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Did You Know: Mill Scale on Bridges

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Did You Know?

…That under the right conditions, mill scale— the bluish-black flaky surface consisting of mixed iron oxides that forms during the hot rolling process at a steel mill and also forms when rivets are heated in a forge prior to being driven—can survive on a metal truss bridge for over 100 years? The Cedar Hill Bridge, which carries Road 2380 over the Animas River in San Juan County, New Mexico, is an example. The single span bridge is approximately 100 feet in length, consisting of a five panel pin-connected Pratt through truss. The bridge is historically significant as a rare surviving example of its type in New Mexico, as well as the entire Mountain States region of America. The bridge is also significant for its lack of alteration, and even more so for its very remarkable lack of deterioration in its steel.

The truss structure of the Cedar Hill Bridge is remarkable for the lack of rust-related deterioration of its steel materials. This may be due to the dry climate of the region, which has greatly limited the bridge's exposure to moisture and rain, and the bridge's location on a rural road where corrosive winter deicing salts and chemicals likely have never been in use. Nearly all the steel on the bridge could only be described as "like new." It appears that the bridge was never painted, indicating that this bridge has avoided deterioration by virtue of its location and material properties alone. Moreover, it appears that when the bridge was erected, mill scale survived on the bridge, and, in a number of areas, this mill scale remains in place and visible today. Typically, if a bridge was erected over 100 years ago and it had mill scale on it when erected, one would expect that time and weather would have removed all traces of it by today, which is what makes the Cedar Hill Bridge remarkable. Its unusual lack of deterioration also manifests itself in the sharp edges of all the steel on the bridge which have not worn down, and the easily legible steel mill name on the channels. The floorbeams of this bridge even have surviving hand-painted part and job numbers on them which appear to date to the original fabrication and erection of the bridge.

The builder of the bridge is not known. The bridge was reportedly constructed shortly after floods in 1911 devastated area bridges. The rolled channels display "Illinois 2." The "Illinois" refers to Illinois Steel

which had become part of United States Steel (USS) in 1904. Until the 1950s, USS continued to roll steel bearing the former company name of the particular mill rolling the steel. Most steel with “Illinois” was followed by a “G” or “S” (referring to respectively to the Gary, Indiana Works and the South Chicago Works). Illinois steel with a “2” after the name is extremely rare on bridges, and the meaning of the “2” is unclear, but may refer to a designation for a particular steel mill.

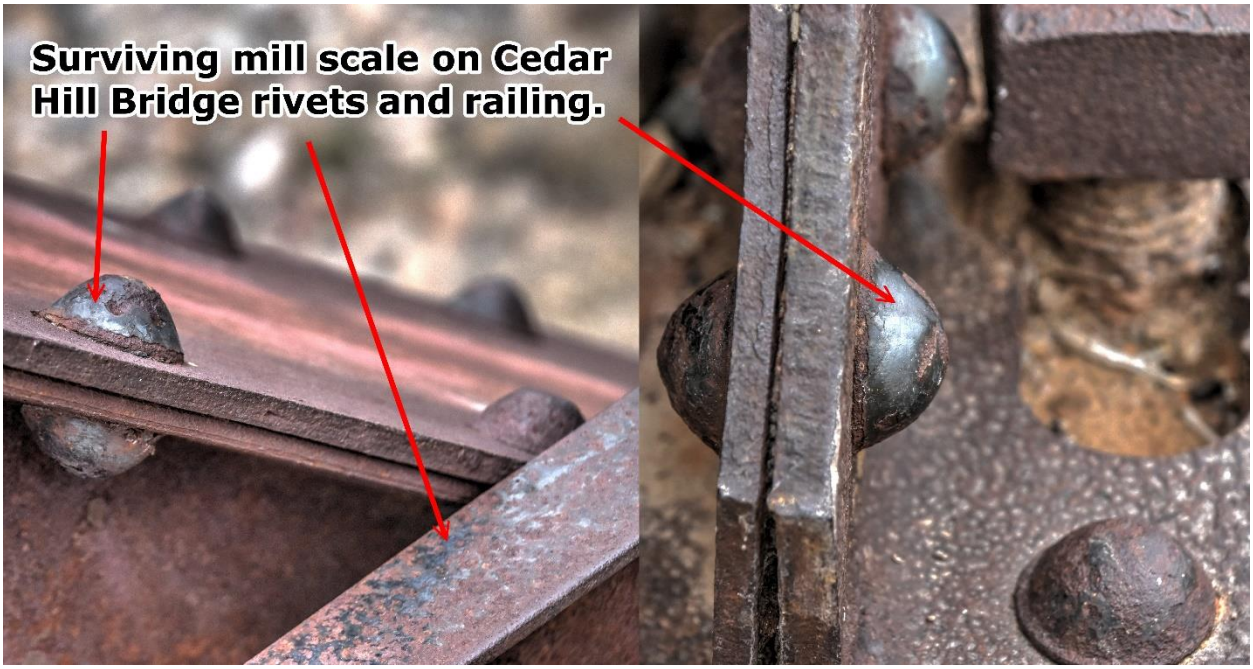
The superstructure and deck of the Cedar Hill Bridge is composed of the following details: end posts and upper chord: back-to-back channels with cover plate and v-lacing; verticals: back-to-back channels with v-lacing on each side; bottom chord: up-set eyebars; diagonal members: up-set eyebars; counters: loop-forged rods with turnbuckles; portal bracing: traditional a-frame design composed of angle; upper and lower lateral bracing: threaded rod; sway bracing: paired angles; floorbeams: rolled American Standard beams; deck stringers: six rows of rolled American Standard beams, plus two fascia channels; deck: timber; railing: two channels mounted to truss vertical members. The bridge has riveted pin plates, which also function as hangers that are bolted to the floorbeams. The truss displays a historical technique used in fabrication shops to produce cutouts of small sections of steel, such as the ends of vertical member channel flanges to make room for eyebar heads. Rather than use a cutting torch or other modern equipment, a series of small holes would be successively drilled in a row to cut the section of material. The use of this technique is readily recognizable by the sawtooth appearance of the area that was cut. The bridge sits on a concrete substructure. The northern end of the bridge has a simple concrete abutment which extends down to the river. A large horizontal crack in this abutment appears to indicate that the abutment was constructed in two concrete pours. The south abutment in contrast is a short section of concrete which rests upon a large rock outcrop along the river.

