pennsylvania
DEPARTMENT OF TRANSPORTATION

470-10-06

DATE: October 14, 2010

SUBJECT: Update to Publication 148 (Traffic Standards – Signals [TC-8800 Series]) and Publication 149 (Traffic Signal Design Handbook), Chapter 20 "Criteria for the Design of Traffic Signal Supports"

TO: District Executives
R. Craig Reed, Director, Bureau of Municipal Services

FROM: R. Scott Christie, P.E. /s/
Deputy Secretary for Highway Administration

This Strike-Off letter is time neutral but will result in increased material costs to meet fatigue design requirements and bring PennDOT in conformance with the most recent release of the American Association of State Highway and Transportation Officials (AASHTO) standard specifications, the Manual on Uniform Traffic Control Devices, and the National Electric Code.

The accompanying revisions to Publication 148 (Traffic Standards – Signals [TC-8800 Series]) and Publication 149 (Traffic Signal Design Handbook), Chapter 20 "Criteria for the Design of Traffic Signal Supports" become effective immediately, for all traffic signal structural supports as follows:

- All Department projects submitting Plans, Specifications, and Estimate packages to Central Office.
- All Highway Occupancy Permits or Municipal projects that do not have an approved Traffic Signal Permit.

This Strike-Off letter also applies to any traffic signal structural support that requires replacement. An exemption to this requirement will be considered only when the following conditions are met:

- The affected **municipality has an existing stockpile of NEW traffic signal structural supports purchased prior to this Strike-Off letter.**
- The municipality provides verification (signed and sealed from a Professional Engineer, licensed in the State of Pennsylvania) attesting to the structural adequacy of the existing foundation and the suitability of the stockpiled signal support material for its intended use and location.
    - A modified base plate configuration as indicated in "Attachment A" will be required.

In addition to the revisions made to the standards, Publication 35, Bulletin 15 - Approved Construction Materials, Section 1104.02 will also be updated accordingly to indicate those manufacturers who have been re-certified to provide traffic signal supports meeting the new criteria. Drawings for the approved manufacturers are available for Department representatives at: ftp://ftp.dot.state.pa.us/transfer/Traffic Signals/Traffic Signal Structrual Supports/.

The Department is implementing the changes to Publication 408 (Specifications) for use immediately on projects, via a Standard Special Provision (Attachment B). These revisions will be permanently incorporated into Publication 408 with the October 2010 update.

These changes have been developed through a collaborative effort involving the Bureau of Highway Safety and Traffic Engineering (BHSTE), the Bureau of Design, the Bureau of Construction and Materials, along with existing Bulletin 15 approved traffic signal support manufacturers.

If you have any questions regarding the attached updates, please contact Glenn C. Rowe, P.E., PTOE, Chief, Transportation Operations Division, BHSTE at (717) 783-6479.

Attachments

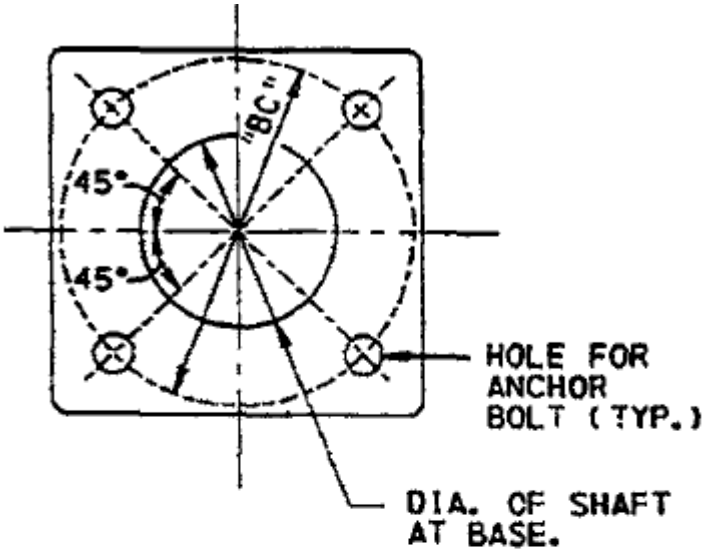
CC: FHWA Pennsylvania Division Office
Pennsylvania State Association of Township Supervisors
Pennsylvania State Association of Boroughs
Pennsylvania State Association of Township Commissioners
Pennsylvania League of Cities and Municipalities
Director, Policy Office
Highway Administration Bureau Directors
Assistant District Executives
District Traffic Engineers
District Bridge Engineers
District Permit Managers
District Plans Engineers
Bureau of Highway Safety and Traffic Engineering Division Chiefs
Bureau of Design Division Chiefs
Bureau of Construction Materials Division Chiefs G. Gordon, P.E., 7th Floor CKB
J. Unick, P.E., 7th Floor CKB
D.T. Wilhelm, P.E., Materials Testing Lab
J. A. Bracken, P.E., Materials Testing Lab

4700/DPF/(3-0333)/lap/(7-3620)/tns(7-7350)

BCC: Directors Correspondence File
TOD Read File

ATTACHMENT A

Modified Base Plate Connection for
Existing Structurally Adequate Foundations



MAST ARM LENGTH	"BC" BOLT CIRCLE
0'-15'	14"
16'-20'	15"
21'-25'	16"
26'-30'	17"
31'-35'	18"
36'-40'	19"
41'-45'	20"
46'-50'	21"
51'-55'	22"
56'-60'	23"

ATTACHMENT B
Changes to Specifications: Section 1104

SECTION 1104—TRAFFIC SIGNALS

Revise Section 1104.01 – General Requirements to add the following:

(b) Structural Material. Fabricate traffic signal structural material according to Section 1105 (steel members only), the American Welding Society (AWS), and the American Association of State Highway and Transportation Officials (AASHTO) Specifications; except, applying water to the base metal during plasma arc cutting is permitted. Bulletin 15 listing and shop inspection is required. Fabricators provide an AWS certified welding inspector (CWI) for welded steel or aluminum pole products as specified in Section 1105.01(g)3. Bulletin 15, shop inspection, and Section 1105 do not apply to painting of aluminum poles and for the following non-welded items: cast aluminum poles, cast steel poles, and cast iron poles.

The Charpy V-Notch toughness test is required for load carrying tension members greater than 13 mm (1/2-inch) in thickness, as required for Zone 2, non-fracture critical criteria, of the applicable AASHTO specifications.

Provide steel poles that either round or multi-sided with a minimum of eight sides.

Provide testing and test methods according to AWS D1.1 (Steel) or AWS D1.2 (Aluminum) and as determined by the Materials Testing Division (MTD).

Provide non-destructive testing on 100% of full penetration groove welds and a random 25% of partial penetration groove welds of longitudinal seams on steel poles and arms. When inspecting full penetration seam welds, use radiographic test methods on material less than 8 mm (5/16-inch) in thickness, and use radiographic or ultrasonic test methods on material 8 mm (5/16-inch) and greater in thickness. Use magnetic particle inspection on partial penetration seam welds.

Provide non-destructive testing by ultrasonic test methods on random 25% of all pole to base plate and arm to arm plate full penetration groove welds. For tube material less than 8 mm (5/16-inch) in thickness, have the fabricator submit a detailed ultrasonic testing procedure, including acceptance criteria, to the MTD for review and approval before testing.

For all other welds on steel traffic poles, perform magnetic particle inspection on a minimum of 25% of the length of each weld. Provide inspection for the full length of the weld when less than 150 mm (6 inches) in length. For aluminum traffic pole structures, perform fabrication and non-destructive testing in accordance with Section 1101.01.

Where less than 100% of the weld is non-destructively tested, and a rejectable defect is found, test 100% of the length of the weld.

Where applicable, the Department's plant inspector will select portions of welds to be tested. Perform and evaluate all non-destructive testing according to cyclically loaded non-tubular tension criteria.

ATTACHMENT B
Changes to Specifications: Section 1104

(c) Certification. As specified in Section 106.03(b)3. Certify from the manufacturer, that all signal supports satisfy the Department's criteria and are adequate to support the loads indicated on the approved plans. Include on the certification the signature and seal of a Professional Engineer registered in the State. Certify the structural adequacy of all sign and signal brackets as well as all other mounting hardware.

Revise Section 1104.02 – Traffic Signal Supports to read as follows:

1104.02 TRAFFIC SIGNAL SUPPORTS—

(a) General.

1. **Design and Acceptance.** Design in accordance with Publication 149. Submit shop drawings in accordance with Publication 149, including calculations for all special structures, for review and acceptance.

2. **Supports.**
   Fabricate shafts and arms in any of the following shapes and styles:

   A. Round Tapered.
   - i. One longitudinal seam, continuously welded, and ground or rolled flush.
   - ii. Transverse butt welds are not acceptable.
   - iii. Uniform wall thickness.
   - iv. Uniform taper, 11.7 mm (0.14 inch) maximum and 5.8 mm (0.07 inch) minimum per meter (foot) of length.

   B. Round Stepped.
   - i. Round pipe sections, each with not more than one longitudinal seam continuously welded and ground or rolled flush. Join sections by a hot-swaged shrink fit continuously seal-welded to prevent entrance of water.
   - ii. Uniform wall thickness for each section.
   - iii. Maximum change in diameter between stepped sections not to exceed 54 mm (2 1/8 inches).

   C. Multi-Sided Tapered.
   - i. Maximum of two longitudinal seams, continuously welded, and ground or rolled to a maximum bead height of 3.2 mm (1/8 inch).
   - ii. Transverse butt welds are not acceptable.
   - iii. Uniform wall thickness.
   - iv. Uniform taper, 11.7 mm (0.14 inch) maximum and 5.8 mm (0.07 inch) minimum per meter (foot) of length.
   - v. Minimum of eight sides.

   D. Round Untapered.
   - i. Maximum of one longitudinal seam, continuously welded, and ground or rolled flush.
   - ii. Uniform wall thickness and diameter.
   - iii. Transverse butt welds are not acceptable.

3. **Cable Support.** Weld a cable support to the inside top of the shaft.

4. **Grounding.** Weld a UL-Listed grounding lug, capable of accommodating a 13.3 mm^2 (No. 6 AWG) stranded copper cable, to the inside of the shaft adjacent to the handhole.

5. **Handholes.** Provide a handhole in the shaft of the poles, as shown on the Standard Drawings. Reinforce the area to develop the minimum guaranteed yield strength of the shaft. Furnish a cover and keeper chain.

6. **Wire Inlets.** Provide a wire inlet at each signal head or at each electrically operated sign location. Weatherproof each inlet with an insulated grommet. Provide a deburred hole, 63.5 mm (2 1/2-inch) minimum diameter, in the flange plate and shaft, which serves as a wire entrance into the arm from inside the shaft. Provide Type LB access fittings from Type II mounted controller cabinet into pole shaft and in pole shafts for pedestrian pushbuttons.

7. **Anchor Bases.**
   A. Fabricate the base clean, smooth, and of the dimensions necessary for adequate pole mounting and structural support.
   B. Provide holes for anchor bolts.
   C. Fabricate the base to telescope over the shaft and be secured in place by welding.

8. **Galvanizing.** Section 1105.02(s) and as follows:

   A. Galvanize steel shafts and arms, including those manufactured of high strength and corrosion resistant steels, according to the American Society of Testing Materials (ASTM) A 123 (AASHTO M 111). Galvanize accessories and hardware according to ASTM A 153 (AASHTO M 232).

   B. **Overhead Supports.** As shown on the Standard Drawings and as follows:
      i. Shaft and Arms—AASHTO M270/ASTM A709, Grade 36 or Grade 50, ASTM A36, ASTM A 53, ASTM A 572 Grade 50, ASTM A 501 and A 595.
      ii. Luminaire Mounting Arms—Section 1101.03.
      iii. Anchor (Base) Plates, Flange (Arm and Column Connection) Plates, and Gusset Plates,—AASHTO M 270 (ASTM A 709), Grade 36. ASTM A 36, ASTM A 572 Grade 50.
      iv. Miscellaneous Shapes, plates and bars- AASHTO M 270 (ASTM A 709), Grade 36. ASTM A 36, ASTM, ASTM A 572 Grade 50 and ASTM A992.
      v. Flange Plate Assembly Bolts, Nuts and Washers— ASTM A325, ASTM 563 and ASTM F436. Mechanically galvanize in accordance with ASTM B695. Furnish bolts, nuts and washers for testing purposes and test as specified in Section 1050.3(c) 7.b.
      vi. Shaft and Arm Caps—Galvanized steel (C-coat) cast iron or cast aluminum.
      vii. Handhole CHandhole Cover Plates – AASHTO M 270 (ASTM A 709), Grade 36. ASTM A 36, ASTM, ASTM A 572 Grade 50 and ASTM A 1011.

viii. Pipe Caps – AASHTO M 270 (ASTM A 709), Grade 36. ASTM A 36, ASTM, ASTM A 572, ASTM A 1011 or ASTM B 26.

ix. Arm dampening – Harmonic dampening device, when provided.

C. **Pedestal Supports.** As shown on the Standard Drawings and as follows:

i. **Aluminum.**

a. Support—One length, 114 mm (4 1/2-inch) minimum outside diameter aluminum pipe, Schedule 40, ASTM B 210, or B 221, Alloy 6063-T6.

b. Bases—Cast aluminum, ASTM B 26, or B 108, Alloy 356-T6; aluminum plate, ASTM B 209, Alloy 6061-T6.

c. Pole Tops—Aluminum.

ii. **Steel.**

a. Support—One length, 114 mm (4 1/2-inch) minimum outside diameter steel pipe, Schedule 40, ASTM A 53, Type F.

b. Base—Steel casting, ASTM A 27, Grade 65-35; gray iron casting, ASTM A 126, Class 26; steel plate, AASHTO M 270 (ASTM A 709), Grade 36.

D. **Pedestrian Stub Poles.** As specified in Section 1104.02(c) except having a fixed length of 1,500 mm (60 inches) and a rounded top cap to minimize injuries.

E. **Anchor Bolts.** As shown on the Standard Drawings and as follows:

i. Anchor Bolts—ASTM A 449 or F 1554.

ii. Hex Nuts—ASTM A 563M/A 563.

iii. Washers—ASTM F 436.

Galvanize the top 200 mm (8 inches) of bolts and all associated hardware as specified in Section 1105.02(s) (ASTM A 153), or by another acceptable method conforming to the coating thickness, adherence, and quality requirements of ASTM A 153. Furnish template prints for setting anchor bolts with each support.

F. **Wood Support Poles.** When used for temporary signal installations, certify sawn material, both rough and dressed by the mill as to grade and mark in accordance with the grading rules and basic provisions of the American Lumber Standards (PS-20-70) by a lumber grading or inspection bureau or agency. If dressed, the grade mark shall be applied after dressing.

G. **Span Wire.** ASTM A 475, Class A, Siemens-Martin, or ASTM B 416.

H. **Tether Wire.** ASTM A 475, Class A, Siemens-Martin, or ASTM B 416.

I. **Lashing.** As shown on the Standard Drawings for attaching cable to span wire.

OS-299 (7-08)	TRANSMITTAL LETTER	**PUBLICATION:** 148
pennsylvania DEPARTMENT OF TRANSPORTATION		**DATE:** **10/14/2010**

SUBJECT:

Traffic Standards - Signals (TC-8800 Series)

INFORMATION AND SPECIAL INSTRUCTIONS:

Conformance with the 2001 American Association of State Highway and Transportation Officials (AASHTO) "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" including interim specifications up to 2006, the national Manual on Uniform Traffic Control Devices 2009 Edition, and the National Electric Code 2008 Edition.

The accompanying revisions to Publication 148 (Traffic Standards – Signals [TC-8800 Series]) and Publication 149 (Traffic Signal Design Handbook), Chapter 20 "Criteria for the Design of Traffic Signal Supports", for all traffic signal structural supports as follows:

- All Department projects submitting Plans, Specifications, and Estimate packages to Central Office.
- All Highway Occupancy Permits or Municipal projects that do not have an approved Traffic Signal Permit.
- For any traffic signal structural supports that require either removal or replacement. An exemption to this requirement will be considered only when the following conditions are met.
    - o The affected municipality has an existing stockpile of NEW traffic signal structural supports purchased prior to this Strike-off letter.
    - o The municipality provides verification (signed and sealed from a Professional Engineer, licensed in the State of Pennsylvania) attesting to the structural adequacy of the existing foundation and the suitability of the stockpiled signal support material for its intended use and location.
        - ☐ A modified base plate configuration as indicated in "Attachment A" will be required.

CANCEL AND DESTROY THE FOLLOWING:

This will replace the June 1989 Publication 148 (Traffic Standards - Signals (TC-7800 Series)) and the September 1988 "Criteria for the Design of Traffic-Related Structures" (currently Publication 149 (Traffic Signal Design Handbook), Chapter 20) on the effective date.

ADDITIONAL COPIES ARE AVAILABLE FROM:

☒ PennDOT SALES STORE
(717) 787-6746 phone
(717) 787-8779 fax
ra-penndotsalesstore.state.pa.us

☒ PennDOT website - www.dot.state.pa.us
Click on Forms, Publications & Maps

☒ DGS warehouse (PennDOT employees ONLY)

	APPROVED FOR ISSUANCE BY: Allen D. Biehler, P.E. Secretary of Transportation By:  Daryl St. Clair, P.E. Acting Director, Bureau of Highway Safety and Traffic Engineering

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

pennsylvania
DEPARTMENT OF TRANSPORTATION

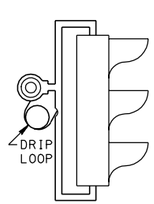
TRAFFIC STANDARDS – SIGNALS
TC–8800 SERIES

BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

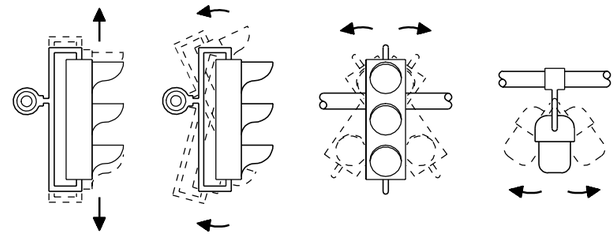
PUB. 148 (10-10)

INDEX OF TRAFFIC STANDARDS – SIGNALS

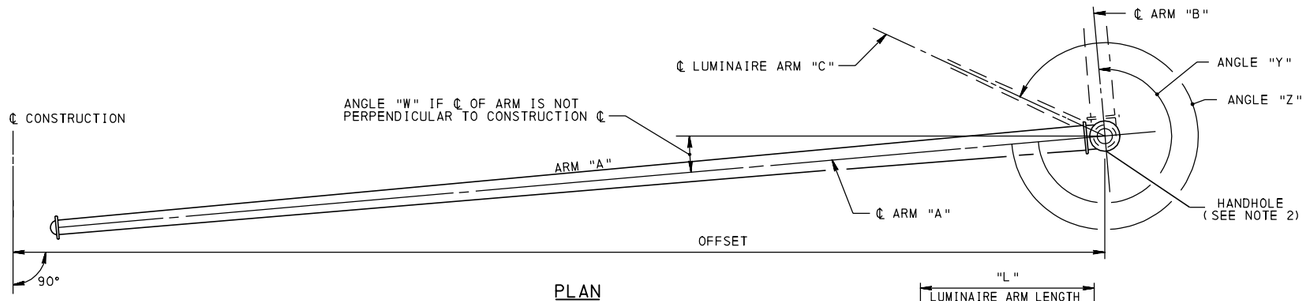
STANDARD DRAWING NO.	DATE	DESCRIPTION
TC-8801 (7 SHEETS)	October 14, 2010	TRAFFIC SIGNAL SUPPORT
TC-8802	October 14, 2010	CONTROLLER ASSEMBLY
TC-8703 (2 SHEETS)	October 14, 2010	MISCELLANEOUS
TC-8804 (2 SHEETS)	October 14, 2010	ELECTRICAL DISTRIBUTION
TC-8805	October 14, 2010	SIGNAL HEADS
TC-8806 (2 SHEETS)	October 14, 2010	DETECTORS



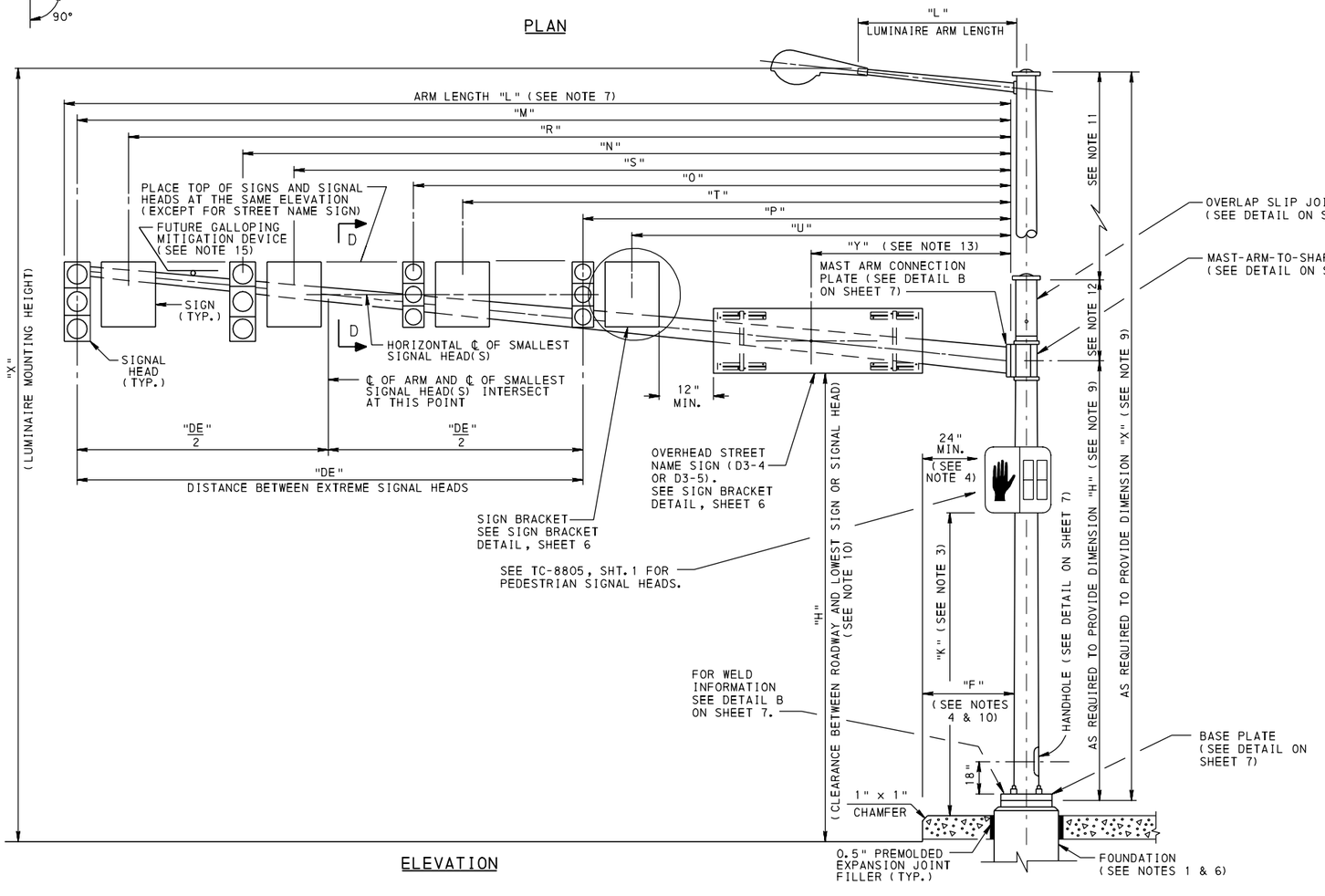
SECTION D-D



DETAIL A



PLAN



ELEVATION

NOTES:

