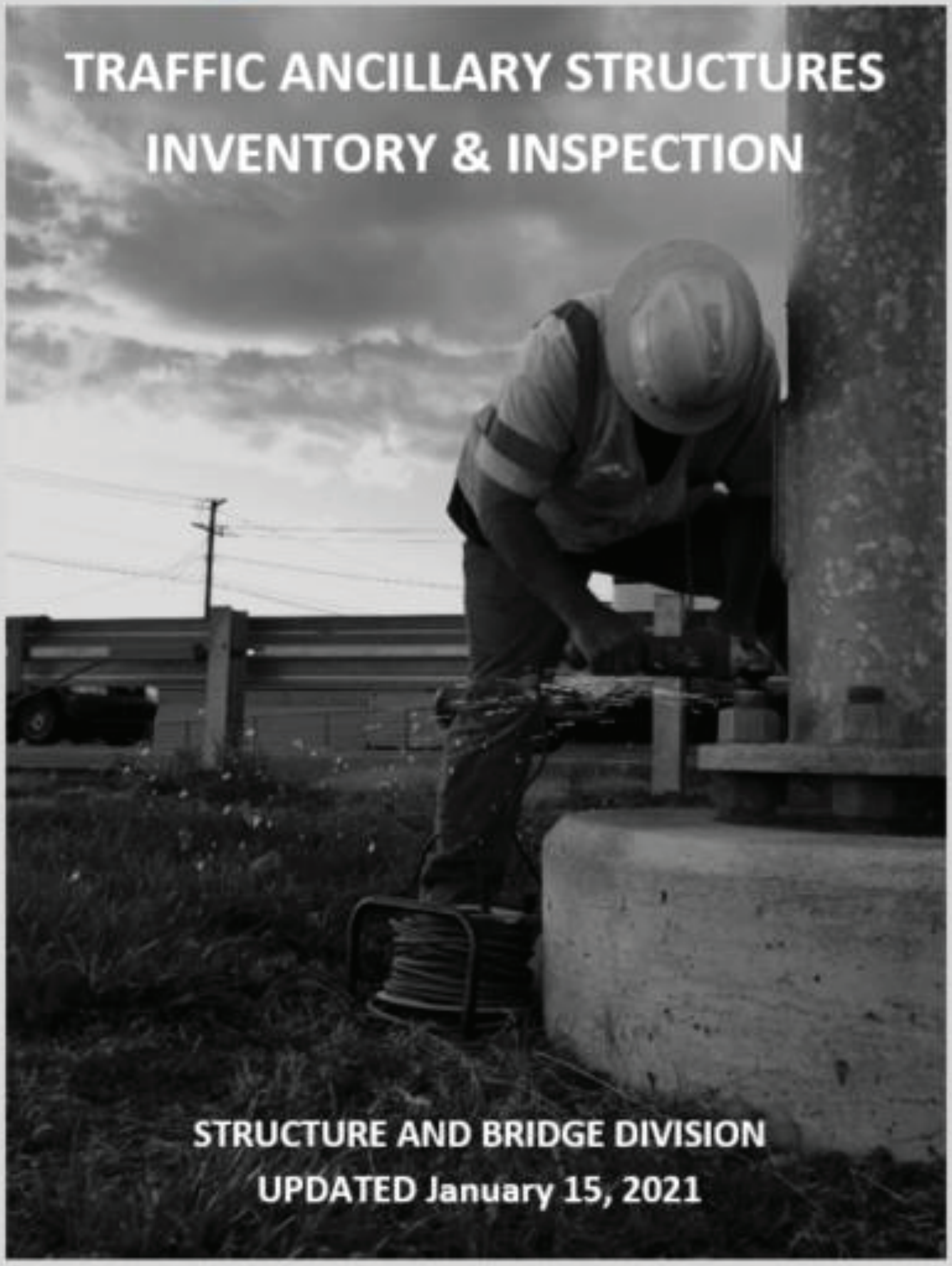
VDOT
Virginia Department of Transportation

TRAFFIC ANCILLARY STRUCTURES INVENTORY & INSPECTION



STRUCTURE AND BRIDGE DIVISION
UPDATED January 15, 2021

ACKNOWLEDGEMENTS FOR UPDATED EDITION

We would like to convey acknowledgement and appreciation to the individuals and organizations shown below for their contributions to the composition, development, and review of this updated Traffic Ancillary Structures Inventory and Inspection Manual.