Immediately west and parallel to the bridge is an irrigation flume which carries water over the Animas River. This flume structure is a pin-connected truss composed of members that are similar to those used in the highway bridge, but it has a significantly different overall configuration and appearance because it was purposely designed to serve as a flume. The flume itself is quite unusual and may have individual historic significance. It also compliments the architectural appearance of the highway truss bridge.

View beside bridge at southwest quadrant facing northeast.

General view looking south. Cedar Hill Bridge pictured to the left, with the flume shown to the right.

This photo of rivets being driven on another bridge illustrates the formation of mill scale after the rivet has been heated.



Surviving mill scale on the Cedar Hill Bridge.

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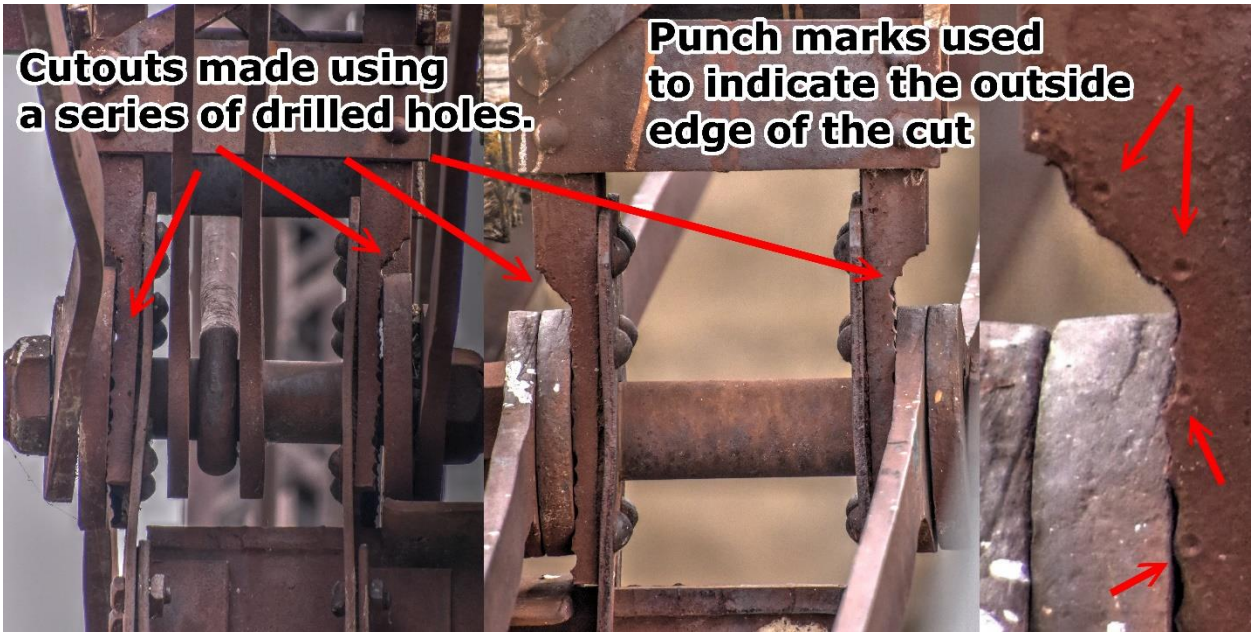

Lower chord connection detail. Cutouts for the channel are visible. These cutouts were made using a series of drilled holes, whose location was guided by punch marks which are visible along the edges of the cutout.

Portal view of bridge facing north.

East elevation, view facing northwest.

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General view, west elevation. Cedar Hill Bridge pictured behind the flume bridge.

"Illinois 2" rolled into vertical member channel. Typical for vertical member, upper chord, and end post channel.

Detail of floorbeam showing what appears to be “2224” and “FB1” which may refer to Job # 2224 and Floorbeam #1 from the original construction of the bridge.

View beside bridge at southwest quadrant facing northeast.

View of the flume bridge showing water flowing on the bridge.