1. FOR FOUNDATION DETAILS, SEE SHEETS 3 THROUGH 5.
2. PLACE HANDHOLE 90° OR 180° FROM CENTERLINE OF ARM "A".
3. DIMENSION "K" IS FROM SIDEWALK. IF NO SIDEWALK, DIMENSION "K" IS FROM PAVEMENT GRADE AT CENTER OF ROADWAY. PROVIDE SPECIFIED DIMENSION "K" SUCH THAT CLEARANCE IS IN THE RANGE OF: 8′ MINIMUM, 15′ MAXIMUM FOR TRAFFIC SIGNAL HEADS; 7′ MINIMUM, 10′ MAXIMUM FOR PEDESTRIAN SIGNAL HEADS.
4. DIMENSION "F" IS 2′ MINIMUM FROM CURB OR FROM EDGE OF SHOULDER. PLACE POST-MOUNTED SIGNALS 2′ MINIMUM BEHIND CURB OR EDGE OF SHOULDER.
5. A "ROUND TAPERED" SUPPORT IS USED FOR ILLUSTRATION PURPOSES. THE TYPE OF SUPPORT MAY BE ANY OF THOSE INDICATED IN PUBLICATION 408.
6. INSTALL A MINIMUM OF ONE GROUND ROD AT EACH FOUNDATION. SEE TC-8804.
7. ARMS LESS THAN 31′ WILL BE ONE SECTION.
8. RIGIDLY MOUNT ALL SIGNAL HEADS ON THE MAST ARM UNLESS OTHERWISE INDICATED. PROVIDE MOUNTING BRACKETS THAT:
   a. ATTACH TO THE TOP AND BOTTOM OF THE SIGNAL HEAD. FOR 5-SECTION HEADS, ATTACH EITHER TO THE TOP AND BOTTOM OF THE SIGNAL HEAD, OR TO THE BOTTOM AND BETWEEN THE RED AND YELLOW SECTIONS OF THE SIGNAL HEAD.
   b. PERMIT THE ADJUSTMENTS SHOWN IN DETAIL A.
   c. HAVE GROMMETED WIRE ENTRANCE.
   d. DO NOT ENTRAP WATER INSIDE THE BRACKET.
9. OBTAIN ELEVATION OF ROADWAY AND TOP OF FOUNDATION PRIOR TO DETERMINING THIS DIMENSION.
10. PROVIDE SPECIFIED CLEARANCE IN ACCORDANCE WITH PUBLICATION 149 AND "THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES".
11. USE ONE-PIECE SHAFT WHEN LUMINAIRE IS REQUIRED EXCEPT FOR ROUND STEPPED SUPPORTS, OR UNLESS ALTERNATE OVERLAP SLIP JOINT IS SPECIFIED OR APPROVED ON A PROJECT-BY-PROJECT BASIS.
12. IF SPECIFIED, PROVIDE 36" MINIMUM STUB TO ALLOW FUTURE LUMINAIRE ATTACHMENT VIA OVERLAP SLIP JOINT.
13. FOR MAXIMUM ALLOWABLE DIMENSION "Y", SEE THE DEPARTMENT'S "CRITERIA FOR THE DESIGN OF TRAFFIC SIGNAL SUPPORTS", PUBLICATION 149.
14. FOR QUANTITY, SIZE, SIZE OF HOLES AND BOLT CIRCLE FOR ANCHOR BOLTS, SEE SHEET 3.
15. DURING 30-DAY TEST PERIOD, VISUALLY INSPECT NEW MAST ARM INSTALLATION FOR GALLOPING IN 5 TO 20 MPH WIND CONDITION. CONTINUE VISUAL INSPECTION FOR ANOTHER 180-DAY PERIOD AS INDICATED IN PUB. 408. PROVIDE GALLOPING MITIGATION DEVICE AS RECOMMENDED BY THE FABRICATOR AND APPROVED BY THE OWNER IF THE MAXIMUM DISPLACEMENT (MAX. POSITIVE TO MAX. NEGATIVE) AT THE MAST ARM TIP EXCEEDS 8". IF A MITIGATION DEVICE IS INSTALLED, CONTINUE VISUAL INSPECTION OF MAST ARM FOR THE ABOVE CRITERIA DURING 180-DAY PERIOD. PROVIDE VISUAL INSPECTION RECORDS TO THE OWNER AT THE END OF THE 180-DAY PERIOD. GALLOPING MAY RESULT IN LARGE AMPLITUDE, RESONANT OSCILLATIONS IN A PLANE NORMAL TO THE DIRECTION OF WIND FROM UNIQUE COMBINATIONS OF ATTACHMENT GEOMETRY, ATTACHMENT ORIENTATION, ATTACHMENT WEIGHTS, WIND DIRECTION AND STRUCTURE STIFFNESS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

TRAFFIC SIGNAL SUPPORT

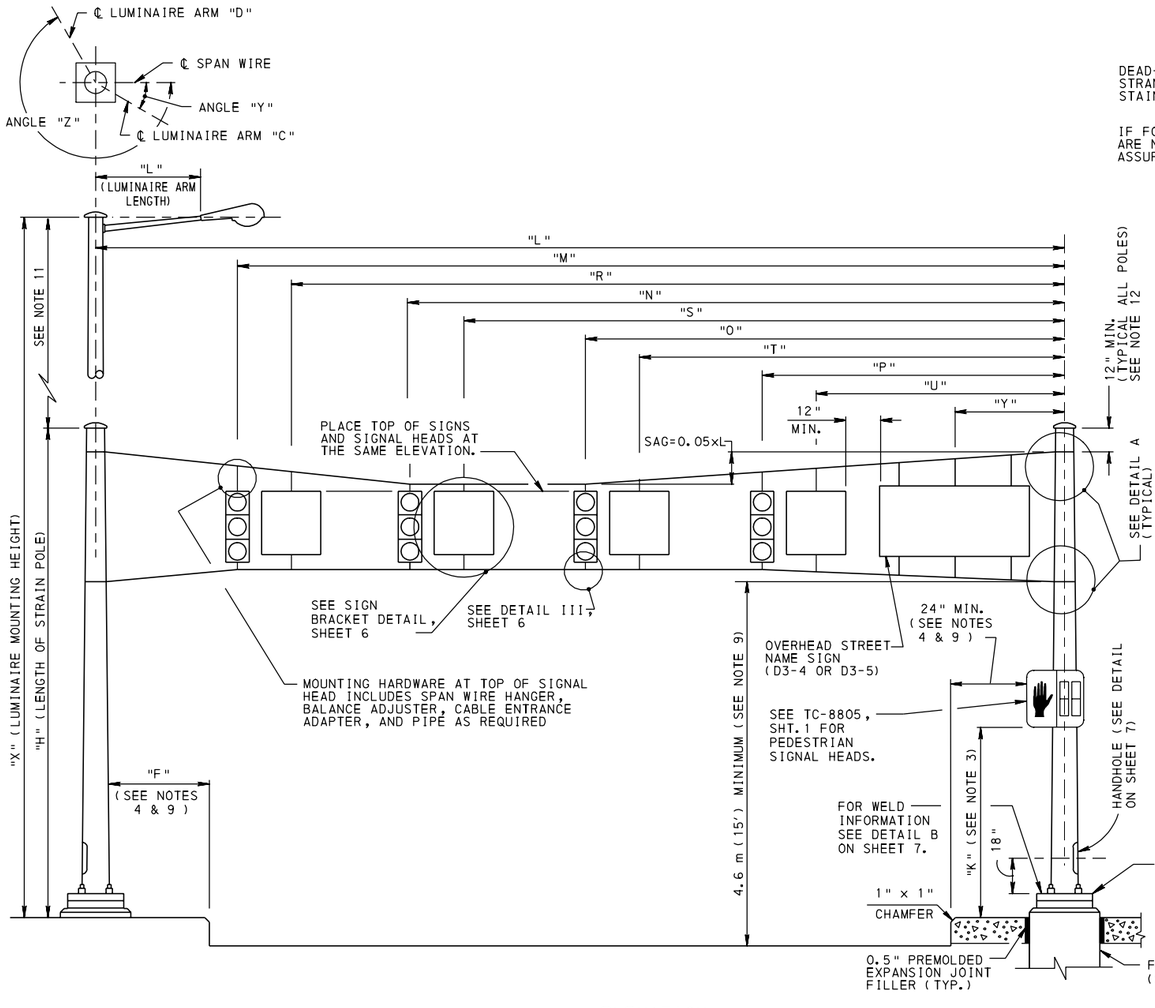
MAST ARM

RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHEET 1 OF 7
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8801

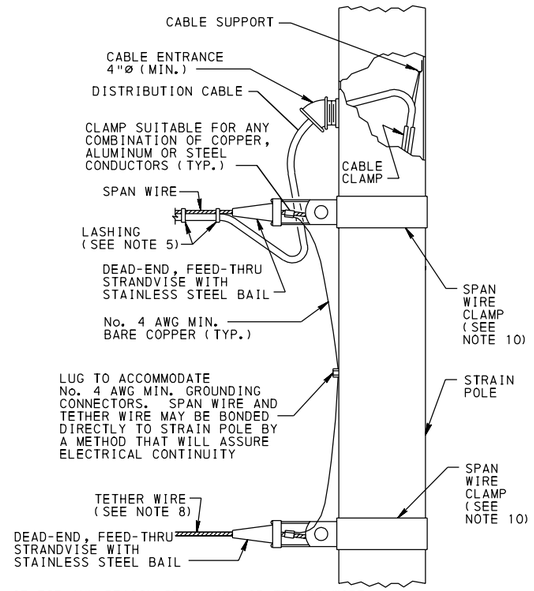
MINIMUM BREAKING STRENGTH OF SPAN WIRE

NOM. DIA. OF SPAN WIRE (IN)	ASTM A 475, CLASS A, SIEMENS-MARTIN GRADE (lbs)	ASTM B 416 (lbs)
1/4"	3150 lbs	6301 lbs
5/16"	5350 lbs	10,020 lbs
3/8"	6950 lbs	15,930 lbs
7/16"	9350 lbs	19,060 lbs
1/2"	12,100 lbs	23,000 lbs

BREAKING STRENGTH OF SPAN WIRE WILL EQUAL OR EXCEED DESIGN TENSION OF THE STRAIN POLE

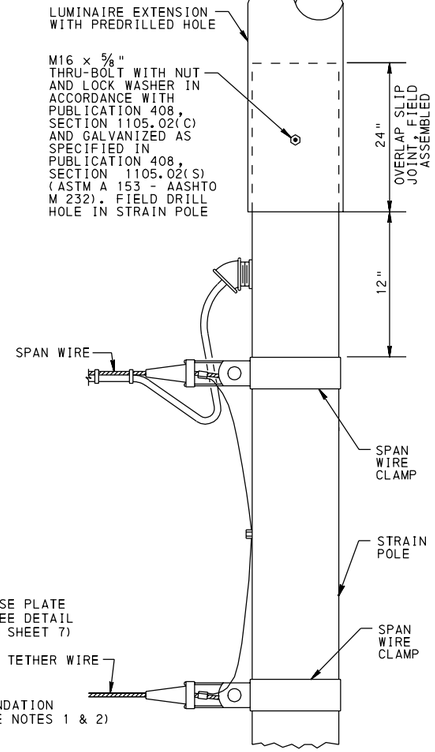


ELEVATION



IF FOR ANY REASON SPAN WIRE OR TETHER WIRE ARE NOT CONTINUOUS, PROVIDE A JUMPER TO ASSURE ELECTRICAL CONTINUITY

DETAIL A



OVERLAP SLIP JOINT DETAIL
(ALTERNATE METHOD TO PROVIDE LUMINAIRE)
(SEE NOTES 11 AND 12)

NOTES:

1. FOR FOUNDATION DETAILS, SEE SHEETS 3 THROUGH 5.
2. INSTALL A MINIMUM OF ONE GROUND ROD AT EACH FOUNDATION, SEE TC-8804, SHT. 1.
3. DIMENSION "K" IS FROM SIDEWALK. IF NO SIDEWALK, DIMENSION "K" IS FROM PAVEMENT GRADE AT CENTER OF ROADWAY. PROVIDE SPECIFIED DIMENSION "K" SUCH THAT CLEARANCE IS IN THE RANGE OF: 8' MINIMUM, 15' MAXIMUM FOR TRAFFIC SIGNAL HEADS; 7' MINIMUM, 10' MAXIMUM FOR PEDESTRIAN SIGNAL HEADS.
4. DIMENSION "F" IS 2' MINIMUM FROM CURB OR FROM EDGE OF SHOULDER. PLACE POST-MOUNTED SIGNALS 2' MINIMUM BEHIND CURB OR EDGE OF SHOULDER.
5. LASH DISTRIBUTION CABLE TO THE SPAN WIRE WITH PREFORMED GALVANIZED STEEL RODS, SELF-LOCKING CABLE TIES OF THE OUTDOOR TYPE, SOLID COPPER WIRE, GALVANIZED STEEL WIRE, STAINLESS STEEL WIRE, OR CABLE RINGS AND SADDLES. MAKE ONE COMPLETE WRAP WITH WIRE LASHING AT INTERVALS NOT EXCEEDING 6". SECURE ENDS OF WIRE LASHING TO THE SPAN WIRE WITH AN ALL PURPOSE SPLIT BOLT CONNECTOR. PLACE CABLE TIES AT INTERVALS NOT EXCEEDING 12". PROVIDE PROPER SIZE AND SPACING OF CABLE RINGS AND SADDLES ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
6. PROVIDE DEAD-ENDS THAT DEVELOP THE STRENGTH OF THE SPAN WIRE.
7. FOR QUANTITY, SIZE, SIZE OF HOLES AND BOLT CIRCLE FOR ANCHOR BOLTS, SEE SHEET 3.
8. TETHER WIRE - 1/4" DIAMETER (NOMINAL) WITH A BREAKING STRENGTH OF 1900 lbs MEETING ASTM A 475, CLASS A, COMMON GRADE.
9. PROVIDE SPECIFIED CLEARANCE IN ACCORDANCE WITH PUBLICATION 149 AND THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES".
10. EACH SPAN OR TETHER WIRE WILL HAVE AN INDIVIDUAL SPAN WIRE CLAMP.
11. USE ONE-PIECE STRAIN POLE WHEN LUMINAIRE IS REQUIRED EXCEPT FOR ROUND STEPPED SUPPORTS, OR UNLESS ALTERNATE OVERLAP SLIP JOINT IS SPECIFIED OR APPROVED ON A PROJECT-BY-PROJECT BASIS.
12. IF SPECIFIED, PROVIDE 36" MINIMUM STUB TO ALLOW FUTURE LUMINAIRE ATTACHMENT VIA OVERLAP SLIP JOINT.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

TRAFFIC SIGNAL SUPPORT

STRAIN POLE

RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHEET 2 OF 7
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8801

ANCHOR BOLT DESIGN TABLE, MAST ARM

MAST ARM LENGTH (FT)	QTY.	ONE ARM				TWO ARMS *			
		DIA. (IN)	LGTH. (FT)	B.C. (IN)	HOLE (IN)	DIA. (IN)	LGTH. (FT)	B.C. (IN)	HOLE (IN)
0 - 10	6	1¾"	**	18"	2"	1¾"	**	18"	2"
>10 - 15	6	1¾"	**	18"	2"	1¾"	**	18"	2"
>15 - 20	6	1¾"	**	18"	2"	1¾"	**	18"	2"
>20 - 25	6	1¾"	**	18"	2"	1¾"	**	18"	2"
>25 - 30	6	1¾"	**	21"	2"	1¾"	**	21"	2"
>30 - 35	6	1¾"	**	21"	2"	1¾"	**	21"	2"
>35 - 40	6	2"	**	24"	2¼"	2"	**	24"	2¼"
>40 - 45	6	2"	**	24"	2¼"	2"	**	24"	2¼"
>45 - 50	6	2"	**	24"	2¼"	2"	**	24"	2¼"
>50 - 60	6	2"	**	24"	2¼"	2"	**	24"	2¼"

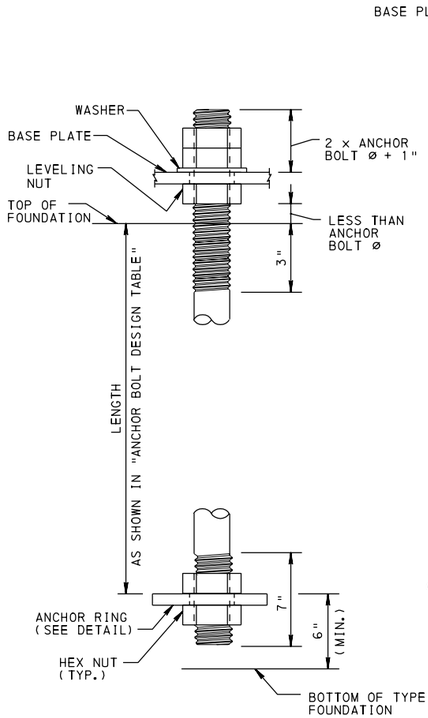
ANCHOR BOLT DESIGN TABLE, STRAIN POLE

DESIGN TENSION (LBS)	QTY.	SHAFT LENGTH 20' - 24'				SHAFT LENGTH 26' - 30'				SHAFT LENGTH 32' - 34'			
		DIA. (IN)	LGTH. (FT)	B.C. (IN)	HOLE (IN)	DIA. (IN)	LGTH. (FT)	B.C. (IN)	HOLE (IN)	DIA. (IN)	LGTH. (FT)	B.C. (IN)	HOLE (IN)
1000	6	1¾"	**	18"	2"	2"	**	18"	2¼"	2"	**	18"	2¼"
2000	6	1¾"	**	18"	2"	2"	**	18"	2¼"	2"	**	18"	2¼"
3000	6	1¾"	**	18"	2"	2"	**	18"	2¼"	2"	**	18"	2¼"
4000	6	1¾"	**	18"	2"	2"	**	18"	2¼"	2"	**	18"	2¼"
5000	6	1¾"	**	18"	2"	2"	**	18"	2¼"	2"	**	18"	2¼"
6000	6	2¼"	**	18"	2½"	2¼"	**	21"	2½"	2¼"	**	21"	2½"
7000	6	2¼"	**	18"	2½"	2¼"	**	21"	2½"	2¼"	**	21"	2½"
8000	6	2¼"	**	18"	2½"	2¼"	**	21"	2½"	2¼"	**	21"	2½"
9000	6	2¼"	**	18"	2½"	2¼"	**	21"	2½"	2½"	**	21"	2¾"
10,000	6	2¼"	**	18"	2½"	2¼"	**	21"	2½"	2½"	**	21"	2¾"

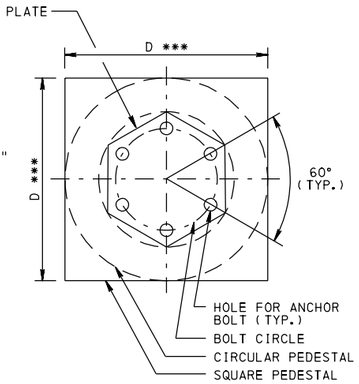
* TWO ARMS PERPENDICULAR TO EACH OTHER. ADDITIONAL STRUCTURAL ANALYSIS IS REQUIRED FOR TWO MAST ARMS AT ACUTE OR OBTUSE ANGLES TO EACH OTHER

** FOR FOUNDATION TYPE A, ANCHOR BOLT LENGTH IS 6'. FOR FOUNDATION TYPE B, ANCHOR BOLT LENGTH IS EQUAL TO "Y" OR "Z" DEPTHS MINUS 6"

B.C. = BOLT CIRCLE DIAMETER

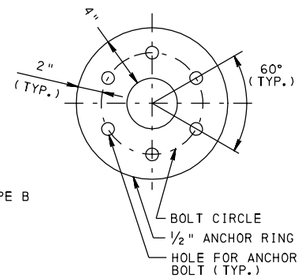


ANCHOR BOLT



*** FOR D VALUES SEE SHEETS 4 AND 5

BASE MOUNT PLAN
(MIN. 6 ANCHOR BOLTS SHOWN)



ANCHOR RING DETAIL
(N.T.S.)

DESIGN CRITERIA (SEE NOTE 13)

ALL MAIN LOAD CARRYING TENSION MEMBERS GREATER THAN ½ INCH THICKNESS MUST MEET AASHTO ZONE 2, NON-FRACTURE CRITICAL MEMBER COMPONENTS (FCM) CHARPY V-NOTCH (CVN).

