DEPARTMENT OF TRANSPORTATION

SIGN PLAN DESIGN

Conventional Roads

MAY 2021

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1. Introduction

1.1. Purpose & Use

1.1.1. Purpose

The purpose of this manual is to provide designers that already have a basic understanding of the design and application of traffic signing with additional design guidance for MnDOT projects.

This manual will be used in concert with a 10-hour training targeted to designers that have already gained a basic understanding of the design and application of traffic signing. New designers are encouraged to attend the Signs 101 training, considered a prerequisite for this course.

This manual is intended to be used for the design of signs, delineators and markers on conventional roads and intersections. Separate manuals are being developed for use on Expressways & Complex Intersections and on Freeways.

MANUAL ORGANIZATION

The manual has been divided into six chapters and appendices that contain the following information:

- **Chapter 1:** Introduction
- **Chapter 2:** General Principles of Traffic Signing
- **Chapter 3:** Plan Components and Design Process
- **Chapter 4:** Special Provisions
- **Chapter 5:** Submittal Process
- **Chapter 6:** Class Exercises
- Appendices

Document Updates

This manual is intended to be a living document and may be periodically updated. As content is updated, a revision date will be included next to each section heading. Users that print hard copies of this manual are encouraged to periodically check the MnDOT Signing Publications website for updates.

District Preferences

MnDOT districts may have preferences on certain elements of sign design and plan formatting. Designers are encouraged to discuss any district preferences that may apply to a project with their district traffic engineer or delegate, herein referred to as the District Signing Engineer.

1.1.2. Use

HOW TO USE THE DOCUMENT

A quick way for users to find information on a topic is by using the Search tools in PDF viewers or the Find features in web browsers.

Linked Content

Links to other sections within this manual, links to other manuals, design guidance, current sample plans and supporting documentation have been added throughout the document through the use of hyperlinks.

Links Legend:

Text	Links to other sections or figures within the document
Text	Links to external sources and webpages
i Text	Links to additional information

Callout Content

Practical scenarios and recommended actions are presented throughout the document in various ways.

COMMONLY SEEN ERROR:

✖ Commonly Seen Errors callouts are provided throughout the manual to provide guidance that will facilitate the design and review process.

BEST PRACTICE:

✔ Best Practice callouts are provided throughout the manual to call attention to preferred methods and design practices.

ADDITIONAL GUIDANCE

Guidance in these call outs includes information such as design and formatting options

Plan Sheet Content

Text that is taken directly from an example plan sheet is stylized in the following way: TEXT

1.2. MnDOT Organization and Contact Information

MnDOT's headquarters can be reached at:

- Minnesota Department of Transportation
  395 John Ireland Blvd.
  Saint Paul, MN 55155-1800
- Phone: 651.296.3000 | Toll Free: 800.657.3774

MnDOT Organization Chart

Office of Traffic Engineering Org Chart

Office of Traffic Engineering Contacts

MnDOT's Signing Technical Experts are housed at the Waters Edge District office:

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1.3. Written Communication Policy

To request this document in an alternative format, please contact the Affirmative Action Office at 651.366.4723 or 1.800.657.3774 (Greater Minnesota); 711 or 1.800.627.3529 (Minnesota Relay). You may also send an email to ADArequest.dot@state.mn.us. Please allow at least one week for processing.

1.4. Acknowledgments

The development of this Sign Plan Design for Conventional Roads manual has been the result of the efforts of the MnDOT Office of Traffic Engineering, HDR Engineering, Inc. and Alliant Engineering, Inc. It has included the input and guidance from the individuals that formed the Technical Advisory Committee:

- Josie Tayse, PE
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- Brian Barrett
- Chiashia (Crystal) Yang
- Michelle Hoff
- Chris Dochniak
- Rick Sunstrom
- Mike Martinez, PE
- Natalie Sager, PE
- Mike McCurdy, PE
- Brian Miller

1.5. Disclaimer

This manual is disseminated under the sponsorship of the MnDOT Office of Traffic Engineering. Updates to design guidance is an ongoing process and this manual may become out of date between updates. MnDOT, HDR Engineering, Inc. and Alliant Engineering, Inc. assume no liability for its contents or use thereof. All MnDOT signing plans, specifications and construction cost estimates must be prepared under the direct supervision of a professional engineer licensed to provide engineering services in the State of Minnesota. The contents of this manual do not necessarily reflect the official policy of MnDOT.

DEPARTMENT OF TRANSPORTATION

CHAPTER 2

General Principles of Traffic Signing

2. General Principles of Traffic Signing

2.1. Acronyms and Definitions

TERM	DEFINITION
Advisory Speed	A recommended speed for all vehicles operating on a section or highway and is based on the highway design, operating characteristics and conditions.
Certifying Engineer (formally Engineer of Record)	An engineer licensed in the State of Minnesota that assumes responsibility for a given plan, portion of a plan or a special provision.
Conventional Road (CR)	An undivided road with a speed limit less than or equal to 60 mph -OR- A divided road with a speed limit less than or equal to 55 mph that is not otherwise categorized as an expressway or freeway.
Curbed Roadway	A road that has a raised concrete curb alongside the travel lanes or shoulder. These are often referred to as urban sections.
Delineator	A retroreflective device mounted adjacent to the roadway in a series to indicate the alignment of the roadway.
District Signing Engineer	The state's signing representative on a project. On standalone signing projects, this individual is often also the state's project manager. On reconstruction projects, this individual is the District Traffic Engineer or their delegate.
Engineering Judgement	The evaluation of available pertinent information, and application of appropriate principles, provisions and practices as contained in the MUTCD or other traffic engineering resources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. Engineering Judgement shall be exercised by an engineer, or by an individual working under the direct supervision of an Engineer.
Expressway (E)	A divided, multi-lane highway with a speed limit greater than or equal to 60 mph
Freeway (F)	A divided highway with full access control.
Furnish and Install	Provide (supply), erect, install and assemble item in use for regular operation. For signing, furnish and install implies all materials be provided and installed, and may include the sign panel, sign post, base and mounting hardware.
Guide Sign	A sign that shows route designations, destinations, directions, distances, services, points of interest, or other geographical, recreational or cultural information.
Inplace	A sign support, panel or assembly that is present in the field prior to beginning design.
Install	Erect and assemble a component of a sign assembly, or an entire sign assembly provided by the salvaging of inplace signage or supplied by someone other than the person(s) performing the sign installation.
Intersection	The area embraced with the prolongation of lateral curb lines or pavement edges of two roadways that cross at-grade.

Table continues on the following page

TERM	DEFINITION
Mill and Overlay Projects	Involve the grinding and removal of some or all of the inplace pavement and replaces with new bituminous pavement. These projects may also include spot locations with ADA, guardrail and hydraulic work. These projects will typically not impact the inplace signs, delineators or markers.
Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD)	A manual that establishes a uniform system of traffic control devices for streets, highways, bikeways and private roads open to public travel within Minnesota, and correlates and conforms to the Federal MUTCD.
Multiple Disciplines (Multidicipline) Projects	Involve multiple engineering disciplines and the design of which is led by someone other than the signing designer. These projects will often completely replace the roadway pavement and base. The associated excavation often impacts inplace signing. Signs, delineators and markers on these projects are typically removed and replaced with new devices.
Object Marker	A device used to mark obstructions within or adjacent to the roadway.
Office of Traffic Engineering (OTE)	MnDOT Office that establishes guidelines and procedures—striving for uniformity in traffic engineering—throughout the state of Minnesota, and builds relationships between state, county and city engineering staff to resolve questions and engineering and roadway safety.
Plaque	A small panel mounted above or below a panel conveying the primary message. Plaques provide additional detail including distance, word messages, direction or restrictions.
Primary Guide Sign	Guide signs that display directional and distance information related to prominent destinations or roadways. These signs are covered in MN MUTCD Sections 2D & 2E.
Reconstruction Project	A project that typically involves completely replacing the inplace roadway and underlying granular base. Signs on these types of projects are typically impacted.
Remove	Remove, dismantle and dispose of item. For signing, removal implies removal of some or all components of a sign structure and disposal off roadway right-of-way.
Retroreflectivity	A property of a surface that allows a large portion of the light coming from a source to be returned directly back to a point near its origin.
Salvage	Remove, dismantle and store salvaged materials to allow re-use. For signing, salvage implies removing and storing some components of the sign structure for re-installation. If funding rules allow, some sign structure components may be salvaged to the governing agency for future re-use.
Sign	Any traffic control device with a message displayed on retroreflective sheeting over an aluminum substrate placed on supports that is intended to communicate specific information to road users through word, symbol and/or arrow legend.
Sign Assembly	A combination of a sign panel(s), mounting hardware, sign support(s) and in some cases, a sign base that when fastened together, display a message to motorists.
Sign Panel	A sign (see definition above) that does not include supports.
Sign Sheeting	Retroreflective material that displays the sign legend.

Table continues on the following page

TERM	DEFINITION
Sign Support	A steel post or structural configuration used to erect a sign panel. The current MnDOT standard is a steel square tube post. The terms and abbreviations listed below are utilized in the tabulations section of the signing plans: • BR-SN: BRIDGE MOUNTED STREET NAME • BR-MG: BRIDGE MOUNTED MINOR GUIDE • MA: (SIGNAL) MAST ARM • R: ROUND POST • SQ: SQUARE TUBE (Current MnDOT standard ground mount support) • U: U CHANNEL
Standalone Signing Projects	Often referred to as Sign Renewal Projects, Sign Replacement Projects, or Changeover Projects. These projects typically replace all signs and supports that are greater than 5 years in age unless newer signs do not meet MUTCD, TEM, other district guidelines, crashworthy standards or are otherwise damaged.
Supplemental Sign	Signs that display secondary pieces of information not included on Primary Guide Signs. These include private business signs, city population signs, destinations that aren't located on the Primary Guide sign and other messages identified in the MN MUTCD sections 2H through 2K. an overview of the Supplemental Guide Sign program can be found online.
Symbol	The approved design of a pictorial representation of a specific traffic control message for signs and other traffic control devices shown in the MUTCD.
Traffic Engineering Manual (TEM)	A reference guide that establishes traffic engineering related uniform guidelines and procedures, primarily for use by MnDOT. The TEM can be found online.
Trunk Highway (TH)	A roadway under the jurisdiction of MnDOT.
Unbonded Overlay Projects	These projects will often raise the pavement elevation, causing inplace signs, delineators and markers to no longer meet mounting height requirements. Inplace signs will require new supports, but sign bases may be retained and reused if not impacted and in good condition. If the sign sheeting is near the end of design life, project may require new sign panels.
Uncurbed Roadway	A road that has no raised concrete curb alongside the travel lanes or shoulder. These are often referred to as rural sections.
Widening Projects	Involve adding travel lanes or shoulders to inplace roadways. The wider roadway will likely cause inplace signs, delineators and markers to no longer meet lateral offset requirements. If impacted, inplace signs will require new supports and bases. If the sign sheeting is near the end of design life, project may require new sign panels.

2.2. Overview (Review of Signs 101)

2.2.1. State Statute

Chapter 6-3.00 of the Traffic Engineering Manual discusses the legal authority for placement of traffic signs granted by Minnesota State Statutes for installation by MnDOT forces, Contractor or by Others by Maintenance Permit.

Minnesota Statute (Minn. Stat. Sec.) 169.06, Subd.2 provides that the Commissioner of Transportation shall place and maintain traffic signs according to the MN MUTCD and the MnDOT Standard Specifications for Construction as deemed necessary to regulate, warn, or guide traffic on the Minnesota trunk highway system.

ADDITIONAL GUIDANCE

Minnesota Statutes also establish:

- Statutory speed limits
- Names and designations of certain memorial highways
- Other regulations that shape certain signing policies unique to the Minnesota trunk highway system.

Minnesota Statues Chapters 160 to 170A cover Transportation.

2.2.2. Five Principles of Traffic Control Devices

As stated in the MN MUTCD Section 1A.2, for traffic signs to be effective, they should meet the following basic requirements:

1. Fulfill a need
2. Command attention
3. Convey a clear, simple meaning
4. Command respect from road users
5. Give adequate time for proper response

Items 2, 3 and 4 mostly cover how the sign is designed. That is, addressed by following the design rules and policies as set forth in the appropriate documents. Items 1 and 5 address the engineering behind signing. That is, the sign must fulfill a given need and the placement should be such to give adequate time for the driver to respond.

2.2.3. Coordination with Other Disciplines

Traffic signs are typically installed on their own structures. However, there are instances that signs will be installed on other structures. Some examples include traffic signal poles and mast arms, bridges, concrete barrier, walls, or light poles (if allowed by local agency).

These installations will require coordination with the other disciplines and designers to ensure all provisions for placement on these structures are accounted for.

2.2.4. Basic Considerations for the Installation of Signs

Design, placement, operation, maintenance and uniformity are aspects that should be carefully considered to maximize the ability of a traffic control device. Vehicle speed, type of roadway and geometrics should all be carefully considered as an element that governs the design, operation, placement and location of various traffic control devices.

2.2.5. Signing Actions

Signing actions define the work to be performed, as defined in and in accordance with the current edition of the Minnesota Standard Specifications for Construction. See the Acronyms and Definitions list for Furnish and Install, Install, Salvage and Remove definitions.

2.2.6. Project Impacts on Inplace Signing

Projects can impact inplace signing in a variety of ways. See the Acronyms and Definitions for typical construction types. Many projects contain elements of multiple project types. See Figure 2.1: Typical Impacts to Inplace Signing to identify what signing work is typically required for each project type.

Figure 2.1: Typical Impacts to Inplace Signing

PROJECT TYPE	TYPICAL IMPACTS TO INPLACE SIGNING		
	SIGN BASE	SIGN SUPPORT	SIGN PANEL
STANDALONE/RENEWAL	Replace	Replace	Replace
MULTIDISCIPLINED WITH GEOMETRIC CHANGES (i.e. Reconstruction)	Replace	Replace	Replace
MULTIDISCIPLINED WITH NO IMPACTS* (i.e. Mill & Overlay)	Remain	Remain	Potentially Replace
MULTIDISCIPLINED WITH PROFILE CHANGES (i.e. Unbonded Overlay)	Replace	Replace	Potentially Replace

** To grading or geometry*

2.2.7. Anatomy of a Sign

As shown in Figure 2.2: Sign Pay Item Diagram, A sign (and the corresponding sign pay item) is comprised of a sign panel, riser post, base assembly, and in some cases, stringers. The entire Sign Pay Item Diagram can be found on MnDOT's design website.

2.2.8. Sign Classifications

The MN MUTCD identifies three classifications of signs: regulatory, warning and guide.

- Regulatory signs inform road users of traffic laws or regulations and indicate the applicability of legal requirements that would not otherwise be apparent.
- Warning signs are used to call attention to unexpected conditions on or adjacent to a highway, street, or private road open to public travel and to situations that would not be readily apparent to the motorist.
- Guide signs are used to provide directions to motorists, informing them of intersecting routes, directing them to cities and other important destinations, and guiding them to available services, points of interest, and other geographic, recreational, or cultural sites.

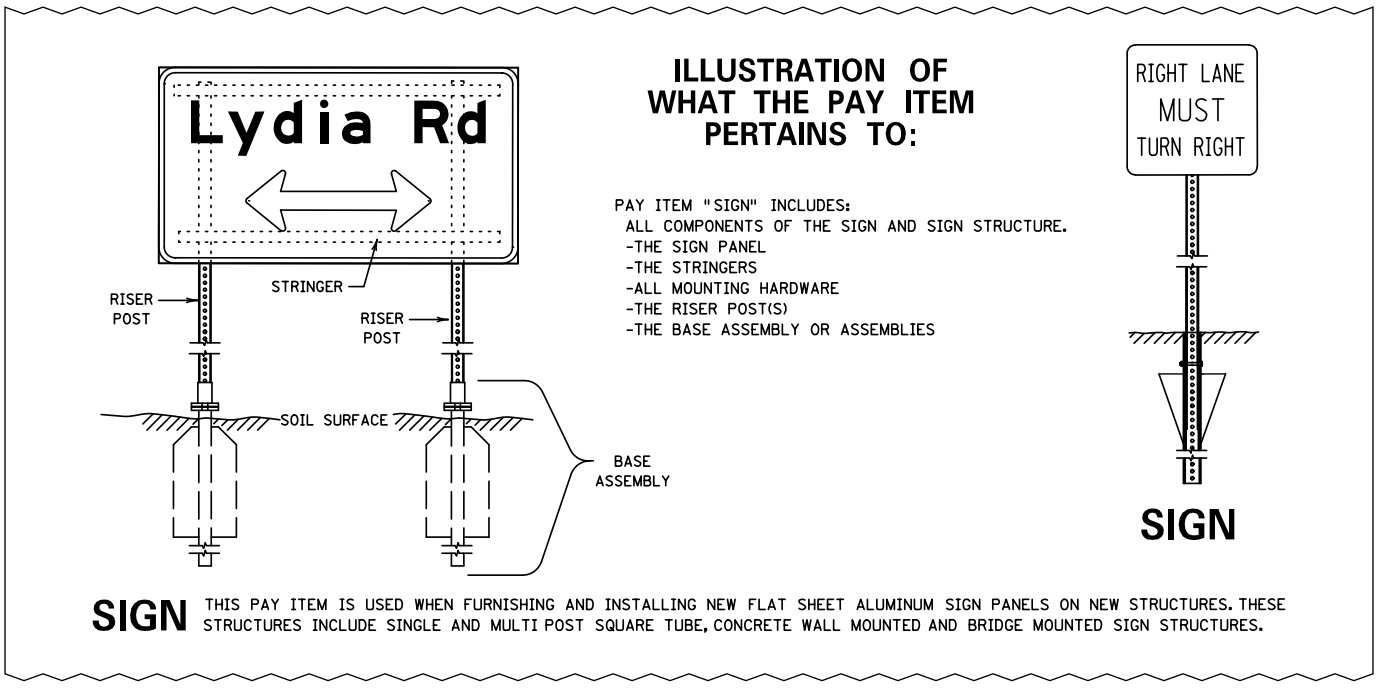
Further, guide signs for highways have two sub-classifications: primary guide signs and supplemental guide signs.

- Primary guide signs consist of advance guide signing, exit directional signs, destination and distance signs. On freeways and expressways, exit numbers are included.
- Supplemental guide signs further provide the driver geographic orientation and secondary destinations at certain interchanges. Destinations include cities, motorist services, or traffic generators

See Figure 2.3: Sample Regulatory, Warning and Guide Signs for visual examples of different sign supports.

Figure 2.3: Sample Regulatory, Warning and Guide Signs

Figure 2.2: Sign Pay Item Diagram



2.3. Types of Signs

Traffic control devices that display messages using legends on panels typically fall into three types: Signs, Delineators and Markers. These devices are supported by a wide variety of structural supports, with the standard being square tube posts. Signal poles and mast arms, I beams, and overhead sign structures are other common support types. U channel posts are not considered crashworthy and are being phased out.

See Figure 2.4: Sign Types for examples and information.

2.4. Placement

The MN MUTCD provides specific requirements for placement of signs along the roadway. Some other general considerations for proper sign placement include sightlines, sign spacing, sign clutter and environmental impacts.

Refer to 3.3.9. Sign Spacing and Sightlines for guidance on sightlines and sign spacing. Signs should be placed to avoid a cluttering in one area. Several signs in series may desensitize a roadway user's comprehension of the individual signs or fail to command attention, which tend to reduce the effectiveness of the signs. Placement of signs may also be impacted by the surrounding environment. Ditches, trees, wetlands, rocky soils, areas of high winds, downtown obstructions and impacts to environmentally sensitive species are all considerations for proper sign placement.

2.5. Lateral Offset

Information on lateral clearance can be found in the Part 2A of the MN MUTCD and TEM Chapter 6. Minimum lateral offsets for standard signs are identified in Standard Plan 5-297.701 and markers and delineators in Standard Plan 5-297.702 for both curbed and non-curbed locations.

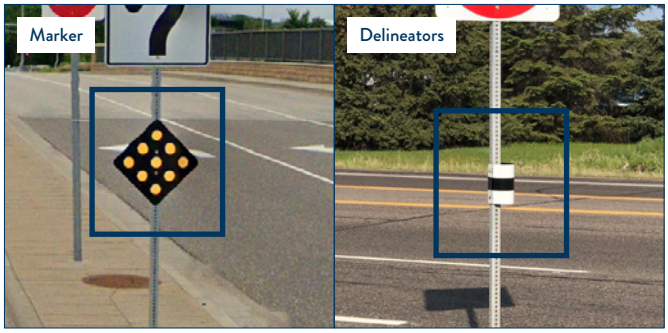
2.6. Horizontal Alignment Signs

A variety of horizontal alignment signs can be used to advise roadway users of a change in the roadway alignment. Uniform application of these signs with respect to the amount of change in the roadway alignment conveys a consistent message establishing driver expectancy and promoting effective roadway operations. Table 2C-5 in Part 2C of the MN MUTCD provides guidance on usage of these signs based on difference between speed limit and advisory speed. For further guidance see the TEM Ch 6.

Figure 2.4: Sign Types

EXAMPLE SIGN TYPES

Markers and delineators



Delineators are used to indicate the roadway alignment. Markers are used to identify objects in or near the roadway.

Signal-mounted signs

Standard sign panel installed on a traffic signal pole or mast arm.

Ground-mounted signs

Standard regulatory, warning, route marker assembly, auxiliaries and smaller guide, destination, or informational sign structure (square tube post, base, sign panel) installed within or along the roadway.

Bridge-mounted signs

Guide sign attached directly to a bridge structure or a post designed specifically for attachment to a bridge or other concrete structure.

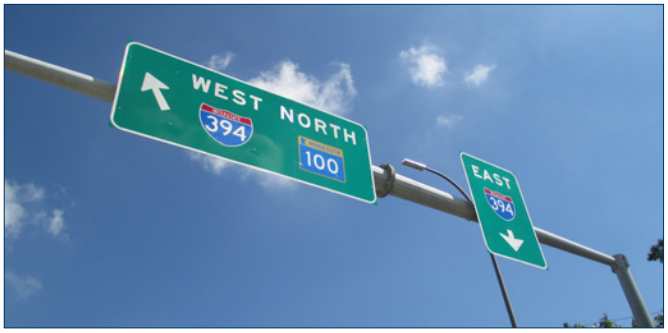
I Beam sign

Large breakaway, guide, directional, or informational extruded sign panels normally installed on mainline freeways, expressways and occasionally on conventional roads. They are supported on wide-flange steel posts.

Truss-mounted overhead sign

Large guide, directional, or informational signs placed over the driving lanes. These structures use trusses to support sign panels and dynamic message signs (DMS).

Monotube-mounted overhead sign



Smaller guide signs placed over the driving lanes.

2.7. Manuals and Resources

BEST PRACTICE:

✔ Always use the most current version of these manuals.

2.7.1. Minnesota Manual on Traffic Control Devices

The Minnesota Manual on Uniform Traffic Control Devices for Streets and Highways (MN MUTCD) provides a uniform system of traffic control devices on all streets, highways, bikeways and private roads open to public travel within the State of Minnesota. In accordance with Minnesota Statutes, Section 169.06, subd. 1, the MN MUTCD is published by the Minnesota Department of Transportation.

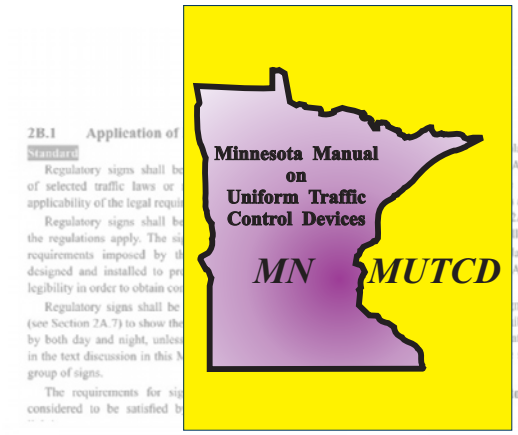
The MN MUTCD is in substantial conformance with the current edition of the National MUTCD. Most of the text, figures and tables in MN MUTCD are identical to those found in the National MUTCD. Some text, figures and tables have been modified to meet State laws, or to reflect the conditions and policies of Minnesota more closely. Text in the MN MUTCD that was added or changed from the Federal MUTCD is shown in a sans-serif font.

Serif font **vs.** Sans-serif font

Part 2 of the MN MUTCD is dedicated to traffic signs. It contains Standards, Guidance, and Options for signing on all streets, highways, bikeways and site roadways open to public travel.

ADDITIONAL GUIDANCE

The MN MUTCD provides guidance on the conditions under which traffic control devices should be used.



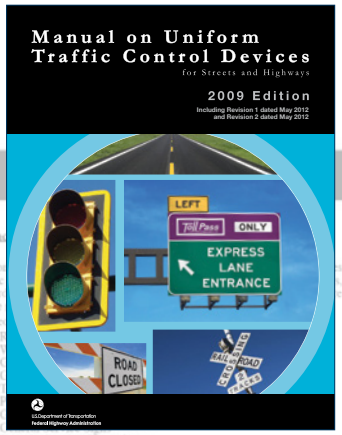
Chapter 2 of the MN MUTCD focuses on Traffic Signs

2.7.2. National Manual on Uniform Traffic Control Devices

The National Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) establishes national standards for all traffic control devices (which includes signs, signals and pavement markings) on all streets, highways, bikeways and private roads open to public travel within the United States. It promotes safety and efficiency by creating uniformity in the meaning, use and appearance of traffic control devices. The National MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F.

All States must officially adopt the National MUTCD or risk losing federal funds. When FHWA publishes a new or updated National MUTCD, States are given two years to officially adopt the National MUTCD either in its entirety, with supplemental provisions, or as a separate published document.

Minnesota adopts the National MUTCD by publishing a separate document, the Minnesota MUTCD.



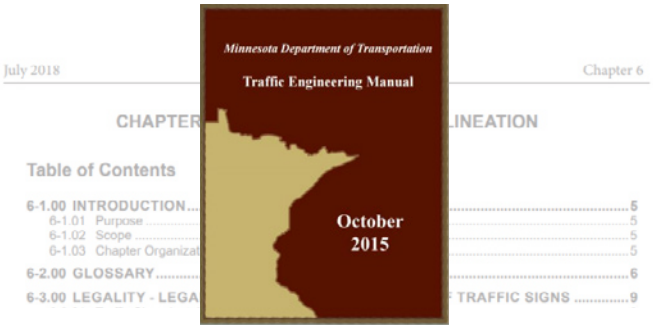
Chapter 2 of the National MUTCD focuses on Traffic Signs

2.7.3. Traffic Engineering Manual

The Traffic Engineering Manual (TEM) is issued and updated by the MnDOT Office of Traffic Engineering (OTE). The purpose of the TEM is to establish uniform guidelines and procedures, primarily for use by personnel at MnDOT. Counties, cities and local units of government will also find this manual useful when striving for uniformity in traffic engineering throughout the state of Minnesota.

ADDITIONAL GUIDANCE

The TEM provides additional guidance beyond that in the MUTCD on where to place traffic control devices.



Chapter 6 of the TEM focuses on Traffic Signs

2.7.4. MnDOT Standard Signs and Markings Manual

The MnDOT Standard Signs and Markings Manual is a supplement to the FHWA Standard Highway Signs and Markings book. The MnDOT manual includes sign and marking designs for MnDOT specific signs as well as designs not found in the FHWA book. It also includes punching codes for signs mounted on MnDOT structures.

Sample from MnDOT Standard Signs and Markings Manual

2.7.5. MnDOT Standard Signs and Markings Summary

As the name implies, the MnDOT Standard Signs and Markings Summary is a summary of specific standard signs used in Minnesota. It includes the MUTCD sign code, a drawing of the sign and the color and sizes of the sign. Unlike the Standard Signs Manual, it does not contain the detailed layouts of the sign.

Sample R Series from MnDOT Standard Signs and Markings Summary

2.7.6. Guide Sign Design Manual

The MnDOT Guide Sign Design Manual is designed to enable designers to acquire basic design skills needed to design traffic guide signs using the SignCAD® software. The manual includes a series of examples on layout of guide signs.

Sample Sign Panel Layout from Guide Sign Design Manual

2.8. Manual Terminology

When used in the sections of the MN MUTCD, the text headings shall be defined as follows:

MN MUTCD TEXT HEADINGS

Standard

STANDARD: A statement of required, mandatory, or specifically prohibitive practice regarding a traffic control device. The verb "shall" is typically used. Standards are sometimes modified by Options.

Guidance

GUIDANCE: A statement of recommended, but not mandatory, practice in typical situations, with deviations allowed in engineering judgment or engineering study indicates the deviation to be appropriate. The verb "should" is typically used. Guidance statements are sometimes modified by Options.

Option

OPTION: A statement of practice that is a permissive condition and carries no requirement or recommendation. Options may contain allowable modifications to a Standard or Guidance. The verb "may" is typically used.

Support

SUPPORT: An informational statement that does not convey any degree of mandate, recommendations, authorization, prohibition, or enforceable condition. The verbs "shall", "should" and "may" are **not** used in Support statements.

2.8.1. MnDOT Signing Website

MnDOT OTE Signing Website references are generally organized under four signing products and services categories: Publications, Design, Training schedule and Construction.

- Publications
- Design
- Training Schedule
- Construction

2.8.2. Design Scene

MnDOT's Design Scene is digital guidance documents for designers, technicians and engineers to provide best practices for plan development. The goal of the Design Scene is improved plan quality and reduced cost and time of plan preparation. Chapter 16 of the Design Scene addresses signing best practices. Designers should check the Design Scene periodically for updates.

2.8.3. MnDOT Standard Specifications for Construction and Special Provisions Webpages

BEST PRACTICE:

✔ Always use the most current version and ensure that the effective date and project letting date correspond.

The Spec Book contains standard specifications to be used and referred to in the design of plans and in the preparing of Special Provisions. Plan designers need to be aware of the specifications contained in the Spec Book that may apply to their individual project. The book is made of three divisions:

ADDITIONAL GUIDANCE

The hierarchy of contract documents is as follows, with items at the top of the list holding the highest precedence.

1. Change orders
2. Addenda
3. Special Provisions
4. Project Specific Plan Sheets
5. Supplemental Specifications
6. Standard Plan Sheets
7. Standard Plates
8. Standard Specifications

Division I – General Requirements and Covenants

- Generally contain contractual documents and processes

Division II — Construction Details

- Each Division II Specification number begins with "2" (2021 - 2582) and each section is given a numeric series.
- Signing specifications are located in 2564, Traffic Signs and Devices.
- Sign removal specifications are located in 2104, Removing Pavement and Miscellaneous Structures.

Each section is further divided as follows:

1. Description
2. Materials
3. Construction Requirements
4. Method of Measurement
5. Basis of Payment

Division III — Materials

- Each Division III specification number begins with "3" (3101 – 3973) and each section is given a numeric series. Division II cross references various sections.
- Conventional roadway signing material specifications are located in 3352, Signs, Delineators, and Markers; 3401, Flanged Channel Sign Posts; and 3402, Square Tubular Sign Posts.

2.8.4. Supplemental Specifications

This document will be updated more frequently than the Spec Book and overrides language in the spec book that has become obsolete or contains errors.

2.8.5. Special Provisions

General project special provisions, called Division S, and Signing Special Provisions, called Division ST are just that, *special* provisions. If an item(s) is adequately addressed or specified in the Spec Book, Supplemental Specifications, Standard Plates, Plan, or other Contract documents, then that item(s) should not be duplicated within the Special Provisions.

The Special Provisions need to cover every special item from the Plan and any .500 series pay items that need to be modified from the standard specifications for the project. A special item is any item where the digit after the decimal is a "6" (for example 2564.601). Additional discussion specific to the Division ST special provisions, including designer guidance for modifying templates to specific projects, can be found in Chapter 4.

ADDITIONAL GUIDANCE

Refer to Chapter 2: Quantities and Tabulations in the Design Scene for detailed breakdown of the relationship between the three digits after the decimal and the item units.

DEPARTMENT OF TRANSPORTATION

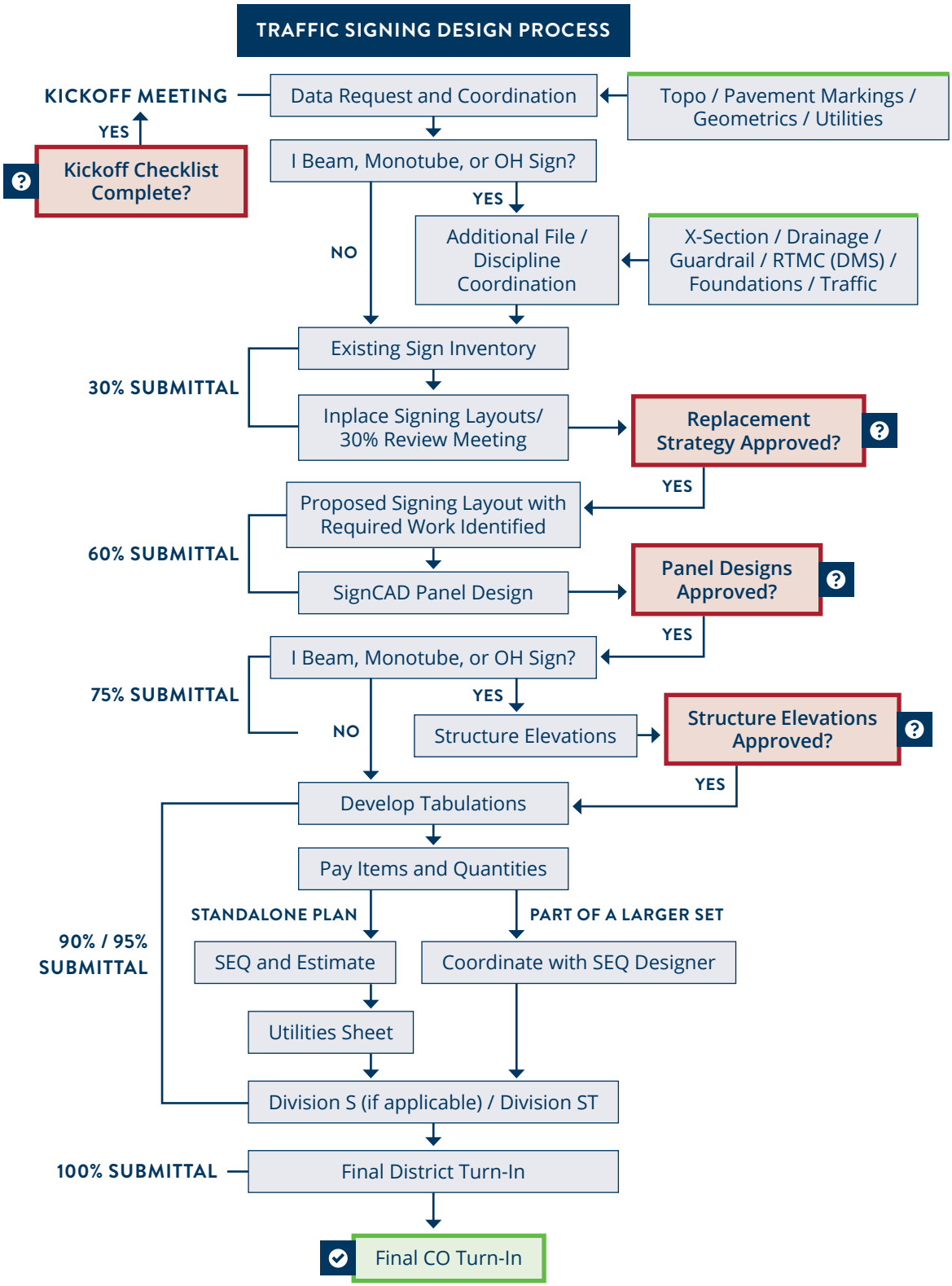
CHAPTER 3

Plan Components and Design Process

3. Plan Components and Design Process

This section will provide a detailed guide to developing a complete, standalone signing plan. The design process is summarized in Figure 3.1: Design Process Flowchart.

Figure 3.1: Design Process Flowchart



3.1. Data Request & Coordination

At the beginning of each project, designers should coordinate with their District Signing Engineer to request information necessary for the upcoming design. Even if a particular project does not include a meeting to discuss signing, designers are encouraged to schedule a phone call with the District Signing Engineer.

Designers should utilize the Kickoff Meeting Checklist to better clarify the impact a project has on signing.

COMMONLY SEEN ERROR:

✖ On projects with multiple disciplines, a kickoff meeting with the District Signing Engineer is often omitted, especially if MnDOT is not the lead agency.

BEST PRACTICE:

✔ Designers are encouraged to schedule a meeting with the District Signing Engineer for all projects involving State-owned signs.

On projects with multiple disciplines, ongoing coordination with other disciplines as design progresses will be necessary to identify and mitigate potential conflicts where signing is proposed. It is the designer's responsibility to confirm that their reference files remain current and accurate, and that reference files from other disciplines remain current.

On standalone signing projects, all design files will be "owned" by the designer and ongoing coordination with other disciplines is unlikely to lead to changes in other disciplines files over the course of the project.

BEST PRACTICE:

✔ Early coordination will reduce the risk of surprises later in the design process and constructability issues in the field, which can result in costly change orders paid by MnDOT or other roadway owners.

Reference files may change throughout the design process and signing designers should discuss any changes that could impact the signing design with the other disciplines.

Encourage other designers to inform you if there is any change, large or small, that could potentially impact the project signing. If provided an opportunity to perform a discipline plan coordination review, signing designers should review the other plans within the set to identify any conflicts that may not have been previously discussed or coordinated.

3.1.1. Inplace Roadway Mapping (Topography) File

This file contains line work depicting topography, often captured from LIDAR survey. It typically includes the following *inplace* infrastructure:

- Roadway geometry
- Guardrail
- Culverts
- Bridges
- Retaining walls
- Traffic Signals
- Right of way fence
- Lighting
- Buildings
- Vegetation

While this information is useful and should be noted when placing proposed signing, much of it is often extraneous and can be turned off. The 30% Signing Plan Checklist identifies which elements should be displayed in the signing plans.

This information will be available from the District Signing Engineer and should be requested at the beginning of the project and shown on every submittal.

3.1.2. Alignment File

On projects with multiple disciplines, this MicroStation file will be available from the roadway/geometric designers. It will contain the alignment line for all roads within the construction limits as well as associated stationing and tick marks. On standalone signing projects it is possible that the information is available from the District Signing Engineer, though it will be the designer's responsibility to confirm the alignment and stationing covers the entire project limits. Any missing ramp or mainline segment alignments are the designer's responsibility to develop. *This information should be requested at the beginning of the project and shown on every submittal.*

Less desirable alternative options to using stationing include reference points or mile posts. A discussion should be had with the District Signing Engineer before pursuing one of these alternatives.

3.1.3. Sign Inventory

Some MnDOT districts will provide a shape file export from Transportation Asset Management System (TAMS) that can be converted to MicroStation to locate inplace signing. This shapefile database information can also be pulled into a spreadsheet, which includes panel characteristics and legends. The steps on the following page outline the recommended process to confirm that the inplace sign information is accurate.

Each sign panel should have two stickers on the back side: a fabrication sticker and a MnDOT sticker. The fabrication sticker contains the name of the manufacturer and the year it was fabricated. The MnDOT sticker lists the year the sign was installed and the fine amount if the panel were to be stolen. This information can be used to verify the age of a panel if necessary for sign warranty purposes, but is generally not necessary for inventory purposes.

See Figure 3.2 MnDOT Sign Panel Stickers to see an example.

SIGN INVENTORY PROCESS

The recommended process for conducting a sign inventory is as follows:

1. Create sheets that include topography and street names. If coordinate-correct sign locations are available, they should also be referenced into the signing reference file.
2. Populate the sheets using Google Earth or a video log (if available).
3. Drive the corridor(s) to:
   a. Verify inplace signing locations and legends.
   b. Note missing and added signs.
   c. Note condition and base type, especially during transition from U Channel posts to square tubes.
      » All structures need to be MASH-16 compliant. More information regarding which bases are approved, should be replaced by attrition, or replaced immediately can be found on MnDOT's Signing Training website. Sign bases currently approved for use on MnDOT right of way can be found in the Approved Products List.
   d. Identify agency ownership of each sign. All signs on MnDOT right of way should included or added to the TAMS database.
   e. Note placement and position of mast arm signs.
   f. Note placement of pavement markings that affect sign placement, such as lane drop markings and no passing zones.
   g. Perform ball-banking testing on horizontal curves to determine advisory speeds (if necessary). See 3.1.4. Ball Banking Data Collection for more information.
   h. Identify other signs which may need to be evaluated to determine if they still meet standards or need to be relocated.

BEST PRACTICE:

✔ Designers are discouraged from stopping on the side of a road to collect sign data.

Two staff should be used to collect video and/or photos of signs during the field review. The first person is responsible for driving and should not be collecting data. If stopping is necessary, staff should be familiar with and be prepared to apply traffic control devices consistent with the Minnesota Traffic Control Field Manual.

If staff is on foot, they should remain in or near areas designated for pedestrians. The first person is responsible for monitoring traffic in relation to the second, and should be standing close enough for warnings to be heard. Staff shall wear retroreflective clothing if working outside of the vehicle. The second person is responsible for documenting the necessary data from the inplace signs.

Figure 3.2 MnDOT Sign Panel Stickers

COMMONLY SEEN ERROR:

✖ Relying solely on TAMS exports, Google Earth and/or the video log is not acceptable when populating the Roadway Layout sheets. This is one data set designers can use, but the inplace signing should *always* be verified with an in-person site visit. If signs are not field verified there may be incorrect signs shown on the plan, which creates confusion for contractors and inspectors and often leads to cost overruns and schedule implications due to the need to order/fabricate additional panels or sign supports.

3.1.4. Ball Banking Data Collection

Requirements for horizontal alignment warning signs are based off the speed differential between the roadway's mainline speed and the horizontal curve's advisory speed. Section 2C of the MN MUTCD notes that "because changes in conditions, such as roadway geometrics, surface conditions, or sight distance, might affect the advisory speed, each location should be evaluated periodically or when conditions change".

Early in the project, or even during scoping, signing designers should work with the District Signing Engineer to identify which curves should be tested.

The method used by MnDOT to determine advisory speeds on horizontal curves is the ball bank indicator test. The testing procedure is further detailed in Chapter 3.6 of FHWA's Procedures for Setting Advisory Speeds On Curves. MnDOT's Ball Banking Form can also be referenced. Additional information regarding ball bank testing can be found in the TEM and Chapter 2C of the MN MUTCD.

On a new roadway or alignment where ball bank testing is not possible, the designer should work with the District Signing Engineer to determine the advisory speed based on the curve design speed. After construction, it is recommended that the advisory speed be field verified using ball-bank testing.

COMMONLY SEEN ERROR:

✖ Designers are often not running enough tests. Per the ball bank testing procedure, at least three tests must pass at the advisory speed. At least one test at a speed 5 mph over the advisory speed must be conducted to show that it does not pass at a higher speed.

BEST PRACTICE:

- ✔ Use the existing posted advisory speed to pick which speed to run the first test. If a posted advisory speed is 25 mph, then it is recommended that the first test be conducted at 30 mph. If that test fails, then conduct tests at 25 mph. If the test passes three times at 25 mph, then you have verified that the advisory speed has not changed. If there is no posted advisory speed, use the curve's radius to estimate the design speed and use that as a starting point for testing.

  During testing, it is recommended that a flashing beacon and/or hazard lights on the car be activated during testing to notify other drivers that a test is in progress.

  Vehicle selection is important. SUVs and pickup trucks with relatively soft suspensions and sports cars with stiff suspensions should be avoided in favor of a traditional passenger car.

  Plan ahead for testing. Road conditions should be dry during testing. Additionally, tire pressure should be within the normal recommended range and tire treads should be at or above the minimum recommended thickness. The vehicle's speedometer should also be calibrated. Make sure that equipment is properly set up per the test procedure.

3.1.5. Geometric Design Files

On projects with multiple disciplines, MicroStation files for proposed geometrics and guardrail will be available from the roadway/geometric designers. Regular check-ins will be necessary to capture ongoing changes to the proposed geometry file. On standalone signing projects, this information is included in the topography file.

This information should be requested at the beginning of the project and shown on submittals beginning at 30% Design.

3.1.6. Right of Way Files

On projects with multiple disciplines, existing and proposed right of way files will be available from the roadway designers. Regular check-ins will be necessary to capture ongoing changes to the proposed right of way. On standalone signing projects, designers will only need the existing right of way file, which will be available from the District Signing Engineer.

This information should be requested at the beginning of the project and shown on every submittal. It is desirable to show the right of way on all roadway layout sheets. However, if plans become cluttered and the right of way is shown elsewhere in the plan set, this information can be turned off.

3.1.7. Hydraulic Design File

On projects with multiple disciplines, a file showing culverts should be available from the drainage designers. Ongoing coordination will be necessary to capture ongoing changes to the proposed hydraulic design. On standalone signing projects, the inplace culverts should be included in the topography file (see Section 3.2.1).

3.1.8. Project Numbers

If your project crosses a city or county boundary, or a MnDOT control section, it is possible that quantities will need to be spread across multiple project numbers. These may take the form of State Project (S.P.) or State Aid Project (S.A.P.) numbers and may include multiple funding sources within a S.P. or S.A.P. number. The District Signing Engineer can provide this information at the kickoff meeting or early in the project.

If a project has multiple S.P. numbers, one will be designated the Prime S.P., and will appear within the border on all plan sheets. Secondary S.P. numbers will only appear on the title sheet, general layout, tabulations and on roadway layout sheets that contain the boundary between control sections.

This information should be requested/obtained at the beginning of the project and shown on every submittal. See sections 3.3.5, 3.5 and 3.8 for additional guidance on specific sheets.

