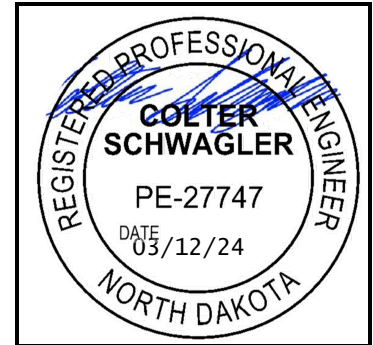


Geotechnical Memo for Traffic Signal Foundations

TO:	Design Division
FROM:	Riley Roesler – Geotechnical Section
DATE:	03/11/2024
PROJECT:	7-002(178)019
PCN:	23335
DESCRIPTION:	US-2, 9th Ave W to N of 34th St in Williston
SUBJECT:	Traffic Signal Foundation Design

The geotechnical section was tasked with providing design recommendations for the proposed drilled shafts to support the proposed traffic signal project. This memo outlines the design and recommendations for the proposed foundations.



The drilled shaft foundations were designed based on the Brom's method described in C13.6.1.1 of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals 2013 and the requirements for axial capacity of drilled shafts described in 4.6.5.1 of the AASHTO Standard Specifications for Highway Bridges 2002. For sign and high mast light tower foundation design the NDDOT uses a factor of Safety of 2.5 based on the recommendations from AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals 2013. Through years of experience, this has proven to be an effective and conservative design assumption.

See Appendix A for a map of the proposed traffic signal location.

The table below shows the traffic signal assumed soil strengths used for the design calculations.

Table 1: Soil Strength Parameters

Assumed Soil Strength Parameters – Drilled Shaft Foundations	
Undrained Analysis	c=500psf
Drained Analysis	$\phi = 25^\circ$

c=Undrained Shear Strength

ϕ =Friction Angle

The critical loads for the proposed traffic signal on the drilled shaft foundation were supplied by the consultant and are listed in the table below.

Table 2: Traffic Signal Loads

Service Loads – Traffic Signal	
Load Type	Traffic Signal Location
V (Shear) (kip)	3.813
F _y (Axial) (kip)	7.490
M (Moment) (kip-ft)	178.839

Drilled Shaft Foundation Design

The shear load and moments acting at the top of the drilled shaft were used with Brom's method to develop a minimum embedment depth for the drilled shaft. That embedment depth was then used to calculate the axial capacity of the drilled shaft and checked against the supplied axial load. Based on the information provided, the embedment depths are shown in the table below for the requested drill shaft diameters. For specific design calculations please contact the NDDOT Geotechnical Section.

The recommendations below are based on embedding the drilled shaft foundation in existing ground to the depth specified. If proposed fill is being placed at the drilled shaft foundation the length of the shaft will need to be extended to accommodate that fill height. If the drilled shaft is being placed on a slope, the embedment length should be measured from the low side to ensure the foundation depth meets the requirements below. If any of the drilled shafts are placed on slopes steeper than a 3:1, contact the NDDOT Geotechnical section as the embedment depths may need to be updated.

Table 3: Design Results – Drilled Shaft Foundations

Design Results – Drilled Shaft Foundation Embedment Depths	
Diameter (ft)	Embedment Depth
4	19.5'
5	20.0'
6	20.5'
7	21.0'

Limitations

This report should be made available to prospective designers and contractors for information on factual data only and not as a warranty of subsurface conditions. This report should not be used without approval if any of the following occurs:

- Conditions change due to natural forces or human activity under, at, or adjacent to the site.
- Assumptions stated in this report have changed.
- Project details change or new information becomes available such that the analyses, conclusions, and recommendations may be affected.
- The site ownership or land use has changed.
- More than 5 years has passed since the date of this report.

Unanticipated soil and water table conditions are commonly encountered and cannot be fully determined by a limited boring and testing program.

Within the limitations of scope and schedule, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical and geological principles and practice in this area at the time this report was prepared. We make no other warranty, either express or implied.


If there are any questions or concerns, please contact Riley Roesler rroesler@nd.gov or Colter Schwagler cschwagler@nd.gov of the NDDOT Geotechnical Section.

APPENDIX A

Project Location Map

Traffic Signal Location

Legend

 Traffic Signal Location