EXTERNAL LOADS — AASHTO SIGN SPEC †

ICE LOAD	SECTION 3.7
WIND LOAD	APPENDIX C, SECTION C.3, EQ. C-1, WITH 80 MPH WIND AND 30% GUST FACTOR

GROUP LOADS — AASHTO SIGN SPEC SECTION 3.4 †

BOLT CRITERIA — AASHTO SIGN SPEC †

BOLT CRITERIA	SECTION 5.16
ALLOWABLE ANCHOR BOLT STRESSES	SECTION 5.17

SPREAD FOOTINGS

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MINIMUM AREA IN BEARING	100%
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT

DRILLED SHAFTS (CAISSONS) — DM4 SECTION 10.7.3.8.2P

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MAXIMUM DESIGN LATERAL DISPLACEMENT	0.5"
MODULUS OF SUBGRADE REACTION:	
ABOVE WATER TABLE	K = 60.0 POUNDS PER CUBIC INCH
BELOW WATER TABLE	K = 40.0 POUNDS PER CUBIC INCH
WATER TABLE	3 FEET BELOW GRADE
UNIT WEIGHT OF SOIL	120 POUNDS PER CUBIC FOOT
ANGLE OF INTERNAL FRICTION	25°
COHESION	0 KIPS PER SQUARE FOOT

† LEGEND:

AASHTO SIGN SPEC:	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION (2001) INCLUDING INTERIM SPECIFICATIONS (2002, 2003 AND 2006)
DM4:	PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, SEPT. 2007 (INCLUDING CHANGE NO.1 DATED JUNE 2009)
U.N.O.:	UNLESS NOTED OTHERWISE

FOUNDATION NOTES:

1. PROVIDE 3" CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615/A615M-96A FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. CHAMFER EXPOSED CONCRETE EDGES 1" x 1".
6. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 20°C (68°F).
7. GALVANIZE ALL STRUCTURAL STEEL IN ACCORDANCE WITH PUB. 408, SECTION 1104.02 (a) 9.
8. PROVIDE ANCHOR BOLT HOLES ¼" LARGER THAN BOLT DIAMETER.
9. PROVIDE ANCHOR BOLTS CONFORMING TO ASTM F1554 GRADE 55 PER PUBLICATION 408, SECTION 1105.02 (c) 3.
10. USE STEEL TEMPLATE TO SET ANCHOR BOLTS IN ACCORDANCE WITH PUBLICATION 408, SECTION 1104.02 (d).
11. STEEL TEMPLATE TO BE PROVIDED BY MAST ARM OR STRAIN POLE FABRICATOR.
12. PROVIDE ANCHOR BOLTS WITH THREADS WHICH EXTEND A MINIMUM OF 3" BELOW THE TOP OF THE FOUNDATION.
13. SEE PENNDOT PUBLICATION 149 "CRITERIA FOR THE DESIGN OF TRAFFIC SIGNAL SUPPORTS".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

TRAFFIC SIGNAL SUPPORT FOUNDATION NOTES AND ANCHOR BOLT DETAILS

RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHEET 3 OF 7
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8801

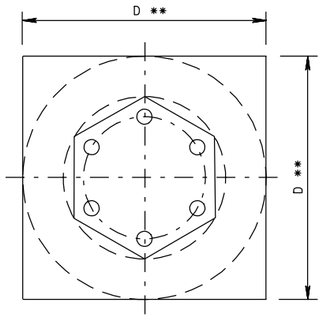
FOUNDATION FOR TRAFFIC SIGNAL SUPPORT, MAST ARM

MAST ARM LENGTH (FT)	"D" (FT)	H (FT)		"W" BAR	
		ONE ARM	TWO ARMS*	QTY.	SIZE
0 - 10	3'-0"	10'-0"	10'-6"	12	#9
>10 - 15	3'-0"	11'-6"	12'-0"	12	#9
>15 - 20	3'-0"	13'-0"	13'-0"	12	#9
>20 - 25	3'-0"	13'-6"	14'-0"	12	#9
>25 - 30	3'-0"	14'-6"	15'-0"	12	#9
>30 - 35	3'-0"	15'-0"	15'-6"	12	#9
>35 - 40	3'-6"	15'-6"	16'-6"	14	#9
>40 - 45	3'-6"	15'-6"	17'-0"	14	#9
>45 - 50	3'-6"	16'-6"	17'-6"	14	#9
>50 - 60	3'-6"	17'-0"	18'-6"	14	#9

* TWO ARMS PERPENDICULAR TO EACH OTHER. ADDITIONAL STRUCTURAL ANALYSIS IS REQUIRED FOR TWO MAST ARMS AT ACUTE OR OBTUSE ANGLES TO EACH OTHER.

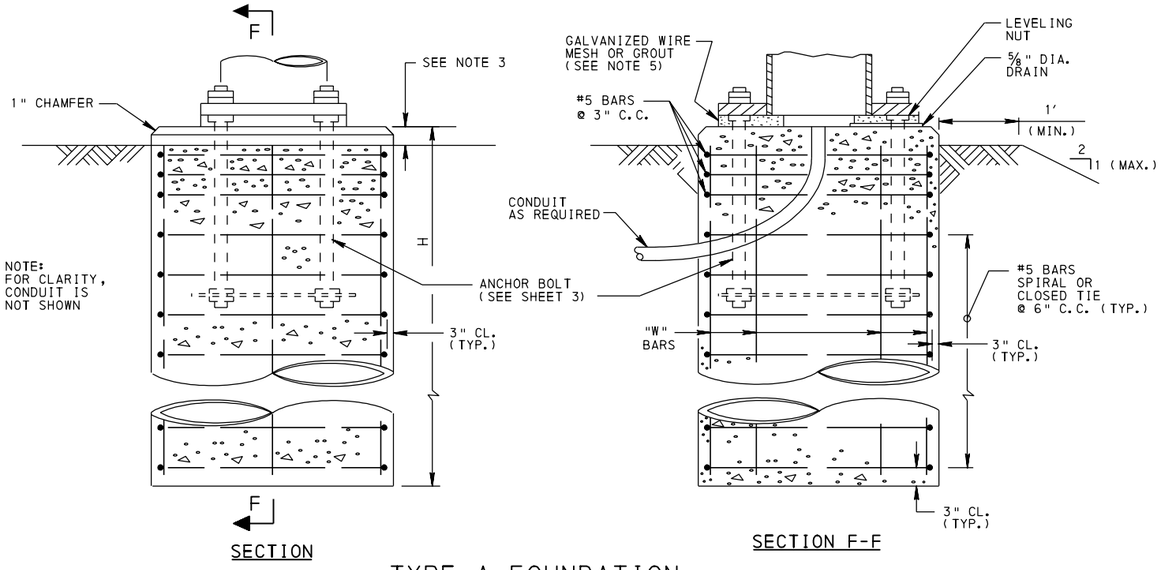
MAST ARM FOUNDATION NOTES:

1. WHEN THE SHAFT OF THE SUPPORT IS EXTENDED IN LENGTH AND PROVIDED WITH A LUMINAIRE ARM, OR WHEN THE SHAFT OF THE SUPPORT IS EXTENDED IN LENGTH BY 36" MINIMUM TO ALLOW FOR INSTALLATION OF A LUMINAIRE IN THE FUTURE VIA AN OVERLAP SLIP JOINT, THE DEPTH "H" REQUIRED BY THE DESIGN TABLE FOR THE TYPE "A" FOUNDATION SHALL BE INCREASED BY 8".
2. NO DEVIATION IN THE FOUNDATION DESIGN GIVEN HERE IS REQUIRED WHEN THE TRAFFIC SIGNAL CONTROLLER CABINET IS MOUNTED ON THE SHAFT.
3. MAST ARM FOUNDATIONS ARE BASED ON STANDARD STRUCTURE LOADINGS SHOWN IN THE DEPARTMENT'S "CRITERIA FOR THE DESIGN OF TRAFFIC SIGNAL SUPPORTS", PUBLICATION 149. FOUNDATION DESIGN ASSUMES :
   (1) LUMINAIRE, WHEN USED, HAS A 30' MOUNTING HEIGHT AND A 15' ARM LENGTH.
   (2) THE CENTROID OF SIGNALS AND SIGNS ON MAST ARM AT 20' MAXIMUM FROM TOP OF THE FOUNDATION.
   (3) A CABINET, WHEN USED, HAS A 51" HEIGHT, 30" WIDTH, 22" DEPTH AND DEAD LOAD OF 281 LBS WITH CENTROID LOCATED AT 54" MAXIMUM FROM TOP OF THE FOUNDATION.
4. WHEN A MAST ARM SUPPORT HAS TWO ARMS WHICH ARE PERPENDICULAR TO EACH OTHER, USE THE FOUNDATION IN THE DESIGN TABLE FOR THE LENGTH OF THE LONGER ARM.



PLAN

** DIAMETER IF CIRCULAR, OR SIDE IF SQUARE. CIRCULAR FOUNDATIONS SHALL BE SQUARE FROM THE TOP TO A POINT 6" BELOW THE GROUND LINE, IF SIDEWALK IS PRESENT



TYPE A FOUNDATION

FOUNDATION FOR TRAFFIC SIGNAL SUPPORT, STRAIN POLE

DESIGN TENSION (LBS)	"D" (FT)	SHAFT LENGTH 20' - 34'									
		"W" BAR		20' SHAFT	22' SHAFT	24' SHAFT	26' SHAFT	28' SHAFT	30' SHAFT	32' SHAFT	34' SHAFT
		QTY.	SIZE	FOUNDATION DEPTH H (FT)	FOUNDATION DEPTH H (FT)	FOUNDATION DEPTH H (FT)	FOUNDATION DEPTH H (FT)	FOUNDATION DEPTH H (FT)	FOUNDATION DEPTH H (FT)	FOUNDATION DEPTH H (FT)	FOUNDATION DEPTH H (FT)
1000	3'-0"	12	#9	11'-0"	11'-6"	11'-6"	12'-0"	12'-6"	12'-6"	13'-0"	13'-0"
2000	3'-0"	12	#9	12'-6"	13'-0"	13'-0"	13'-6"	14'-0"	14'-0"	14'-6"	14'-6"
3000	3'-0"	12	#9	14'-0"	14'-0"	14'-6"	15'-0"	15'-0"	15'-0"	15'-6"	16'-0"
4000	3'-0"	12	#9	15'-0"	15'-0"	15'-6"	16'-0"	16'-0"	16'-6"	17'-0"	17'-0"
5000	3'-0"	12	#9	16'-0"	16'-0"	16'-6"	17'-0"	17'-0"	17-'6"	18'-0"	18'-0"
6000	3'-0"	12	#9	16'-6"	17'-0"	17'-0"	17'-6"	18'-0"	18'-0"	18'-6"	19'-0"
7000	3'-0"	12	#9	17'-6"	17'-6"	18'-0"	18'-6"	19'-0"	19'-0"	19'-6"	20'-6"
8000	3'-0"	16	#9	18'-0"	18'-6"	19'-0"	19'-6"	19'-6"	20'-6"	21'-0"	21'-6"
9000	3'-0"	16	#9	19'-0"	19'-0"	19'-6"	20'-6"	21'-0"	21'-6"	22'-0"	22'-6"
10,000	3'-0"	16	#9	19'-6"	20'-6"	21'-0"	21'-6"	22'-0"	22'-6"	23'-6"	24'-0"

FOUNDATION FOR TRAFFIC SIGNAL SUPPORT, PEDESTAL DESIGN TABLE

SHAFT LENGTH (FT)	"D" (FT)	ANCHOR BOLTS			DEPTH H (FT)	"W" BAR	
		QTY.	DIA. (IN)	LENGTH (FT)		QTY.	SIZE
0' - 10'	3'-0"	6	3/4"	2'-0"	6'-0"	8	#8
>10' - 14'	3'-0"	6	3/4"	2'-0"	6'-6"	8	#8

STRAIN POLE FOUNDATION NOTES:

1. NO DEVIATION IN THE FOUNDATION DESIGN GIVEN HERE IS REQUIRED WHEN A TRAFFIC SIGNAL CONTROLLER CABINET OF THE FOLLOWING SIZE IS MOUNTED ON THE SHAFT:

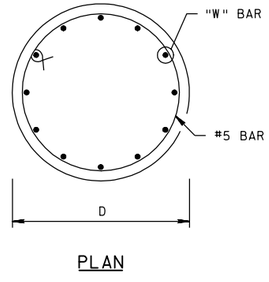
   MAXIMUM CABINET SIZE: 51" HEIGHT, 30" WIDTH, AND 22" DEPTH WITH DEAD LOAD OF 281 LBS AND CENTROID HEIGHT LOCATED AT 54" MAXIMUM FROM TOP OF THE FOUNDATION.

2. NO DEVIATION IN THE FOUNDATION DESIGN GIVEN HERE IS REQUIRED WHEN THE SHAFT OF THE SUPPORT IS EXTENDED IN LENGTH AND PROVIDED WITH A LUMINAIRE ARM, OR WHEN THE SHAFT OF THE SUPPORT IS EXTENDED IN LENGTH BY 36" MINIMUM TO ALLOW FOR INSTALLATION OF A LUMINAIRE IN THE FUTURE VIA AN OVERLAP SLIP JOINT. THE FOUNDATION DESIGN ASSUMES A 15' LUMINAIRE ARM LENGTH AND THE FOLLOWING LUMINAIRE MOUNTING HEIGHTS:

LENGTH OF STRAIN POLE (FT)	LUMINAIRE MOUNTING HEIGHT "X" (FT)
20', 22', AND 24'	30'
26', 28', AND 30'	35'
32' AND 34'	40'

NOTES:

1. PROVIDE THE TYPE "A" FOUNDATION AT ALL LOCATIONS, EXCEPT THE TYPE "B" FOUNDATION (SHOWN ON SHEET 5) MAY BE USED WHEN PHYSICAL CONDITIONS PREVENT PLACING THE TYPE "A" FOUNDATION TO ITS REQUIRED DEPTH.
2. FOR DESIGN CRITERIA SEE SHEET 3.
3. IN A PAVED AREA, PLACE THE TOP OF FOUNDATION FLUSH WITH THE SURFACE OF THE ADJACENT PAVEMENT. IN UNPAVED AREAS TOP OF FOUNDATION TO BE AT LEAST 6" ABOVE TOP OF GROUND.
4. FOR GROUND ROD SIZE AND INSTALLATION DETAILS, SEE TC-8804.
5. IN A PAVED AREA, GROUT SHALL BE PLACED.



PLAN

CLOSED TIE DETAIL

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

TRAFFIC SIGNAL SUPPORT

FOUNDATION TYPE A

RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHEET 4 OF 7
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8801

FOUNDATION FOR TRAFFIC SIGNAL SUPPORT, MAST ARM

MAST ARM LENGTH (FT)	"D" (FT)	"W" BAR		"L" BAR	Y (FT)	S (FT)		Z (FT)	S (FT)	
		QTY.	SIZE	SIZE		ONE ARM	TWO ARMS*		ONE ARM	TWO ARMS*
0 - 10	3'-0"	12	#9	#4	4'-0"	9'-6"	9'-6"	5'-0"	9'-6"	9'-6"
>10 - 15	3'-0"	12	#9	#4	4'-0"	10'-6"	10'-6"	5'-0"	10'-6"	10'-6"
>15 - 20	3'-0"	12	#9	#5	4'-0"	11'-6"	11'-6"	5'-6"	11'-6"	11'-6"
>20 - 25	3'-0"	12	#9	#6	4'-0"	12'-0"	12'-0"	6'-0"	12'-0"	12'-0"
>25 - 30	3'-0"	12	#9	#6	4'-6"	12'-6"	13'-0"	6'-6"	12'-6"	12'-6"
>30 - 35	3'-0"	12	#9	#7	4'-6"	13'-0"	13'-6"	7'-0"	13'-0"	13'-6"
>35 - 40	3'-6"	14	#9	#7	5'-0"	13'-6"	14'-0"	7'-0"	13'-0"	13'-6"
>40 - 45	3'-6"	14	#9	#7	5'-0"	13'-6"	14'-6"	7'-6"	13'-0"	13'-6"
>45 - 50	3'-6"	14	#9	#7	5'-6"	14'-0"	14'-6"	8'-0"	13'-0"	13'-6"
>50 - 60	3'-6"	14	#9	#8	5'-6"	14'-6"	16'-0"	8'-0"	13'-6"	14'-6"

* TWO ARMS PERPENDICULAR TO EACH OTHER. ADDITIONAL STRUCTURAL ANALYSIS IS REQUIRED FOR TWO MAST ARMS AT ACUTE OR OBTUSE ANGLES TO EACH OTHER.

FOUNDATION FOR TRAFFIC SIGNAL SUPPORT, STRAIN POLE

DESIGN TENSION (LBS)	SHAFT LENGTH 20' - 24'										SHAFT LENGTH 26' - 30'										SHAFT LENGTH 32' - 34'									
	"D" (FT)	"W" BAR		"L" BAR	Y (FT)	S^L (FT)	S (FT)	Z (FT)	S^L (FT)	S (FT)	"D" (FT)	"W" BAR		"L" BAR	Y (FT)	S^L (FT)	S (FT)	Z (FT)	S^L (FT)	S (FT)	"D" (FT)	"W" BAR		"L" BAR	Y (FT)	S^L (FT)	S (FT)	Z (FT)	S^L (FT)	S (FT)
		QTY.	SIZE	SIZE								QTY.	SIZE	SIZE								QTY.	SIZE	SIZE						
1000	3'-0"	12	#9	#4	4'-0"	9'-6"	9'-0"	4'-0"	9'-6"	9'-0"	3'-0"	12	#9	#4	4'-0"	10'-6"	10'-6"	4'-0"	10'-6"	10'-0"	3'-0"	12	#9	#4	4'-0"	11'-0"	10'-6"	4'-0"	11'-0"	10'-6"
2000	3'-0"	12	#9	#4	4'-0"	10'-6"	10'-6"	4'-0"	10'-6"	10'-6"	3'-0"	12	#9	#5	4'-0"	12'-0"	12'-0"	4'-0"	12'-0"	11'-6"	3'-0"	12	#9	#5	4'-0"	12'-6"	12'-0"	4'-0"	12'-6"	12'-0"
3000	3'-0"	12	#9	#5	4'-0"	11'-6"	11'-6"	4'-0"	12'-0"	11'-6"	3'-0"	12	#9	#5	4'-0"	13'-0"	13'-0"	5'-0"	12'-6"	12'-0"	3'-0"	12	#9	#6	4'-0"	13'-6"	13'-0"	5'-0"	12'-6"	12'-6"
4000	3'-0"	12	#9	#5	4'-0"	12'-6"	12'-0"	5'-0"	12'-0"	12'-6"	3'-0"	12	#9	#6	4'-6"	14'-0"	14'-0"	6'-0"	12'-6"	12'-6"	3'-0"	12	#9	#6	4'-6"	14'-0"	14'-0"	6'-0"	13'-0"	13'-0"
5000	3'-0"	12	#9	#6	4'-6"	13'-0"	12'-6"	6'-0"	12'-0"	12'-6"	3'-0"	12	#9	#6	5'-0"	14'-6"	14'-6"	6'-6"	13'-0"	13'-0"	3'-0"	12	#9	#7	5'-0"	14'-6"	14'-6"	6'-6"	13'-6"	13'-0"
6000	3'-0"	12	#9	#6	5'-0"	13'-0"	13'-0"	6'-6"	12'-6"	12'-6"	3'-0"	12	#9	#7	5'-6"	14'-6"	14'-6"	7'-0"	13'-6"	13'-0"	3'-0"	12	#9	#7	5'-6"	14'-6"	14'-6"	7'-0"	14'-0"	13'-6"
7000	3'-0"	12	#9	#7	5'-0"	13'-6"	13'-6"	7'-0"	13'-0"	13'-0"	3'-0"	12	#9	#7	6'-0"	15'-0"	15'-0"	8'-0"	13'-6"	13'-6"	3'-0"	16	#9	#8	6'-0"	15'-0"	15'-0"	8'-0"	14'-0"	13'-6"
8000	3'-0"	12	#9	#7	5'-6"	14'-0"	14'-0"	7'-6"	13'-0"	13'-0"	3'-0"	12	#9	#8	6'-6"	15'-6"	15'-6"	8'-6"	13'-6"	13'-6"	3'-0"	16	#9	#8	6'-6"	15'-6"	15'-6"	8'-6"	14'-0"	14'-0"
9000	3'-0"	12	#9	#7	6'-0"	14'-0"	14'-0"	8'-0"	13'-6"	13'-6"	3'-0"	16	#9	#8	7'-0"	15'-6"	15'-6"	9'-0"	14'-0"	13'-6"	3'-0"	16	#9	#9	7'-0"	15'-6"	15'-6"	9'-0"	14'-6"	14'-6"
10,000	3'-0"	12	#9	#8	6'-6"	14'-6"	14'-0"	8'-6"	13'-6"	13'-6"	3'-0"	16	#9	#9	7'-6"	15'-6"	15'-6"	10'-0"	14'-0"	14'-0"	3'-0"	16	#9	#9	7'-6"	15'-6"	15'-6"	10'-0"	14'-6"	14'-6"

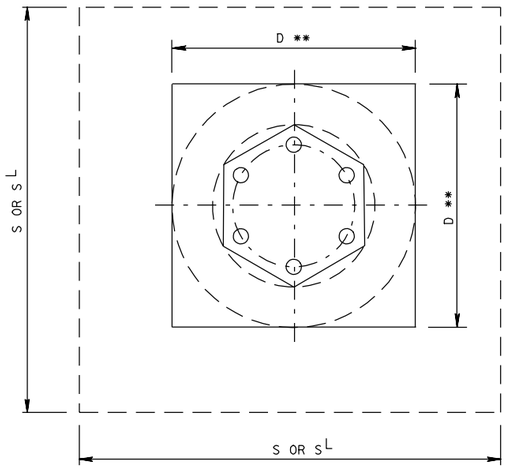
S^L = WITH LUMINAIRE

MAST ARM FOUNDATION NOTES:

1. NO DEVIATION IN THE FOUNDATION DESIGN GIVEN HERE IS REQUIRED WHEN THE SHAFT OF THE SUPPORT IS EXTENDED IN LENGTH AND PROVIDED WITH A LUMINAIRE ARM, OR WHEN THE SHAFT OF THE SUPPORT IS EXTENDED IN LENGTH BY 36" MINIMUM TO ALLOW FOR INSTALLATION OF A LUMINAIRE IN THE FUTURE VIA AN OVERLAP SLIP JOINT. THE FOUNDATION DESIGN ASSUMES A 15' LUMINAIRE ARM LENGTH AND A 30' MOUNTING HEIGHT.
2. NO DEVIATION IN THE FOUNDATION DESIGN GIVEN HERE IS REQUIRED WHEN A TRAFFIC SIGNAL CONTROLLER CABINET OF SIZE SPECIFIED ON SHEET 4 IS MOUNTED ON THE SHAFT.
3. MAST ARM FOUNDATIONS ARE BASED ON STANDARD STRUCTURE LOADINGS SHOWN IN THE DEPARTMENT'S "CRITERIA FOR THE DESIGN OF TRAFFIC SIGNAL SUPPORTS", PUBLICATION 149. FOUNDATION DESIGN ASSUMES THAT THE CENTROID OF SIGNALS AND SIGNS ON MAST ARM AT 20' MAXIMUM FROM TOP OF THE FOUNDATION.
4. WHEN A MAST ARM SUPPORT HAS TWO ARMS WHICH ARE PERPENDICULAR TO EACH OTHER, USE THE FOUNDATION IN THE DESIGN TABLE FOR THE LENGTH OF THE LONGER ARM.