BEST PRACTICE:

- ✔ It is important to have clear direction on S.P. boundaries and funding splits before beginning work on tabulations because the quantities are separated by S.P. number and funding source in the tabulations (Section 3.5) and SEQ (Section 3.9).

3.1.9. Existing SignCAD® files

If your project includes guide signing or other specially designed panels, the District Signing Engineer may be able to provide existing SignCAD® files. This information is useful in understanding how inplace panels should be modified.

This information should be requested/obtained at the beginning of the project and utilized to populate the inplace Roadway Layout sheets and as a basis to design the proposed signing.

3.1.10. Traffic Signals

If your project has traffic signals that either have or should have mast arm signing, the District Signing Engineer must coordinate with MnDOT's signal group to have a structural analysis completed to confirm the pole and mast arm can accommodate the proposed signing.

ADDITIONAL GUIDANCE

On standalone signing projects, signs mounted on signal poles and mast arms will typically be included in the scope. On projects with traffic signal pay items, this signing is included in the lump sum pay item for signal work. These signs should be shown on the signing plans for completeness, but a note should be added to clarify that panels are included with the traffic signal pay item.

Typically, the District Signal Engineer will either have access to the information (available in Georilla) or will have contact information for the partner agency. Designers should follow the project's communication protocols when contacting partner agencies or other MnDOT resources.

On projects with multiple disciplines, signal designers are responsible for designing and quantifying panels mounted on signal equipment.

Ongoing coordination with signal designers is necessary to confirm the desired messages can be accommodated on the signal.

Mast arm signs have associated standard plan sheets (see 3.8. Standard Plans, Standard Plates and Signing Details) that must be included in the plan set. This information should be requested/obtained at the beginning of the project and utilized to develop the proposed signing.

3.1.11. Local Agencies

Most, if not all projects will involve signs corresponding to multiple agencies. Designers must understand which agency owns the right of way on which signs are proposed to be placed. For instance, MnDOT often places state-owned signs on cross street approaches to a trunk highway. If these signs are placed on another agency's right of way, designers should not assume that the local agencies signs can be moved or removed to accommodate MnDOT's. The same is true of a local agency's signs on MnDOT right of way.

BEST PRACTICE:

- ✔ Designers should coordinate with the District Signing Engineer to review the cost participation policy, which describes which signs MnDOT assumes responsibility for maintaining.

Where sign spacing or right of way becomes constrained, designers should make their District Signing Engineer aware and provide recommendations for how each agency's signs can be located to best benefit both agencies and the public that relies on those signs.

Another example of design impacting multiple agencies is mast arms signing. For instance, not every county will place route markers on signal mast arms.

BEST PRACTICE:

- ✔ Designers should follow the communication protocol for the project when seeking this information. If a designer has been provided the authority to reach out to a partner agency, it is a good practice to copy both the MnDOT and consultant project managers. On standalone signing projects, it is good practice to copy the District Signing Engineer.

The designer and District Signing Engineer should establish who is authorized to contact other agencies at the beginning of the project. Similarly, it is customary to provide interim plans to the other agencies for review and concurrence of proposed signing locations.

Local agencies should be provided the opportunity to review plans beginning at the 60% milestone. This will help identify coordination issues before the tabulations are started. These reviews can provide direction relating to the replacement strategy of street name slats (sign slats) and can help verify that street names are labeled and spelled correctly.

3.1.12. Bridge Mounted Signs

A project along a conventional road may have flat panel aluminum signs attached to the sides of bridges that need to be modified or replaced. Typically, these signs are small guide signs or street name slats, see Figure 3.3: Bridge Mounted Sign for an example.

COMMONLY SEEN ERROR:

- ✖ When mounted on a bridge face, designers often confuse flat panel signs with those using extruded aluminum panels. These signs are paid for with different pay items and are tabulated differently. There are generally two ways to distinguish between them:

  First, the larger extruded aluminum signs will be supported with a steel structure visible from the front of the sign. Second, the larger extruded aluminum signs can be seen from behind the panel.

A discussion with the District Signing Engineer should be had at the 30% Review Meeting to determine if the panel needs to be updated and if the anchorage system should be replaced. Also verify that the existing bridge structure is installed over the correct lane. These signs have associated standard plans (see Section 3.8.3).

Figure 3.3: Bridge Mounted Sign

Figure 3.4: I Beam Sign with Extruded Aluminum Panels

This information should be requested/obtained at the beginning of the project and utilized to develop the proposed signing.

3.1.13. Public Right of Way Accessibility Guidelines (PROWAG)

If your project includes placing signs adjacent to sidewalks and pedestrian ramps, designers must evaluate how sign panels are placed. On projects with multiple disciplines, this will require ongoing coordination with the geometric designers to understand the balance of needs within the right of way. Often a Pedestrian Access Route (PAR) or a Maintenance Access Route (MAR) will be required by the governing agency.

Designers should coordinate with their District Signing Engineer to understand the restrictions. Additional context can be found on MnDOT's Accessibility website.

COMMONLY SEEN ERROR:

- ✖ Designers should not assume that inplace signs can be left inplace or replaced in kind without confirming that the PAR or MAR has been provided.

On projects with bicycle facilities, additional lateral offset is required between the edge of the facility and the near edge of the sign panel. Refer to Part 9B of the MN MUTCD for additional guidance.

This information should be requested/obtained at the beginning of the project and utilized to develop the proposed signing.

3.1.14. Utilities

MnDOT's Utility Coordination Process must be followed on all projects. Designers are responsible for maintaining proper offsets to overhead and subsurface utilities. The MnDOT Utility Accommodation and Coordination Manual provides basic clearances and depths for various type of utilities.

COMMONLY SEEN ERROR:

- ✖ On projects with multiple disciplines, ongoing coordination with utility designers is critical to avoid conflicts and rework later in the design process.

  Accurate and up-to-date signing and reference files help, but should not be a substitute for direct coordination between designers.

On standalone signing projects, designers will be required to complete a limited number of tasks within the MnDOT Utility Coordination process, and the processes for completing these tasks may vary between projects completed entirely by MnDOT staff and those performed by consultants. In any case, these tasks are associated with project milestones and should be planned out in coordination with the overall project schedule. Standalone signing projects will always include a utility tabulation sheet (see Section 3.7) and display existing utilities on the Roadway Layout sheets (see Section 3.3).

This information should be requested/obtained at the beginning of the project and utilized to develop the proposed signing.

3.1.15. Environmental

Designers may encounter environmentally or culturally significant resources that prevent placement of signs in certain locations or restrict work to certain times of the year. Examples include native burial grounds and protected plants and animals.

Mature trees are often important to and valued by the community. While tree trimming may be necessary to maintain sightlines, designers should not assume that trees, even those within the public right of way, can be removed.

On projects with multiple disciplines, this task is typically controlled by other disciplines. Designers should communicate the potential for signing impacts and communicate refined information during the design process.

On standalone signing projects, designers should coordinate with the District Signing Engineer at the beginning of the project to determine if these factors are present and how they affect proposed signing and the project schedule.

3.1.16. Pavement Markings

Many signs have placement requirements and guidelines associated with pavement marking colors and patterns. Examples include: stop bars, lane drops and no passing zones.

On projects with multiple disciplines, ongoing coordination with pavement markings designers is necessary to understand if their design impacts sign locations.

On standalone signing projects, the inplace pavement marking information is sometimes included in the topography file received at the beginning of a project and used to populate the proposed signing.

COMMONLY SEEN ERROR:

✖ Designers must field verify the current location of pavement markings that affect sign location. They should not assume that inplace signs can be left in place or replaced in the same location. For instance, a recently completed project to add a turn lane may not be reflected in the topography file, video log, Google Earth or TAMS.

BEST PRACTICE:

✔ Place the alignment line on a separate level from the stationing and tick marks. This allows the designer to turn the stationing line off so it does not cover the pavement marking pattern.

3.1.17. Coordination with Other Projects

Identify early on if your project overlaps with another. Regular coordination may be necessary as the projects progress. Discuss what work is being done for each project as well as timing, limits and types of construction impacts. Also identify if signs from the other project should be shown in your plan, or vice-versa, with the note **BY OTHERS (S.P. XXXX-XX)**.

3.2. Sheet Order and Title Block Content

Sections 3.3 through 3.10 are sequentially ordered to follow how designers will develop elements of the plan, not the order that the sheets will be found in the plan.

3.2.1. Sheet Types and Sheet Order

Each item in the list below relates to specific sheet types and will always appear in the order shown in the list. These sheet types are further discussed in the following sections.

Standalone Signing Projects

- **PLAN TITLE SHEET** (Section 3.10)
- **GENERAL LAYOUT** (Section 3.11)
- **STATEMENT OF ESTIMATED QUANTITIES** (Section 3.9)
- **TABULATIONS** (Section 3.5)
- **STANDARD PLAN SHEETS** (Section 3.8)
- **SIGNING DETAILS** (Section 3.8)
- **INPLACE UTILITIES** (Section 3.7)
- **ROADWAY LAYOUTS** (Section 3.3)
- **PANEL LAYOUTS** (Section 3.4)

Multi-Discipline Projects

- **PLAN TITLE SHEET** (Section 3.10)
- **GENERAL LAYOUT** (Section 3.11)
- **TABULATIONS** (Section 3.5)
- **SIGNING DETAILS** (Section 3.8)
- **ROADWAY LAYOUTS** (Section 3.3)
- **PANEL LAYOUTS** (Section 3.4)

COMMONLY SEEN ERROR:

✖ Designers will often populate sheet names with text that seems logical. However, to facilitate the procurement process, it is important that the sheet names be consistent with the list shown above.

For example, **SIGN PANEL DETAILS** may seem like a logical title for a sheet that contains dimensioned sign panel exports from SignCAD®. However, these sheets must be labeled **PANEL LAYOUTS** and match the index exactly.

On projects with multiple disciplines, the Plan Title Sheet, General Layout, Utilities and project-wide Statement of Estimated Quantities (SEQ) will be the responsibility of the overall project manager. Standard plans specific to traffic signs and devices will be grouped with other Standard Plans, not with the signing plans.

On standalone signing projects, plans will typically include each sheet type listed previously.

3.2.2. General Title Block Content

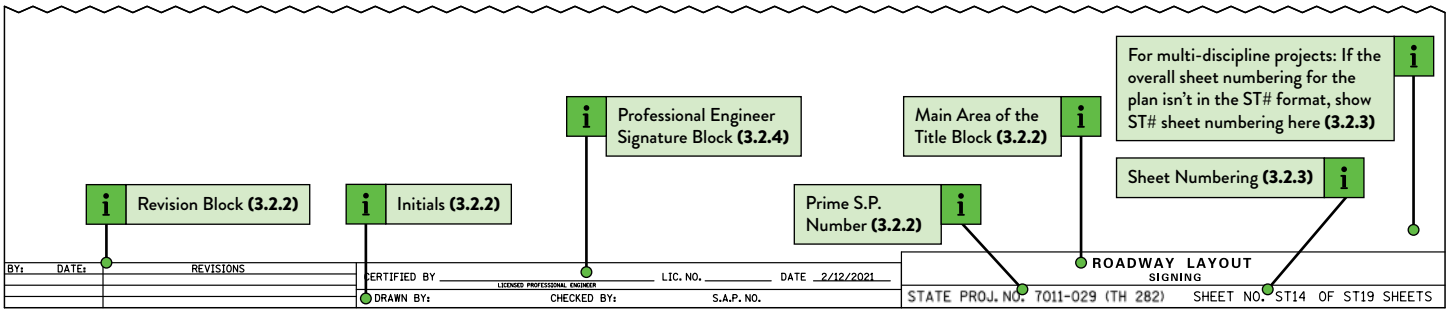
For projects with multiple disciplines on conventional roads, there will typically only be one border file used within a signing plan. This section describes the content needed to properly populate the title block.

Figure 3.5: Title Block Components graphically displays each component of the title block. The list below provides guidance for content and use.

- The main area of the title block must include a reference to the sheet index. On plans with multiple disciplines, this text will typically be **SIGNING** or **SIGNING PLANS**. The text must exactly match the term used in the overall sheet index. A secondary description, matching the sheet types listed in Section 3.2.1 may be included to further distinguish the different sheets within a signing plan.
- On standalone signing projects, the only description used in this section of the title block will be that matching the sheet types listed in Section 3.2.1.
- Title blocks are available for download within the CAD resources section of the MnDOT Computer Aided Engineering Services (CAES) website, though it is not mandatory to use these.
- Another area below or adjacent to the main area must include the prime S.P. number.
- The Title block should also include a revision block and an area for the individuals involved with the design to place their initials.
- All title block text shall be in all caps.

Figure 3.5: Title Block Components

i *Link to additional information*



3.2.3. Sheet Numbering

An area directly below or adjacent to the main area must include the current sheet number and the total sheet number. These sheet numbers can be included within the overall plan sheet numbering or can be numbered ST# to ST#. Plans completed by MnDOT staff will typically use the ST# format.

3.2.4. Professional Engineer Signature Block

Within the title block, a space should be provided for the professional engineer's signature, with the following fields:

- Certified by
- License number
- Date

Signatures are not needed until the final submittal; this field can be left blank or covered with a watermark that indicates the submittal phase (i.e. "60% Submittal; Not For Construction") until then.

BEST PRACTICE:

✔ On large plan sets, it may be easiest to add the signature to a reference file (such as the border file) and attach it to all signing plan sheets.

3.3. Roadway Layout

Roadway Layout sheets visually depict the inplace and proposed signing along a project corridor. They also contain notes reflecting the actions required by the contractor. This section is organized in the order designers will develop plans.

The following sections provide additional detail and guidance for inplace and proposed signing design and plan formatting. Designers should also reference Section 3.1 and the MnDOT Sample Plan for Conventional Roads and Intersections.

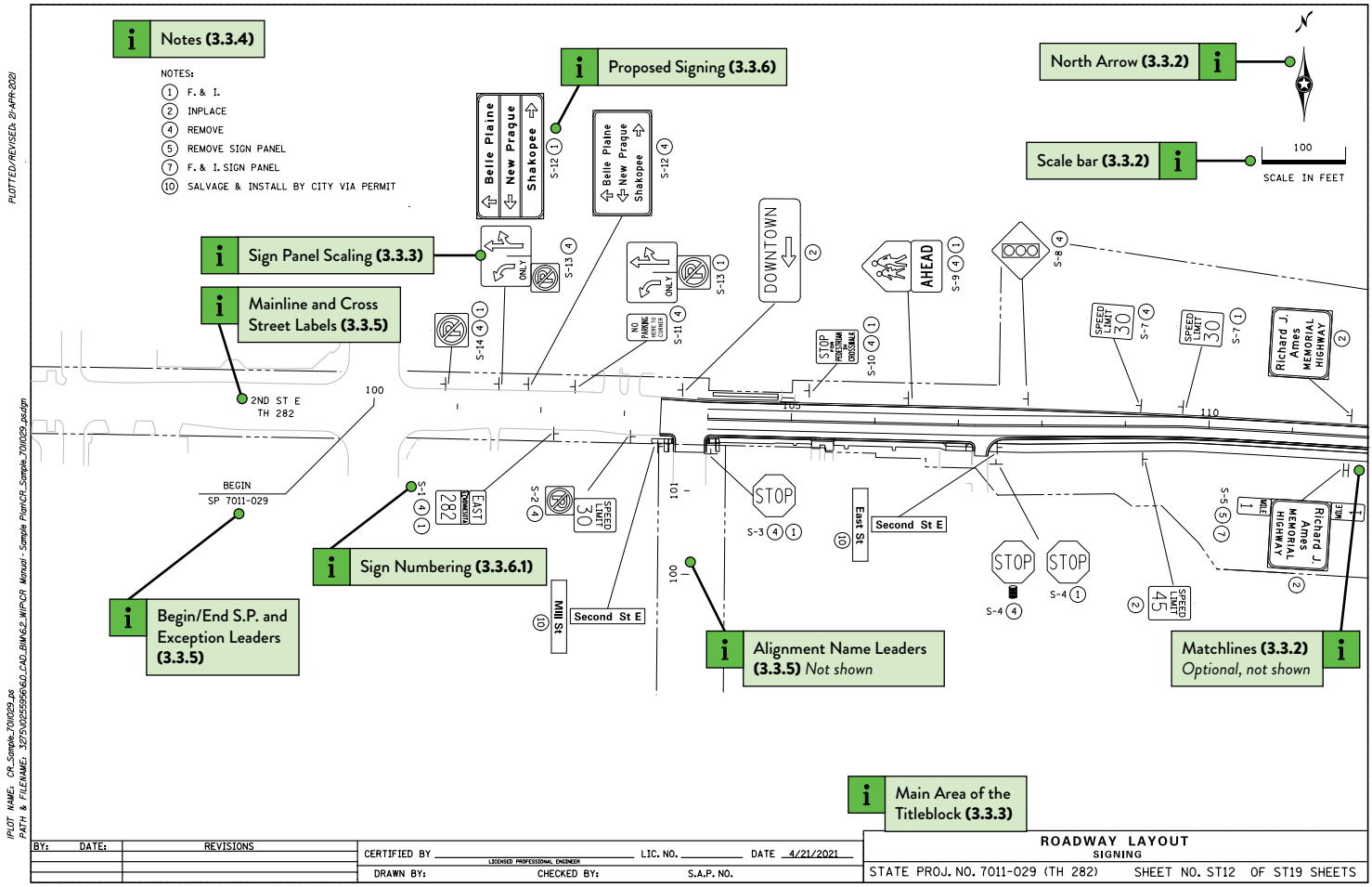
ADDITIONAL GUIDANCE

Sheet scale should be discussed with the District Signing Engineer at a kickoff meeting. General guidance includes:

- Corridors with infrequent signing (i.e. rural, with stop controlled intersections): **200 scale**
- Corridors with moderate signing (i.e. most expressways and freeways with interchanges spaced at least one mile apart): **100 scale**
- Urban corridors with dense signing (i.e. roadways within cities; often with closely spaced signalized or roundabout controlled intersections): **50 scale**

Figure 3.6: Roadway Layout Components

i Link to additional information



3.3.1. Reference Files

Designers should create a signing base file using a MicroStation seed file from MnDOT's Computer Aided Engineering Services webpage. The following coordinate-correct reference files should be referenced.

- Inplace topography file
- Alignment file
- Right of way file
- Utilities

A border file with a title block should be used to develop sheet files. Designers may use the "Sheet C" cell from the Sign.cel library located on MnDOT's Computer Aided Engineering Services website. Consultant projects will often utilize a project border.

ADDITIONAL FILE REFERENCES

On projects where the geometry is changing, the following additional files should be referenced.

- Proposed geometry file
- Proposed right of way file
- Proposed Hydraulics file
- Proposed traffic signals file
- Proposed utility file
- Proposed pavement marking file

These files must be referenced during design to make informed decisions on where to place signs. This discussion focuses on the MicroStation files that must be used during design, not necessarily which files are displayed on submittal.

Additional discussion relating to the information that must be displayed on submittals can be found in the submittal checklists. If one or more of these files is not available, the District Signing Engineer should discuss options with the Pre-letting Office.

Designers should reference MnDOT's Signing File Naming guidance for naming of signing reference and sheet files as well as when assigning levels to various elements.

On projects with multiple disciplines, additional design files will be necessary. See Section 3.3.1 for more information. See the Submittal Checklists for additional information regarding sheet scaling and what should be shown on Roadway Layout sheets at each submittal stage.

There are many ways for designers to use reference and sheet files to develop signing plans. This manual lists a preferred method and an acceptable alternative method to do so. Ultimately, it is important that the files meet MnDOT CAD standards and the final PDFs contain correct and biddable information.

BEST PRACTICE:

✔ On projects with multiple disciplines, designers from other disciplines may reference the signing reference file into their own reference files. The only information other designers need are the sign support locations. All other signing CAD work will only clutter their files with irrelevant information. It is recommended that the sign supports be placed on a unique level so it can be isolated when others reference in the signing file.

An alternative method to populate CAD files that minimizes the effort needed by others is to limit this information in the signing base file to the sign support symbols. Notes, panel symbols and callouts can be placed in an annotation file or directly into the sheet files. This way, other disciplines do not need to manipulate levels when referencing in the signing base file.

3.3.2. Roadway Layout Sheet Orientation and Order

Sheets should be oriented such that the north arrow is approximately pointed at an angle between straight up and to the right. When corridors are diagonal or have a substantial change in direction, the sheets should still be laid out such that the overall corridor is generally traveling from south to north or west to east. With very few exceptions, sheets should be sequenced in the order of ascending stationing.

The scale bar is typically placed immediately below the north arrow.

On projects with multiple disciplines, it is acceptable for designers to use the same sheet views as are used elsewhere in the plan. However, it is possible that the due to advance signing requirements and signs that are made obsolete by the revised geometry, the signing limits often extend further than the reconstruction limits.

COMMONLY SEEN ERROR:

✖ Many inspectors print plans for use in tracking sign installations in the field. Designers should look at the plan from the inspector's perspective when deciding if match and break lines are necessary for others to navigate the plan set. Stationing alone may not be enough.

Match lines that link one *mainline sheet to another* are encouraged, but are not necessary, on plans featuring conventional roads. See Figure 3.7: Match Line Example for an example of a match line.

On projects with conventional roads and expressways where the signing limits of cross streets do not fit on the mainline sheets, the remaining cross street information should be shown on the sheet immediately following the sheet showing the intersection, connected by match or break lines (See Figure 3.8: Break Line Example for an example of a break line).

Figure 3.7: Match Line Example

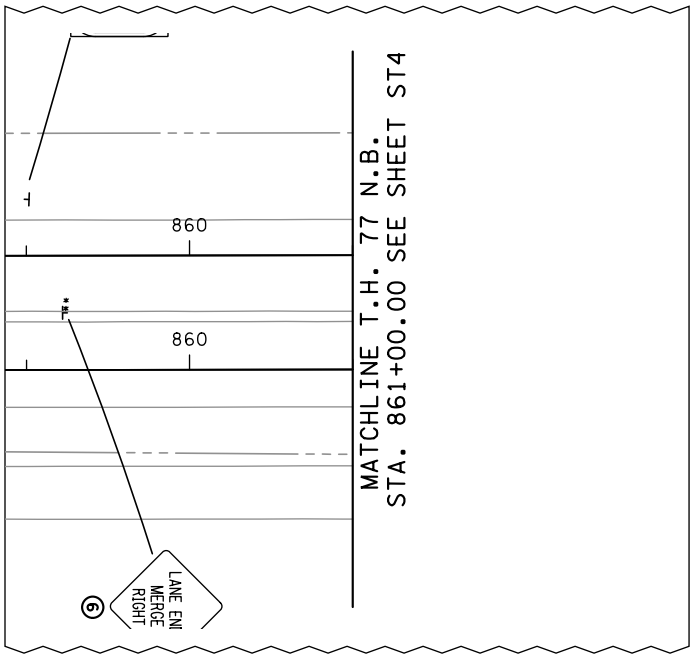
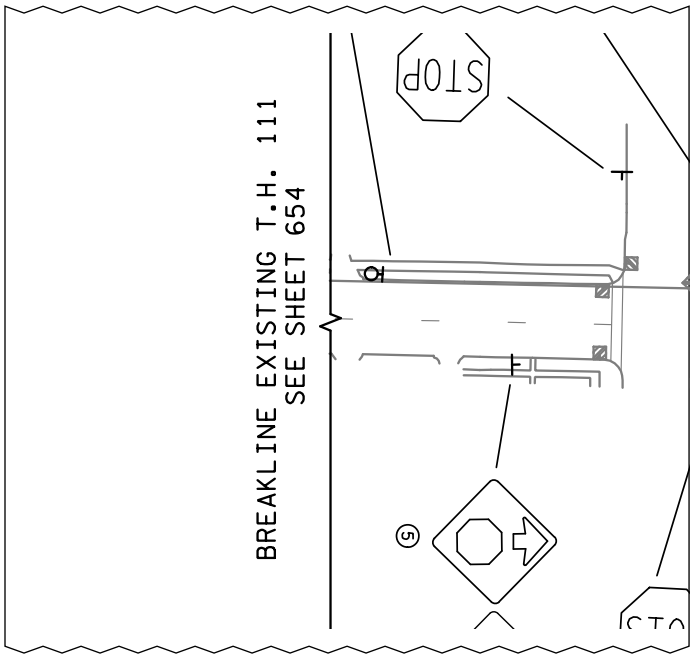


Figure 3.8: Break Line Example



Alternatively, where there is enough space on the sheet showing the intersection, either of the following methods can be used to provide this information:

- Provide insets with match or break lines.
- Provide dimension lines with notes clearly indicating the desired sign placement.

Designers should provide clear distinction between break lines and match lines. When break lines are used, designers must provide a clear indication of the distance covered by the break line. This can be done using any of the following methods:

- Provide a dimension between the break lines.
- Provide at least two stationing callouts on each side of the break lines to provide spatial context.
- Provide dimension lines with notes clearly indicating the desired sign placement referencing a known object location.

BEST PRACTICE:

✔ When used, match line text should include the alignment name and station, as well as a sheet number reference to the sheet containing the match or break line information.

Where a plan sheet does not contain any signing, designers should discuss the desired solution with the District Signing Engineer. Two options are identified:

- Omit the sheet using break lines on the adjacent sheets. Designers should be confident that the omitted sheet does not contain inplace information that may influence signing on adjacent sheets.
- Or, include the sheet, but add the following text in large font to a prominent part of the sheet: **THIS SHEET DOES NOT CONTAIN ANY SIGNING**.

It is undesirable to omit a sheet that only includes inplace signing to remain. This can cause issues in the field where the contractor is unclear if the signing was mistakenly omitted, or if those signs influence spacing to others. Omitting sheets in this situation should only be done with approval from the District Signing Engineer.

3.3.3. Inplace Roadway Layout

Following the sign inventory guidance described in Section 3.1, designers should populate each sheet with inplace signing. Designers are encouraged to utilize the sign.cel found on the CAD resources section of MnDOT's Computer Aided Engineering Services webpage to place panel symbols. Designers should consider the type of project that is impacting the inplace signs (mill & overlay, turn lane extension, unbonded overlay, bridge re-decking, roadway reconstruction, etc.) to determine if/how the inplace signing is affected. A list of typical projects and the impact they generally have on signs can be found in Section 2.2.6 of this manual. Designers should confirm which signs are included in the scope of the project at the kickoff meeting.

It is not necessary for designers to precisely locate the lateral offset of the sign supports because the sign support symbols are not drawn to scale. Standard Plans, discussed in Section 3.8, provide this guidance to the contractor.

Sign panels should be installed at a consistent scale where they are legible and fit on the sheet. Larger guide sign panels can be installed at a smaller scale, though they should still appear relatively larger than the small standard signs, markers and delineators. Panel symbols must be rotated to face traffic.

Designers should use the information collected from the sign inventory to assess the condition and compliance to MN MUTCD, Standard Signs and Markings Manual and TEM to determine if a sign should be removed, salvaged or left inplace. These recommendations must be included in the 30% plan using Notes (see Section 3.3.4).

If the inplace panel is bent, scratched or otherwise damaged, replace the panel. A separate assessment should be made regarding the condition of the supports.

BEST PRACTICE:

- ✔ Designers should verify that an inplace sign still meets current MUTCD standards before deciding to reinstall or leave the sign inplace. For example, a previous iteration of an MUTCD standard stated the panel size of an R3-7 (Right and Left Lane Must Turn Left) was 30 x 30-inches. The current standard is 36 x36-inches, therefore the inplace sign should be removed.

If the inplace panel is supported by obsolete sign supports within MnDOT right of way, designers should recommend replacing the supports with current designs, regardless of the age or condition of the panel. For example, designers encountering a panel first installed within the last 5 years on U Channel supports should use the Salvage Sign Panel pay item (which discards the supports) together with the Install Sign pay item (which provides new, compliant supports.

Evaluation of inplace warning signs in the project should be completed to determine if they are needed and in the correct location. Examples of warning signs that should be evaluated include: No passing zone signs (verify these are correctly placed at the beginning of the solid pavement marking line), hidden entrance signage (verify the condition is still present), school bus signs (see Chapter 14 of the TEM), stop ahead signs and signal ahead signs (See Section 2C.36 of the MN MUTCD).

Sightlines, stopping sight distance, advanced placement distance (MN MUTCD Table 2C-4) and other potential safety concerns should be assessed to determine the need for warning signs. If there isn't a clear reason to maintain an inplace warning sign, note it as a designer's note to discuss during the 30% comment resolution meeting.

Using information determined during the sign inventory, discuss actions for handling signs that are not owned by MnDOT with the District Signing Engineer. Where possible, requester-pay and city-owned street name slats should be left inplace or salvaged and installed.

On standalone signing projects, the utility linework will be shown on the Roadway Layout sheets. Do not list the owners on these sheets. The owner information can be found in the utility tabulation (see Section 3.7). On projects with multiple disciplines, the plan will typically include a separate utility plan. In these cases, the utility linework should not be shown in the signing plans.

BEST PRACTICE:

- ✔ Use designer notes to indicate signs that are owned by agencies other than MnDOT, such as dynamic speed display, street name and community recognition signs. Designers should prompt a discussion at the 30% Review Meeting to discuss their replacement strategy and how they should be paid for. See 3.5. Signing Tabulations for information regarding tabulating such signs.
- ✔ Do not include guardrail markers, culvert guard posts/markers, right of way markers, infiltration area markers or snowplow markers on signing plans. These are not traffic control devices and should be placed on the appropriate discipline's sheets, with rare exceptions. These signs will not be included in the scope of standalone signing projects.

Designer recommendations for inplace signing as well as the replacement strategy will be discussed at the 30% Review Meeting.

ADDITIONAL GUIDANCE

There are only three options the designer must consider when populating the main area of the title block: "Inplace Roadway Layout", "Proposed Roadway Layout", or both: "Roadway Layout".

3.3.4. Notes

Notes are used to identify what action is being done on a sign. Notes 1 through 7 will *always* refer to the same actions required of the contractor on all signing plans. Refer to Section 2.1 for definitions of these terms.

1. Furnish and Install (or F. & I.)
2. Inplace
3. Salvage
4. Remove
5. Remove Sign Panel
6. Install
7. Furnish and Install Sign Panel (or F. & I. Sign Panel)

Designers may need to develop additional notes to clearly communicate the designer's intent. A numerical note will always be assigned the same action throughout the plan. Notes should be rotated the same way that the sign panel is rotated (facing traffic). Each note will correspond to a unique action in a plan. The Activities tab in the Signing Tabulations template includes several commonly used notes.

COMMONLY SEEN ERROR:

✖ Notes numbered 8 and higher should be numbered consecutively and without gaps within the plan. The legend on each sheet should only contain Notes used on each sheet. -When a note is used in a plan, it should be assigned the same action through out the plan. For instance, If note 8 is assigned the task Remove Marker, this combination should be used consistently throughout the plan.

ADDITIONAL GUIDANCE

Some districts prefer to include Note 2 (Inplace) when a sign or sign panel is being removed or salvaged. While this can be seen as redundant, either option is acceptable and designers should discuss this preference with the District Signing Engineer at the kickoff meeting.

Notes should be shown in the numerical order next to the sign number. If a sign is moving, the same symbol can be used to point at the old and new locations using multiple leaders.

BEST PRACTICE:

✔ Notes recommending whether a sign should be removed, salvaged or left inplace should be added to inplace signs presented in the 30% submittal. These recommendations will be confirmed or revised during the replacement strategy discussion at the 30% Review Meeting. See 3.3.3. Inplace Roadway Layout for more.

COMMONLY SEEN ERROR:

✖ Notes pertaining to the required contractor actions should be shown on each roadway layout sheet. Designers must only show notes that apply on that particular sheet.

If sheets become very cluttered, rather than move the notes onto a separate sheet, it is recommended that designers place the markings (if proposed signing and pavement markings are combined) or mast arm signs on a separate sheet.

Another option is to place the inplace signing on its own sheet. Similarly, placing every note used on the project on each roadway layout sheet is not acceptable.

3.3.5. Other Notes & Labels

Designers must label the following elements according to the Text Sizing Guidelines from MnDOT's CAD Data Standards.

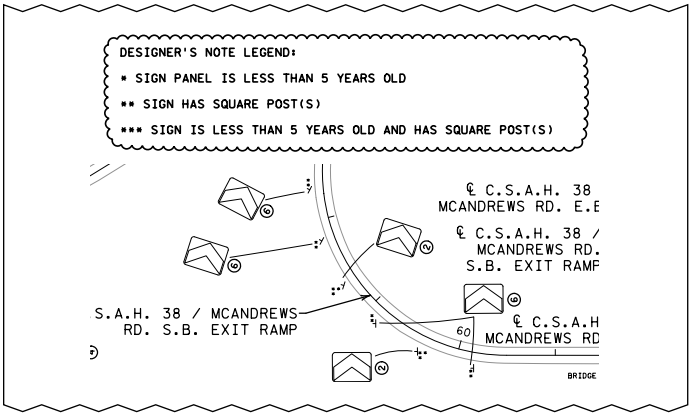
- Mainline and cross-street name labels
- Begin/End S.P. and exception leaders
- Alignment name leaders (optional)

Designer's notes may be used on 30% and 60% submittals to call attention to specific items to discuss at comment resolution meetings. This involves placing clouds around text that begins with **DESIGNER'S NOTE:** followed by a short description of the desired issue. By the 90% submittal, designers are expected to have these issues resolved and the use of designer notes should no longer be used. See Figure 3.9: Example Designer Note for 30% Submittal and Figure 3.10: Example Designer Note for 30% Submittal for examples of designer notes that could be used for a 30% submittal. See Chapter 5 for additional discussion on submittal expectations.

COMMONLY SEEN ERROR:

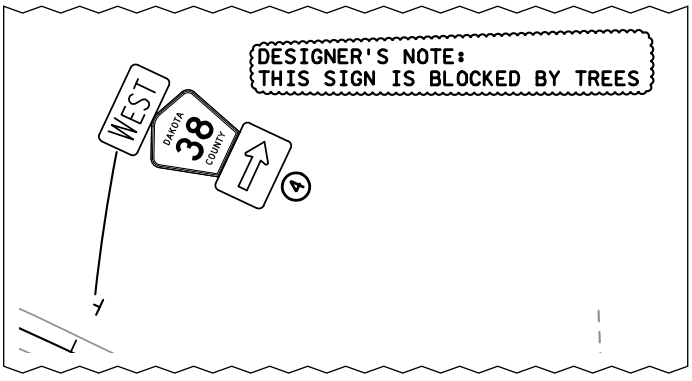
✖ Designers must include Begin/End S.P. notes on the Roadway layout sheets. However, they must not include non-signing actions in the construction actions, such as Begin Mill and Overlay, in the Begin/End notes.

Figure 3.9: Example Designer Note for 30% Submittal



Use of Asterisks to Denote Sign Ages and Post Types

Figure 3.10: Example Designer Note for 30% Submittal



Sign Blocked by Trees

BEST PRACTICE:

✔ Designer notes can be avoided by proactively discussing the issue with the District Signing Engineer prior to the submittal.

3.3.6. Proposed Roadway Layout

MnDOT Standard Plans, the TEM and MN MUTCD are excellent resources for designers when selecting proposed sign locations. They each contain detailed information regarding the placement of many signs. The Guide Sign Design Manual and corresponding examples on the MnDOT Signing Design website similarly provide designers with guidance specifically related to guide signs. These resources provide guidance for the ideal placement of signs. However, designers must apply the guidance to their project's actual site conditions, as the ideal placement often may not be able to accommodate the sign.

Designers should populate the Signing Layout sheets with proposed signs based on the discussion at the 30% Review Meeting. Notes describing recommended actions (see Section 3.3.4) for proposed signing should be added under the proposed signing, or in numerical order with the notes for inplace signing.

For projects that include signing on signal mast arms, designers should first determine the agency(ies) associated with ownership of the signal. Should a new panel be required, either because the inplace panel is missing or does not meet the current standards, designers should evaluate whether the new panel will fit between signal heads and that the mast arm can support the wind loading caused by the panel. The wind loading evaluation should be coordinated through the District Signing Engineer.

BEST PRACTICE:

- ✔ When the inplace and proposed geometry does not change significantly, such as on standalone signing or mill and overlay projects, It is preferable to show inplace and proposed signing on the same Roadway Layout sheet. However, should they become too cluttered, designers may choose to separate inplace and proposed signing along the entire corridor or just for individual sheets.

  Similarly, they may use insets to separate inplace/proposed signing in a particular area or may split the sheet to show inplace on the top half and proposed on the bottom half.

Consideration must also be given to utility conflicts when placing signs. Sign bases for standard and small guide signs installed in soil extend 48 inches into the ground and may conflict with inplace utilities. Designers should utilize the information collected in 3.1.14. Utilities to determine the potential for conflicts.

On standalone signing projects, the utility linework will be shown on the Roadway Layout sheets. Do not list the owners on these sheets. The owner information can be found in the utility tabulation. See Section 3.7 for more information. On projects with multiple disciplines, the plan will typically include a separate utility plan. In these cases, the utility linework should not be shown in the signing plans.

BEST PRACTICE:

- ✔ If an inplace sign has the potential to come in conflict with a utility, consider providing a Salvage and Install quantity for it. This gives field staff the flexibility to move it without executing a change order. If the sign ends up being suitable in its current location, it is a much easier "change" to negotiate with the contractor.

When a project overlaps or is adjacent to another, some signs may be upgraded by the other project. In these situations, designers should show the proposed signs as designed by the other project with a note stating, **BY OTHERS (S.P. XXXX-XX)** to clarify which contract will upgrade the sign. Early and ongoing coordination is important to make sure that the other projects design remains current.

Contractors are required to construct projects as detailed in the plans and special provisions. Sometimes is it beneficial for MnDOT or another group to fabricate or install certain items. For these deviations, a Public Interest Finding (PIF) or Cost Effectiveness Finding (CEF) must be completed.

- PIFs are required if the State or Local Agency furnishes materials, equipment or products (items) for construction projects. MnDOT supplies warning stickers for the signs and thus a PIF is required on most signing projects.
  - CEFs are required when State or Local Agency forces will complete elements of the project in lieu of Contractor Staff.

Information on these topics can be found on the MnDOT Special Provisions webpage. Designer recommendations for the proposed signing will be discussed at the 60% Review meeting.

3.3.6.1. Sign Numbering

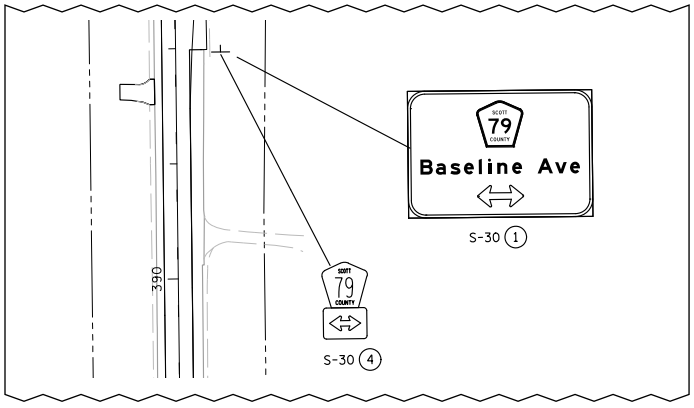
Each sign support on a project is assigned a unique sign number, which is used to cross-reference signs and sign assemblies shown in the layout sheet with the tabulations. In most cases, signs, delineators and markers will receive a number that begins with "S-". The exception is for overhead signs ("OH-"), I beam signs ("IB-") and exit panel ("EP-") signs, which will be discussed in the Expressway and Freeway manuals.

The sign number is typically shown under the sign panel on the layout. The sign number should be rotated in the same direction as the panel and note (rotated to face traffic).

If a sign is salvaged and installed, it will utilize the same S-# for both actions. The same is true for a sign that is being removed and replaced by furnishing and installing a new one. If the sign being removed has a similar message as the one being furnished and installed, they should also be assigned the same S-#.

Designers should discuss these situations with the district signing Engineer at the 30% review meeting.

Figure 3.11: Example of Inplace and Proposed Signs with the Same S-#



See Section 3.5 for more information on sign numbering and tabulation.

Some districts export data from the TAMS database to supplement the sign inventory. This system tracks sign locations, ages, conditions, work orders and other pertinent information. The system is used to support maintenance decisions and budgeting. When information from TAMS is used, designers are encouraged to assign S- numbers at the 30% level. Designers should discuss implications of using TAMS information with the District Signing Engineer.

The State Signing Engineer and the AMPO Office may also be considered resources when using this information. If information from TAMS is not used, designers are encouraged to number the signs at 60% and must number signs at the 90% submittal. Again, designers should discuss expectations with the District Signing Engineer.

BEST PRACTICE:

- ✔ Signs should generally be numbered in order of appearance in the plan. If a sign needs to be added late in the design process, it is acceptable to provide an S-# with a decimal point (for example, S-43.1) to maintain the order. If a sign is removed, still provide a line for it in the tabulation, but note that it is not used.

3.3.7. District Preferences

This manual describes the preferred method of developing signing plans. However, different districts may have specific plan formatting, panel size, mounting and support preferences that are more detailed than described in this manual and other statewide resources. One example is that some districts choose to place X4-3 (Wrap Around Delineators) below each Stop Sign, while others do not. Designers should discuss expectations with the District Signing Engineer at the kickoff meeting.

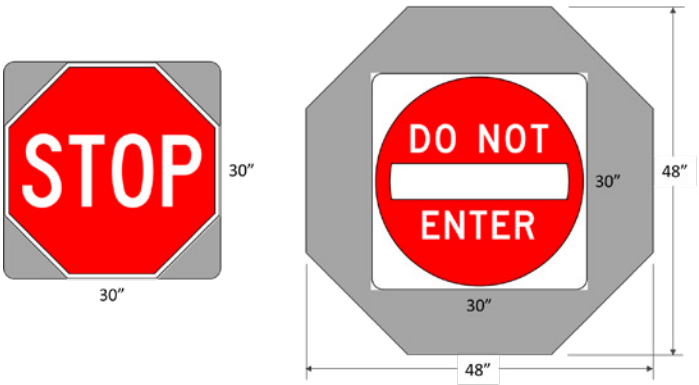
3.3.8. Sign Groupings

Signs that are grouped onto a common support are referred to as sign assemblies. Traffic signs with non-complimentary messages should not be placed facing the same direction on the same assembly. Exceptions should be discussed with the District Signing Engineer.

Signs may be placed back to back or at 90 degrees on the same assembly. A common example is a No Left Turn sign placed back to back with a Keep Right sign. Special considerations are required when placing signs behind a stop or yield sign. In these cases, the other sign should stay within the edges of the STOP or YIELD sign. If necessary, the size of the stop or yield sign may be increased.

For example, if a 30”x30” R5-1 (Do Not Enter) sign placed back to back with a 30”x30” R1-1 (Stop) sign, the Do Not Enter panel will completely hide the octagonal shape of the Stop sign. Increasing the Stop sign to 36”x36” will still have the corners of the Do Not Enter sign extending beyond the shape of the stop sign. A designer should increase the Stop sign to 48”x48” for the Do Not Enter sign to fit completely within the edges of the Stop Sign. See Figure 3.12: Example Do Not Enter Behind a Stop Sign for a visual.

Figure 3.12: Example Do Not Enter Behind a Stop Sign



(Left = Incorrect Method, Right = Correct Method)

Permanent sign assemblies should not be placed side by side. This places unnecessary burden on driver to perceive and react to the messages. Instead, they should be sequential and spaced appropriately for drivers to understand. Directional messages can often be combined on to the same panel to provide a more concise panel.

Similarly, designers should use caution when placing multiple panels on a single post. An excessive number of panels can be difficult for drivers to comprehend. It may also cause issues with minimum mounting heights and maximum wind loading.

Designers should account for the width of the panel and recommended clearances to the edge of pavement when selecting locations for proposed signs. Standard Plan 5-297.701 summarizes this guidance.

ADDITIONAL GUIDANCE

Street name slats must not be mounted on state-owned supports.

3.3.9. Sign Spacing and Sightlines

Signs along a corridor must be placed in a manner that allows drivers to perceive and react to the message. Signs that are spaced too closely can provide information more frequently than a driver can absorb. Similarly, signs placed closely behind other objects may not provide drivers enough time to digest the panel message.

The MN MUTCD recommends that each inch of panel text provides 30 feet of legibility. For example, a message using 6-inch text is intended to be legible 180 feet in advance of the sign. Symbols used on panels are designed to be legible 250 feet in advance of the sign. Designers should space signs from other objects, including other signs to maintain the full intended legibility. Below is a list of objects that may limit visibility to signs:

- Other signs
- Power poles
- Lighting units
- Traffic signal equipment
- ITS components
- Guardrail
- Inplace signs
- Vegetation
- Buildings
- Transit facilities

Delineators, markers, street name slats and reference post signs (mile markers) do not factor into the determination of sign spacing.

Designers will need to balance the need to place a sign at a particular location with an object that may obstruct visibility to that sign.

For example, if the ideal location for a Right Lane Must Turn Right sign places a light pole between the driver and the sign, the designer must evaluate if the sign can be moved to a more visible location, or if it is reasonable for sightlines to be blocked for a short period of time.

On projects with multiple disciplines, designers may have the option of moving the obstruction. Standard Plan 5-297.701 indicates that signs shall be placed a minimum of 10-feet from the nearest obstacle and limits the number of posts to two within a 7-foot circle.

COMMONLY SEEN ERROR:

✖ Signs may not be installed on MnDOT-owned light poles due to crashworthiness and structural concerns. It may be possible to place them on light poles installed by other agencies, though designers should seek agency approval in writing before doing so.

