

CEEn-2017CPST-006

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TEMPORARY SLOPE REPAIR FOR HIGHWAY EXPANSION

Overview

During construction of a road widening project near Irving, Texas, a temporary cut slope slumped and required a temporary repair.

A picture showing the site conditions after failure is shown below. It was observed that the failure daylighted approximately mid-way down the slope, and a high moisture content existed in the soil.

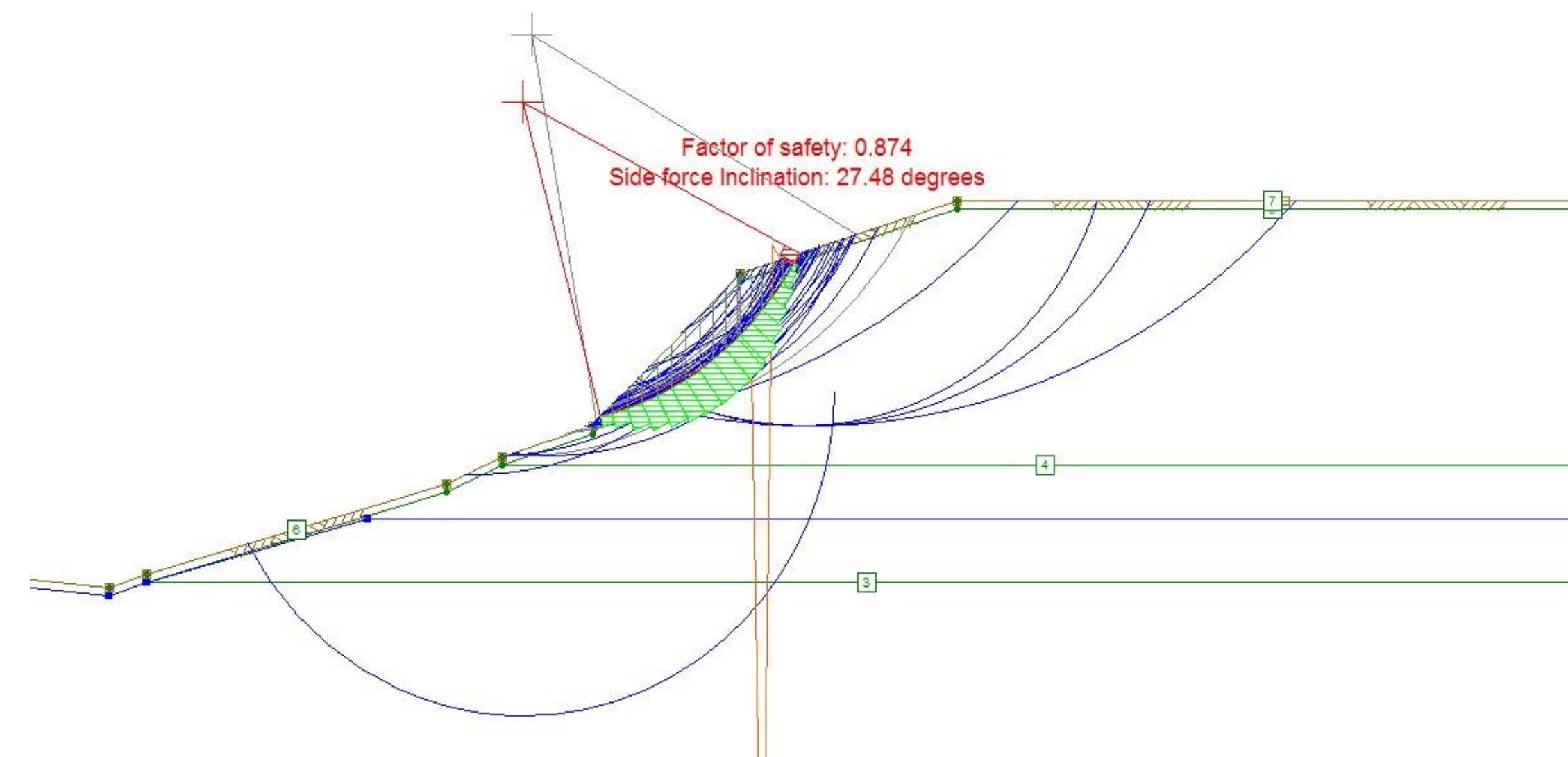


A Texas Cone Penetrometer test was completed and the soil properties were determined from the boring log as seen in the table. The soil layers in the table are a representation of the soil stratification, starting from the top most layer to the bottom bedrock.