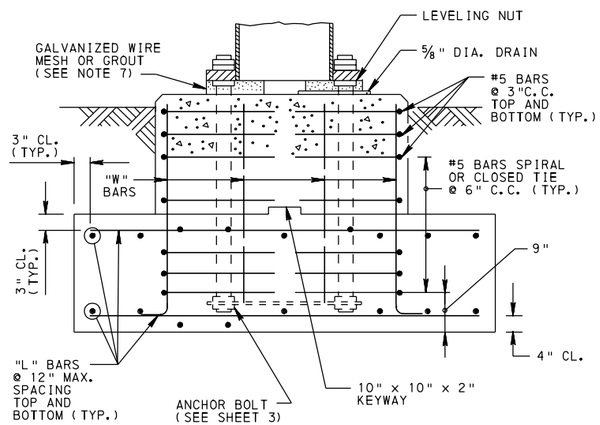
NOTES:

1. THE TYPE "B" FOUNDATION MAY BE AUTHORIZED FOR USE WHERE CONDITIONS PREVENT PLACING THE TYPE "A" FOUNDATION (AS SHOWN ON SHEET 4) TO ITS REQUIRED DEPTH.
2. FOR DESIGN CRITERIA SEE SHEET 3.
3. IN A PAVED AREA, PLACE THE TOP OF FOUNDATION FLUSH WITH THE SURFACE OF THE ADJACENT PAVEMENT. IN UNPAVED AREAS TOP OF FOUNDATION TO BE AT LEAST 6" ABOVE TOP OF GROUND.
4. FOR GROUND ROD SIZE AND INSTALLATION DETAILS, SEE TC-8804.
5. DISTANCE "F" AS REQUIRED TO AVOID PAVEMENT AND/OR CURB EXCAVATION.
6. SEE SHEET 4 FOR CLOSED TIE DETAIL.
7. IN A PAVED AREA, GROUT SHALL BE PLACED.

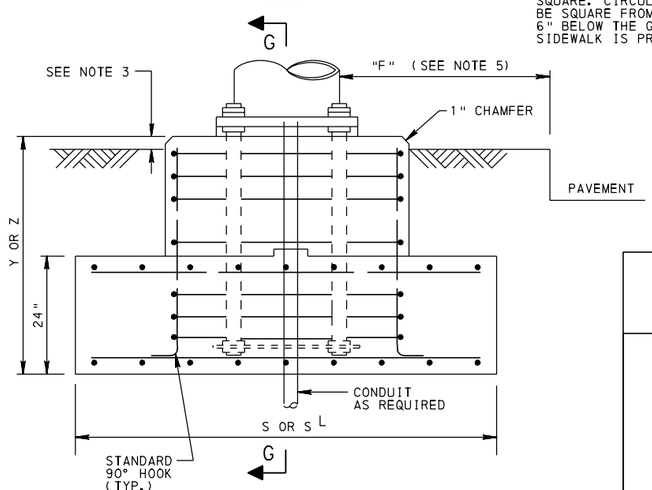


PLAN

** DIAMETER IF CIRCULAR, OR SIDE IF SQUARE. CIRCULAR FOUNDATIONS SHALL BE SQUARE FROM THE TOP TO A POINT 6" BELOW THE GROUND LINE, IF SIDEWALK IS PRESENT.



SECTION G-G
(FOR CLARITY, CONDUIT IS NOT SHOWN)



SECTION

STRAIN POLE FOUNDATION NOTES:

1. NO DEVIATION IN THE FOUNDATION DESIGN GIVEN HERE IS REQUIRED WHEN A TRAFFIC SIGNAL CONTROLLER CABINET OF SIZE SPECIFIED ON SHEET 4 IS MOUNTED ON THE SHAFT.
2. USE S FOUNDATION SIZE WHEN THE SHAFT OF THE SUPPORT IS EXTENDED IN LENGTH AND PROVIDED WITH A LUMINAIRE ARM, OR WHEN THE SHAFT OF THE SUPPORT IS EXTENDED IN LENGTH BY 36" MINIMUM TO ALLOW FOR INSTALLATION OF A LUMINAIRE IN THE FUTURE VIA AN OVERLAP SLIP JOINT. THE FOUNDATION DESIGN ASSUMES A 15' LUMINAIRE ARM LENGTH AND THE FOLLOWING LUMINAIRE MOUNTING HEIGHTS:

LENGTH OF STRAIN POLE (FT)	LUMINAIRE MOUNTING HEIGHT "X" (FT)
20', 22', AND 24'	30'
26', 28' AND 30'	35'
32' AND 34'	40'

TYPE B FOUNDATION

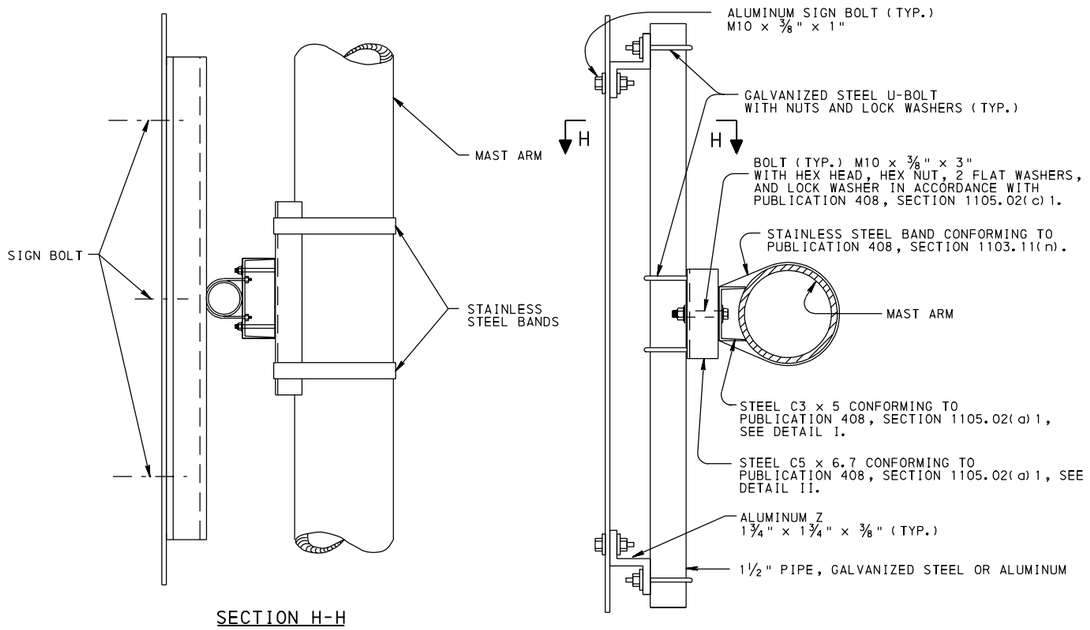
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

TRAFFIC SIGNAL SUPPORT

FOUNDATION TYPE B

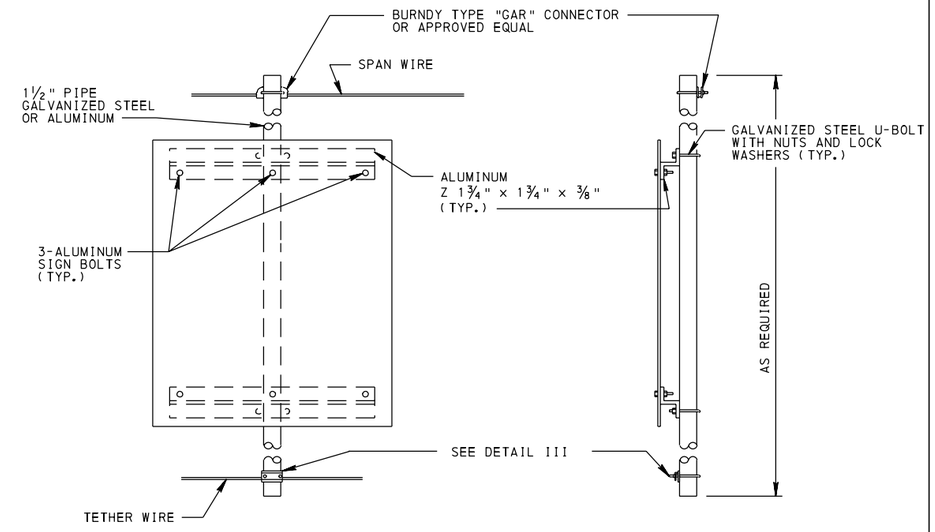
RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHEET 5 OF 7
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8801



SECTION H-H

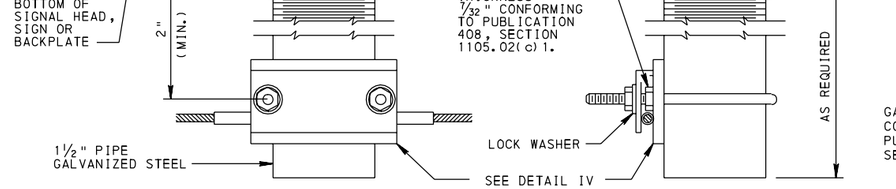
SIGN BRACKET - MAST ARM

(AN ALTERNATE METHOD FOR ATTACHING SIGNS TO THE MAST ARM MAY BE USED IF APPROVED BY THE ENGINEER)

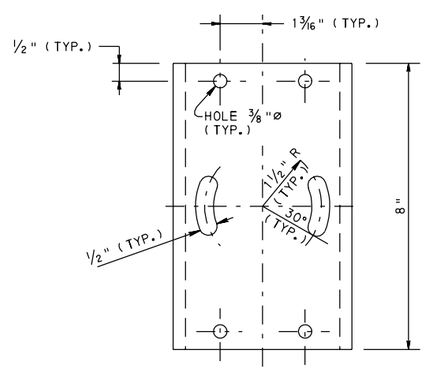


SIGN BRACKET - SPAN WIRE

(AN ALTERNATE METHOD FOR ATTACHING SIGNS TO THE SPAN WIRE MAY BE USED IF APPROVED BY THE ENGINEER)

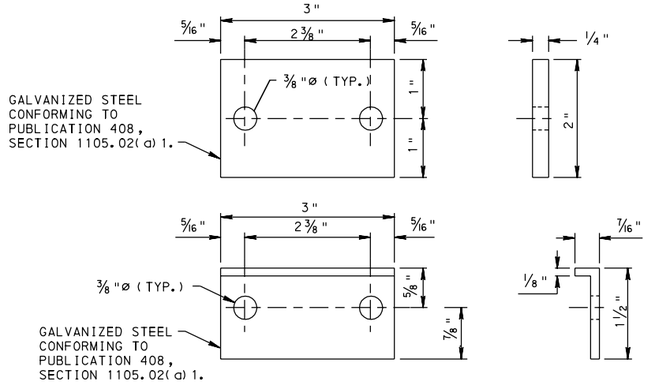


STEEL C3 x 5 GALVANIZED AFTER FABRICATION DETAIL I



STEEL C5 x 6.7 GALVANIZED AFTER FABRICATION DETAIL II

DETAIL III



DETAIL IV

NOTES:

1. USE ONE BRACKET FOR SIGNS WITH A WIDTH OF 36" OR LESS. USE TWO BRACKETS FOR SIGNS WITH WIDTHS GREATER THAN 36" AND NOT EXCEEDING 48". USE THREE BRACKETS FOR SIGNS WITH WIDTHS GREATER THAN 48" AND NOT EXCEEDING 96".
2. Z 1 3/4" x 1 3/4" x 3/8" SHALL BE MANUFACTURED FROM ALUMINUM CONFORMING TO ASTM B 209M, ALLOY 6061-T6.
3. 1.5" GALVANIZED STEEL PIPE SHALL CONFORM TO PUBLICATION 408, SECTION 1105.02(j)1.
4. ALLUMINUM SIGN BOLTS, NUTS, WASHERS AND NYLON WASHERS SHALL CONFORM TO PUBLICATION 408, SECTION 1103.11(o), SECTION 1103.11(p), SECTION 1103.11(b)1 AND SECTION 1103.11(b)2 RESPECTIVELY.
5. GALVANIZED STEEL U-BOLTS, NUTS AND LOCK WASHERS SHALL BE CONFORM TO PUBLICATION 408, SECTION 1105.02(c)1, AND SHALL BE OF M6 x 1/4" x 3" x 2 3/8".

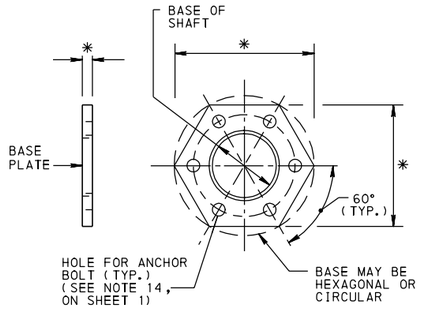
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

TRAFFIC SIGNAL SUPPORT

BRACKETS

RECOMMENDED Oct.14,2010 Dan C Rowe CHIEF, TRANSPORTATION OPERATIONS DIVISION	RECOMMENDED Oct.14,2010 Daryl R Wilt ACTING DIR., BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	SHEET 6 OF 7 TC-8801



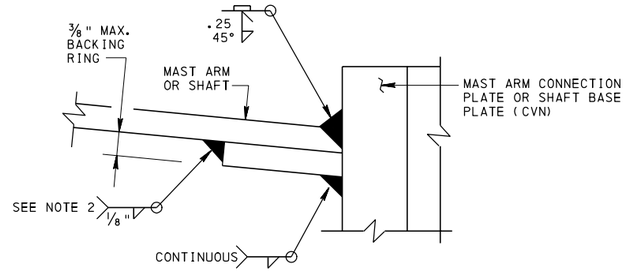
* AS REQUIRED TO MEET THE DEPARTMENT'S "CRITERIA FOR THE DESIGN OF TRAFFIC SIGNAL SUPPORTS", PUBLICATION 149.

BASE PLATE

(MIN. 6 ANCHOR BOLTS SHOWN)

BASE PLATE AND CONNECTION PLATE THICKNESS

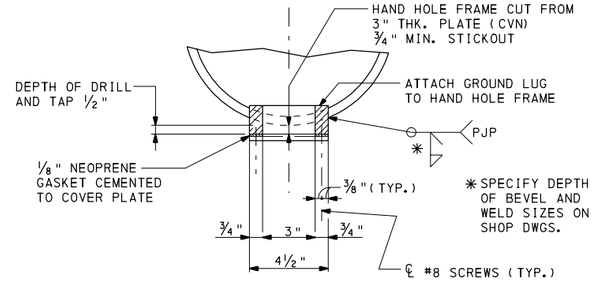
SHAFT OR COLUMN CONNECTION DIAMETER (IN)	PLATE THICKNESS MINIMUM (IN)
LESS THAN 6"	1"
6" TO 13"	2"
GREATER THAN 13" BUT LESS THAN 19"	2½"
GREATER THAN OR EQUAL TO 19"	3"



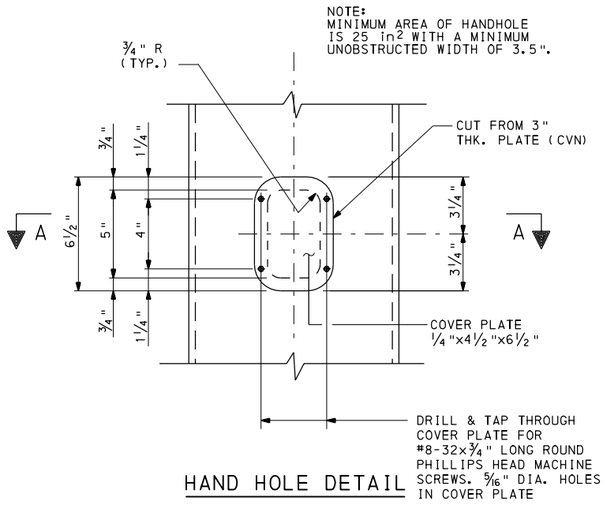
DETAIL B

(MAST ARM CONNECTION SHOWN, SHAFT CONNECTION TO BASE PLATE SIMILAR)

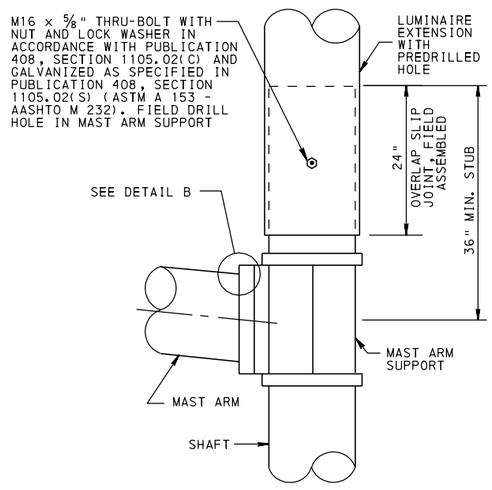
1. BACKING RING MUST BE FITTED/SIZED TO THE MAST ARM OR SHAFT AND CONTINUOUSLY FILLET WELDED TO THE CONNECTION PLATE OR BASE PLATE BEFORE THE FULL PENETRATION GROOVE WELD IS MADE. BACKING RING MUST BE FABRICATED AS A CONTINUOUS RING.
2. FOR MAST ARMS OR SHAFTS LESS THAN 18"ø, THIS FILLET WELD IS NOT REQUIRED BUT SHOP IS TO APPLY SILICON CAULKING TO THIS LOCATION AFTER POLE ASSEMBLY IS GALVANIZED.



SECTION A-A

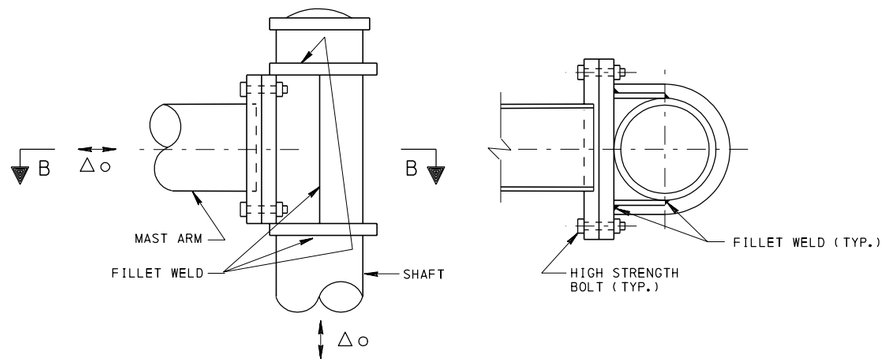


HAND HOLE DETAIL



OVERLAP SLIP JOINT DETAIL

(ALTERNATE METHOD TO PROVIDE LUMINAIRE)
(SEE NOTES 11 AND 12 ON SHEET 1)



ELEVATION SECTION B-B

MAST-ARM-TO-SHAFT CONNECTION DETAIL

(RING-STIFFENED BUILT-UP BOX)

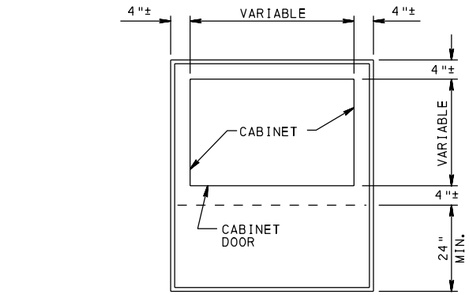
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

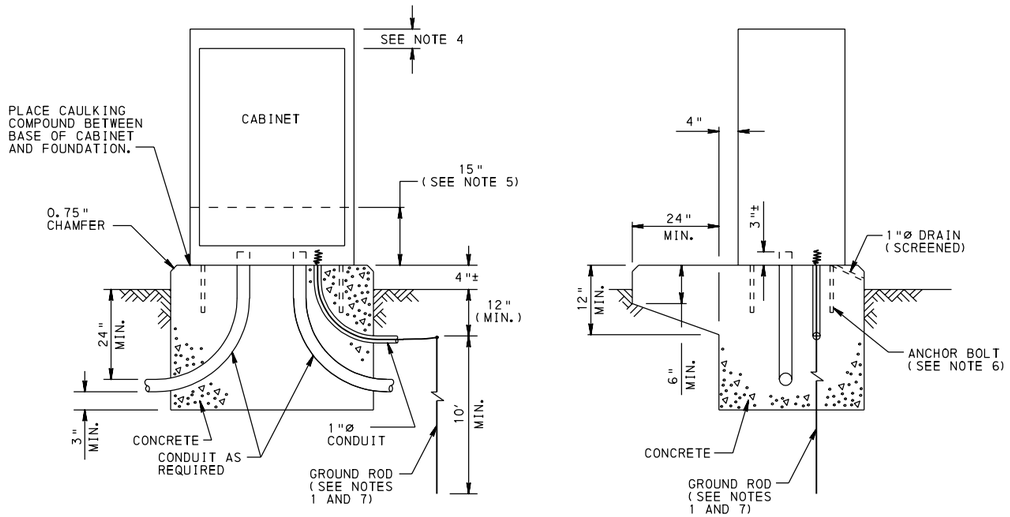
STANDARD

TRAFFIC SIGNAL SUPPORT

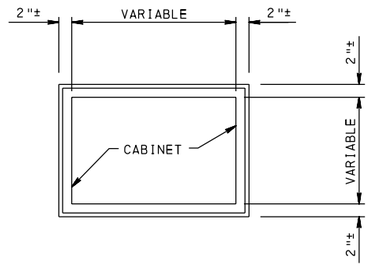
MISCELLANEOUS DETAILS

RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHEET 7 OF 7
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8801



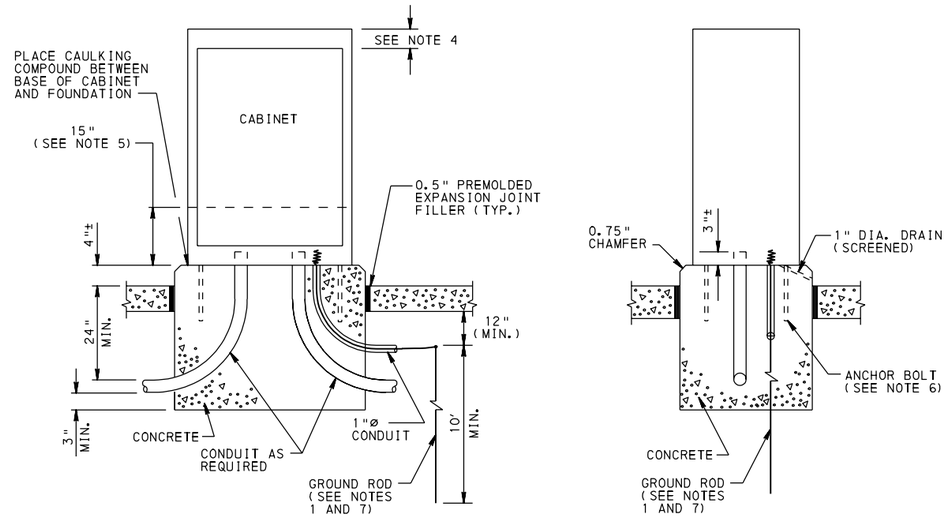


IN EARTH



NOTE:

BASE-MOUNTED CONTROLLER ASSEMBLIES LOCATED IN A PAVED SURFACE SHALL HAVE THE ANCHOR BOLTS INSIDE THE CABINET.

