

Design Build Landslide Remediation, Crookston, MN

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In September 2003, a six-acre landslide occurred between U.S. Trunk Highway 2 (TH 2) and Red Lake River in Crookston, Minnesota. Historically, a slide that had occurred at the same location in the 1930s resulted in loss of homes and a motel.

The 2003 landslide scarp was approximately 20-ft high and adjacent to the south side of TH 2. Given the location of the scarp, the busy corridor and adjoining homes were threatened. In response to the slide, Minnesota Department of Transportation (MnDOT) undertook a monitoring program with the objective of developing a conceptual site model relative to slide mechanisms.



2003 Photo of Damage, Courtesy of MnDOT



“Long Stick” excavator used to construct the CB shear walls.

Glacial lake deposits underlying the site are over 200-ft deep and are comprised of: hard ground moraine, till, and highly plastic lacustrine clay. Slope inclinometers identified two active slip planes within the Red Lake Falls lacustrine deposit. Additionally, regional upward groundwater flow underneath the clay deposit produces an artesian condition at depth and strength reduction along critical failure surfaces.

In 2014 MnDOT funded a remedial measure for stabilization of the slope via Design/Build Project Delivery. The team of Nicholson Construction Company and Brierley Associates were selected to provide geotechnical design and turn-key construction. Sub-consultants Itasca Consulting Group and SRF Consulting provided FLAC3D computer modeling, and civil design, respectively.

Unlike a retaining wall, which runs parallel with the slope, ten shear walls aligned perpendicular to the slope were selected to reduce project costs and mitigate slope movement. FLAC3D was used to analyze a group of shear walls to capture the arching of the soil between panels and load transfer through the walls to the underlying glacial till.

The shear walls were constructed using cement bentonite (CB) slurry, designed to reach an ultimate compressive strength of 250 psi. CB wall installation was by Inquip Associates, Inc. using one of the world’s largest long-reach excavators. The shear walls were excavated to a width of 3-ft and a depth of 75-ft to extend about 10-ft into the underlying ground moraine. Typical wall lengths were 100-ft and were broken into two 50-ft sections. Shorter walls at 50-ft lengths were used to accommodate the geometric constraints of the existing surface drains.

During construction, Brierley provided geotechnical field engineering and QA/QC. Shear walls were constructed during an 18-day time-frame spanning 3.5-weeks with completion in September 2015. Subsequent to construction, a real time solar powered monitoring system was installed by Soldata, a Division of Nicholson, to track slope movement and remedy effectiveness.

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