MEMORANDUM

From: Scott Weinland, P.E.

Date: August 30, 2022

RE: Site Review for Central District

Location: SR101L (Agua Fria) x McDowell Road Structure S-E/W

Requested by: Joselyn Valero, P.E., Development Engineer – Central District

Date of request: August 17, 2022

Participants: Scott Zealley and Marty Smith (Central District), Navaphan Viboolmate PE (Bridge Design), Tad Niemyjski PE and Scott Weinland PE (Geotechnical Services)

Description

On August 17, 2022, the Central District contacted Bridge Group regarding excessive erosion from beneath the slope paving at the west side of the north abutment of the SR101L structure (S-E/W) over McDowell Road (See Figure 1). Apparently, erosion has been occurring at this location for some time and the District was considering repair by removal of the affected slabs, placement and compaction of subgrade soils, and replacement of the slope paving. The District suspected that the water was coming from a gap in the roadway between the approach slab and the approach barrier. (See email dated 08/17/22 from Mark Killian to Joselyn Valero).

On August 25, 2022, representatives from the Central District and Bridge Group met on site to perform an inspection. (See list of participants above). As reported by the District, there was considerable evidence of excessive erosion including accumulation of soil at the base on the slope paving (See Figure 2), as well as voids under the slope paving as detected by sounding at the concrete surface (i.e. chaining). Settlement of the slope paving was also noted by observing the paint line at the interface between the abutment and the slope paving (See Figure 3). This condition was also observed at adjacent bridge abutments and is likely due to poor compaction of the slope paving subgrade during construction. However, it is also likely that the erosion problem at this specific location has exacerbated the extent of the voids. During the inspection, the District noted that in the recent past two or more 10-wheel dump trucks of eroded soil material had been removed from the toe of the slope paving. They also reported that two mixer truck loads (presumably about 20 cubic yards) of slurry had been placed in a void at the very top of the slope paving adjacent to the abutment wing wall. Despite these efforts, the erosion

appears to have continued as evidenced by the continued deposition of the fine grained soil at the toe of the northwest corner of the slope paving.

As reported by the District, a significant gap does exist between the approach slab and the approach barrier at the northwest corner of the structure (See Figure 4). This appears to be where water is entering the abutment area. However, at this point it is unclear how the water could be migrating from the roadway side of the approach to the outside of the wing wall. A 4.5 foot long piece of rebar was made available by the District which was placed down into the gap between the approach slab and the inside of the barrier wall without reaching the bottom of the void.

On August 26, I located the record drawings for the structure in question, as well as the ADOT standard drawings for the approach slab, anchor slab, and slope paving. These documents were reviewed and it was determined that the wing walls are cantilever type which means they are not supported by their own foundation. Rather, they are supported by and cantilever off the end of the bridge abutment. It was also determined that these wing walls only extend to a depth of 3 or 4 feet below the slope paving (See Figure 5). Given this configuration, as well as the depth of the void as measure with the 4.5' piece of rebar, it appeared likely that water could easily migrate from the roadway side of the wing wall to under the slope paving.

On Monday, August 29, I returned to the bridge site to try and get a better idea regarding the extent of the void under the approach slab. Prior to visiting the site, I obtained a longer piece of rebar and cut it to a total length of 11 feet. I bent the rebar to create a "U" shape with side lengths of 2 feet, 6 feet and 3 feet, respectively (see Figure 6). The rebar was used as a type of "feeler gauge" to try and determine the horizontal and vertical limits of the void beneath the pavement surface.

The gap between the approach slab and the approach barrier measures 1-1/8 to 1-1/4 inches wide, by about 4.5 feet long. The gap begins approximately 16 inches south of the joint between the approach slab and the anchor slab and extends to the south (see Figure 4). Using a metal tape measure, the bottom of the void near the inside of the wing wall is estimated to be 11 feet below the top of pavement. Using the rebar feeler gauge, the void at a depth of 6 feet below the top of pavement is at least 3 feet wide towards the north end of the gap, as well as in a northerly direction towards the sleeper slab (See Figure 7). It should be noted that the sleeper slab runs below and supports the approach slab and anchor slab where they meet. At a depth of about 6 feet, the void is between 2 and 3 feet wide towards the south end of the gap.

Along the outside of the wing wall, a metal tape measure was used to estimate the depth of void (see Figure 8). At this location, the void appears to extend to a depth of about 8 feet below the surface of the slope paving. This is not surprising given the observed depth of the bottom of the void on the inside of the wing wall being about 11 feet below the pavement surface.

Discussion

Given the likely extent of the void as estimated with the rebar feeler gauge, as well as the location of the gap between the approach slab and the approach barrier, it is likely that some of the soil beneath the sleeper slab has eroded away. This is a significant concern that needs to be addressed as soon as possible. The voids and erosion beneath the slope paving is a secondary concern but not as problematic as the void under the approach.