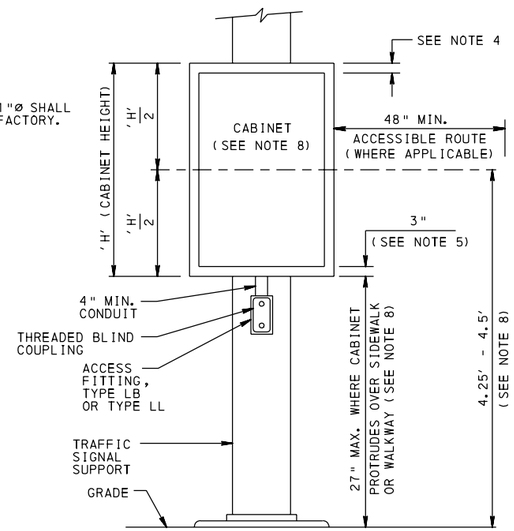


IN PAVED SURFACE

CONTROLLER ASSEMBLY ON CEMENT CONCRETE FOUNDATION TYPE I MOUNTING

NOTE:

ANY HOLE LARGER THAN 1"ø SHALL BE REINFORCED AT THE FACTORY.



CONTROLLER ASSEMBLY ON TRAFFIC SIGNAL SUPPORT TYPE II MOUNTING

NOTES:

1. PROVIDE GROUND ROD AS SPECIFIED IN SECTION 1101.11(J) OF PUBLICATION 408.
2. ANCHOR BOLT, NUT AND WASHER SHALL BE GALVANIZED.
3. HARDWARE FOR ATTACHING CABINET TO TRAFFIC SIGNAL SUPPORT SHALL BE ALUMINUM, GALVANIZED STEEL, OR STAINLESS STEEL.
4. NO PORTION OF ANY EQUIPMENT, EXCEPT FAN, BETWEEN THE TOP OF DOOR OPENING AND TOP OF CABINET.
5. MINIMUM CLEARANCE BETWEEN BOTTOM OF CABINET AND TERMINALS, EQUIPMENT OR DEVICES.
6. ANCHOR BOLTS M12 x ½" x 12" OR DRILL CONCRETE TO RECEIVE ½" DIA x 3.75" LONG EXPANSION BOLT OR APPROVED EQUAL.
7. FOR GROUND ROD SIZE AND INSTALLATION DETAILS, SEE TC-8804.
8. MOUNT CABINET ON TRAFFIC SIGNAL SUPPORT IN A MANNER NOT TO PROTRUDE OVER EXISTING SIDEWALK. WHERE THIS IS NOT POSSIBLE, COMPLY WITH TYPE II MOUNTING DETAIL AND PUBLICATION 13M, CHAPTER 6.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

CONTROLLER ASSEMBLY

RECOMMENDED Oct.14,2010 CHIEF, TRANSPORTATION OPERATIONS DIVISION	RECOMMENDED Oct.14,2010 ACTING DIR., BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	SHT. 1 OF 1 TC-8802

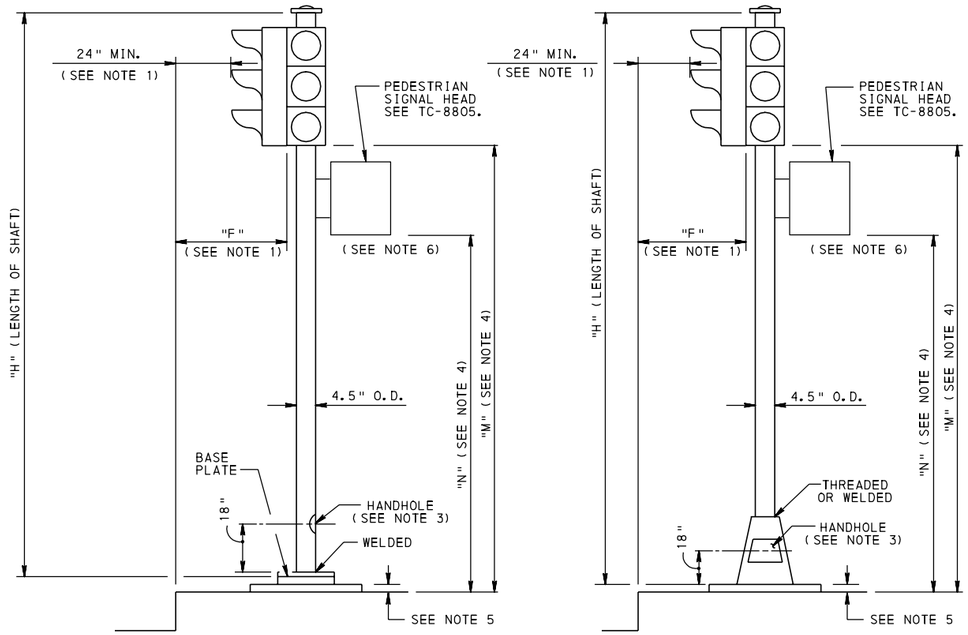
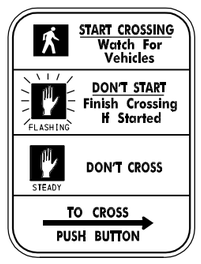


PLATE BASE CAST BASE

TRAFFIC SIGNAL SUPPORT-PEDESTAL

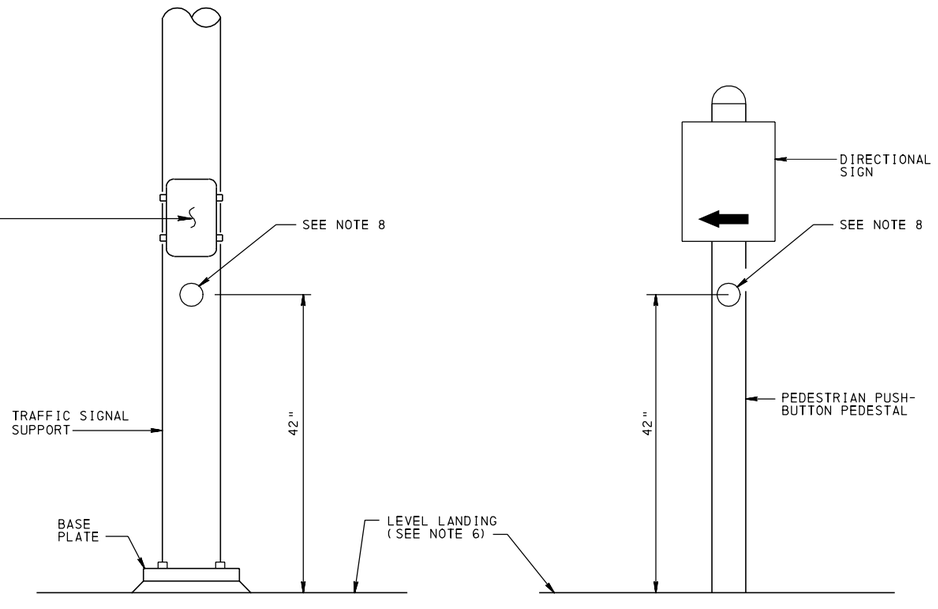
R10-3B



R10-3E

R10-4B

NOTE:
R10-4B, OR R10-3B, OR R10-3E AT LOCATIONS WITH WALKING PERSON/UPRAISED HAND PEDESTRIAN SIGNALS.



PEDESTRIAN PUSHBUTTON VERTICAL PLACEMENT

NOTES:

1. PROVIDE 24" MINIMUM CLEARANCE. IF THERE IS NO CURB, CLEARANCE IS FROM EDGE OF SHOULDER.
2. FOR DETAIL OF FOUNDATION, SEE TC-8801.
3. PROVIDE 3" x 5" HANDHOLE OPENING WITH A MINIMUM FRAME THICKNESS OF ⅜".
4. DIMENSIONS "M" AND "N" ARE FROM SIDEWALK. IF NO SIDEWALK, DIMENSIONS ARE FROM PAVEMENT GRADE AT CENTER OF ROADWAY. PROVIDE SPECIFIED DIMENSION "M" SUCH THAT CLEARANCE IS IN THE RANGE OF 8' MINIMUM, 19' MAXIMUM FOR TRAFFIC SIGNAL HEADS. PROVIDE SPECIFIED DIMENSION "N" SUCH THAT CLEARANCE IS IN THE RANGE OF 7' MINIMUM, 10' MAXIMUM FOR PEDESTRIAN SIGNAL HEADS.
5. IN A PAVED AREA, PLACE THE TOP OF THE FOUNDATION FLUSH WITH THE SURFACE OF THE ADJACENT PAVEMENT.
6. ALL ACCESSIBILITY FEATURES MUST BE COMPLIANT TO PENNDOT PUBLICATION 13M (DM-2), CHAPTER 6, PUBLICATION 72M (RC STANDARDS) CRITERIA AND PUBLICATION 149.
7. PEDESTRIAN PUSHBUTTONS SHALL BE OF A TYPE APPROVED BY THE DEPARTMENT AND LISTED IN PUBLICATION 35 (BULLITIN 15).
8. PEDESTRIAN PUSHBUTTONS SHOULD BE A MINIMUM OF 2" DIAMETER AND A FORCE PER ACTUATION THAT CANNOT EXCEED 5 LBS.
9. PROVIDE 4'-0" x 4'-0" MINIMUM LANDING WITH 2.00% MAXIMUM SLOPE IN ALL DIRECTIONS WHERE PEDESTRIANS PERFORM 180° TURNING MANEUVERS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

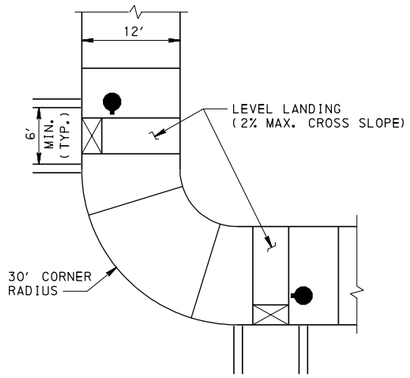
MISCELLANEOUS
TRAFFIC SIGNAL SUPPORT-PEDESTAL
PEDESTRIAN PUSHBUTTON

RECOMMENDED Oct.14,2010
CHIEF, TRANSPORTATION OPERATIONS DIVISION

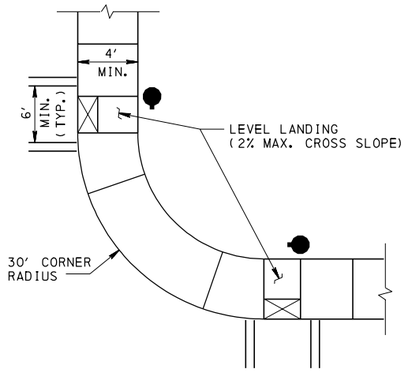
RECOMMENDED Oct.14,2010
ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

SHT. 1 OF 2

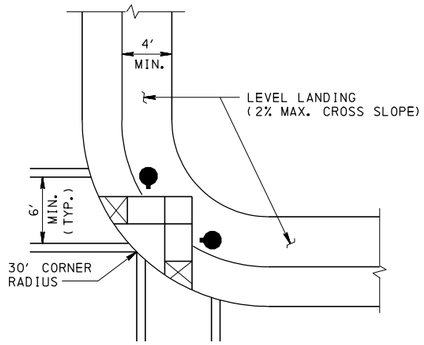
TC-8803



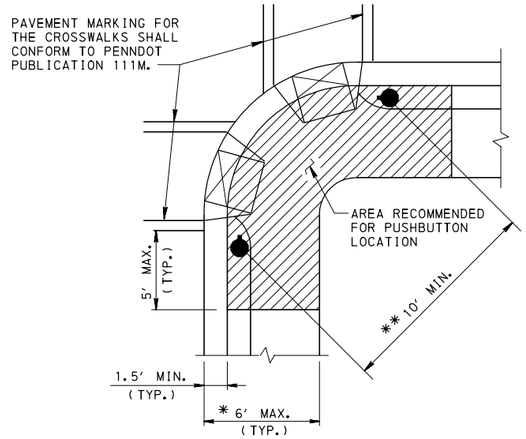
PARALLEL RAMPS WITH WIDE SIDEWALK



PARALLEL RAMPS WITH NARROW SIDEWALK



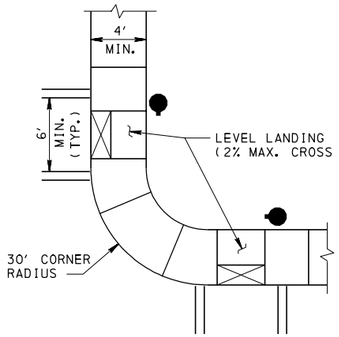
PERPENDICULAR RAMPS WITH SIDEWALK SET BACK FROM ROAD WITH CROSSWALKS CLOSE TOGETHER



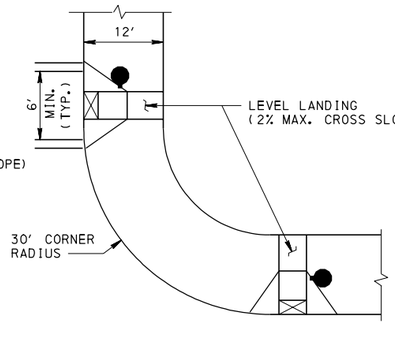
RECOMMENDED PUSHBUTTON LOCATIONS

* WHERE THERE ARE CONSTRAINTS THAT MAKE IT IMPRACTICAL TO PLACE THE PEDESTRIAN PUSHBUTTON BETWEEN 1.5′ AND 6′ FROM THE EDGE OF THE CURB, SHOULDER, OR PAVEMENT, IT SHOULD NOT BE FURTHER THAN 10′ FROM THE EDGE OF CURB, SHOULDER, OR PAVEMENT.

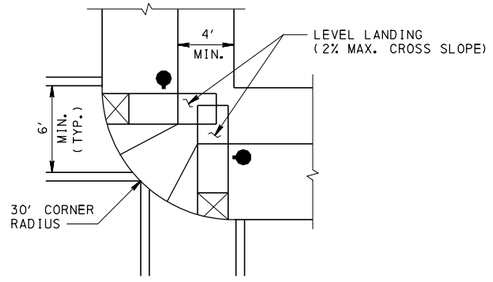
** WHERE THERE ARE CONSTRAINTS ON A PARTICULAR CORNER THAT MAKE IT IMPRACTICAL TO PROVIDE 10′ SEPARATION BETWEEN THE TWO PEDESTRIAN PUSHBUTTONS, THE PUSHBUTTONS MAY BE PLACED CLOSER TOGETHER OR ON THE SAME POLE.



PARALLEL RAMPS WITH NARROW SIDEWALK AND TIGHT CORNER RADIUS



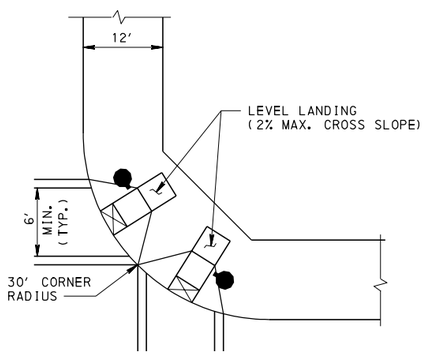
PERPENDICULAR RAMPS WITH CROSSWALKS FAR APART



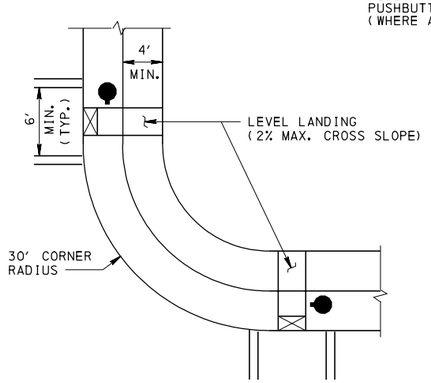
PERPENDICULAR RAMPS WITH SIDEWALK SET BACK FROM ROAD WITH CONTINUOUS SIDEWALK BETWEEN RAMPS

LEGEND

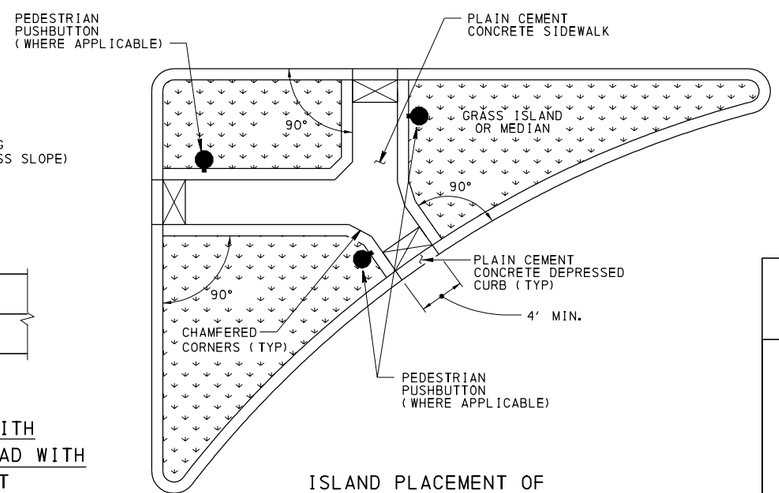
- PEDESTRIAN PUSHBUTTON
- DETECTABLE WARNING SURFACE



PERPENDICULAR RAMPS WITH CROSSWALKS CLOSE TOGETHER



PERPENDICULAR RAMPS WITH SIDEWALK SET BACK FROM ROAD WITH CROSSWALKS FAR APART



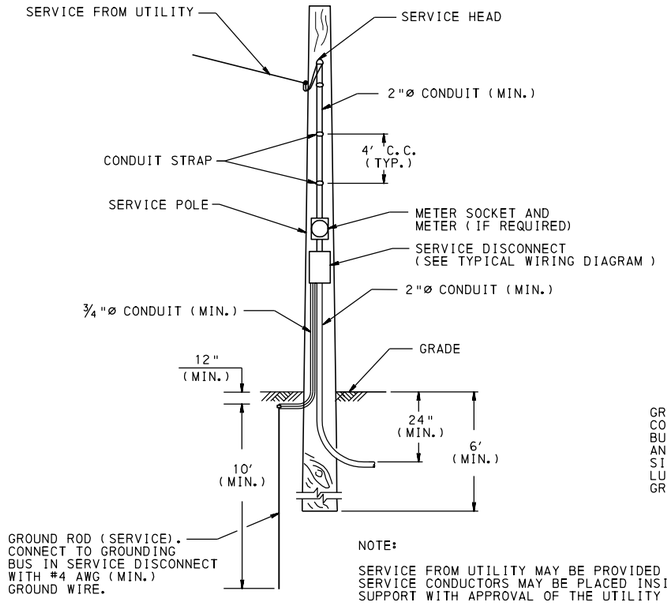
ISLAND PLACEMENT OF PEDESTRIAN PUSHBUTTONS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

MISCELLANEOUS TYPICAL PEDESTRIAN PUSHBUTTON LOCATIONS

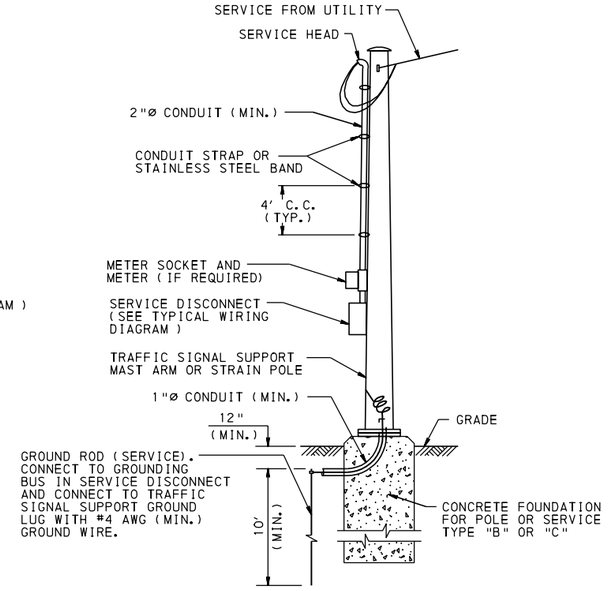
RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHT. 2 OF 2
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR., BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8803



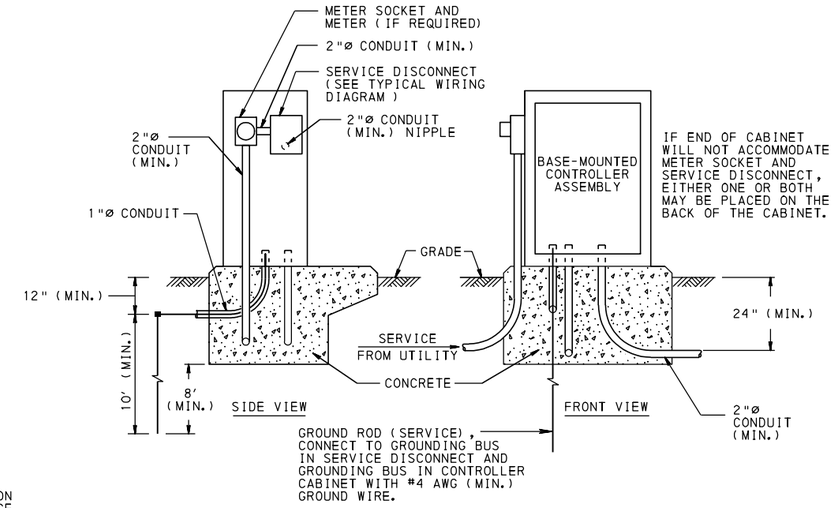
NOTE:

SERVICE FROM UTILITY MAY BE PROVIDED UNDERGROUND. ALSO, SERVICE CONDUCTORS MAY BE PLACED INSIDE THE TRAFFIC SIGNAL SUPPORT WITH APPROVAL OF THE UTILITY COMPANY.