VDOT
Virginia Department of Transportation

Christopher Williams, PE, Assistant State Structure and Bridge Engineer
Stuart Godsey, PE Ancillary Structure Program Manager
Raju Iyer, PE
William L. Crafton
Sravani Sayyaparaju

COLLINS ENGINEERS INC.

Timothy Weeks, PE, Project Manager
Mark Hebert
Rose Lort
C. Christopher Thrift, NICET IV

PREVIOUS ACKNOWLEDGEMENTS

We would like to convey acknowledgement and appreciation to the individuals and organizations shown below for their contributions to the composition, development, and review of this Traffic Ancillary Structures Inventory and Inspection Manual.

VDOT
Virginia Department of Transportation

Claude Napier, PE, Assistant State Structure and Bridge Engineer
Christopher Williams, PE, Ancillary Structure Program Manager
Lance Click, PE
Leslie Danovich, PE
Ali Foroughi, PE
Karl Larson, PE
Shannon Ternes, PE

CLARK◆NEXSEN

Staci Dugan, PE, Principal
Christopher Roberts, PE, Project Manager
Andy Heeze

COLLINS ENGINEERS INC.

Charles Conrad, PE, Project Manager
James Cavalet, PE
Thomas Cross
Michael Garlich, PE SE
Jeremy Koontz, PE SE
Timothy Weeks, PE

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF PHOTOS

PREFACE

Purpose of the Program and Manual

The purpose of the Traffic Ancillary Structure Program is to provide the Virginia Department of Transportation (VDOT) with the inventory and inspection information necessary to determine the ancillary structures' physical and functional condition. This information will be used to develop priorities for their maintenance or replacement.

Due to their typically non-redundant structural configuration and proximity to the roadway, these ancillary structures have the potential to directly affect the safety of the roadways. This program primarily focuses on structural evaluation, with a secondary focus on functionality. This focus is mandated by the level of impact a structural defect could have on the roadway. As an example, a sign with poor legibility may cause distraction or hazards along the roadway it serves, and the program should address such a defect. However, a collapsing sign may land in the roadway, posing a much larger danger. For this reason, the primary focus of the program is on the structural evaluation of the traffic ancillary structures.

Due to several significant failures having occurred throughout the US, increasing focus has and is being placed by many States, as well as the Federal Highway Administration (FHWA), on the proper management, inventory, and inspection of these structures.

VDOT has long recognized the value of such a program, having officially issued the first inspection manual in 1999 with updates in 2006 and 2014. Throughout the years, more structure types have been identified as necessitating inspection, better inspection methodologies developed, and the program has continued to grow. The purpose of this manual is to provide the most current inventory and inspection practices and procedures that will continue to ensure safety on the roadway.

Due to the vast variation of the elements, configurations, and inspection techniques of ancillary structures, it is not practical to capture all of these variations within the manual. The intent of the manual is to outline some of the most common of these variations. Through comparison to what has been provided here, and through judgment and experience, the inspector should be sufficiently equipped to distinguish the appropriate approach to the inspection.

Responsibilities and Duties of the Inspector

The inspectors play a critical role in the Traffic Ancillary Structure Program. It is only through their diligence and attention to fine detail that structural deficiencies may be found. The collection of inspection information will save lives.

Historically, when a structure has suffered a failure, this failure has been directly linked to specific features of the structure. Shared failure prone details that have been properly inventoried can be isolated, allowing for a rapid, accurate, and efficient inspection effort of the structures sharing these potentially compromising features. For this reason, along with evaluation of the structures through inspection, the accurate inventorying of the structures plays a crucial role.

In combination with the Bridge Inspection and Tunnel Inspection Programs, a safe and reliable roadway infrastructure is only achievable through the direct efforts of the Inspector. The Traffic Ancillary Structure Program inspector's responsibilities and duties shall conform to the current *Bridge Inspector's Reference Manual*.

Above all, the inspector's judgment must be exercised at all times to ensure critical thinking and appropriate inspection is being applied to the ancillary structures. Due to the vast number of structures and their significant variation of condition, configuration, type, and inspection techniques, the inspector's judgment is of the utmost importance.

CHAPTER 1. TYPES OF TRAFFIC ANCILLARY STRUCTURES

1.1 Introduction

This chapter covers the various types of traffic ancillary structures within VDOT's inventory. Altogether, the Department currently manages over 35,000 traffic ancillary structures. It is expected this number will continue to climb as more areas are increasingly developed.

