

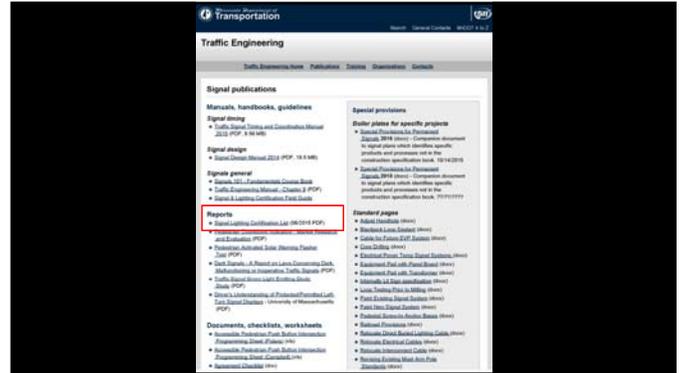
**CERTIFICATION CLASS
LIVE PRESENTATION
HANDOUTS
2020**



**DEPARTMENT OF
TRANSPORTATION**

Data Practices Act

- Verify roster information, if needed make corrections and Initial
- Student will be the one certified thus their data will only be used for sending cards or other necessary information & upon other inquiry we will only verify certification status.



What's New Since 2015

CHAPTER 2 STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

"2018 SPEC BOOK"

THE 2018 SPEC BOOK IS NOW THE GOVERNING DOCUMENT ON ALL MnDOT SIGNAL AND LIGHTING PROJECTS

STANDARD SPECIFICATIONS FOR CONSTRUCTION

MANY ITEMS THAT WERE IN THE MnDOT SPECIAL PROVISIONS FOR THE 2016 SPEC BOOK HAVE BEEN MOVED TO THE NEW 2018 SPEC BOOK

2018 EDITION

"2018 SPEC BOOK"

THE 2018 SPEC BOOK WRITING STYLE IS
PLAIN LANGUAGE
ACTIVE VOICE/ IMPERATIVE MOOD
COMPLETE, CORRECT, CLEAR, CONCISE, CONSISTANT

2565.3 G.1
PROVIDE PREFORMED RIGID PVC OR SAW- CUT INDUCTIVE LOOP DETECTORS AS REQUIRED BY THE CONTRACT. IN THIS WRITING FORMAT THE CONTRACTOR IS ASSUMED.

"2018 SPEC BOOK"

STANDARD SPECIFICATIONS FOR CONSTRUCTION

THE STANDARD SPECIFICATIONS FOR CONSTRUCTION WILL BE UPDATED EVERY FIVE YEARS. NEXT UPDATE JUNE 2020

2018 EDITION

“WHAT’S NEW SINCE 2015”

2545 & 2565 Pay Item Extensions 2565.5 BASIS OF PAYMENT

The Department will pay for new traffic control signal systems on the basis of the following schedule:

Item No:	Item:	Unit
2565.501	Emergency Vehicle Preemption System	lump sum
2565.501	Traffic Control Interconnect	lump sum
2565.502	APS Push Button Station	each
2565.502	APS Push Button and Sign	each
2565.502	APS Cabinet Control Unit	each
2565.502	APS Pole Mounting Adaptor	each
2565.502	APS Push Button Mounting Spacers	each
2565.516	Traffic Control Signal System	system

This change in pay item extensions (last 3 digits) was made so all pay items have consistent extensions with regards to lump sum, each, system, and other extension unit naming.

“WHAT’S NEW SINCE 2015”

The 2020 Spec Book 3842 “Electrical Systems Compounds and Lubricants” clarifies the three very different compounds
Anti Seize, No Ox, And Ferrous Metal Electrically Conductive Compound



CHAPTER 2

STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS



“ITEMS TO REMEMBER”



m DEPARTMENT OF TRANSPORTATION

STANDARD SPECIFICATIONS FOR CONSTRUCTION

THE STANDARD SPECIFICATIONS (SPEC BOOK) IS A COLLECTION OF PROVISIONS AND REQUIREMENTS PERTAINING TO THE PERFORMANCE OF WORK

2-2

THE SPEC BOOK IS DIVIDED INTO THREE DIVISIONS:



DIVISION I: General Requirements and Covenants
DIVISION II: Construction Details (2545 & 2565)
DIVISION III: Materials (3800 Series)

NUMERIC SERIES BY DIVISION

DIVISION I:
ALL SPECIFICATIONS BEGIN WITH NUMBER 1 (1101 THRU 1911)

DIVISION II:
ALL SPECIFICATIONS BEGIN WITH NUMBER 2 (2021 THRU 2581)

DIVISION III:
ALL SPECIFICATIONS BEGIN WITH NUMBER 3 (3101 THRU 3973)

DIVISION I
GENERAL REQUIREMENTS AND COVENANTS

DIVISION I
GENERAL REQUIREMENTS AND COVENANT
Definitions and Terms
1101 WORDING OF SPECIFICATIONS

Since the 2014 edition, the Minnesota Department of Transportation's Standard Specification for Construction (Standard Specifications) has emphasized the active voice. In Division 1, the Contractor's and Department's responsibilities are written in the active voice-indicative mood. In a sentence written in the active voice-indicative mood, someone acts on something. For example: "The Engineer will take a sample."

In Divisions 2 and 3, only the Department's responsibilities are written in the active voice-indicative mood.

In Divisions 2 and 3, the Contractor's responsibilities are written in active voice-imperative mood; the Department states its requirements or directions for performing the work to the Contractor. The imperative mood is used when the party issuing an instruction and the party receiving it are already understood. Such statements have the same force as if they contained the word "shall" and are considered mandatory. In an imperative sentence such as, "Pour the concrete," the Department is indicating that it requires the Contractor to pour the concrete. In the material specifications in Division 3, the subject may also be the supplier, fabricator, or manufacturer supplying the materials, products, or equipment for use on the project.

2018 EDITION

DIVISION I
GENERAL REQUIREMENTS AND COVENANTS

THIS DIVISION IS DIVIDED INTO NINE (9) SECTIONS

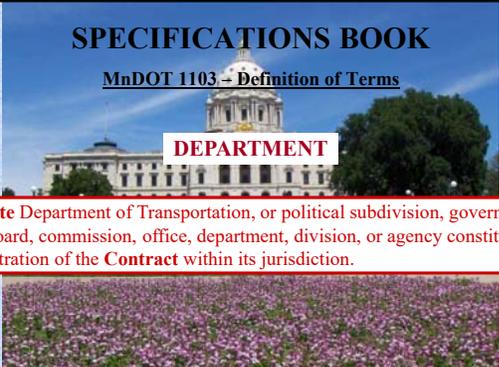
- (1101-1103) DEFINITIONS AND TERMS
- (1301-1307) Award and Execution of Contract
- (1401-1408) Scope of Work
- (1201-1313) Bidding Requirements and Conditions
- (1501-1517) CONTROL OF WORK
- (1601-1609) Control of Material
- (1701-1721) Legal Relations and Responsibility to the Public
- (1810-1809) Prosecution and Progress
- (1901-1911) Measurement and Payment

2-1

SPECIFICATIONS BOOK
MnDOT 1103 – Definition of Terms

DEPARTMENT

The State Department of Transportation, or political subdivision, governmental body, board, commission, office, department, division, or agency constituted for administration of the Contract within its jurisdiction.

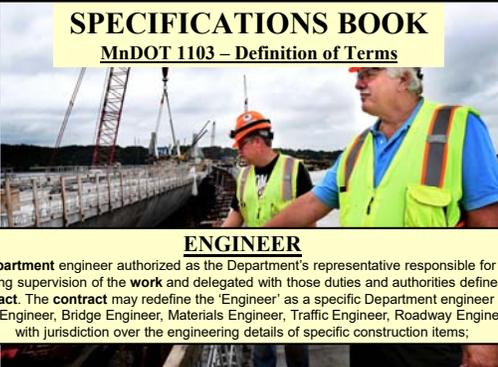


2-1

SPECIFICATIONS BOOK
MnDOT 1103 – Definition of Terms

ENGINEER

A Department engineer authorized as the Department's representative responsible for the engineering supervision of the work and delegated with those duties and authorities defined in the contract. The contract may redefine the 'Engineer' as a specific Department engineer (i.e. Concrete Engineer, Bridge Engineer, Materials Engineer, Traffic Engineer, Roadway Engineer, etc.) with jurisdiction over the engineering details of specific construction items;



2-1

SPECIFICATIONS BOOK
MnDOT 1103 – Definition of Terms



INSPECTOR
 The Engineer's authorized representative assigned to make detailed inspections of Contract work.

“SHALL”



THE TERM “SHALL” IS NOT USED IN CONTRACT DOCUMENTS HOWEVER YOU WILL FIND THIS TERM USED FOR PRODUCT SPECIFICATIONS.

IN THESE DOCUMENTS THE TERM “SHALL” MEANS THAT THE ACTION OR CONDITION IS **MANDATORY**.

2-2

SPECIFICATIONS BOOK
DIVISION I – CONTROL OF WORK
Spec 1504 -Coordination of Plans and Specifications

1504 COORDINATION OF CONTRACT DOCUMENTS
 A requirement appearing in one of the Contract documents is as binding as though the requirement appears in all. If discrepancies exist between the Contract documents, the following order of precedence applies:

- (1) Addenda,
- (2) Special Provisions,
- (3) Project-Specific Plan Sheets,
- (4) Supplemental Specifications,
- (5) Standard Plan Sheets and Standard Plates,
- (6) Standard Specifications.

If discrepancies exist between dimensions in the Contract documents, the following order of precedence applies:

- (1) Plan dimensions,
- (2) Calculated dimensions,
- (3) Scaled dimensions.

The Department and Contractor shall inform each other as to any discrepancy or defect they discover. Neither the Contractor nor the Engineer shall take advantage of any discrepancy or defect. The Engineer will review the alleged discrepancy or defect to determine if a contract revision is necessary in accordance with 1402, "Contract Revisions." The Engineer will decide all issues concerning a discrepancy or defect.

2-2

SPECIFICATIONS BOOK
DIVISION I (Spec 1504)
Coordination of Plans and Specifications
IN CASE OF DISCREPANCIES:

- (1) Addenda,
- (2) Special Provisions,
- (3) Project-Specific Plan Sheets,
- (4) Supplemental Specifications,
- (5) Standard Plan Sheets and Standard Plates,
- (6) Standard Specifications.

2-2

DIVISION II

THIS DIVISION IS DIVIDED INTO SIX (6) SECTIONS:

- General (2021 – 2051)**
- Grading (2101 – 2118)**
- Base Construction (2201- 2232)**
- Pavement Construction (2301- 2360)**
- Bridges and Structures (2401 – 2481)**
- Miscellaneous (2501 – 2581)**

2-2

SPECIFICATIONS BOOK
DIVISION II
2565 - Traffic Control Signals



- Description**
- Materials**
- Construction Requirements**
- Method of Measurement**
- Basis of Payment**

2-2

SPECIFICATIONS BOOK

MnDOT 2565 – Traffic Control Signals

Description

This section describes the required work and other types of systems governed by these Specifications.

Materials

This section covers general material specifications such as conduit and accessories with references to materials in Division III.

2-3

SPECIFICATION BOOK

2545 & 2565 – Traffic Control Signals

2545.1B QUALIFICATION OF WORKERS



MINNESOTA DEPARTMENT OF TRANSPORTATION
The Bearer of this card has been certified as a
Signal and Lighting Technician
Jason Johnson
MnDOT Electrical System Engineer
Name:
Certification Number:
Expiration Date:

Signal and Lighting Certification: When the Contractor is working on Traffic Signal System(s) or Lighting System(s), provide at least one Contractor employee on the site who is MnDOT Signal and Lighting Certified to perform or directly supervise the installation and testing of any MnDOT Traffic Signal System or Lighting System.

2-4

SPECIFICATIONS BOOK

MnDOT 2565 – Traffic Control Signals

Construction Requirements

This section specifies the requirements of the actual construction of a traffic control signal system.

SPECIFICATIONS BOOK

CONSTRUCTION REQUIREMENTS

Installation Requirements 2565.3A.4
2545.3A.4 References 2565

A.4 Installation Requirements
Install materials and devices in accordance with contract documents and in accordance with manufacturer's installation requirements.

SPECIFICATIONS BOOK

CONSTRUCTION REQUIREMENTS

Pole to Concrete Foundation Anchor Rods

The Standard Specifications for Construction for signals and lighting have requirements for tightening the pole to the foundation anchor rods.



2-4

SPECIFICATION BOOK

MnDOT 2565 – Traffic Control Signals



METHOD OF MEASUREMENT

This section explains how the components of a traffic control signal system will be measured for payment:

2565.4 METHOD OF MEASUREMENT

THE NEW TRAFFIC CONTROL SIGNAL SYSTEM WILL BE MEASURED AS AN INTEGRAL UNIT COMPLETE IN PLACE AND OPERATING WITH THE COMPLETE INSTALLATION AT ONE INTERSECTION CONSIDERED AS ONE UNIT.

2-5

SPECIFICATIONS BOOK
MnDOT 2565 – Traffic Control Signals

BASIS OF PAYMENT

A new traffic signal system will be paid for on the basis of the following schedule:

Item No:	Item:	Unit
2565.516	Traffic Control Signal System	system
2565.502	APS Push Button Station	each
2565.502	APS Push Button and Sign	each
2565.502	APS Cabinet Control Unit	each
2565.502	APS Pole Mounting Adaptor	each
2565.502	APS Push Button Mounting Spacers	each
2565.501	Emergency Vehicle Preemption System	lump sum
2565.501	Traffic Control Interconnect	lump sum

SPECIFICATION BOOK
MnDOT 2545 – Lighting Systems

METHOD OF MEASUREMENT

This section explains how the components of a lighting system will be measured for payment:

2545.4 METHOD OF MEASUREMENT

Lighting Units

Engineer will separately measure lighting units of each type of mounting and luminaire design by the number of units of each type, complete in place.

Direct Buried Lighting Cable

Engineer will separately measure direct buried lighting cable of each kind and size by the length between end terminals along the centerline of the cable as installed.

SPECIFICATIONS BOOK
MnDOT 2545 – Lighting Systems

BASIS OF PAYMENT

A new lighting system will be paid for on the basis of the following schedule:

ITEM No.	ITEM	UNIT
2545.502	Lighting Unit, Type	Each
2545.503	Direct Buried Lighting Cable, __ Cond No. __	Linear Foot

SPECIFICATIONS BOOK
MnDOT 2545 – Lighting Systems

BASIS OF PAYMENT

Some Lighting Projects may be paid for on the basis of the following schedule:

ITEM No.	ITEM	UNIT
2545.501	Lighting System	Lump Sum

2-5

DIVISION III – Materials
ELECTRICAL MATERIALS (3801 – 3850)

- Conduit (3801 thru 3805)
- Lighting Luminaires (3810)
- Light Poles (3811)
- Photoelectric Controls (3812)
- EVP Equipment (3814)
- Electrical Cables and Conductors (3815)
- Mast Arm Pole Standards (3831)
- Traffic Signal Pedestals (3832)
- Vehicle Signal Heads (3834)
- Pedestrian Signal Heads (3835)
- Electrical Service Equipment (3837)
- Lighting Service Cabinet (3850)

2-6

CONTRACT PROPOSAL

Each MnDOT project has a Proposal. The following information is on the front cover of the Contract Proposal:



- Name and Address of the Contractor awarded the Contract.
- State Project Number.
- Governing Specifications.
- Location of Work.
- Starting and Completion Date.

CONTRACT PROPOSAL

The Proposal contains "important" documents



- Addendum's
- Notices to Bidder
- Special Provisions
 - DIVISION S (GENERAL)
 - DIVISION SS (SIGNALS)
 - DIVISION SL (LIGHTING)
 - DIVISION SZ (TMS)
- Drawings and Details
- Attachments
- Schedule of Prices

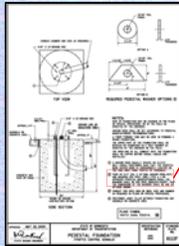
SPECIFICATIONS BOOK MnDOT 2545.3A & 2565.3A - General



The location of component parts as indicated in the Contract --- *"are approximate only"* the exact locations will be established by the Engineer.

Except Ped Ramps, Push Buttons and Signal Poles.

"OTHER" SPECIFICATIONS



FOUR (4) 3/4" DIA. X 18" MDN. ANCHOR RODS, NUTS AND WASHERS PER SPEC. 3385 (TYPE A), OR APPROVED PEDESTAL MANUFACTURERS' EQUIV. THE WASHERS SHALL BE PER SPEC. 3632.2C3, EXCEPT THAT THE DIMENSIONS OF THE WASHERS SHALL BE ONE OF OPTIONS SHOWN.

NOTE NO. 2: the Standard Plate specifies the requirements for anchor rods. The note refers the Contractor to Spec. 3385 Anchor Rods. This specification is found in the Spec Book which details the requirements for various types of anchor rod material.

SPECIAL PROVISIONS

SPECIAL PROVISIONS ARE "ADDITIONS AND REVISIONS TO THE STANDARD SPECIFICATIONS COVERING CONDITIONS PECULIAR TO AN INDIVIDUAL PROJECT".

SPECIAL PROVISIONS ARE JUST THAT --- "SPECIAL" . IF AN ITEM IS ADEQUATELY SPECIFIED IN THE SPEC BOOK, PLANS, STANDARD PLATES, OR OTHER CONTRACT DOCUMENTS, THEN IT IS NOT TO BE DUPLICATED IN THE SPECIAL PROVISIONS.

SPECIAL PROVISIONS DIVISION SS (TRAFFIC CONTROL SIGNALS)

DIVISION SS MAY BE THREE OR MORE "SS" SECTIONS:



- SS-1 Traffic Control Signals
- SS-2 Emergency Vehicle Preemption (EVP) System
- SS-3 Traffic Control Interconnection

SPECIAL PROVISIONS DIVISION SS -TRAFFIC CONTROL SIGNALS

Signals Special Provisions are "SIMILAR" to the spec book format:

SS-2	Description
SS-2.1	General Section
SS-2.2	Materials Section
SS-2.3	Construction Requirements
SS-2.4	Measurement and Payment

SPECIAL PROVISIONS
2565 – Traffic Control Signals

SS-2 DESCRIPTION PARAGRAPH

THIS SECTION DESCRIBES:

- THE WORK TO BE DONE
- THE LOCATION OF THE WORK
- THE RULES WHICH GOVERN THE WORK

SPECIAL PROVISIONS
SS-2.1 General Section



Will list the Department furnished materials

Will list the material that the Contractor is required to furnish and install in order to complete the installation of the Department furnished material.



This Section also includes the notification requirements of the Contractor for picking up the Department furnished materials.

MnDOT Electrical Services Section

ESS



SPECIAL PROVISIONS
SS-2.1 General Section

IMPORTANT REQUIREMENTS FOR THE CONTRACTOR TO REMEMBER:

CONTRACTOR'S RESPONSIBILITY TO OBTAIN DEPARTMENT FURNISHED MATERIALS FROM ESS

CONTRACTOR TO DIRECT ESS TO T.E. REQUEST NO.

CONTRACTOR TO REQUEST DEPARTMENT FURNISHED MATERIALS AT LEAST 30 NORMAL WORKING DAYS IN ADVANCE OF CONTRACTOR NEED

SPECIAL PROVISIONS
SS-2.1 General Section

IMPORTANT REQUIREMENTS FOR THE CONTRACTOR TO REMEMBER:

CONTRACTOR'S RESPONSIBILITY TO DELIVER COMPONENTS THAT NEED TO BE INSTALLED WITHIN THE DEPARTMENT FURNISHED TRAFFIC SIGNAL CABINET TO THE ELECTRICAL SERVICES SECTION AT LEAST 30 NORMAL WORKING DAYS IN ADVANCE OF WHEN THE CABINET IS REQUIRED ON THE JOB SITE.

CONTRACTOR SHALL GIVE ESS AT LEAST 3 WORKING DAYS NOTICE OF INTENT TO PICKUP DEPARTMENT FURNISHED MATERIALS

SPECIAL PROVISIONS
SS-2.2 Materials Section: Service Equipment



MnDOT projects require SSB signal service cabinets. They come with or without battery backup systems.

The Special Provisions will refer the Contractor MnDOT's Approved Products List (APL) for the approved SSB signal service cabinets

SPECIAL PROVISIONS



THE LETTERS **"I"** AND **"Q"** ARE NOT USED IN EITHER THE SPEC BOOK OR SPECIAL PROVISIONS. AS A RESULT, IN BOTH CASES, EACH LETTER WILL BE INCLUDED FOLLOWED BY THE WORD **"BLANK"**.