When the recommended spacing cannot be achieved, designers should consider the factor(s) precluding the proper spacing. For instance, if a light pole is blocking sightlines to a sign, can the sign be moved in front of the light pole? If vegetation is blocking sightlines to a sign, can it be removed? If desirable spacing between two signs cannot be achieved, can one of the signs be moved?

Where sign spacing approaches the minimum desirable distance, designers may consider placing signs on both sides of the road and/or signing a panel up for additional conspicuity. Even so, designers will likely find occurrences where the desired spacing cannot be achieved.

- On uncurbed roadways, designers should reference the TEM
- On curbed roadways with speed limits of 35 MPH or less, the sign spacing may be reduced to 100 feet
- On curbed roadways with speed limits of 40 MPH, the sign spacing may be reduced to 150 feet

BEST PRACTICE:

✔ Designers should show obstructions on the plans to clarify sign placement eliminate unintended adjustments in the field.

COMMONLY SEEN ERRORS:

✖ Designers should not assume that inplace signing should be replaced in kind. The designer's assessment should include analysis to determine if the current panels meet sign spacing requirements and current design standards based on roadway type.

3.3.10. Engineering Justification Memo

Designers will often make engineering judgment decisions based on actual site conditions. Often these decisions involve sign placement, legend or omission of recommended signs. These decisions must be documented in a memo to the District Signing Engineer identifying the standard or recommendation, how the design deviated from it and why the decision to do so was made. The District Signing Engineer stores this information in ProjectWise, with the plan. This information may also be stored in TAMS.

3.4. Panel Layouts

MnDOT uses the software SignCAD® to lay out sign panels. These sign designs are shown on Panel Layout sheets within the plan set. The following sections describe the components and layout of Panel Layout sheets.

Refer to the MnDOT Guide Sign Design Manual for guidance on design of guide signs. The MnDOT Design Website also contains charts containing guidance for selection of guide sign text height based on roadway characteristics.

ADDITIONAL GUIDANCE

Refer to the Guide Sign Panel Design section of the MnDOT Design website when designing unique sign panels.

3.4.1. Which Sign Panels are Included?

All new sign panels which are not already detailed in the MnDOT Standard Signs and Marking Manual should be shown on panel layout sheets. This primarily includes guide signs.

Additionally, standard signs with modified designs should also be shown on panel layout sheets; this does not include speed limit signs, route markers, distance plaques, etc. An example would be modifying the legend of a W14-X16 from **WATCH FOR TURNING VEHICLES** to **WATCH FOR LEFT TURNING VEHICLES**. If city-funded street name slats (paid for as Sign Type Special) are being replaced on the project, those panel designs should also be included.

3.4.2. Sign ID

Since custom design signs are assigned a unique identifier in the format, P#. This identifier should be provided above each panel design. If a panel design applies to multiple signs, then list all P Numbers and separate them with a comma. For example, "P1, P5". SignCAD® file naming guidance can be found in the Sign Panel Library Coding Manual.

3.4.3. Identifier

SignCAD® contains a field for designers to describe the panel. It is accessed by right-clicking on a panel in the software and selecting Edit Data. This information is displayed in the top line of the notes associated with each panel and is called the Identifier.

Figure 3.13: Identifier in SignCAD

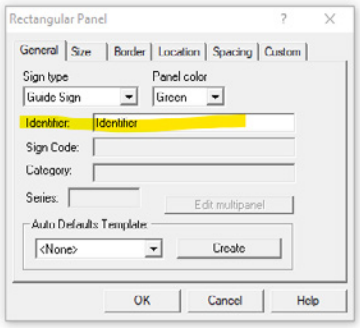
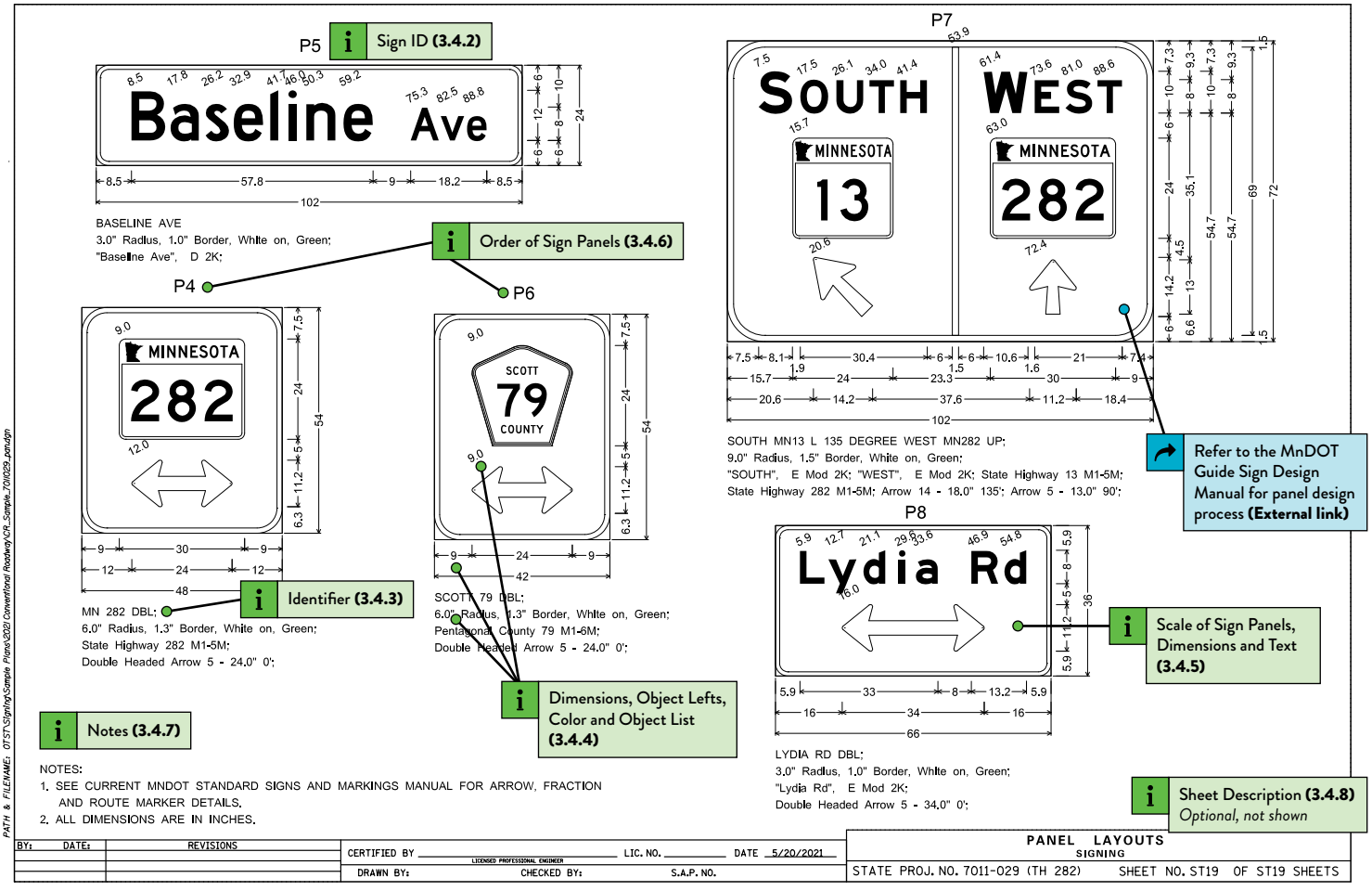


Figure 3.14: Panel Layout Components

i Link to additional information



The sign identifier is a description of the panel elements, not the P Number or MUTCD code. It is developed based on guidance in the Sign Panel Library Coding Manual.

3.4.4. Dimensions, Object Lefts, Color and Object List

Panel dimensions, object lefts, color and object lists should be shown for each panel. Verify that dimension text does not overlap and is legible. See the Design page of the MnDOT Signing Website for more information regarding CAD symbology guidance.

3.4.5. Scale of Sign Panels, Dimensions and Text

It is considered best practice to use consistent sign panel, dimension and text scaling and to size elements such that they are legible when printed. See the Design page of the MnDOT Signing Website for additional guidance. In particular this website includes SignCAD(R) examples that apply recommended dimension settings and PDFs that the completed sign panels. The design website also includes guidance for the selection of text, route marker and arrow size to match a roadway's characteristics.

BEST PRACTICE:

- ✔ Designers should discuss design parameters pertaining to panel design with the District Signing Engineer at the kickoff meeting.

3.4.6. Order of Sign Panels

Generally, order the panels in order of ascending Sign IDs from left to right and top to bottom in a way that best fits on the sheet. The number of sign panels per sheet will vary depending on sign panel sizes.

3.4.7. Notes

The following notes should be included in the bottom left corner of all panel layout sheets:

1. SEE CURRENT MNDOT STANDARD SIGNS AND MARKINGS MANUAL FOR ARROW, FRACTION AND ROUTE MARKER DETAILS.
2. ALL DIMENSIONS ARE IN INCHES.

3.4.8. Sheet Description

A sheet description may be used to further distinguish different types of panel layouts. If used, this sheet description should be consistent with the Pay Item used for the panels and displayed in the bottom right corner of the sheet, just above the title block. On projects on conventional roads, this sheet description may not be necessary, as most panel layouts will be for Signs, as opposed to sign panel overlays, which are more common on Expressway and Freeway projects.

3.5. Signing Tabulations

In most cases, one tabulation is generated as part of the signing plan, the Sign and Delineator/Marker Tabulation. Some projects may contain street name sign slats, panels with LED borders, Rapid Rectangular Flashing Beacons (RRFBs), or vehicle speed feedback signs, paid for as **SIGNS SPECIAL**, and be tabulated separately. Designers are encouraged to utilize the currently available Signing Tabs Template (XLSX) when generating this tabulation.

This tabulation provides the details pertaining to each inplace and proposed sign installation and their associated item quantities. This tabulation will always be labeled "ST-A".

As the tabulation name suggests, Signs, delineators and markers are combined into one tabulation. This tabulation includes the following columns:

3.5.1. Multiple Funding Sources

In cases where there are multiple funding sources (S.P., S.A.P. and/or local funds), devices associated with each funding source will be grouped and subtotaled. Signs associated with the prime S.P. number are shown first and local funding is shown last. A space is provided between funding source quantities. Project totals are shown at the bottom.

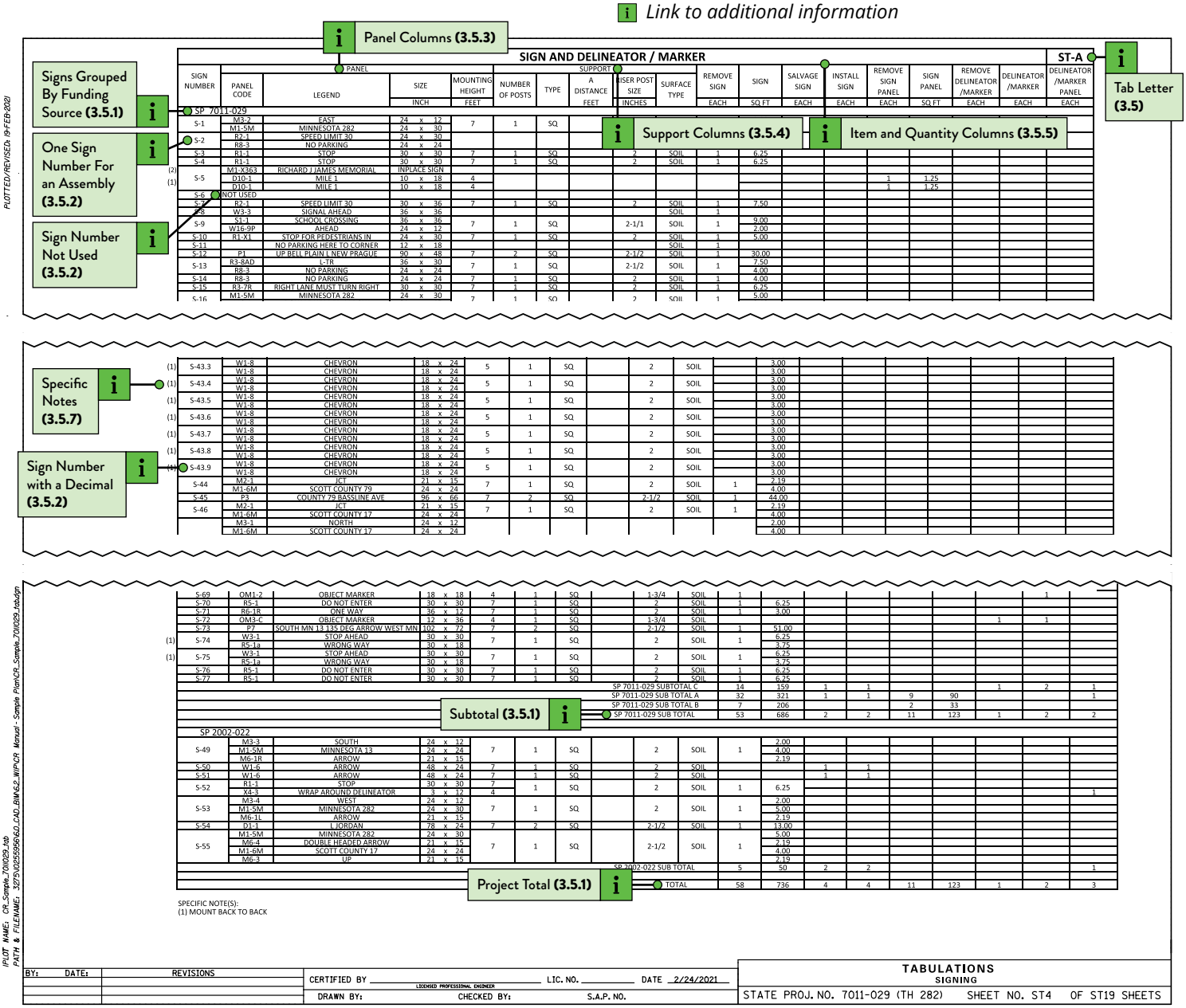
Designers should treat signs owned by other agencies in the same manner described for multiple S.P. numbers. Quantities for these other agencies will also be grouped and subtotaled.

COMMONLY SEEN ERROR:

✖ Verify funding sources and cost splits early in the project to avoid tabulation, signing layout and cost estimate changes late in the project.

Figure 3.15: Tabulation Components

i Link to additional information



3.5.2. Sign Number

See Section 3.3.6.1 for discussion of sign numbering. Signs on conventional roads have the numbering format S-#. Designers should use one row per support. Sign assemblies (multiple panels on the same support) are grouped and assigned one sign number. Multiple panels on one assembly should be listed from top to bottom, left to right on the tabulations. Information for each panel within an assembly is described in a different row.

BEST PRACTICE:

- ✔ In situations where a proposed sign has a similar message as the inplace sign, the same sign number should be used for both the inplace and proposed signs. In the tabulations, the inplace sign being removed or salvaged should be placed in the same row as the sign being installed or furnished and installed.
- ✔ For example, if an R3-7R is replaced by an R3-8CA, the same S-# can be used for both signs, even if the MUTCD code is different. See Section 3.3.6.1 for further discussion on this.

Up through the 90% submittal, when signs are added or removed, they should be renumbered to eliminate gaps in sign numbering. Though undesirable, it is sometimes unavoidable to add and remove signs from the tabulations after the 90% submittal. If a designer needs to add a sign(s) after the 90% submittal, they may add a decimal to the previous sign numbers and insert them into the tabulation.

Similarly, if an *existing* sign is no longer needed after the 90% submittal, designers should:

1. Only clear the information from the pay item column.
2. Replace the information in the Size column with **INPLACE SIGN**.

If a *proposed* sign is no longer needed after the 90% submittal,designers should clear the content from the row except for the sign number and place NOT USED in the Panel Code column (see Section 3.5.3) and the Conventional Road Sample Plan.

3.5.3. Panel Data

Panel columns within the tabulation include the following:

- **PANEL CODE**
  - Populated from the MnDOT Standard Signs and Markings Summary. Specially designed panels will receive a numbering format of P#, with no hyphen separating the P and subsequent number.
- **LEGEND**
  - This column contains a description of the panel message. Long legends may be abbreviated.
- **SIZE (INCH) (W X H)**
  - Designers must select the appropriate panel size based on the roadway type. Exceptions should be made for site specific conditions and in some cases, district preferences.
  - See the MnDOT Standard Signs and Markings Summary to determine the appropriate panel size. Definitions of roadway types can be found in the Sign Use Key below the table of contents. This information is also shown in Figure 3.16: Panel Size is Based on Roadway Types. Figure 3.18: Sign Support Selection Example describes the process designers must use to select the proper panel size.
- **MOUNTING HEIGHT (FEET)**
  - Measured from the bottom of the panel to the top of the curb or adjacent roadway surface. This is typically 7' for primary signs and 4' for markers and delineators.
  - Supplemental signs, which are mounted either above or below the primary sign, should similarly be assigned a mounting height. See Placement Standard Plans (discussed in Section 3.8.1).

ADDITIONAL GUIDANCE

Crashworthy height differs from mounting height in that this dimension is measured from the bottom of the sign panel to the surface in which the sign is installed. Crashworthy heights are 4 feet (minimum) for bendable structures and 7 feet (minimum) for breakaway structures.

Crashworthy heights and bendable/breakaway designations are defined in the notes on each square tube sign structure base detail/ standard plan sheet listed on the MnDOT Design website. A short video that provides an introduction to crashworthiness can be found on the MnDOT Training website. Mounting heights and crashworthy heights are most likely to vary in rural environments where the sign is installed in the slope of a ditch.

Figure 3.16: Panel Size is Based on Roadway Types

B-P:	Bike Path
B/Rt:	Bike Route
M:	Minimum
CR-SL:	Conventional Road, Single Lane
CR-ML:	Conventional Road, Multiple Lanes Undivided multi-lane, Speed Limit ≤ 60 mph Divided multi-lane, Speed Limit ≤ 55 mph
E:	Expressway Divided multi-lane, Speed Limit > 60 mph
F:	Freeway
RA:	Ramp
O:	Oversize

COMMONLY SEEN ERROR:

✖ When multiple panels are on the same support, designers should populate the mounting height of the primary panel and each panel below it.

Most districts will utilize a 7 foot mounting height. Some districts in the western part of the state will utilize a lower mounting height, but no less than the MUTCD minimum of 5 feet, to reduce the wind load on the sign support. While the mounting height may be lowered, the crashworthy height *must remain* at least 7 feet.

ADDITIONAL GUIDANCE

For example, a sign placed in a cut section of a roadway (i.e. no ditch) that is assigned a mounting height of 5 feet (above the adjacent roadway surface), must still have the lowest sign panel placed 7 feet (above the ground surface it which it is installed) to be considered crashworthy.

Designers should discuss mounting heights at the kickoff meeting and refer to Standard Plan 297.701 for additional guidance.

3.5.4. Support Data

Support columns within the tabulation include the following:

- NUMBER OF POSTS
  - Designers must use the Windloading Chart for Square Tube spreadsheet on the Signing Design website to determine the appropriate sign base and support dimensions.

COMMONLY SEEN ERROR:

✖ Signs within the clear zone and within 50 ft of an intersection should be on one post. Where practical, signs that require multiple posts should be moved further away from the intersection or be redesigned to use one post. Roundabouts are an exception to this. When assessing if multiple posts can be used, factors related to crashworthiness such as angle of approach and speed should be considered. Engineering judgement should be used to determine how likely a sign on multiple posts is to be hit at an angle that is not crashworthy.

- TYPE
  - Bridge Mounted Street Name (BM-SN)
  - Bridge Mounted Minor Guide (BM-MG)
  - Mast Arm (MA)
  - Round Post (R).
    - » This support type includes signal poles and round steel sign supports sometimes used by local agencies.
  - Square Tube (SQ)
    - » As of December 31, 2019, square tubes are the MnDOT standard support.
  - U Channel (U)

ADDITIONAL GUIDANCE

The Square Tube FAQ discusses square tube sign structure installations.

BEST PRACTICE:

✔ When selecting the support type, designers should identify and add the associated standard plans or details to the plan set.

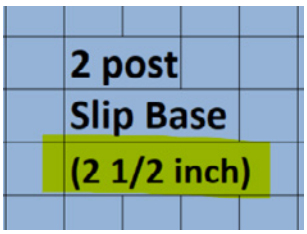
- A DISTANCE
  - Used to identify the placement of a panel on a signal mast arm or monotube structure, and is measured from the end of the mast arm to the left edge of the sign panel. If a project does not contain mast arm signing, this column should be removed. The monotube A Distance is described on Standard Plan 5-297.745.
- SURFACE TYPE
  - Designers must populate the type of material that the support is being installed in. Typically, it will be soil or concrete. Less common conditions are listed in the TYPE section.
  - Each of these installation types will likely include adding a corresponding standard plan sheet or detail to the plan.

ADDITIONAL GUIDANCE

Each sign structure is assigned a unique sign number. When tabulating multiple signs on a signal pole and/or mast arm, each sign should be assigned a row associated with this sign number.

- RISER POST SIZE (INCHES)
  - This is determined from the Windloading Chart for Square Tube. As shown in Figure 3.17: Riser Post Size, the riser dimensions are noted in parentheses below the slip base.

Figure 3.17: Riser Post Size



3.5.5. Item & Quantity Data

Designers will add item and quantity columns to the right of the support columns that correspond to signing actions identified on the Roadway Layout sheets.

The column headers must match the item description associated with these actions exactly. Designers should reference the Signing Tabulations template for definitions of actions. Designers should use the AASHTOWare Project Item List search tool to identify item descriptions. The columns are added in the following order (left to right). When items are not used in a plan, the columns should be omitted.

Designers may reference the Signs, Marker and Delineator Pay Item Definitions for guidance on items included in the Sign pay item.

- REMOVE **SIGN (EACH)**
  - Used for removing a sign panel *and* support
- SIGN **(SQ FT)**
  - Used for furnishing and installing a sign panel *and* support
- SALVAGE **SIGN (EACH)**
  - Used for salvaging sign panel *and* support
- INSTALL **SIGN (EACH)**
  - Used for Installing a sign panel *and* support
- **REMOVE** SIGN PANEL **(EACH)**
  - Used for removing a sign panel from an inplace support
- **SIGN PANEL (SQ FT)**
  - Used for furnishing and installing a sign panel
- **SALVAGE SIGN PANEL (EACH)**
  - Used for removing a sign panel from an inplace support
- **INSTALL SIGN PANEL (EACH)**
  - Used for installing a sign panel
- **REMOVE DELINEATOR/MARKER (EACH)**
  - Used for removing a delineator or marker *and* the inplace support
- **DELINEATOR/MARKER (EACH)**
  - Used for furnishing and installing a delineator or marker panel *and* support
- **SALVAGE DELINEATOR/MARKER (EACH)**
  - Used for salvaging a delineator or marker *and* the inplace support
- **INSTALL DELINEATOR/MARKER (EACH)**
  - Used for installing a delineator or marker *and* the inplace support
- **REMOVE DELINEATOR/MARKER PANEL (EACH)**
  - Used for removing a delineator or marker *panel* from the inplace support
- **DELINEATOR/MARKER PANEL (EACH)**
  - Used for furnishing and installing a delineator or marker *panel*
- **SALVAGE DELINEATOR/MARKER PANEL (EACH)**
  - Used for salvaging a delineator or marker *panel* from the inplace support
- **INSTALL DELINEATOR/MARKER PANEL (EACH)**
  - Used for installing a delineator or marker *panel*

BEST PRACTICE:

✔ When reviewing the tabulations, use the Find tool in the PDF viewer to search for the sign number (i.e. S-54) if a particular sign is hard to find in the tabulations. This will also identify if the sign number has a typo or has been omitted.

3.5.6. Street Name Slats

The agency who owns the street slats is responsible for verifying that they are installed to current standards. If street name slats are impacted on a project, coordinate with the local agency to determine how these should be included in the plans. If a local agency requests a new device, they may be added to the Roadway Layouts, and assigned a Note Stating F & I BY CITY VIA PERMIT or SALVAGE AND INSTALL BY CITY VIA PERMIT. These items should not be included in the tabulations.

COMMONLY SEEN ERROR:

✖ Street slats cannot be installed on a support that is shared with a sign owned or maintained by MnDOT. This is most commonly seen with stop signs. When placed within state right of way, they must be on a crashworthy support.

✖ Designers should discuss exceptions with the District Signing Engineer at kickoff meeting. Refer to TEM Section 6-7.06.02 for additional guidance.

3.5.7. Specific Notes

Specific notes are used to provide additional direction regarding the orientation of panels on a support or other unique information. A common specific note is used when signs are mounted back to back. These specific notes are added to the left of the tabulation, in parentheses.

3.5.8. TAMS Export to Excel

As discussed in Section 3.4.6, some districts currently utilize the TAMS asset management database to track each sign and it is anticipated that all districts will do so in the future. TAMS data should be at least 90% accurate for use on plan tabulations. If this information is used, designers should discuss the process and expectations with the District Signing Engineer.

Figure 3.18: Sign Support Selection Example

To determine the supports needed for the all-way stop sign assembly shown below to be installed in soil at an intersection of:

- A 40 MPH roadway with one through lane in each direction and no turn lanes
- A 30 MPH roadway with one lane in each direction and no turn lanes

1 Determine the roadway type from the front of the Standard Signs Summary.

M:	Minimum
CR-SL:	Conventional Road, Single Lane
CR-ML:	Conventional Road, Multiple Lanes Undivided multi-lane, Speed Limit ≤ 60 mph Divided multi-lane, Speed Limit ≤ 55 mph
E:	Expressway Divided multi-lane, Speed Limit > 60 mph

2 In the Standard Signs Summary, determine the panel dimensions for each sign panel in the assembly.

STOP	White on Red	B-P	18 x 18
		M, CR-SL, B/Rt	30 x 30
		CR-ML, E	36 x 36
		O	48 x 48
ALL WAY	White on Red	CR-SL, ML	18 x 6
		O	30 x 12

3 Designers should refer to text below the panel to determine if any conditions apply.

A minimum size of 36 x 36 inches shall be used for STOP signs that face multi-lane approaches.

There are no multi-lane approaches

Where side roads intersect a multi-lane street or highway that has a speed limit of 45 mph or higher, the minimum size of the STOP signs facing the side road approaches, even if the side road only has one approach lane, shall be 36 x 36 inches.

Since there are no multi-lane streets, the speed limit does not factor into the determination.

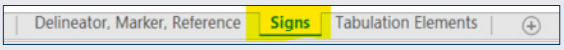
Where side roads intersect a multi-lane street or highway that has a speed limit of 40 MPH or lower, the minimum size of the STOP signs facing the side road approaches shall be as shown above based on the number of approach lanes on the side street approach.

Since there are no multi-lane streets, the speed limit does not factor into the determination.

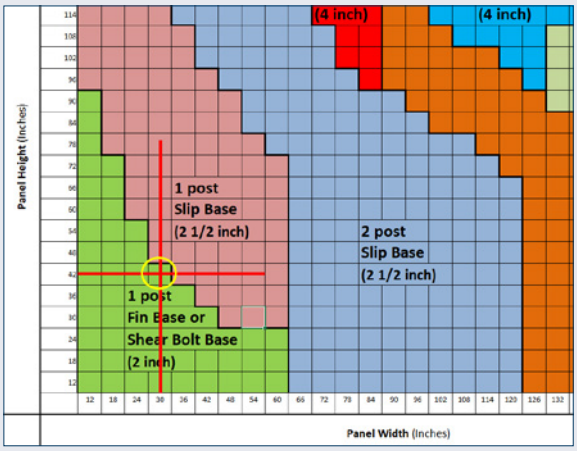
Multi-Lane - more than one lane moving in the same direction. A multi-lane street, highway, or roadway has a basic cross-section comprised of two or more through lanes in one or both directions. A multi-lane approach has two or more lanes moving toward the intersection, including turning lanes.

4 Determine the overall panel assembly dimensions. Conservatively use the width of widest panel (30") and the combined height of both panels in the assembly (30" + 6" = 36").

5 Select the Signs tab in the Wind Loading Chart for Square Tube spreadsheet.



6 Extend a line from the middle of the cell along each axis using the dimensions in Step 3. If a value lands between two grid lines, round up.



7 Enter the appropriate information into the tabulation.

SIGN AND DELINEATOR / MARKER									
SIGN NUMBER	PANEL		SIZE	MOUNTING HEIGHT	NUMBER OF POSTS	TYPE	SUPPORT		
	PANEL CODE	LEGEND					A DISTANCE	RISER POST SIZE	SURFACE TYPE
			INCH	FEET			FEET	INCHES	
S-61	R1-1 R1-3P	STOP ALL WAY	30 x 30 18 x 6	7	1	SQ		2	SOIL

3.6. Signing Title Sheet

On projects with multiple disciplines, the first signing sheet will be the signing title sheet, which includes the Permanent Signing Summary, signing plan index, applicable abbreviations, applicable signing legend elements, general information and a title block. See Section 3.8 for additional guidance.

On standalone signing projects, this sheet can be omitted as it becomes redundant to the sheet containing the Statement of Estimated Quantities, further described in Section 3.9.

A template for this type of title sheet can be found in the MnDOT signing cell library, "sign.cel", using a cell named "TSHEETB".

This cell library file can be downloaded from the MnDOT Computer Aided Engineering Services site.

BEST PRACTICE:

- ✔ The signing cell library undergoes infrequent, but constant changes. Designers should check for new versions every 6-12 months.

3.6.1. Permanent Sign Summary

Signing items will be summarized in a permanent signing summary, organized by increasing item number. Designers should utilize the Signing Pay Item Spreadsheet to select the appropriate item for a particular action. This summary will be assigned "ST" and be labeled in the upper right-hand corner of the table. Columns for Tab letter (Always "ST-A") and Sheet number (Always the sheet(s) following the Sign Tabulation Sheet), Item, Unit and quantities are provided (left to right). Quantities are separated into columns for each funding type and/or S.P. and are totaled.

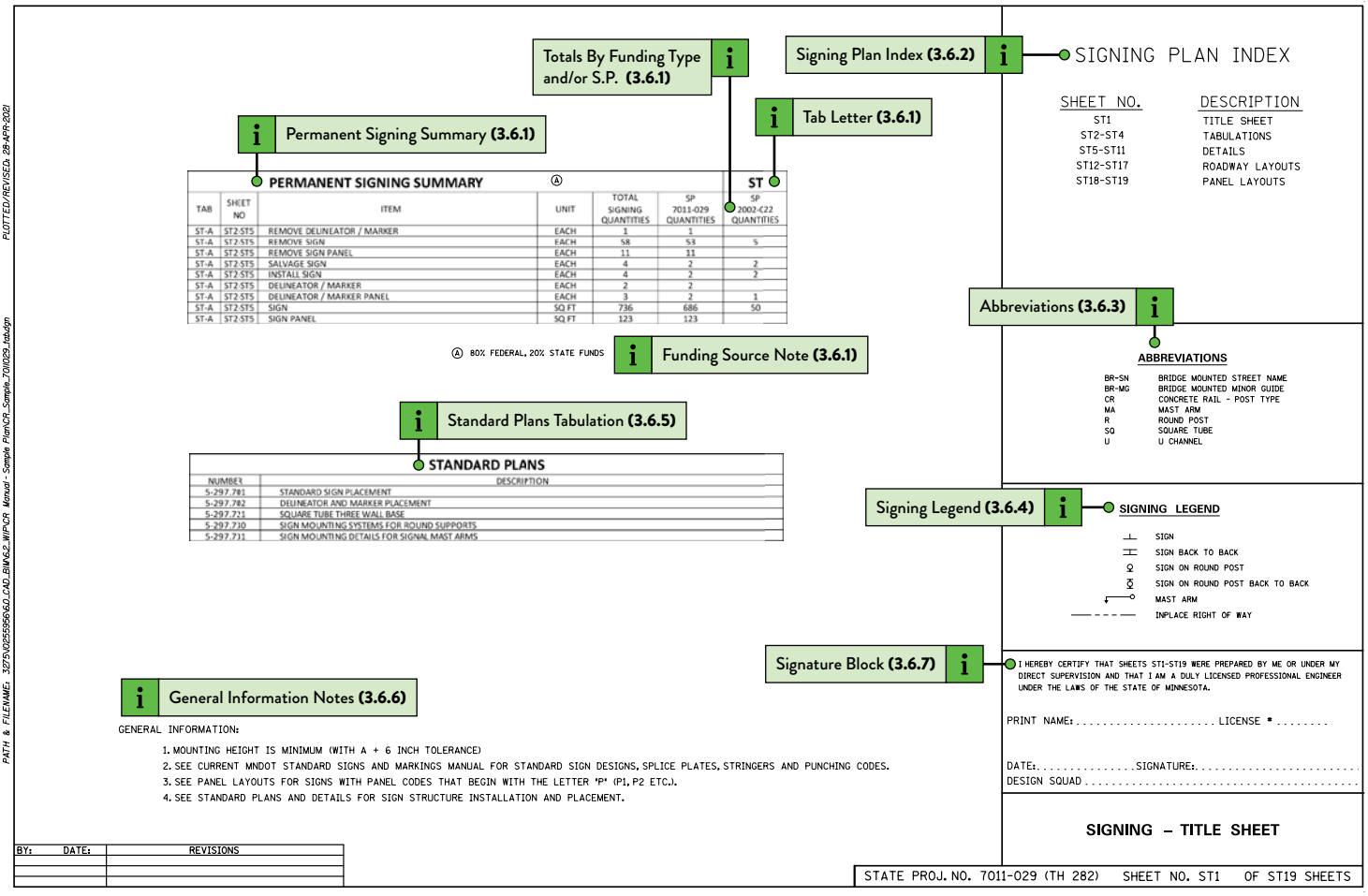
Funding notes are used to describe the funding source. These notes will use a capital letter rather than a number. Funding notes may apply to an entire source or to individual items. See Section 3.9 for more information.

3.6.2. Signing Plan Index

The signing plan index is shown in the upper right hand corner of the signing title sheet and should list each type of signing sheet contained in the plan to the right of the associated sheet numbers (i.e., **ROADWAY LAYOUTS**, **PANEL LAYOUTS**, etc., as described in Section 3.2.1). This terminology must match exactly what is used within the title block on the signing plans.

Figure 3.19: Signing Title Sheet Components (only used on projects with multiple disciplines)

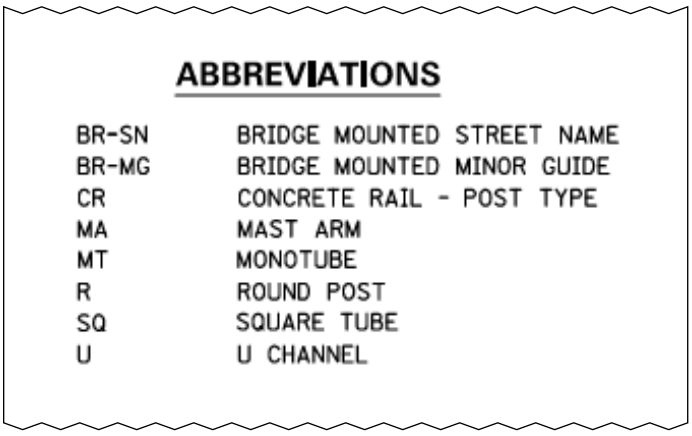
i Link to additional information



3.6.3. Abbreviations

The abbreviations used in the Signing and Delineator / Marker tabulation are shown below the Signing Plan Index on the signing title sheet for multi-discipline projects, or on the right side of the SEQ for sign replacement projects. See Figure 3.20: Abbreviations. *Designers should pare the list down to those that apply to the project.*

Figure 3.20: Abbreviations



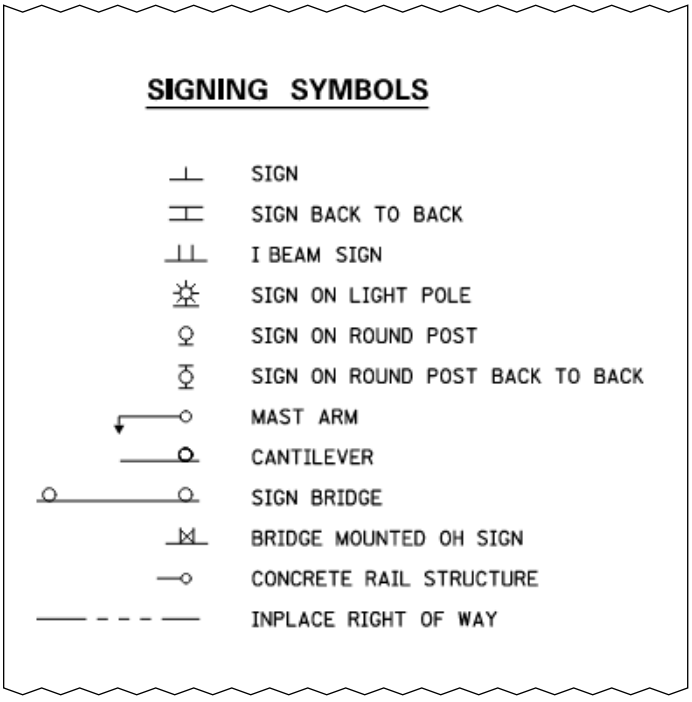
ABBREVIATIONS

BR-SN	BRIDGE MOUNTED STREET NAME
BR-MG	BRIDGE MOUNTED MINOR GUIDE
CR	CONCRETE RAIL - POST TYPE
MA	MAST ARM
MT	MONOTUBE
R	ROUND POST
SQ	SQUARE TUBE
U	U CHANNEL

3.6.4. Signing Legend

The signing legend is placed on the signing title sheet on multi-discipline plans, or with the SEQ on sign replacement projects. See Figure 3.21: Signing Symbols. *Designers should pare the list down to those that apply to the project.*

Figure 3.21: Signing Symbols



SIGNING SYMBOLS

SIGN
SIGN BACK TO BACK
I BEAM SIGN
SIGN ON LIGHT POLE
SIGN ON ROUND POST
SIGN ON ROUND POST BACK TO BACK
MAST ARM
CANTILEVER
SIGN BRIDGE
BRIDGE MOUNTED OH SIGN
CONCRETE RAIL STRUCTURE
INPLACE RIGHT OF WAY

3.6.5. Standard Plans Tabulation

Standard plans are tabulated on the signing title sheet (or with the SEQ on sign replacement projects) and are listed in order of standard plan number. See Section 3.8 for more information on Standard Plans.

3.6.6. General Information

General notes are shown at the bottom of the signing title sheet (or with the SEQ on sign replacement projects) and apply to the signing plan. These notes include information about minimum mounting height, references to the MnDOT Standard Signs and Markings Manual, references to Panel Layout Sheets, and references to Standard Plans and Details.

3.6.7. Certifying Engineer Signature Block

The Certifying Engineer for the signing plan should sign the signing title sheet and provide name, license number, date, signature and design squad information. This information goes in the signature block in the lower right corner of the sheet.

3.7. Utility Tabulation

The Utility Tabulation will reflect the results of the Utility Coordination Process described in Section 3.6. On projects with multiple disciplines, the utility tabulations will be separated from the signing plans. Signing designers should coordinate potential impacts with the utility designers. This section will focus on standalone signing projects on conventional roads. On these types of plans, signs will typically be field located to avoid any inplace utility.

If utility facilities are present but the project will not affect them, utility tabulations are not necessary, and the Utility Tabulation sheet will reflect a **NO AFFECTED UTILITIES** status.

3.7.1. Utility Notes

A No Affected Utility Tabulation will include the following plan notes:

- **THE SUBSURFACE UTILITY INFORMATION IN THIS PLAN IS UTILITY QUALITY LEVEL __**. This note is always included, regardless of whether utilities are affected.
  - For standalone signing projects on conventional roads, the quality level will be typically be "D". Discuss exceptions with the District Signing Engineer. This utility quality level is determined according to the guidelines of CI/ASCE 38-02, entitled, "Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data."
- **NO UTILITIES ARE AFFECTED BY THE PROJECT** when utilities are present, but not affected by the project.
- **THE FOLLOWING UTILITY OWNERS HAVE FACILITIES INSIDE THE LIMITS OF THE PROJECT.**
  - Add a list of the utility owner names.
- If there are no utility facilities in the project limits, include the quality level note and the following sentence **THERE ARE NO UTILITY FACILITIES WITHIN THE PROJECT LIMITS**. *This will be extremely rare*, possibly on some segments along rural highways.

Figure 3.23: Utility Notes

UTILITIES

NO UTILITIES WILL BE AFFECTED BY THIS PROJECT

GENERAL NOTES:

1. THE SUBSURFACE UTILITY INFORMATION IS UTILITY QUALITY LEVEL D. THIS UTILITY QUALITY LEVEL WAS DETERMINED ACCORDING TO THE GUIDELINES OF CI/ASCE 38-02, ENTITLED "STANDARD GUIDELINES FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA".
2. THE EXACT LOCATION OF UNDERGROUND UTILITIES ARE UNKNOWN. THE CONTRACTOR SHALL CONTACT GOPHER STATE ONE PRIOR TO STARTING ANY EXCAVATION OR PLACEMENT OF POSTS.

   GOPHER STATE ONE CALL SYSTEM.....1-800-252-1166

STATE PROJ. NO. 8827-339				
SHEET NO.	3	OF	59	SHEETS

BEST PRACTICE:

✔ Designers must confirm that the names of the utility owners on the plan sheets match the current legal names of those companies or agencies. Refer to the contact list on the MnDOT Utilities website for the current names. Do NOT include contact names, phone numbers and/or e-mail addresses.

COMMONLY SEEN ERROR:

✖ Designers should review the sign inventory photos/ video to determine if the project includes overhead utilities. These types of utilities may not be identified by the One call request.

Figure 3.22: List of Utility Companies Within the Project Area

NICOLLET COUNTY	
ROADWAY	
TH 15/CSAH 1 (#1)	TH 14/CSAH 12 (#2)
NUVERA COMMUNICATIONS	NUVERA COMMUNICATIONS
GREATER MN TRANSMISSION	GREATER MN TRANSMISSION
UNITED NATURAL GAS	UNITED NATURAL GAS
CENTURYLINK	COMCAST
RENVILLE SIBLEY FIBER COOP	XCEL
XCEL	

3.8. Standard Plans, Standard Plates and Signing Details

MnDOT Signing uses both standard details and standard plans. Signing has the 700 series for standard plans. Standard plans can be found on the MnDOT Signing Design webpage, or on the Standard Plans website. Standard details that have not yet become standard plans can be found on the MnDOT Signing Design webpage.

Standard plans are constantly being updated. When this happens, OTE will develop a detail of the updated content and begin the approval process to create or update the standard plan. There is a period during the update process where OTE will encourage designers to utilize the content of the proposed update in lieu of the current standard plan. Sheets containing details must be signed by a licensed engineer, whereas standard plans are already signed by MnDOT Engineers.

COMMONLY SEEN ERROR:

✖ Either the detail with updated information OR the current standard plan it is proposed to replace should be included in a plan set (not both).

BEST PRACTICE:

✔ Designers should verify that the most current version is included in the plans. This should be rechecked right before project turn in.

The following categories of standard plans and details are applicable to this course and are further discussed in the following sections:

- Placement
- Square Tube Sign Structures
- Signs Mounted on Other Structures

Information on how to insert standard plans and details into a plan set is provided in Section 3.8.4.

3.8.1. Standard Plans – Placement

There are two standard plans that relate to signing on conventional roads:

- Standard Sign Placement – (5-297.701)
- Delineator and Marker Placement (5-297.702)

These standard plans provide information regarding minimum sign mounting heights and clearances, as well as minimum offsets for curbed and uncurbed roadways. Placement standards are different for delineators and markers than for other street signs. Placement sheets should be included in all signing plans, as applicable.

COMMONLY SEEN ERRORS:

✖ Not accounting for clearances to sidewalk or trail: Per Standard Plan 5-297.701, a 2' minimum clearance should be provided between the edge of sign and sidewalk or trail. In curbed locations where boulevard widths are too narrow to achieve these offsets, it is permitted to provide the 2' minimum from signpost instead of from the sign edge. If these minimums cannot be achieved while also meeting minimum offsets from edge of shoulder or curb and gutter, then an engineering judgement conversation should take place with the District Signing Engineer.

Consider the following: Can the sign be placed in a location with a wider boulevard width? Can the sign be placed on the far side of the trail or sidewalk instead? Is there a way to provide the same message with a narrower sign width? Can the sign be omitted?

Not accounting for obstacles that can block sightlines to signs: Per Standard Plan 5-297.701, signs shall be placed a minimum of 10' from the nearest obstacle. When placing signs, confirm that sightlines are not blocked by light or power poles, trees, signs, buildings or other obstacles. Note locations with potential sightline concerns during the field visit and reference topography and utility files during design.

3.8.2. Standard Plans and Details - Square Tube Sign Structures

The following square tube sign structure details or plans are available from the MnDOT Signing website Design page:

- Square Tube Mounting
- Square Tube Three-Wall Sign Base
- Square Tube Fin Base
- Square Tube Shear Bolt Base
- Square Tube Slip Base

The Square Tube Mounting Details provide information on how to attach sign panel(s) to square tube posts depending on the sign panel width and number of posts needed. These Standard plans have options for both soil and concrete.

Depending on sign panel size, stringers may be needed. The MnDOT Standard Signs and Markings Manual provides information on mounting holes (punch codes). See the Square Tube FAQ document for background on square tube posts.

ADDITIONAL GUIDANCE

Several of the Square Tube Sign Structure details include options for concrete installation. The Shear Bolt and Slip bases have options for installing the base into the surface of the concrete as well as for coring through the concrete. When considering a surface mount concrete installation, designers should be aware of the slope of the concrete and minimum thickness requirements in each detail.

