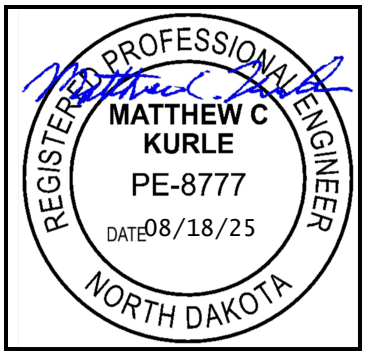
Geotechnical Memo for Traffic Signal Foundations

TO:	**Bridge & Design Division**
FROM:	**Matthew Kurle – Geotechnical Section**
DATE:	**08/14/2025**
PROJECT:	**RCE-NHU-SU-CRP-6-297(014)000**
PCN:	**24115**
DESCRIPTION:	**Demers and 42nd**
SUBJECT:	**Traffic Signal Foundation Design**



The geotechnical section was tasked with providing design recommendations for drilled shafts to support the proposed Traffic signals at the SW and NW quadrants of 42nd St. and 7th Ave for the above referenced 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.

Information from soil borings prepared for the referenced project were used to develop the soil parameters for the geotechnical design of these foundations. See the Geotechnical Engineering Report prepared for this project prepared by Olsson Engineering Inc. for the soil boring logs, analysis, and a map of the soil borings. The table below shows the soil parameters used for the design calculations.

Table 1: Design Soil Parameters

Soil Parameters – Drilled Shaft Foundations	
Friction angle (degrees)	18
Cohesion (psf)	450
Unit weight (psf)	120

According to the soil boring logs at the time of exploration, the water table was identified at approximately an elevation of 827 ft. It is anticipated that the water table may be encountered during the required excavations needed to install foundations for the project.

The estimated water table and boring logs are only representative of the exact location and time period from which the data was obtained, and soil samples taken. Fluctuations in the water table and soil conditions may occur due to rainfall, spring thaw, drainage, and other factors. Construction planning should recognize the possibility of fluctuations. The NDDOT assumes no responsibility if the water table or soil conditions encountered during construction differ from those shown. The boring locations shown are approximate.

The critical loads for the high mast lights proposed on drilled shaft foundations were supplied by Bolton & Menk, Inc. and are listed in the table below.

Table 2: High Mast Light Loads

Service Loads – Traffic Signal (SW 42nd St @ 7th Ave)	
Load Type	Traffic Signal
V (Shear) (kip)	3.384
F_y (Axial) (kip)	7.839
M (Moment) (kip-ft)	156.9
Service Loads – Traffic Signal (NW 42nd St @ 7th Ave)	
Load Type	Traffic Signal
V (Shear) (kip)	3.149
F_y (Axial) (kip)	7.816
M (Moment) (kip-ft)	150.4

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 get in touch with the NDDOT Geotechnical Section.

The recommendations below are based on embedding the drilled shaft foundation in the 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 2: Design Results – Drilled Shaft Foundations

Diameter (ft)	**Design Results – Drilled Shaft Foundation Embedment Depths (ft)**	
	SW 42nd St @ 7th Ave	**NW 42nd St @ 7th Ave**
2.5	20.5	20.5
3	20.0	19.5
3.5	19.5	19.5

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 have 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 Matthew Kurle mkurle@nd.gov or Colter Schwagler cschwagler@nd.gov of the NDDOT Geotechnical Section.