"SPECIAL PROVISIONS"

ADVANCE WARNING FLASHERS



THE CONTRACTOR IS REQUIRED TO FURNISH AND INSTALL THE ENTIRE ASSEMBLY. THE PLAN DETAIL AND SPECIAL PROVISIONS INDICATE ALL REQUIREMENTS

SPECIAL PROVISIONS

Traffic Signs and Devices



MANY SIGNAL SYSTEM PROJECTS WILL INCLUDE LANGUAGE COVERING SIGNS THAT ARE MOUNTED ON MAST ARMS.

THIS ITEM IS PAID FOR AS PART OF THE TRAFFIC SIGNAL SYSTEM AND THE REQUIREMENTS ARE SPECIFIED IN THE CONTRACT DOCUMENTS.

SPECIAL PROVISIONS

SS-2.3 CONSTRUCTION REQUIREMENTS

CONDUIT PLACEMENT



IN ADDITION TO THE LANGUAGE IN THE SPEC BOOK, SOME MnDOT DISTRICTS HAVE ADDITIONAL REQUIREMENTS FOR CONDUIT PLACEMENT. THESE REQUIREMENTS ARE INCLUDED IN THE SPECIAL PROVISIONS.

SPECIAL PROVISIONS

SS-2.3 CONSTRUCTION REQUIREMENTS

REMOVALS

WHEN AN EXISTING TRAFFIC SIGNAL SYSTEM IS TO BE REMOVED, THE REMOVAL REQUIREMENTS ARE SPECIFIED IN THE SPECIAL PROVISIONS

THE CONTRACTOR SHALL PROVIDE A COPY OF THE ESS RECEIPT FOR SALVAGED MATERIAL TO THE ENGINEER FOR THE PROJECT FILE

SPECIAL PROVISIONS

SS-2.3 CONSTRUCTION REQUIREMENTS

REMOVAL and SALVAGE

Removal means the contractor is responsible for removing the item and the item then becomes the property of the contractor to properly dispose of the item.

Remove and Salvage means the contractor must remove the item and return it to MnDOT at the location as defined in the contract documents

DEFINITION OF TERMS

Cut Sheet, Catalog Sheet, or Specification Sheet

A document showing a finished product including part numbers and an ordering matrix if required.

Shop Drawing

A detailed document showing how a specific product will be fabricated and constructed. This document will also include required material specifications and requirements.

1103, 2545, and 2565.

1906.2 Material on Hand

The Contractor shall provide the following actual, authentic, customary, and auditable documents, produced in the normal course of business, to receive payment for Materials on hand:

- (1) Invoices **and proof of payment** for the Materials,
- (2) An itemized list detailing the cost of Contractor-produced Material, and
- (3) Documents containing complete Material description and identification.

Questions ???

What's New Since 2015 CHAPTER 3 STANDARD PLATES

MnDOT is working on moving all of our details to either Standard Plans or Standard Plates.

The general definition of a standard plan is for something constructed in the field.

The general definition of a standard plate is for something constructed at a manufacturing facility.

STANDARD PLATES MANUAL CHAPTER 3 STANDARD PLATES

STATE OF MINNESOTA
DEPARTMENT OF TRANSPORTATION

STANDARD PLATES BOOK

- HAND OUT BOOK HAS ALL SIGNAL AND LIGHTING RELATED PLATES
- CHANGES PENDING AS NOTED

3-1

- STANDARD PLATES SPECIFY THE DETAILS OF THE ITEMS TO BE FURNISHED OR CONSTRUCTED.
- CONTRACTORS & INSPECTORS SHOULD HAVE THESE PLATES IN THEIR POSSESSION AND BE FAMILIAR WITH THEM
- STANDARD PLATES HAVE AN APPROVAL PROCESS BEING ISSUED
- THEY DO NOT HAVE TO BE APPROVED ON A PROJECT BY PROJECT BASIS

3-1

STANDARD PLATES	
BLANK	8000 SERIES
PAVEMENT	1000 SERIES
BLANK	3000 SERIES
CULVERT AND APPURTENANCES	4000 SERIES
SEWER APPURTENANCES	4000 SERIES
SEWER CONTROL STRUCTURES	4000 SERIES
BLANK	6000 SERIES
CURB, CURB AND OUTER, SIDEWALK	7000 SERIES
BARRICADES, SIGNALS, MARKERS, ETC.	8000 SERIES
MISCELLANEOUS	9000 SERIES

8000 SERIES - SPECIFICATION REFERENCES	
1000 SERIES - PAVEMENT	
1015	W.L. Reinforced Panel Over Culverts
1016	J. Signal Street Box Assembly
1018	G. Pavement Reroute For Road Joint Construction
1019	Construction Of Manhole Covers
1019	F. Concrete Pavement Adjacent To Railway Crossing
3000 SERIES - CULVERT AND APPURTENANCES	
3000	L. Reinforced Concrete Pipe (R.C. Pipes)
3001	B. Reinforced Concrete Retainer Pipe
3002	C. Reinforced Concrete Inverted Pipe
3006	G. Sinker Joint for R.C. Pipe (2 Sheets)
3007	H. Steel Reinforcement For Precast Drainage Structures
3008	I. Reinforced Concrete Pipe Arch (2 Sheets)
3009	J. Reinforced Precast Concrete Cattle Pass (8' x 7')
3010	K. Precast Concrete End Structure (2 Sheets)
3010	A. Precast Cattle Pass Transition Structure
3011	L. Construction Details Entering 18" x 18" Cattle Pass And New Product Transition
3044	F. Curbless
3045	G. Compacted Steel Pipe Culvert (20' x 20" x 12" Corrugated)
3046	H. Compacted Steel Pipe Culvert (20" Corrugated)
3048	B. Design Data Structural Plate Structures (10' Center Radius)

MINNESOTA DEPARTMENT OF TRANSPORTATION		NUMERICAL INDEX OF STANDARD PLATES (Sheet 1 of 2)	September 1998
--	--	---	----------------

3-1

8000 SERIES - BARRICADES, SIGNALS, MARKERS, ETC.	
8000	Channelizers
8002	Permanent Barricade
8106	Equipment Pad B
8107	RLF Equipment Pad Foundation Layout
8110	Traffic Signal Bracketing (Pole Mounted)
8111	Traffic Signal Bracketing (Pedestal Mounted) (3 Sheets)
8112	Pedestal Foundation (Traffic Control Signals)
8117	Precast Concrete HandHole With Vehicle Load
8118	Service Equipment & Pole Traffic Control Signals
8119	Ground Mounted Cabinet Foundation
8120	Pole Foundation (PA85)
8121	Transformer Base and Pole Base Plate (PA85, PA90 and PA100) (2 Sheets)
8122	Pedestal and Pedestal Base (For Traffic Control Signals Support) (2 Sheets)
8123	Pole and Mast Arm Luminaires and Traffic Lights Assembly (For All Pole Types) (2 Sheets)
8126	Pole Foundation (PA80 and PA100)
8127	Light Foundation - Design E, Precast/Cast-In-Place, 40 ft. Pole or Less (2 Sheets)
8128	Light Foundation - Design H, Precast/Cast-In-Place, 49 ft. Pole (2 Sheets)

3-1

8000 SERIES - BARRICADES, SIGNALS, MARKERS, ETC.	
8000	I. Standard Barricades
8000	I. Permanent Barricades
8106	A. Equipment Pad A (Cast-In-Place or Precast)
8106	A. Equipment Pad B (Cast-In-Place or Precast)
8110	D. Traffic Signal Bracketing (Pole Mounted)
8111	C. Traffic Signal Bracketing (Pedestal Mounted) (2 Sheets)
8112	C. Pedestal Foundation (Traffic Control Signals)
8114	A. P.V.C. Handhole/Pullbox (No Vehicle Load) (2 Sheets)
8118	D. Pedestrian Push Button Installation
8117	F. Precast Concrete Handhole (Or Pullbox) (No Vehicle Load) (2 Sheets)
8118	C. Service Equipment & Pole Traffic Control Signals
8119	C. Ground Mounted Cabinet Foundation
8120	K. Pole Foundation P-85
8121	D. Transformer Base and Pole Base Plate (PA85, PA90 and PA100) (2 Sheets)
8122	C. Pedestal and Pedestal Base (Traffic Control Signals)
8123	E. Pole and Mast Arm - Luminaires and Traffic Lights (2 Sheets)
8124	E. Mast Arm Signal Head Mounts (One-Way & Two-Way Mounts) (2 Sheets)
8126	B. Pole Foundation (PA80 and PA100)
8127	B. Light Base - Design E (40 Ft. Pole or Less)
8128	B. Light Base - Design H (49 Ft. Pole)
8130	D. Saw Cut Loop Detectors
8130	B. Roadway Lighting Service Cabinet (Pole Mounted)
8150	B. Installation of Curb Markers
8207	P. Steel Plate Beam Guardrail (2 Sheets)
8210	B. Cable Fence Barrier
8316	C. Connection for Cable Guardrail to Type J Railing & Concrete Bridge Rail (2 Sheets)
8316	C. Post Seat for Anchorage on Footing or Box Culverts
8316	C. Guardrail Anchorage Plate for Bridges and BCT's
8320	D. Flexible Plastic Glare Screens
8320	G. Eccentric Leader Breakaway Cable Terminal (ELT) (4 Sheets)
8320	D. S-Cable Guardrail (2 Sheets)
8332	A. Anchor Bolt Cluster
8334	A. Concrete Type F Median Barrier (Non-Glare Screen Type) (2 Sheets)
8336	A. Guardrail Transition Detail at Intersecting Roadways
8336	A. Type F Concrete Median Barrier & Glare Screens (2 Sheets)
8337	A. Temporary Portable Precast Concrete Barrier Type F
8338	A. Steel Plate Beam Guardrail (Steel Posts)
8400	M.E. Pipe Railing
8401	C. At Grade Pipe Railing (Adjacent to Sidewalk)

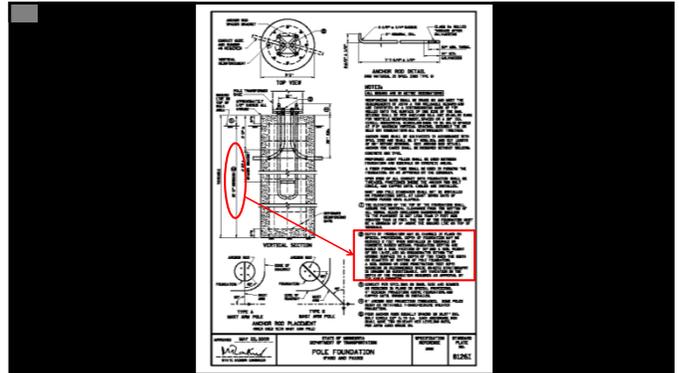
STANDARD PLATES - SIGNAL SYSTEMS	
THE FOLLOWING STANDARD PLATES, APPROVED BY THE FEDERAL HIGHWAY ADMINISTRATION, SHALL APPLY ON THIS PROJECT	
PLATE NO.	DESCRIPTION
8120B	A. DETECTABLE WARNING SURFACE TRUNCATED DOMES
8121B	A. CONCRETE APPROX. NOSE DETAIL
8111	E. TRAFFIC SIGNAL BRACKETING (PEDESTAL MOUNTED)
8112	C. PEDESTAL FOUNDATION
8117	G. PRECAST CONCRETE HAND HOLE
8118	D. SERVICE EQUIPMENT AND POLE
8119	E. GROUND MOUNTED CABINET FOUNDATION
8120	G. POLE FOUNDATION (PA-85)
8120B	H. TRANSFORMER BASE AND POLE BASE PLATE
8122	F. PEDESTAL AND PEDESTAL BASE
8123	G. POLE AND MAST ARM
8126	L. POLE FOUNDATION (PA80 AND PA100)
8127	A. SHIM AND WASHER
8130	B. SAW CUT LOOP DETECTORS
8130	B. PREFORMED RIGID PVC CONDUIT LOOP DETECTOR
STANDARD PLATES APPLICABLE TO THIS PROJECT	

THE FOLLOWING STANDARD PLATES APPROVED BY THE MINNESOTA DEPT. OF TRANSPORTATION AND THE FEDERAL HIGHWAY ADMINISTRATION SHALL APPLY ON THIS PROJECT.

STANDARD PLATES	
PLATE NO.	DESCRIPTION
8106B	EQUIPMENT PAD B
8000I	STANDARD BARRICADES
8127C	LIGHT FOUNDATION DESIGN E
8128D	LIGHT FOUNDATION DESIGN H
8129A	SHIM AND WASHER

MnDOT HAS UPDATED MANY STANDARD PLATES THAT DEAL WITH SIGNALS AND LIGHTING

- 8112G - Pedestal Foundation (backfill, compact, projections)
- 8117F - Precast Concrete Hand Hole
- 8120P - Pole Foundation (backfill, compact, projections, antiseize)
- 8121G - Transformer Base and Pole Base Plate
- 8122F - Pedestal and Pedestal (shims)
- 8123G - Pole and Mast Arm
- 8126J - Pole Foundation (backfill, compact, projections, antiseize)
- 8127C - Light Base - Design E (backfill, compact, projections, antiseize, foundation not base)
- 8128C - Light Base- Design H (backfill, compact, projections, antiseize, foundation not base)
- 8309B - Reinforced Concrete Medium Barrier Type F & Glare Screen (anchor bolts galvanized, dimensions width)



STANDARD PLATES MANUAL

STANDARD PLATES:

- GET MODIFIED
- GET DELETED
- ARE NEWLY CREATED

DEPARTMENT OF TRANSPORTATION

3-2

TWO WAYS TO OBTAIN STANDARD PLATES:

1. MnDOT WEB SITE: <http://standardplates.dot.state.mn.us/StdPlate.aspx>
2. PURCHASE THE MANUAL FROM MnDOT MAPS AND MANUAL SALES UNIT (651-366-3017)

STANDARD PLATES MANUAL

Questions?

STATE OF MINNESOTA
DEPARTMENT OF TRANSPORTATION

Office of Traffic Engineering

Mn/DOT Sample Plan

Jerry Kotzenmacher
MnDOT

Without a plan!

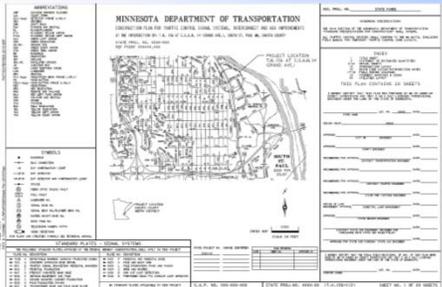


Traffic Signal Plans

- Why do we need a plan?
 - Building the traffic signal.
 - Bidding
 - Tort Claims
 - Maintenance
 - Locates



Title Sheet – front page



Title Sheet – front page

- Governing Specs and Index of Sheets

This defines the governing specifications for the project, the project funding and the index of the sheets contained within the plan set.

GOVERNING SPECIFICATIONS	
THE 2014 EDITION OF THE MINNESOTA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION SHALL GOVERN.	
ALL TRAFFIC CONTROL DEVICES SHALL CONFORM TO THE MN MUTCD, EXCLUDING PUBLISHED MANUAL FOR TEMPORARY TRAFFIC CONTROL SIGNAL LAYOUTS.	
INDEX	
1	TITLE SHEET
2-14	SECTION OF ESTIMATED QUANTITIES
15-16	TRAFFIC SIGNALS
17	INTERSECTION LAYOUT
18	TRAFFIC SIGNAL LAYOUT/CONSTRUCTION NOTES
19-20	PUBLIC REVIEW DRAWINGS
21	CONTRACT AGREEMENT & TERMS
22	CIVIL RIGHTS STATEMENT
THIS PLAN CONTAINS 20 SHEETS	
I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A duly LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.	



Title Sheet – front page

- Signature Block

The Designer should consult with the Mn/DOT project manager to ensure that the appropriate signature block is used.

DESIGNED BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE
RECOMMENDED FOR APPROVAL	DATE
RECOMMENDED FOR APPROVAL	DATE
RECOMMENDED FOR APPROVAL	DATE
OFFICE OF THE	DATE
APPROVED	DATE
RECOMMENDED FOR APPROVAL	DATE
APPROVED	DATE



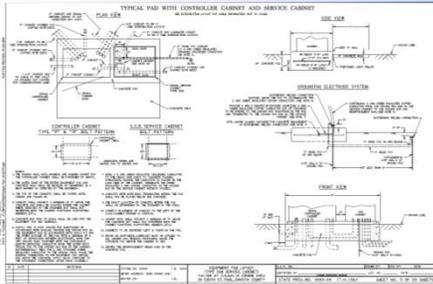
heet – front page

- Index Map

The index map is used to identify the location of the project(s).



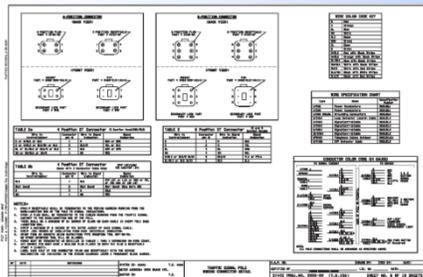
Page 5 - Equipment Pad - Details



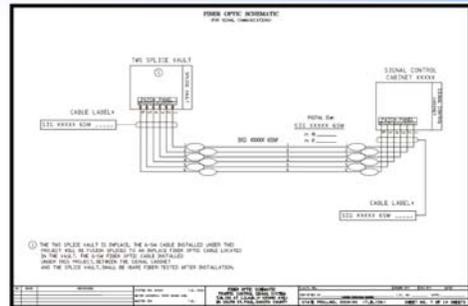
Controller & Service Cabinet



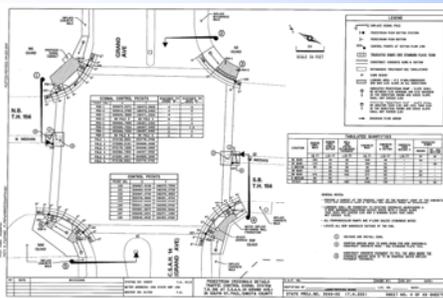
Page 6 - Pole Wiring Connector - Details



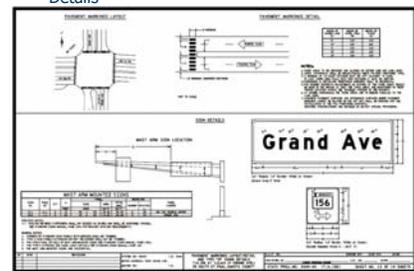
Page 7 - Fiber Optic Schematic - Details



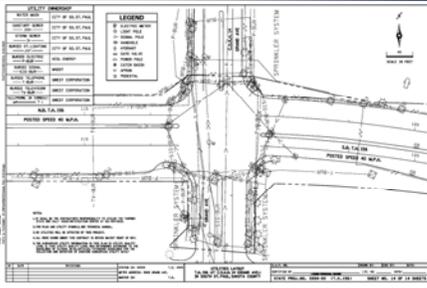
Page 8 - Ped Curb Ramp - Details



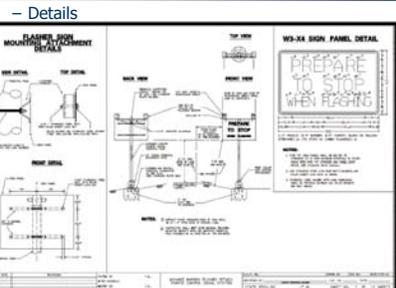
Page 19 - Pavement Markings & Signs - Details



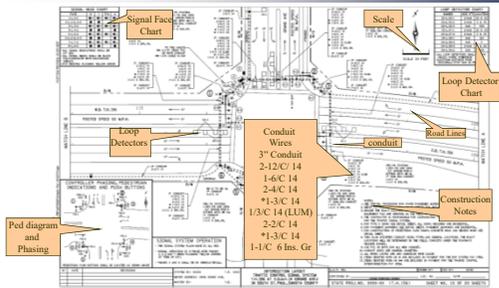
Page 20 – Utilities Layout



Not part of your plan



Page 15 - Signal Layout



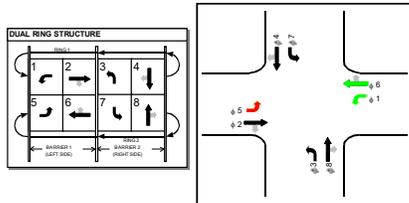
Page 15– Intersection Layout

– Typical Controller Phasing Diagram
8 phase NEMA Controller

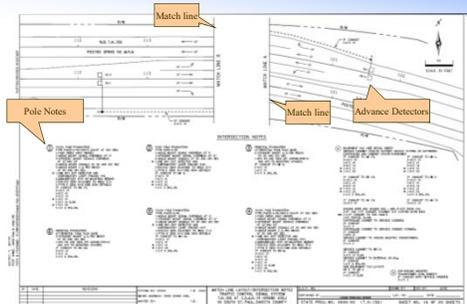


Controller Operations

- Phasing
- Dual-ring and Concurrent group Controllers



Page 16 - Signal Layout



Office of Traffic Engineering

Page 15 & 16 – Intersection Layout

– Equipment Pad and SOP Notes

Label, in a circle, the controller cabinet or equipment pad "A" and the source of power "B"

100

Office of Traffic Engineering

Page 15 – Intersection Layout Mast Arm & Pole Symbols

101

Office of Traffic Engineering

Page 15 – Intersection Layout

➤ Pole 4

102

Office of Traffic Engineering

Picture of Pole 4

103

Office of Traffic Engineering

Page 15 – Intersection Layout

Pedestrian Signal Face

CONTROLLER INDICATIONS

WALKING PEDESTRIAN PUSH BUTTONS

Pedestrian Push Button

104

Office of Traffic Engineering

Page 15 – Intersection Layout

– Signal Faces Table

SIGNAL FACE CHART		R	SY	FY*	G
FACE	R L T FTY G				
1-1, 1-2	← ← ← ←	●	●	●	●
2-1, 2-2, 2-3	← ← ← ←	●	●	●	●
3-1, 3-2	← ← ← ←	●	●	●	●
4-1, 4-2	← ← ← ←	●	●	●	●
5-1, 5-2	← ← ← ←	●	●	●	●
6-1, 6-2, 6-3	← ← ← ←	●	●	●	●
7-1, 7-2	← ← ← ←	●	●	●	●
8-1, 8-2	← ← ← ←	●	●	●	●

ALL SIGNAL INDICATIONS SHALL BE 12" LED
 ALL SIGNAL HEADS SHALL BE BLACK POLYCARBONATE WITH BACKGROUND SHIELDS
 *FYA DENOTES FLASHING YELLOW ARROW

105

Office of Traffic Engineering

Page 15 – Intersection Layout

– Loop Detectors Table

NUMBER	SIZE (FT)	LOCATION
D1-1, D5-1	2-6x6	20 & 50
D1-2, D5-2	2-6x6	5 & 35
D2-1, D2-2	6x6	400
D3-1, D7-1	2-6x6	20 & 50
D3-2, D7-2	2-6x6	5 & 35
D4-1, D8-1	6x6	120
D4-2, D8-2	2-6x6	0 & 15
D4-3, D8-3	2-6x6	5 & 20
D6-1, D6-2	6x6	400

-ALL LOOP DETECTORS SHALL BE PVC UNLESS NOTED OTHERWISE
-LOCATION IN DISTANCE FROM CROSSWALK/STOP BAR IN FEET

DOT

109

Office of Traffic Engineering

Page 15 – Intersection Layout

– Handhole Labeling

DOT

110

Office of Traffic Engineering

Page 17 – Field Wire Diagram

DOT

111

Office of Traffic Engineering

Page 18 – Field Wire Diagram (2nd Sheet of Wire Diagram)

DOT

112

Office of Traffic Engineering

Wiring Diagram

> Field Wiring

DOT

113

Office of Traffic Engineering

Wire Diagram to Layout Cross reference

page 18

page 15

DOT

114

Office of Traffic Engineering

Wiring Notes

- Field Wiring

Signal Base Number
Signal Phase Number
Loop Detector Graphic Name
Cable Number - Label in Numerical Order
Source of Power
S.O.P.

