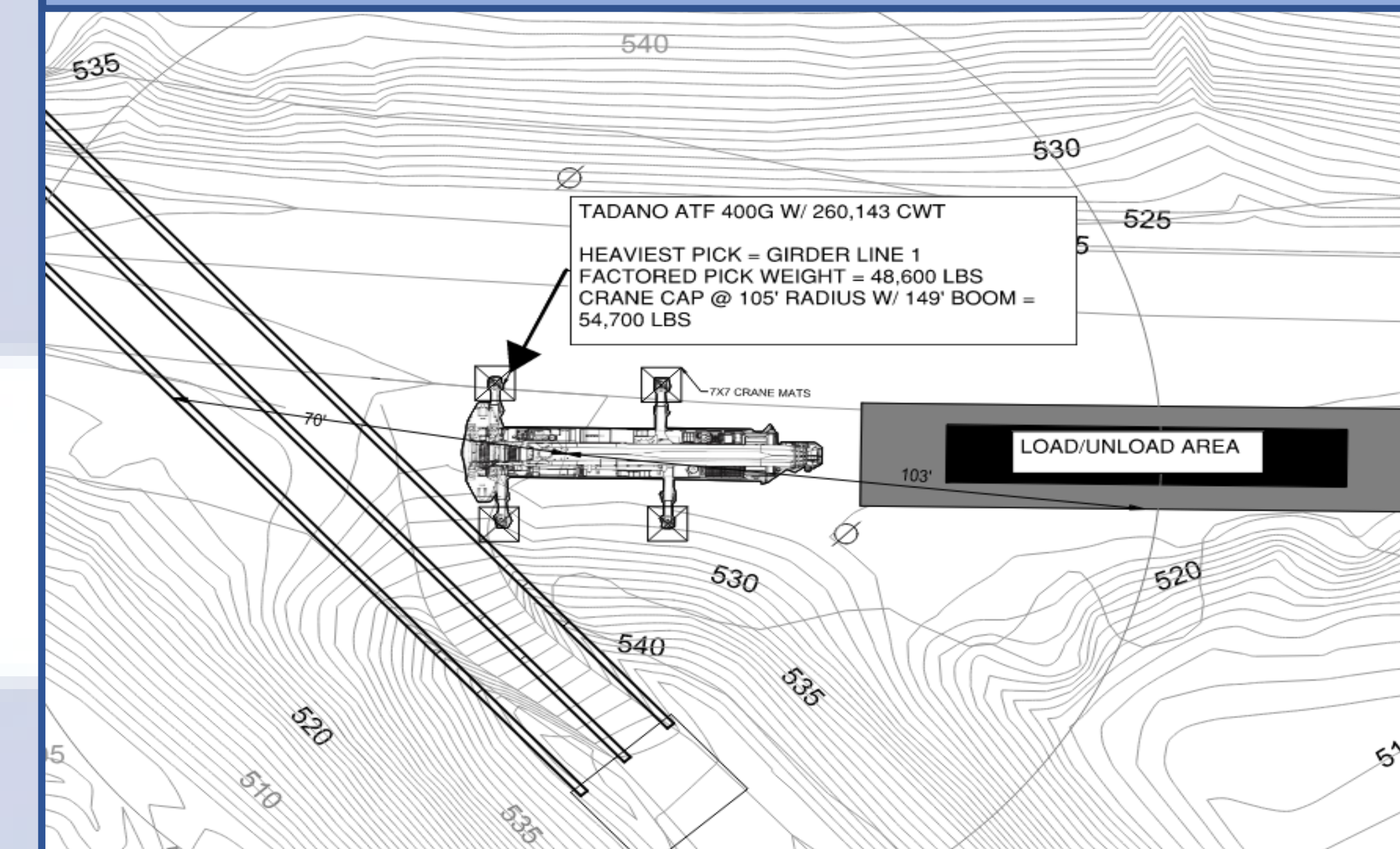
IMAGE SOURCE: NH.GOV

## GEOTECHNICAL ELEMENTS

- City of Keene requested two locations for boring hole placement, on either side of Route 101, directly under the location of the future abutments.
- From these boring holes, a soil boring report will be given that will help determine the layers of soil for the proposed site location, strength capability of the soil, as well as used to estimate foundation sizing.
- For the continuation of this project, a soil boring report that was determined for the Main St/Route 12 bridge, located about 1.5 miles from the proposed site location for the Prowse Bridge, was used.
- Additionally, there are several utility poles along the span of Route 101. A considered alternative is to reroute utility powerlines underneath the bridge.



## STRUCTURAL ELEMENTS



The bridge will built one girder string at a time, 5 steps per girder using shoring towers to withhold the middle span's weight as the CJP weld