COMMONLY SEEN ERROR:

✖ On standalone signing projects, don't assume that the existing base will be sufficient for a proposed sign. Verify that the existing base type is designed for square tube posts and will accommodate the new panel size. Also verify the age and design life of the post. Doing this will reduce the risk of field changes later on.

3.8.3. Standard Plans and Details- Signs Mounted on Other Structure Plans

The following details or plans are available for signs mounted on other structures:

- Sign Mounting Systems for Round Supports (5-297.730) commonly applies to signs mounted on traffic signals poles, overhead sign structure posts, Road Condition Weather Information Systems (RCWIS) poles or, ramp meter poles). Stiffeners should only be omitted for panels with a width equal to or less than 24.

COMMONLY SEEN ERROR:

✖ Designers are discouraged from placing panels on luminaire poles and may only do so under the two following conditions: 1) If the pole is determined to have the structural capacity to accommodate additional wind loading, and 2) with concurrence from the District Signing Engineer. Sign panels may not be mounted on breakaway luminaire poles due to structural capacity and crashworthiness concerns.

- Sign Mounting Details for Signal Mast Arms (5-297.731) provides details on mounting signs onto mast arms. This commonly applies to guide and regulatory signs such as left turn yield on flashing yellow arrow or turn restriction signs. A wind loading analysis should be done every time a panel is added or replaced on a mast arm, even if the panel placement or panel area has not changed.
- Concrete Rail Mounted Sign (5-297.740) commonly applies where bridges are present. Designers should verify with the District Signing Engineer that the detail is compatible with the bridge type on the project and should coordinate with the MnDOT structures group to confirm the structure can accommodate both the support anchorage and the additional wind load. Designers must not exceed the moment arms and areas identified in the selection table at the bottom of the standard plan.

BEST PRACTICE:

✔ Designers are discouraged from using concrete rail mounted supports. Verify a proposed sign is necessary and that it can't be moved to a ground mounted installation before selecting this support type.

- Structural Details for Bridge Mounted Signs – Street Name (5-297.741) and Structural Details for Bridge Mounted Signs – Minor Guide Signs (5-297.742) provide details on bridge mounted street name and minor guide signs. For existing bridge-mounted signs, the age and condition of the structure should be assessed, and changes to the sign panel should be discussed with the District Signing Engineer. For any new bridge-mounted signs, coordination with and approval from the Bridge office will be necessary. See Section 3.1.12 for more information. Designers must not exceed the maximum panel length identified on the plan.
- Concrete Wall Mounted Signs Detail applies where the roadway is next to a concrete retaining wall and there isn't sufficient space to ground mount signs. These supports cannot be put on columns of noise walls or on MSE walls. The designer should prompt a discussion with MnDOT structural engineers to confirm that the standard plans apply to a specific project need. Maximum panel dimensions are noted on the plans. This detail more commonly applies to freeways, but may apply to conventional roads. Before considering mounting a sign on concrete wall, verify that there is adequate clearance between the edge of sign panel and traffic and that the wall is owned by MnDOT.

BEST PRACTICE:

✔ Designers are discouraged from using concrete wall mounted supports. Verify a proposed sign is necessary and that it can't be moved to a ground mounted installation before selecting this support type.

3.8.4. How to Insert Details and Standard Plans into a Plan

Standard Plans are already signed and approved by MnDOT, and they should not use the project border. Some standard plans include multiple sheets. In these cases, designers must include all sheets in each Standard Plan "set".

Few elements within a standard plan should be edited. They include the title block, which should be updated to include the state project number (with the primary road name in parenthesis) and the sheet numbers. Additional modifications must be formatted as described in the Guidelines for Standard Plan Modification, accessed through the main menu on the Standard Plans website.

Standard Plans should be placed in order of the Standard Plan number, for example, Standard Plan 5-297.701 should go before Standard Plan 5-297.702.

On projects with multiple disciplines, Standard Plans associated with signing design should be grouped with the others used on the project. The first sheet of the signing plan should include a table with a list of signing-related Standard Plans. On standalone signing projects, the Standard Plans should be placed as described in Section 3.2.1.

Details are not signed by MnDOT and must be signed by the Certifying Engineer. It is recommended that the most recent MnDOT revision date of the standard detail be noted in the bottom left corner of the detail.

See MnDOT's Design Scene and Guidance webpage for more information on how to insert details and standard plans into a plan set.

3.8.5. Standard Plates

MnDOT's Standard Plates can be found on the Standard Plate webpage. Standard plates are details meant for fabricators. Standard plate tables are typically placed after the Statement of Estimated Quantities (SEQ), however, if there is room on the SEQ sheet, the table can be shown on the same sheet. See MnDOT's Design Scene and Guidance webpage for more information on standard plate tables.

If any standard plates apply to your project, these should be tabulated in the plan, with the plate number and description noted. There are currently no standard plates for signing. However, standalone signing plans will typically include a traffic control item, and will therefore include Standard Plate for channelizers, number 8000_.

3.9. SEQ/Engineer's Estimate

3.9.1. Statement of Estimated Quantities (SEQ)

MnDOT's Design Scene website provides detailed SEQ Guidance for the development of the Statement of Estimated Quantities (SEQ).

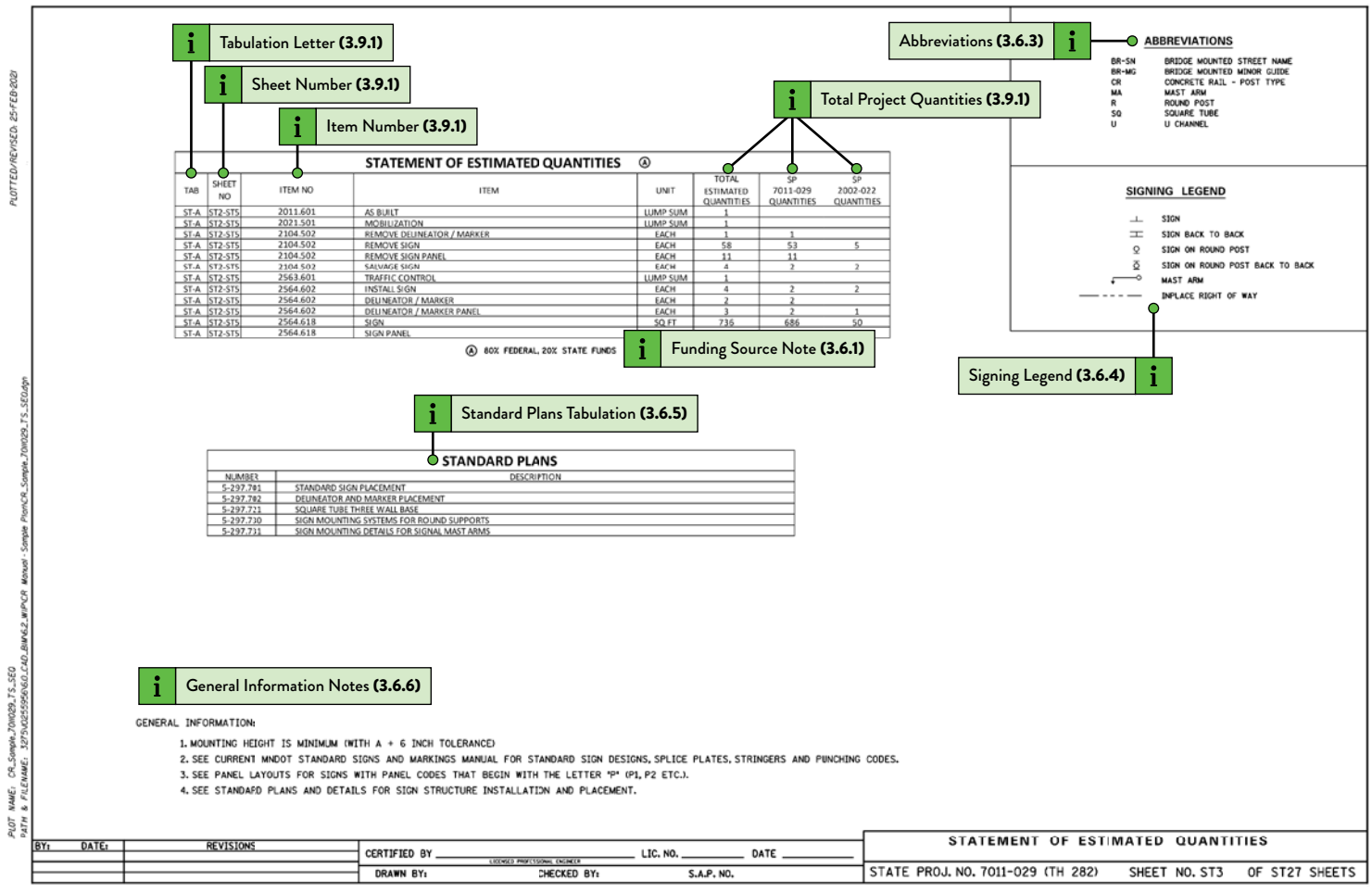
For projects with multiple disciplines, this task will likely be prepared by another discipline, delegated by the project manager.

The following information provides additional guidance specific to standalone signing projects. Designers should utilize the Signing Tabulations template and/or the AASHTOWare website to identify item numbers, descriptions and unit.

When preparing an SEQ, the first step is to identify the item numbers associated with the project and the funding source(s) they correspond with. This step is mostly completed during the development of the tabulations, as quantities should have already been split by item number and funding source. See 3.5. Signing Tabulations for additional guidance on tabulations.

Figure 3.24: Statement of Estimated Quantities Components

i Link to additional information



Additional items that are not included in the tabulations, such as **AS-BUILTS**, **MOBILIZATION** and **TRAFFIC CONTROL** will likely need to be added. The tabulation letter and sheet number (left most columns of the SEQ) are left blank for these items.

The third column from the left shows the item numbers, which are identified in the MnDOT Standard Specification for Construction Book (Spec Book). To search for MnDOT item numbers, visit the AASHTOWare Project Item List website. Designers may also reference the Design Scene's Chapter 2 – Quantities and Tabulations to confirm the item number matches the intended unit. Designers are encouraged to check with the District Signing Engineer or the Pre-Letting Office when unsure which item number to use.

Item numbers should be ordered by ascending item numbers, identified in the Signing Pay Item spreadsheet. Include four digits to the left of the decimal and the three numbers to right of the decimal under the items column of the SEQ. See Chapter 4 for additional discussion on .6## series item numbers. These are associated with items that are not covered in the Spec Book.

BEST PRACTICE:

- ✔ Item numbers may change when spec books are updated. When reviewing MnDOT's items, verify the item number, description and units.

The column(s) to the right of the units contains the total project quantities. Commas must not be used when displaying quantities. On projects with multiple funding sources, additional columns are used to separate quantities. Quantities associated with the prime S.P. are placed next to the total quantities and county or city funding sources are placed in the furthest right column. The quantities shown in the SEQ should be rounded to the nearest whole number, even if the tabulations show additional precision. Mobilization and Traffic Control may be carried out to the hundredths. The SEQ Guidance on MnDOT's Design Scene website provides more guidance relating to separating quantities by funding source and rounding.

Funding notes are used to describe the funding source. These notes will use a capital letter rather than a number. Funding notes may apply to an entire source or to individual items. The Spec Book and SEQ Guidance in the Design Scene provide additional guidance.

Some items are deemed to be difficult and/or expensive to measure in the field. These items are designated as Plan Quantities. Signing plans on conventional roads will rarely contain Plan Quantities.

On standalone signing projects, there won't be a signing title sheet, so the SEQ sheet may also show standard plans tabulation, general information notes, a list of abbreviations used in the tabulations and a signing legend. See Section 3.6 for more information on these.

3.9.2. Engineer's Estimate

The engineer's (cost) estimate is usually submitted at 90%. The engineer's estimate is essentially the SEQ with cost information. Funding split columns must be identical to those shown in the SEQ. The bottom row of the estimate should display the total project estimates for the total project and each funding source/S.P. number.

To determine unit costs, review MnDOT's Average Bid Price documents on the Bid Letting webpage. These documents provide the average bid price of items used each year. If an item was not used on a construction project in a year, there may not be an associated average bid price provided. Due to spec book changes, items may vary year to year.

BEST PRACTICE:

- ✔ Designers should check with the District Signing Engineer before using the historical average bid prices. Districts may have more accurate historical costs for locally sourced products and be in tune with industry shortages.

  Designers should review the quantity of each item in the average bid price documents to determine whether the average bid price is reasonable. For example, items that had fewer quantities in a year may provide a less reliable unit cost estimate than items with larger quantities. It is also recommended to use the average of multiple years (two to four years is recommended), as opposed to using just one year's average. However, this should still be reviewed for reasonableness.

COMMONLY SEEN ERROR:

- ✖ The engineer's estimate is not public information until after award and should not be shared outside of the project team. Designers should coordinate with the District Signing Engineer to discuss how to transfer that information. Do not transmit this document via email.

Some items will require additional investigation to populate the unit cost. Designers should never use average bid prices to calculate unit costs for Lump Sum items (or any other .600 series item number), such as **AS-BUILTS**, **MOBILIZATION** and **TRAFFIC CONTROL**. These are highly variable, project specific costs. When submitting engineer's estimates, designers will need to provide documentation for these costs.

AS-BUILTS costs on a project are based on the number of sign assemblies on a project. The District Signing Engineer or Central Office Signing staff will be able to provide a current cost per asset point. Asset points are determined by adding the total number of Install Sign and F&I Sign locations on a project.

On standalone signing projects, the cost of **MOBILIZATION** is determined as a percentage of the project cost. These costs vary depending on the length of the corridor and the type of

equipment the contractor must have to complete the projects.

On standalone signing plans, traffic control plans are typically not included. In these cases, the cost assigned to the **TRAFFIC CONTROL** item is also determined as a percentage of the total project cost, which varies depending on anticipated complexity of the traffic control devices needed to protect the work zone and restrictions placed on the contractor's working hours.

On projects with multiple disciplines, lump sum items need to be consolidated with the other disciplines.

BEST PRACTICE:

- ✔ Link the cost estimate spreadsheet to the SEQ. This way, if quantities are updated in the SEQ, they will automatically update the cost estimate.

3.10. Plan Title Sheet

The format of the title sheet will be slightly different depending if the project is a standalone signing project or a project with multiple disciplines. If it is a reconstruction project, this likely will be prepared by another discipline, delegated by the project manager.

The following information provides guidance specific to standalone signing projects.

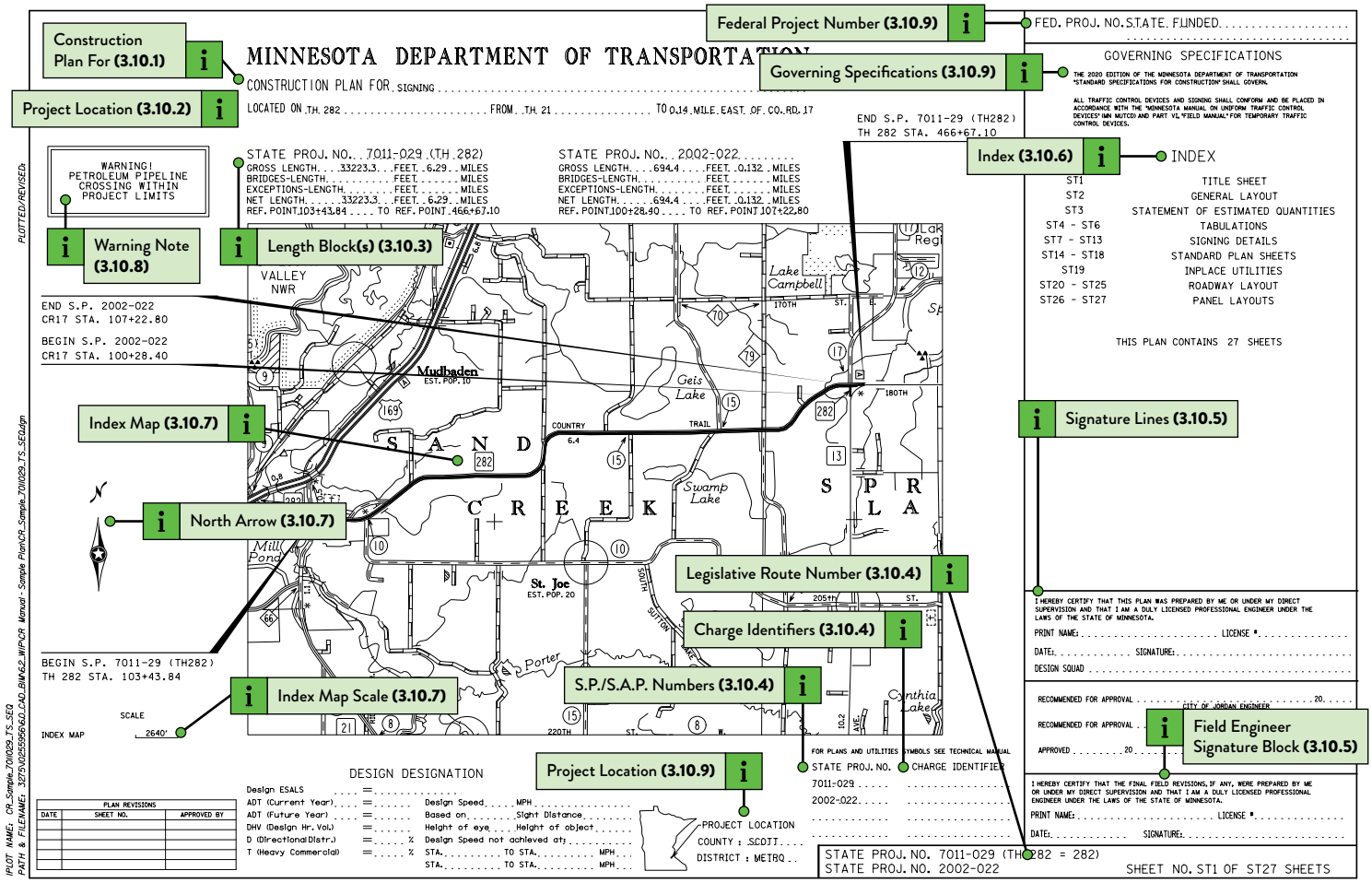
The final signed copy of the plan sheet for signatures should be printed to PDF. The title sheet should be developed per guidance in MnDOT's Design Scene. The following sections provide information on some of the elements that are included on a title sheet.

3.10.1. "Construction Plan for..."

In virtually all cases, **SIGNING** will be added to the "Construction plans for..." section. It is possible that other associated work will be included, such as **GUARDRAIL**.

Figure 3.25: Title Sheet Components

i Link to additional information



3.10.2. "Located on…"

The project location is noted at the center top of the title sheet and states the primary roadway, as well as the *approximate* start and end points, typically denoted by other cross streets or other easily identifiable physical references such as river or water feature names.

3.10.3. Length Blocks

The State Project (S.P. and/or S.A.P.) numbers associated with the project are listed below the project location description in the length block(s). The roadway's T.H. number is included in parentheses behind each S.P. number.

For each S.P. number, a length block is included and notes the gross length are added, calculated in both feet and miles, measured along the alignment from Begin S.P. to End S.P. Bridge length does not need to be included on standalone signing projects

In some cases a standalone signing project does not run along a continuous line but rather is sporadic. These plans may *not* require a length block to be filled in with lengths. But at a minimum the length block should contain the begin and end reference points.

Net length is the length of the exception(s) subtracted from the gross length, also in feet and miles.

The start and end reference points are also noted for each S.P. number. Reference point information can be found on MnDOT's Roadway Project Mapping application.

COMMONLY SEEN ERROR:

✖ Reference points are often mistaken for mile points or carto miles. Reference points are shown in the format XXX + XX.XXX, with the number before the plus sign being the number of the previous reference post and the digits after the plus sign being the number of miles beyond the previous reference post.

3.10.4. State Project Numbers and Charge Identifiers

Each S.P. or S.A.P. number will be placed in the lower right-hand corner of the title sheet, with the Prime S.P. listed above the others. Verify with the District Signing Engineer which S.P. will be designated the Prime S.P.

The T.H. and primary legislative route number will be shown in parentheses behind each S.P. number. This information can be found in the Roadway Project Mapping Application.

ADDITIONAL GUIDANCE

There are two types of S.P. numbers: Grading and State Aid S.P.s. Grading S.P. numbers require legislative route numbers while State Aid S.P. and S.A.P. numbers do not.

Leave a space for charge identifiers for each S.P. or S.A.P. number, this will be populated in the field.

3.10.5. Agency Signature lines

Signature lines are located in the middle/bottom right side of the title sheet. The top signature box is for the engineer certifying the plan.

Spaces for other signatories to sign and date the title sheet should be provided as well. Designers should coordinate with the District Signing Engineer to verify which signatories need to be added to the title sheet. As of July 17, 2020, MnDOT only requires the following signatures on the title sheet:

- Recommended for approval: **DIRECTOR OF LAND MANAGEMENT**
- Reviewed by: **CITY ENGINEER,** if applicable (only applies to State Aid Plans)
- Reviewed by: **COUNTY ENGINEER,** if applicable (only applies to State Aid Plans)
- Approved by the **STATE DESIGN ENGINEER**

A space should be left for the field engineer to sign the plan.

3.10.6. Index of Sheets

The index is shown in the upper right hand corner of the title sheet. On standalone signing projects, the index should list each type of signing sheet contained in the plan to the right of the associated sheet numbers (i.e., **ROADWAY LAYOUTS**, **PANEL LAYOUTS**, etc., as described in Section 3.2.1). This terminology must match exactly what is used within the title block on the signing plans. On projects with multiple disciplines, the index will reference the **SIGNING PLAN**.

3.10.7. Index Map

The index map shows the project location, with the following elements called out or labeled:

- North arrow
- Scale
  - Select a scale such that the entire project extents are shown
- Begin/End S.P.
- Begin/End Construction
  - Not required if the project consists of isolated work areas rather then the more common project corridor
- Bridge numbers

The index map may be obtained from MnDOT's Geographic Information & Mapping (GIS) webpage. See MnDOT's Design Scene for additional guidance on index maps, including acceptable formats for leader lines.

3.10.8. Petroleum, High Pressure Gas & High Voltage Electric Utilities

If there is a petroleum or high-pressure gas line in the vicinity of the project, include appropriate warning note(s) on the title sheet of the plan. (e.g. **WARNING! PETROLEUM PIPELINE CROSSING**). Electrical lines can be seen in the field, so a note on the title sheet is not needed.

3.10.9. Miscellaneous

- Federal Project Number (top right corner)
  - If the project is state funded, put **STATE FUNDED** here. This information can be found on MnDOT's CHIMES database. This is only accessible by MnDOT staff. Designers should request this information from the District Signing Engineer.
- Governing Specifications
  - The MnDOT Standard Specifications for Construction are typically updated every five years. The version used by a project is based on the project letting date, which may be a future version. Verify the version with the District Signing Engineer.
- Project location with county(ies) and district indicated with a leader pointing to the approximate location within the state outline.

3.11. General Layout

General Layouts show where sheet cuts are located on a project and are used to help plan reviewers navigate the plan. General layouts are not typically required on signing plans along conventional roads. Exceptions include projects where the signing is replaced at isolated intersections rather than along a corridor or when a plan extends in multiple directions.

If included, general layout sheet(s) are placed after the title sheet and before the SEQ. See MnDOT's Design Scene for more guidance on general layouts.

3.11.1. North Arrow and Scale

Include a north arrow on all general layout sheets and scale the sheet(s) such that it is legible. If possible, it is ideal to fit the general layout on one sheet, however, to maintain readability, it is recommended that the scale not be greater than 1"=2000'. If multiple general layout sheets are used, use match lines and break lines. Similar to on layout sheets, it is best practice to show the scale under the north arrow.

3.11.2. Sheet Order

As noted in Section 3.3.2, sheets should generally be oriented such that the north arrow is rotated to point at an angle somewhere between up and right. Sheets also should be ordered according to the alignment, in the direction of increasing station number (typically from west to east or south to north).

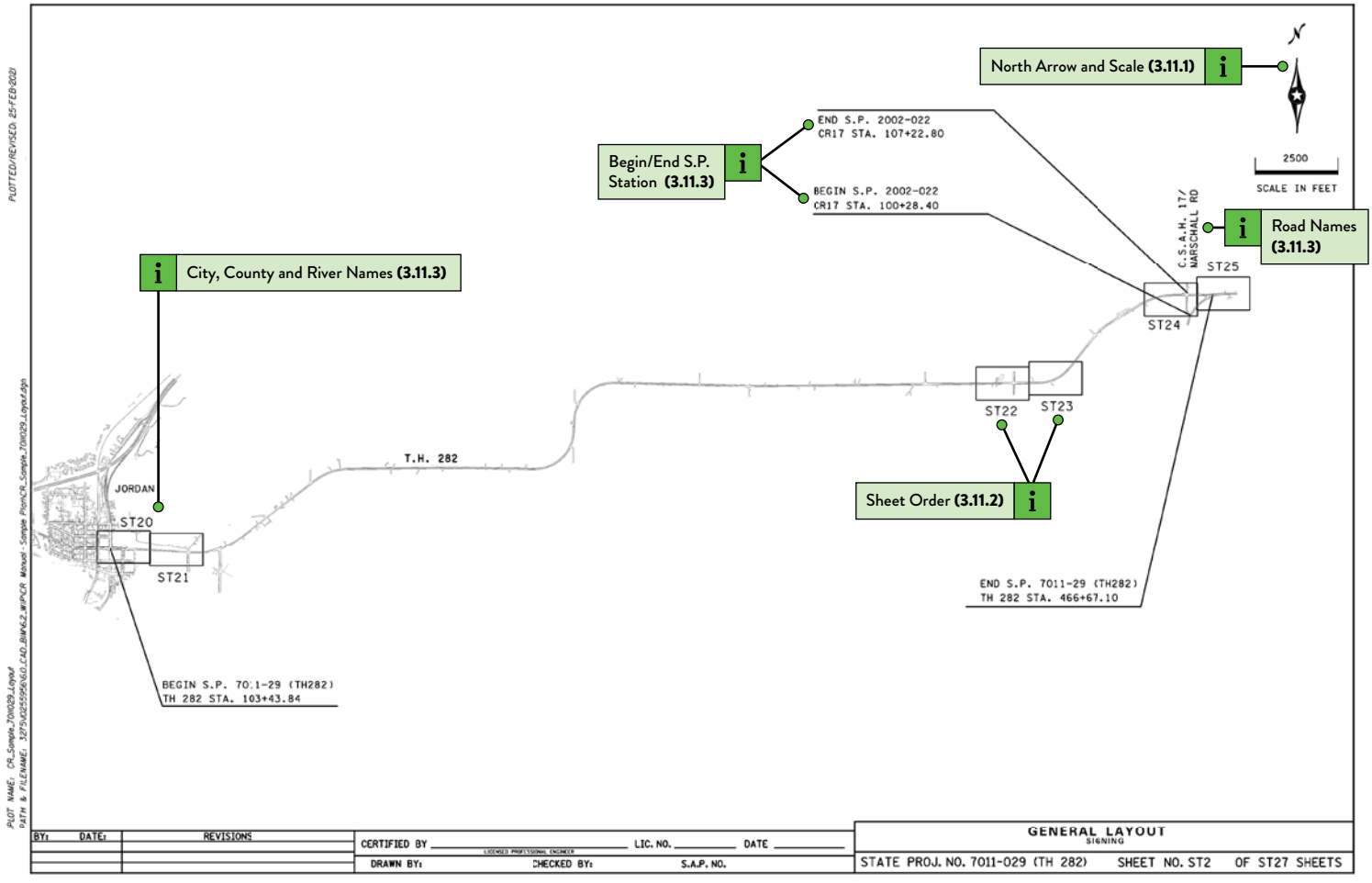
3.11.3. Callouts

On the General Layout, include callouts or labels for the following:

- Begin/end S.P. station
- Begin/end construction station
- Bridge numbers
- Road names (mainline and cross streets)
- Layout sheet boundaries and sheet numbers
- Include boundaries for insets if applicable
  - City, county and river names
- Areas of Environmental Sensitivity must be shown on the general layout to communicate that these areas are not to be impacted.

Figure 3.26: General Layout Components

i Link to additional information



DEPARTMENT OF TRANSPORTATION

CHAPTER 4

Special Provisions

4. Special Provisions

Discussion on the Standard Specifications for Construction in Minnesota (Spec Book) can be found in 2.8.3. MnDOT Standard Specifications for Construction and Special Provisions Webpages. Special provisions include additions and revisions to the Spec Book covering conditions specific to an individual project.

All special provisions related to signing, delineators and markers are placed in the Division ST document. Editable templates for Division ST documents can be found on the MnDOT Signing Design website. These templates are undergoing constant updates.

BEST PRACTICE:

✔ When starting to write the Division ST special provisions, designers should always use a current template taken from the MnDOT Signing Design website rather than editing a document from a past project.

ADDITIONAL GUIDANCE

The Division ST templates are organized into three provisions:

- ST-1 (2104) Removing Miscellaneous Structures
  - Focuses on actions and requirements to inplace devices.
- ST-2 (2564) Traffic Signs and Devices
  - Focuses on actions and requirements to new and reinstalled devices.
- ST-3 (3352) Square Tubular Sign Posts
  - Focuses on material requirements for new devices.

Each of these provisions contains the following sections:

- Description
- Materials
- Construction Requirements

Provisions ST-1 and ST-2 will also contain a Method of Measurement and Basis of Payment section.

If a spec writer adds a provision to the Division ST (this will be very rare), it must contain these four sections. Designers may reference MnDOT Specification Writer's Guide for more guidance:

The difference between the ST-2 and ST-3 sections is that the ST-2 section focuses on the installation of signs, delineators and markers and the ST-3 section focuses on material requirements of new signs, delineators and markers.

4.1. Editing the Division ST Templates

When editing Division ST templates, designers should reference the signing SEQ to identify items associated with the project. Items with a ".6##" suffix will require a special provision.

The Division ST templates may also contain recommended language associated with items that contain a ".5##" suffix. Language associated with these items is often associated with district specific options, a correction/update to the Spec Book or project specific needs. Designers should include language from the templates that applies to their project.

The template includes two types of highlighted text. Text highlighted in yellow provides guidance to the designer. Text highlighted in green refers to project-specific information that must be filled in. See Figure 4.1: Highlighted text in the Division ST templates for an example.

Designers should begin the development of the Division ST by updating the S.P. in the document header. Only the Prime S.P. should be shown. The next step is to read through the template, editing language to match the plans and removing provisions that do not apply to the project.

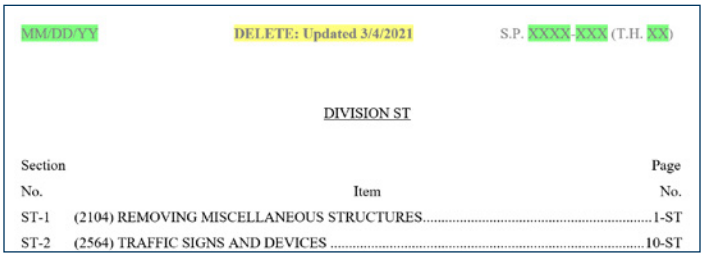
COMMONLY SEEN ERROR:

✖ Designers should be aware of the difference between the "...Sign" (or "Delineator" or "Marker") and the "...Sign Panel" (or "Delineator Panel" or "Marker Panel") items and associated actions. Items that exclude the "Panel" term pertain to the panel, sign base, supports and mounting hardware. In other words, the entire sign assembly. Items that include the "Panel" term only pertain to the panel and mounting hardware. Designers may reference the Signs, Markers and Delineators Pay Item Definitions for additional guidance.

BEST PRACTICE:

✔ Designers should request contact information from the District Signing Engineer for individuals named in the Division ST template. Common occurrences include personnel that supply warning stickers, provide field spotting of signs and SignCAD panel layouts. Metro District contacts are provided in the template.

Figure 4.1: Highlighted text in the Division ST templates


MM/DD/YY DELETE: Updated 3/4/2021 S.P. XXXX-XXX (T.H. XX)

DIVISION ST

Section No.	Item	Page No.
ST-1	(2104) REMOVING MISCELLANEOUS STRUCTURES	1-ST
ST-2	(2564) TRAFFIC SIGNS AND DEVICES	10-ST

4.1.1. Method of Measurement & Basis of Payment

The Method of Measurement and Basis of Payment section (see Figure 4.2: Method of Measurement & Basis of Payment Section of Division ST) will specify the units associated with items discussed in the Division ST. This section also contains a statement clarifying the work included with each item. The item(s) in this section must match the item(s) listed on the estimated quantity sheet in the Plan. Designers will typically leave these statements unchanged.

COMMONLY SEEN ERROR:

✖ The tables in the Method of Measurement & Basis of Payment section reflect items that are not in the Spec Book. Designers sometimes either leave this table unchanged or modify it to include all items in the plans. This list must be modified to only include items with provisions in the Division ST. The underscore at the end of each description in this table should remain as-is.

4.1.2. Special Installations

Several provisions in the Division ST templates discuss removals or installations on bridge rails and/or structures, light poles, signal poles and mast arms, etc. Should a project contain these conditions, designers should confirm that the Surface Type column in the tabulations contains the corresponding description. See Section 3.5.3 for more information.

4.2. As-Builts

As-Builts are not be included in the Division ST document. On projects with multiple disciplines, signing designers should let the individual writing the Division S specification know of the need to include provisions for signing.

On standalone signing projects, this provision is included, though it is placed in the Division S document.

ADDITIONAL GUIDANCE

In MnDOT Metro, the District Signing Engineer will typically arrange for the MnDOT Pre-Letting Office to write this section. However, some districts will have the Consultant prepare the Division S. Verify with the District Signing Engineer who will be responsible for this.

4.3. Time and Traffic Considerations:

On standalone signing projects, the designer should verify with the District Signing Engineer who is responsible for preparing the Time and Traffic provisions. In the MnDOT Metro district, construction typically prepares this. In other districts, it may be the designer's responsibility to prepare this. MnDOT construction should be included in the review of the plans and Time and Traffic Provisions.

Figure 4.2: Method of Measurement & Basis of Payment Section of Division ST

ST-2.3 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The Engineer will measure each item according to the Contract and the 2564, "Traffic Signs and Devices: Construction Requirements" section of these Special Provisions.

The Department will include all work described in the Contract and the 2564, "Traffic Signs and Devices: Construction Requirements" section of these Special Provisions as part of the contract unit price per unit of measure.

The Department will pay for traffic signs and devices on the basis of the following schedule:

Include only pay items that contain work specified in these special provisions.

Item No.:	Item:	Unit:
2564.502	Modify Post	Each
2564.502	Install Extruded Sign Panel	Each
2564.502	Install Sign Panel	Each
2564.502	Install Sign Panel Type Special	Each
2564.502	Extend Walkway Support	Each
2564.502	Friction Fuse	Each
2564.502	Keeper Plate	Each
2564.502	Delineator Type Special	Each
2564.510	Overhead Sign Structure Repair	Hour
2564.518	Sign Panels Type Special	Square Foot
2564.602	Install Sign Collar	Each

DEPARTMENT OF TRANSPORTATION

CHAPTER 5

Submittal Process

5. Submittal Process

5.1. Overview

The following milestones are typical for signing plans and are discussed in the following sections. This list follows the flowchart in Section 3.1 and is typical for standalone signing projects.

- Kickoff Meeting
- 30% Submittal (Inplace signing)
- 60% Submittal (Proposed signing)
- 90% Submittal (Tabulations)
- 100% Submittal
- Final Submittal

Submittals may vary slightly for projects with multiple disciplines. In many cases, signing isn't added to the plan until the 60% submittal. Verify with the District Signing Engineer early on if this is the case. Even if signing won't be submitted at 30%, designers are encouraged to contact the District Signing Engineer at the start of the project to clarify the scope and identify any project specific details and district preferences. Even if it won't be included in the 30% submittal, designers should perform the sign inventory at the start of the project and send it to the District Signing Engineer.

COMMONLY SEEN ERROR:

✖ On projects with multiple disciplines, signing plans are occasionally not submitted to the District Signing Engineer until the 90% submittal. This does not provide adequate opportunity for review. To reduce risk of plan changes late in the project, designers must include signing in the 60% and subsequent submittals.

Design checklists for each submittal are provided for each of the submittal phases and can be found at MnDOT's Design website.Also noted in the following sections is typical design unit coordination and utility coordination that is typically needed prior to or at that submittal phase.

5.2. Kickoff Meeting

Designers are encouraged to discuss the project's impacts on signing at the beginning of the project in a kickoff meeting. On standalone signing projects, this is required. During this meeting, make sure everyone's role on project is discussed. Also discuss data management, communication protocols, file transfer, project protocols and points of contact.

COMMONLY SEEN ERROR:

✖ These meetings are often missed on projects with multiple disciplines or when external parters design the plan.

5.2.1. Kickoff Meeting Checklist

A Kickoff Meeting Checklist, which lists typical data requests by project type, as well as questions that should be discussed, should be brought to the kickoff meeting. See Section 3.1 for more background and information on data requests.

5.3. 30% Submittal

The 30% submittal is the first submittal stage for some projects. On multi-discipline projects, signing may not be required per the scope at 30%, however, designers are encouraged to include signing at 30% for review, especially on longer corridors with a relatively high amount of signing and when the geometry isn't changing. If not included in the scope or if it is unclear, check with the District Signing Engineer when finalizing the project's scope or contract.

The 30% plan includes inplace signing layouts on the roadway and the sign locations. Also shown on the plan is the current mapping (topography), existing alignment, right of way and inplace pavement markings (if available). See Section 3.3.3 for more information on inplace roadway layouts.

30% plans may also include designer notes that prompt discussion at the 30% Review Meeting. See Section 3.3.5 for more information. These notes should not be included after the 30% submittal.

After the District Signing Engineer has reviewed the 30% submittal, a 30% comment resolution meeting between the signing designer and District Signing Engineer is recommended. At this meeting, inplace signing will be discussed, along with a replacement strategy.

BEST PRACTICE:

✔ Notes recommending whether a sign should be removed, salvaged or left inplace should be added to inplace signs presented in the 30% submittal. These recommendations will be confirmed or revised during the replacement strategy discussion at the 30% Review Meeting. While not required, if all signs are to be replaced, these notes may not be needed.

5.3.1. 30% Design Checklist

30% Design Checklists can be found on MnDOT's Design website.

5.3.2. 30% Design Unit Coordination

On projects with multiple disciplines, it will be important to know which inplace signs will be impacted by the project. Coordinate with the appropriate design units and the project manager to understand the work being completed, along with the impacts to existing infrastructure.

Identify early on if there is another construction project that overlaps with yours and coordinate with the other project regularly. See Section 3.1.11 for more information. See Section 3.1 for other data requests and coordination needed in the project.

5.4. 60% Submittal

The 60% plan includes complete and accurate placement of inplace signs and proposed signs. These will have the correct locations and sign panel layouts with notes indicating what actions is required for each sign. Notes typically relate to the associated pay item. For instance, Note 1 is associated with Furnishing and Installing a Sign. If the density of signs and utilities on shared plan sheets appear too cluttered, the signing and utility elements can be separated into separate signing roadway layout sheets and utility roadway layout sheets in the plan.

This submittal also includes sign panel layouts of custom signs. The plan should also include utilities shown on the plan sheets. If the density of signs and utilities on shared plan sheets appear too cluttered, the signing and utility elements can be separated into separate signing roadway layout sheets and utility roadway layout sheets in the plan. Sign panel design layouts, including the SignCAD® files, are also included in this submittal.

An option to fast-track project could be to submit panels prior to 60% so they can be reviewed and approved sooner. Check with District Signing Engineer if this is an option that should be considered. See Section 3.3.6 for more information on proposed roadway layouts.

Designer recommendations for the proposed signing will be discussed at the 60% Comment Resolution Meeting.

5.4.1. 60% Design Checklist

60% Design Checklists can be found on MnDOT's Design website.

5.4.2. 60% Design Unit Coordination

Ongoing coordination, including with other design units and construction, should continue to take place as discussed in Section 3.1. On projects with multiple disciplines, continue to coordinate with other disciplines to identify impacts to signs. Also continue to coordinate with other projects that overlap with yours.

Pavement markings can influence where signs are placed, for example, no passing zone signs and turn lane signs. See Section 3.1.16 for further discussion on pavement marking coordination.

BEST PRACTICE:

- ✔ Once the 60% plans are complete, the plans should be routed to local agencies for review and comment. Coordinate with the project manager or District Signing Engineer on who will be organizing this effort.

5.5. 90% Submittal

The 90% submittal includes a complete signing plan (see plan components listed in Section 3.2.1), Division ST Special Provisions (see Chapter 4), and an Engineer's Estimate (see Section 3.9.2). The plan should include a level of detail that the Certifying Engineer is comfortable signing. It should not include missing elements of the design.

5.5.1. 90% Design Checklist

90% Design Checklists can be found on MnDOT's Design website.

5.5.2. 90% Design Unit Coordination

Ongoing coordination with others, including construction, as discussed in the previous sections should continue through the 90% submittal. This may be the last chance to verify references and that staging and plans reflect what was agreed to. Additionally, the 90% plan should be routed to local agencies for verification of changes.

5.6. 100% Submittal

Comments received from the 90% review are incorporated into the 100% submittal documents. This is the final opportunity for the district to review the submittal documents before they go to Central Office for review. The only changes required after the 90% submittal should be to resolve comments from the 90% plan review.

ADDITIONAL GUIDANCE

Some districts refer to this as a 95% submittal.

5.6.1. 100% Design Checklist

100% Design Checklists can be found on MnDOT's Design website.

5.6.2. 100% Submittal Documents

100% submittal documents typically include:

- Plan (PDF)
- Division ST (PDF and Word)
- Engineer's Estimate (PDF and Excel)
  - Discuss the method of transmittal for this document with the District Signing Engineer; do not email this.
  - On reconstruction projects the overall estimate should be consolidated and sent to the individual assigned to receive the document (the project manager)

BEST PRACTICE:

- ✔ It is recommended that the title sheet be submitted to MnDOT's pre-letting group for review at the 90% submittal. This will reduce risk of changes after signatures are added after the final submittal.

5.7. Final Submittal

5.7.1. Final Submittal Documents

Final submittal documents typically include:

- Final (Signed) Plan (PDF)
- Final (Signed) Division ST (signed PDF and Word)
- Engineer's Estimate (PDF and Excel)
  - Submitted separately as discussed in Section 5.6.2
- Engineering Justification Memo (signed PDF)
- Quality Control Check Process Forms
- MicroStation Files into MnDOT ProjectWise.
  - References should be hard copied into one file to avoid the issue of breaking references.
- SignCAD files
- Plan Title sheet
  - Should be submitted separately from the plan due to signatures, as discussed in Section 3.10.

COMMONLY SEEN ERROR:

✖ SignCAD® files should always be submitted to the District for incorporation into TAMS. The district may also choose to provide these files to the contractor. However, the Contractor is responsible for fabrication and the designs should be based off the plans in the contract, not the SignCAD® files.

5.7.2. MnDOT Project Manager Responsibilities

MnDOT Project Managers are responsible for preparing and submitting the Submittal Memo to the Pre-Letting Office. This document includes the PM Utility Certification form, and any CEF or PIF findings, among others. The designer may be asked to assist with some of these items.

MnDOT Project Managers are also responsible for verifying that all documents have been received from external partners, and that all databases listed on the 100% checklist have been updated.

DEPARTMENT OF TRANSPORTATION

CHAPTER 6

Class Exercises

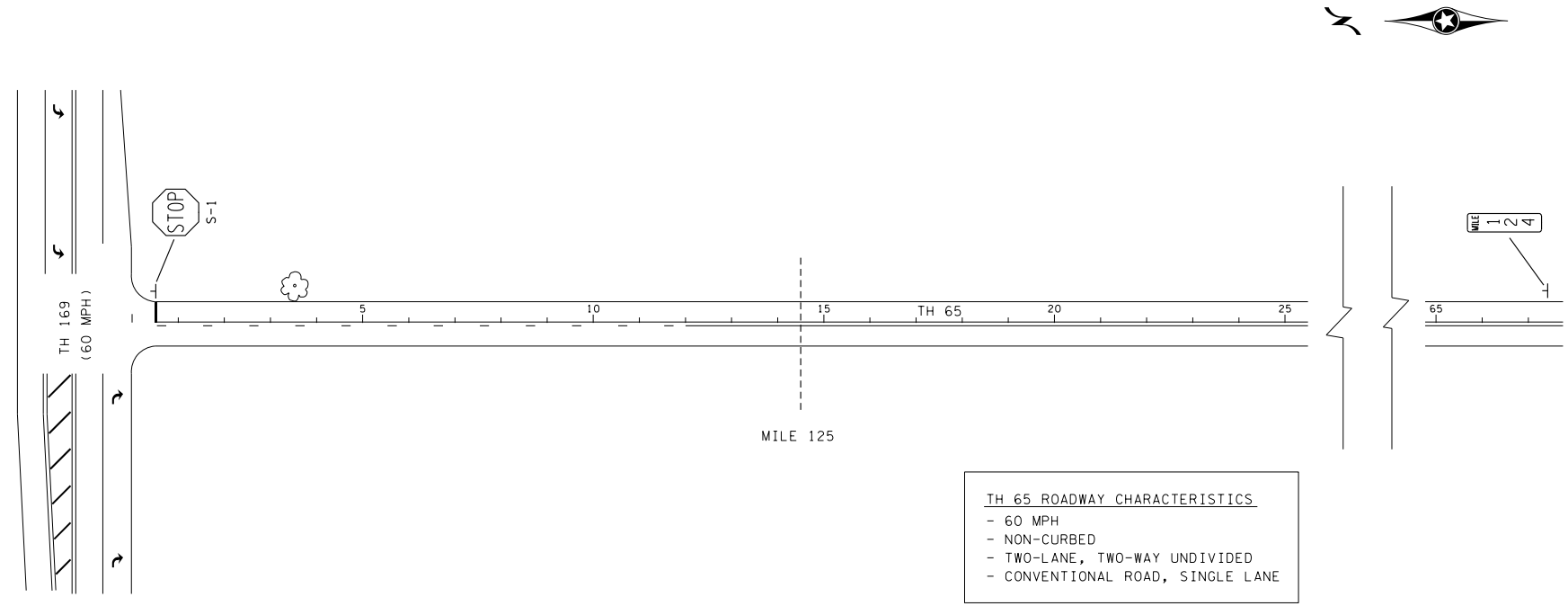
EXAMPLE PROBLEM 1

CR-SL, Non-Curbed, Stop-Controlled Intersection Signing

Q1: WHAT IS THE MINIMUM SIZE REQUIRED FOR THE STOP SIGN (S-1)?