115

Office of Traffic Engineering

Interconnect layout – NOT PART OF YOUR PLAN

116

Office of Traffic Engineering

Other Material Reference

- **MnDOT Manuals**
 - Signal Design Manual
 - Roadway Lighting Manual
 - Signal Timing Manual
 - Traffic Engineering Manual
 - MN-MUTCD

117

Office of Traffic Engineering

Questions?

118

CHAPTER 4

PLANS

Typical Lighting Plan

MINNESOTA DEPARTMENT OF TRANSPORTATION
CONSTRUCTION PLAN FOR ELECTRIC LIGHTING SYSTEM
LOCATED ON: 74 62 FROM SOUTHWEST BLVD TO PLATO BLVD

INDEX SHEET NO. 1

119

APPROVED PRODUCTS APL

APL Can be found on line:
<http://www.dot.state.mn.us/products/>
(In Appendix pages 40 - 41 of manual)

Items on the APL meet all standards and specifications without further testing.

Why an APL?

APPROVED PRODUCTS APL

Signal Items:

- LED Indications
- Paint
- EVP
- Signal Heads
- Loop splice kits and Sealant
- Hand Holes/covers
- Pedestrian buttons
- Cabinets (SSB) /Batteries/UPS

APPROVED PRODUCTS APL

Roadway Lighting Items:

- Lamps
- Screw-in Light Foundations
- Luminaires
- Service Cabinets
- Hardware - holders/splice blocks/Photo Cells/fuse kits

STATE FURNISHED MATERIAL

Signals - Cabinet and Controller
(need TE Number)

Lighting - Smart Photo Control

Why State Furnished?

CONTRACTOR FURNISHED MATERIALS

Must use either APL or Specs
Material pre-inspected
Materials List (starts on Appendix 17)

QUESTIONS?

Steve Grover
MN/DOT - Materials Lab

6-1...

CHAPTER 6 GOPHER STATE ONE CALL

Color Code for Marking Underground Utilities

WHITE	Area of Proposed Excavation
PINK	Temporary Survey Markings
RED	Electric
YELLOW	Gas, Oil, Steam, Propane
ORANGE	Communication, CATV, Fiber
BLUE	Water
PURPLE	Reclaimed Water, Irrigation
GREEN	Sewer

2019 Handbook

6-1 & 6-2

GOPHER STATE ONE CALL (GSOC)

What is it?

It's a state wide one call center for anyone who engages in any type of excavation using machine-powered equipment of any kind, to file a locate request at least **48 hours, excluding weekends and holidays**, before excavation can begin. Excavator may notify up to **14 calendar days** before excavation.

GSOC Handbook Pg. 1

6-1

GSOC -What is it? GSOC Handbook Pg. 2

Once a locate is filed by the excavator, GSOC notifies those facility operators who have joined Gopher State One Call

Color Code for Marking Underground Utilities

WHITE	Area of Proposed Excavation
PINK	Temporary Survey Markings
RED	Electric
YELLOW	Gas, Oil, Steam, Propane
ORANGE	Communication, CATV, Fiber
BLUE	Water
PURPLE	Reclaimed Water, Irrigation
GREEN	Sewer

2019 Handbook

The cost of GSOC is paid by the operators and the service provided by GSOC is free to excavators.

GSOC Handbook

GSOC Handbook- Page 3

What GSOC Doesn't Do:

Main Points:

- It doesn't physically locate and mark any underground facilities.
- It doesn't settle disputes between excavators and facility operators.
- It doesn't maintain a database of exact location of underground facilities.

GSOC Handbook

GSOC Handbook Pgs. 4-5 underground utilities

- GSOC ITIC allows locate requests via the internet 24/7
 - Emergency locates by phone 24 hours a day
 - Process locates and meets by phone:

April- October	M-F 6am- 6pm
November- March	M-F 7am-5pm

GSOC Handbook

Definitions of "Excavator" and "Operator" in accordance with Minnesota State Law Chapter 216 D

EXCAVATOR: (Handbook Pg. 66)

A PERSON WHO CONDUCTS EXCAVATION IN THE STATE

OPERATOR: (Handbook Pg. 67)

A PERSON WHO OWNS OR OPERATES AN UNDERGROUND FACILITY

GSOC Handbook Pg. 95

EXCAVATORS RESPONSIBILITIES

Color Code for Marking Underground Utilities

WHITE	Area of Proposed Excavation
PINK	Temporary Survey Markings
RED	Electric
PURPLE	Reclaimed Water, Irrigation
GREEN	Sewer



(855)454-0002 or (800)252-1184

GOPHER STATE ONE CALL

GSOC Handbook Pg. 95

The Minnesota Rules in 7560.0350 sets forth requirements for a meet



811
Minnesota One Call
Call before you dig



811
Minnesota One Call
Call before you dig

GSOC Handbook Pg. 16

EXCAVATORS RESPONSIBILITIES

White Marks

GSOC Handbook Pg. 16

Main Points:

- The excavator is required to use white markings to define the entire area where excavation will occur.
- Include a safety buffer when marking the area.
- Break large projects down into multiple tickets.

GSOC Handbook Pg. 16

EXCAVATORS RESPONSIBILITIES

Color Code for Marking Underground Utilities

2018

GSOC Handbook Pg. 16

Excavators are required to use white markings for indicating the area of proposed excavations unless it can be shown it is not practical



811
Minnesota One Call
Call before you dig



ANNIVERSARY
1988-2018
www.gopherstateonecall.org

GSOC Handbook Pg. 16

EXCAVATORS RESPONSIBILITIES

When White Marks Are Not Practical



What to do when there is snow?

6-8

MnDOT 1507.2

Standard Specifications for Construction Requiring White Marks

PINK	Temporary Survey Markings
RED	Electric
YELLOW	Gas, Oil, Steam, Propane
ORANGE	Communication, CATV, Fiber



2019 Handbook

1507.2 NOTIFICATION

The Contractor shall fulfill all the obligations of an excavator in Minnesota Statutes Chapter 216D and rules adopted to implement that statute. **The Contractor's obligations include but are not limited to marking the proposed excavation**, contacting "Gopher State One Call" at least 48 h before starting excavation operations (excluding Saturdays, Sundays, and Holidays), and providing support and protection for underground facilities in and near the construction area.

6-8

MnDOT Division S Special Provisions

Failing to Use White Marks

Underground Utilities

WHITE	Area of Proposed Excavation
PINK	Temporary Survey Markings
RED	Electric



GOPHER STATE ONE CALL

S-27.2 Any work performed by the Contractor that does not comply with MnDOT 1507.2 may be considered Unauthorized Work in accordance with MnDOT 1512.2.



811
Minnesota One Call
Call before you dig



811
Minnesota One Call
Call before you dig

6-9

Contractors Responsibilities for locating underground facilities within the construction limits of the project

At the pre construction (Pre Con) meeting the contractor should supply detailed contact information for whom to contact when locating is required an excavator within the construction limits of a project

6-10

Repair of Damaged Underground Facilities

Color Code for Marking Underground Utilities

- The law is silent with regard to how fast an Operators facility must be repaired.
- Generally the operator will facilitate and take charge of the repair of it's damaged facility.

6-10

Section 216D.06 Damage to Facility

GSOC Handbook (Pgs. 77-78)

Underground Utilities

- WHITE Area of Proposed Excavation
- Pink Temporary Survey Markings
- RED Electric
- YELLOW Gas, Oil, Steam, Propane
- ORANGE Communication, CATV, Fiber

2019 Handbook

If the damage results in the escape of any flammable, toxic, or corrosive gas or liquid or endangers life, health, or property, the excavator responsible SHALL immediately notify the operator and the 911 public safety answering point, as defined in section 403.02, subdivision 19, and take immediate action to protect the public and property.

6-10

Repair of Damaged Underground MnDOT Facilities

If a MnDOT roadway lighting system is damaged the following requirements must be met:

Lighting systems 2545.3.A

If damage due to Contractor's negligence occurs to electrical cable, within 24 hours replace the entire run of lighting system electrical cable at no additional cost to the Department.

If damage due to Contractor's negligence occurs to individual conductor(s) in conduit and to the conduit, within 24 hours replace all the individual conductors in the conduit and the conduit at no additional cost to the Department.

Do not splice electrical cable and bury underground.

Do not splice damaged conductors and place back in conduit.

6-10

Repair of Damaged Underground MnDOT Facilities

If a MnDOT traffic control signal system is damaged the following requirements must be met.

Signal Systems 2565.3B

If existing electrical system components are damaged due to Contractor operations, within 24 hours repair or replace the damaged components at no additional cost to the Department, in accordance with 1716 and relevant to specifications for new construction.

Failure to repair or replace damaged components within 24 hours will result in the Department repairing or replacing and deducting costs from project money entitled to the Contractor.

6-10

Call GSOC Before You DIG

52-1164

Color Code for Marking Underground Utilities

- WHITE Area of Proposed Excavation
- Pink Temporary Survey Markings
- RED Electric
- YELLOW Gas, Oil, Steam, Propane
- ORANGE Communication, CATV, Fiber
- BLUE Water
- PURPLE Reclaimed Water, Irrigation
- GREEN Sewer

2019 Handbook

811

Your Life and the life of those working on or around the project area depend on it.

Color Code for Marking Underground Utilities

WHITE	Area of Proposed Excavation
PINK	Temporary Survey Markings
RED	Electric
YELLOW	
ORANGE	
BLUE	
PURPLE	Reclaimed Water, Irrigation
GREEN	Sewer

QUESTIONS? Handbook

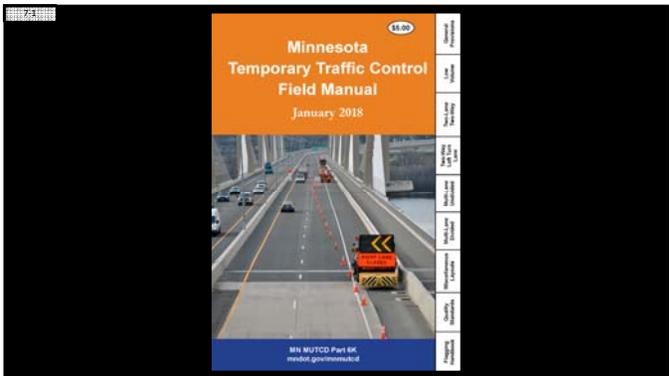
811
Have your utilities marked. Call before you dig.

GSOC
GOPHER STATE ONE CALL

(651)454-0002 - or - (800)252-1164

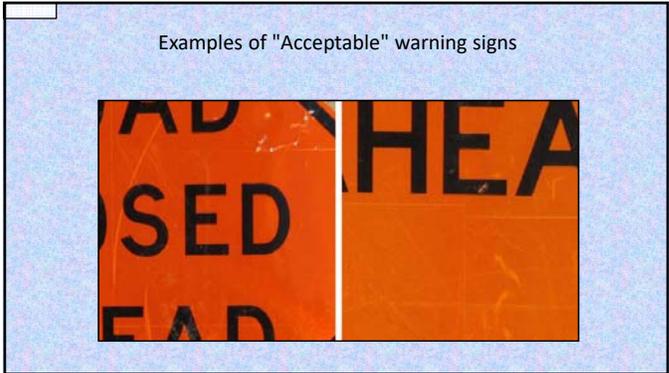
www.gopherstateonecall.org

**CHAPTER 7
TRAFFIC CONTROL**



FIELD MANUAL HAS SPECIFIC REQUIREMENTS FOR ALL TYPES OF LANE CLOSURES

YOU WILL ALSO FIND REQUIREMENTS FOR THE SAFETY EQUIPMENT WHICH INCLUDES VESTS, PANTS, CONES, BARRELS AND SIGNS



Examples of "Marginal" warning signs



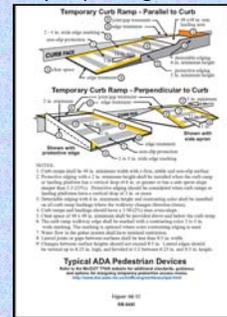
Examples of "Unacceptable" warning signs



Examples of "Unacceptable" Channelizing Devices



Some projects may require signed Pedestrian Detours



7-3

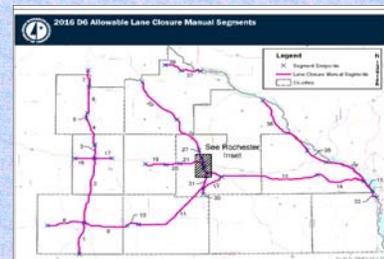
When closing lanes in the Twin Cities Metro Area consult the Lane Control Manual (LCM) for approved lane closure time windows.



7-3

The District 6 Allowable Lane Closure Manual Segments can be found by following the link below.

<http://www.dot.state.mn.us/d6/trafficlane closuremanual/index.html>



FOR THE SAFETY OF THE WORKERS
AND THAT OF THE MOTORING PUBLIC
THESE REQUIREMENTS MUST BE OBSERVED

TRAFFIC CONTROL IS THE RESPONSIBILITY OF THE CONTRACTOR

IN MOST CASES TRAFFIC CONTROL IS PAID FOR AS A SEPARATE
PAY ITEM

MnDOT DOES OFFER CLASSES FOR TRAFFIC CONTROL AND
FLAGGERS

INFORMATION MAY BE FOUND AT THE MnDOT WORK ZONE
SAFETY WEB SITE

<http://www.dot.state.mn.us/const/wzs/training.html>

7-4

7.2 Chapter 7 Resources

MnDOT also offers Work Zone Safety Training Courses at the following website:
www.dot.state.mn.us/const/wzs/training.html

MnDOT's Temporary Traffic Control Zone Layouts Field Manual
<http://www.dot.state.mn.us/trafficeng/publ/fieldmanual/>

Temporary Traffic Control Zone Layouts Field Manual ordering information found at:
www.dot.state.mn.us/mapsales

Metro Lane Closure Manual
<http://www.dot.state.mn.us/metro/trafficeng/laneclosure/index.html>

MnDOT also offers Work Zone Safety Training Courses at the following website:
www.dot.state.mn.us/const/wzs/training.html

QUESTIONS ?

CHAPTER 8 STAKING

Traffic Control Signal Systems

8-1

Staking Signal System

• On most projects MnDOT's District Traffic Office stakes the signal system. District Traffic Office works with the survey crew and ADA office and verifies the staked locations.

• Locations of some components on the plan are approximate only.

• Signal poles and ped stations are staked according to X and Y coordinates provided in the plan. The ADA office must be notified of ramp and ped station construction.

Items To Consider When Staking

- When staking the signal pole, correctly position the left turn signal head by adding 2 feet for the pole width plus the length of the mast arm. **8-2**
- The minimum set back for signal pole foundations is 6 feet from edge of curb.
- When staking the location of the loop detectors, use the distances given in the chart and measure from the crosswalk (or stop bar to the front edge of the loop). **8-4**
- In new construction areas the curb and gutter should be installed before installing the new traffic control signal system. **8-4**
- Contact the district traffic office to confirm the staked locations before excavating. **8-6**

QUESTIONS?

CHAPTER 8

STAKING Lighting Systems

Staking Lighting Systems

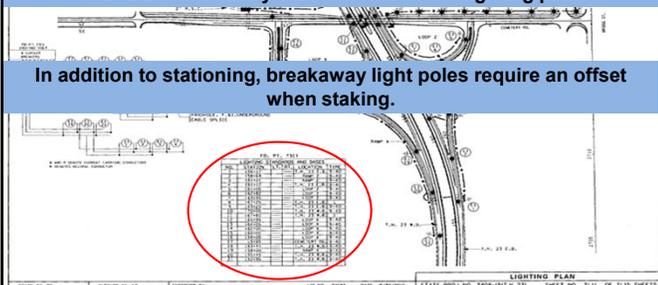
LIGHT POLES

- For best placement of light pole foundations- roadway, shoulders, and ditches should be established before staking locations.
- The District Traffic Office will stake light pole foundation locations that require an offset.
- Provide the District Traffic Office or the survey crew plenty of notice before planning to excavate and install foundations.

Staking Light Poles

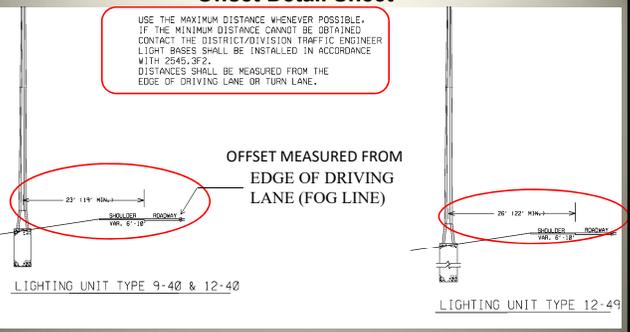
Light poles are staked according to the stationing found on the Light Standards Summary Table shown on the lighting plan.

In addition to stationing, breakaway light poles require an offset when staking.



Offset Detail Sheet

USE THE MAXIMUM DISTANCE WHENEVER POSSIBLE. IF THE MINIMUM DISTANCE CANNOT BE OBTAINED CONTACT THE DISTRICT/DIVISION TRAFFIC ENGINEER. LIGHT BASES SHALL BE INSTALLED IN ACCORDANCE WITH 2845.3F2. DISTANCES SHALL BE MEASURED FROM THE EDGE OF DRIVING LANE OR TURN LANE.





8-8 **Items To Consider When Staking**

Locations can be moved maximum 10 feet in either direction parallel to the roadway if there is an obstruction.

LINE NO.	TYPE	DEPTH	DIA.	MATERIAL	DATE	BY
1
2
3
4
5
6
7
8
9
10

8-9 **Items To Consider When Staking**

Clearance between the back of guardrail and the front of light poles should be at least 4 feet and no more than 7 feet.

8-9 **Items To Consider When Staking**

Light poles should not be closer than 20 feet in any direction from power lines.