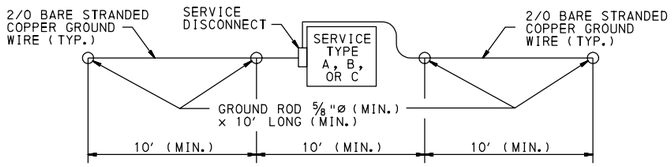
SERVICE TYPE A



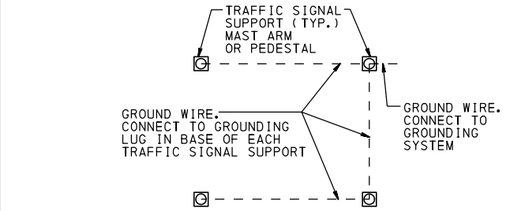
SERVICE TYPE B



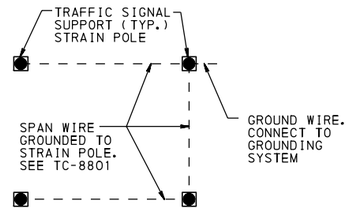
SERVICE TYPE C



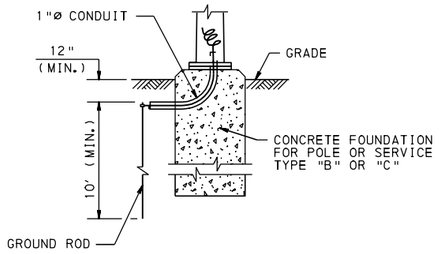
SERVICE GROUNDING ELECTRODE SYSTEM



MAST ARM OR PEDESTAL SUPPORT

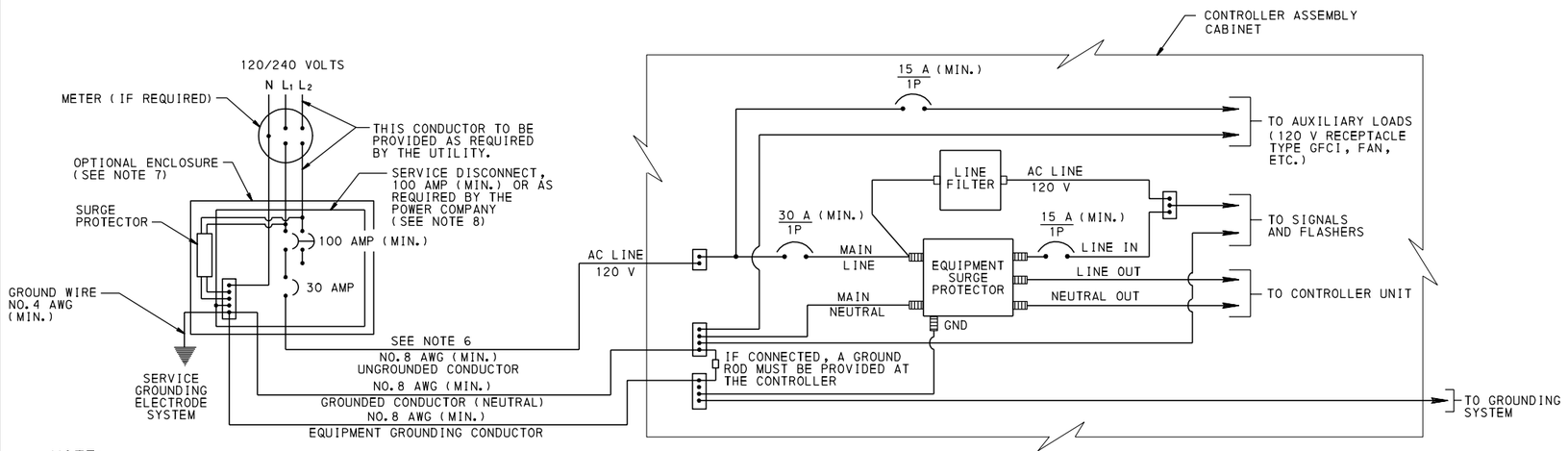


STRAIN POLE SUPPORT



DETAIL "Z"

GROUNDING SYSTEM



NOTE:

INSTALL GROUND RODS UNTIL IMPEDANCE IS LESS THAN 25 Ω

TYPICAL WIRING DIAGRAM

NOTE:

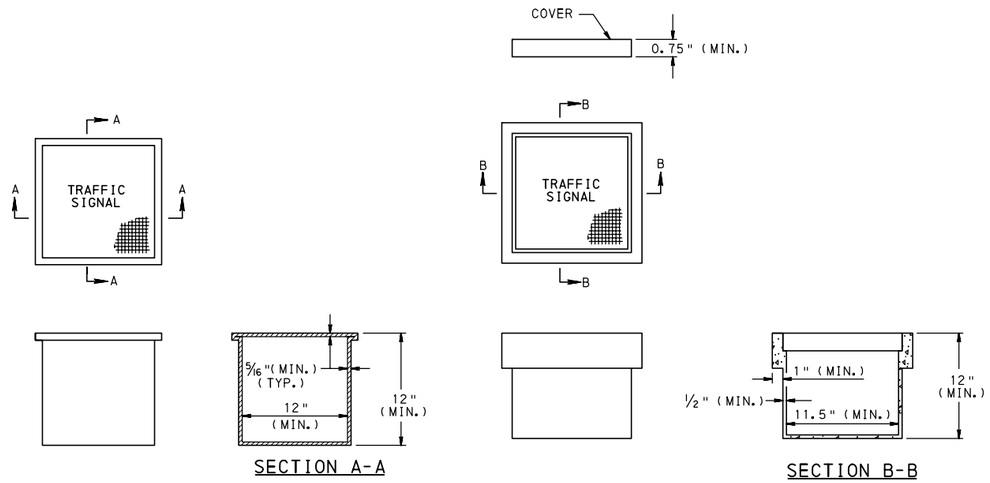
1. FOR DETAIL OF TRAFFIC SIGNAL SUPPORT FOUNDATION, SEE TC-8801.
2. FOR DETAIL OF CONTROLLER ASSEMBLY FOUNDATION, SEE TC-8802.
3. ALL GROUND RODS ARE ⅝" DIA. (MIN.) x 10' LONG (MIN.). USE EXOTHERMIC WELD OR BRONZE CONNECTOR TO CONNECT GROUND WIRE TO GROUND ROD.
4. INSTALL SERVICE TYPES A, B OR C AS APPROVED BY THE UTILITY COMPANY.
5. PROVIDE ALL SERVICE CONDUITS OF THE HDG RIGID METALLIC TYPE WITH WATERTIGHT CONDUIT HUBS.
6. REFER TO UTILITY'S SERVICE DETAIL WHEN UNMETERED LIGHTING IS INSTALLED ON TRAFFIC POLES. A SEPARATE DISCONNECT MAY BE REQUIRED.
7. PROVIDE THE SERVICE DISCONNECT INSIDE AN OPTIONAL ALUMINUM ENCLOSURE, WHERE INDICATED.
8. PROVIDE ADDITIONAL BREAKERS AS REQUIRED FOR LIGHTING LOADS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

ELECTRICAL DISTRIBUTION

RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHT. 1 OF 2
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8804



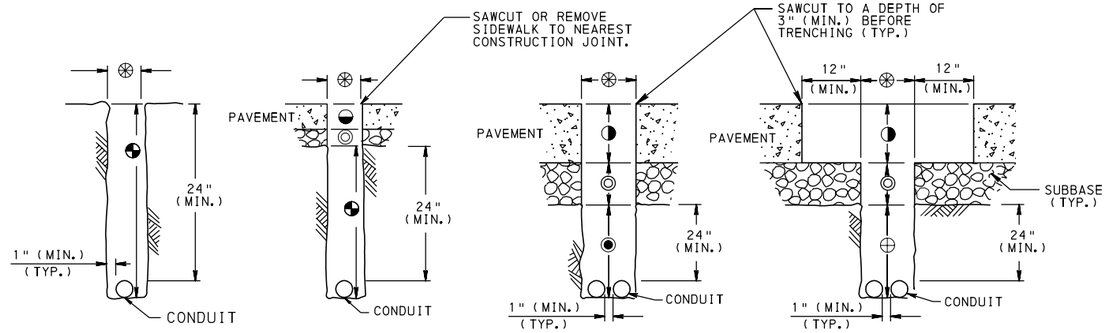
SECTION A-A

SECTION B-B

CAST IRON OR STEEL

REINFORCED PLASTIC MORTAR / POLYESTER RESIN
HIGH-DENSITY POLYMER CONCRETE / POLYETHYLENE

JUNCTION BOX, TYPE JB-26



TYPE I
EARTH

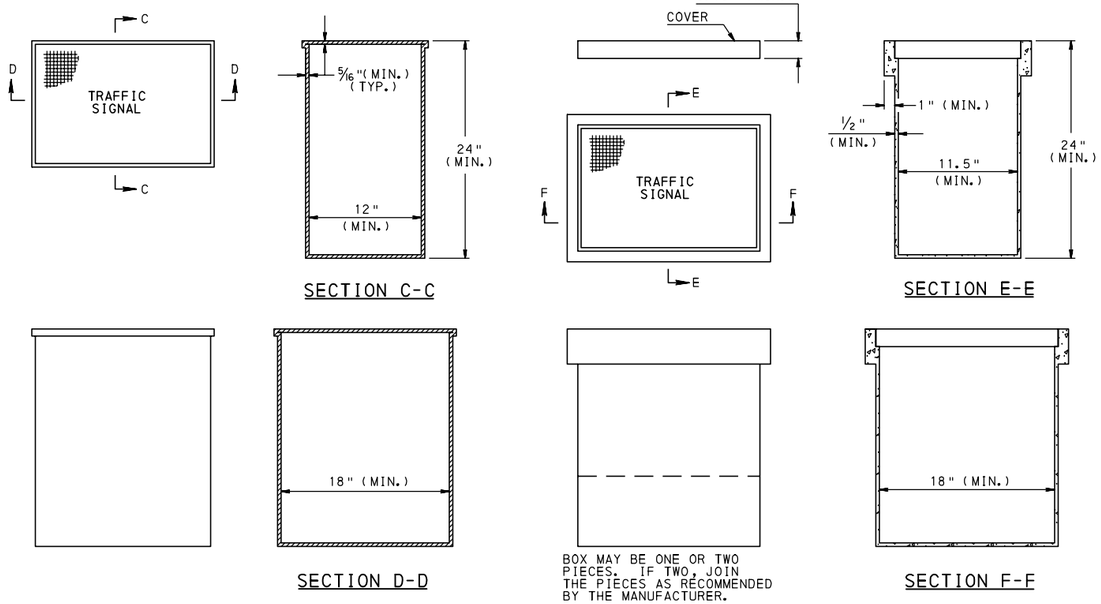
TYPE II
SIDEWALK
PAVED SHOULDER

TYPE III
ROADWAY

TYPE IV
ROADWAY

- ⊛ WIDTH OF TRENCH AS REQUIRED TO PROPERLY INSTALL CONDUIT AND BACKFILL.
- ⊕ BACKFILL WITH SUITABLE ON-SITE MATERIAL AS SPECIFIED.
- ◑ RESTORE PAVEMENT AS SPECIFIED IN SECTION 954, PUBLICATION 408.
- ◉ BACKFILL WITH CLASS A CEMENT CONCRETE TO BOTTOM OF EXISTING SUBBASE.
- ◒ BACKFILL AS SPECIFIED IN SECTION 954, PUBLICATION 408.
- ◎ REPLACE SUBBASE IN KIND.
- ◒ REPLACE IN KIND.

TRENCH AND BACKFILL



SECTION C-C

SECTION E-E

SECTION D-D

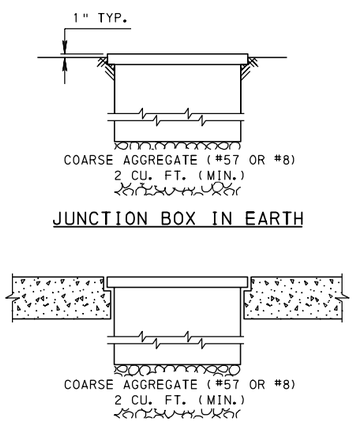
BOX MAY BE ONE OR TWO PIECES. IF TWO, JOIN THE PIECES AS RECOMMENDED BY THE MANUFACTURER.

SECTION F-F

CAST IRON OR STEEL

REINFORCED PLASTIC MORTAR OR
HIGH-DENSITY POLYMER CONCRETE

JUNCTION BOX, TYPE JB-27



JUNCTION BOX IN EARTH

JUNCTION BOX IN PAVED SURFACE

TYPICAL JUNCTION BOX INSTALLATION

NOTES:

1. JUNCTION BOXES -- PROVIDE COVER WITH A NON-SLIP SURFACE AND A MINIMUM OF TWO CORROSION RESISTANT FASTENERS.
2. JUNCTION BOXES -- USE JB-26 AND JB-27 ONLY IN AREAS NOT SUBJECT TO VEHICULAR TRAFFIC.
3. JUNCTION BOXES -- BOTTOM MAY BE OPEN OR CLOSED. IF CLOSED, PROVIDE A DRAIN HOLE 2" DIAMETER MINIMUM.
4. FOR DETAIL OF JUNCTION BOXES JB-1, JB-2, JB-11 AND JB-12, SEE STANDARD DRAWINGS, RC-81M AND RC-82M OF PENNDOT PUB. 72M.
5. GROUND EXPOSED METAL PARTS OF JUNCTION BOXES. USE GROUNDING LUGS. DO NOT CONNECT GROUND WIRE DIRECTLY TO LID.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

ELECTRICAL DISTRIBUTION

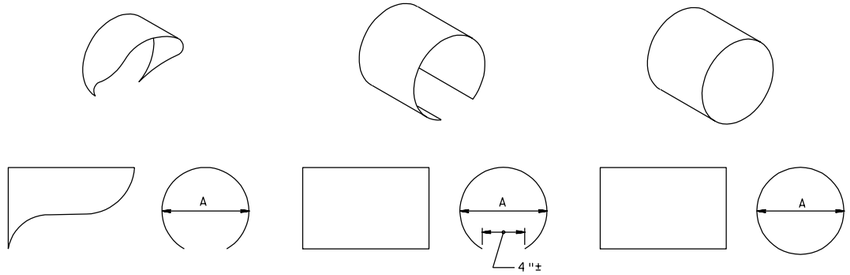
RECOMMENDED Oct.14,2010
CHIEF, TRANSPORTATION OPERATIONS DIVISION

RECOMMENDED Oct.14,2010
ACTING DIR., BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

SHT. 2 OF 2

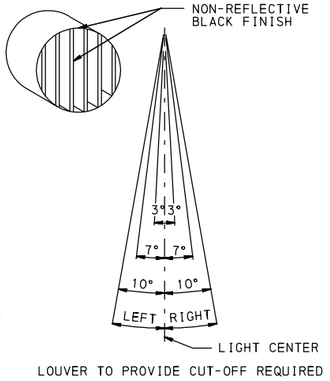
TC-8804

THE VISOR SHALL BE A MINIMUM OF 9.5" FOR A 12" SIGNAL LENS AND 7" FOR AN 8" SIGNAL LENS WITH A DOWNWARD TILT OF 3.5 DEGREES.



CUT-AWAY VISOR TUNNEL VISOR FULL-CIRCLE VISOR

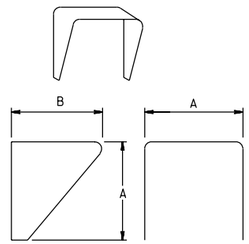
VISOR TYPES FOR VEHICULAR SIGNAL HEAD



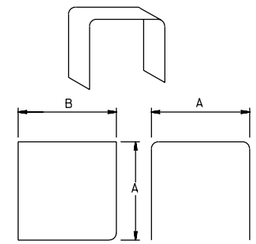
LOUVER TO PROVIDE CUT-OFF REQUIRED

LOUVER FOR VEHICULAR SIGNAL HEAD

(DO NOT USE WITH CUT-AWAY VISOR)

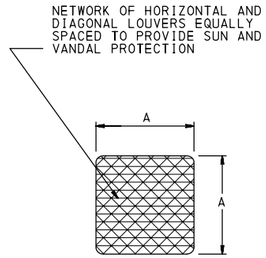


CUT-AWAY VISOR



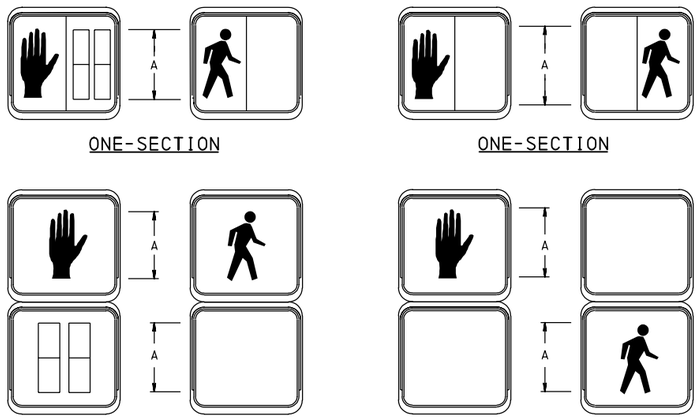
DIMENSION A AS REQUIRED.
DIMENSION B ≈ DIMENSION A

TUNNEL VISOR



LOUVER VISOR
(FOR PEDESTRIAN SIGNAL HEAD ONLY)

VISOR TYPES FOR PEDESTRIAN SIGNAL HEAD AND LANE-USE TRAFFIC CONTROL SIGNAL HEAD



ONE-SECTION ONE-SECTION

TWO-SECTIONS TWO-SECTIONS

TYPE A
(COUNTDOWN) *

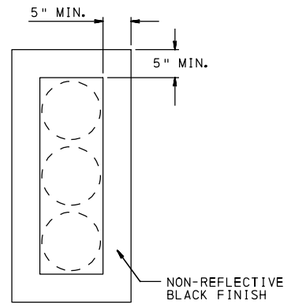
TYPE B
(SYMBOL) **

TYPE	DIMENSION A
A	6" *
B	6" **

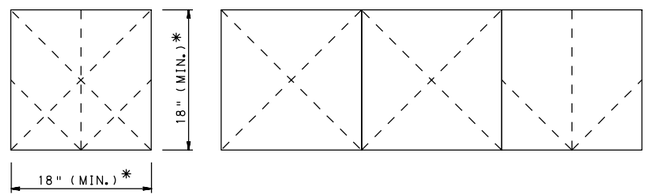
* COUNTDOWN PEDESTRIAN SIGNALS SHALL CONSIST OF PORTLAND ORANGE NUMBERS THAT ARE AT LEAST 6" IN HEIGHT. FOR CROSSWALKS WHERE THE PEDESTRIAN ENTERS THE CROSSWALK MORE THAN 100' FROM THE COUNTDOWN PEDESTRIAN SIGNAL DISPLAY, THE NUMBERS SHOULD BE AT LEAST 9" IN HEIGHT.

** FOR CROSSWALKS WHERE THE PEDESTRIAN ENTERS THE CROSSWALK MORE THAN 100' FROM THE PEDESTRIAN SIGNAL HEAD INDICATIONS, DIMENSION "A" SHOUD BE AT LEAST 9" HIGH.

PEDESTRIAN SIGNAL HEAD



BACKPLATE FOR VEHICULAR SIGNAL HEAD



ONE-SECTION TWO OR THREE SECTIONS

* NOMINAL. ACTUAL DIMENSIONS ARE AS REQUIRED TO PROVIDE SYMBOLS IN ACCORDANCE WITH ITE STANDARD FOR "LANE-USE TRAFFIC CONTROL SIGNAL HEADS" AND CURRENT ADDITION OF MUTCD.