is done. Pick analysis of the middle girder shows the pick is adequate for bending stress using only 21% allowed. The heaviest picks were analyzed to ensure construction safety and picks were analyzed with a factor of safety of 50%.

Prowse Bridge is erected in 3 girder strings each weighing roughly 69 kips each from field measurements and calculations. With the difficulty of not having splice plates due to historic integrity, CJP welding was used to connect the girders to maintain the aesthetic of the Prowse Bridge (AISC Table 8-2 Pg. 8-42). The bridge was analyzed using its own self weight resulting in 79% of its allowable bending stress. The bridge will be set using a 450-ton crane at a radius of 105 feet. The bridge is presumed to be A36 (supp) steel with a working stress if 22 ksi. This makes the bridge more difficult to be adequate with large loads as the full span is 216 feet.



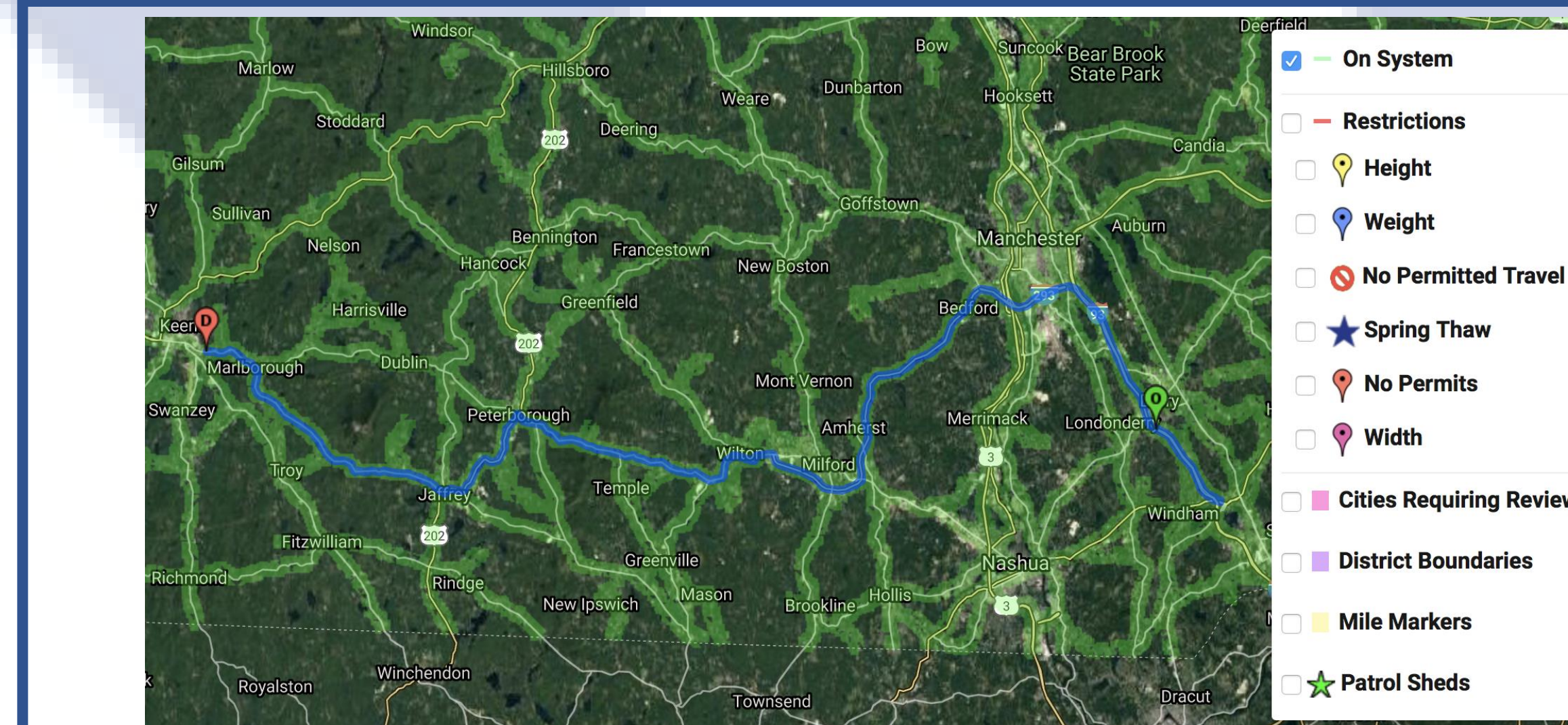
## EXISTING CONDITIONS & HISTORIC CONSIDERATIONS