QUESTIONS?

What's New Since 2015

**CHAPTER 9
EXCAVATION
AND
BACKFILL**

What's New Since 2015

**New -2018 Spec. Book Language Change
For 2451.3.D Backfilling and Compacting Excavations**

Old

Uniformly distribute suitable backfill materials in layers no thicker than **8 inch loose measurement**. Compact the backfill.....



New

Uniformly distribute suitable material in horizontal layers of no more than **6 inch compacted layers**.

CHAPTER 9

**EXCAVATION
AND
BACKFILL**

9-1

Excavation and Backfill

Keep the excavated area to a minimum necessary to do the work.



9-1

Excavation and Backfill

Over-Excavation



9-1

Excavation and Backfill

Excavate at a distance from the edge of roadway without damaging or undermining the roadbed.



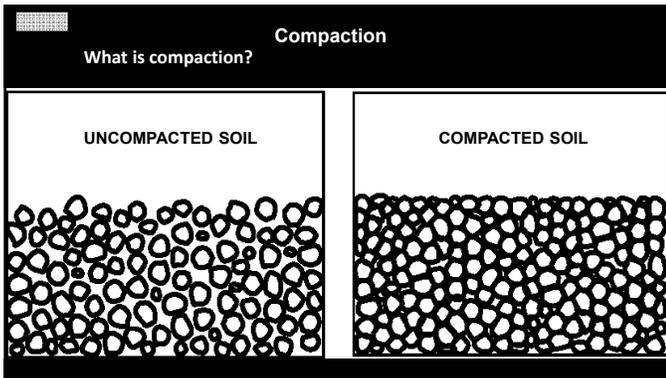
9-1 and 9-2

Excavation and Backfill

Compaction

Place backfill material in horizontal compacted layers not more than 6 inches thick to ensure proper compaction around foundations, handholes and conduits.





9-2

Excavated Material and Work Zone Hazards

The contractor and inspector must not allow unprotected hazards to exist for motorists or pedestrians during the construction of the project.

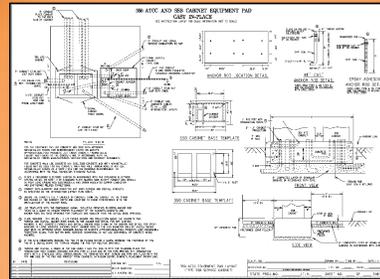


QUESTIONS?

What's New Since 2015

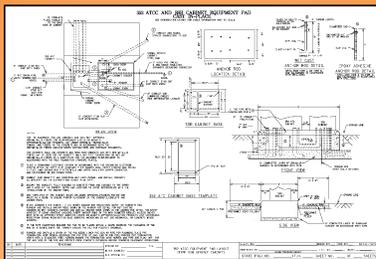
CHAPTER 10 FOUNDATIONS AND EQUIPMENT PADS

"WHAT'S NEW SINCE 2015"



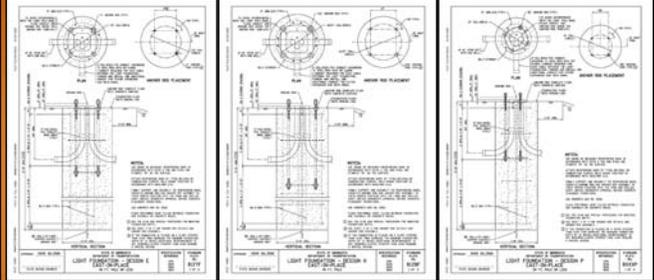
The New 350 ATC Cabinet Pad is Required in 2020

"WHAT'S NEW SINCE 2015"



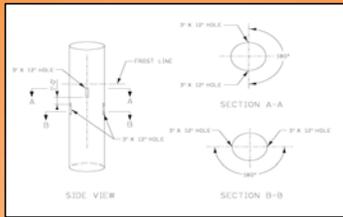
The New 352 ATC Cabinet Pad Will be Required When an Agency Wants to Use a Single Wide Cabinet

"WHAT'S NEW SINCE 2015"



There will soon be revised standard plates for Design E and H Foundations
There will be a new Design P Standard Plate.

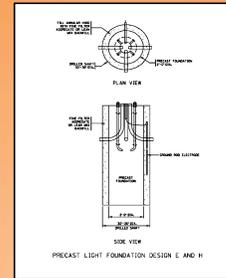
"WHAT'S NEW SINCE 2015"



SPECIAL REQUIREMENTS WHEN A FULL LENGTH FIBER FORMING TUBE IS USED FOR MAST ARM PA POLE FOUNDATIONS

"WHAT'S NEW SINCE 2015"

NEW INSTALLATION REQUIREMENTS FOR PRECAST CONCRETE LIGHT FOUNDATIONS DESIGN E AND DESIGN H



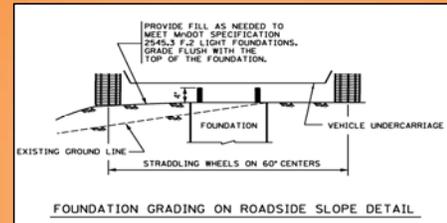
"WHAT'S NEW SINCE 2015"

STEEL SCREW IN LIGHT FOUNDATIONS DESIGN E AND H AND INSTALLATION REQUIREMENTS.



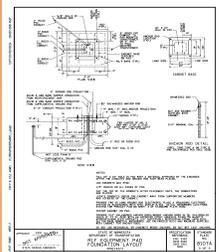
"WHAT'S NEW SINCE 2015"

SPECIFICATION LANGUAGE FOR LIGHT POLE FOUNDATION GRADING ON ROADSIDE SLOPES.



"WHAT'S NEW SINCE 2015"

RLF EQUIPMENT PAD DETAIL HAS BEEN CONVERTED INTO STANDARD PLATE 8107 WITH THE OPTION TO USE PRECAST

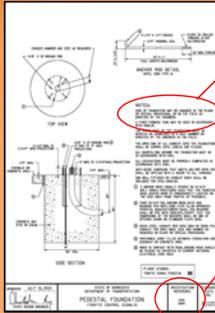


TYPE RURAL LIGHTING AND FLASHER (RLF) SERVICE CABINET

**Chapter 10
FOUNDATIONS
AND
EQUIPMENT PADS**

10-1

Carry all the contract documents on the project



NOTES:
 SIZE OF FOUNDATION MAY BE CHANGED IN THE PLANS OR SPECIAL PROVISIONS, OR IN THE FIELD AS DIRECTED BY THE ENGINEER.
 A FIBER FORMING TUBE MAY BE USED IN ACCORDANCE WITH 2565.3F.

SPECIFICATION REFERENCE
 2461
 2565

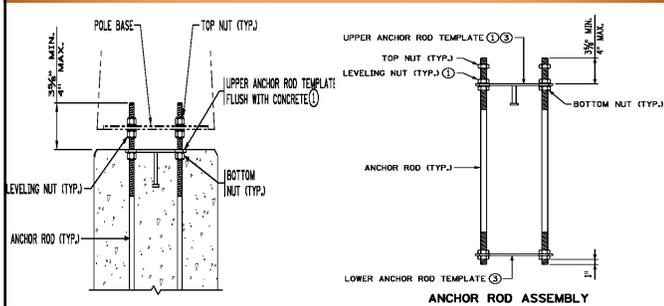
10-3

Standard Specifications

Remove the template after 24 hours of concrete placement.



10-2



10-4



10-5



10-6





10-5 Standard Specification Requirements
3385.2. Galvanize Type A, Type B, and Type C Anchor Rods

ASTM F1554 S3 requirement steel die stamped with the grade identification on the end of the anchor rod projecting from the concrete

10-7 - 10-9

PA Signal Pole Foundations

Avoid using a full length forming tube.

Use a forming tube for the upper portion of the foundation and 4 feet below grade.

10-9 and 10-10

Mast Arm Pole Foundations
Requirements For Using Full Length Forming Tube- PA 85, 90, and 100 Foundations

FOUR 3 IN X 12 IN RECTANGULAR HOLES

10-11

POLE FOUNDATION TYPE BA

A FORMING TUBE MAY ONLY BE USED FOR FORMING THE TOP 4 FEET OF THE DRILLED SHAFT FOUNDATION

A FIBER FORMING TUBE MAY ONLY BE USED FOR FORMING THE TOP FOUR (4) FEET OF THE DRILLED SHAFT FOUNDATION. THE DRILLED HOLE SHALL BE PROTECTED AGAINST COLLAPSING.

INSTALL LIGHT FOUNDATIONS FLUSH WITH GROUND LINE



Flanged top breakaway transformer type bases

INSTALL LIGHT FOUNDATIONS FLUSH WITH GROUND LINE



INSTALL LIGHT FOUNDATIONS FLUSH WITH GROUND LINE



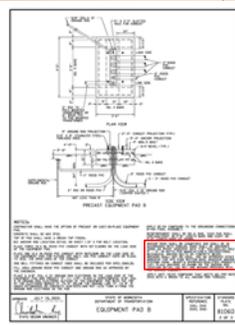
INSTALL LIGHT FOUNDATIONS FLUSH WITH GROUND LINE



INSTALL LIGHT FOUNDATIONS FLUSH WITH GROUND LINE



10-27 **Precast Equipment Pads (B 8106 and RLF 8107)**

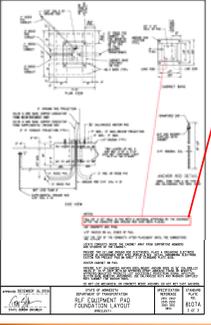


DO NOT USE MECHANICAL ANCHOR BOLTS OR CONCRETE WEDGE ANCHORS

USE EPOXY ADHESIVE ANCHORS.



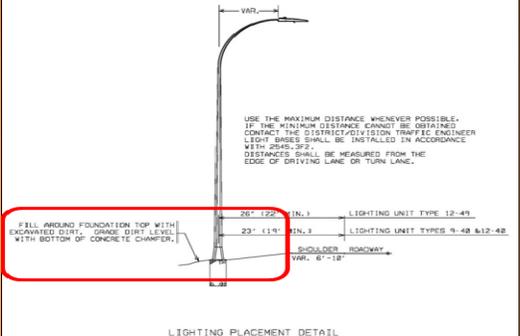
Precast Equipment Pads (B 8106, RLF 8107.)



FILL 10" X 10" HOLE IN PAD WITH A MATERIAL APPROVED BY THE ENGINEER AFTER THE CONDUITS AND GROUND ROD HAVE BEEN PLACED.



10-29 **LIGHT FOUNDATION GRADING ON ROADSIDE**



USE THE MAXIMUM DISTANCE WHENEVER POSSIBLE. IF THE MINIMUM DISTANCE CANNOT BE OBTAINED, CONTACT THE DISTRICT/DIVISION TRAFFIC ENGINEER. LIGHT BARS SHALL BE INSTALLED IN ACCORDANCE WITH 2545.3F2. DISTANCES SHALL BE MEASURED FROM THE EDGE OF DRIVING LANE OR TURN LANE.

FILL AROUND FOUNDATION TOP WITH EXCAVATED SOIL. GRADE OVER LEVEL WITH BOTTOM OF CONCRETE CHAPER.

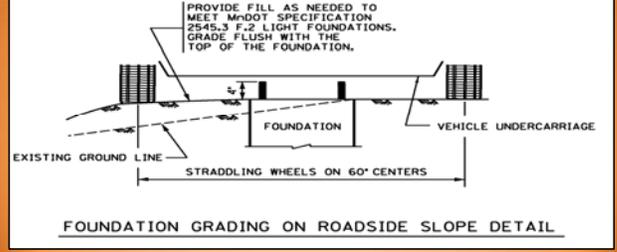
26" (122) (IN.) LIGHTING UNIT TYPE 12-49
23" (114) (IN.) LIGHTING UNIT TYPES 9-48 & 12-48

SHOULDER ROADWAY VAR. 6'-18"

LIGHTING PLACEMENT DETAIL

10-29, 30 **Installing Foundations On Roadside Slope**

".....Shape the terrain around the foundations to ensure anchor rods do not project more than a maximum of four (4) inches above a horizontal line between the straddling wheels of a vehicle on 60 inch centers."



PROVIDE FILL AS NEEDED TO MEET M-207 SPECIFICATION 2545.3 F-2 LIGHT FOUNDATIONS. GRADE FLUSH WITH THE TOP OF THE FOUNDATION.

EXISTING GROUND LINE

FOUNDATION

VEHICLE UNDERCARRIAGE

STRADDLING WHEELS ON 60" CENTERS

FOUNDATION GRADING ON ROADSIDE SLOPE DETAIL

Substantial remains of breakaway supports shall not project more than 4 in. above a line between the straddling wheels of a vehicle on 60-in. centers. The line connects any point on the ground surface on one side of the support to a point on the ground surface on the other side, and it is aligned radially or perpendicular to the centerline of the roadway.

C12.5.3

Breakaway supports, including those placed on roadside slopes, must not allow impacting vehicles to snag on either the foundation or any substantial remains of the support. Surrounding terrain may be required to be graded to permit vehicles to pass over any nonbreakaway portion of the installation that remains in the ground or rigidly attached to the foundation. The specific limit on the maximum stub height lessens the possibility of snagging the undercarriage of a vehicle after a support has broken away from its base, and minimizes vehicle instability if a wheel hits the stub. The necessity of this requirement is based on field observations. Application of the clearance requirement is illustrated in

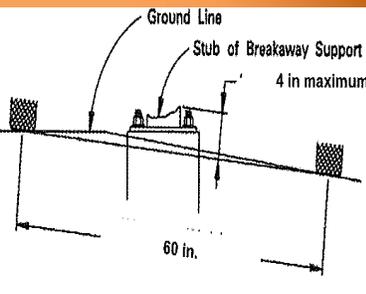
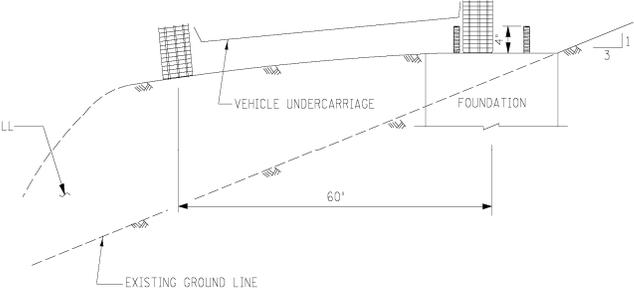


Figure C12.5.3-1—Stub Height Requirements



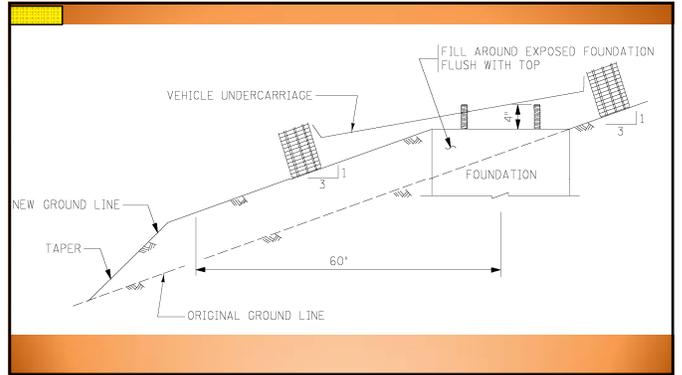
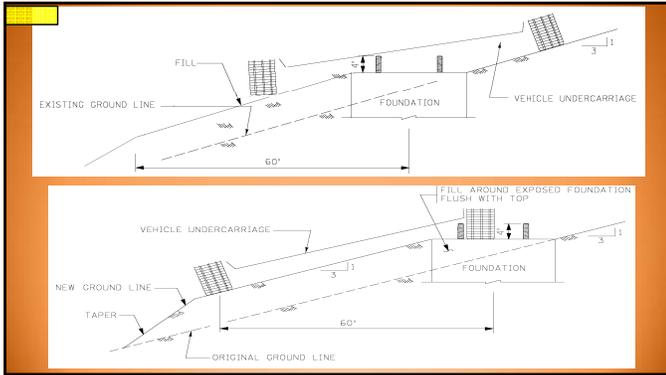
FILL

EXISTING GROUND LINE

VEHICLE UNDERCARRIAGE

FOUNDATION

60'



Questions?

CHAPTER 11 CONDUITS AND FITTINGS

INSTALLATION REQUIREMENTS

- Directional boring is the preferred method of installing conduit under roadway surfaces. HDPE conduit is the preferred conduit.
- Refer to the Contract documents for Rigid PVC or HDPE conduit installation requirements
- If Rigid PVC is used under the roadway Long Line couplings must be used to join the conduit.
- If boring operations are abandoned for any reason, the voids must be grouted.



INSTALLATION REQUIREMENTS
MnDOT Liquid Tight LFNC-B Conduit Requirements
MnDOT 3804



Type LFNC-B.
NRTL Listed and labeled in accordance with UL standard 1660.
Listed for 80° C (176° F) in a dry location.
Listed for 60° C (140° F) in a wet location.
Listed for 70° C (158° F) in an oily location.
Sunlight resistant.
Rated for outdoor use.
CSA certified for use at 75° C (167° F) in dry and oily locations and for minus 18° C (0° F) low temperature applications.
Shall not have a metallic integral reinforcement within the conduit wall.

TYPES OF CONDUITS

There are 3 main types of conduits used on signal and lighting systems:

- Rigid Steel (RSC)- 3801
- Non-Metallic Conduit- 3803
- PVC Coated Hot Dipped Galvanized RSC- 3805



TYPES OF CONDUITS

MnDOT 3805
MnDOT now requires PVC coated hot-dipped galvanized rigid steel conduit and fittings be installed on bridges.

“On bridges” includes:

- Concrete Encased
- Hanging
- Surface Mounted (2565.3.D.6)

↑
REMEMBER THIS



Conduit Size Not Specified In The Contract

2565.3 D.1

If the contract does not specify the size of conduit, provide conduit at least 3/4 inch and sized so the area occupied by the electrical cables and conductors does not exceed 40 percent of the internal cross-sectional area of the conduit for rigid steel conduit or 35 percent for non-metallic conduit

ABOVE GROUND CONDUIT

When conduits are attached to wood poles, the conduit must be secured with two-hole conduit straps that meet the National Electrical Code (NEC).



UNDERGROUND CONDUIT INSTALLATION

Underground conduit must be placed no less than 18 inches below the surface of any ground area and not less than 24 inches below any roadway surface



Open Ends

2565.3D.2.b requires that open ends of conduits in cabinet pads and pole foundations must be sealed after the installation of the cables and conductors with an approved sealing compound.



EXPANSION & DEFLECTION/EXPANSION FITTINGS

Expansion Deflection/Expansion



The 2016 Standard Specifications for Construction require the expansion and deflection/expansion fittings to be PVC coated.
MnDOT 3839

QUESTIONS?

What's New Since 2015

**CHAPTER 12
HANDHOLES, PULLING VAULTS
AND
JUNCTION BOXES**

“WHAT’S NEW SINCE 2015”
MnDOT HAS A NEW HANDHOLES LISTED ON THE APL



Chapter 12

**Handholes
Pulling Vaults
&
Junction Boxes**

HANDHOLE INSTALLATION



COARSE FILTER AGGREGATE

Handholes are to be placed on a compacted rock (coarse filtered aggregate) drain bed as specified in the contract documents

HANDHOLE INSTALLATION

Excavation for each handhole must be backfilled around the installed handhole and the backfill material must be like kind to adjacent soils and compacted to approximately the same density.



The cover must be in place prior to backfilling around the handhole.

HANDHOLE INSTALLATION

Keep handholes away from structures to ensure proper compaction around handhole



HANDHOLE INSTALLATION



Handholes must not be placed on roadway shoulders



HANDHOLE INSTALLATION

Conduits terminating in handholes must extend 2 to 3 inches beyond the inside wall of the handhole



HANDHOLE INSTALLATION

Direct buried lighting cable entering or exiting a handhole must have conduit stub outs.