- A1: 30″x30″
- A2: 36″x36″
- A3: 48″x48″

Q1



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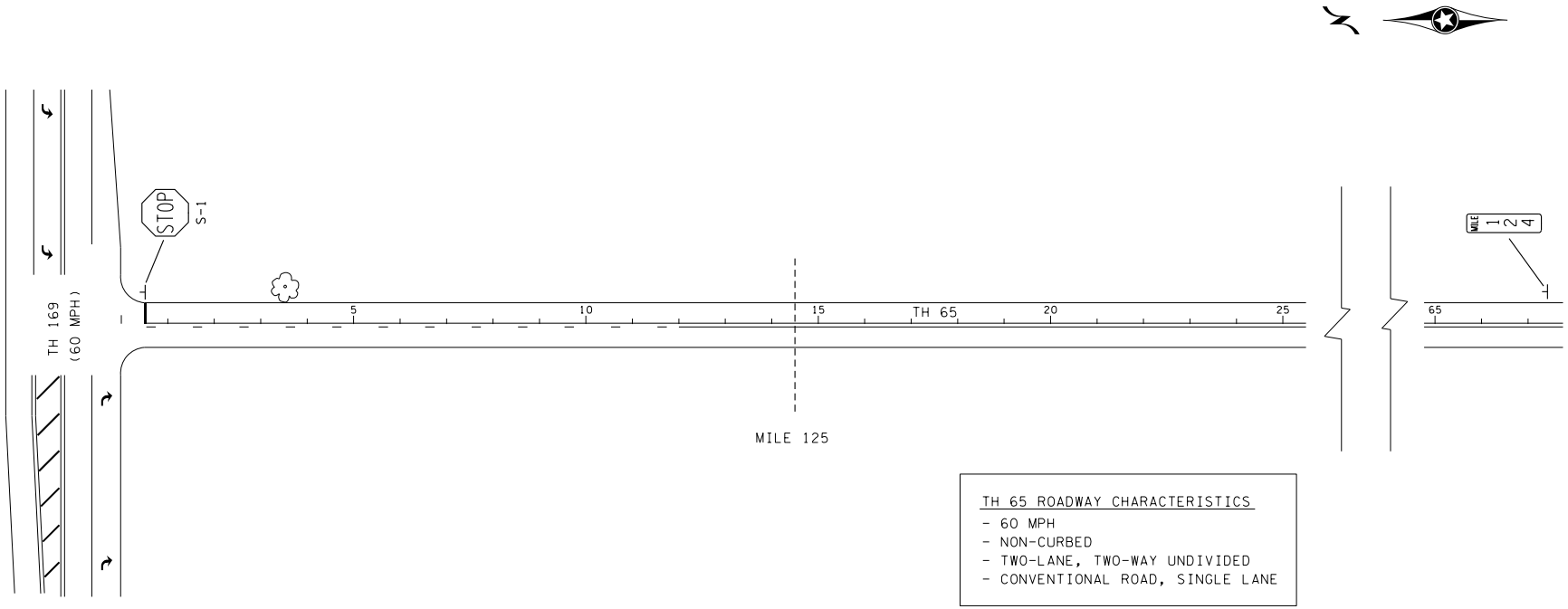
ANSWER Q1



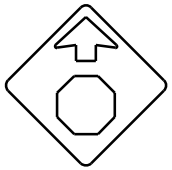
REFERENCE: ***Standard Signs & Marking Summary Sign R1-1***

- Intersecting highway (TH 169) has multi-lane approaches and side road (TH 65) has a speed limit higher than 45 mph. Minimum is 36” x 36”, even though side road (TH 65) only has one approach lane and classifies as conventional roadway – single lane.

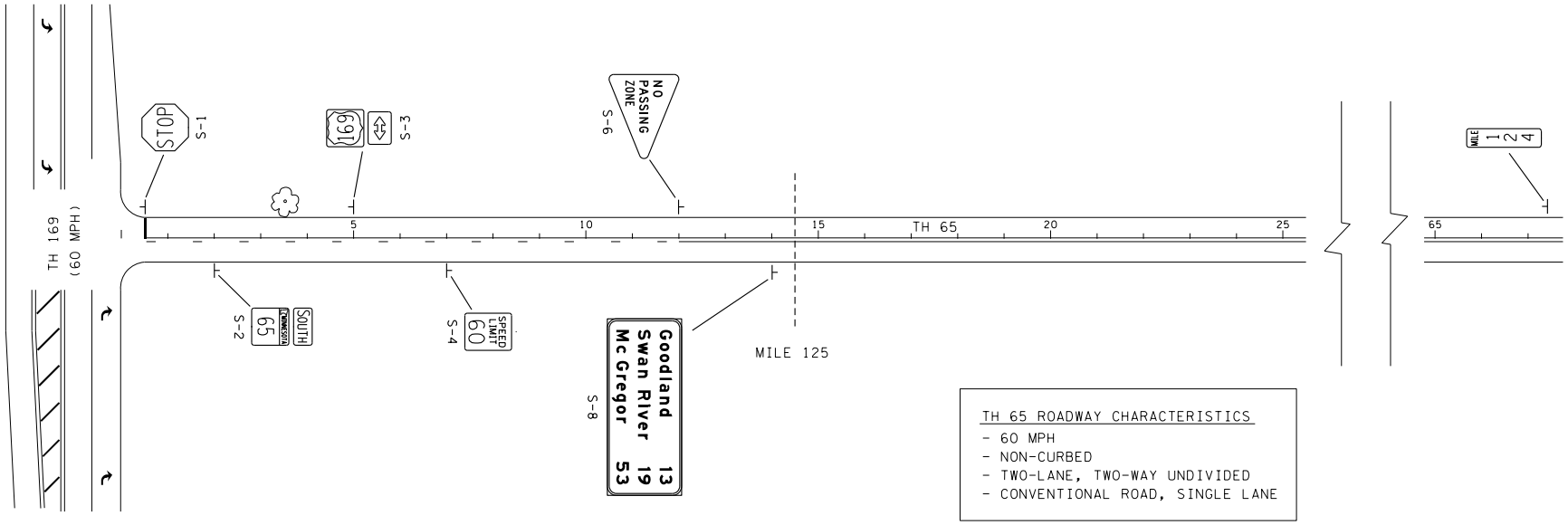
CR-SL, Non-Curbed, Stop-Controlled Intersection Signing

Q2: SIGHT DISTANCE TO STOP SIGN FOR NB APPROACHING VEHICLE IS 300'. IS STOP AHEAD WARNING SIGN NECESSARY? IF SO, AT WHAT STATION SHOULD IT BE PLACED?

- A1: No, not needed
- A2: Yes, Sta. 7+00
- A3: Yes, Sta. 8+00



Q2



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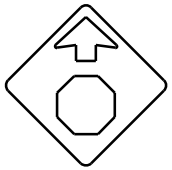
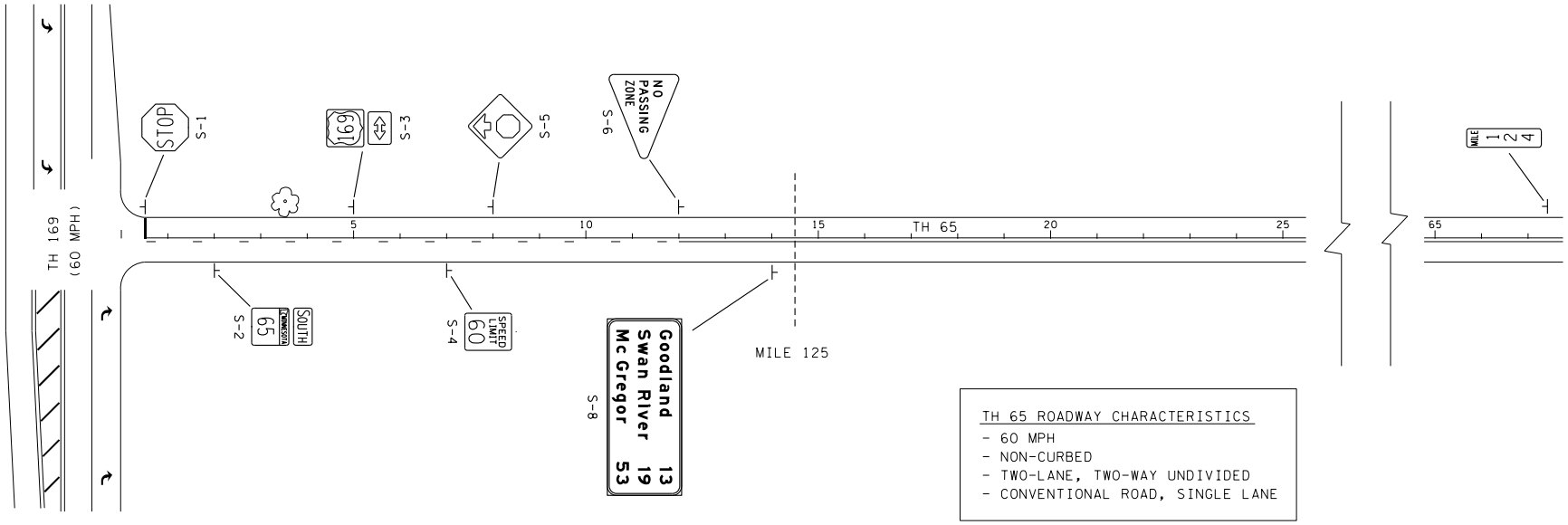


ANSWER **Q2**



REFERENCE: ***MN MUTCD Table 2C-4, TEM Figure 6.24A***

- Minimum advance warning distance for 60 mph roadway deceleration to 0 mph (stop condition) is 400'.
- Not enough advance warning to stop sign, stop ahead warning sign is needed.
- Per Figure 6.24A, spacing between route marker directional assembly and stop ahead sign is 300', sign should be placed at Sta. 8+00.

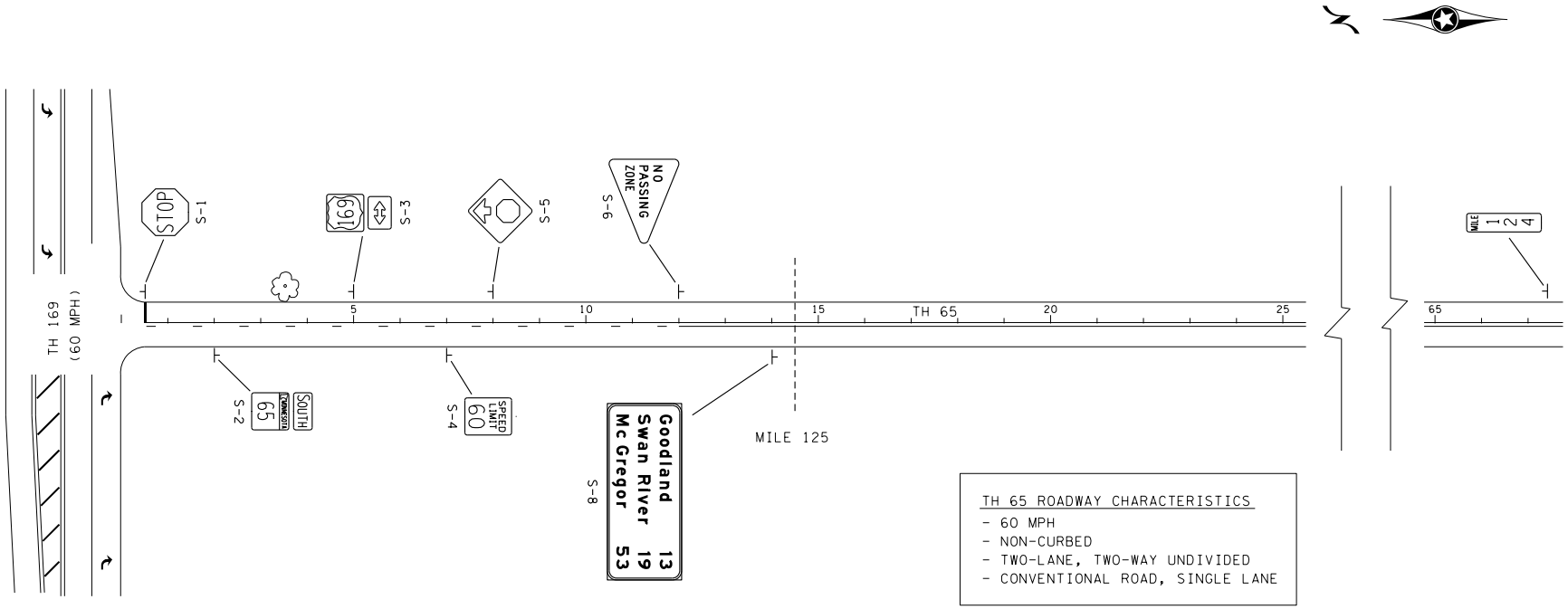
EXAMPLE PROBLEM 1

CR-SL, Non-Curbed, Stop-Controlled Intersection Signing

Q3: WHERE SHOULD THE NB GRAND RAPIDS/HIBBING DESTINATION SIGN BE PLACED?

- A1: Sta. 10+00
- A2: Sta. 11+00
- A3: Sta. 13+00

Q3



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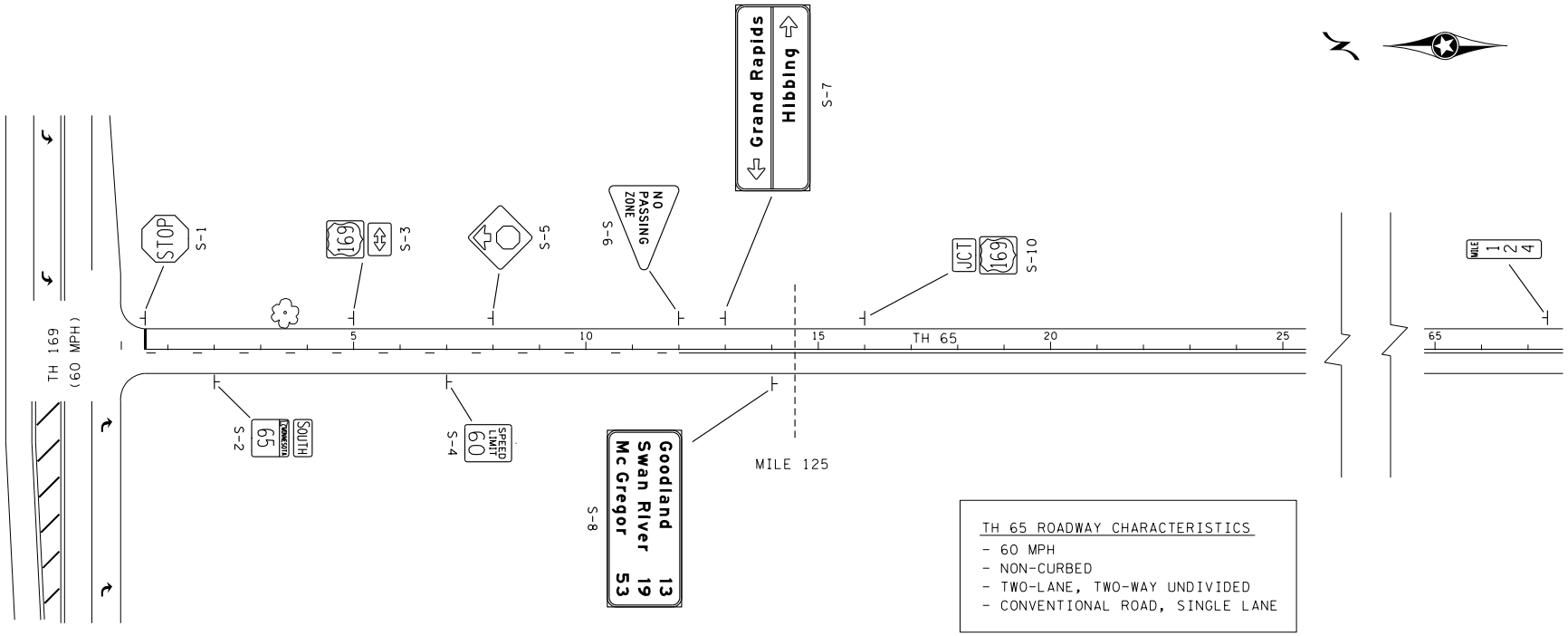
ANSWER Q3



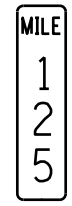
REFERENCE: ***TEM Figure 6.24A***

- Per Figure 6.24A, spacing between stop ahead and destination guide sign is 300', which would put the sign at Sta. 11+00. However, sign would be obstructed by No Passing Zone sign at Sta. 11+00.
- Place sign south of No Passing Zone sign. Sta. 13+00 is best option.

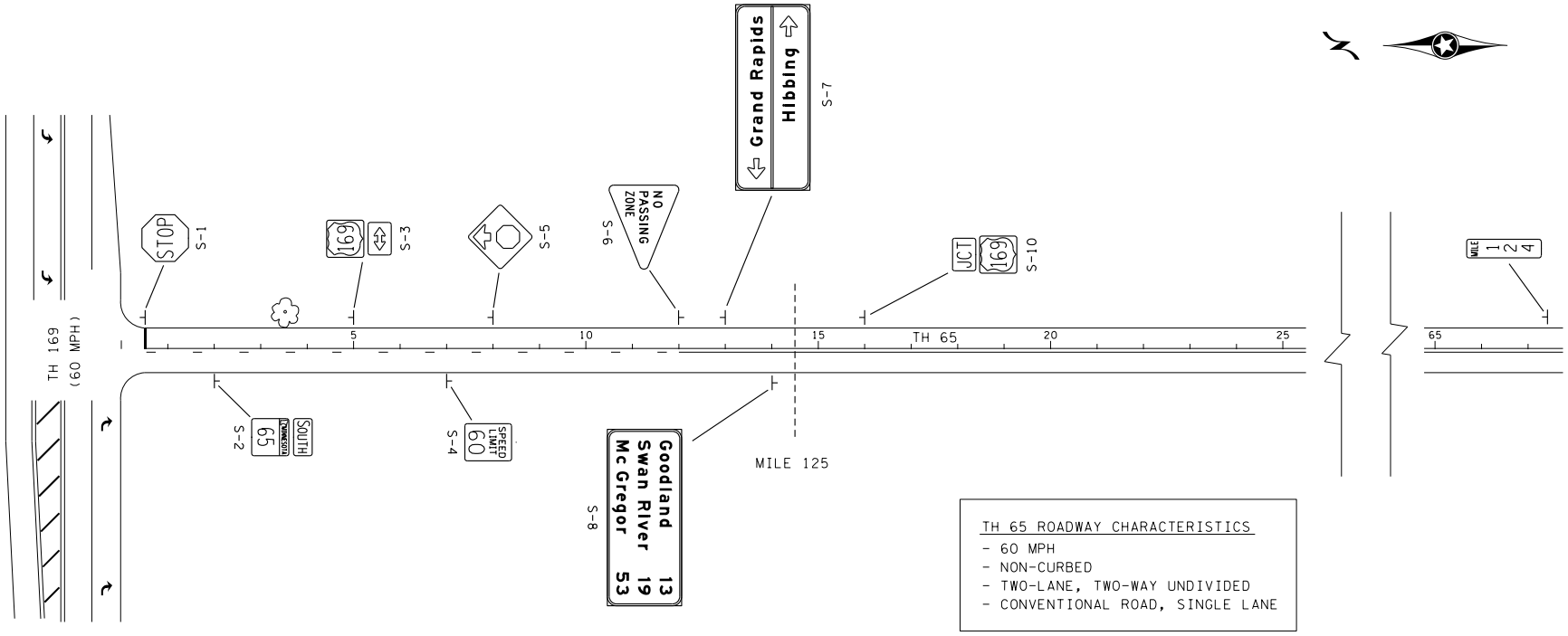
CR-SL, Non-Curbed, Stop-Controlled Intersection Signing

Q4: WHERE SHOULD THE MILE 125 EB & WB REFERENCE LOCATION SIGNS BE PLACED?

- A1: Sta. 14+50, Back-to-back on east side of TH 65
- A2: Sta. 14+50, Back-to-back on west side of TH 65
- A3: Sta. 14+50, On separate posts on east and west side of TH 65
- A4: Below adjacent EB & WB guide signs



Q4



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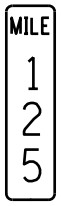
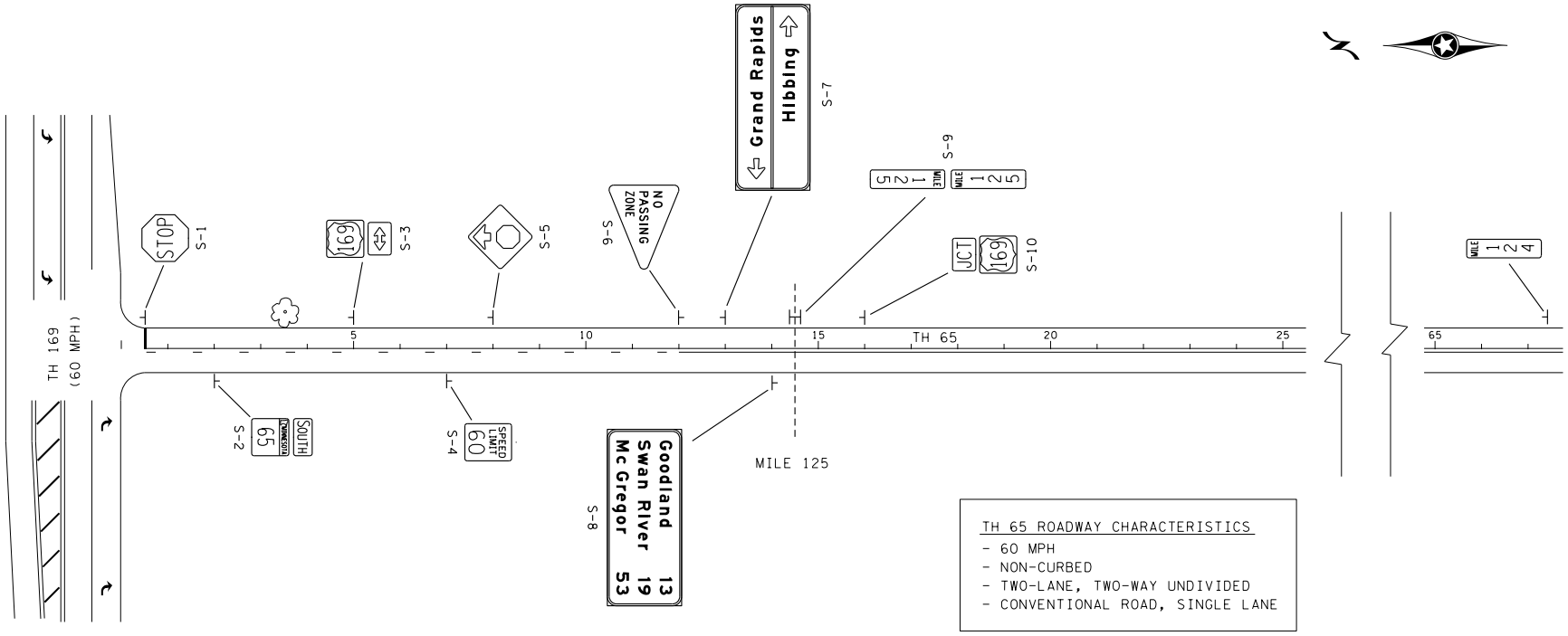


ANSWER Q4



REFERENCES: ***MN MUTCD Section 2H.5, TEM Section 6-8.05***

- Per MUTCD, on two-lane conventional roadways, reference location signs may be installed back-to-back on one side of the roadway only.
- Per TEM, Reference Location Sign shall be installed within six feet of its correct location (Mile 125 reference point).
- Standard practice is to place Reference Location signs on right side of roadway of increasing distance numbering (mile 124 < mile 125).

CR-SL, Non-Curbed, Stop-Controlled Intersection Signing

Q5: THE LOCAL AGENCY DESIRES STREET NAME SLATS INSTALLED AT THE INTERSECTION. WHERE DOES MNDOT PREFER THEY BE PLACED?

- A1: Above stop sign
- A2: On separate post in same quadrant as stop sign (SE Quad)
- A3: On separate post in quadrant opposite stop sign (SW Quad)

EXAMPLE PROBLEM 1

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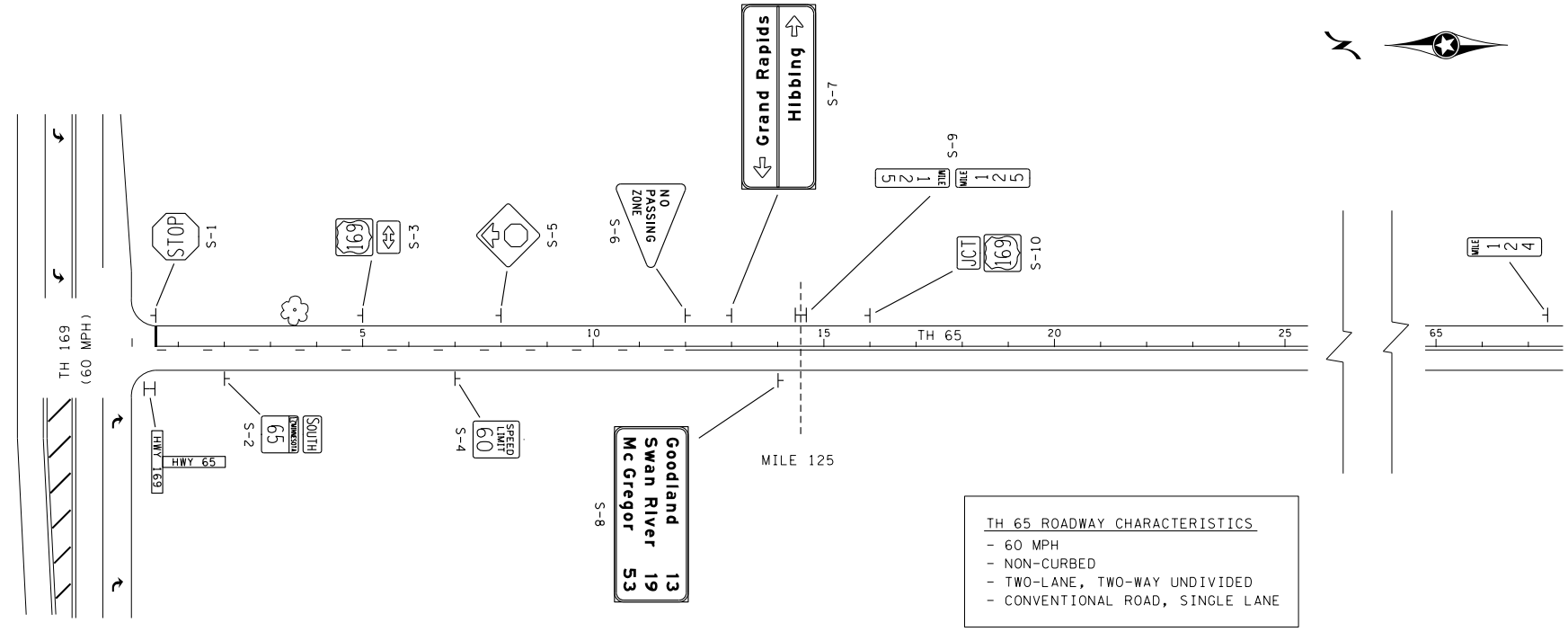
ANSWER Q5



REFERENCE: ***TEM Section 6-7.06.02.02***

- Street name signs, slat style, should be mounted in street corners opposite of stop signs.

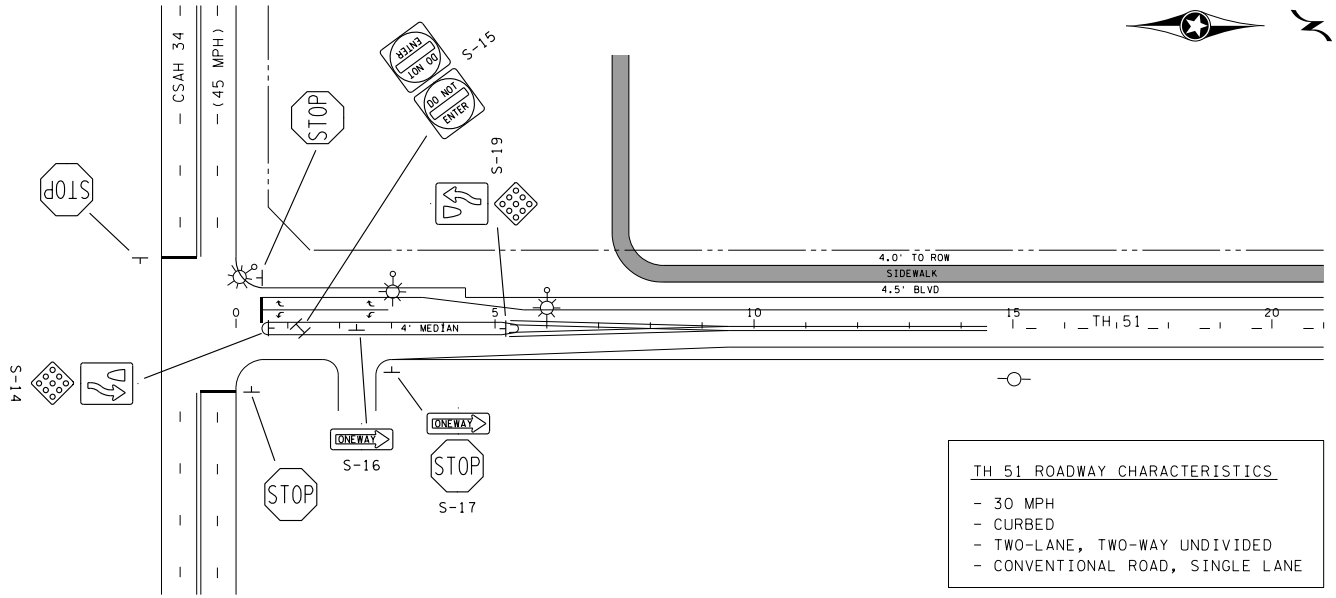
EXAMPLE PROBLEM 2

CR-SL, Curbed, Stop-Controlled Intersection Signing

Q1: THIS INTERSECTION HAS STOP CONTROL FOR ALL THREE APPROACHES. WHAT SIGN GOES UNDERNEATH STOP SIGNS?

- A1: R1-2AP "To oncoming traffic" sign
- A2: R1-3 "Three-way" sign
- A3: R1-4P "All-way" sign

Q1



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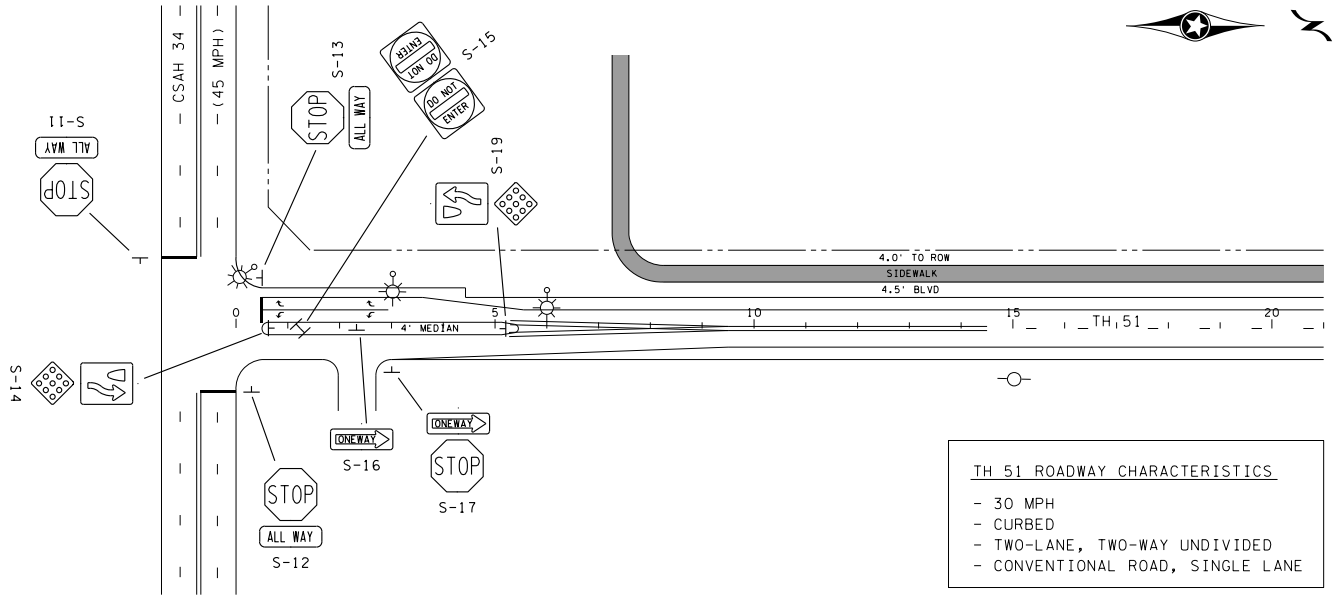
ANSWER Q1



REFERENCE: ***MN MUTCD Section 2B.5***

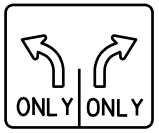
- Per MUTCD, at intersections where all approaches are controlled by stop signs, an ALL WAY supplemental plaque shall be mounted below each stop sign. Supplemental plaques with legends such as 2-WAY, 3-WAY, 4-WAY shall not be used with stop signs.

EXAMPLE PROBLEM 2

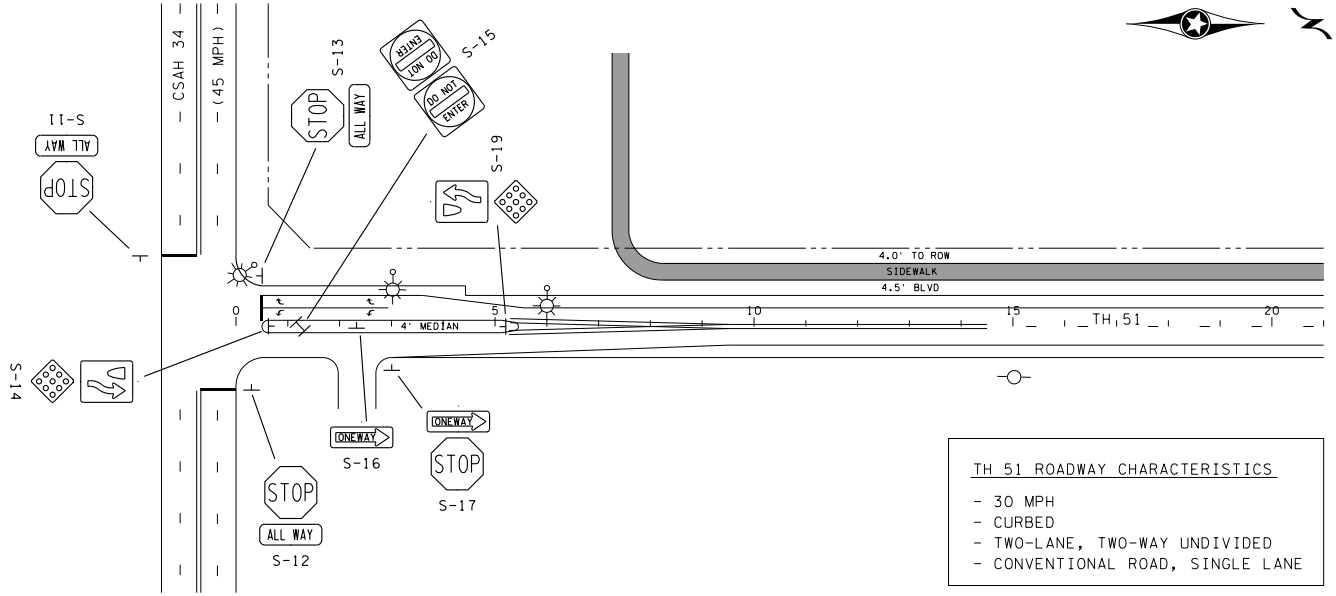
CR-SL, Curbed, Stop-Controlled Intersection Signing

Q2: WHERE SHOULD R3-8AA (LEFT ONLY, RIGHT ONLY) LANE DESIGNATION SIGN BE PLACED?

- A1: At full width turn lane location (Sta. 3+50)
- A2: At beginning of taper (Sta. 5+50)
- A3: On light pole at Sta. 6+00
- A4: At Sta. 6+50



Q2



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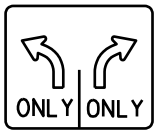
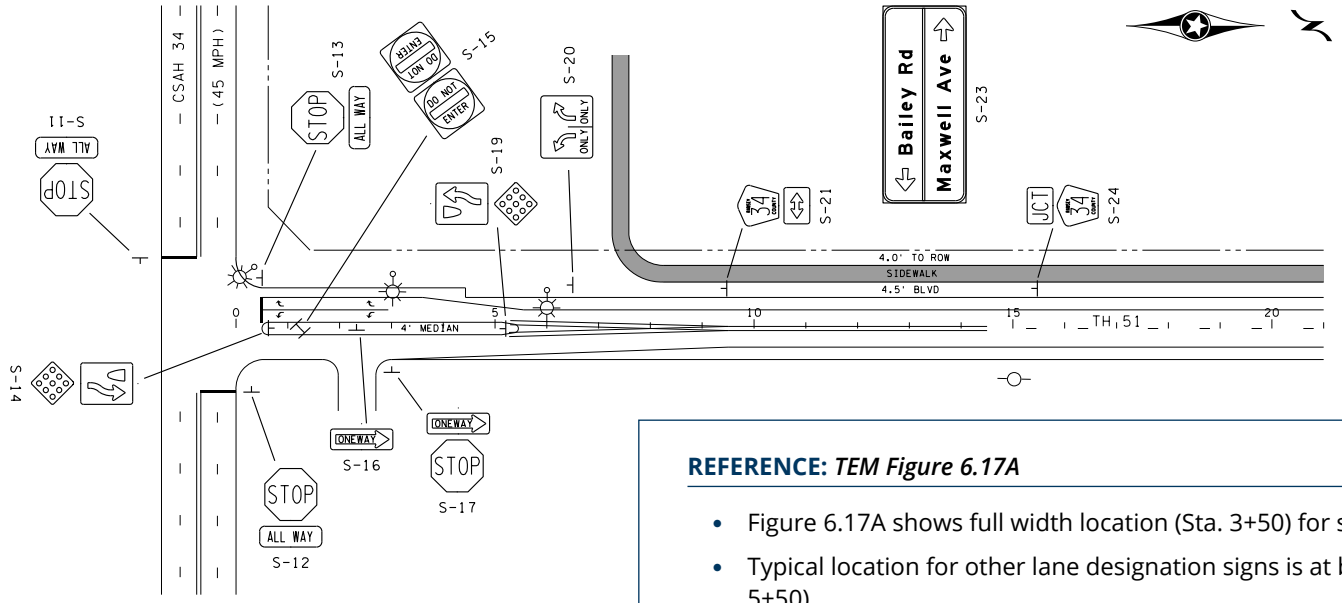
Q2: WHERE SHOULD R3-8AA (LEFT ONLY, RIGHT ONLY) LANE DESIGNATION SIGN BE PLACED?

- **A1:** At full width turn lane location (Sta. 3+50) *or*
- A2: At beginning of taper (Sta. 5+50)
- A3: On light pole at Sta. 6+00
- **A4:** At Sta. 6+50



ANSWER **Q2**



REFERENCE: ***TEM Figure 6.17A***

- Figure 6.17A shows full width location (Sta. 3+50) for sign placement.
- Typical location for other lane designation signs is at beginning of taper (Sta. 5+50).
- Light pole obstruction a concern for both locations-Sign panels attached to MnDOT light poles compromise breakaway function of the poles. Therefore, no signs are allowed on breakaway light poles unless local agency light pole vendor allows for signs to be placed on light pole.
- Station 6+50 is optimal location based on previous bullet points, but Station 3+50 would also be acceptable.

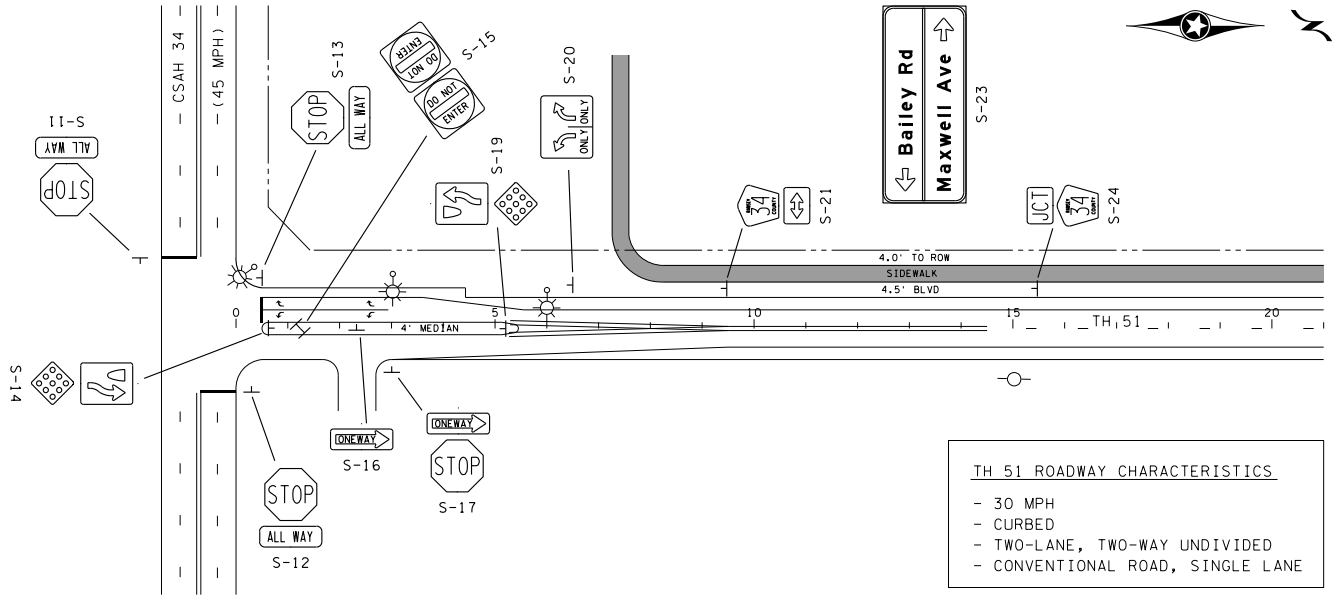
EXAMPLE PROBLEM 2

CR-SL, Curbed, Stop-Controlled Intersection Signing

Q3: WHERE SHOULD THE 9' WIDE ADVANCE STREET NAME DIRECTIONAL SIGN (S-23) BE PLACED?

- A1: In 4.5' boulevard at Sta. 12+50
- A2: On backside of sidewalk at Sta. 12+50
- A3: Omit sign
- A4: Move to lane designation location and move lane designation sign to 3+50

Q3



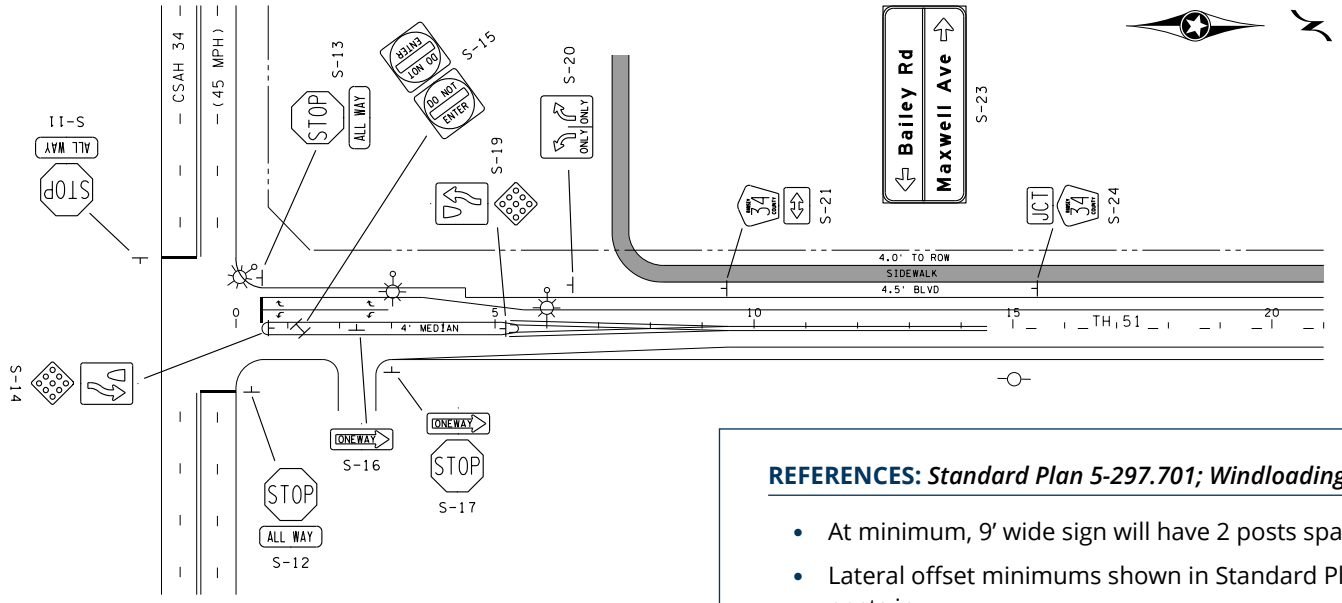
EXAMPLE PROBLEM 2

CR-SL, Curbed, Stop-Controlled Intersection Signing

Q3: WHERE SHOULD THE 9' WIDE ADVANCE STREET NAME DIRECTIONAL SIGN (S-23) BE PLACED?