The Department currently recognizes three main groups of structures, which are listed below. In the remainder of the chapter, each group will be further subdivided and discussed, with common elements being identified and nomenclature developed.

- Sign Structures, which include:
    - Overhead Span Sign Structures
    - Cantilever Sign Structures
    - Butterfly Sign Structures
    - Bridge Parapet Mount Sign Structures
- Traffic Signal Structures, which include:
    - Mast Arm Traffic Signal Structures
    - Span Wire Traffic Signal Structures
    - Overhead Span Traffic Signal Structures
- Pole Structures, which include:
    - Conventional Luminaire Pole Structures
    - Offset Luminaire Pole Structures
    - High Mast Light Pole Structures
    - Camera Pole Structures
    - Cell Tower Pole Structures

Do note that significant variation of configurations exists throughout the structures, so the examples shown may not always be applicable. Therefore, this chapter should provide an excellent introduction to the traffic ancillary structures.

Some structures may be of a hybrid type, where they have characteristics that may be applicable to more than one type of structure. In this case, the primary function of the structure will be assessed, and this will be how the structure is classified. As an example, a traffic signal that also has a conventional luminaire attached should be classified by the primary function, which is as a traffic signal structure.

1.2 Sign Structures

Sign structures typically consist of four main components: the sign panel that displays the message, the horizontal portion of the structure that carries the sign panels and is located over traffic, the vertical supports adjacent to the roadway that carry the horizontal component of the structure, and the foundation that anchors the vertical supports and so, also anchors the structure overall.

The sign panels may be rigid panels on which a message is placed using reflective material. They may also be variable message signs (VMS), which are signs that can vary light emitting elements to display various messages. For both types of panels, reflective material and lights are arranged and displayed in accordance with the message they are intended to communicate to traffic.

The horizontal component of the structure, which the signs are attached to, provide structural support for the sign over the roadway. The three main types are overhead span, cantilever, and butterfly structures. The type of horizontal support typically determines the nomenclature of the structure. These configurations usually involve one or more horizontal members called chords. In case of multiple chords, the chords are connected by intermediate bracing members, forming a truss.

The vertical supports provide structural support for the horizontal components of the structure. The vertical supports also extend the sign upward, creating clearance between traffic on the roadway and the bottom of the sign structure. These vertical supports are usually single poles or a vertical plane truss with two main vertical members.

The foundation provides structural support for the vertical supports. The majority of the foundation is below ground. The foundation transfers the loads that act on the structure to the ground.

While general nomenclature and other various structure details will be discussed within this chapter, numbering and orientation of specific structures, components, and elements will be covered in Section 4.6.

1.2.1 Overhead Span

These structures span the roadway, with poles on both sides of the structure. They may span the roadway in both directions of traffic, with poles on the outside edges of the roadway. Overhead spans may also span a single direction of traffic, with one pole in the median and one pole on the outside edge of roadway. Depending on the structure's requirements and design, one of four configuration types may be chosen. The types are listed by the number of chords that make up the horizontal portion of the structure that spans the roadway. The four types of overhead span structures are the Single Chord, Two Chord Truss, Tri-Chord Truss, and Four Chord Truss.

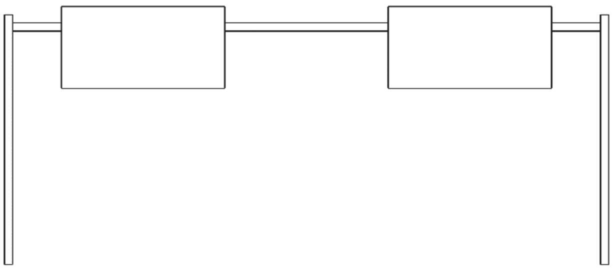


Figure 1.1 *Overhead Span, Single Chord*

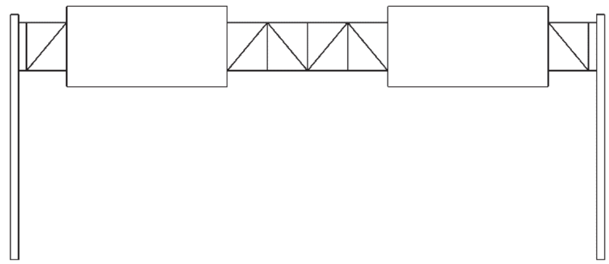


Figure 1.2 *Overhead Span, Multi Chord with Truss*

Photo 1.1 *Overhead span sign structure*

Photo 1.2 *Overhead span sign structure*

The overhead span structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Sign panels
- Horizontal supports
- Vertical supports
- Foundation

1.2.1a *Sign Panel: Zee Bar Type*

The sign panel is attached to the chord. It displays information on the side facing traffic and has support elements on the side away from traffic, where it connects to the superstructure. Some of the specific subcomponents of the sign panel are detailed in the list below. For numbering convention and orientation of the structure, refer to Section 4.6.3.

