

February 20, 2024

Load Rating Review
MDT Bridge 02939

Bridge 02939 is a single span thru-truss with a structure length of 120 ft, constructed in 1911. The superstructure was inspected in June 2023, and the following rating evaluation summary is based on the 2023 inspection findings, as supplemented by available photos and notes from the bridge inspection record available on BrM.

The steel stringers of this bridge exhibit widespread severe corrosion with up to 100% loss of section, particularly in bearing zones. The field notes indicate that Stringer 1 exhibits an area of complete section loss (holed through) over a length of 18 inches and a maximum height of 1 ½ inches with a 3-inch diameter hole in the web at the Abutment 1 end. Stringer 8 also exhibits an area with 100% section loss to the web at Abutment 1 (11 ½ inches long by 1 inch high, see Photo 1). These holes in the stringer webs over the bearing areas result in the loss of bearing capacity since the stringer reactions cannot be transmitted to the substructure.



Photo 1: Stringer 8 at Abutment 1



Photo 2: Stringer 8 at Floorbeam 2

Stringer 8 at Floorbeam 2 exhibits full loss of section in the base of the web over the floorbeam. The hole in the web is 8 inches long by up to 3 inches high (see Photo 2), and this deterioration has also resulted in zero bearing capacity in the current condition. The stringer is continuous over the floorbeam, but the web hole extends over the full length of the bearing (the top flange of the floorbeam) and renders the stringer incapable of being considered in a load rating model since it has no analytical capacity and is susceptible to web local yielding. Since this is a fascia stringer, there is also no ability to consider redundancy in the deck to bypass this “failed” stringer.

Both Stringers 1 and 8 exhibit holes in the webs at Abutment 2. The hole in Stringer 1 is 14 inches long by 3 inches high, while the hole in Stringer 8 is 14 inches long by 3 ½ inches high. In both cases, the stringers have lost full bearing capacity and cannot transmit bearing reactions to the substructure.

The section loss described above appears to be present and progressing over the past several inspection cycles. This deterioration progression is to be expected and is symptomatic of an end-of-life deterioration curve that typically accelerates toward local failures. As section loss progresses and material thicknesses are severely reduced, additional incremental section loss results in an acceleration in the percentage of material thickness lost. In addition, and perhaps more importantly, the corrosion process accelerates when active electrochemical



Photo 3: Stringer 1 at Abutment 2

corrosion cells are present on the surface of the steel, as is the case throughout the steel members of this bridge. As an example, the images below (Photo 4) depict the progression of section loss documented at Stringer 8 (Abutment 2) over two inspection cycles, and the section loss has progressed toward the possibility of local failures due to a bearing capacity of effectively zero at this location, among others previously described.



Photo 4: Progression of Section Loss in Stringer 8 web at Abutment 2 (2019 to 2023)

Since several stringers have progressed to a full loss of section in bearing areas, resulting in zero bearing capacity, the current rating of the bridge can be considered 0 Tons by engineering judgment unless designed repairs are made to the deteriorated elements to restore their capacity (i.e. steel repairs, bearing stiffener installation, cribbing, etc.).

In addition to the severe stringer section loss, some of the truss eyebars also exhibit severe deterioration and reduced capacity. For example, member L1'-L0' at L0' (South Truss) is noted as having 1/4" average thickness remaining for the full height of the eyebar (Photo 5). This represents approximately 60% section loss from the original eyebar thickness (5/8"). The eyebar head also exhibits significant section loss, and the pin at this panel point, like others, appears to be compromised (see Photo 6 for another example of a deteriorated pin).



Photo 5: Eyebar section loss at L0' (South Truss)

The large holes in the stringer webs are symptomatic of accelerated corrosion that could lead to localized member failures. The active nature of the corrosion indicates that further section loss can be expected. Several members already appear to have a compromised bearing capacity, and crushing or web local yielding can be expected to occur in the near future without mitigation. Given the cumulative effect of the severe section loss and compromised fracture critical elements, it is advisable to restrict all vehicular traffic from this bridge unless designed repairs are made to the deteriorated elements to restore their capacity.

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Photo 6: Severely corroded pin at L0 (South Truss)