- A1: In 4.5' boulevard at Sta. 12+50
- A2: On backside of sidewalk at Sta. 12+50
- **A3:** Omit sign *or*
- **A4:** Move to lane designation location and move lane designation sign to 3+50

ANSWER Q3



REFERENCES: ***Standard Plan 5-297.701; Windloading Chart***

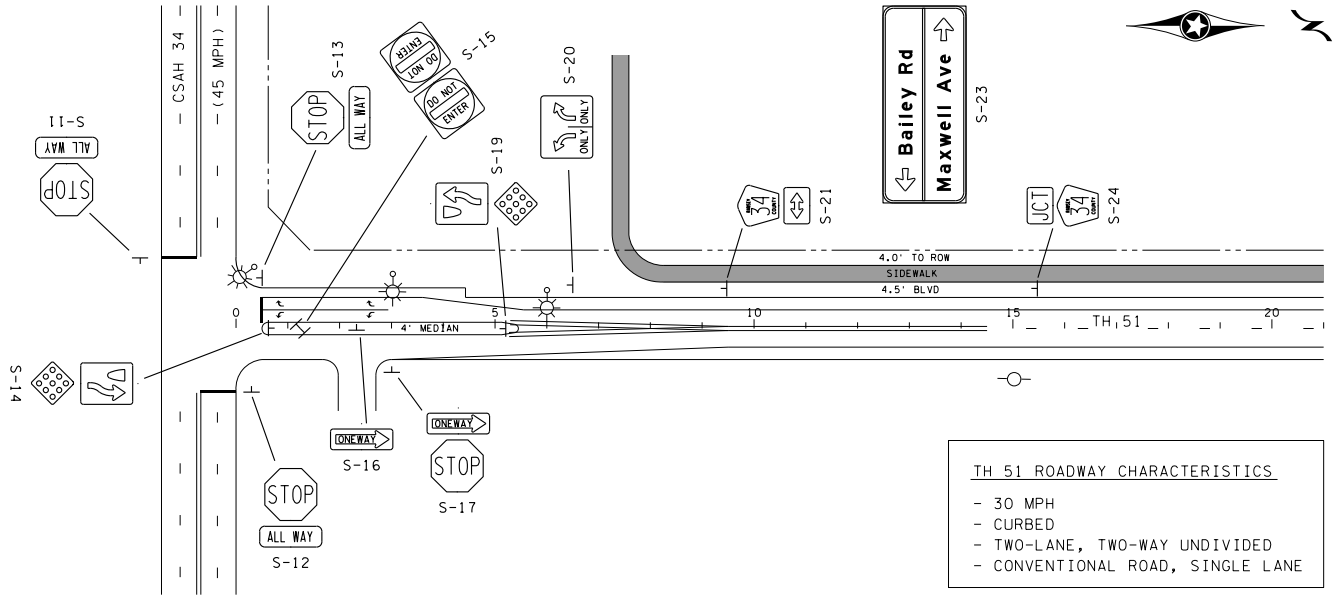
- At minimum, 9' wide sign will have 2 posts spaced 54" apart.
- Lateral offset minimums shown in Standard Plan not met for 4.5' wide posts in 4.5' boulevard or 4' green area between sidewalk and ROW line.
- Sign could be omitted via engineering judgement due to inadequate green space for installation.
- Per solution notes from Question 2, sign could be moved to lane designation location and lane designation sign relocated to Sta. 3+50.

CR-SL, Curbed, Stop-Controlled Intersection Signing

Q4: WHERE SHOULD NB NORTH TH 51 CONFIRMATORY ROUTE MARKER ASSEMBLY BE PLACED?

- A1: At Sta. 1+00
- A2: At Sta. 2+00
- A3: At Sta. 5+00

Q4



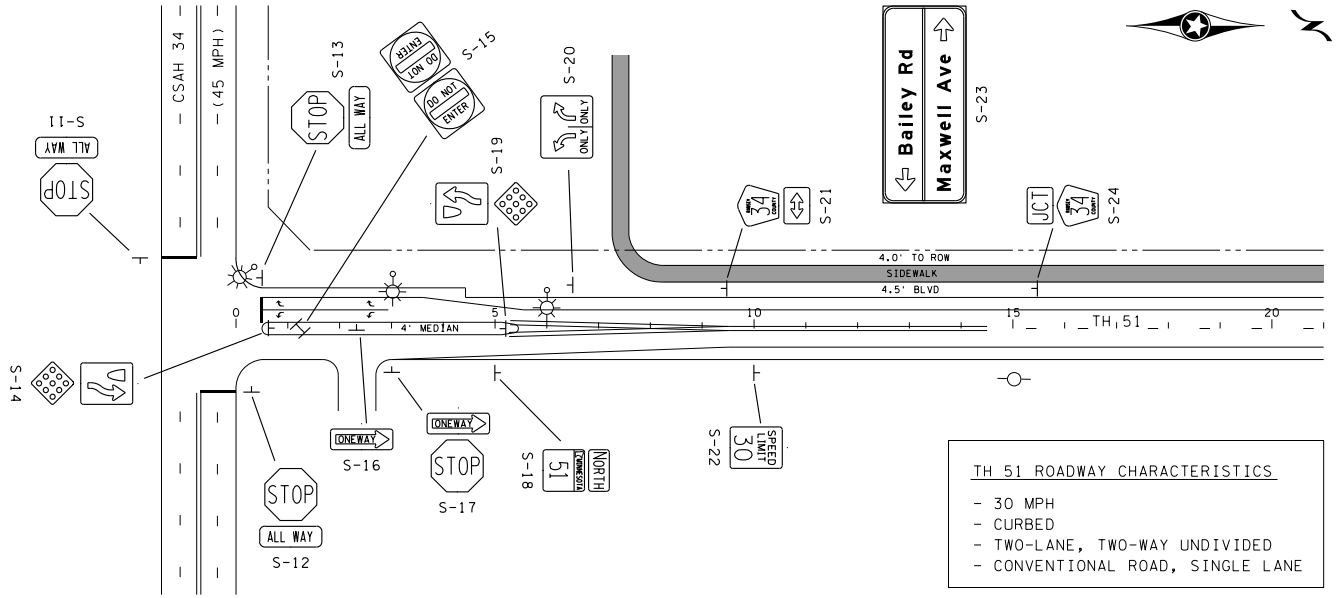
EXAMPLE PROBLEM 2

CR-SL, Curbed, Stop-Controlled Intersection Signing

Q4: WHERE SHOULD NB NORTH TH 51 CONFIRMATORY ROUTE MARKER ASSEMBLY BE PLACED?

- A1: At Sta. 1+00
- A2: At Sta. 2+00
- **A3:** At Sta. 5+00

ANSWER Q4



REFERENCE: ***TEM Figure 6.24A***

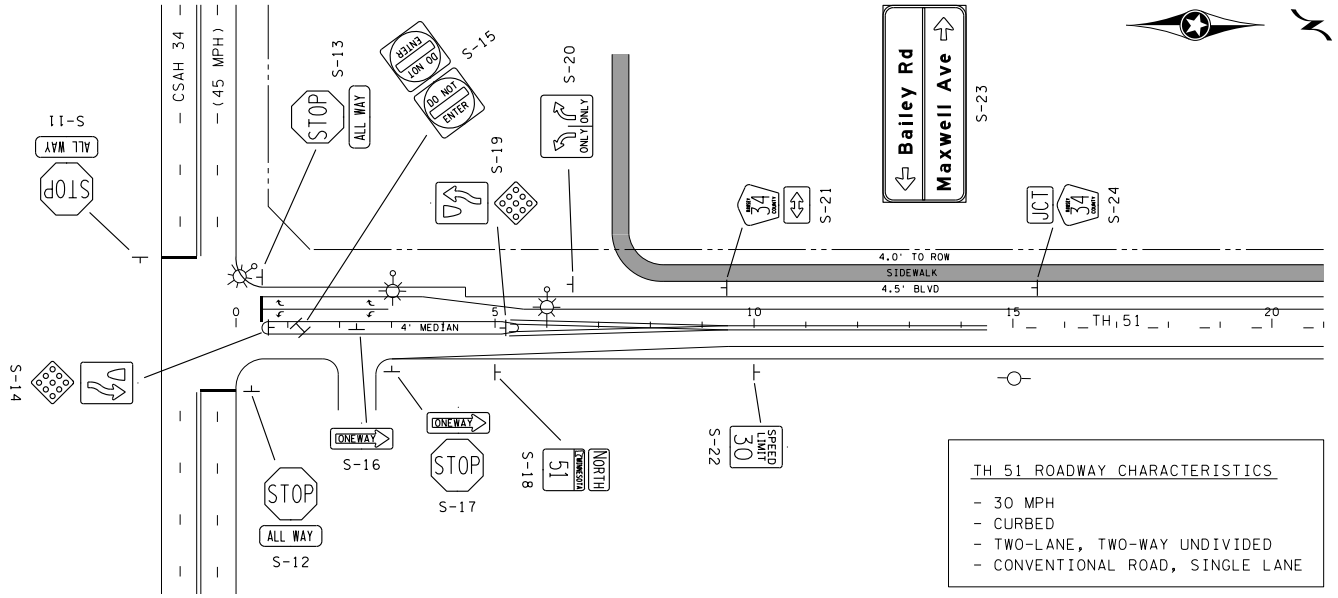
- Per TEM, recommended confirmatory route marker placement is 200' from edge of intersecting roadway. 200' (Sta. 2+00) would place the sign in the driveway.
- Station 5+00 is best option for placement.

CR-SL, Curbed, Stop-Controlled Intersection Signing

Q5: THERE IS A NON-BREAKAWAY, UNPROTECTED UTILITY POLE 6' BEHIND CURB AT STA. 15+00. WHAT TYPE OF SIGN SHOULD BE USED TO MARK OBSTRUCTION FOR NB TRAFFIC?

- A1: OM 1-2 object marker
- A2: OM3-L object marker
- A3: OM3-R object marker
- A4: No sign needed

Q5



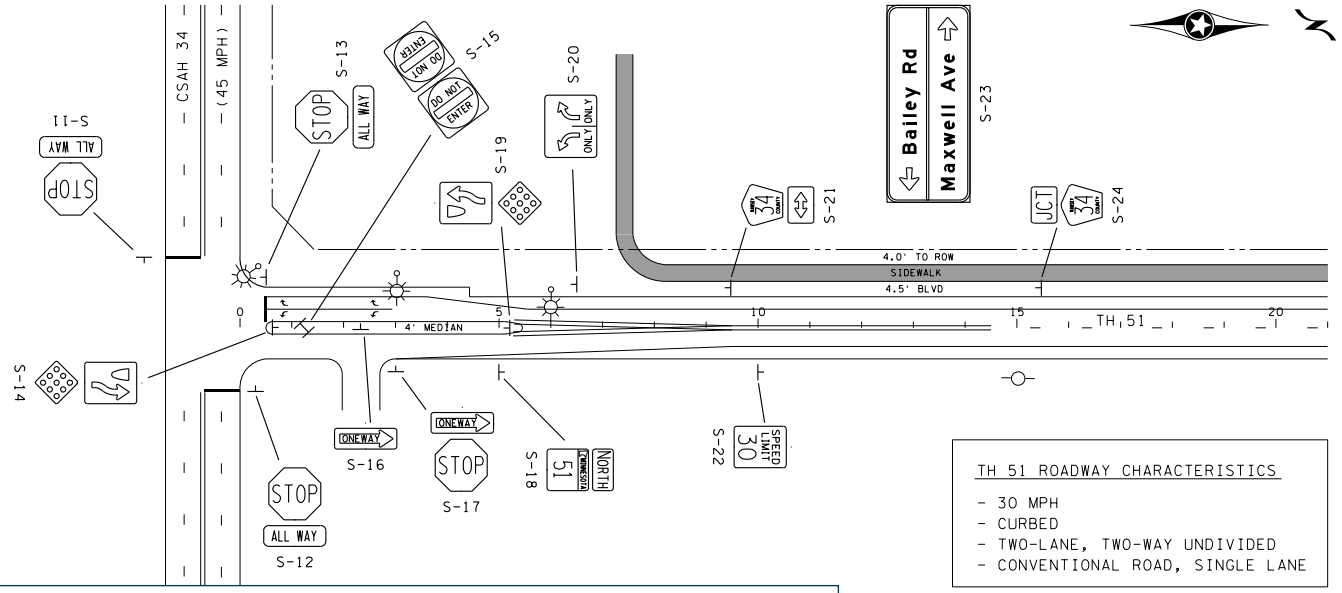
EXAMPLE PROBLEM 2

CR-SL, Curbed, Stop-Controlled Intersection Signing

Q5: THERE IS A NON-BREAKAWAY, UNPROTECTED UTILITY POLE 6' BEHIND CURB AT STA. 15+00. WHAT TYPE OF SIGN SHOULD BE USED TO MARK OBSTRUCTION FOR NB TRAFFIC?

- A1: OM 1-2 object marker
- A2: OM3-L object marker
- A3: OM3-R object marker
- **A4:** No sign needed

ANSWER Q5



REFERENCE: ***Standard Plan 5-297.702***

- Per Standard Plan leader note with Obstruction Type 3 Object Marker detail, pole should be marked with an object marker since it is less than 8' from paved surface. However, since TH 51 is curbed roadway, object marker is not needed since utility pole is more than 2' from face of curb.

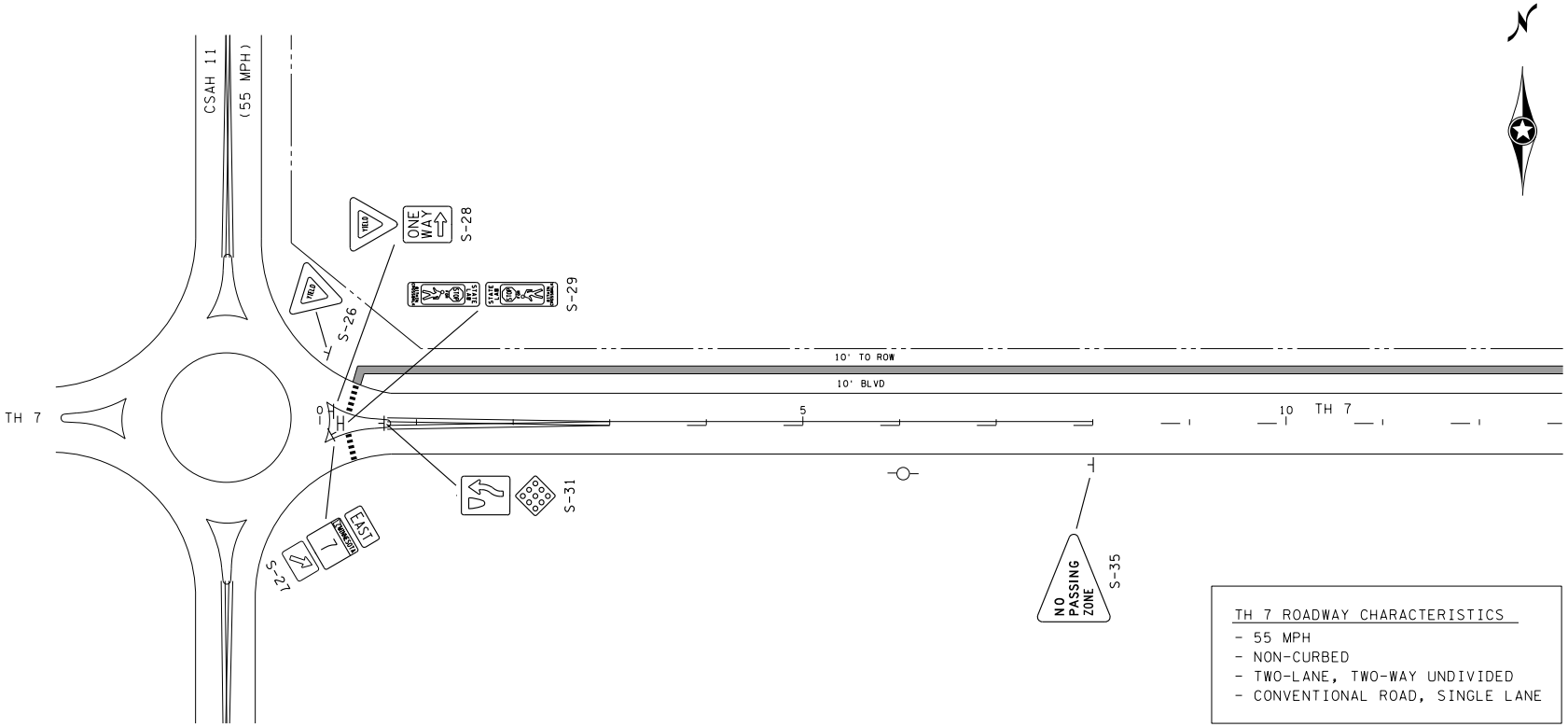
EXAMPLE PROBLEM 3

CR-SL, Non-Curbed, Roundabout Signing

Q1: WHAT WARNING SIGNS ARE REQUIRED AT THE PEDESTRIAN CROSSING?

- A1: W11-2 Ped crossing and W16-7P 45 deg down arrow at roundabout entrance
- A2: W11-2 Ped crossing and W16-7P 45 deg down arrow at roundabout exit
- A3: Both A1 & A2
- A4: None

Q1



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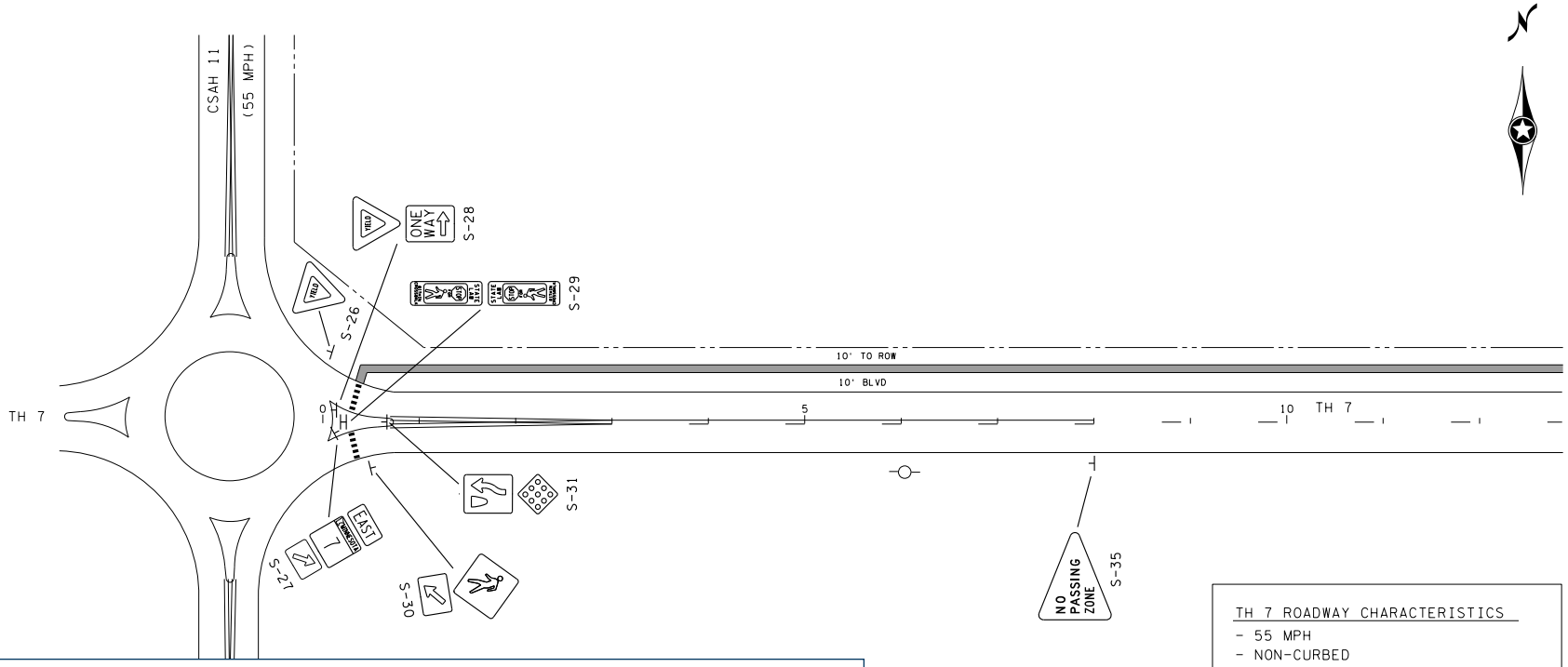
- A3: Both A1 & A2
- A4: None

ANSWER Q1



REFERENCE: ***TEM Figure 6.27***

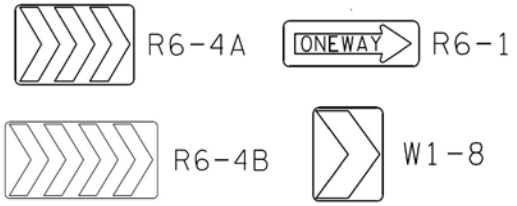
- Figure 6.27 shows Ped Crossing and 45 Deg Down Arrow at Roundabout Exit- Ped Crossing sign not desirable for this application at Roundabout Entrance as it will likely obstruct yield sign.

EXAMPLE PROBLEM 3

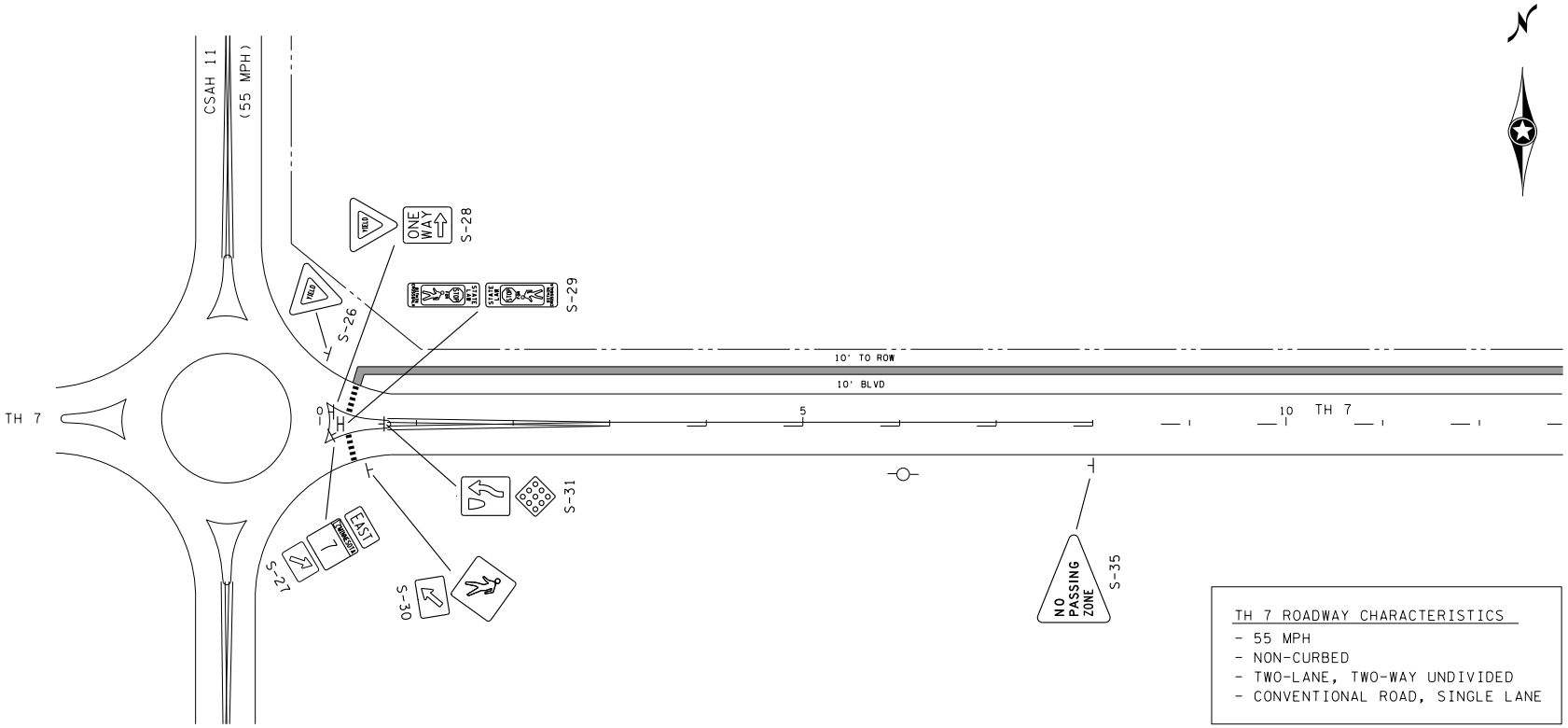
CR-SL, Non-Curbed, Roundabout Signing

Q2: WHAT SIGN(S) ARE PLACED IN THE ROUNDABOUT CENTRAL ISLAND?

- A1: R6-4A Roundabout directional
- A2: R6-4B Roundabout directional
- A3: R6-1 One-way and R6-4A roundabout directional
- A4: R6-1 One-way and R6-4B roundabout directional
- A5: W1-8 Chevron



Q2



EXAMPLE PROBLEM 3

CR-SL, Non-Curbed, Roundabout Signing

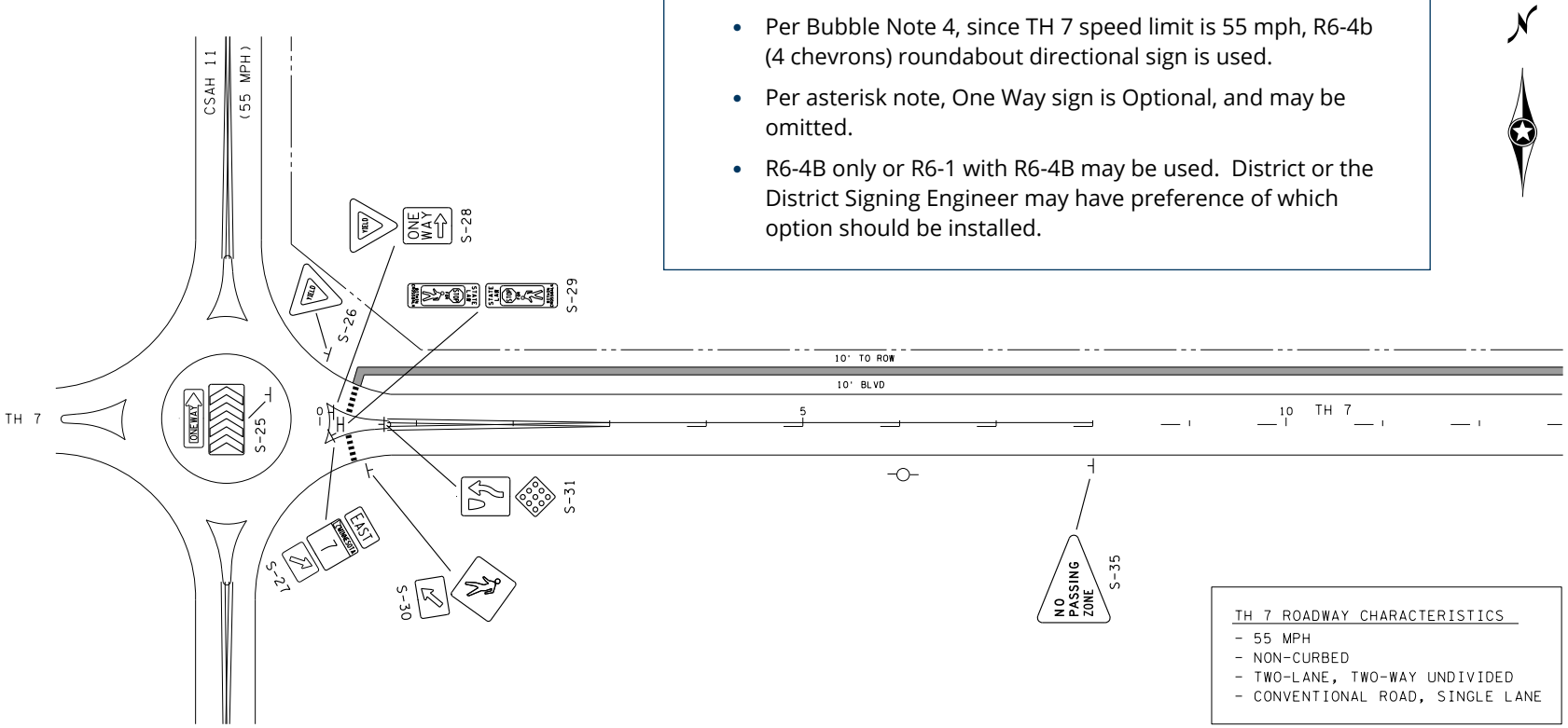
Q2: WHAT SIGN(S) ARE PLACED IN THE ROUNDABOUT CENTRAL ISLAND?

- A1: R6-4A Roundabout directional
- **A2:** R6-4B Roundabout directional *or*
- A3: R6-1 One-way and R6-4A roundabout directional
- **A4:** R6-1 One-way and R6-4B roundabout directional
- A5: W1-8 Chevron

ANSWER Q2

REFERENCE: ***TEM Figure 6.27***

- Figure 6.27 identifies Roundabout Directional sign as required sign in center median of roundabout.
- Per Bubble Note 4, since TH 7 speed limit is 55 mph, R6-4b (4 chevrons) roundabout directional sign is used.
- Per asterisk note, One Way sign is Optional, and may be omitted.
- R6-4B only or R6-1 with R6-4B may be used. District or the District Signing Engineer may have preference of which option should be installed.

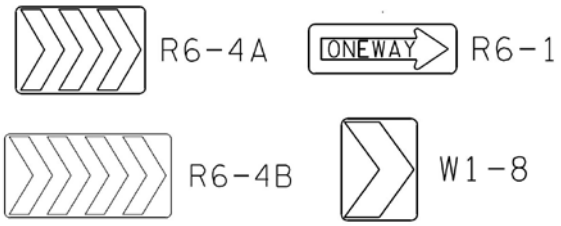


EXAMPLE PROBLEM 3

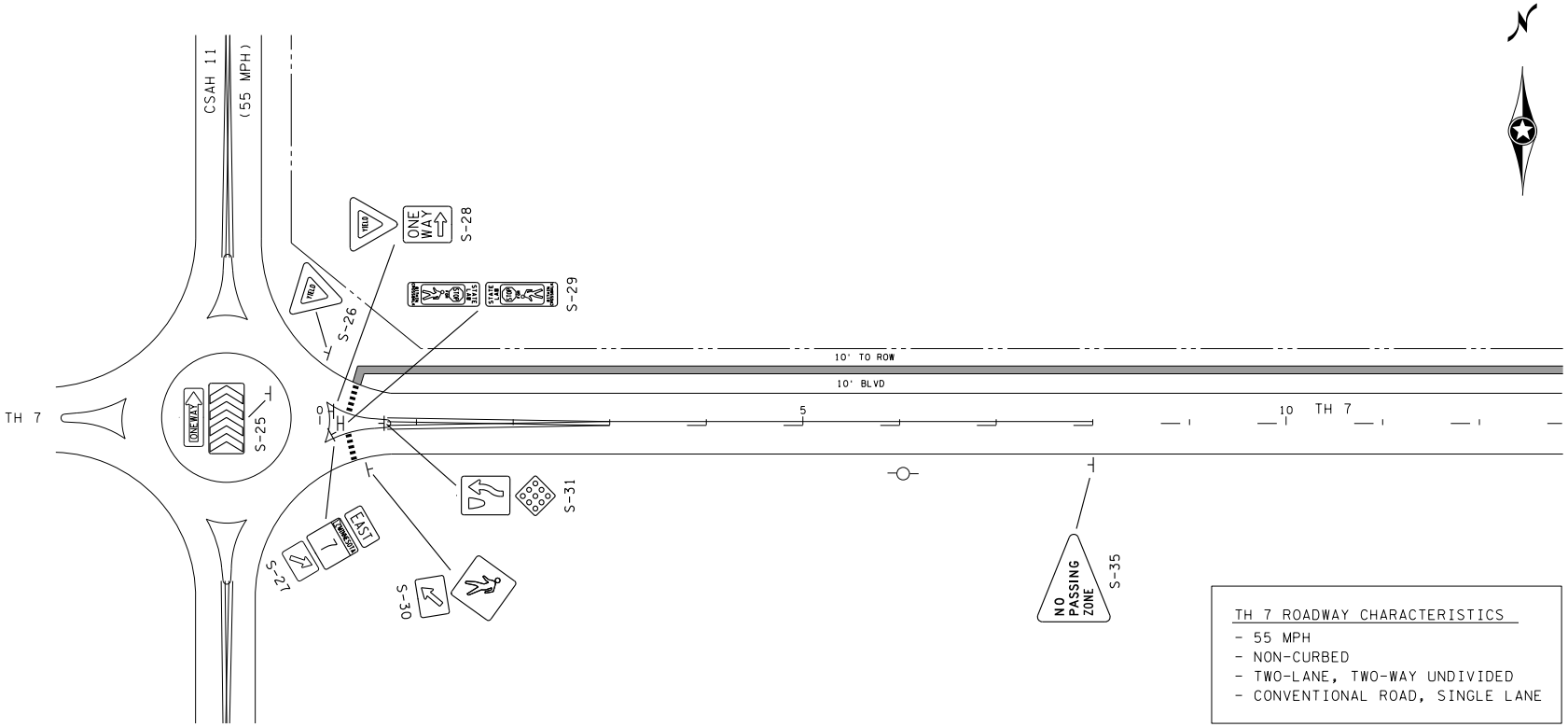
CR-SL, Non-Curbed, Roundabout Signing

Q3: IF THIS WERE A MINI-ROUNDABOUT WHAT SIGN(S) ARE PLACED IN THE ROUNDABOUT CENTRAL ISLAND?

- A1: R6-4A Roundabout directional
- A2: R6-4B Roundabout directional
- A3: R6-1 One-way
- A4: W1-8 Chevron
- A5: None



Q3



CR-SL, Non-Curbed, Roundabout Signing

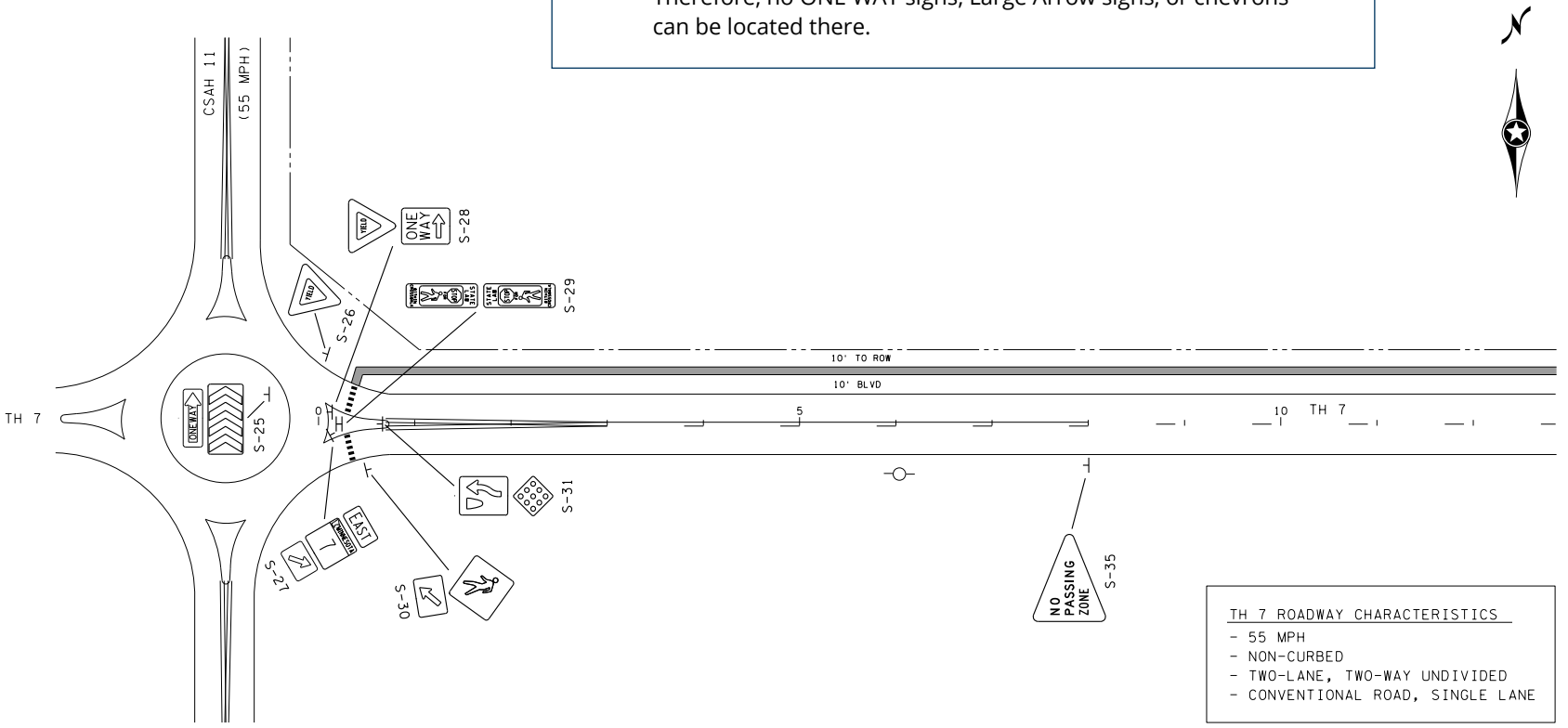
Q3: IF THIS WERE A MINI-ROUNDABOUT WHAT SIGN(S) ARE PLACED IN THE ROUNDABOUT CENTRAL ISLAND?

- A1: R6-4A Roundabout directional
- A2: R6-4B Roundabout directional
- A3: R6-1 One-way
- A4: W1-8 Chevron
- **A5:** None

ANSWER Q3

REFERENCE: ***FHWA Roundabouts: An Informational Guide Section 7.1.7***

- The central island of a mini-roundabout is fully mountable. Therefore, no ONE WAY signs, Large Arrow signs, or chevrons can be located there.

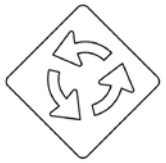


EXAMPLE PROBLEM 3

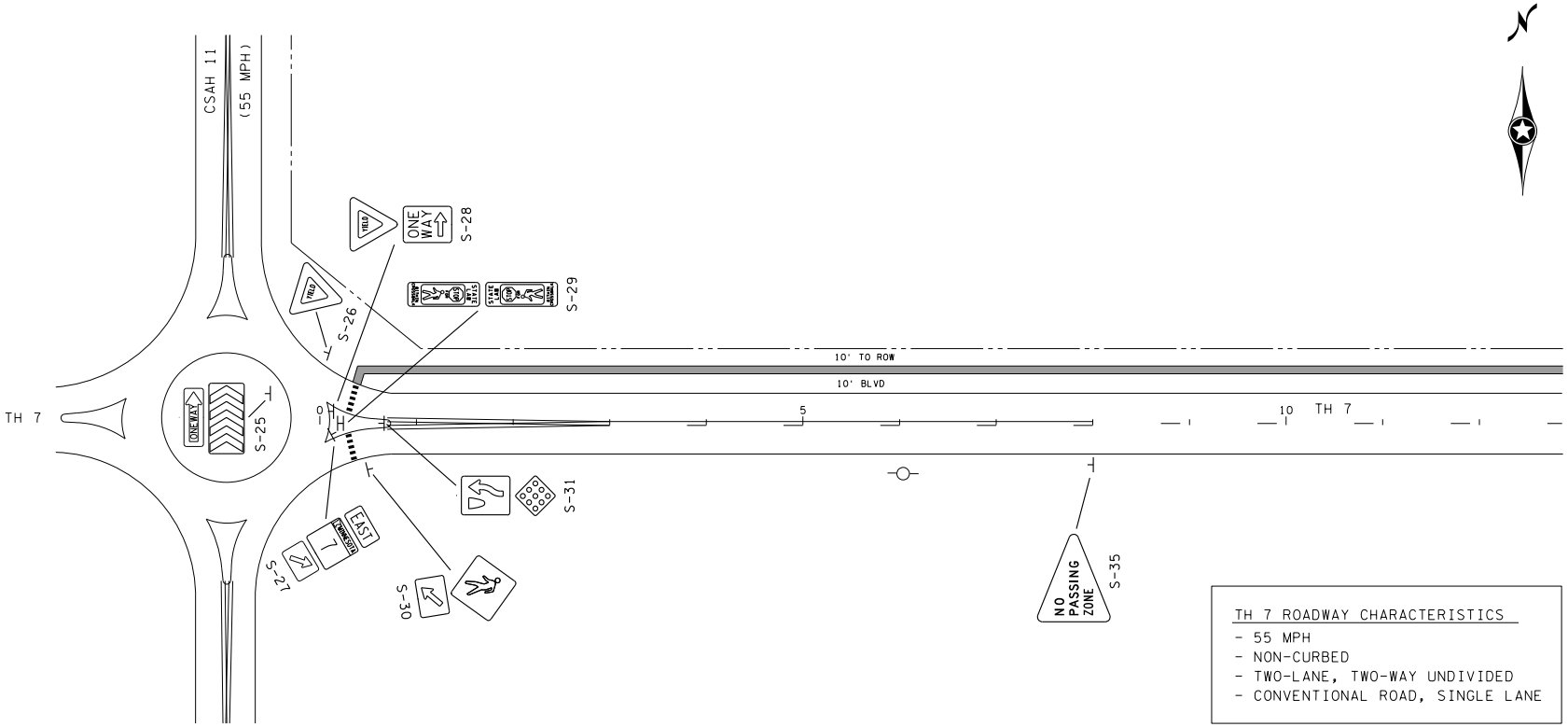
CR-SL, Non-Curbed, Roundabout Signing

Q4: WHICH OF THE FOLLOWING ARE ADEQUATE LOCATIONS FOR W2-6 ROUNDABOUT AHEAD WARNING SIGN PLACEMENT?

- A1: Sta. 3+00
- A2: Sta. 3+25
- A3: Sta. 6+00
- A4: A1, A2, or A3
- A5: A2 or A3



Q4



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CR-SL, Non-Curbed, Roundabout Signing

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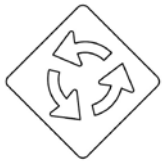
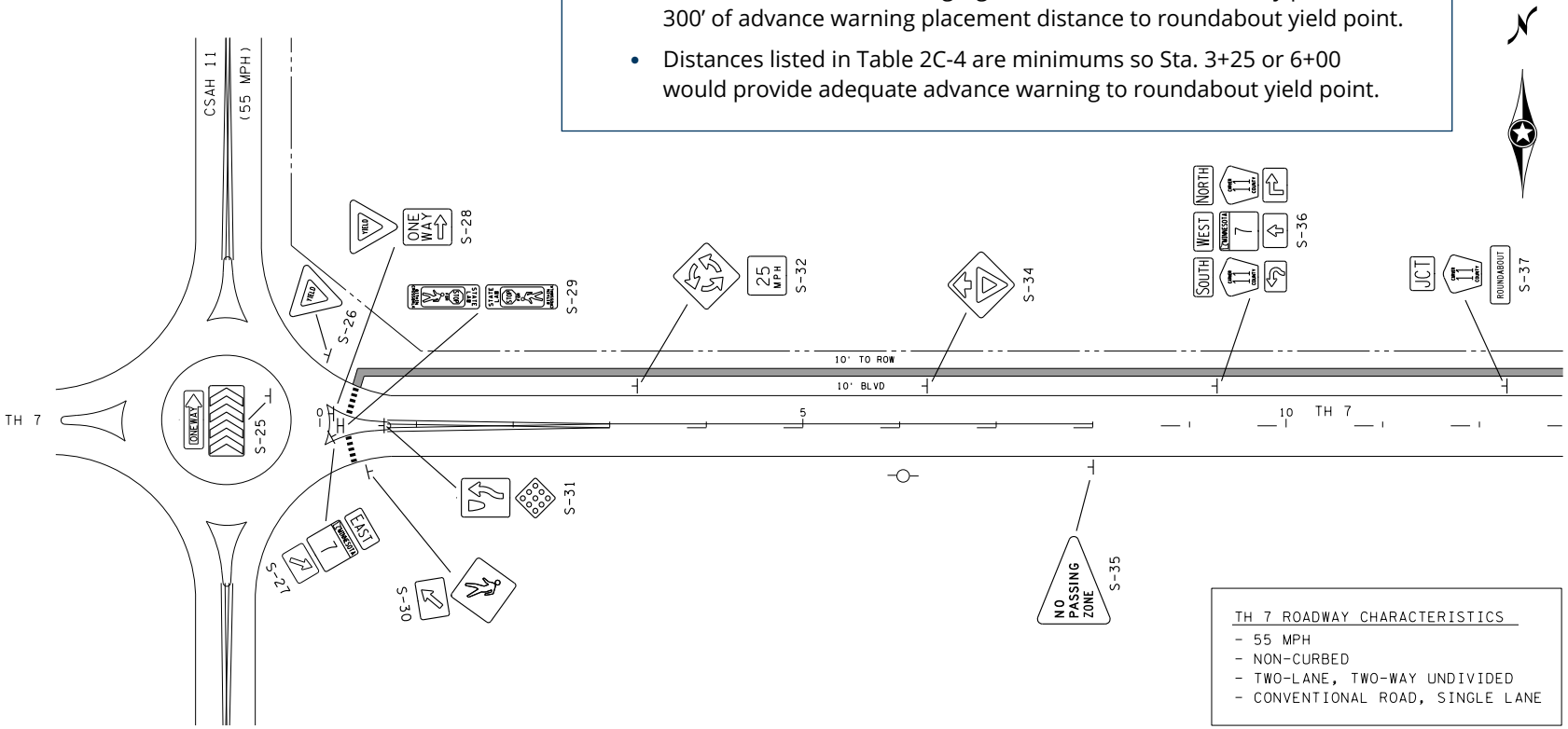
- A1: Sta. 3+00
- A2: Sta. 3+25
- A3: Sta. 6+00
- A4: A1, A2, or A3
- **A5:** A2 or A3



ANSWER **Q4**

REFERENCE: ***MN MUTCD Table 2C-4***

- Minimum advance warning distance for 55 mph roadway deceleration to 0 mph is 325'.
- Roundabout ahead warning sign at Station 3+00 would only provide 300' of advance warning placement distance to roundabout yield point.
- Distances listed in Table 2C-4 are minimums so Sta. 3+25 or 6+00 would provide adequate advance warning to roundabout yield point.