Stub outs must be a 2-inch conduit and a minimum 36 inches long. End bells must be installed on both ends of the conduit

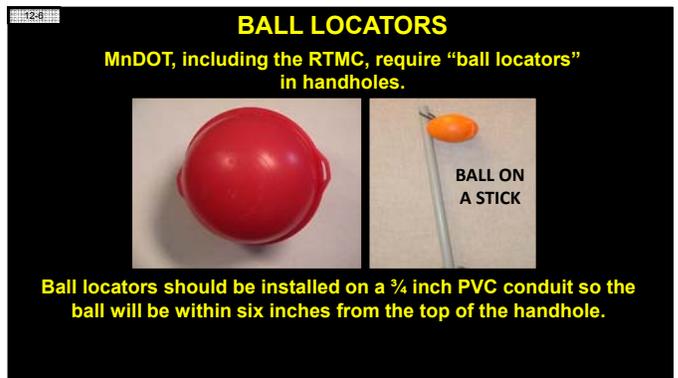
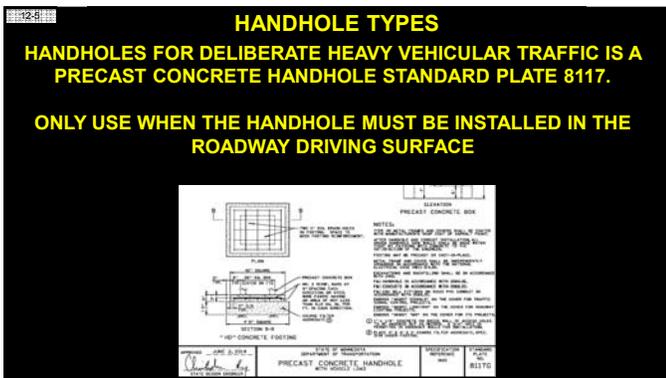
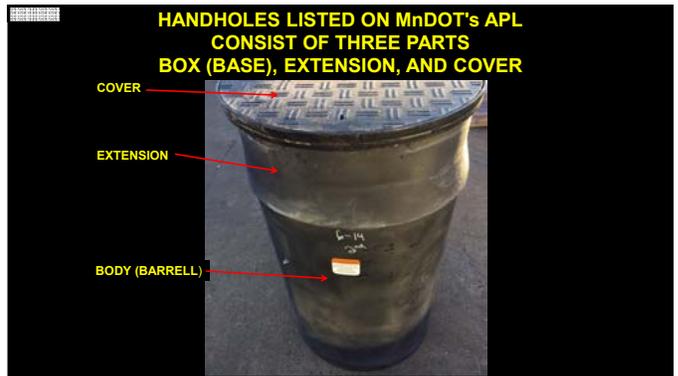



HANDHOLE TYPES

There are two types of MnDOT handholes

- HANDHOLES FOR NON-DELIBERATE HEAVY VEHICULAR TRAFFIC (commonly used)
- HANDHOLES FOR DELIBERATE HEAVY VEHICULAR TRAFFIC (rarely used)





What's New Since 2015

CHAPTER 13 GROUNDING AND BONDING

"WHAT'S NEW SINCE 2015"

GROUNDING FOR HIGH MAST LIGHTING TOWERS HAS BEEN CHANGED

F.3.a Grounding Systems for Mat Foundations

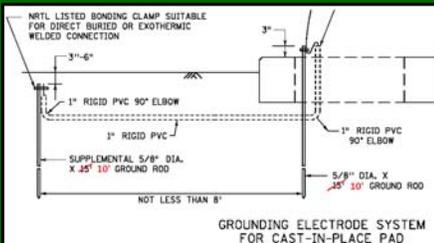
- (1) Lightning protection conductors specified on the Plan
- (2) Four 10 foot ground rod electrodes in accordance with 3818 per foundation
- (3) Two bronze bonding lugs for each high mast lighting unit sized
 - (a) For the lightning protection conductors
 - (b) To fit on to the HMLT base bonding studs and under the nuts for a tight connection.

F.3.b Grounding Systems for Pile Foundations

- (1) Lightning protection conductors specified on the Plan
- (2) Two exothermic grounding connectors for each pile foundation as shown on the Plan sized for the lightning conductors and designed for welding to the pile used on the Project
- (3) Two bronze bonding lugs for each high mast lighting unit sized
 - (a) For the lightning protection conductors
 - (b) To fit on to the HMLT base bonding studs and under the nuts for a tight connection

"WHAT'S NEW SINCE 2015"

GROUND ROD LENGTH CHANGES FOR TRAFFIC SIGNAL AND LIGHTING SYSTEM FOUNDATIONS AN EQUIPMENT PADS



SEE SPECIAL PROVISION FOR THE CHANGE FROM 15 FT TO 10 FT IN TRAFFIC SIGNAL AND LIGHTING SYSTEM FOUNDATIONS AND EQUIPMENT PADS

* WILL REMAIN 15 FT IN BARRIER LIGHT POLE FOUNDATIONS

"WHAT'S NEW SINCE 2015"

12 FT GROUND RODS ARE USED INSTEAD OF 15 FT WHEN GROUND RODS ARE REQUIRED IN TRAFFIC SIGNAL HANDHOLES

GROUND ROD INSTALLATION IN A TRAFFIC SIGNAL HANDHOLE



SEE SPECIAL PROVISIONS FOR THE CHANGE FROM 15 FT TO 12 FT GROUND RODS IN TRAFFIC SIGNAL HAND HOLES

"WHAT'S NEW SINCE 2015"

GROUNDING ELECTRODES INCLUDE GROUND RODS AND PLATES DEFINED IN MnDOT 3818

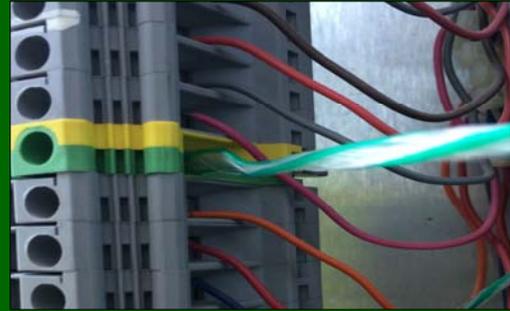


CHAPTER 13 GROUNDING AND BONDING

All bonding and grounding must be in accordance with Article 250 of the National Electrical Code (NEC)



CABLE FILLER



DEFINITIONS:

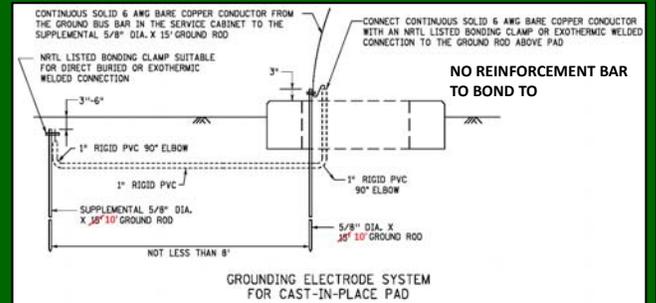
Bonding:

Is defined in the NEC as a permanent joining of metallic parts required to be electrically connected

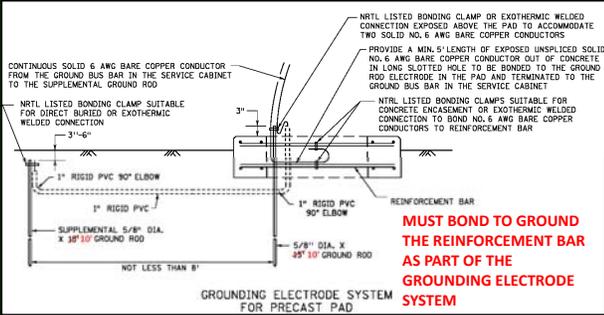
Grounding:

Is defined in the NEC as a conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth or to some conductive body that serves in place of earth

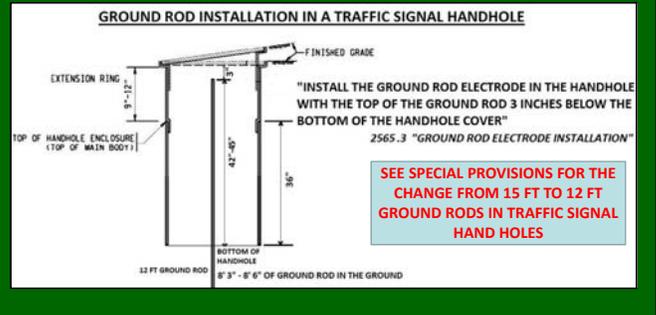
CAST-IN-PLACE EQUIPMENT PAD "GROUNDING ELECTRODE SYSTEM" FOR TRAFFIC SIGNAL AND LIGHTING SYSTEMS



PRECAST EQUIPMENT PAD "GROUNDING ELECTRODE SYSTEM" FOR TRAFFIC SIGNAL AND LIGHTING SYSTEMS



INSTALLING A SUPPLEMENTAL GROUND ROD IN HANDHOLE



13-2

EXOTHERMIC WELDING

Bond ground rod electrodes in hand holes to the 6 AWG insulated green equipment grounding conductor by exothermic welding for traffic signal systems .



13-2 and 13-3

GROUNDING CONDUCTORS FOR TRAFFIC SIGNALS

All new traffic signal systems require a 6 AWG green insulated stranded grounding conductor from the signal cabinet to each pole base (See Figures 13-7 AND 13-8)

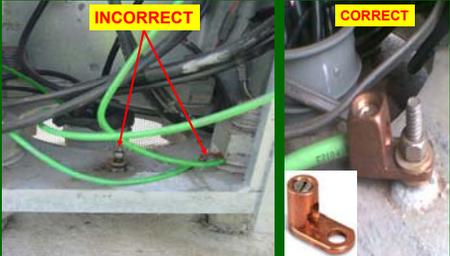


6 AWG green insulated stranded bonding jumpers and grounding electrode conductors are required for traffic signal systems.

13-2

BONDING POLE BASES

Use an active clamping grounding lug with mounting tang in traffic signal and light pole bases.



13-3 and 13-4

OXIDE INHIBITOR AGENT

Oxide inhibitor agent in accordance with 3843 must be applied to all (traffic signals and lighting) grounding connections before assembly and after final connection.



13-4

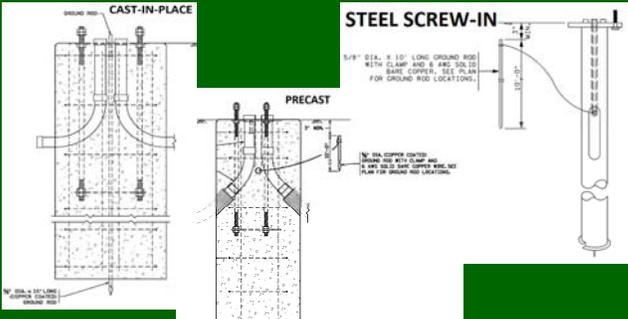
SUPPLEMENTAL GROUND RODS AT LIGHT FOUNDATIONS

MnDOT Spec. 2545.3.R "Bonding and Grounding"
Provide ground rods at every other light foundation and at the light foundations located at both ends of a run.

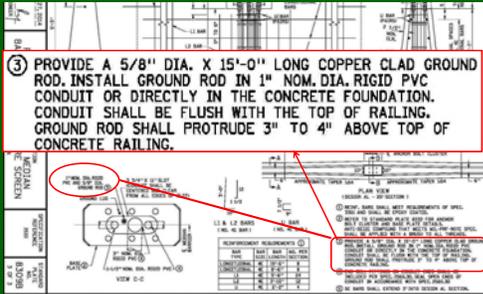


13-4

10 FT GROUND RODS FOR LIGHT FOUNDATIONS EXCEPT.....



15 FT GROUND RODS IN BARRIER LIGHT FOUNDATIONS



Grounding and Bonding Direct Buried Lighting Cable

IN THE LIGHT POLE BASE THE COPPER SHIELDING AND GROUNDING CONDUCTOR MUST BE BONDED TOGETHER BY DRILLING THE SHIELDING AND PLACING IT UNDERNEATH AN ACTIVE CLAMPING GROUNDING LUG WITH TANG, BOLT ASSEMBLY TO POLE BASE PLATE. TERMINATE GROUNDING CONDUCTOR IN THE ACTIVE CLAMPING GROUNDING LUG.

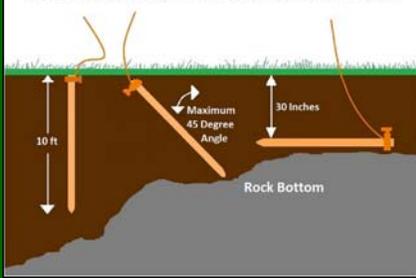


6 AWG SOLID BARE BONDING JUMPERS AND GROUNDING ELECTRODE CONDUCTORS ARE REQUIRED FOR LIGHTING SYSTEMS.

GROUND ROD INSTALLATION

- Drive ground rods to a depth not less than 10 feet
- If rock is encountered drive the ground rod no more than 45 degrees from vertical
- If more than 45 degrees bury in a trench that is at least 30 inches deep

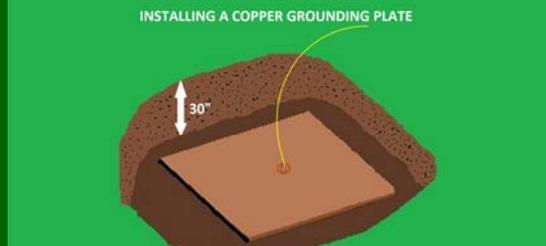
INSTALLATION REQUIREMENTS FOR GROUND RODS



DO NOT CUT GROUND RODS!

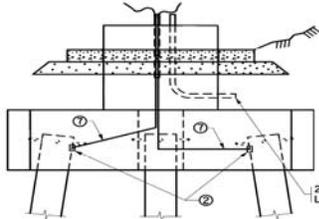
GROUNDING COPPER PLATE ELECTRODE

INSTALLING A COPPER GROUNDING PLATE



If it is not possible to install ground rods according to the installation requirements of the NEC, install grounding copper plate electrodes in accordance with MnDOT Spec. 3818

GROUNDING REQUIREMENTS FOR HIGH MAST LIGHT PILE FOUNDATION IN PLANS AND HIGH MAST SPECIAL PROVISIONS



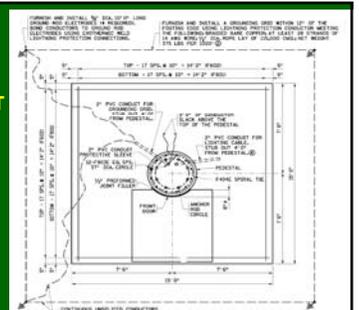
UPDATED INFORMATION TO REPLACE ON PAGE 13-5 IN THE FIELD GUIDE

- ② OBTAIN THE ENGINEER'S APPROVAL OF THE EXOTHERMIC WELDED BONDING PILE CONNECTIONS BEFORE PLACEMENT OF PILE CAP REINFORCEMENT.
- ① FURNISH AND INSTALL TWO UNSPLICED LENGTHS OF LIGHTNING PROTECTION CONDUCTORS MEETING THE FOLLOWING: BRAIDED BARE COPPER; AT LEAST 28 STRANDS OF 14 AWG WIRE 1/2" DIA. ROPE LAY OF 115,000 CMIL; NET WEIGHT 375 LBS PER 1000 FT. BOND ONE END OF EACH CONDUCTOR TO THE PILING AS SHOWN USING EXOTHERMIC WELDED LIGHTNING PROTECTION CONNECTIONS DESIGNED FOR PILING.

GROUNDING GRID REQUIREMENTS FOR HIGH MAST LIGHT FOUNDATION MAT DESIGN IN PLANS AND HIGH MAST LIGHTING SPECIAL PROVISIONS

UPDATED INFORMATION TO REPLACE ON PAGE 13-5 IN THE FIELD GUIDE

- ② OBTAIN THE ENGINEER'S APPROVAL OF THE COMPLETED GROUNDING GRID BEFORE BACKFILLING AROUND THE FOOTING.



QUESTIONS?

What's New Since 2015

CHAPTER 14 WIRING

“WHAT’S NEW SINCE 2015”

MnDOT now requires that only split bolts be used for splicing neutral conductors in light pole bases.



“WHAT’S NEW SINCE 2015”

SPEC. 3806 UNDERGROUND NON-DETECTABLE MARKING TAPE REQUIREMENTS



“WHAT’S NEW SINCE 2015”

USE A 2 AMP FAST ACTING FIBER TUBE CARTRIDGE FUSE IN LUMINAIRE FUSE HOLDERS



“WHAT’S NEW SINCE 2015”

SPEC. 3843 ANTI-OXIDANT JOINT COMPOUND



Provide anti-oxidant joint compound for conductor terminations as specified in the Contract to prevent corrosion and oxidation, and improve conductivity and the integrity of electrical connections.

“WHAT’S NEW SINCE 2015”

SPECIFICATION LANGUAGE IN THE SPEC BOOK TO INSTALL DIRECT BURIED LIGHTING CABLE IN PVC OR HDPE CONDUIT WHEN NOT LOCATED UNDER TOP SOIL.

2545.3.G.2

Install direct buried lighting cable in rigid PVC or HDPE conduit if located under bituminous, concrete, or other material not considered a top soil. Provide 3 in conduit if the contract does not specify size of conduit.

“WHAT’S NEW SINCE 2015”

REMOVING DIRECT BUIRED LIGHTING CABLE SHOULD NOW BE A SEPARATE PAY ITEM ON ALL PROJECTS THAT REQUIRE CABLE REMOVAL

Remove Direct Buried Lighting Cable

Remove direct buried lighting cable as indicated in the Plan is measured by the linear foot. Direct buried lighting cable is paid for under pay Item No. 2104.503 (REMOVE DIRECT BURIED LIGHTING CABLE) at the Contract price per LINEAR FOOT, which price is compensation in full.

**CHAPTER 14
WIRING**

**General Wiring Requirements
Traffic Control Signal and Lighting Systems**



- All cables and conductors must conform to the NEC. MnDOT requirements may exceed those of the NEC.
- A few general MnDOT wiring requirements in 3815 for cables and individual conductors:
 - NRTL Certified (exception is loop lead-in and EVP cable)
 - Insulation rated for 600V
 - Meeting requirements of ANSI, ASTM, and ICEA/NEMA
 - Wire sizes for conductors based on the AWG

**Inspection of Cables for Traffic Control
Signal and Lighting Systems**

- Cables are usually inspected at the distributor by the MnDOT Materials Lab.
- Cut sheet showing the project number, reel number, and MnDOT test number will be included with each project shipment.
- Any cables not having the inspection documentation must be sampled and submitted to the MnDOT Materials Lab.

**Inspection of Cables for Traffic Control Signal
and Lighting Systems**

- Ensure a cut sheet is provided so the cable can be tracked where it comes from and shows that it has been tested by the MnDOT Materials Lab.
- Cables must be inspected and approved before installation.

Inspection of Individual Conductors for Traffic Control Signal and Lighting Systems



- Individual conductors are not tested by the MnDOT Materials Lab. (The one exception to this is loop wire contained in a black poly tubing used for saw cut loop detectors.)
- Inspectors should check the labeling on individual conductors to ensure it meets the requirements in MnDOT Spec. 3815 and other contract documents.
- It is the contractor's responsibility to provide conductors specified in the contract documents.

Wiring Installation- General Requirements Traffic Control Signal and Lighting Systems



- All electrical cables and conductors must be continuous, without splices from the signal or lighting cabinet to pole bases and from pole base to pole base.
- Unless specified in the contract or approved in writing by the district traffic engineer, do not use underground splices.
- When underground splices are specified use an approved epoxy splice kit listed on MnDOT's APL.

Wiring Installation- General Requirements Traffic Control Signal and Lighting Systems



Hand pull cables and conductors through conduit raceways to avoid damaging the cable or conductor insulation.
MnDOT Spec. 2565.3.J.2

Wiring Installation- Cable Labels Traffic Control Signal and Lighting Systems

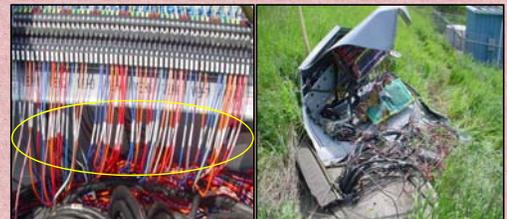


2565.3.J.1 states;
"Identify cables as shown on the field wiring diagram in all handholes, junction boxes, traffic control signal pedestal bases, mast arm pole bases, light pole bases, and cabinets. Except for the individual conductors terminated at the cabinet fuse panels, wrap white vinyl adhesive tape around the cable to identify cables and conductors."

TRAFFIC CONTROL SIGNAL SYSTEMS WIRING INSTALLATION

Traffic Control Signal Systems Wiring Installation

Use machine printed labels meeting the requirements of 2565.3.J.1 for individual conductors terminated at the traffic control signal cabinet fuse panel.



Traffic Control Signal Systems Wiring Installation
 Traffic Signal Cabinet Hook-Up Chart included in every traffic control signal cabinet. The chart contains a signal indications and vehicle detector table for hook-up.

Pole base connectors are required on all new signals:
 They must be the ones listed on the APL for Signals.

Traffic Control Signal Systems Wiring Installation

- Pins, Sockets, Plugs and Sealing Plugs are all listed on the APL separately.
- The required crimper is also listed on the APL.

If revising a signal and terminal blocks are present:
 The blocks must be sprayed with pole base terminal block coating.
 The white marker strip must be labeled.

LIGHTING SYSTEMS WIRING INSTALLATION

DIRECT BURIED LIGHTING CABLE

4 CONDUCTOR #4 AWG DIRECT BURIED LIGHTING CABLE WITH A COPPER SHIELD OR TAPE. THE CONDUCTORS ARE 19 COPPER STRAND WITH COLOR CODED INSULATION.