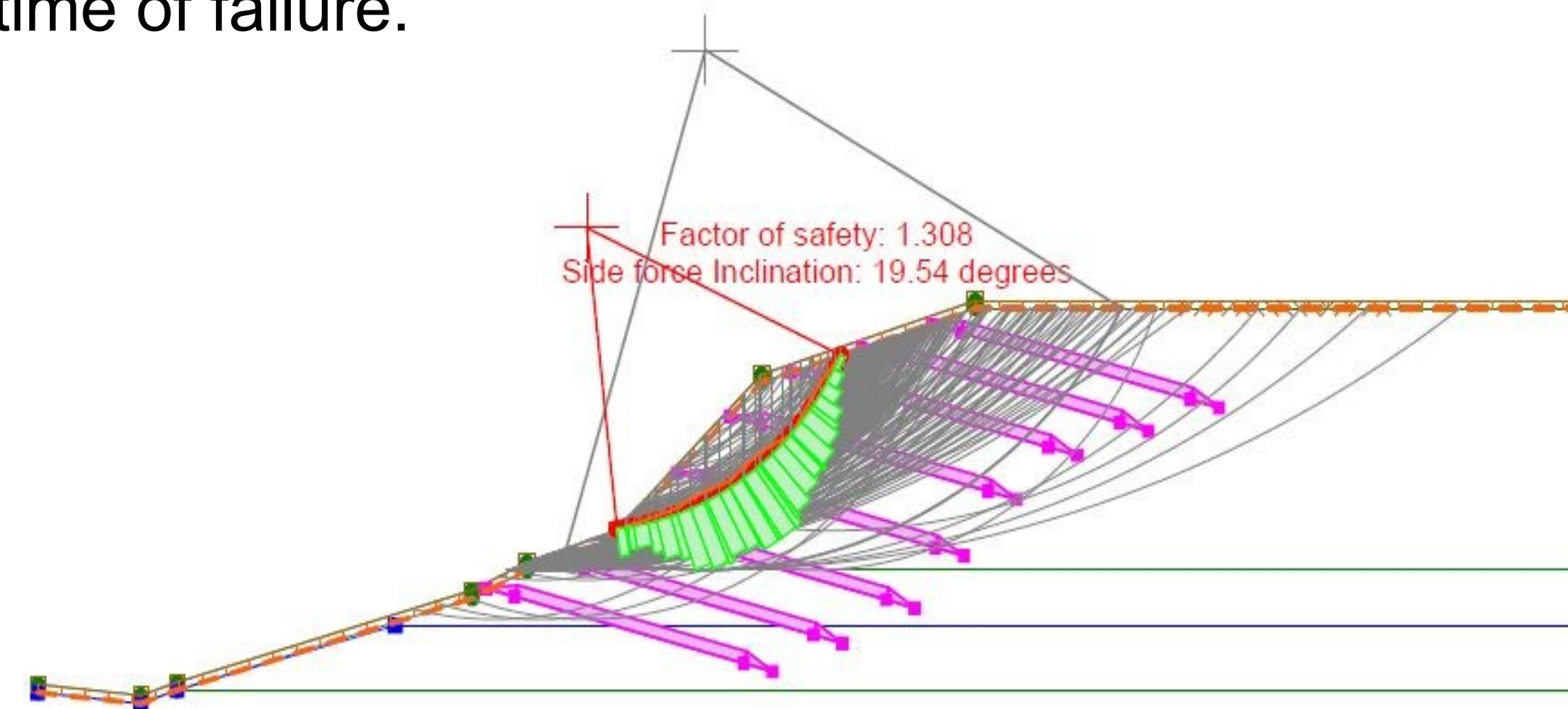
Soil Type	Unit Weight γ (pcf)	Cohesion C, (pcf)	Friction Angle Φ, (°)
Clay (CL)(sandy, tan)	135	959	29
Sand (tan)	125	-	30
Clay (CL)	120	2867	-
Sand (tan)	125	-	36
Clay (CH) (sandy, tan, and gray)	135	1922	-
Shale (gray)	150	-	-

Problem Analysis

The slope was analyzed in 50 ft. increments within UTexas, a slope analysis program, to determine a factor of safety against sliding. The minimum factor of safety found during analysis was located at station 489+50, and was 0.874. The analysis from that section is located below.



The analysis of the slope indicated that the slope failure was located approximately at the midpoint of the slope, which confirms the on-site observations at the time of failure.



Several design methods were considered, including driven piles, drilled shafts, and soil nails. Soil nails were chosen based on their efficiency, availability, and cost effectiveness. Preliminary calculations were computed to select soil nail parameters, which were then modeled in UTexas. The design was adjusted until the desired factor of safety of 1.30 was reached.

Final Design

The method chosen to repair the slope was a combination of soil nails every 5 ft. down the slope and 4 ft. across the repair width, with initial and final shotcrete facings to hold the soil and nails in place. The project is estimated to be completed in one month and will cost \$167,000. The construction drawings are shown below.