Recommendations

In order to provide stable support for the roadway and structural elements at the northwest corner of the bridge, it is recommended that grout be pumped into the void space beneath the approach slab. This could be accomplished by drilling or coring a hole in the approach slab near the gap where water enters the fill, and pumping grout from that location. Grout should be lean (one or two sack), flowable (high slump), and have a maximum aggregate size of 3/8-inch. The top of grout should be placed no higher than the bottom of the approach slab to avoid filling the existing expansion joint between the approach slab and approach barrier. Following the grouting operation, the gap (joint) between the approach slab and approach barrier should be filled/sealed with a polymerized bituminous, or asphalt rubber, joint filler. It is imperative that the gap be filled or sealed to prevent water from entering the abutment backfill area in the future.

Given the void depth where the slope paving meets the wing wall, it is also recommended that lean grout be used to fill this area. This repair should occur after the approach area repair has been completed and the grout has reached initial set. Otherwise, grout from the approach area could flow out of the hole created to pump grout under the slope paving.

At this time, there is no practical way to estimate grout quantities required to effectively fill either of the two described areas of concern. In addition, it is likely that grout pumped under the approach slab will flow under the wing wall and out beneath the slope paving. To minimize the likelihood of this, water could be withheld from the first load of grout so that the initial material placed is stiffer than desired for the overall work. Once the first couple yards are pumped beneath the approach slab, the remaining water could be added to increase the flowability of the remaining grout.

We recommend that the Construction and Materials Group be contacted to obtain specific requirements for grout material and bituminous joint filler.

Please feel free to contact me at (480) 789-9979 if there are any questions.

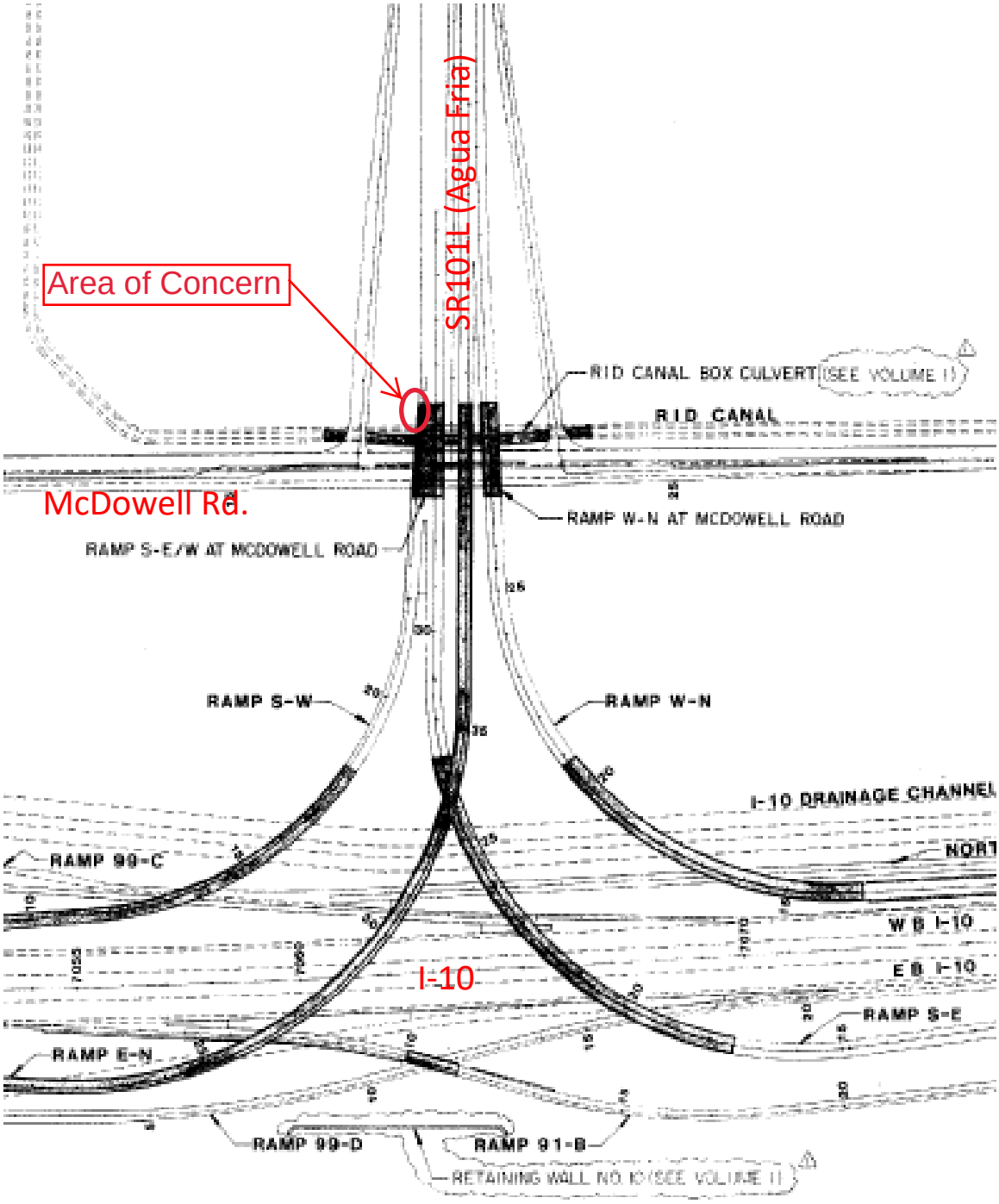

Figure 1

General site layout showing location of Ramp S-E/W at McDowell Road, and overall system interchange. Image from record drawings for project 101L-MA-001 H457701C, Volume 3 of 3.