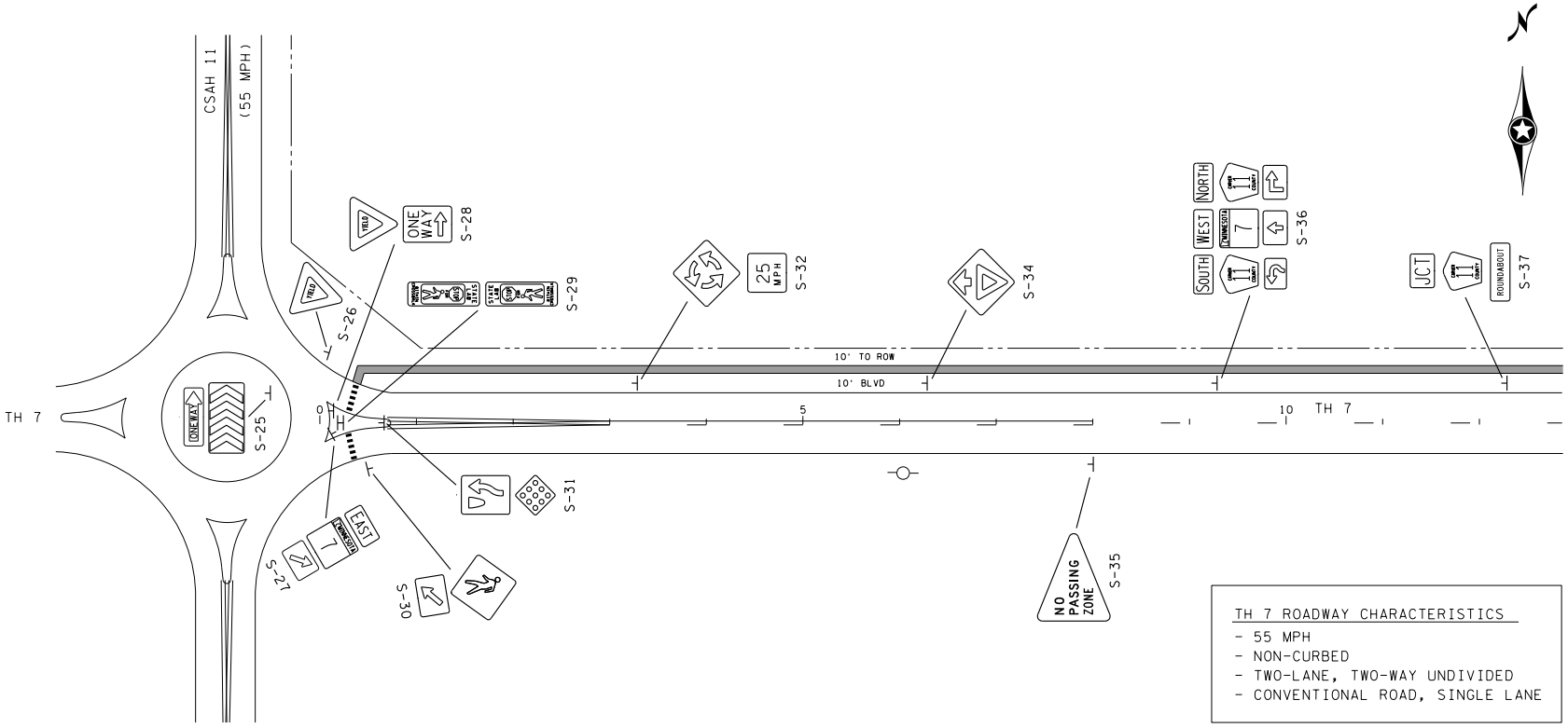
EXAMPLE PROBLEM 3

CR-SL, Non-Curbed, Roundabout Signing

Q5: IF JUNCTION MARKER ASSEMBLY WAS OMITTED FOR THIS APPROACH, WHERE WOULD THE W16-17P ROUNDABOUT PLAQUE BE PLACED?

Q5

- A1: Above roundabout ahead warning assembly (S-32)
- A2: Below roundabout ahead warning assembly (S-32)
- A3: Above directional route marker assemblies (S-36)
- A4: Below directional route marker assemblies (S-36)
- A5: Omit W16-17P sign



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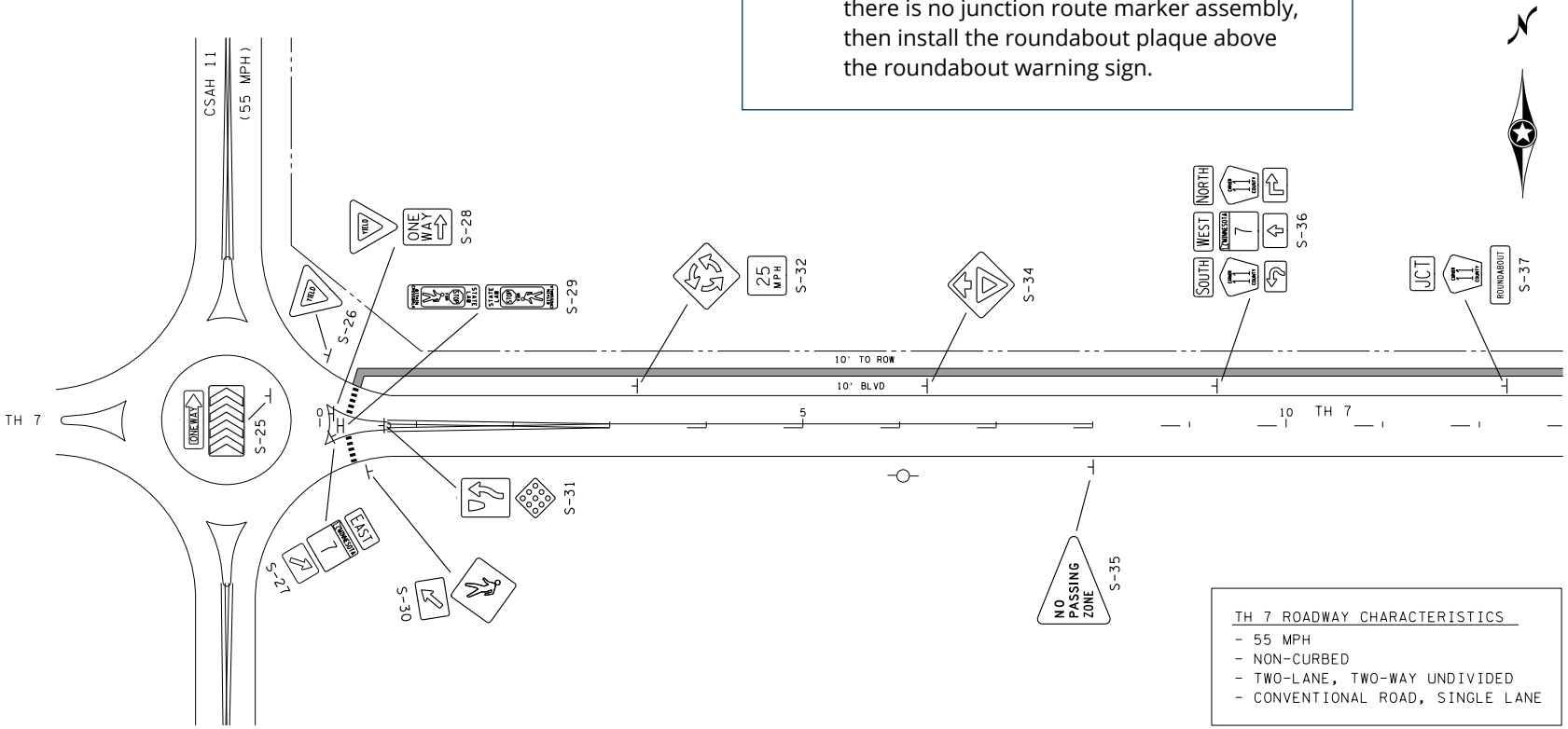
- A4: Below directional route marker assemblies (S-36)
- A5: Omit W16-17P sign

ANSWER Q5

REFERENCE: ***TEM Figure 6.27***

- Bubble note 4 in Figure 6.27 states that if there is no junction route marker assembly, then install the roundabout plaque above the roundabout warning sign.



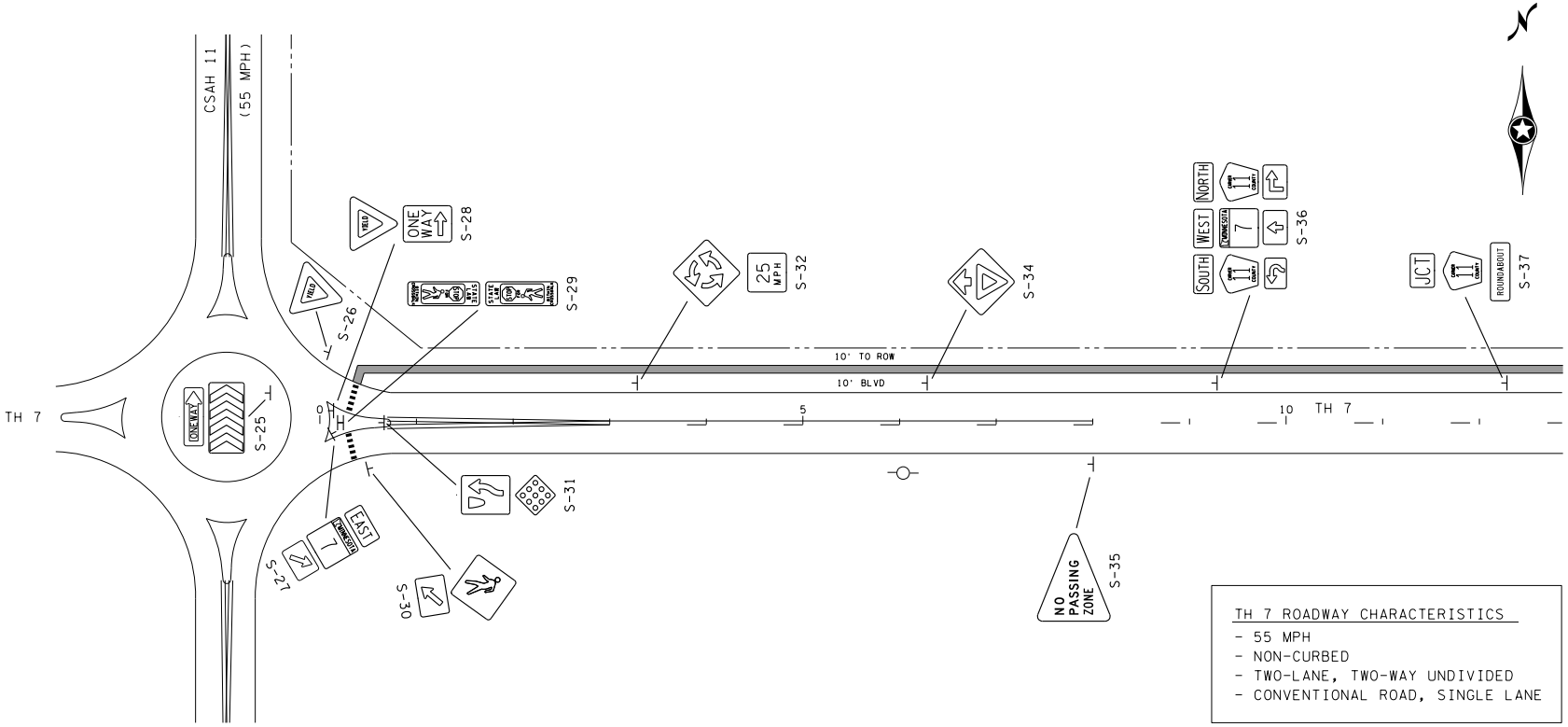
EXAMPLE PROBLEM 3

CR-SL, Non-Curbed, Roundabout Signing

Q6: THERE IS A NON-BREAKAWAY, UNPROTECTED UTILITY POLE 6' FROM THE PAVED ROADWAY AT STA. 6+00. WHAT TYPE OF SIGN SHOULD BE USED TO MARK OBSTRUCTION FOR EB TRAFFIC?

- A1: OM1-2 Object marker
- A2: OM3-L Object marker
- A3: OM3-R Object marker
- A4: No sign needed

Q6



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CR-SL, Non-Curbed, Roundabout Signing

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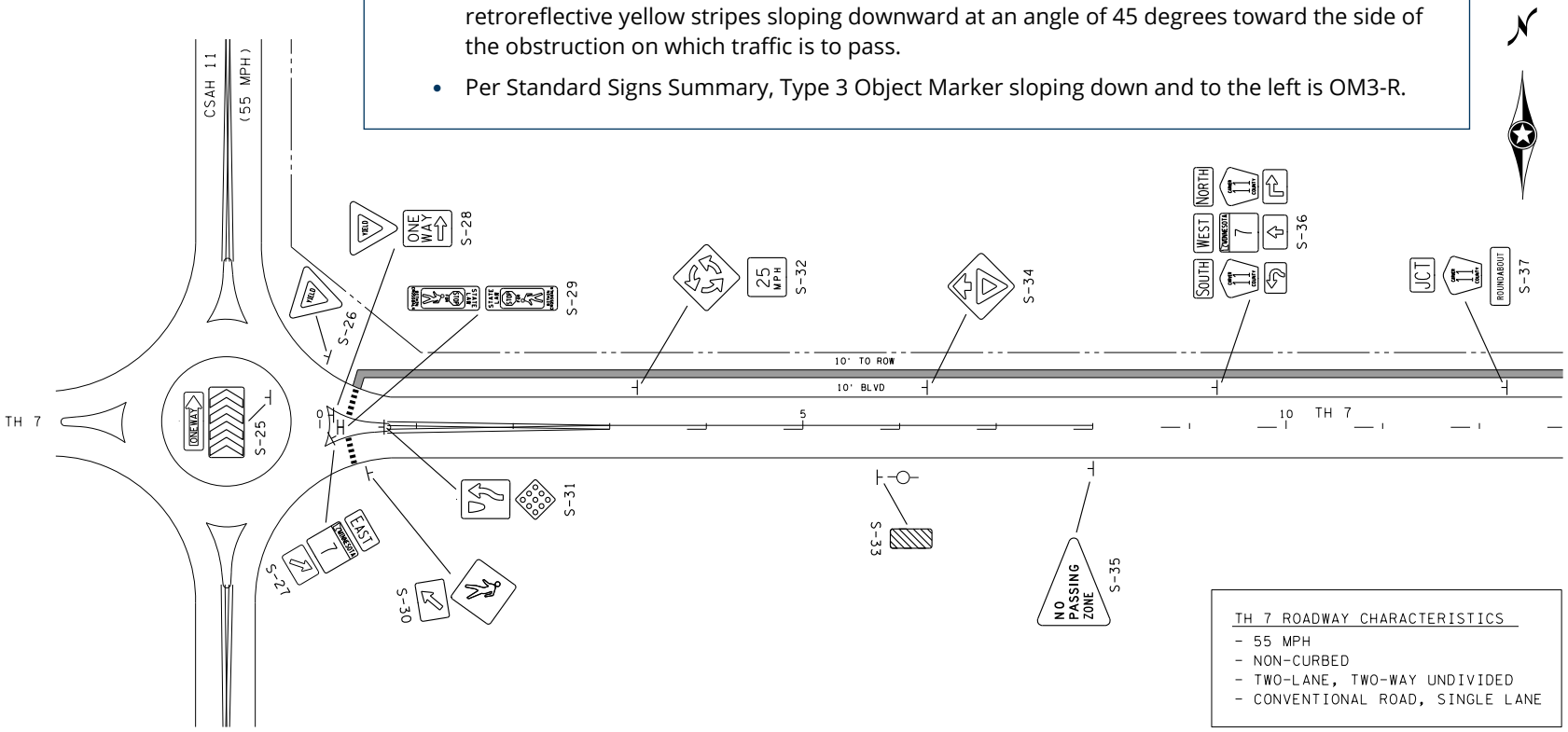
- A2: OM3-L Object marker
- **A3:** OM3-R Object marker
- A4: No sign needed

ANSWER Q6

REFERENCES: ***Standard Plan 5-297.702, MN MUTCD Section 2C.63, Standard Signs Summary***

- Per Std. Plan leader note with Obstruction Type 3 Object Marker detail, pole should be marked with a Type 3 Object Marker since it is less than 8' from paved surface.
- Per MN MUTCD Section 2C.63, Type 3 Object Marker shall have alternating black and retroreflective yellow stripes sloping downward at an angle of 45 degrees toward the side of the obstruction on which traffic is to pass.
- Per Standard Signs Summary, Type 3 Object Marker sloping down and to the left is OM3-R.



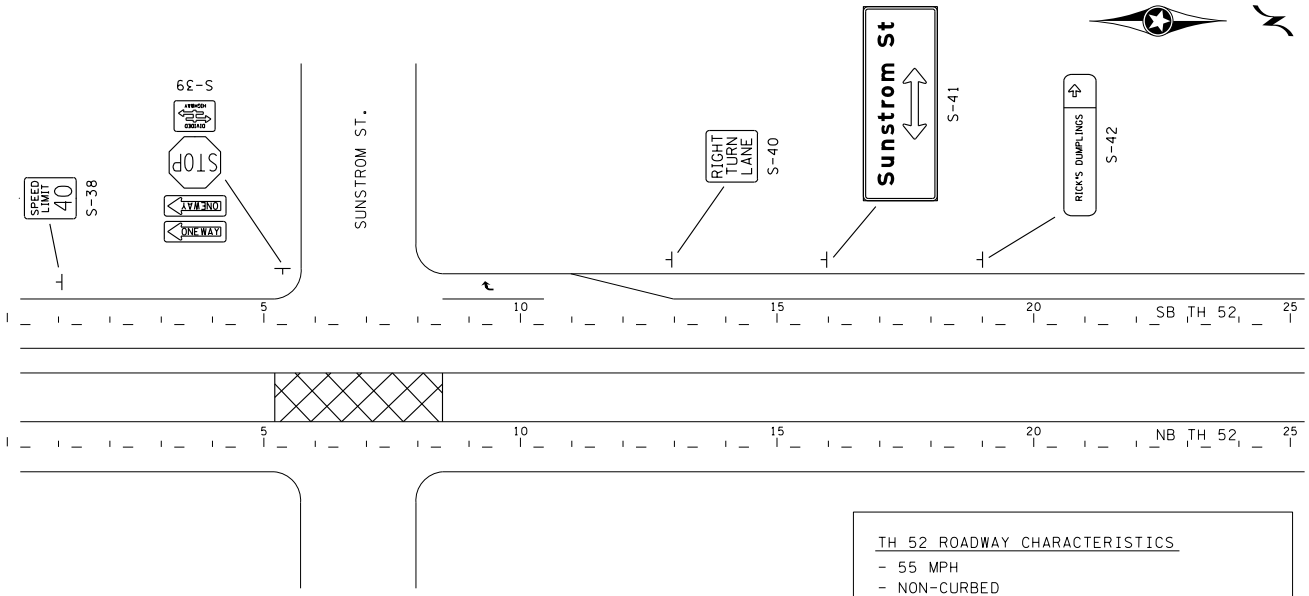
EXAMPLE PROBLEM 4

CR-ML, Non-Curbed, Sign Replacement

Q1: DISTRICT HAS RECEIVED FEEDBACK FROM LAW ENFORCEMENT THAT DRIVERS NOT SEEING/ OBEYING SPEED REDUCTION TO 40 MPH. WHAT OPTION(S) COULD BE UTILIZED TO ENHANCE SPEED LIMIT SIGN S-38?

Q1

- A1: Increase size of speed limit sign from expressway to freeway size
- A2: Add left-hand side speed limit sign to double-up or "gatepost" speed limit signing
- A3: Add W3-5 reduced speed limit ahead warning sign upstream
- A4: Add a solid or fluorescent yellow rectangular "header panel" above the speed limit sign
- A5: Any of the above



TH 52 ROADWAY CHARACTERISTICS
- 55 MPH
- NON-CURBED
- FOUR-LANE DIVIDED
- CONVENTIONAL ROAD, MULTILANE
- PROJECT IS CLOSING MEDIAN CROSSING
- SB SIGN REPLACEMENT IN PROJECT SCOPE

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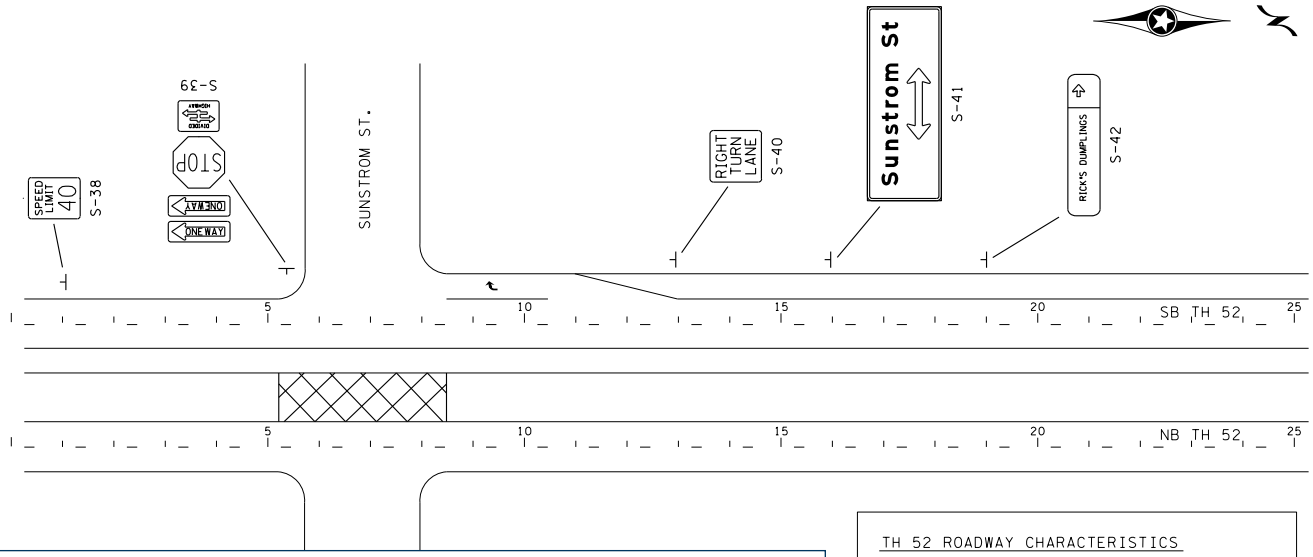

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- SB SIGN REPLACEMENT IN PROJECT SCOPE

REFERENCES: ***MN MUTCD Section 2A.15, MN MUTCD Section 2C.38***

- Answers 1, 2, and 4 are all discussed in Section 2A.15 (Enhanced Conspicuity for Standard Signs).
- Section 2C.38 states that reduced speed limit ahead sign (answer 3) should be used in this instance since speed reduction from 55 mph to 40 mph is more than 10 mph.

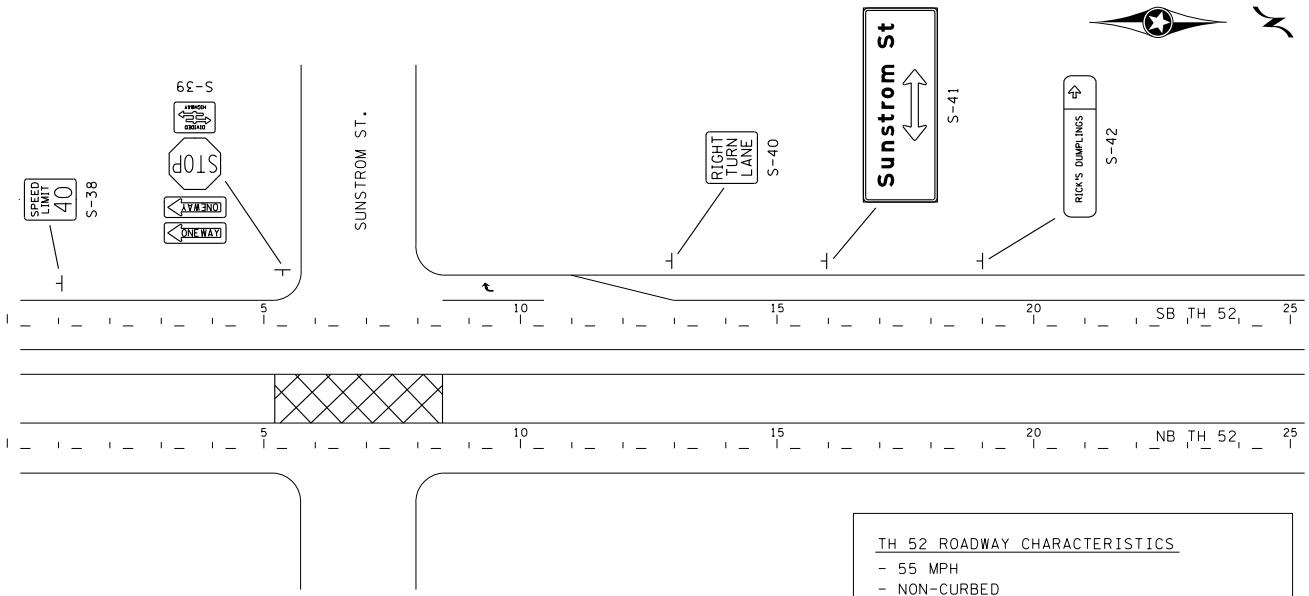
EXAMPLE PROBLEM 4

CR-ML, Non-Curbed, Sign Replacement

Q2: WHAT SIGN(S) NEED TO BE REMOVED FROM SIGN ASSEMBLY S-39?

- A1: Nothing, leave inplace
- A2: One-way left sign on backside of sign
- A3: Divided highway sign
- A4: A2 & A3

Q2



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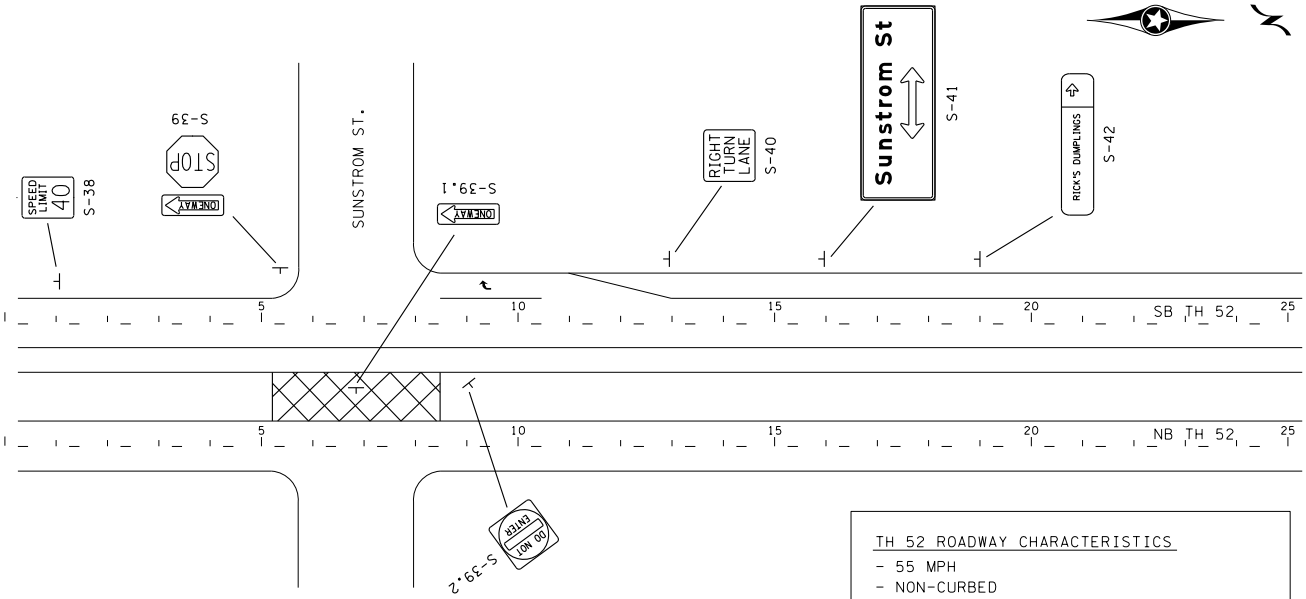
ANSWER Q2



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REFERENCE: *TEM Figure 6.2*

- Because median is being closed at Sunstrom Street, divided highway sign is no longer applicable and one-way left sign on back of assembly doesn't serve any roadway users since EB Sunstrom vehicles can't cross median.
- Supplemental information not related to solution: Per Figure 6.2, one-way right sign should be installed in the median, facing WB Sunstrom St traffic.

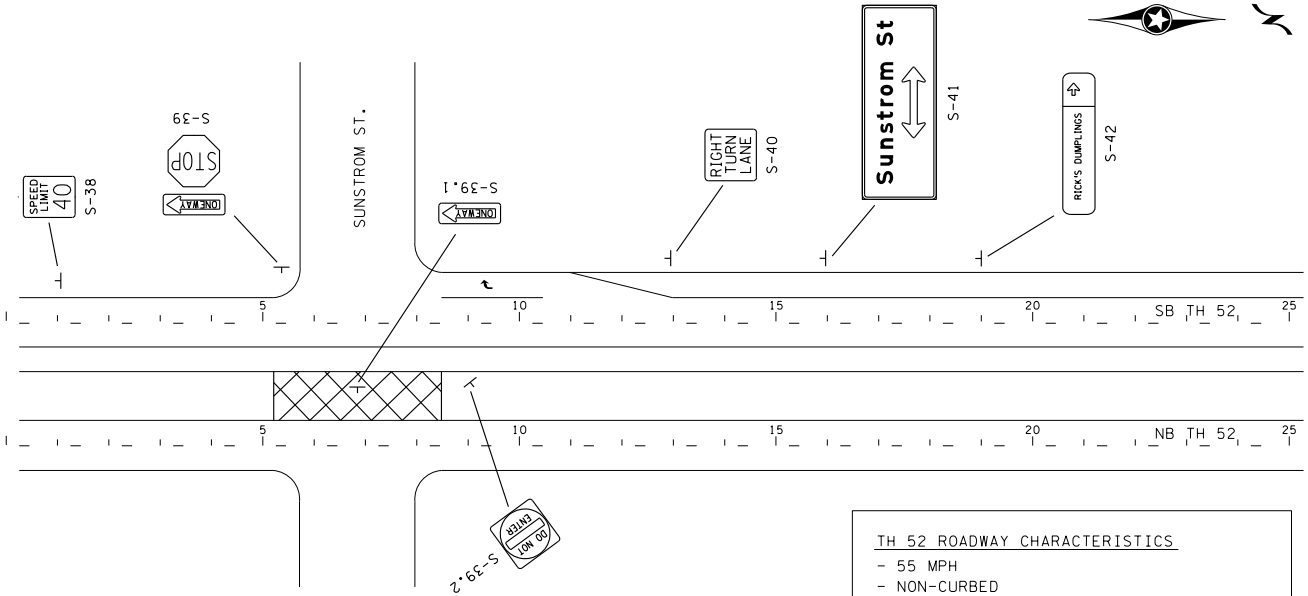
EXAMPLE PROBLEM 4

CR-ML, Non-Curbed, Sign Replacement

Q3: SIGN S-40 IS LESS THAN 5 YEARS OLD AND IN GOOD CONDITION. WHAT WORK IS REQUIRED FOR THIS SIGN?

- A1: Nothing, leave inplace
- A2: F&I new sign at current location
- A3: F&I new sign at full turn lane width location (Sta. 11+00)
- A4: Replace with R3-7R at Sta. 11+00

Q3



EXAMPLE PROBLEM 4

CR-ML, Non-Curbed, Sign Replacement

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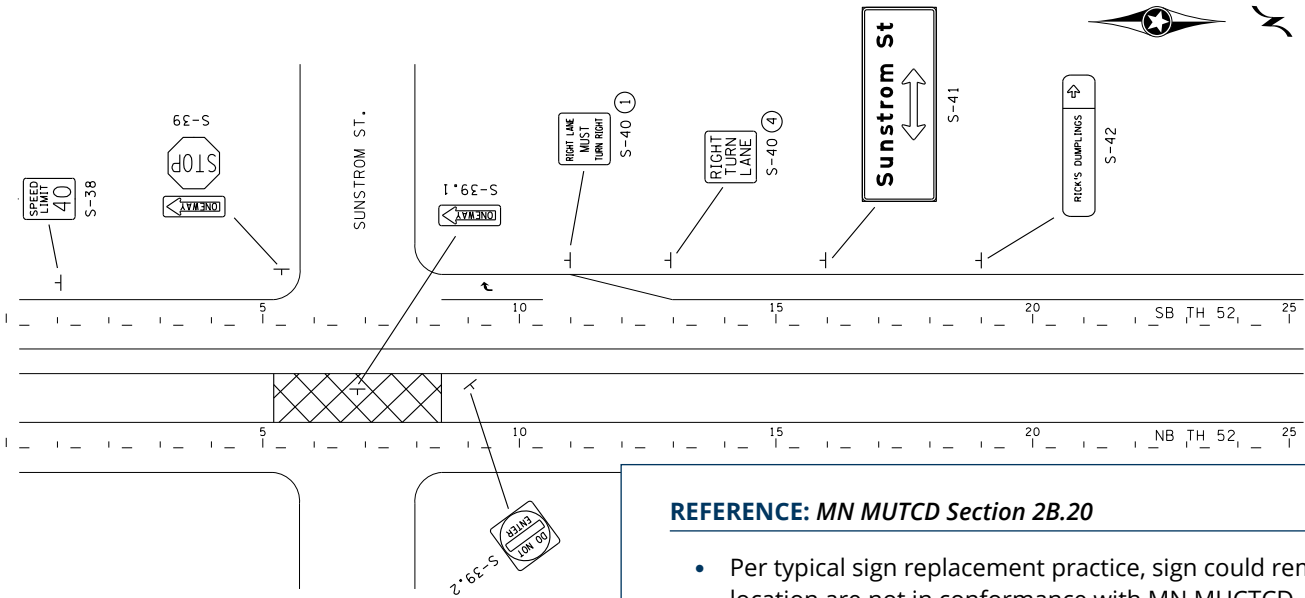
- **A4:** Replace with R3-7R at Sta. 11+00

ANSWER Q3



REFERENCE: ***MN MUTCD Section 2B.20***

- Per typical sign replacement practice, sign could remain inplace, but message and location are not in conformance with MN MUCTCD.
- Right Turn Lane sign no longer recognized in MN MUTCD. The Mandatory Movement Lane Control (R3-7) sign shall include the legend RIGHT (LEFT) LANE MUST TURN RIGHT (LEFT).
- Per Section 2B.20, use of Right Lane Must Turn Right sign should be limited to only locations that are adjacent to the full-width portion of a mandatory turn lane, and should not be installed adjacent to a through lane in advance of turn bay taper or adjacent to a turn bay taper.

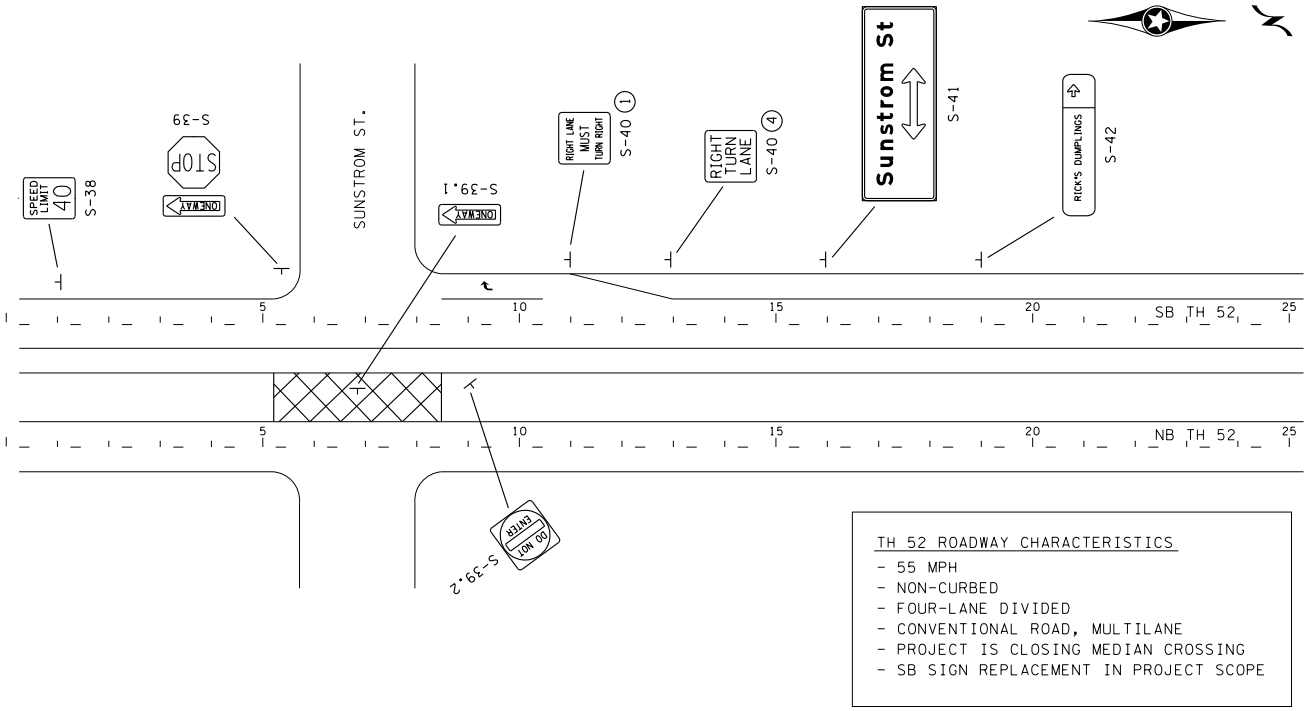
EXAMPLE PROBLEM 4

CR-ML, Non-Curbed, Sign Replacement

Q4: SIGN S-41 WAS INSTALLED LAST YEAR ON SQUARE TUBE POSTS. WHAT WORK IS REQUIRED FOR THIS SIGN?

- A1: Nothing, leave inplace
- A2: S&I at begin of RTL taper (Sta. 13+00)
- A3: F&I new sign

Q4



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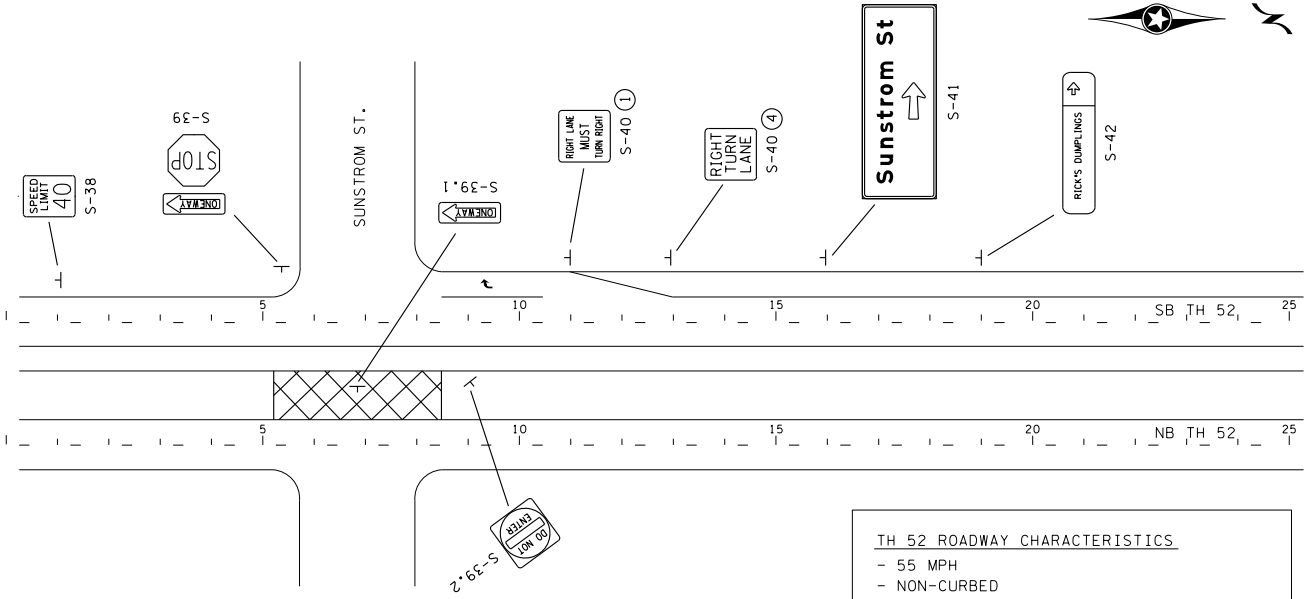
- **A3:** F&I new sign

ANSWER Q4



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- 55 MPH
- NON-CURBED
- FOUR-LANE DIVIDED
- CONVENTIONAL ROAD, MULTILANE
- PROJECT IS CLOSING MEDIAN CROSSING
- SB SIGN REPLACEMENT IN PROJECT SCOPE

REFERENCES: ***TEM Figure 6.26B, Engineering Judgment***

- Per Figure 6.26B, this sign should be placed 300’ in advance of the beginning of right turn lane taper.
- Due to median closure, traffic can no longer turn left to go east on Sunstrom Street.
- Sign should be redesigned with a right arrow only under Sunstrom Street.

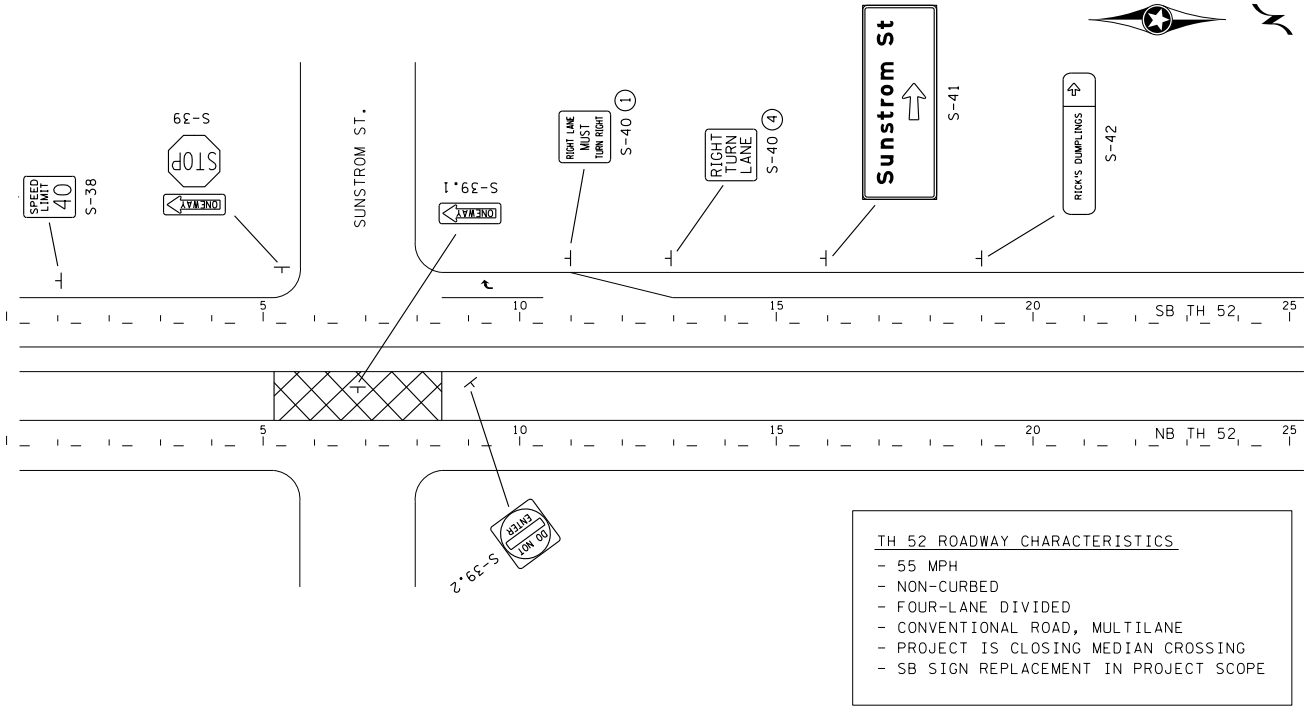
EXAMPLE PROBLEM 4

CR-ML, Non-Curbed, Sign Replacement

Q5: SIGN S-42 IS 10 YEARS OLD AND INSTALLED ON U CHANNEL POSTS. WHAT WORK IS REQUIRED FOR THIS SIGN?

