Standard Plan Overhead and Changeable Message Signs

This module presents the Department’s standard of practice for the investigation, design, and reporting of foundation recommendations for standard plan Overhead (OH) and Changeable Message Signs (CMS), hereafter referred to as sign(s).

Sign foundation design consists of choosing standard designs from the current Standard Plans and/or Revised Standard Plans (RSP). Sign types, related foundation types, and pertinent Standard Plan Sheets are presented in Table 1.

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<th>Sign Type</th>
<th>Foundation Type</th>
<th>2018 Standard Plan</th>
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<td>OH Signs-Truss, Single Post</td>
<td>CIDH, Spread Footing</td>
<td>RSP S1, RSP S2, S8</td>
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<td>OH Signs-Truss, Two Post</td>
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<td>OH Signs-Lightweight</td>
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<td>CMS Model 500</td>
<td>CIDH</td>
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Sign foundation types and sizes shown on the Standard Plans were designed using assumed soil strength parameters. The objective of a standard plan sign foundation investigation is to determine if the soil strength at the proposed sign location meets or exceeds the assumed soil strength used to design the sign, and to evaluate constructability.

Sites that do not meet the minimum design requirements will require a special foundation design. Notify the design engineer when the minimum requirements are not met to determine whether the sign can be relocated or if a special design sign is required. Special designs for sign foundations must follow the applicable foundation design module.

Investigations

Exploration for a sign foundation design seeks to identify and describe the subsurface material, determine its strength or verify that the strength exceeds the design strength and unit weight, locate the water table (if within the depth of the anticipated sign foundation), and to identify conditions that might affect the foundation construction, such as caving, the presence of cobbles and boulders, or shallow rock.

Borings for standard overhead signs should extend no deeper than 45 feet below the finished grade at the overhead sign. The deepest foundation required for a standard plan overhead sign is 39 feet and there is little reason to consider drilling deeper.

Auger borings are preferred since they mimic the typical construction method for sign CIDH pile foundations. They provide information on hole stability, water table, and...
presence of cobbles and boulders or shallow rock, which might render CIDH piles
difficult to construct. Borings into rock are performed for constructability evaluation only
since the minimum strength requirements are met.

Sampling and testing should be limited to Standard Penetration Testing (SPT) in
granular soil or undisturbed sampling with field pocket penetrometer or torvane testing
in cohesive soils. Soil corrosion testing should be performed as specified in Section 7.1
of the Corrosion Guidelines.

As sign foundation design is based on constructability and standard soil strength cases,
laboratory testing should not be performed for the purposes of determining soil strength
or Soil Classification. SPT, pocket penetrometer and torvane measurements are
sufficient for correlating to soil strength. Use the Soil Correlations module to determine
depth and unit weight. Presenting the Soil Identification as determined by the
visual/manual method provides sufficient information for designing and constructing sign
foundations. Consider performing laboratory strength tests only when the field test
results are near to but less than the minimum strength requirements.

It is not necessary to conduct a drilling program for signs that will be founded entirely in
fill that has yet to be placed, such as elevated roadway embankments or sliver
widening, as fills constructed to a minimum of 90% relative compaction exceed the
minimum required soil strength.

Design Procedures
CIDH pile foundations require a minimum soil angle of internal friction of 30 degrees
and a unit weight of 120 pcf (or submerged unit weight of 58 pcf), or a shear strength of
1.5 ksf for cohesive soils. Engineered fills compacted to 95% relative compaction (e.g.,
approach fills within 150 ft of a bridge abutment) should be assumed to satisfy the
requirements for phi = 35°. Engineered fills compacted to 90% relative compaction
(most fills other than abutment approach fills) should be assumed to satisfy the
requirements for phi = 30°.

It is generally not economical to try to shorten piles. Do not perform lateral or axial
resistance analyses if the minimum soil strength is available.

The Standard Plans currently show a spread footing option for OH Signs-Truss, Single
Post and Two Post, and OH Signs-Lightweight. In the rare case where a spread footing
design is considered, contact the standard plan owner to obtain the loads and
eccentricities, then calculate the bearing capacity, and check it against the design
criteria to verify the geotechnical design.

The maximum required ultimate soil bearing capacity of a standard plan overhead sign
spread footing is about 7.5 ksf. This is typically satisfied by an average \( N_{160} \) value of
10 or larger within the depth B below the bottom of the proposed footing.
Seismic investigations are not necessary except to evaluate liquefaction potential. If liquefaction is probable, contact the client and discuss whether or not to include recommendations for mitigation in the report.

Signs are sometimes added to a project by the District late in the PS&E process (after field investigations are completed and/or geotechnical reports have been completed). If soil data are not available, check with the project engineer to determine if a risk-based design, using the most conservative (longest) pile lengths, is appropriate. Such design should only be done if the groundwater elevation is known.

**Truss Single Post Types II through IX**
Single post truss signs may be supported by either spread footings or CIDH piles. Spread footings use the footing dimensions as specified in the revised Standard Plan RSP S2. CIDH pile foundations use Standard Plan S8 for pile dimensions.

**Truss Two Post Types I-S through VII-S**
Two post truss signs may be supported by either spread footings or CIDH piles. Spread footings use the footing dimensions as specified in the Standard Plan S9. CIDH piles use Standard Plan S15 for pile lengths.

**Overhead Signs - Tubular**
Single post and two post tubular signs are supported by CIDH piles. See Standard Plan S36 and S37 for pile dimensions.

**Overhead Signs - Lightweight Extinguishable Message Sign and Flashing Beacons**
Lightweight Extinguishable Message Sign and Flashing Beacons may be supported by either spread footings or CIDH piles. Spread footings use the footing dimensions as specified in Standard Plan S49. CIDH pile foundations use Standard Plan S49 for pile dimensions.

**Overhead Signs - Truss, Single Post, Unbalanced/Balanced/Full Cantilever Butterfly CMS Model 500**
Model 500 CMS are supported by CIDH piles. See Standard Plan S116 for pile details.
Reporting

Sign foundation recommendations are conveyed to the client in a Geotechnical Design Report (GDR). Reporting for a sign should be brief and include only the following information:

- Location of the overhead sign
- Sign type
- Summary of investigation performed
- Soil description, strength, and unit weight
- Corrosion test results
- Discussion of liquefaction potential
- Recommended foundation type(s) and dimensions;
  - Pile length and diameter for CIDH piles including the adjustment for sloping ground if applicable.
  - Spread footing dimensions and bottom of footing elevation or depth of burial.
- Depth to groundwater and recommendation for wet CIDH methods including gamma-gamma inspection pipes if the pile excavation extends below the groundwater level.

A Log of Test Borings (LOTB) or Boring Record must be included with the design recommendations if a boring was drilled or if an as-built boring was used. A note should be added to the report directing the designer to include the LOTB in the contract plans, along with a list of LOTB sheet titles.