- **Reflective Material**: The sign panel displays information that is coated in a light reflective material.
- **Sign Panel**: The sign panel displays information that is applied to one or more thin aluminum sheets. These sheets are combined to form larger signs, held together by backing strips.
- **Backing Strip**: Thin strip of aluminum that overlap a portion of two sign panels, attaching them to one another. The backing strip is held in place by a backing strip stud.
- **Backing Strip Stud**: The fastener connecting the backing strip to the sign panels. The backing strip studs are resistance welded to the panels.
- **Windbeam**: The horizontal members supporting the sign panels. Windbeams typically consist of aluminum Zee bars. Most sign panels are attached to the windbeams using aluminum sign clips and threaded studs resistance welded to the sign panels. Due to the common failure of the resistance welded studs, most of these connections have been retrofit with through bolts. Standards that are more recent require the panels to be connected directly to the windbeams with through bolts.
- **Hanger**: The vertical members are called hangers. Hangers typically consist of steel or aluminum I-beams. On one side, the hangers connect to the windbeams via steel or aluminum bolts, nuts, and flat washers. On the other side, the hangers connect to the sign support structures, which are detailed in the following sections.

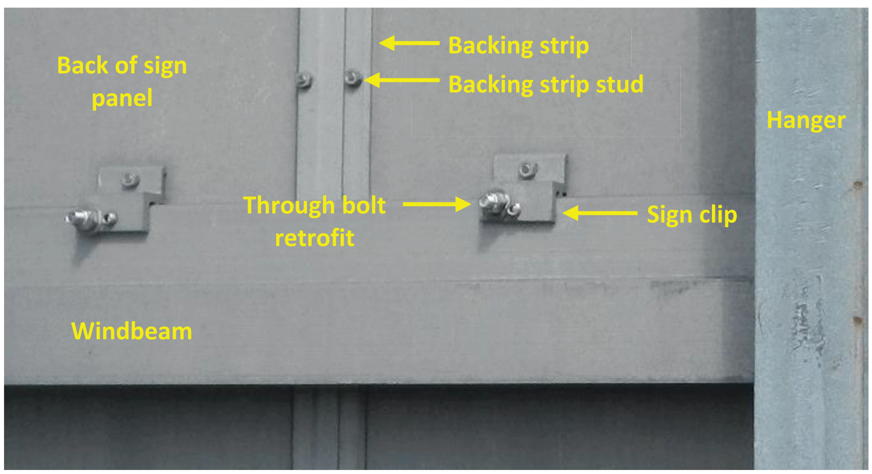


Photo 1.3 *Sign panel attachment to windbeam with retrofitted through bolt*

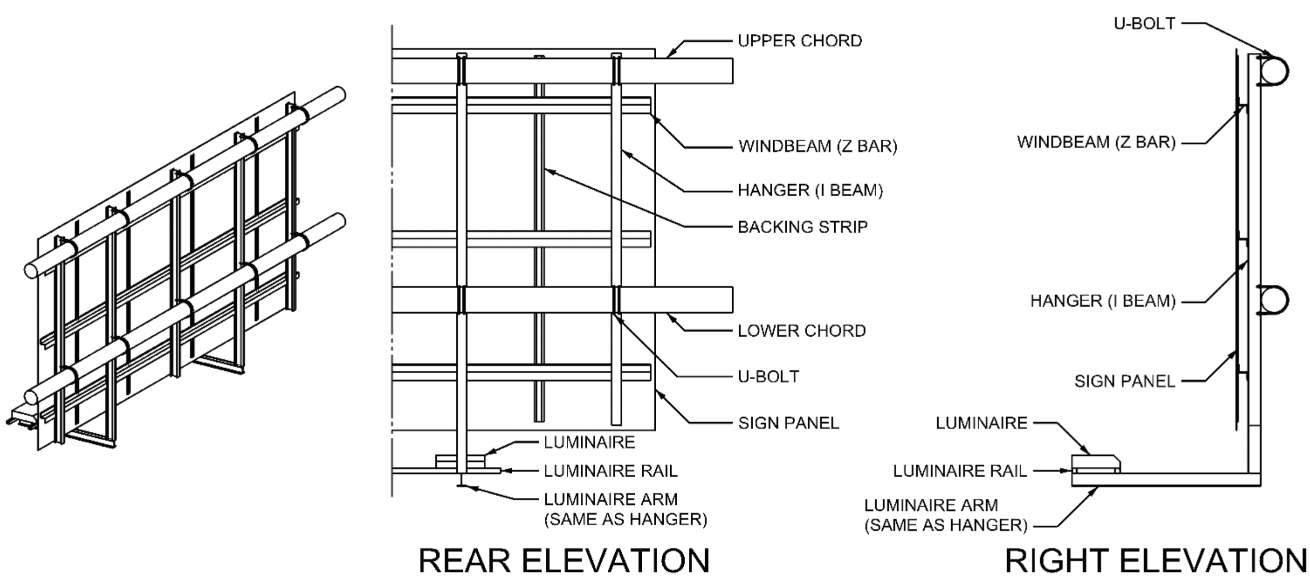


Figure 1.3 *Sign Panel, Zee Bar Type*

1.2.1b *Sign Panel: Extruded Type*