14-7

DIRECT BURIED LIGHTING CABLE IS INSTALLED AT THE SAME DISTANCE BEHIND THE SHOULDER OR CURB AS THE LIGHT FOUNDATIONS



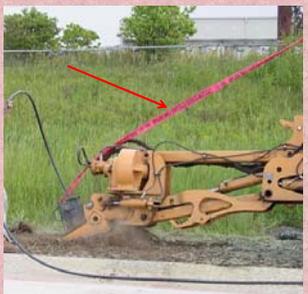
14-7

When an obstruction is in the path of the direct buried lighting cable re-route the cable around the obstruction away from the roadway.



14-7

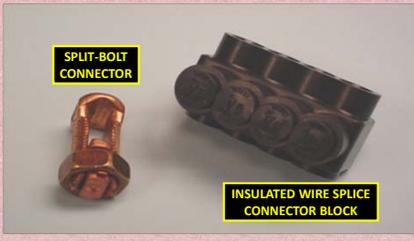
INSTALL UNDERGROUND NON-DETECTABLE MARKING TAPE AT LEAST 12 INCHES ABOVE THE DIRECT BURIED LIGHTING CABLE



14-8

ABOVE GROUND SPLICES

Use split-bolt connectors or insulated wire splice connector blocks for splicing ungrounded "hot" conductors and grounding conductors in light pole bases.



14-8

ABOVE GROUND SPLICES

Only split bolts are used for splicing neutral conductors in light pole bases.

The recent change was made to decrease floating neutral conditions in the lighting systems created from broken or loose neutral splices.

The floating neutral condition can cause an unbalanced load (over voltage) that could be damaging LED luminaires.



Above Ground Split Bolt Wire Splice Connections Require The Use Of Self-Fusing Electrical Insulation Putty Tape In Place Of Rubber Tape

2545.3.G.4.a



14-8

LIGHT POLE WIRING

USE FUSE HOLDERS- BREAKAWAY TYPE LISTED ON MnDOT'S APL For Roadway Lighting

14-8

LIGHT POLE WIRING

2545.3.G.a
Use a 2 Amp 1.5 in X .406 in fast acting fiber tube cartridge fuse in fuse holders

The change was made in an effort to help prevent unbalanced load (over voltage) damage to LED luminaires.

14-9

LIGHT POLE WIRING

Make sure to properly install the fuse holder

14-9

LIGHT POLE WIRING

2545.3.a
After the conductor has been terminated to the fuse holder apply two layers of protective vinyl electrical tape over the terminal and extend the wrap at least 1 in over the incoming conductor insulation.

14-9

WIRE HOLDER

MnDOT requires an approved luminaire wire holder within the end of the light pole tenon near the connection point of the luminaire.

Approved luminaire wire holders are listed on MnDOT's Approved/Qualified Products List for Roadway lighting.

14-9 and 14-6

WIRE HOLDER

There are two types of MnDOT approved wire holders.

3c #14 AWG CABLE 12-2 UF CABLE

14-10

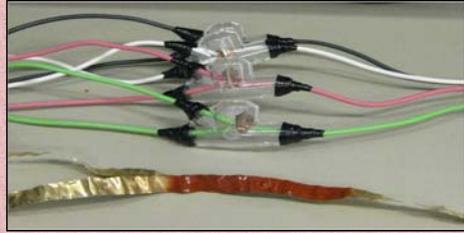
Two Way Underground Handhole Cable Splice for Lighting



MnDOT 2545.3G.4.b (2) define how 4/c #4 shall be terminated in a handhole when there is a two way splice

14-9

Three Way Underground Handhole Cable Splice for Lighting



MnDOT 2545.3G.4.b (3) defines how 4/c 4 AWG is terminated in a handhole when there is a three way splice

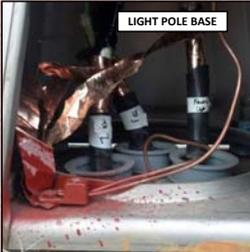
14-10

Labeling Lighting Cable and Conductors

Label direct buried lighting cable in service cabinets and light poles indicating the next termination point.
2545.3.P.2.b



SERVICE CABINET



LIGHT POLE BASE

14-9

MnDOT is considering eliminating any connections in the pole base. All cables would need to be pulled from the cabinet all the way to the device with no splices.



Thoughts?

Questions ?

Building a Rigid PVC Loop
Video

What's New Since 2015

Chapter 15 VEHICLE DETECTION

"WHAT'S NEW SINCE 2015"

TEMPORARY WOOD POLE SIGNAL SYSTEMS NOW USE VIDEO DETECTION SYSTEMS



Chapter 15 Vehicle Detection

There are three different types of vehicle detection used by MnDOT on traffic control signal system projects.

The contractor must refer to the contract documents for the type of vehicle detection system that is required for the specific traffic control signal project.

The three types are presented below:

Preformed rigid PVC conduit loop detectors

Saw cut loop detectors

Video detection

Standard Plate 8132 Preformed Rigid PVC Conduit Loop Detector



- Depth of the milled trench must allow 5 inches from the top of the loop assembly to the top of the finished pavement.

Standard Plate 8130 Saw Cut Loop Detector



The wire is 14 AWG XLPE or XHHW with sleeve.
In compliance with IMSA 51-7

"WHAT'S NEW SINCE 2016"

"BRIDGE GREASE" IS LISTED ON MnDOT's APL UNDER BRIDGE PRODUCTS



ANTI-SEIZE AND LUBRICATING COMPOUND CALLED "BRIDGE GREASE" WILL REPLACE ANTI-SEIZE LUBRICANT MIL-PRF-907E IN CONTRACT DOCUMENTS.

"WHAT'S NEW SINCE 2016"

Approved Rodent Intrusion Barrier Listed on MnDOT's APL



"WHAT'S NEW SINCE 2016"



FILL GAPS BETWEEN THE FOUNDATION AND ALUMINUM LIGHT POLE BASE THAT EXCEED AN 1/8 INCH WITH 100% CLEAR SILICONE .

Chapter 16

SIGNAL AND LIGHT POLES

16-10, 16-11

Installing Signal and Light Poles

Use anti-seize and lubricating compound called "Bridge Grease" on the threads of anchor rods and nuts.and.....



16-11

Installing Signal and Light Poles

Apply anti-seize and lubricating compound to the bearing surface of all nuts and washers.



Apply Anti-seize and Lubricating Compound to the **Bearing Surface of all Nuts and Washers.**



Pole Installation

Immediately after standing the pole on the foundation complete the entire pole installation process.



16-12

Signal and Light Poles

Ensure the top of the anchor rod extends at least one thread beyond the top surface of the top nut.



RE-CALIBRATING TORQUE WRENCHES

The International Organization of Standardization (ISO) states that torque wrenches at a minimum should be re-calibrated **every 5000 uses or every 12 months.**



**Single-Nut Connection
Signal and Roadway Light Poles**

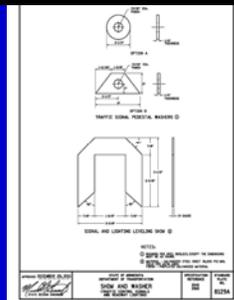


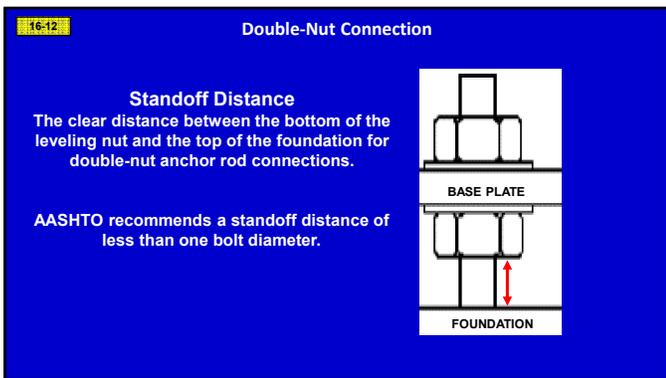
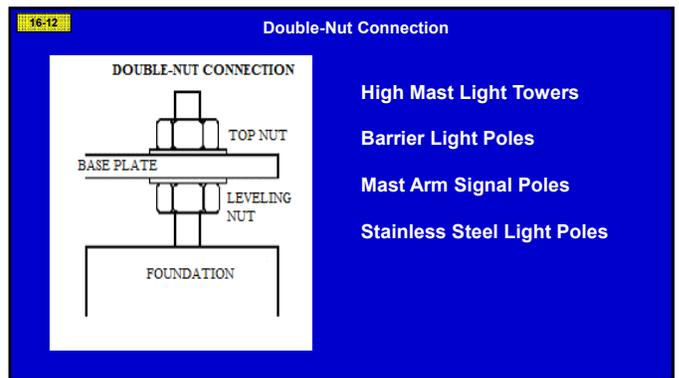
- LIGHT POLE TRANSFORMER BASE
- SIGNAL PEDESTAL BASE
- PUSH BUTTON STATION BASE

16-5

Single-Nut Connection

USE GALVANIZED STEEL SHIMS FOR LEVELING



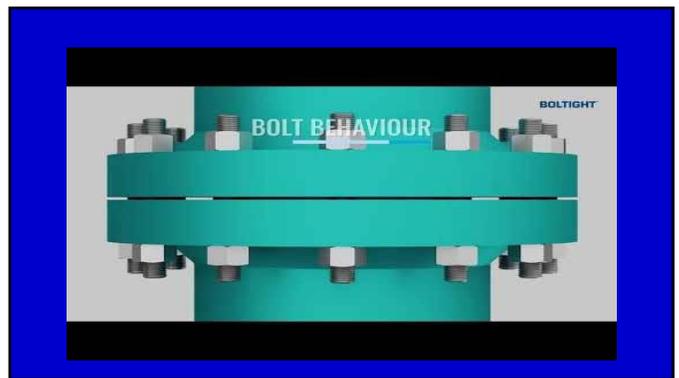
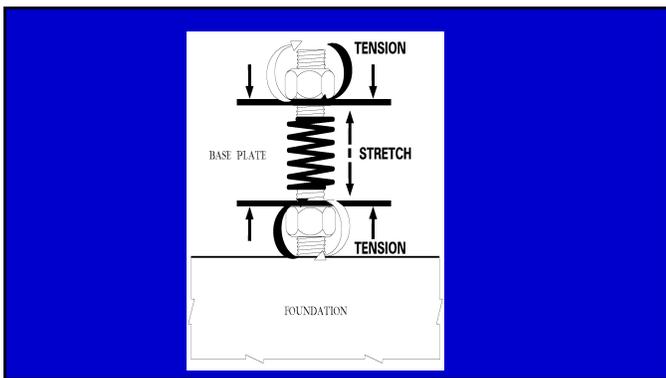


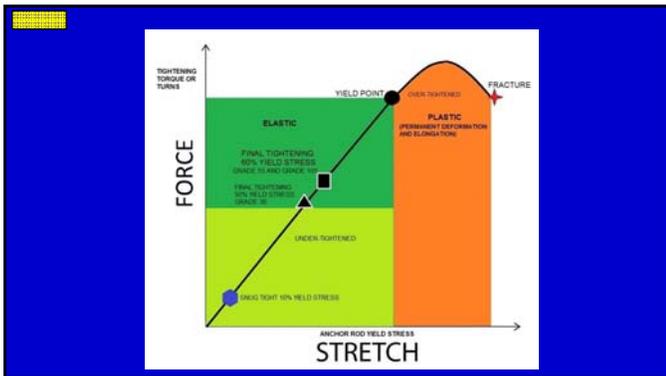
16-12 PAST TIGHTENING REQUIREMENTS

Table 2545-1
Leveling Nut Rotation for Tightening Double-Nut Anchor Rod Connection

Anchor Rod Diameter, in	Nut Rotation beyond Snug-Tight
≤ 1 1/2	1/6 turn
> 1 1/2	1/12 turn

* Before turning the leveling nuts to the required rotation, mark the top of the foundation showing the before and after rotation positions of each leveling nut. Incrementally turn the leveling nuts using a crisscross or star pattern until the required nut rotation shown in this table has been achieved. Turn the nuts in at least two full tightening passes. Verify the nut rotation after tightening.





FACTORS THAT DETERMINE HOW MUCH TO TIGHTEN?

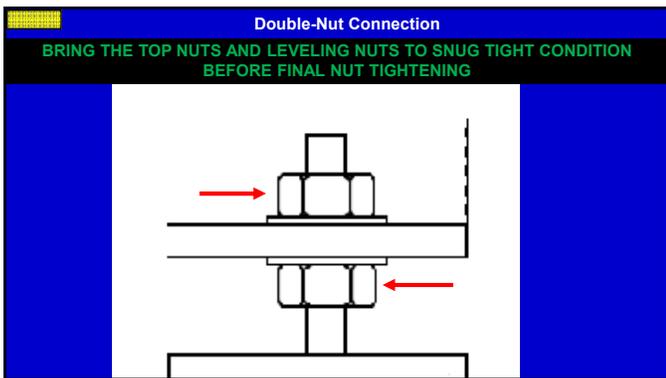
Anchor Bolt \varnothing (in)	Bolt Type (per ASTM Spec. 3362)	Base Plate Thickness (in)
1	Type B Grade 55 Spec. 3385 2B	1/4
1	ASTM A325 8 UNC Hex Head Bolt	1/4
1	Type B Grade 55 Spec. 3385 2B	1
1	Type C Grade 105 Spec. 3385 2C	1

ANCHOR ROD DIAMETER
 ANCHOR ROD TYPE (MATERIAL AND GRADE)
 BASE PLATE THICKNESS (GRIP LENGTH)

Table P-1-Torque and Turns for Mn/DOT Structures

Signals & Lighting Structures

Anchor Bolt \varnothing (in)	Bolt Type (per ASTM Spec. 3362)	Base Plate Thickness (in)	Pole Type	Verification Torque, T _v (ft-lbs)	Snug Torque (ft-lbs)	Re-tightening Torque, T _r , 48 Hours After Tightening	Rotation Beyond Snug
3/4	ASTM A325 10 UNC Hex Head Bolt	3/8	Pedestrian Walkway Light Poles	138	23	152	1/12
		1/2					1/12
3/4	Type A Grade 58 Spec. 3385 2A	3/8	Pedestrian Walkway Light Poles	45	9	50	1/3
		1/2					1/3
1	Type B Grade 55 Spec. 3385 2B	1/4	40 Stainless Steel Light Poles	200	33	220	1/18
		3/4					1/2
1	ASTM A325 8 UNC Hex Head Bolt	1/4	40 Stainless Steel Light Poles	335	56	368	1/12
			40 or 40 ⁺ Single Arm or Twin Arm				



WHAT IS SNUG TIGHT?

Mn/DOT Spec. Snug tight is defined as the minimum force of an impact wrench or the full effort of an adult using an open-end wrench to bring all plies of the connection together in firm contact.

16-18 **MnDOT SNUG TIGHT RE-DEFINED** **IOWA STATE**

*For anchor rods $\leq 1\text{-}\frac{1}{4}$ " diameter use a 12" long wrench to snug tighten nuts pulling the handle with one arm in one smooth motion.

Anchor Rod Diameter, (in)	Anchor Gr. (Yield Stress)			Wrench Length, (in)
	36	55	105	
3/4				12
1				
1-1/4		12*		
1-1/2	7	11	21	
1-3/4	11	18	34	
2	17	26	50	
2-1/4	25	39	74	
2-1/2	35	53	101	

OR USE THE SNUG TIGHT TORQUE VALUES IN THE TABLE

16-13 **Installing Traffic Signal Mast Arm Poles**

HYDRAULIC TORQUE WRENCH CLEARANCE IN PA TRAFFIC SIGNAL BASE

Appendix-38, 39

Perform tightening in a star pattern in 2 cycles

Anchor Rod Tightening Torque and Turn Guide MnDOT Traffic Signal and Light Pole

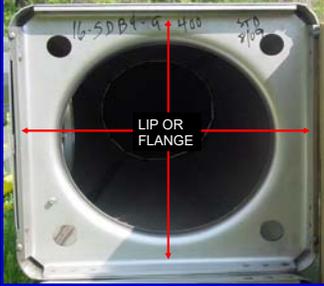
Pole Type	Anchor Rod Φ (in)	Rod Type (galvanized to Spec. 3362)	Base Plate Thickness (in)	Using Torque Wrenches Manual and Hydraulic			Using Standard Wrenches Combination, Socket, Sockets, or Open-End Slugging Wrenches	
				Snug Torque (ft-lbs)	Verification Torque, T_v (ft-lbs)	Re-tightening Torque, T_r 48 Hours After Tightening	Snug Tight Wrench Length (in)	Final Nut Rotation Beyond Snug
Traffic Signal Mast-Arm PA 85	1- 1/2	Type C Grade 105 Spec. 3385.2 C	1-1/4	221	1328	1460	21	1/4
Traffic Signal Mast Arm PA 90 & 100	2	Type C Grade 105 Spec. 3385.2 C	1-1/4	525	3150	3465	50	1/6
BA90 Signal Mast Arm Pole	1-1/2	Type C Grade 105 Spec. 3385.2 C	3	221	1328	1460	21	1/4
BA85 Signal Mast Arm Pole	1- 3/4	Type C Grade 105 Spec. 3385.2 C	3	349	2095	2304	34	1/6

DIGITAL PENDANT WITH DIGITAL TORQUE READ OUT

OPEN END SLUG/STRIKING WRENCH AND SHORT HANDLE 3-5 LB SLEDGE HAMMER

Place on leveling nuts and bring the plies of the connection into firm contact

Installing Stainless Steel Roadway Light Poles 40 ft. Design E



USE THE 1/2" THICK WASHERS

Appendix-36		LIGHT POLES (pg 1)						
Pole Type	Anchor Rod Φ (in)	Rod Type (galvanized to Spec. 3392)	Base Plate Thickness (in)	Using Torque Wrenches Manual and Hydraulic			Using Standard Wrenches Combination, Socket, Structural, or Open-Jaw Slugging Wrenches	
				Snug Torque (ft-lbs)	Verification Torque, T _v (ft-lbs)	Re-tightening Torque, T _r 48 Hours After	Snug Tight Wrench Length (in)	Final Nut Rotation Beyond Snug
Pedestrian Walkway Light Poles on Steel Screw-In Foundations	3/4	ASTM A325 10 UNC Hex Head Bolt	3/8 1/2 5/8 3/4	23	138	152	≤ 12 Pull with one arm 1/12 1/6 1/6	
Pedestrian Walkway Light Poles	3/4	Type A Grade 36 Spec. 3385.2 A	3/8 1/2 5/8 3/4	9	45	50	≤ 12 Pull with one arm 1/3 1/2 1/2	
		Type B Grade 55 Spec. 3385.2 B	15	80	80			
40' Stainless Steel Light Poles	1	Type B Grade 55 Spec. 3385.2 B	1/4	33	200	220	≤ 12 Pull with one arm 1/18	
40' Stainless Steel Light Poles on Steel Screw-In Foundations	1 (Steel Screw-In Foundations)	ASTM A325 8 UNC Hex Head Bolt	1/4	55	335	368	≤ 12 Pull with one arm 1/12	

Verification Form

HIGH STRENGTH ANCHOR ROD INSTALLATION RECORD

Program: _____

Project: _____

Location: _____

Inspector: _____

Date: _____

Step 1: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 2: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 3: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 4: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 5: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 6: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 7: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 8: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 9: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 10: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 11: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 12: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 13: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 14: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 15: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 16: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 17: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 18: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 19: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 20: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 21: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 22: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 23: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 24: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 25: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 26: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 27: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 28: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 29: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 30: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 31: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 32: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 33: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 34: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 35: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 36: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 37: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 38: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 39: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 40: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 41: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 42: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 43: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 44: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 45: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 46: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 47: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 48: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 49: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 50: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 51: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 52: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 53: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 54: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 55: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 56: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 57: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 58: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 59: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 60: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 61: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 62: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 63: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 64: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 65: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 66: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 67: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 68: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 69: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 70: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 71: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 72: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 73: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 74: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 75: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 76: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 77: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 78: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 79: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 80: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 81: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 82: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 83: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 84: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 85: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 86: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 87: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 88: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 89: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 90: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 91: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 92: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 93: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 94: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 95: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 96: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 97: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 98: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 99: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Step 100: Verify that anchor rods are installed in the proper location, depth, and orientation. _____

Questions?

Midway Review Questions Chapters 1 thru 16

12/30/2019 mndot.gov 395

Review Questions

Special Provisions governs over all other contract documents (not including addendum)?

Request department furnished materials at least 30 normal working days in advance.

Place backfill material in horizontal compacted layers not more than 6 inches.

If soil conditions do not allow sidewalls of the drilled shaft to remain open then a full length forming tube with four 3 in x 12 in rectangular holes will be used.