- Crudely cut pieces due to deconstruction causing reconstruction concerns.
- Significant rusting damage due to its outdoor storage.
- Final location of bridge is in the City of Keene to continue the preexisting Cheshire Recreational Rail Trail that runs over route 101.
- Pre-existing abutment on North side.
- Maximum traffic speed of about 47-48 mph in 40 mph zone.
- Estimated traffic volume of roughly 11,000 cars per hour.
- Little information on the steel used is recoverable due to the age the project was erected.

- To maintain the historic significance of the continuously welded frame, a specialized erection plan was developed to prevent any further deformation of the bridge:
- Only 3 of the original 5 girder strings are being reused for this project (2 exterior spans to maintain the aesthetics of the original façade of the bridge and 1 interior span)
- The proposed plan also allows the bridge to maintain its original span of 216 ft over Route 101, preventing the need for it to be shortened.
- Plan to incorporate coffered wing walls that served as a distinctive aesthetic feature at the previous bridge location.

## TRANSPORTATION

The Proposed location for the bridge to be re-erected is over RT 101 in line with the Cheshire Railroad Arch Bridge in Keene, NH. Using the NHDOT website, an OS/OW permit was completed to identify if the bridge members required a permit to be transported. With the given dimensions and weights of the individual members, no permit is necessary if only one member is transported at a time. The only exception to the statement above is that two bridge piers can be transported together since they weigh less and fit well dimensionally on a tractor trailer bed.



## ENVIRONMENTAL CONSIDERATIONS

The site of the bridge once it is transported is in the proximity of Branch River. The following are ways to minimize the environmental impact:

- To prevent the contaminated runoff, stream barriers should be used during construction.
- To preserve the vegetation adjacent to the project, silt fencing may be used.
- Removing the existing concrete abutments causes the potential for concrete dust to create air pollution. While removing the concrete, an option is to wet the concrete and cover to prevent windblown dust.

## COST ANALYSIS

- The following cost estimate includes site visit/pre-erection coordination meetings, equipment preparation, weekend shutdown work, crew hours, crane use, and installation costs.

SUBTOTAL + MARKUP = \$163,000.00

- The following cost estimate includes fuel cost, truck cost.

TRANSP. TOTAL = \$9,520.00

- The following cost estimate includes the cost of two (2) boring hole locations.

BORING COST ~ \$8,000.00

**TOTAL COST ESTIMATE = \$180,520.00**