



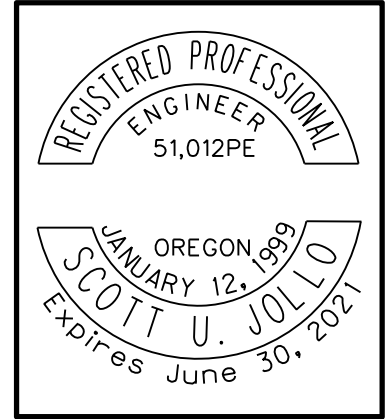
# Standard Drawing Report

**Date:** July 10, 2020

**Technical Owner:** Scott U. Jollo, P.E.  
State Traffic Structures Engineer

**Standard Drawing Number:** TM653

**Drawing Title:** Traffic Signal Supports  
Foundation Requirements



**Original Report Date:** January 7, 2011

## Background Information, Including Reference Material:

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals with 2001, 2002, 2003, and 2006 Interims

The Standard drawing Calculation book 5323 contains additional design information and calculations that pertain to the Signal Pole Foundation design.

The following is a list of the revisions that have been made to the drawing:

1. June 30, 2005 – TM 653, Standard Traffic Signal Supports Foundation Requirements (both English & Metric), was created by the Traffic Structures group.
2. June 30, 2006 – Added callout to PLAN – TOP OF FOOTING DETAIL stating that "Signal Arm Center Line can be oriented in a direction relative to top of footing". By allowing the foundation to be rotated, right of way issues might be avoided.
3. June 30, 2006 – Added Strain Pole Types column and Mastarm to Pole Types column in the Standard Foundations table.



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4. June 30, 2006 – Added foundation note “Shafts 7, 8, and 9 do not include torsion rebar”. The torsion reinforcement is not required for these strain poles because the torsion to moment ratio is low enough to not require the torsion rebar.
5. June 30, 2007 – Modified Stand Foundations table by removing required footing depths and modifying associated table notes. The increased loading conditions in conjunction with variable soil strength parameters required geotechnical exploration and foundation design in the preliminary design phase to produce more accurate foundation depths.
6. June 30, 2007 – Removed Soil Types definitions.
7. June 30, 2007 – Revised anchor bolt projection dimensions and added ¼” expansion jointed adjacent to sidewalk note on ELEVATION – TOP OF FOOTING detail. There was foundations installed incorrectly in the field and this modification was an attempt to clarify the dimensions to use.
8. January 4, 2008 – Added the requirements that the rock will be unfractured with a hardness of at least R1, an unconfined compressive strength (qu) of at least 100 psi, and tight joints.
9. January 4, 2008 – Modified the asterisk note from “or Required footing depth” to “or embed to a total depth that is at least equal to the required footing depth”.
10. January 5, 2009 – Removed the revisions and updated the drawings title block to 2008.
11. July 2, 2009 – The conduit statement, “Galvanized rigid steel conduit sweep as required by the project plans and National Electric Code” was revised to “Conduit”. This change was required because the signal group has changed the type of conduit that they are specifying from a galvanized steel to a fiberglass. The fiberglass is more expensive than the steel, so the contractor will most likely find it on this drawing and recommend using the cheaper product. This creates a conflict in the plans and it needs to be removed for this location.

## Assumption Made:



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## Design Narrative:

### History:

The signal support Standard drawing has been in existence since the Bridge drawing 31006 was released on October 31, 1975. This drawing shows up to four three section heads with an area of 9 ft<sup>2</sup> each that are separated by a minimum of 8 feet and up to four signs with an area of 5 ft<sup>2</sup> that are located 3 feet from each signal head. The foundation was 3 feet in diameter and was 5 feet, 6 feet, or 7 feet in depth. There were different depth and rebar configurations for the foundations over the years. TM653 was released in July 2005 that specified depths for a "Good", "Average", and "Poor" soil and was designed to resist the larger design loads shown on TM650.

The old Standard Drawing foundations were designed using the Rutledge method. The standard soil strength was a value of 1500 psf and this was considered a poor soil condition that could be used in most locations in the State. This design method is shown in Section 13.10 of the 4th Edition AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. Section 13.10 is used for the design embedment of lightly loaded small poles and posts. The new signal poles, especially with the larger loading, are not considered lightly loaded and are not used for signal pole foundation designs.

The original classifications for the soils had a "Good" soil with at least a phi of 35 degrees and an "Average" soil with a phi of 25 degrees. In practice, the signal foundation locations would sometimes come close to the 35 degree phi, but almost never reached this good soil condition. The result was to almost always use the average soil depths with the low phi of 25 degrees. A report was released by the FHWA that stated the signal pole depths appeared excessive and this prompted ODOT to revise the signal pole foundation depths.

In many cases, a boring had to be performed to get the phi of the soil to determine if the soil was "Good", "Average" or "Poor". Having a soils



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report for the location results in the Geotechnical Engineer having all of the information needed to provide a report and design values for an Engineer to use Section 13.6.1.1 from the 4th Edition AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals to calculate embedment depths. This site specific foundation design significantly reduced the foundation depths and provided valuable Geotechnical reports that are used by Contractors during construction.

Additional information about the foundation design and assumption is contained in the ODOT Traffic Structures Design Manual, the ODOT Geotechnical Design Manual, and Calculation book 5323.

## January 7, 2011 Revision:

The terminology was changed in several notes from "anchor bolts" to Anchor Rods" on ELEVATION – TOP OF FOOTING and PLAN – TOP OF FOOTING.