Figure 2

Soil accumulation at the base of the slope paving

Figure 3

Settlement of slope paving adjacent to wing wall

Figure 4

Gap between the approach slab and wing wall/approach barrier

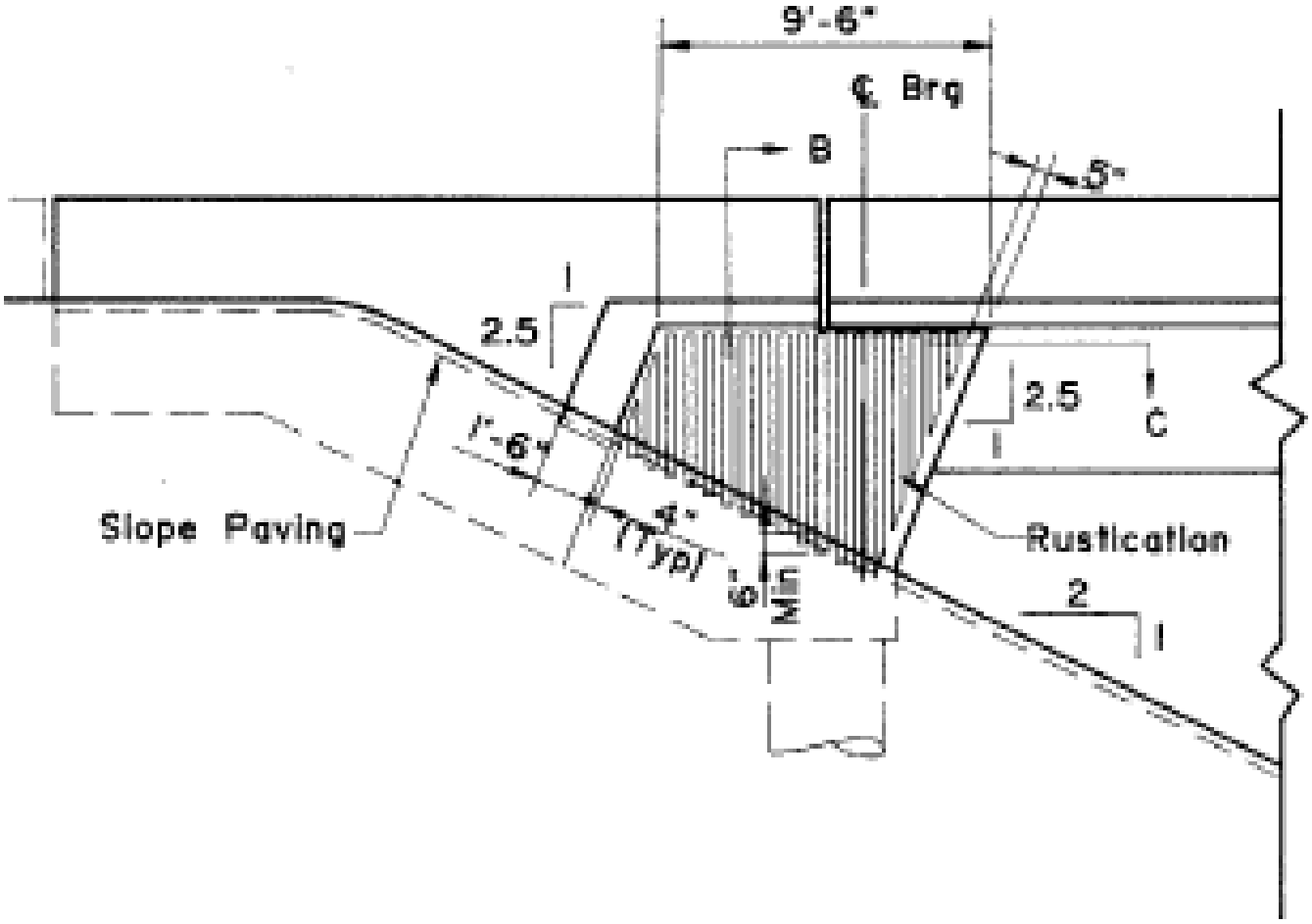

Figure 5

Abutment wing wall configuration from record drawings

Figure 6

“U” shaped rebar feeler gauge leaning against the barrier wall

Figure 7

“U” shaped rebar inserted into the north end of the gap. Note that the 2 foot leg is laying on the surface of the approach slab. The 3 foot leg is 6 feet below the slab within the void.

Figure 8

Depth of void measures approximately 8 feet where the slope paving meets the wing wall