MNDOT light foundations in the clear zone must be installed flush with finish grade.

Review Questions

Provide 3/4 inch conduit, if conduit is not specified in contract documents.

Conduits terminating in handholes must extend 2-3 inches beyond the inside wall.

In MnDOT signal systems what size and type grounding wire is used and how is it bonded to the ground rod electrode? 6 AWG stranded green insulated /exothermic weld

MnDOT only requires split bolts for splicing neutral conductors in light pole bases.

Fiber optic cable minimum bending radius is determined by the cable diameter.

Apply anti-seize and lubricating compound to exposed threads and bearing surface of all nuts and washers.

What's New Since 2015

CHAPTER 17 SIGNAL HEADS AND LUMINAIRES

"WHAT'S NEW SINCE 2015"

MnDOT REQUIRES DATE MARKING WITH A MACHINE PRINTED LABEL

2565.2

1.6 Signal and Pedestrian Indication Labeling

Label the indications with the installation date as follows:

Place a date of installation on the back of the indication.

Provide labels for the date of installation on the back of the indication meeting the following requirements:

- (1) Record the installation date on white self-adhering label,
- (2) Use machine printed numbers,
- (3) Black text 1/8 inch (12.7 mm) tall,
- (4) Month/Year numeric format,
- (5) Suitable for placement in wet locations,
- (6) Paper based labels are not acceptable, and
- (7) Place inside on the back of the indication.

6-15

"WHAT'S NEW SINCE 2015"



MnDOT Requires Backplates (Background Shields) with rolled edges.

"WHAT'S NEW SINCE 2015"



UNIFORM APPEARANCE

8" / 12" LED Traffic Ball Signal Modules

Features & Benefits

- Industry's lowest power for all colors
- Manufactured with anti-capillary wires
- Meets or exceeds ITE intensity, color & uniformity specs, including 40°C/ 45°C requirements at 48VDC
- Conformal coated power supply
- Temperature compensated power supplies for longer LED life
- Secondary lens treatment for abrasion resistance
- Uniform appearance
- Patents No. 7,261,835 and other patents pending
- Expanded view radiation pattern suitable for sign wire and steep grade applications
- All units operate at 36-48VDC

Color	Part Number Signal Lens	Part Number Clear Lens	Wattage at 25°C	Peak Intensity at 25°C	View Angle at 25°C	Power LED Type
8" Module						
Red	433-3110-0096L	433-3115-0096L	625	1.1	765	•
Yellow	433-3100-0096L	433-3110-0096L	580	5	490	•
Green	433-3200-0096L	433-3115-0096L	580	4	215	•
12" Module						
Red	433-3210-0096L	433-3215-0096L	625	4	365	•
Yellow	433-3200-0096L	433-3210-0096L	580	10	315	•
Green	433-3200-0096L	433-3215-0096L	580	7	475	•

MnDOT is considering 48 VDC Indications. Note the low power consumption

"WHAT'S NEW SINCE 2015"



MnDOT HAS APPROVED LED REPLACEMENTS FOR VERTICAL MOUNT LUMINAIRES. A 90 DEGREE TENON MOUNT ADAPTOR LISTED ON MnDOT'S APPROVED/QUALIFIED PRODUCTS LIST MUST BE USED.

“WHAT’S NEW SINCE 2015”



MnDOT has High Mast LED Luminaires (Asymmetrical & Symmetrical) on the APL.
All of the MnDOT high mast towers State wide have been retrofitted with LED luminaires.

“WHAT’S NEW SINCE 2015”

Light Emitting Diode (LED) roadway luminaires - 5 lane applications

LED Luminaires 5 Lane Application Use on the Roadway Shoulder Operating Voltage Range of 120 through 277 Volts AC			
Product	Manufacturer	Manufacturer Address	Approval Date
CCT CELLSTRON Solid State LED Area / Roadway Luminaire CCT-6-3-2-0-13-4-07-10K-AP-4P-4P-0207	LEDco	1121 Highway 74 South Peachtree City, Ga 30089	03/01/2018 Light Loss Factor = .81

LED Luminaires 5 Lane Application Use in the Roadway Center Median Operating Voltage Range of 120 through 277 Volts AC			
Product	Manufacturer	Manufacturer Address	Approval Date
CCT CELLSTRON Solid State LED Area / Roadway Luminaire CCT-6-3-2-0-13-4-07-10K-AP-4P-0207	LEDco	1121 Highway 74 South Peachtree City, Ga 30089	03/01/2018 Light Loss Factor = .81

MnDOT has 5 Lane LED Luminaires on the APL.

**CHAPTER 17
SIGNAL HEADS AND LUMINAIRES**



**2565.1C
MnDOT has defined the following terms**

- Pedestrian Signal Head
- Pedestrian Signal Housing
- Pedestrian Signal Indication
- Signal Head
- Signal Section
- Signal Housing
- Signal Indication

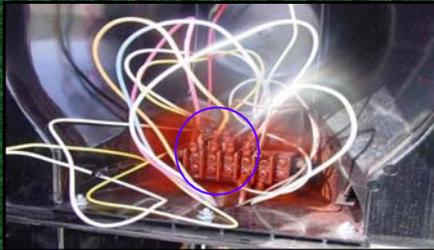
MnDOT standard signal housings are black polycarbonate and are found on MnDOT’s APL for Signals



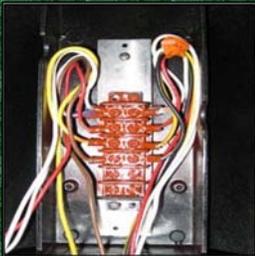
17-1
**Label the Date of Installation.
 2018 Standard Specifications for
 Construction Requires Printed Labels**



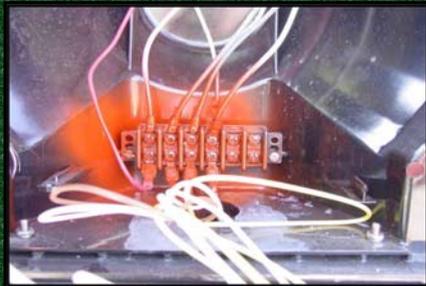
17-1
**Standard Specifications for Construction
 have specific requirements for terminating
 conductors in the signal heads
 2565.31.7**



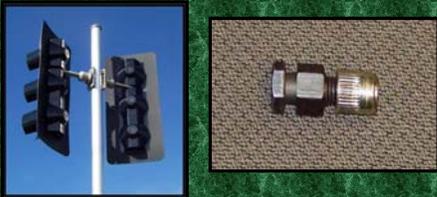
17-1
**Vertical Mounted
 Terminal Block Example**



17-1
3 Section Head Example



17-3
Captive Fastener (Rivet Nut)



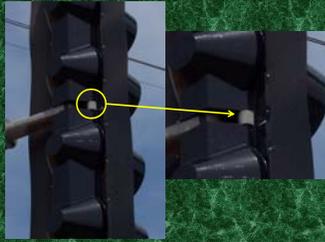
**You must use the a supplied tool for properly
 seating the captive fastener in the pedestal shaft**

17-4



17-4

Signal Head Mounting Spacers



4 and 5 section heads are required to have signal head mounting spacers part number 11F

17-5

Straight and angle mounting hardware



You must use the nut and washers supplied with the mounts

17-6

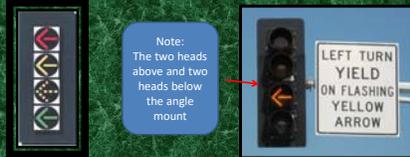
Pedestrian Signal Heads



- The indications are 16" tall x 18" wide with count down timers
- Note the angle mount with cap

17-7

Flashing Yellow Arrow FYA



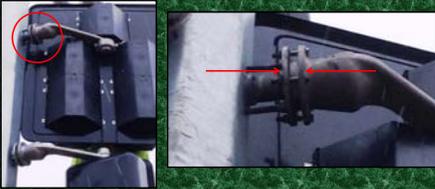
FYA is the MnDOT design standard for left turns. See Technical Memorandum 12-10-T-03

17-8

Angle Mounts & Cluster Head Installation

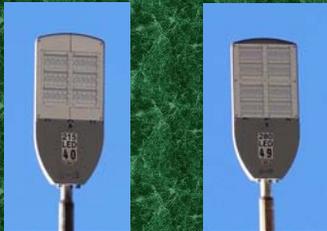
The angle mount must be installed and adjusted so there is no gap on the back side at the ball and socket.

This will allow the background shield to clear the pole.



17-9

MnDOT APPROVED LED ROADWAY LUMINAIRES FOR USE AT A 40 & 49 FOOT MOUNTING HEIGHTS ARE LISTED ON MnDOT's APPROVED/QUALIFIED PRODUCTS LIST



17-10 **INSTALL LUMINAIRES IN ACCORDANCE WITH 2545.3Q. MANUFACTURER'S INSTALLATION INSTRUCTIONS**

WARNING
DISCONNECT POWER BEFORE DEVELOPING OR WIRING THE FIXTURE. READ ALL INSTRUCTIONS COMPLETELY BEFORE BEGINNING INSTALLATION.

WARNING
RISK OF FIRE, PRODUCT FAILURE, INSTALLATION AND USE ONLY.

CAUTION
TO AVOID THE RISK OF FIRE OR BURNING, FITTER CLAMP BOLTS MUST BE INSTALLED IN COMPLIANCE WITH ALL APPLICABLE NATIONAL AND LOCAL ELECTRICAL CODES. FITTER CLAMP BOLTS MUST BE INSTALLED IN COMPLIANCE WITH ALL APPLICABLE NATIONAL AND LOCAL ELECTRICAL CODES. FITTER CLAMP BOLTS MUST BE INSTALLED IN COMPLIANCE WITH ALL APPLICABLE NATIONAL AND LOCAL ELECTRICAL CODES.

CAUTION
OVER-TORQUING OF FITTER CLAMP BOLTS CAN CREATE CRACKS IN THE HOUSING CAUSING THE FIXTURE TO FALL TO THE GROUND.

TORQUE FITTER CLAMP BOLTS TO THE CORRECT FT/LBS RECOMMENDED IN THE INSTALLATION INSTRUCTIONS.

AEL American Lighting Equipment

17-10 **INSTALL LUMINAIRE IN ACCORDANCE WITH 2545.3Q. After the light pole has been installed on its foundation;**

- **INSTALL THE LUMINAIRE ON THE LIGHT POLE TENON AND.....**
- **PLACE A LEVEL ON THE AREA PROVIDED ON TOP OF THE LUMINAIRE, AND LEVEL SIDE TO SIDE AND FRONT TO BACK**

17-10 **MnDOT LED LUMINAIRE COME STANDARD WITH 7 PIN PHOTOCONTROL RECEPTACLE WITH SHORTING CAP AND A DIMMING ELECTRONIC DRIVER**

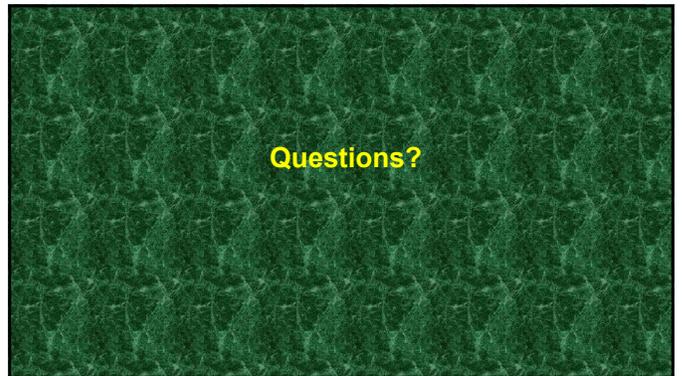
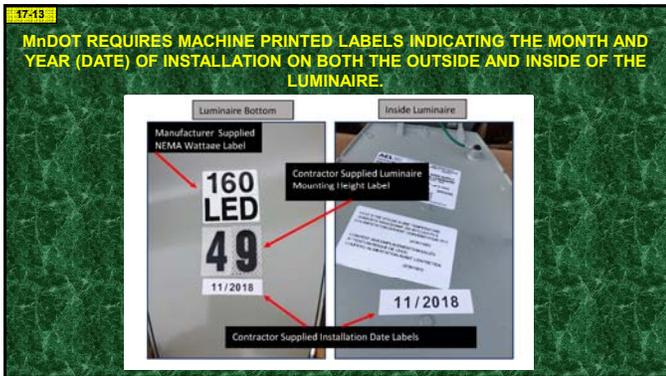
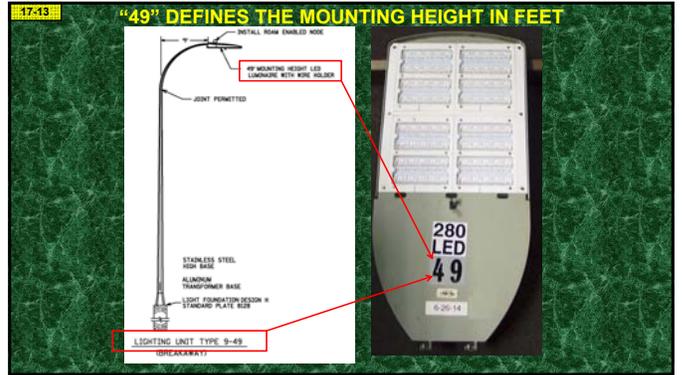
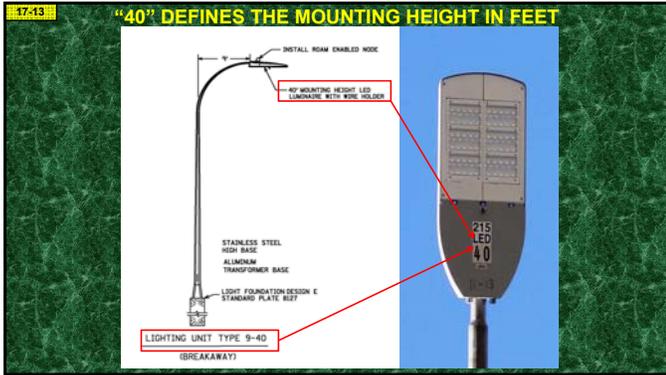
17-10 **Smart Photocontrols**

THE 7 PIN RECEPTACLE MAKES IT POSSIBLE TO PLUG IN A SMART PHOTOCONTROL DEVICE FOR LUMINAIRE LIGHTING CONTROLS

17-10

THIS LABEL WILL BE INSTALLED WHEN SMART PHOTOCONTROL DEVICES AND CONTROLS ARE INSTALLED ON A LIGHTING SYSTEMS. THEY WILL BE INSTALLED ON EACH LIGHT POLE AND THE SERVICE CABINET.

17-13 **MnDOT REQUIRES LABELS SHOWING 40 OR 49 BE INSTALLED ON THE BOTTOM OF THE LUMINAIRE BY THE CONTRACTOR.**



Chapter 18 ACCESSIBLE PEDESTRIAN SIGNAL PUSH BUTTONS



19-1

Accessible Pedestrian Signal (APS)



- APS Buttons are found on the MndOT APL
- Do not drill any weep holes in these buttons
- Place a bead of 100% clear silicone sealant across the top of the button.

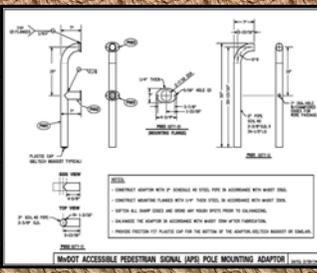
19-1

What Not To Do !



18-1

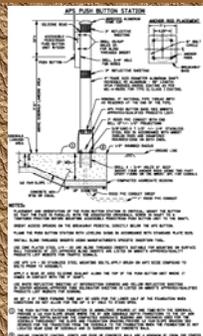
What you can do!

MNDOT ACCESSIBLE PEDESTRIAN SIGNAL (APS) POLE MOUNTING ADAPTOR

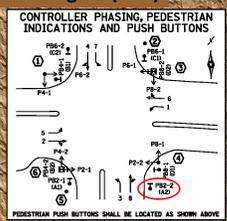
18-1

Revised Pedestrian Push Button Station Foundation



18-1

Accessible Pedestrian Signal (APS)

CONTROLLER PHASING, PEDESTRIAN INDICATIONS AND PUSH BUTTONS

PEDESTRIAN PUSH BUTTONS SHALL BE LOCATED AS SHOWN ABOVE

- Note the reflective sheeting on pedestrian stations
- Each button has a unique address which is located on the plan

18-2

Push Button Mounting Height



The center of the button face must be 42 inches above the walking surface

APS Central Control Unit and I/F Panel

Needs to be delivered to ESS 30 days prior to the traffic signal cabinet pick up day

**Solid State Pedestrian Push Button
APS Ready Signals**

- Mounting cup should have a 3/16 " weep hole.
- Top 1/2 should have a bead of clear 100% silicone sealant applied .

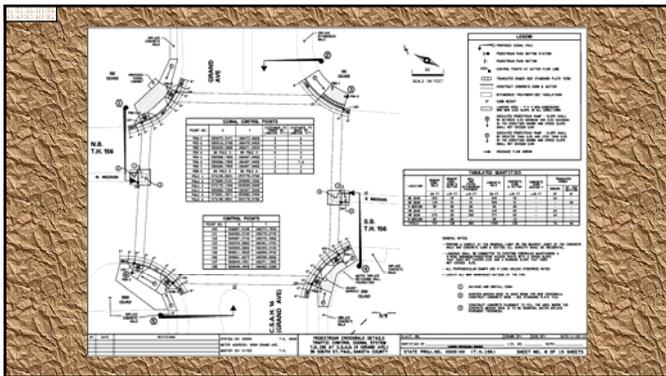
**MnDOT Approved
Two Part Epoxy Requirements**

Epoxy has a fairly short shelf life.
Installation temperature should be 41 °F or above.
One approved epoxy can be installed above 0°F (Red Head)
Proper cleaning of the pre drilled hole is required.
Allow proper curing time prior to installing the ped station.

Two Part Epoxy Installation Requirements
Proper cleaning of the pre drilled hole is required.

WARNING: Instruction insert enclosed in carton to be distributed with each cartridge

WARNING: Manufacturer instructions must be followed.



United States Access Board
A Federal Agency Committed to Accessible Design

The Americans with Disabilities Act (ADA) of 1990
Prohibits discrimination against people with disabilities

PROWAAC
Public Rights-of-Way Access Advisory Committee

PROWAG
Draft Proposed Right-of-way Accessibility Guidelines

Division S Special Provisions ADA Requirements

S-49 PROSECUTION OF WORK (ADA)

The provisions of MnDOT 1803 are supplemented and/or modified with the following:

S-49.1 SPECIAL PROJECT ADA REQUIREMENTS

All pedestrian facilities and shared use paths on this Project must be constructed according to Public Rights-of-Way Accessibility Guidelines (PROWAG) which can be found at: <http://www.dot.state.mn.us/ada/pdf/PROWAG.pdf>. The appropriate pedestrian ramp details for each quadrant are included in the Plan. The Engineer may provide additional details to those provided in the Plan that meet the PROWAG guidelines as the need arises and field conditions dictate.

If the Contractor constructs any pedestrian or shared-use trail facilities that are not per Plan, do not meet the above requirements, or do not follow the agreed upon resolution, the Contractor will be responsible for correcting the deficient facilities with no compensation paid for the corrective work. To ensure that the pedestrian facilities are constructed in compliance with PROWAG, the Contractor shall follow the following three steps:

Additional Information on Division S Special Provisions ADA Requirements

Contact:

Todd Grugel

651 366 3531

todd.grugel@state.mn.us

Questions?

CHAPTER 19 EMERGENCY VEHICLE PREEMPTION/ENFORCEMENT LIGHTING

19-1

The optical emitter activated type EVP system consists of four main components:

1. Optical detector
2. Confirmation light
3. Emitter
4. Phase selector

EVP Discriminators

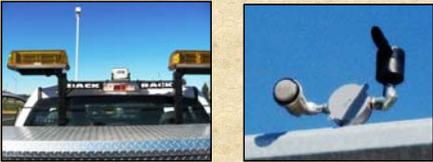


• Must be delivered to ESS 30 days prior to signal cabinet pick up.

• Include the TE Number on materials dropped off

19-1

Range of Optical EVP



- 2565.3W When the intersection geometry and line of sight are ideal the EVP system should detect an approaching vehicle at 1800 feet.
- Detection range must be tested with a vehicle emitter properly mounted.

19-2

Emergency Vehicle Pre-emption (EVP) Detector Cable 3/C#20 3 Conductor 20 AWG with Drain Wire



This cable must be installed with no splices anywhere in the cable run.

Emergency Vehicle Pre-emption (EVP) Detector Cable



- This cable should be installed even if no EVP is required on the project.
- Check the signal plans.
- The cable should be pulled from the cabinet to the round junction box on the mast arm

19-3

Siren Activated Emergency Vehicle Pre-emption



This is only used outside the 8 county metro area.