A revision was made to the slope notation on MINIMUM EMBANKMENT REQUIREMENTS. The old notation of "1.5 : 1" has caused some confusion in the past. The new notation reads "1V:1.5H" to represent a slope with 1 unit of vertical (V) distance to every 1.5 units of horizontal (H) distance. ODOT had historically specified the horizontal value and then the vertical value, which was different than most states, so when the Metric drawings were released this nomenclature was changed to the vertical stated first and then the horizontal value. When the old Bridge drawing BR963 was converted to Metric, the slope was changed from horizontal semicolon vertical to vertical semicolon horizontal. Unfortunately, the English version of the drawing was not changed and the English version of the drawing shows the incorrect horizontal semicolon vertical value that needs to be changed to vertical semicolon horizontal. In addition, to help clarify these values in the future, it was decided to add "V" and "H" to the values.



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Deleted STANDARD in drawing title block. This change was made to be more consistent with previous versions of the drawing and other drawings in the set.

Added "No Scale" to each detail title to match other Traffic Structures Standard Drawings.

## January 10, 2014 Revision:

The Signal Pole Field Verification Form Subcommittee has discussed items on drawings TM652 and TM653 that have resulted in changes to these drawing to make them clearer.

The Anchor Rod Detail had the Projection equal to  $1 \frac{1}{8}'' + 2 \times \text{RD}'' + \text{Tb}'' + 5''$  to the rough float surface. During one of the signal pole field verification meetings, a contractor stated that the top corner of the foundation is the top of the formwork and this is where they reference everything in the field. The projection has been revised to go from the top corner of the foundation (Foundation Control Point) and it will be shown on a new Projection Detail on TM653. This results in removing the projection and rough float surface from the Anchor Rod Detail on TM652.

The new Projection Detail shows the dimensions of the grout under the base plate, base plate thickness "Tb", the washer that is estimated at  $\frac{1}{8}''$ , two nut heights that are approximately the height of two anchor rod diameters "RD" + "RD", and 1" of additional threads beyond the end of the nut. There was a comment that using a projection of 2.5 times the anchor rod diameter would be easier, but this method has a large range of lengths and it is not acceptable. Showing all of the projection length details should help make the projection calculation more straight forward.

The note "Enlarge top of footing as shown when required to meet finish grade" has not been well understood by designers, contractors, or inspectors. As a result, the foundations have not been installed according to it. In areas where one side of the foundation has a sidewalk and the other side has soil, there is no 1 to 1 sloping



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transition necessary and this requirement has been removed from the drawing.

The "Plan – Top of Footing" detail specified "Concrete (or grout) pad top 4" Pour after installing pole and appurtenances". The top pad at the corner is 4" but it increases to 5" under the base plate, so the 4" statement is not correct. The 4" has been changed to "above rough float surface" to describe the closure pour area.

The "Elevation – Top of Footing" and "Plan – Top of Footing" have been scaled up for clarity. Also, the top rebar in the "Elevation – Top of Footing" detail has been changed to reflect that the u-bars are within the square ties as shown on the "Plan – Top of Footing".

The top 1'-0" of the footing is always formed square, but a wood 2"x12" is typically used for the formwork that is 11 ½" tall instead of 12". The "+/- ½"" tolerance has been added to the 1'-0" to allow for the 11 ½" tall 2"x12" formwork. This effects the bottom 2" dimension that can be 1 ½" to 2 ½" and must be updated.

The note "¾" wide slots for zinc drainage" on the "Plan – Top of Footing" detail was not appropriate on the foundation installation drawing TM653 and was removed. The note "Provide adequate slots for zinc drainage or approved equal" on TM652 has been changed to "¾" wide slots for zinc drainage or approved equal" to accommodate the removal of the note from TM653.

1" min. from the top of the footing to the soil has been added to make sure that the soil will not move over the top of the footing in the future.

## July 10, 2017 Revision:

The top of the foundation currently has a slope from the control point corner to the bottom of the base plate. This slope is considered too steep to satisfy the Americans with Disabilities Act (ADA). An adjustment to the top of the signal foundation must be made to allow as much space as possible around the signal pole base plate to have a



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flat traversable surface that matches the surrounding sidewalk slopes that satisfy ADA.

The top of the closure pour will be changed to be level with the sidewalk all the way across the width of the signal foundation. Grout will be installed between the top of the closure pour surface that will be level with the sidewalk and the bottom of the base plate. Most grout pads have a 45 degree slope from the base plate edge to help resist the grout breaking up, but it was decided to make the edges of the grout pad vertical from the edges of the base plate to result in the most usable space possible. Grout shall be only non-shrink high early strength grout (non-ferrous) with a minimum strength of 5000 psi. Also, an additional note on the "ELEVATION – TOP OF FOOTING" detail was added about installing a drain hole in the grout pad. This was not referenced here before and was only specified on the "TYPICAL FOOTING ELEVATION".

## July 08, 2019 Revision:

The previous change to the top of the signal foundation to allow the pedestrian use of the surrounding concrete and asphalt surfaces to the top of the signal foundation results in the requirement to always have the concrete and asphalt flush with the top of the signal foundation instead of allowing the current option of tapering the concrete surface down to the soil elevation that is in the range of 1" to 3". In addition, the 2011 Public Rights-of-Way Accessibility Guidelines (PROWAG) R302.7 requires a maximum vertical surface discontinuity of 1/4" when no bevel is used. To address these issues, the note "0" min. to 1/4" max. between concrete or asphalt finish grade and finish corner of footing." has been added to the detail where the concrete and asphalt are shown level with the top of the signal foundation.

Added missing arrows and fixed "commercial" typographical error.

The Strain Pole Standard drawings TM660 and TM661 have been deleted. As a result, the Strain Pole Types and the corresponding Foundation Numbers 7, 8, and 9 have been removed.



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July 10, 2020 Revision:

Added the accompanied by Recessed Terminal Cabinet drawing TM654.