Q5

- A1: Nothing, leave inplace
- A2: S&I on square tube posts and reposition longitudinally
- A3: Remove and F&I on square tube posts and reposition longitudinally
- A4: Remove sign
- A5: Discuss with DSE



EXAMPLE PROBLEM 4

CR-ML, Non-Curbed, Sign Replacement

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ANSWER Q5

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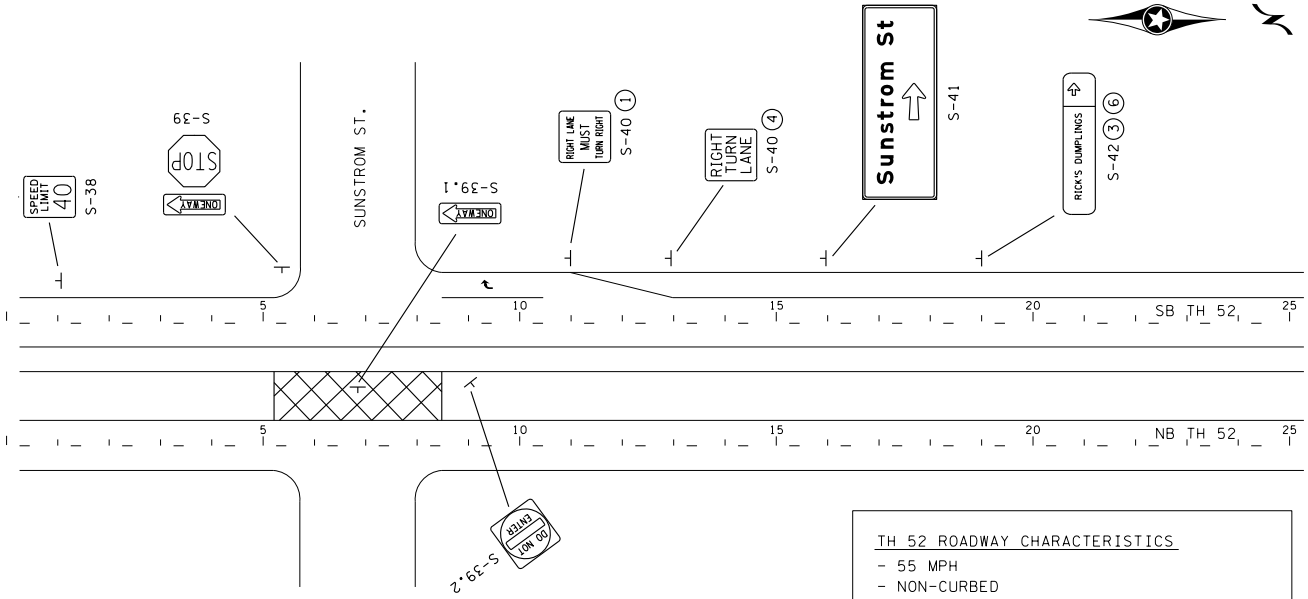
- A3: Remove and F&I on square tube posts and reposition longitudinally
- A4: Remove sign
- **A5:** Discuss with DSE



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- SB SIGN REPLACEMENT IN PROJECT SCOPE

REFERENCES: ***Typical MnDOT Signing Replacement Practice, MnDOT Tech. Memo. No. 17-06-T-01 (Requester Pay)***

- Per typical MnDOT practice, sign could be F&I, remain inplace if not impacted by construction, or S&I on square tube posts. Discuss with the District Signing Engineer since the third-party will be responsible for all work performed for these signs.

EXAMPLE PROBLEM 5

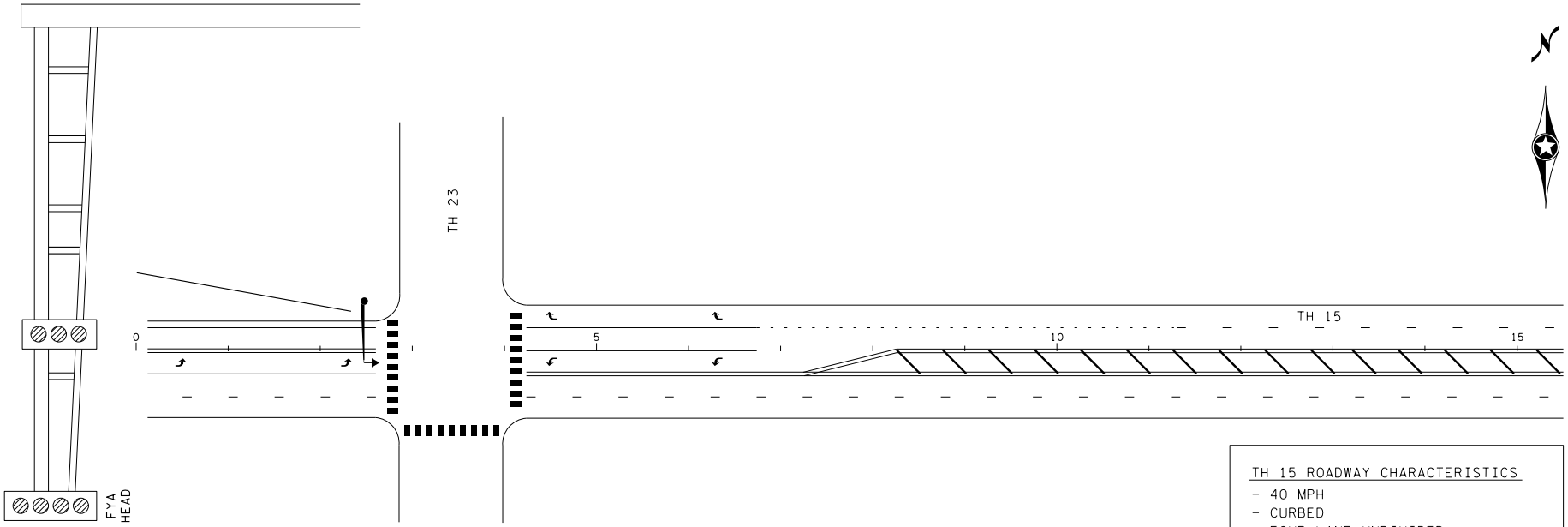
CR-ML, Curbed, Signal-Controlled Intersection Signing

Q1: THIS SIGNAL SYSTEM HAS FLASHING YELLOW ARROW (FYA) LEFT TURN OPERATION. WHAT SIGN IS PLACED TO THE RIGHT OF THE FYA HEAD?

- A1: R10-12
- A2: R10-X12
- A3: R10-X13

R10-12 R10-X12 R10-X13

Q1



EXAMPLE PROBLEM 5

CR-ML, Curbed, Signal-Controlled Intersection Signing

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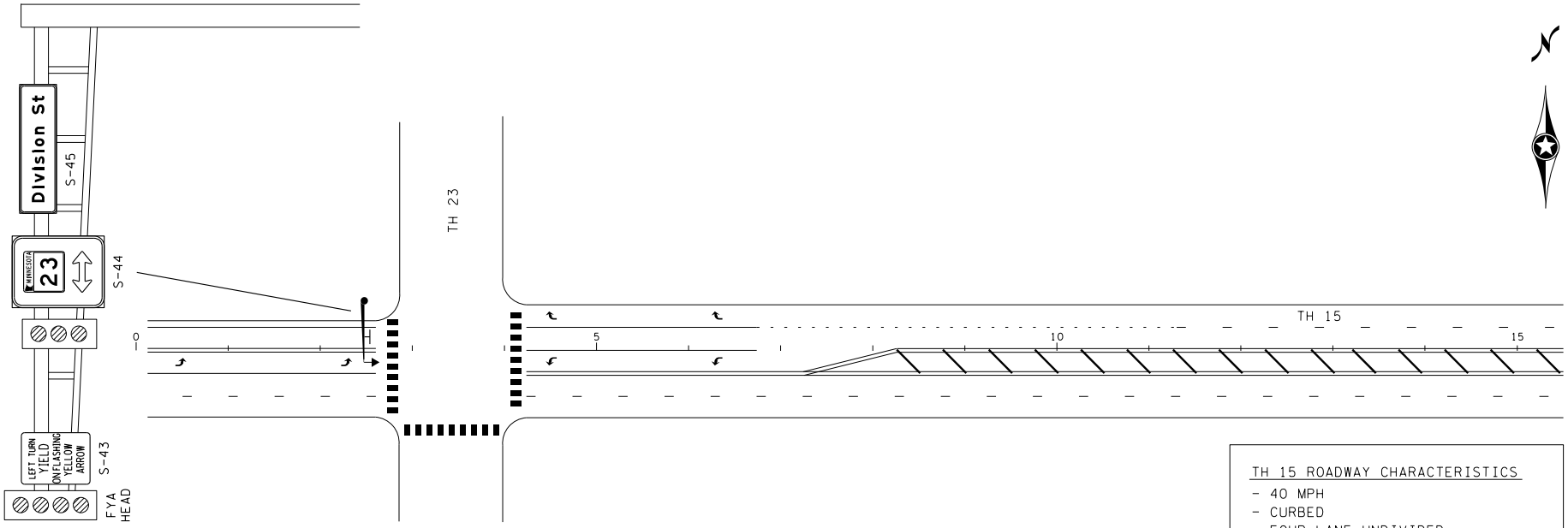
- A1: R10-12
- **A2:** R10-X12
- A3: R10-X13

R10-X12

ANSWER Q1



REFERENCE: ***TEM Figure 6.23B***

- Figure shows R10-X12 sign with a note to place sign to the immediate right of the signal head.

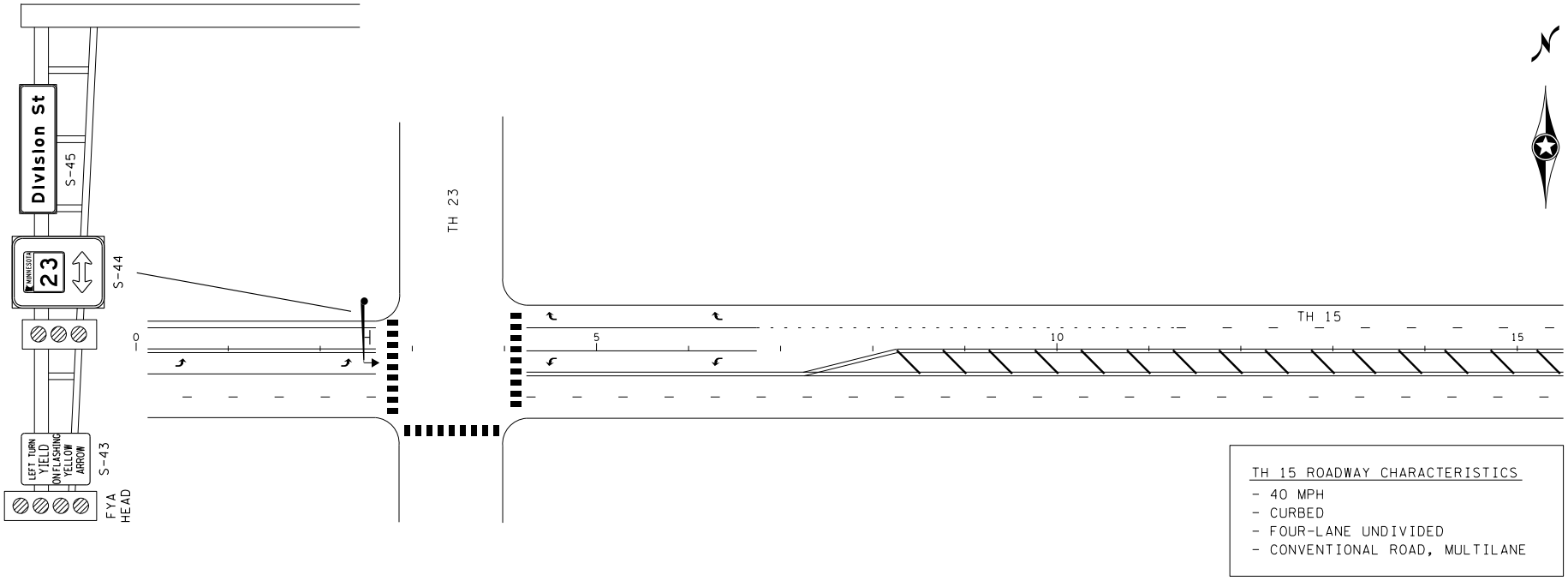
EXAMPLE PROBLEM 5

CR-ML, Curbed, Signal-Controlled Intersection Signing

Q2: WHERE SHOULD MAST ARM STREET NAME SIGN PANEL (S-45) BE POSITIONED ABOVE THE ROADWAY?

- A1: Right edge on right edgeline
- A2: Right edge on right curbline
- A3: Left edge on right curbline

Q2



EXAMPLE PROBLEM 5

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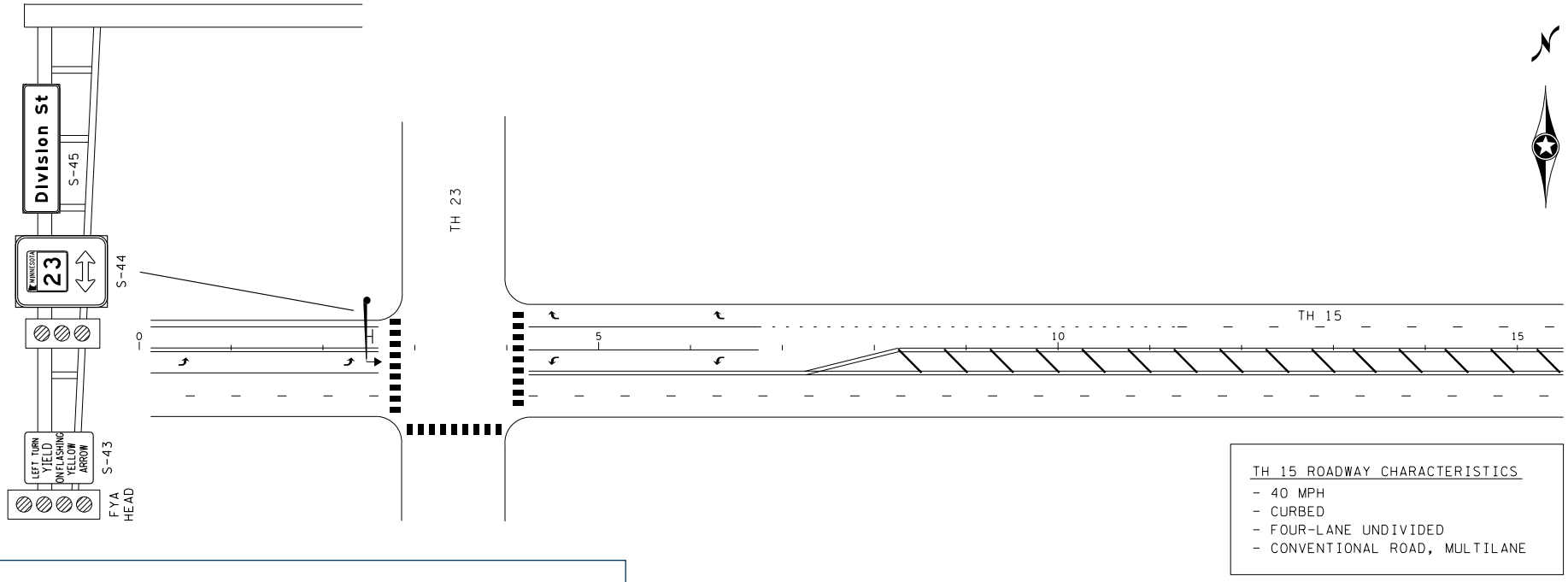
ANSWER Q2



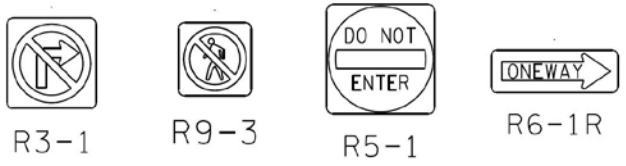
REFERENCE: ***TEM Figure 6.23B***

- Per Figure 6.23B, right edge of sign is lined up with edge of pavement or face of curb if curb is present.

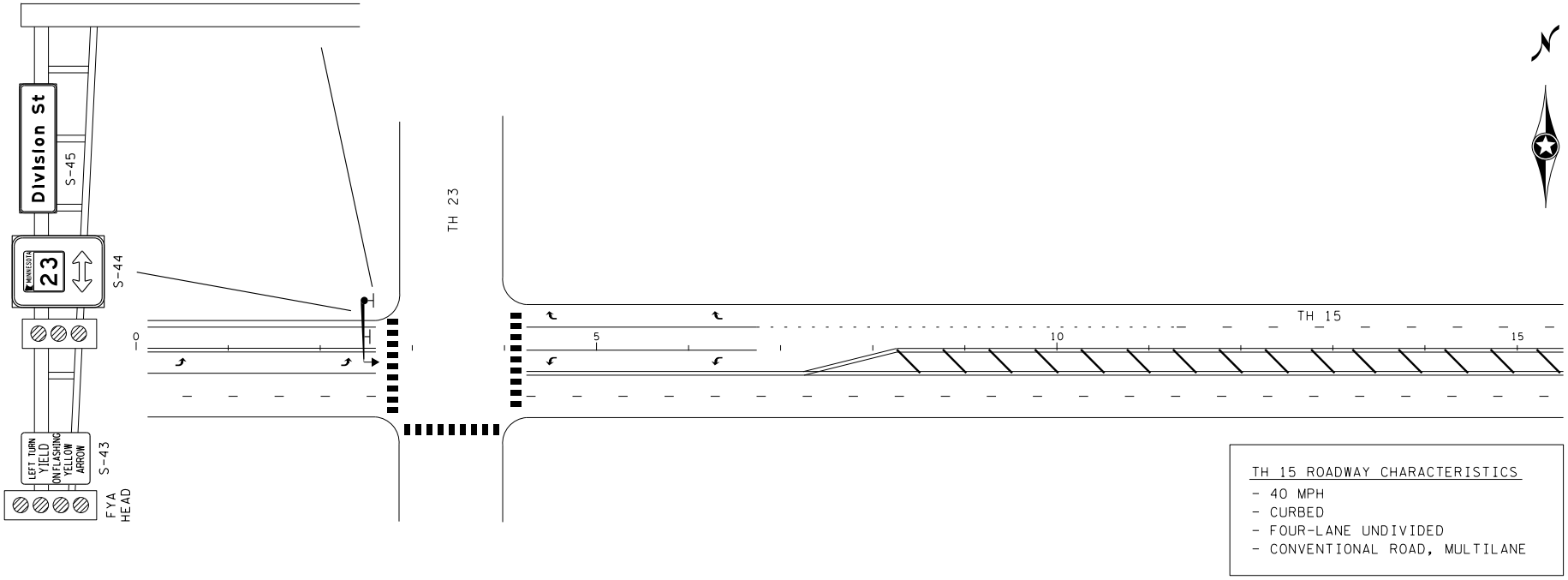
CR-ML, Curbed, Signal-Controlled Intersection Signing

Q3: WHAT SIGN MIGHT BE INSTALLED ON THE MAST ARM POLE, FACING THE NE QUADRANT OF THE INTERSECTION?

- A1: R3-1 (No right turn)
- A2: R9-3 (No pedestrian crossing)
- A3: R5-1 (Do not enter)
- A4: R6-1R (One-way right)



Q3



EXAMPLE PROBLEM 5

CR-ML, Curbed, Signal-Controlled Intersection Signing

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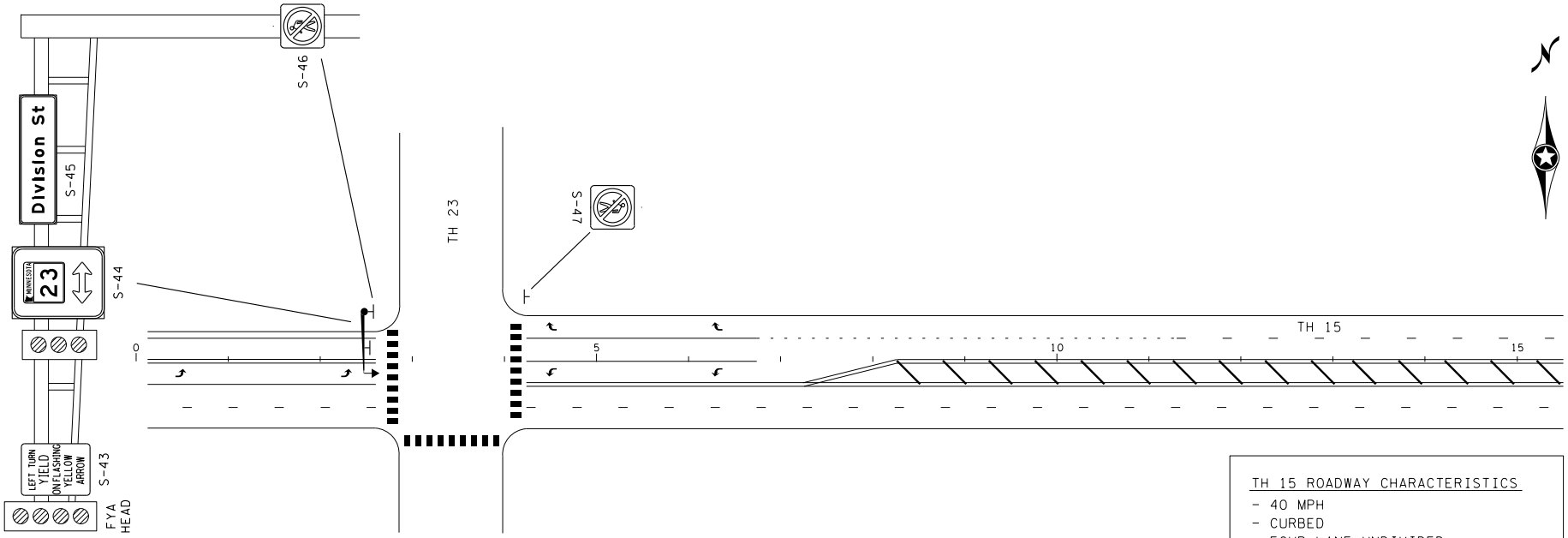
- A3: R5-1 (Do not enter)
- A4: R6-1R (One-way right)

R9-3

ANSWER Q3



REFERENCE: ***MN MUTCD Section 2B.51***

- Per Section 2B.51, the No Pedestrian Crossing (R9-3) sign may be used to prohibit pedestrian from crossing a roadway at an undesirable location or where a crossing is not designated.
- One-way signs not necessary on traffic signal poles at undivided roadway.

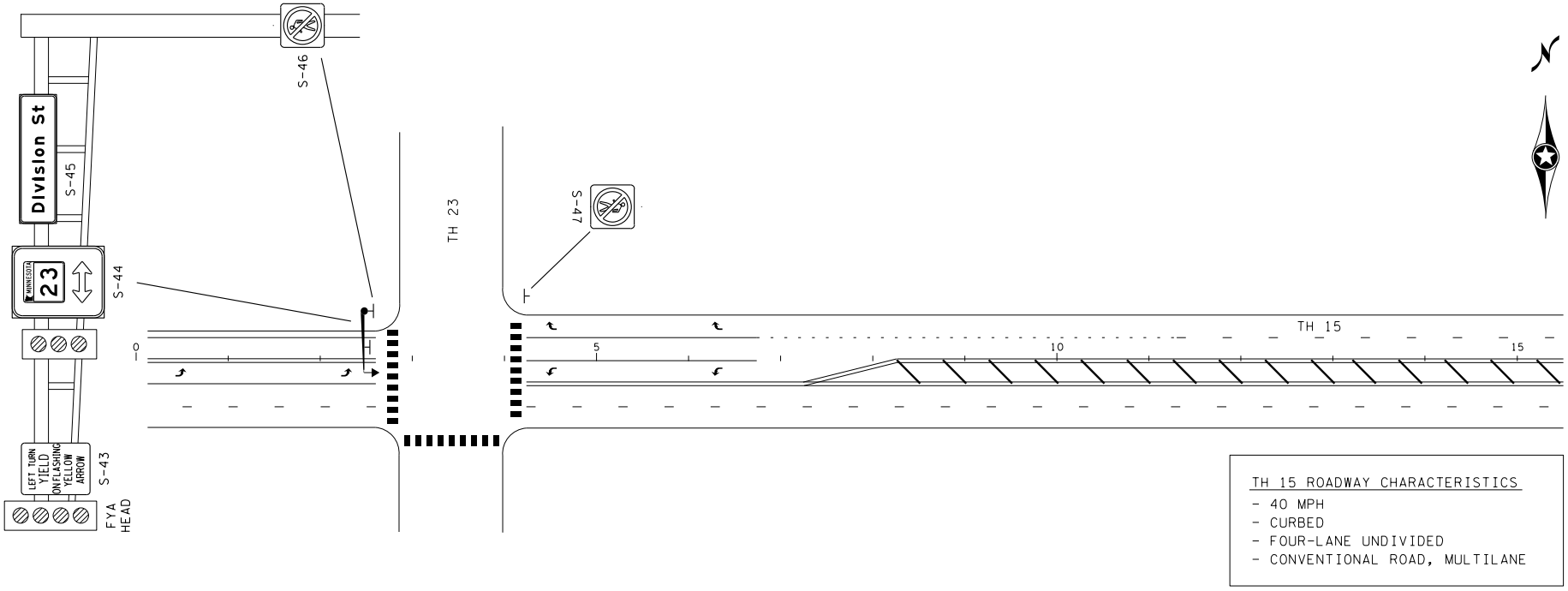
EXAMPLE PROBLEM 5

CR-ML, Curbed, Signal-Controlled Intersection Signing

Q4: WHICH STANDARD PLAN ADDRESSES SIGNAL POLE-MOUNTED SIGN INSTALLATIONS?

- A1: STD. Plan 5-297.701
- A2: STD. Plan 5-297.730
- A3: STD. Plan 5-297.731

Q4



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CR-ML, Curbed, Signal-Controlled Intersection Signing

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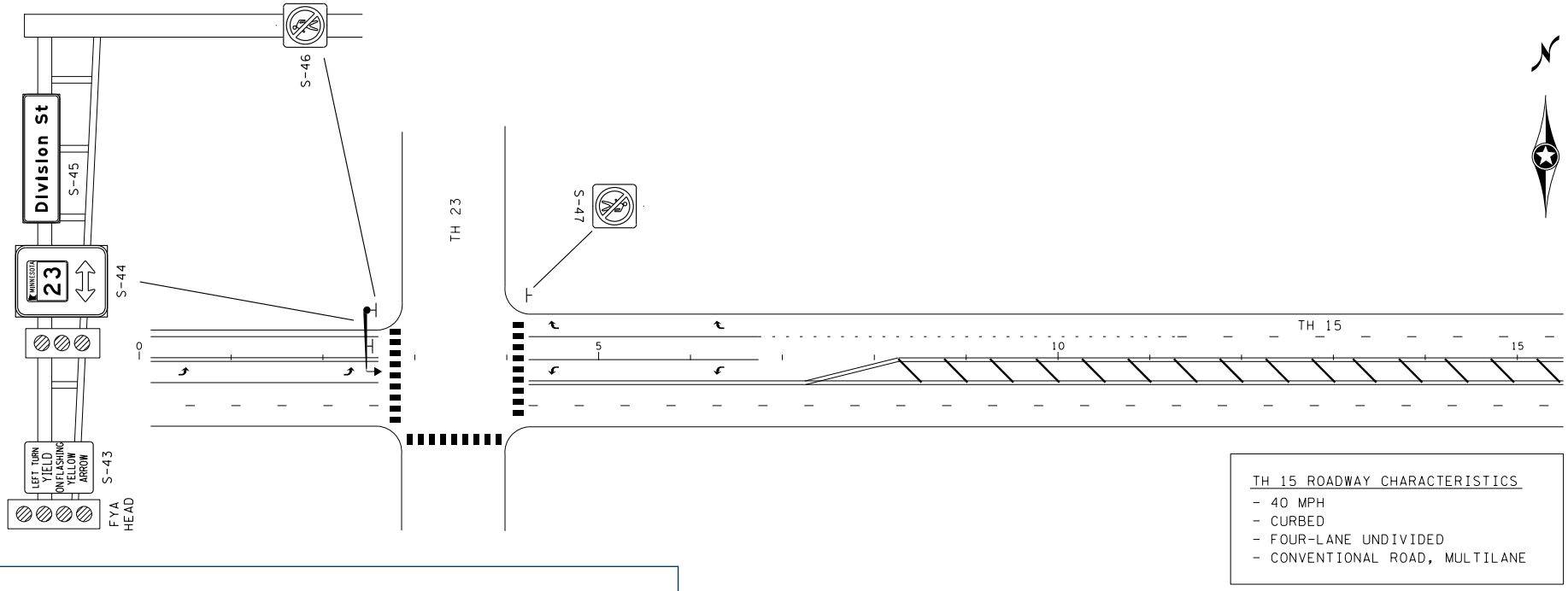
ANSWER Q4



REFERENCE: ***Standard Plan 5-297.730***

- Std. Plan .701 details typical ground-mounted installations.
- Std. Plan .730 details pole-mounted installations.
- Std. Plan .731 details mast arm installations.

CR-ML, Curbed, Signal-Controlled Intersection Signing

Q5: WHAT SIGN SHOULD BE INSTALLED AT STA. 11+25?

- A1: R3-7R (Right lane must turn right)
- A2: W9-1R (Right lane ends)
- A3: W9-2R (Lane ends merge left)
- A4: W20-X3L (Merge left)

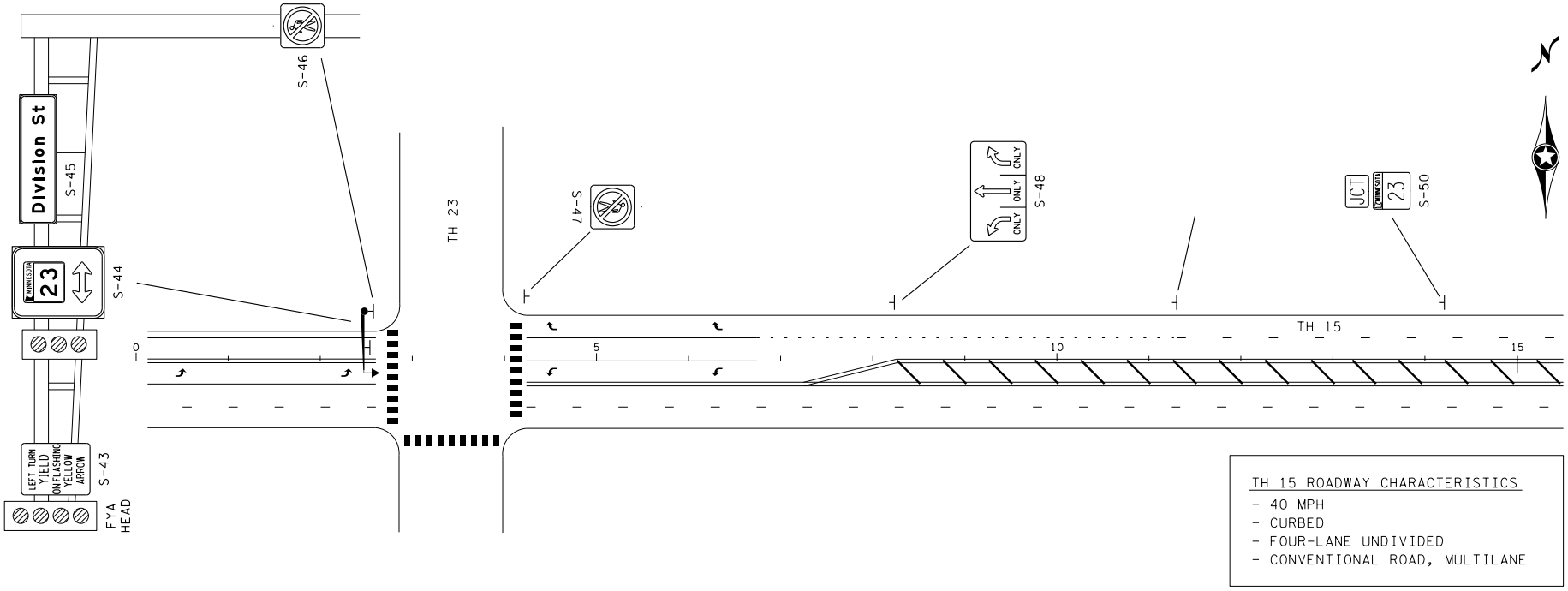
R3-7R

W9-1R

W9-2R

W20-X3L

Q5



EXAMPLE PROBLEM 5

CR-ML, Curbed, Signal-Controlled Intersection Signing

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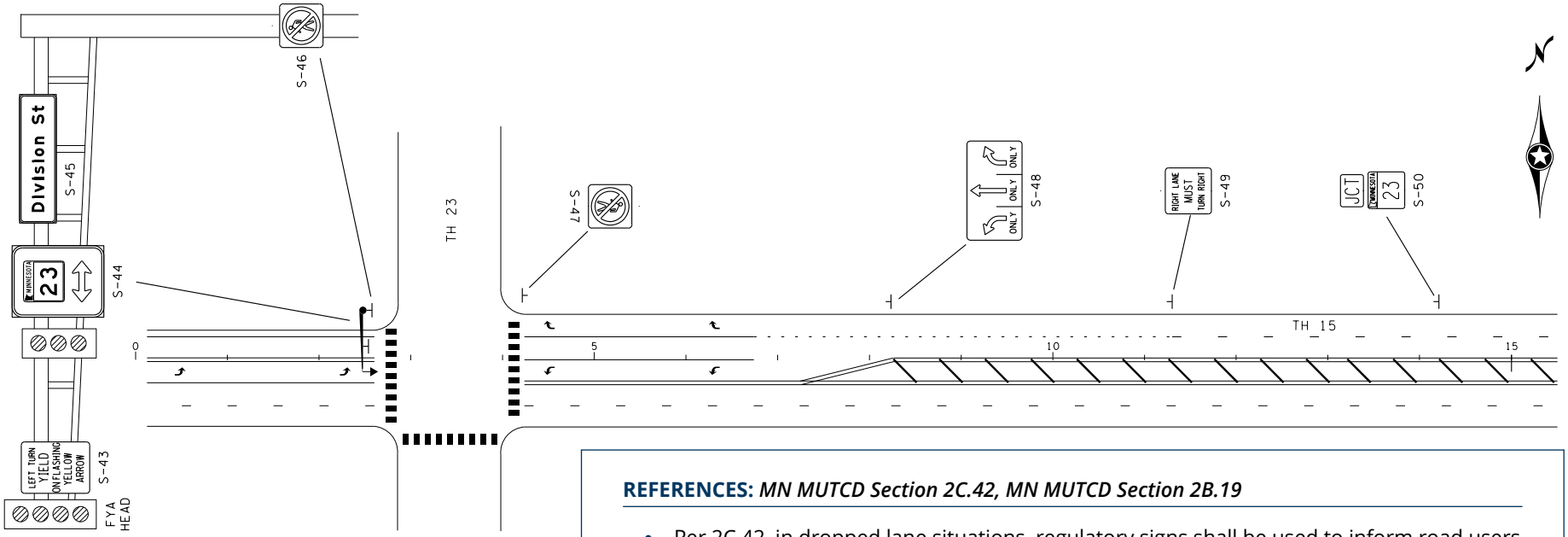
R3-7R

ANSWER Q5



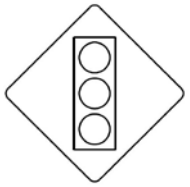
REFERENCES: *MN MUTCD Section 2C.42, MN MUTCD Section 2B.19*

- Per 2C.42, in dropped lane situations, regulatory signs shall be used to inform road users that a through lane is becoming a mandatory turn lane. The W4-2, W9-1, and W9-2 signs shall not be used in dropped lane situations.
- Per 2B.19, at locations where through lanes become mandatory turn lanes, a mandatory movement lane control (R3-7) sign should be post-mounted on the right-hand side of the roadway where a through lane is becoming a mandatory right-turn lane.

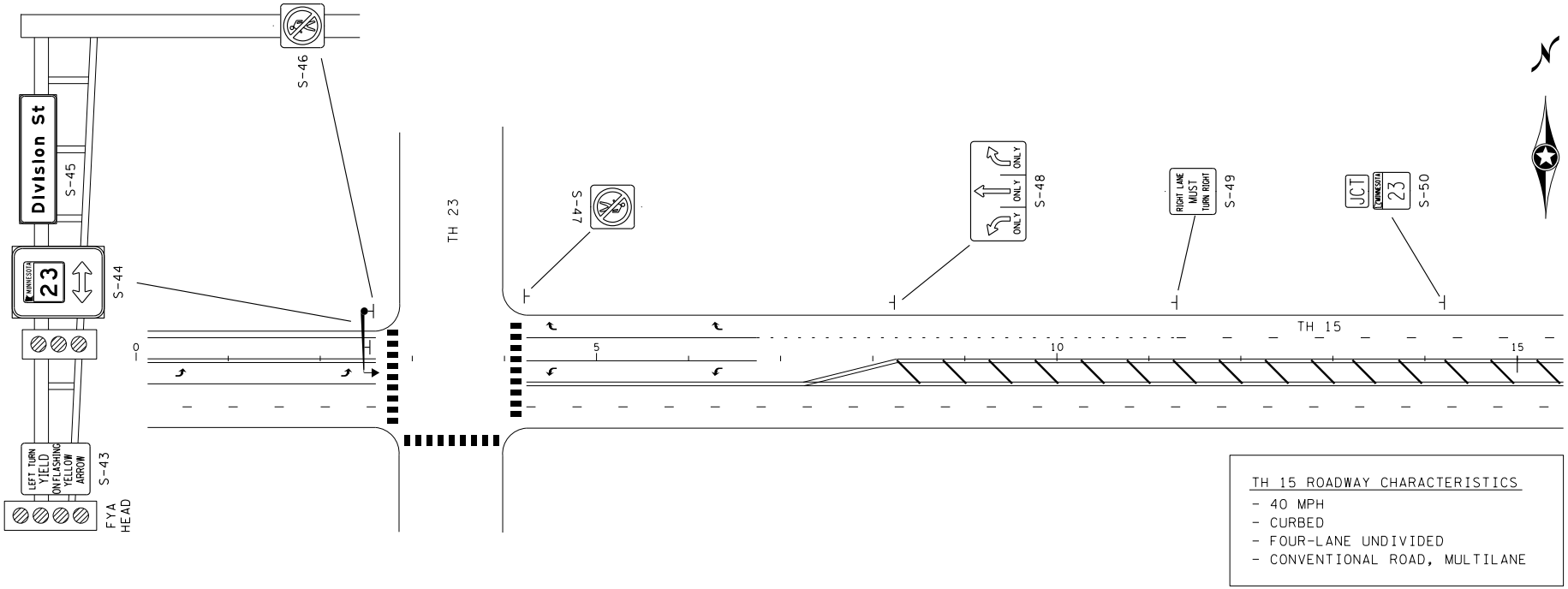
CR-ML, Curbed, Signal-Controlled Intersection Signing

Q6: SIGNAL HEADS FACING WB TRAFFIC ARE CLEARLY VISIBLE 650' FROM SIGNAL (STA. 9+00), WHICH IS 475' IN ADVANCE OF THE WB STOPPING POINT. WHERE SHOULD W3-3 SIGNAL AHEAD SIGN BE PLACED?

- A1: Sta. 9+00, Relocate adjacent signs
- A2: Sta. 14+25, Move junction sign back to Sta. 17+25
- A3: W3-3 Sign not required



Q6



EXAMPLE PROBLEM 5

CR-ML, Curbed, Signal-Controlled Intersection Signing

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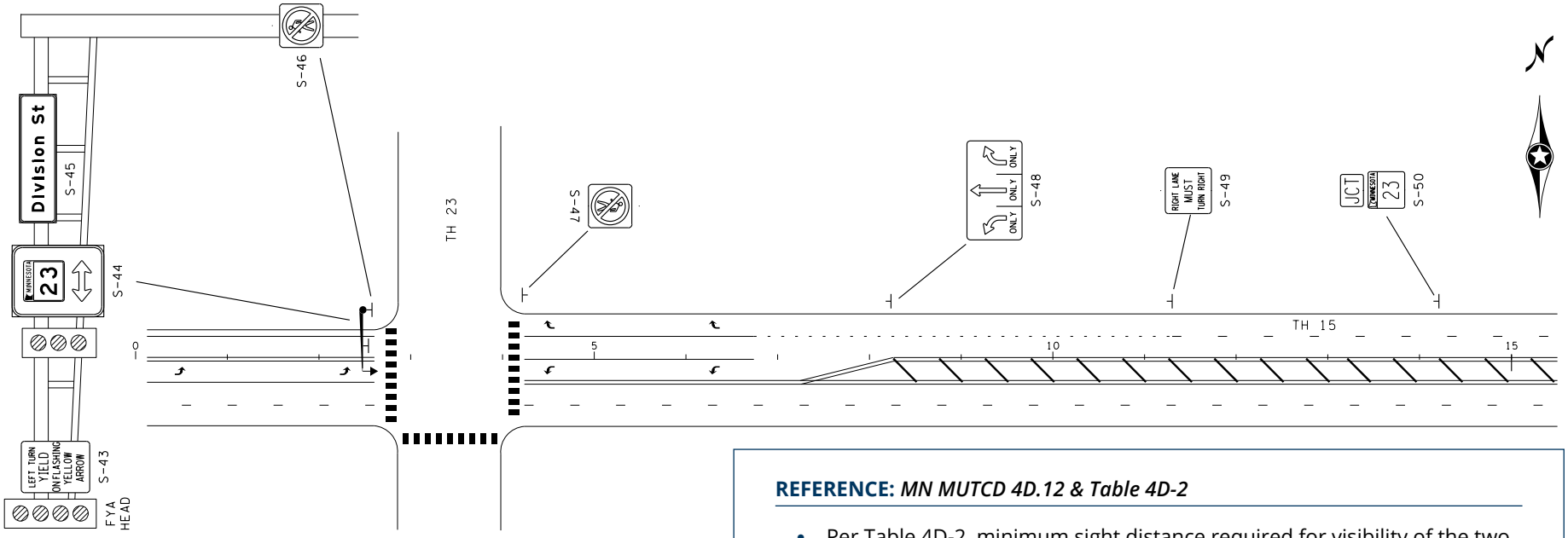
ANSWER Q6



REFERENCE: *MN MUTCD 4D.12 & Table 4D-2*

- Per Table 4D-2, minimum sight distance required for visibility of the two primary signal faces for each approach is 390' for a 40 mph roadway.
- Per 4D.12, the minimum sight distance is in advance of and measured to the stop line
- 475' > 390', so W3-3 signal ahead sign is not required.

DEPARTMENT OF TRANSPORTATION

APPENDIX A

Comprehensive List of References

Comprehensive List of References

Sample Plan

MnDOT Organization Charts and Signing Contacts

- MnDOT Organization Chart
- Office of Traffic Engineering Org Chart
- MnDOT Signing Contact List

State Statutes

- Minnesota Statute (Minn. Stat. Sec.) 169.06

Cost Participation Policy

- Cost Participation for Cooperative Projects and Maintenance Responsibilities between MnDOT and Local Units of Government

MnDOT Websites

- MnDOT's Office of Traffic Engineering (OTE)
- MnDOT Signing
- Publications (Reference Manuals, Training Manuals, etc.)
- Design Division ST
- Training Schedule
- Construction
- Design Scene
- Accessibility
- Standard Plans
- MnDOT's Computer Aided Engineering Services (CAES)
- AASHTOWare Project Item List
- Average Bid Prices
- MnDOT's Roadway Project Mapping (to determine the project start/end reference points on the title sheet)
- Approved Products List

Specifications and Special Provisions

- Standard Specifications for Construction
- Signing Special Provisions (Division ST)

Reference Manuals

- MN MUTCD
- National MUTCD
- Traffic Engineering Manual
- Standard Signs and Markings Manual
- MnDOT Standard Signs and Markings Summary
- MnDOT Utility Accommodation and Coordination Manual

Training Manuals

- Signs 101
- Expressways and Complex Intersections
- Freeways
- Guide Sign Design

Design Checklists

- Kickoff
- 30%
- 60%
- 90%
- 100%

Design Resources

- Ball Banking Form
- Signing Tabs Template (XLSX)
- Windloading Chart for Square Tube
- AASHTOWare Project Item List
- Pay Item Definitions
- Control Section Report (to determine the legislative route number on title sheets)
- 6-Month Tentative Schedule of Lettings (to confirm funding source on title sheet)