19-3

Lamp Socket Conversion



- Remove the stainless holding clip.
- Remove the fiber support washer.
- Reinstall rubber washer and stainless steel holding clip

Optical Emitters



MnDOT has published an Optical Emitter Procurement Guideline for local agencies. This guideline is available on the Traffic Engineering Web Site.
<http://www.dot.state.mn.us/trafficeng/signals/signalworksheets.html>

All Emergency Vehicle Pre-emption must be fully operational at the signal turn on

As we move forward in the 21st Century you will start to hear
Vehicle Priority
instead of EVP and Transit Priority

Questions ?

What's New Since 2015

CHAPTER 20 SERVICE EQUIPMENT

“WHAT'S NEW SINCE 2015”

NEC ARTICLE 110.24 REQUIRES MnDOT TO HAVE AVAILABLE FAULT CURRENT CALCULATIONS AT THE LINE SIDE OF THE METER SOCKET FOR SIGNALS AND LIGHTING.



WARNING	
Arc Flash Hazard Appropriate PPE Required	
Arc Flash Boundary	487 mm (19 in.)
Arc Flash PPE Category	3
Working Distance	457 mm (18 in.)
Arc-Rated Clothing, Min. Arc Rating of 4 cal/cm ²	Protective Equipment:
Arc-rated long-sleeve shirt and pants or arc-rated overall	Hard hat
Arc-rated face shield or arc flash suit hood	Safety glasses or safety goggles
Arc-rated jacket, pants, respirator, or hard hat liner	Shoaring protection (arc-rated pants)
	Heavy duty leather gloves
	Leather footwear
Equipment ID: MnDOT Lighting Service Cabinet W33X	

ADDITIONALLY AND IN CONJUNCTION WITH 110.24 MnDOT REQUIRES A CONTRACTOR PROVIDED ARC FLASH WARNING LABEL IN ACCORDANCE WITH NFPA70E.

CHAPTER 20 SERVICE EQUIPMENT

TYPES OF SERVICE EQUIPMENT

- Wood Pole Mounted – Temporary Signal Systems
- Signal Service Cabinet Type SSB)
- Rural Lighting and Flasher (RLF) Service Cabinet
- Type B, Type L1, and Type L2 Lighting Service Cabinets

WOOD POLE MOUNTED



For wood pole installations, the meter socket is located directly above the disconnecting means.

This type of installation is usually used on temporary signal systems

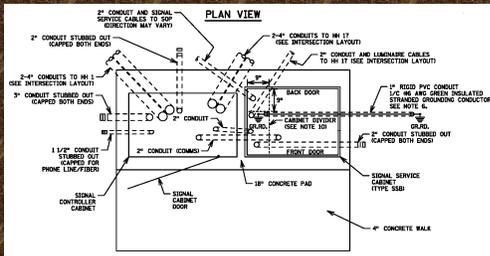
Signal Service Cabinet (Type SSB)



The Type SSB cabinet is used on all MnDOT permanent signal systems

This service cabinet will be installed with or without battery backup capabilities

CONDUIT PLACEMENT



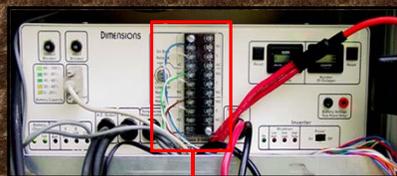
It is very important that conduits for the signal service cabinet are placed as shown on the equipment pad detail in the plan.

WITH BATTERY BACKUP



The cabinet will include batteries, inverter, and other pertinent items so that the service will operate for a specified time during a power outage

INVERTER



Wires must be terminated on the power inverter correctly to ensure that the battery backup system operates as intended during a power outage

WHAT NOT TO DO !



Do not notch the UPS. Remove the UPS shelf supplied by the cabinet manufacturer

Ensure the signal cabinet electrical interface is terminated on both ends.

BATTERY BACK UP INTERFACE HOOK UP

Myers 2010 Cabinet & Alpha Model FMM 1100 UPS Hook Up Chart

Alpha Model FMM 1100 Terminal	6 PR #19 Gauge Wire	12 Gauge Wire	Signal Cabinet Termination Point
Name	014	012	UPS Switching Fail Alarm 4
Name	014	011	Warning Back Up Batteries Low Alarm 3
Name	012	010	Warning on Battery Back Up Alarm 2
Name	010	012	BBU Commanded Flash

The 6 PR 19 AWG telephone cable must be terminated as shown on the Interface Hook Up chart(s) as indicated on the cabinet print

WHATS WRONG WITH THIS PICTURE ?



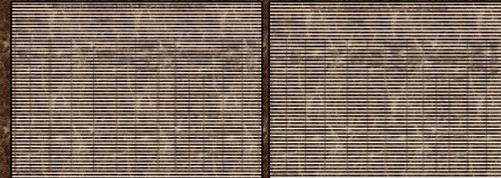
SSB Service Cabinet

RURAL LIGHTING and FLASHER (RLF) CABINET



Some MnDOT lighting system and flasher system projects may require the Contractor to furnish and install a RLF cabinet for providing power to the system

ELECTRIC SERVICE INFORMATION FORM



The Contractor is required to fill out an Electric Service Information Form for each signal and lighting system project that requires service equipment

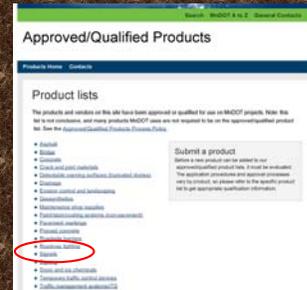
AVAILABLE FAULT CURRENT CALCULATIONS

NEC 110.24
2545.3X & 2565.3CC

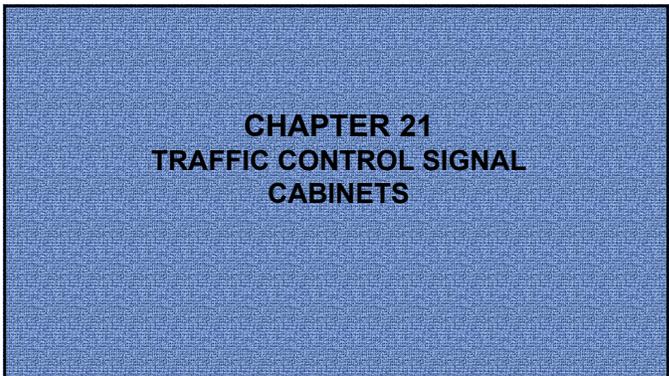
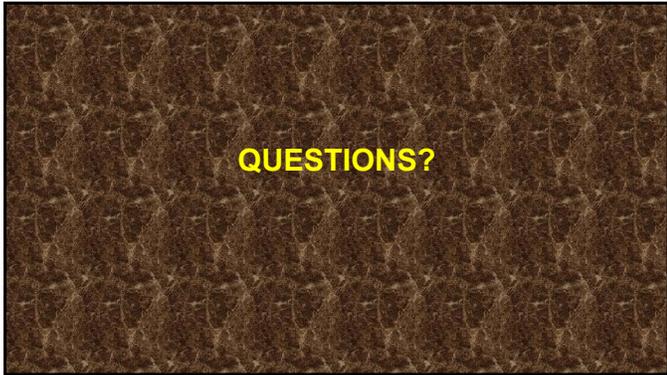
The following is required on the label:

- Transformer Size in KVA
- Available fault current in amps at the terminations of the utility transformer
- Available fault current in amps at the line side of the meter socket.
- The date the calculations were made

APPROVED PRODUCTS LIST (APL)



MnDOT approved signal and lighting service cabinets are listed on the MnDOT's Approved Products List (APL)



MnDOT is placing ATCC's On State Contract. The contract is open to CPV Members



21-1

Cabinet Pick Up



You must give ESS 30 days notice of your anticipated cabinet pickup date. Be sure to provide the TE #

21-1

Cabinet Pick Up



You must give ESS a minimum of 3 days notice of your actual intent to pick up the traffic signal cabinet. Be sure to provide the TE Number.

21-1

Traffic Signal Cabinet Pallet



The contractor must protect and return the traffic control signal pallet to ESS

21-2 and 21-3

Rubber Gasket & Anchor Rods



- Use the bolts nuts and washers provided with each cabinet
- Be sure to use the 1/2" thick rubber gasket provided with each cabinet

21-3

INSTALLATION TECHNIQUES

Use lifting ears with holes on traffic signal cabinets to prevent damage to the cabinet, internal equipment, and wiring.



21-4

Installation Techniques

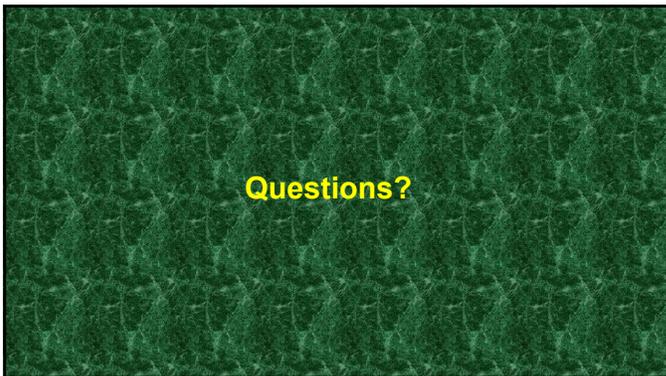
MnDOT cabinets including traffic control signal cabinets are constructed of anodized aluminum



21-4

Installation Techniques

Be careful not to scratch the cabinets.
There is no good way to field repair the finish.

CHAPTER 22 SURFACE FINISH

22-1

Galvanized Finish

In 2008 galvanized finish became MnDOT's standard on new traffic control signal transformer bases, poles, mast arms and luminaire shaft extensions.



22-1

Galvanized Finish

Galvanized coatings are highly abrasion resistant

If the surface is scratched determine if the galvanized coating has been scratched thru to bare steel

Galvanized Pole and Mast Arm Finish Repair 2565.3.Q and 3394



Paint patches appear to cover marks or chips greater than 1/2". The mast arm was not in conformance with the contract and was returned to the manufacturer.

For galvanized surfaces that have handling marks or minor chips with dimensions no greater than 1/2 inch, repair in accordance with ASTM A780 Annex 2 (brush applied paint only). Obtain an approved non-conformance report for each repair.

22-1

Repair of a Galvanized Surface

Approved/Qualified Products

Zinc rich paint for galvanized pole repair

Product	Manufacturer	Date Approved
CRC Zinc-R	CRC Industries	4/27/12
CRC Zinc Re-No	CRC Industries	4/27/12
Crown #7005	Abrak Industries, Inc.	4/27/12
ZRC Galvite	Zinc Worldwide	4/27/12

Guidance

- Specification (PDP)
- Qualification Process (PQP)

Contact

Allen Collins
Materials and Test
Research
#601-296-5546
601-296-5546

2017 Minnesota Department of Transportation
365 John Ireland Blvd., St. Paul, MN 55155
1600
651-296-3000 Toll Free 800-657-3774

Contact MNDOT | Search MNDOT.gov | A to Z
Getting Around | 24/7 Travel Service
Doing Business | Careers/Job | News Room
Department and Staff | ADA and Accessibility
Governor's Site | State of Minnesota | About MNDOT



22-2

Painting of New Poles

MnDOT contract documents are written for galvanized poles to be painted at the factory

MnDOT Requires that all painting be done at the factory

22-2

Painted Poles

The protective wrap on painted poles should be removed as soon as they arrive on the job site



22-2

Repainting Existing Traffic Control Signal Systems

•Contract documents have very specific requirements with regard to re-painting of an existing signal system

22-2 and 22-3

Repainting Existing Traffic Control Signal Systems



- Scraped Paint which contains lead needs to be collected and disposed of properly
- Approved paints are found the APL for signals
- Weather conditions matter

Questions?

CHAPTER 23

Removal and Salvage of Existing Equipment

23-1

Removal of Existing Lighting Cable

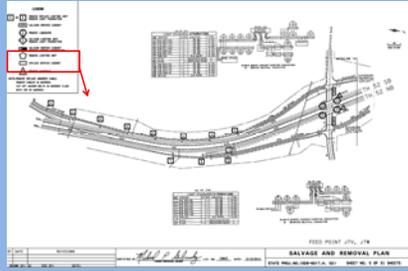
MnDOT Districts require all existing underground direct buried lighting cable from the old system be removed (except when cable is within 2 ft. of the roadbed) and disposed of by the contractor.



23-1

Removal of Existing Lighting Cable

The plan shows what lighting cable must be removed.



Removal of Existing Conduit



Some MnDOT Districts now require all existing underground conduits from the old system be removed and disposed of (except under roadway surfaces) by the Contractor

24-2

Reminder

- All pole mounted signs must be mounted a minimum of 7 feet above the walking surface

24-2

Reminder

- All correct signing shall be in place and incorrect signs removed prior to signal turn on

24-3

2564.3H

The Contractor must affix a Department furnished warning sticker to each sign panel directly above the fabrication sticker.

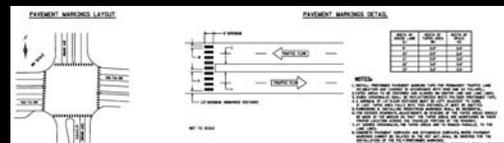


Questions?

Chapter 25

Pavement Markings

25-1



25-1

CROSSWALK PAVEMENT MARKINGS 2565.2.R and 2565.3.S

Crosswalk Pavement Markings (Preformed Pavement Marking Tape for Permanent Traffic Lane Delineation)

Provide (CROSSWALK MARKING-POLY PREFORM-GROUND IN) accordance with 2582.2A.
Install crosswalk block markings in accordance with 2582 and as follows:

Grove the block markings into the pavement surface to protect the marking from snow and ice removal operations.

See 2582.3 for installation requirements.

Mobile retroreflector measurements (MRM) are not required for crosswalk block markings.

Keep cross walks straight



25-2

Attention to the alignment and spacing of the crosswalk pavement marking is important



All required pavement markings must be in place at signal turn on

Only apply the crosswalk or stop bar pavement marking material when the weather conditions are appropriate



Questions?

Chapter 26
Wood Pole Span Wire
Signal Systems

Signal Vs Dump Truck

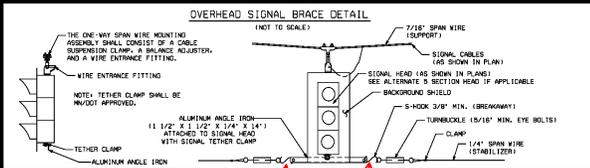


26-1

When a wood pole span wire traffic control signal plan calls for a 5 section head it must be a cluster head (dog house) style



The breakaway portion (S hook) needs to be at the signal head



The breakaway portion (S hook) needs to be at the head



2565.3J5 Span length + 5%
 60 X .05 = 3 60 + 3 = 63 feet
 Span length equals 63 feet.



26-3

When staking a wood pole system ensure that it is placed to allow construction of the new permanent signal system



26-2

What's wrong with this picture ?



This is rigid PVC conduit

NEC 352.30 " so that movement from thermal expansion and contraction is permitted ."

Video Detection is now the standard for temporary wood pole systems



In some cases loop detectors may be used



Salvage heads or other hardware



In some rare cases signal heads and other hardware may be required to be salvaged

Questions ???

Chapter 27
Restoration and Clean Up

27-1

RESTORATION AND CLEANUP

Inspect the construction site to identify and record existing damage before the project begins.

27-1

RESTORATION AND CLEANUP

Recording damage before the project begins will prevent extra costs for the contractor.

The project engineer may require the existing damage be repaired. This would be considered "extra work" and the contractor will be paid accordingly.

RESTORATION AND CLEANUP

Contractor damage to electrical systems that were not part of the construction project must be repaired.

27-2

Guidance for Restoration and Cleanup Activities

Provide final grading and erosion control blanket.

Maintain the restoration work until final acceptance. If damage occurs to the restoration it must be repaired.

Questions?

Chapter 28

Activating/Deactivating A Signal

28-1

Activating/ Deactivating a Signal

Activating requires coordination between with the:

- Project engineer
- Contractor
- District traffic office

Activating Guidelines

Functional Test (Field Testing)

Before activating a signal perform a functional test demonstrating to the engineer that the traffic control components are fully functional. 2565.3.Z

28-1

Activating Guidelines Turn-On Procedure

Traffic control signal systems should not be activated on Fridays or before a holiday just in case there is a malfunction with the new system.

The engineer should be notified at least 48 hours before the signal is scheduled for activating.

The traffic control signal system cannot be put in flash or made operational unless authorized by and in the presence of the engineer (or their representative).

28-4

Deactivating Guidelines

Before deactivating (turning off) a signal the contractor must notify the engineer within a timeframe specified in the contract.

The system cannot be put into flash or deactivated except by MnDOT personnel, unless authorized by and in the presence of the engineer.

Traffic control signal systems should not be deactivated on Fridays or before a holiday.

Questions?

Chapter 29

Project Completion Documents (Warranties and As Built Plans)

29-1 thru 29-5

Project Completion Documents

- Ensures the work done meets specifications.
- Shorter final punch lists.
- Not having to complete long punch lists to meet contract requirements.

ELECTRICAL SYSTEM TESTING AND ACCEPTANCE SHEET

General testing and acceptance measurements must be in accordance with (2545.36)

CONDUCTOR FIELD ELECTRICAL INSPECTIONS

*The following list is a minimum and does not include applicable specifications in The National Electrical Code (NEC)

All Specification References are from the current NEC Code

A. Check List

- 1. Verify all cables, conductors and ground (2545.36)
- 2. All conductors must have ground rods (2545.36) and ground rods (2545.36)
- 3. All conductors must have ground rods (2545.36) and ground rods (2545.36)
- 4. All conductors must have ground rods (2545.36) and ground rods (2545.36)
- 5. All conductors must have ground rods (2545.36) and ground rods (2545.36)
- 6. All conductors must have ground rods (2545.36) and ground rods (2545.36)
- 7. All conductors must have ground rods (2545.36) and ground rods (2545.36)
- 8. All conductors must have ground rods (2545.36) and ground rods (2545.36)
- 9. All conductors must have ground rods (2545.36) and ground rods (2545.36)
- 10. All conductors must have ground rods (2545.36) and ground rods (2545.36)

B. Check Rejection Points

- 1. Verify that the ground rods are installed in accordance with (2545.36)
- 2. Verify that the ground rods are installed in accordance with (2545.36)
- 3. Verify that the ground rods are installed in accordance with (2545.36)
- 4. Verify that the ground rods are installed in accordance with (2545.36)
- 5. Verify that the ground rods are installed in accordance with (2545.36)
- 6. Verify that the ground rods are installed in accordance with (2545.36)
- 7. Verify that the ground rods are installed in accordance with (2545.36)
- 8. Verify that the ground rods are installed in accordance with (2545.36)
- 9. Verify that the ground rods are installed in accordance with (2545.36)
- 10. Verify that the ground rods are installed in accordance with (2545.36)

I certify that the project has met the above described criteria. Liability responsibility will be shared and accepted by the contractor and the engineer.

Contractor: _____ Date: _____

29-6

Warranties

The warranty period starts on the day of turn-on.

Turn on is defined as:

For lighting

The time when the complete and operational lighting system meets all installation, operational, and testing requirements as specified in the contract.

For traffic signals

The time when the complete traffic control signal system meets installation and operational requirements of the contract and is placed in automatic operation.

29-6

Warranties

IN-SERVICE WARRANTY

Provided by the contractor for a period of **one year** after the system is accepted by MnDOT based on **the turn on date**.

Excluded from the in-service warranty period are:

1. All state furnished materials.
2. Any parts or materials that in the opinion of the engineer have been subjected to misuse, negligence or accidents by anyone other than the contractor.

29-6

Warranties

MANUFACTURER'S WARRANTY

Supplied by the manufacturer of each individual product. The length of warranty differs based on the specific product. The warranty begins on the date the product is placed into service.

All documents of the manufacturer's warranty, instruction sheets and parts lists must be submitted to the engineer before final acceptance of the project or when requested by the engineer.

29-7 and 29-8

As Built Drawings

As built means mark up drawings with any discrepancy or change between the original "as designed" contract plan and how the traffic signal or lighting plan was actually built.

As built Special Provision language is now in Division S and is a pay item.

In addition to the mark up drawings, Electronic Data Collection and Submittal (GPS Coordinates for poles, cable, etc.) is required.

Questions ?

Appendix

- District phone numbers
- Plan symbols and abbreviations
- Test reports, inspection forms
- Schedule of materials control
- Certificate of disposal
- Battery back up hook up chart
- Mast arm mounted sign detail
- Electrical service information form
- Light pole installation instructions
- Steel screw-in foundation detail sheets
- Saddle adaptor and template
- Products listed on MnDOT's APL
- MnDOT web links