LANE-USE TRAFFIC CONTROL SIGNAL HEAD

NOTE:

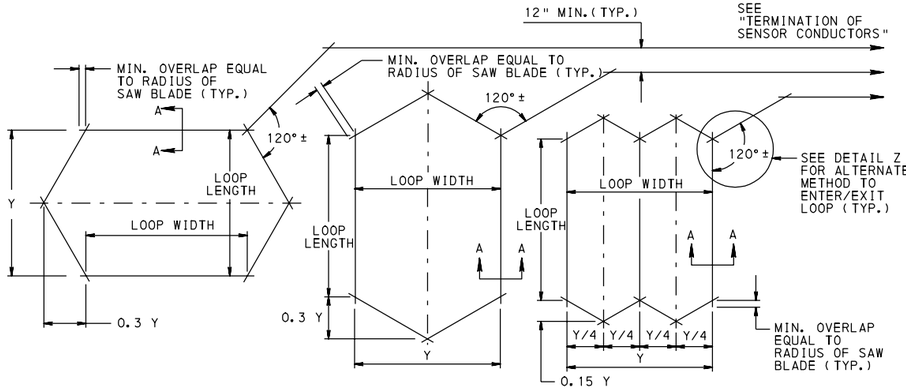
1. PEDESTRIAN SIGNALS MAY INCLUDE A COUNTDOWN TIMER THAT OPERATES DURING THE "FLASHING UPRAISED HAND" PHASE.

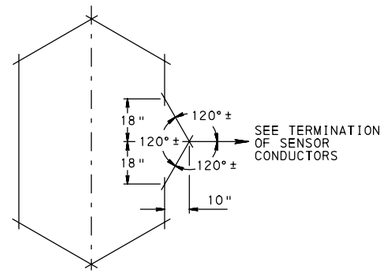
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

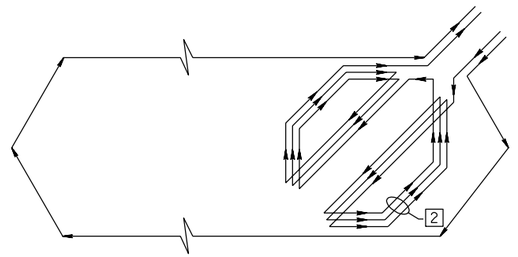
SIGNAL HEADS

RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHT. 1 OF 1
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8805



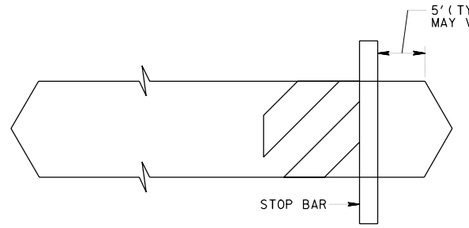


DETAIL Z

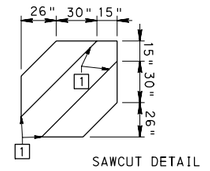


DETECTOR WIRING DETAIL

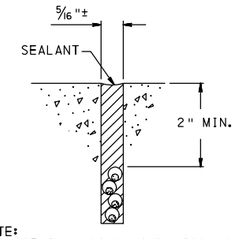
TYPICAL SENSOR INSTALLATION - LOOP DETECTOR



ALTERNATE TYPE A DETECTOR LAYOUT



DETECTOR SAWCUT DETAIL



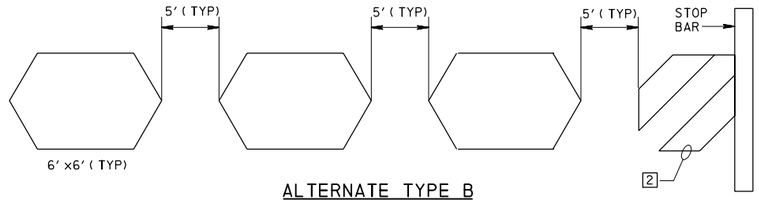
NOTE:
NO MORE THAN FOUR CONDUCTORS SHALL BE PLACED IN A SLOT. FOUR CONDUCTORS SHOWN FOR ILLISTRATION PURPOSES ONLY.

SECTION A-A

THIS TABLE (FOR INFORMATION ONLY) APPROXIMATES THE RESULTANT INDUCTANCE OF A LOOP BASED ON SIZE OF THE LOOP AND NUMBER OF SENSOR TURNS.

LOOP INDUCTANCE (MICROHENRIES)			
LOOP SIZE (FT)	NUMBER OF TURNS		
	2	3	4
5' x 5'	----	62	104
6' x 6'	----	76	129
6' x 10'	51	107	181
6' x 15'	69	147	249
6' x 20'	88	187	320
6' x 22'	96	204	349
6' x 25'	107	229	392
6' x 30'	126	272	461
6' x 35'	146	315	542
6' x 40'	165	359	618
6' x 45'	185	402	695
6' x 50'	205	447	773

USE TWO TURNS AS A MINIMUM



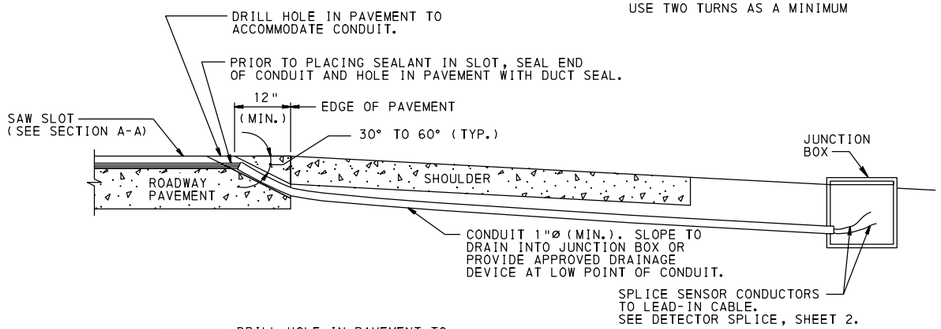
ALTERNATE TYPE B SERIES LAYOUT

ALTERNATE DETECTOR NOTES:

1. ROUND CORNERS OF ACUTE SAWCUTS TO PREVENT DAMAGE TO CONDUCTORS.
2. INSTALL 3 TURNS WHEN ONLY ONE LOOP IS ON A SENSOR UNIT CHANNEL. INSTALL 5 TURNS WHEN ONE LOOP IS CONNECTED IN SERIES WITH 3 ADDITIONAL 6'x6' LOOPS ON A SENSOR UNIT CHANNEL.

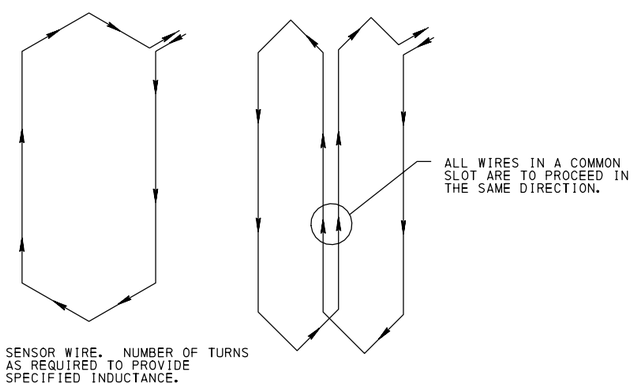
ALTERNATE SENSOR INSTALLATION - LOOP DETECTOR

FOR ENHANCED BICYCLE AND MOTORCYCLE DETECTION



PAYMENT FOR CONDUIT, SEALANT, SAW CUT AND DRILLING IS BE INCIDENTAL TO THE SENSOR.

TERMINATION OF SENSOR CONDUCTORS



SENSOR WIRE. NUMBER OF TURNS AS REQUIRED TO PROVIDE SPECIFIED INDUCTANCE.

TYPES I & II

TYPE III

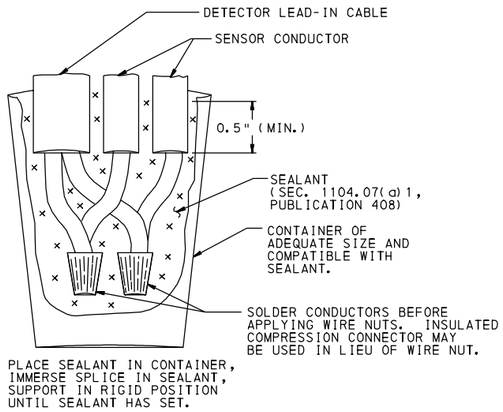
TYPICAL LAYOUT OF LOOP SENSOR

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

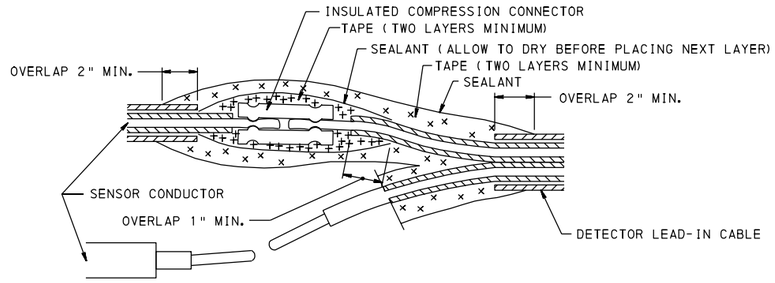
STANDARD

DETECTORS

RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHT. 1 OF 2
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8806



ALTERNATE A



TAPE - ELECTRICAL GRADE, PLASTIC, SELF-ADHESIVE.

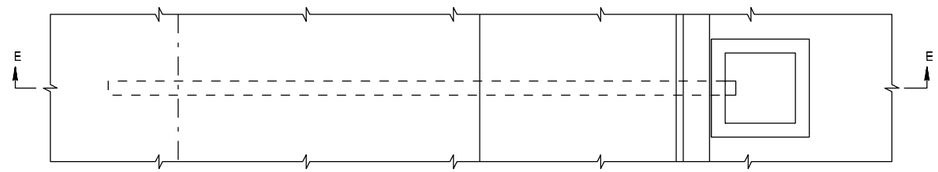
SEALANT - ELECTRICAL GRADE, FAST-DRYING, MOISTURE-RESISTANT, COMPATIBLE WITH PLASTIC ELECTRICAL TAPE.

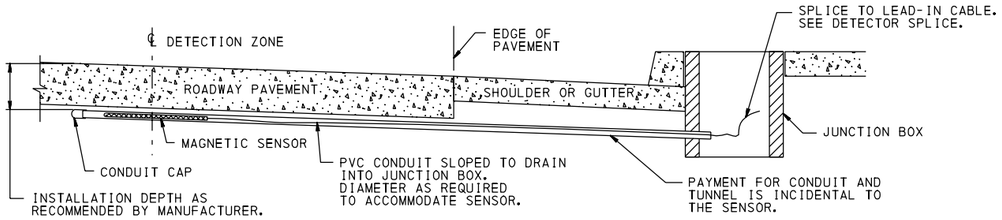
ALTERNATE B

ALTERNATE C SPLICE WILL BE MADE ELECTRICALLY SECURE WITH INSULATED COMPRESSION CONNECTORS THEN COVERED WITH A SPLICING KIT THAT IS MOISTURE-PROOF, SPLICE ENCAPSULATING (INCLUDING CABLE JACKET), AND DESIGNED FOR INSULATING AND SPLICING ELECTRIC CABLE; OR A RE-ENTERABLE SPLICE KIT AS SPECIFIED IN SEC. 1104.07(g)4, PUBLICATION 408.

ALTERNATE C

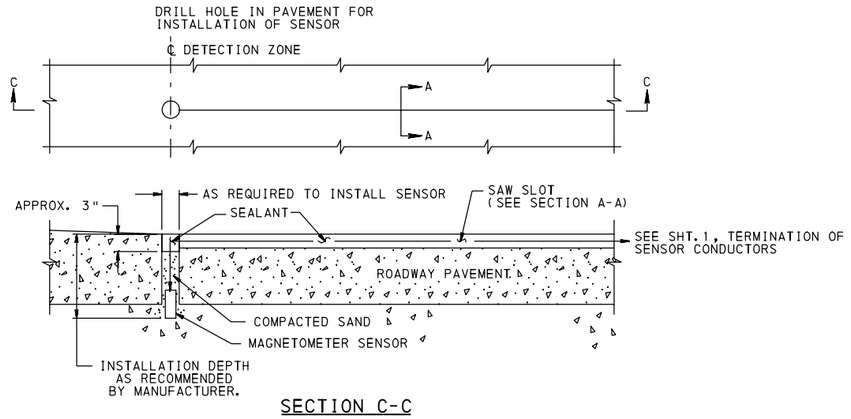
DETECTOR SPLICE





SECTION E-E

TYPICAL SENSOR INSTALLATION - MAGNETIC DETECTOR



SECTION C-C

TYPICAL SENSOR INSTALLATION - MAGNETOMETER DETECTOR

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING

STANDARD

DETECTORS

RECOMMENDED Oct.14,2010	RECOMMENDED Oct.14,2010	SHT. 2 OF 2
CHIEF, TRANSPORTATION OPERATIONS DIVISION	ACTING DIR. BUR. OF HIGHWAY SAFETY AND TRAFFIC ENGINEERING	TC-8806

20.0 CRITERIA FOR THE DESIGN OF TRAFFIC SIGNAL SUPPORTS

The criteria stated herein shall be utilized in the design of galvanized steel structures used for the support of traffic signals.

20.1 PART A - DESIGN CRITERIA FOR ALL SUPPORT STRUCTURES

(See Section 20.2; Part B, "Design Criteria for Strain Poles," for additional requirements for strain poles.)

Vertical poles and mast arms shall be designed and constructed in accordance with the 2001 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" including interim specifications (2002, 2003, and 2006), hereafter referred to as the "AASHTO Specifications." In this part, the AASHTO Specifications article numbering system is followed. Where new sections, articles, equations, figures, or tables have been added, the suffix P is used to designate "Pennsylvania Article." All references to the AASHTO Specifications sections, articles, equations, figures, or tables carry the prefix A, except where noted. References to the AASHTO Specifications commentary carry the prefix AC, except where noted.

- Provide base and connection plates as indicated in Publication 148; TC-8801 sheet 7 of 7.
- Provide a complete joint penetration weld for the connection of the column or shaft to the base plate and the connection of the arm to the flange plate for mast arm and strain pole structures only (this is not a requirement for pedestal poles).
- Attach a back-up ring as specified in the AASHTO Specifications (Table 11-2, Detail 11). The backing ring shall be attached to the plate with a full-penetration weld or with a continuous fillet weld around the interior face of the backing ring.
- For pole diameters 18 inch and larger, seal the top of the backing ring with a continuous 1/8 inch fillet weld to seal off the area between the ring and the pole. For pole diameters less than 18 inch, seal the top of the backing ring with a continuous bead of caulk after galvanizing to seal off the area between the ring and the pole.
- Provide 6 inch complete penetration longitudinal shaft welds at the base plate connection.
- The use of mast arm plate socket connections with fillet welds are prohibited.
- Provide welded connections as shown in Publication 148; TC-8801 sheet 7 of 7.
- The minimum thickness for column and mast materials shall be 3/16 inch or 7 gauges. A non-destructive testing plan is required to be submitted to the

Bureau of Construction Materials for materials less than 5/16 inch.

- Provide a built-up box on columns with mating splice plate for mast arm connection as shown in Example 8 of Figure 11-1(c) in AASHTO Specifications. With prior Department approval, alternate mast arm connections as shown in the AASHTO Specifications (Example 16 of Figure 11-1(c))are permitted.

Section 1: Introduction

Section 1.3 APPLICABLE SPECIFICATIONS

The following shall replace the first sentence of A1.3.

The following specification documents shall be referenced for additional information on design, materials, fabrication, and construction:

The following shall supplement A1.3.

e) PENNDOT Publication 408.

Section 2: General Features of Design

2.5 ROADSIDE REQUIREMENTS FOR STRUCTURAL SUPPORTS

2.5.2 Breakaway Supports

The following shall supplement A2.5.2.

Breakaway supports or yielding-type supports shall not be used for traffic signal support structures, except when permitted by this Handbook and specified in the plans and/or specifications for the project.

Section 3: Loads

3.5 DEAD LOAD

The following shall supplement A3.5.

Dead loads for signs, traffic signals, backplates, brackets, and all appurtenances shall be as given in this Handbook.

3.6 LIVE LOAD

Delete A3.6.

3.8 WIND LOAD

The following shall replace A3.8.

Wind load shall be the pressure of the wind acting horizontally on the supports, signs, luminaires, traffic signals, and other attachments computed in accordance with this Handbook and AASHTO Appendix C.

Section 5: Steel Design

5.14 DETAILS OF DESIGN

5.14.3 Slip Type Field Splice

The following shall replace A5.14.3.

Telescoping (slip-fit) splices for mast arms, which rely solely on friction between the members for their connection, will not be permitted. A thru-bolt must be provided for a positive connection when such slip fit connections are used.

5.15 WELDED CONNECTIONS

The following shall supplement A5.15.

Transverse welds shall not be used to splice pole sections.

5.17 ANCHOR BOLTS

5.17.3 Design Basis

The following shall supplement A5.17.3.

A minimum of six (6) anchor bolts shall be required.

5.17.6.4 Bending Stress in Anchor Bolts

The following shall replace A5.17.6.4.

The clearance between the bottom of the leveling nuts and the top of the concrete foundation shall not be greater than one bolt diameter.

5.18 MINIMUM PROTECTION FOR STRUCTURAL STEEL

5.18.1 General

The following shall replace the first sentence of A5.18.1.

Steel structures shall be protected from the effects of corrosion including those manufactured of high strength steel, by means of galvanizing in accordance with ASTM A 123 (AASHTO M 111). Accessories and hardware shall also be protected from the effects of corrosion by means of galvanizing in accordance with ASTM A 153 (AASHTO M 232).

Section 11: Fatigue Design

11.6 FATIGUE IMPORTANCE FACTORS

The following shall supplement A11.6.

Traffic signal structures with mast arms less than or equal to 60 feet shall be designed for Fatigue Category II. Traffic signal structures with mast arms greater than 60 feet shall be designed for Fatigue Category I. Strain poles should be considered as an alternative to traffic signal structures with mast arms greater than 60 feet.

11.7 FATIGUE DESIGN LOADS

11.7.1 Galloping

The following shall replace A11.7.1.

The dead load and wind surface area of a standard mitigation device shall be considered in the design of cantilevered traffic signal support structures in accordance with the standard drawings. The mitigation device should be installed only within the 180-day monitoring period in accordance with the standard drawings.

11.7.4 Truck-Induced Gust

Delete A11.7.4.

Section 14P: Design Aids

This section shall supplement AASHTO Appendix B.

14.2P STRESSES FOR TUBULAR SECTIONS

The following shall supplement Table 20-2:

Maximum shear stress due to torsion (f_{vt}) for round stepped tubes (hot-swaged shrink fit) shall be computed using the following formula:

$$f_{vt} = \frac{M_z k_t}{6.28 R^2 t}$$

Where:

f_{vt}	=	Maximum shear stress due to torsion, lb/in^2
M_z	=	Total torsional moment, in-lb
R	=	Radius at mid-thickness of smaller diameter tube wall, in
t	=	Thickness of smaller diameter tube wall, in
k_t	=	Stress concentration factor due to change in tube diameter (use k_t = 1.20)

Section 15P: Alternate Method for Wind Pressures

This section shall supplement AASHTO Appendix C.

15.2P WIND LOAD

The following shall replace the second sentence of the first paragraph of C.2:

The design wind pressures shall be computed using the wind pressure formula, Eq. C-1, for a fastest-mile wind speed (V_{fm}) of 80 MPH as shown in Figure C-3.

20.2 PART B - DESIGN CRITERIA FOR STRAIN POLES

(See Section 20.1; Part A, "Design Criteria for All Support Structures," for additional requirements.)

1. Allowable Unit Stresses

The design and construction of strain pole structures shall conform to the allowable unit stresses provided in Section 5 – Steel Design in the 2001 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals", hereafter referred to as the "AASHTO specifications."

2. Span and Tether Wires

Span wire shall conform to ASTM A 475, Class A, Siemens-Martin Grade, or ASTM B 416. Tether wire shall conform to ASTM A 475, Class A, Common Grade.

Strain poles shall be designed for a sag of 5% of the span distance between poles under dead load. In computing dead load, the mass of the span and tether wire shall be based on a value of 1 lb/ft [load=1 lb/ft].

3. Strain Pole Deflection

The maximum horizontal deflection of strain poles, at the span wire connection, due to dead loads only, shall be 2.5% of the distance measured from the base of the strain pole to the span wire connection point.

When strain poles support more than one span, the resultant horizontal deflection, due to the combined action of all span wire loadings, shall not exceed the above.

4. Stringing Tension

To determine the stringing tension in the span wire system between the two strain poles, due to the dead loads of traffic signals, traffic signs, signal wire, and other attachments, the following procedure[1] shall be used:

a. Determine the effective load of each item on the span wire (traffic signal, traffic sign, signal wire, and/or other attachment) by adding to the load of each item, the load of the span wire for a length equal to half the distance in each direction to the next adjacent item or strain pole.

b. Determine the vertical reaction at each strain pole structure by summing the moments (due to the effective load of each item and the vertical reaction at the strain pole) about the other strain pole structure. As a check, the sum of the vertical reactions of the two strain pole structures should be equivalent to the sum of the effective loads of each item.

c. Determine the lowest point due to sag in the span wire by finding the point at which the slope of the span wire changes sign (which will be at the location of one of the load items, most probably a traffic signal). Beginning with the vertical reaction at one of the strain pole structures, determine the vertical shear acting on the span wire by successively and algebraically adding the effective load of each item in moving across to, and ending with the vertical reaction of, the other strain pole structure. The low point in the span wire is the point at which the sign of the vertical shear changes (which indicates that the slope of the span wire has changed). If the vertical shear happens to be zero at any point between the strain pole structures, this indicates that two load items are at the same elevation and share the low point of the span wire. As a check, the vertical shear must begin and end at zero at the constituent strain pole structures.

[1] Based on the General Cable Theorem

d. Determine the stringing tension by evaluating the summation of moments about the low point in the span wire. Since the span wire cannot resist bending moment, set the sum of the moments about the low point of all forces acting on the span wire between the low point and either of the strain pole structures equal to zero, where the horizontal pull acting on that strain pole structure is an unknown force acting at a distance equal to the maximum allowable sag (5% of the span distance) above the low point of the span wire. The stringing tension in the span wire can then be determined by solving the aforementioned summation for the unknown horizontal force acting on each of the strain pole structures.

e. In the case where a strain pole structure supports wires and loading from more than one span, determine the stringing tension of each span wire that it supports, and combine these separate stringing tensions to produce the maximum resultant stringing tension acting on the given strain pole structure to evaluate the required design and construction considerations.

5. Sag

To determine the sag at any load item on the span wire, assume that the span wire follows a straight line between adjacent load items which slopes at a rate equal to the vertical shear at the given load item divided by the horizontal stringing tension. The change in elevation between successive load items is then equivalent to the slope of the span wire between these two load items multiplied by the distance between them. As a check, the elevation of the span wire connection at the second strain pole structure must be obtained by beginning with the connection at the first strain pole structure and successively adding the respective elevation increments in moving across the span wire.

6. Application of Wind Load (see Figure B-1)

W_h for strain pole structures may be applied as a series of concentrated loads along the span wire normal to the span, and W_p (normal to sign faces) shall be applied normal to the span. Strain poles (assuming a single span wire is attached to the support) shall be designed for wind loads W_h and W_p, (normal to the sign faces) applied normal to the span. Only the wind load, W_v, shall account for wind from any direction. The basic load, BL (see Section 3.9.3 of the AASHTO specifications) normal to the span shall be the effect from the wind load W_v, applied at the center of pressure of the support. The full transverse component shall be applied to the support.

7. Design Tension

For a strain pole structure with the ends of the span wire at the same elevation, the following approximate method may be used to determine the force component in the span wire parallel to the span for a wind loading normal to the span.

The span wire loadings (dead load, wind, and ice) are applied as a series of concentrated loads along the wire to represent the actual uniform loadings with a minimum of five equal concentrated loads recommended. The tension forces throughout the wire now become a series of vectors with the vector component in the direction of the span of equal magnitude for each vector. Knowing that the ratio of the vector length over the vector force is proportional to the ratio of the vector component length over a component force, the length of each vector may be expressed by the following equation:

$$\text{Vector Length} = \sqrt{\left(F_x^2 + F_y^2 + F_z^2\right)}\frac{d_x}{F_x}$$

Where :

$\sqrt{\left(F_x^2 + F_y^2 + F_z^2\right)}$ = Resultant vector force

F_x = Vector force component in direction of span

F_y = Vector force component in vertical direction

F_z = Vector force component in direction of wind

d_x = Vector length component in direction of span*

(* If sag is small in relation to span length, neglect any displacements in direction of span.)

F_y and F_z for each vector (between concentrated loads of wire, signals, signs, etc.) may be found by the equations of equilibrium for a body in space. The total length of the span wire may be found for a given sag for a loading of dead load alone. The sum of all the vector lengths is equated to the total length of the span wire. F_x may be solved for since it is the only unknown in the equation. A number of trials may be necessary to closely approximate the actual value.

The following illustrates a procedure for determining the vector components F_x and F_z:

In Figure B-2:

$$F_{Z1} = R_{Z(L)}$$

$$F_{Z2} = R_{Z(L)} - W_A$$

$$F_{Z3} = R_{Z(L)} - W_A - W_B$$

$$F_{Z4} = R_{Z(R)} - W_E - W_D$$

$$F_{Z5} = R_{Z(R)} - W_E$$

$$F_{Z6} = R_{Z(R)}$$

$$\text{The total length of span wire} = \sqrt{\left(F_x^2 + F_{y1}^2 + F_{z1}^2\right)}\frac{d_{x1}}{F_x} + \sqrt{\left(F_x^2 + F_{y2}^2 + F_{z2}^2\right)}\frac{d_{x2}}{F_x} + \cdots$$

The reactions $R_{z(L)}$ and $R_{z(R)}$ may be determined by summing moments about a vertical line at the right end and left end of the span wire respectively. A similar procedure is used in determining F_y components. The reactions in the vertical direction *($R_{y(L)}$* and *$R_{y(R)}$)* may be determined by summing moments about a horizontal line to the ends of the span wire.

The above procedure neglects the effect of the strain pole deflection. This results in excessively conservative values for the wire's force component in the direction of the span (F_x). The effects of the strain pole deflections on the span wire's force component should be considered by calculating the deflections of the strain pole at the span wire connection, in the direction of the span, and recomputing the wire's force component, as above, after making adjustments to the span to account for the strain pole deflections. The reduction in tension does not apply to dead load tension. Given the wire is installed with the specified sag after the pole dead load deflection already has occurred, the wire tension is not reduced.

8. Design Stresses

Strain pole structures shall be designed and constructed to withstand maximum stresses based on Group I, Group II, and Group III loadings (whichever controls), as defined in the AASHTO specifications. In the case of strain poles which support more than one span, the resultant of the respective tensions for each span shall be used in combination with the wind applied in the direction which produces maximum stress.

20.3 PART C - ACCEPTANCE OF STRUCTURAL DESIGNS

The manufacturer shall submit design calculations and detailed structural drawings for those signal supports that are proposed to be supplied in Pennsylvania. In addition, the manufacturer must provide PennDOT with certification, from a professional engineer registered in Pennsylvania, indicating that the designs comply with PennDOT's criteria and are adequate to support the loads specified therein.

After acceptance by the PennDOT, the manufacturer will not be required to submit design calculations or structural drawings on a project-by-project basis, except for signal supports which exceed the standard structure loadings indicated herein. For these special designs, a submission of design calculations, structural drawings and the professional engineer's certification must be made for each different support.

Shop drawings will be required for all traffic signal supports on each project.

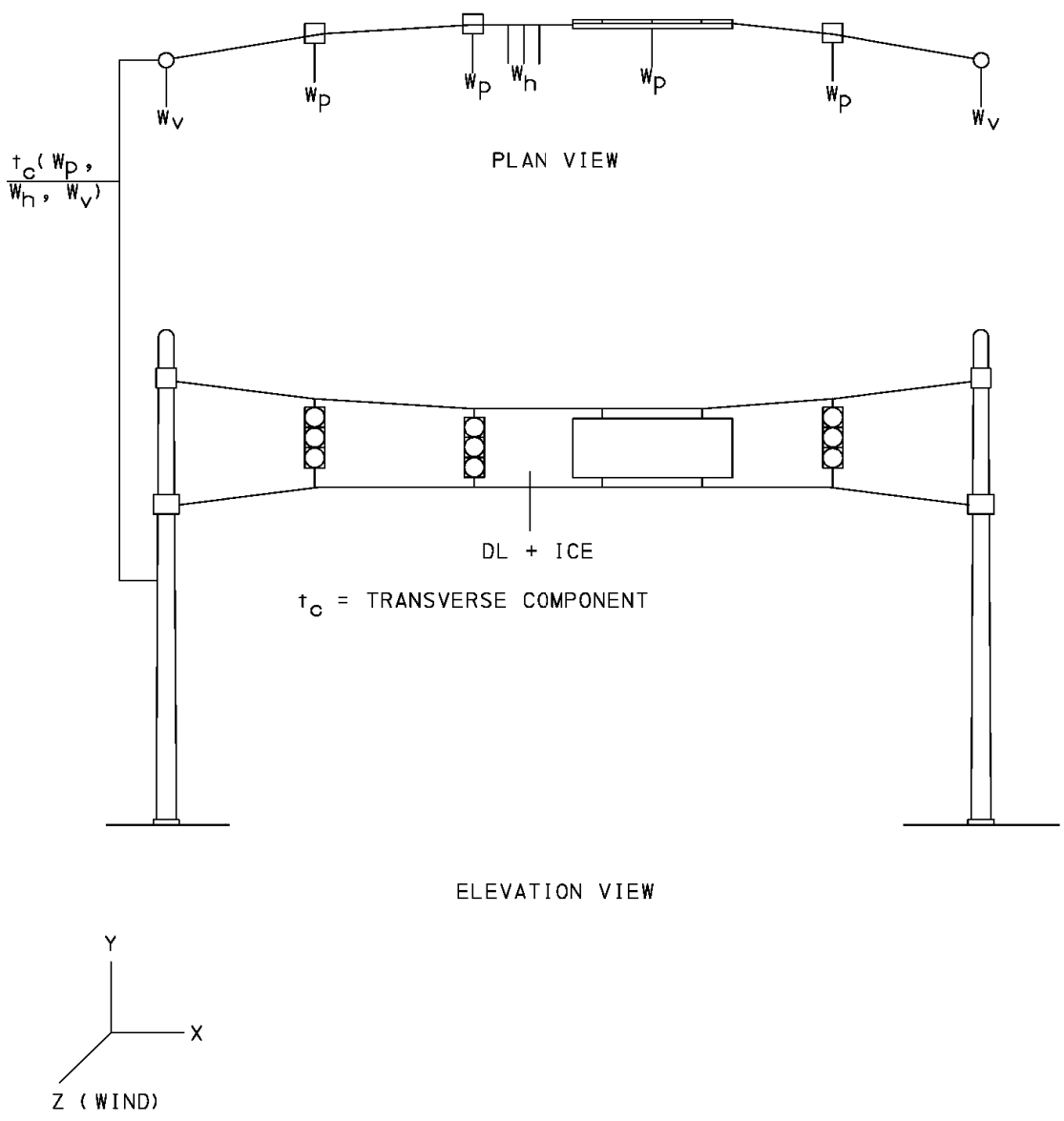


FIGURE 20-1

STRAIN POLE STRUCTURE

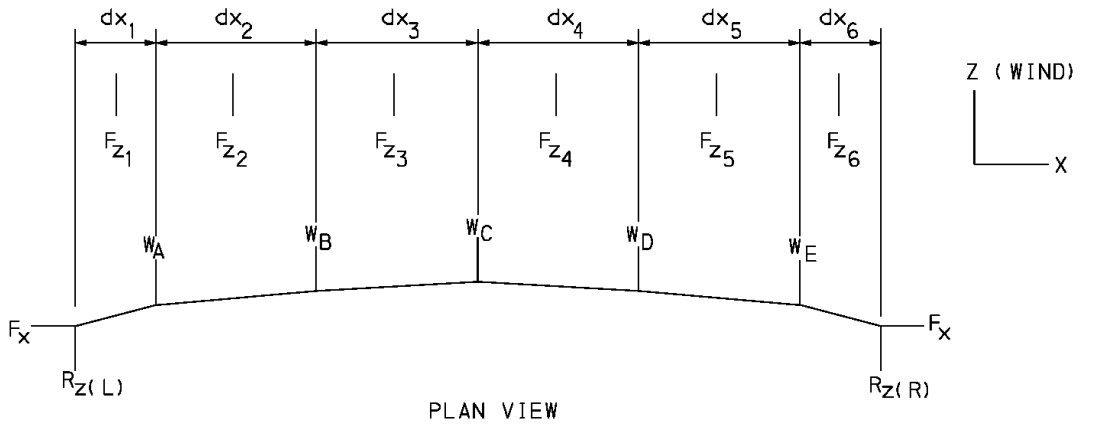
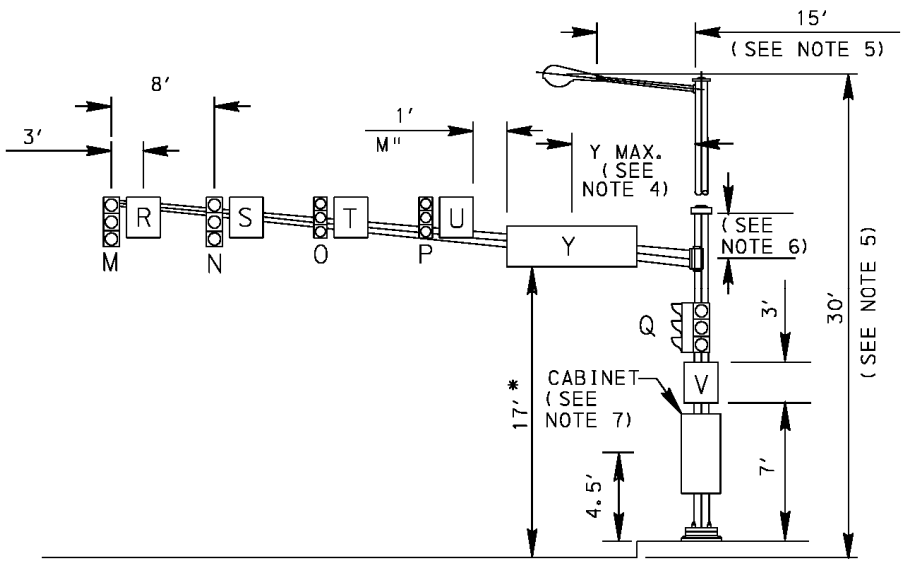


FIGURE 20-2
FORCE DIAGRAM



* CLEARANCE BETWEEN ROADWAY AND LOWEST SIGN OR SIGNAL HEAD

NOTES :

1. THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY IN ORDER TO SHOW HORIZONTAL AND VERTICAL DIMENSIONS. SEE MAST ARM IN STANDARD STRUCTURE LOADING TABLE FOR AREAS AND LOADS TO BE USED FOR EACH ITEM UNDER STANDARD STRUCTURE LOADING. SIGNAL HEADS DEPICTED ON THIS DRAWING MAY DIFFER FROM THE SIGNAL HEADS SHOWN IN THE STANDARD STRUCTURE LOADING TABLE. (FOR EXAMPLE, THIS DRAWING MAY DEPICT A 3-SECTION HEAD WHERE A 5-SECTION HEAD IS USED IN THE TABLE.)

2. ASSUME ALL OVERHEAD SIGNALS HAVE 12" LENSES WITH BACKPLATES 5" BORDER.

3. ASSUME SIGNS R, S, T, U AND V ARE 30" BY 36". FOR MAST ARM LENGTHS OF 10' OR LESS, SIGN Y IS ASSUMED TO BE 72" BY 21". FOR ALL OTHER MAST ARM LENGTHS, SIGN Y IS ASSUMED TO BE 96" BY 32".

4. Y MAX. IS THE MAXIMUM ALLOWABLE DISTANCE FROM THE SHAFT TO THE CENTROID OF SIGN Y.

5. FOUNDATION DESIGN IN PUBLICATION 148 ASSUMES LUMINAIRES, WHEN USED, HAVE A 30' MOUNTING HEIGHT AND A 15' ARM LENGTH.

6. WHEN THE SHAFT OF THE SUPPORT IS EXTENDED IN LENGTH BY 36" MINIMUM TO ALLOW A FUTURE LUMINAIRE VIA AN OVERLAP SLIP JOINT, PROVIDE APPROPRIATE FOUNDATION AND SUPPORT DESIGN.

7. FOUNDATION DESIGN IN PUBLICATION 148 ASSUMES A CABINET, WHEN USED, HAS A 4'-3" HEIGHT, 2'-6" WIDTH, 1'-10" DEPTH AND DEAD LOAD OF 281 lbs..

FIGURE 20-3

MAST ARM - STANDARD STRUCTURE LOADING

Table 20-1
MAST ARM - STANDARD STRUCTURE LOADING

MAST ARM LENGTH (ft)		SIGNALS					SIGNS						MAX Y (ft)
		M	**N**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**Y**	
0-10	W	70				123					39	87	5.2
	A	8.76				8.82					7.48	10.50	
>10-15	W	70				123	39				39	106	6.6
	A	8.76				8.82	7.48				7.48	21.33	
	OR												
	W	70				123					39	106	9.5
	A	8.76				8.82					7.48	21.33	
>15-20	W	97	70			123	39				39	106	6.6
	A	13.89	8.76			8.82	7.48				7.48	21.33	
>20-25	W	97	70			123	39	39			39	106	8.5
	A	13.89	8.76			8.82	7.48	7.48			7.48	21.33	
>25-30	W	97	70	97		123	39	39			39	106	8.5
	A	13.89	8.76	13.89		8.82	7.48	7.48			7.48	21.33	
	OR												
	W	97	70			123	39	39			39	106	13.5
	A	13.89	8.76			8.82	7.48	7.48			7.48	21.33	
>30-35	W	97	70	97		123	39	39	39		39	106	10.8
	A	13.89	8.76	13.89		8.82	7.48	7.48	7.48		7.48	21.33	
>35-40	W	97	70	70	97	123	39	39		39	39	106	7.9
	A	13.89	8.76	8.76	13.89	8.82	7.48	7.48		7.48	7.48	21.33	
	OR												
	W	97	70	70	70	123	39	39			39	106	10.8
	A	13.89	8.76	8.76	8.76	8.82	7.48	7.48			7.48	21.33	
	OR												
	W	97	70	97		123	39	39	39		39	106	15.7
	A	13.89	8.76	13.89		8.82	7.48	7.48	7.48		7.48	21.33	

MAST ARM LENGTH (ft)		SIGNALS					SIGNS						MAX Y (ft)
		M	N	O	P	Q	R	S	T	U	V	Y	
>40-45	W	97	70	70	97	123	39	39		39	39	106	12.8
	A	13.89	8.76	8.76	13.89	8.82	7.48	7.48		7.48	7.48	21.33	
	OR												
	W	97	70	70	70	123	39	39			39	106	15.7
	A	13.89	8.76	8.76	8.76	8.82	7.48	7.48			7.48	21.33	
	OR												
	W	97	70	97		123	39	39	39		39	106	20.7
	A	13.89	8.76	13.89		8.82	7.48	7.48	7.48		7.48	21.33	
>45-50	W	97	70	70	97	123	39	39		39	39	106	17.7
	A	13.89	8.76	8.76	13.89	8.82	7.48	7.48		7.48	7.48	21.33	
	OR												
	W	97	70	70	70	123	39	39			39	106	20.7
	A	13.89	8.76	8.76	8.76	8.82	7.48	7.48			7.48	21.33	
	OR												
	W	97	70	97		123	39	39			39	106	28.5
	A	13.89	8.76	13.89		8.82	7.48	7.48			7.48	21.33	
>50-60	W	97	70	70	97	123	39	39		39	39	106	27.9
	A	13.89	8.76	8.76	13.89	8.82	7.48	7.48		7.48	7.48	21.33	
	OR												
	W	97	70	70	70	123	39	39			39	106	30.8
	A	13.89	8.76	8.76	8.76	8.82	7.48	7.48			7.48	21.33	
	OR												
	W	97	70	97		123	39	39			39	106	38.7
	A	13.89	8.76	13.89		8.82	7.48	7.48			7.48	21.33	

W= Load in lb A=Area in ft^2

Note:

For standard structure loading, place indicated signals and signs beginning at the furthermost point on the arm and then proceeding toward the shaft in accordance with the dimensions shown on Figure B-3 and Publication 148, TC-8801.

Table 20-2

LOADS AND PROJECTED WIND AREAS FOR TRAFFIC SIGNAL HEADS

LENS SIZE – in ALL SECTIONS	SIGNAL CONFIGURATION (1)	SIGNAL SECTIONS EACH DIRECTION	DIRECTIONS	LOAD - Pound (lb) WITHOUT BACKPLATE (2)	WIND AREA - Square feet (ft^2) WITHOUT BACKPLATE (3),(4)	LOAD - Pound (lb) WITH BACKPLATE (2)	WIND AREA - Square feet (ft^2) WITH BACKPLATE 5 in BORDER (3),(5)	WIND AREA - Square feet (ft^2) WITH BACKPLATE 8 in BORDER (3),(5)
8	A	3	1	45	2.40	48	5.97	8.79
8	A	4	1	55	3.19	59	7.46	10.69
8	A	5	1	58	3.99	69	9.17	12.46
8	B	3	2	82	2.40	88	5.97	8.79
8	C	3	2	84	5.12	90	8.69	11.51
8	B	4	2	101	3.19	109	7.42	10.69
8	C	4	2	103	6.82	111	11.09	14.32
8	B	5	2	110	3.99	131	9.17	12.46
8	D	3	3	120	5.12	129	8.69	11.51
8	E	3	3	120	7.84	129	11.41	14.23
8	D	4	3	147	6.82	159	11.09	14.32
8	E	4	3	147	10.45	159	14.72	17.95
8	F	3	4	156	7.84	168	11.41	14.23
8	F	4	4	193	10.45	209	14.72	17.95
12	A	3	1	66	4.17	70	8.76	12.23
12	A	4	1	84	5.55	89	11.04	15.09
12	A	5	1	90	6.94	97	13.89	17.90
12	B	3	2	121	4.17	129	8.76	12.23
12	C	3	2	123	8.82	131	13.41	16.88
12	B	4	2	155	5.55	165	11.04	15.09
12	C	4	2	157	11.75	167	17.24	21.29
12	B	5	2	179	6.94	189	13.89	17.90
12	D	3	3	178	8.82	190	13.41	16.88
12	E	3	3	178	13.47	190	18.06	21.53
12	D	4	3	227	11.75	242	17.24	21.29
12	E	4	3	227	17.95	242	23.44	27.49
12	F	3	4	233	13.47	249	18.06	21.53
12	F	4	4	299	17.95	318	23.44	27.49
12PED	A	2	1	43	2.77	-	-	-
12PED	C	2	2	86	6.93	-	-	-
18PED	A	1	1	40	2.47	-	-	-
18PED	C	1	2	80	5.14	-	-	-

NOTES:

(1) Refer to Figure 20-4, Traffic Signal Configurations and Designations.

(2) A one-way 8 in lens section is 9 lb without attachment hardware and backplate. A one-way 12 in lens section is 15 lb without attachment hardware and backplate.

(3) The area for an 8 in lens section without backplate is based on a 10 in height by a 11.5 in width, and the area for a 12 in lens section without backplate is based on a 13.5 in height by a 14.8 in width.

(4) The area for a 2-section pedestrian signal assumes a 14.1 in height and a 14.1 in width for each section. The area of a 1-section pedestrian signal assumes a 18.9 in height and a 18.9 in width.

(5) Values in *shaded area* are generally not used.

TRAFFIC SIGNAL
CONFIGURATIONS AND DESIGNATIONS

DESIGNATION	TRAFFIC SIGNAL CONFIGURATION	DIRECTIONS
A		1
B		2
C		2
D		3
E		3
F		4

 DIRECTION OF WIND ALL CONFIGURATIONS

FIGURE 20-4
TRAFFIC SIGNAL CONFIGURATIONS