The sign panel is attached to the chord. It displays information on the side facing traffic and has support elements on the side away from traffic, where it connects to the superstructure. Some of the specific subcomponents of the sign panel are detailed in the list below. For numbering convention and orientation of the structure, refer to Section 4.6.3.

- **Reflective Material**: The sign panel displays information, which is coated in a light reflective material.
- **Sign Panel Extruded Section**: The sign panel displays information that is applied across several aluminum extruded sections that are bolted together with stitch bolts. This system eliminates the backing strips and windbeams found in the type of sign panel previously discussed.
- **Hanger**: The vertical members are called hangers. Hangers typically consist of steel or aluminum I-beams. On one side, the hangers connect to the extruded sections via steel or aluminum bolts, nuts, and flat washers. On the other side, the hangers connect to the sign support structures, which are detailed in the following sections.

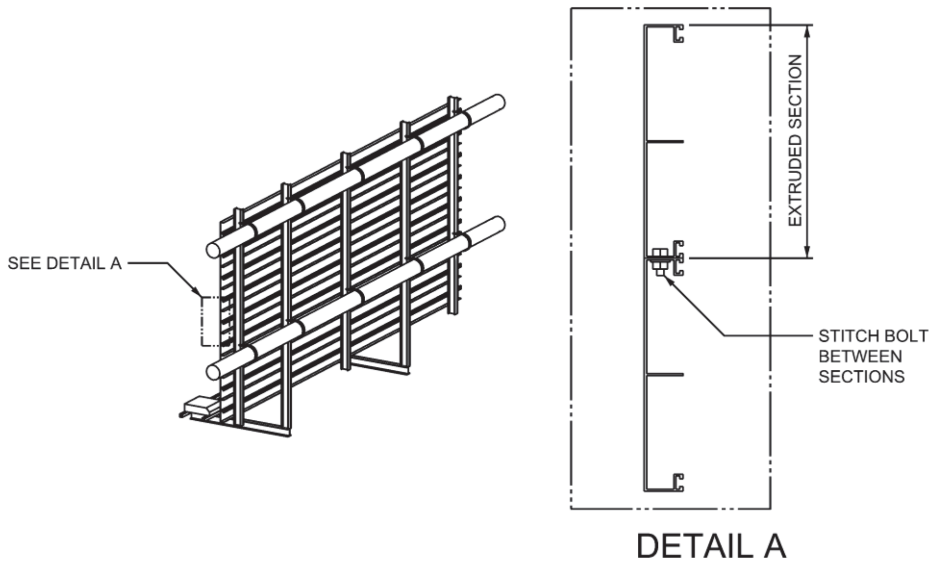


Figure 1.4 *Sign Panel, Extruded Type*

Photo 1.4 *Sign panel, extruded type, rear view*

1.2.1c *Sign Panel: Connection to Superstructure*

Sign panels connect to the support structure, or superstructure, via the hangers. For tubular superstructure members, the hanger to support structure connection is typically made with stainless steel U-bolts, nuts, and flat washers. The connection may also be made using a clamp type setup. For angular superstructure members, the connection may be made using steel through bolts, nuts, and washers.

1.2.1d *Sign Panel: Luminaire System*

The luminaire system illuminates the sign and extends from the bottom of the hangers, out beyond the front of the sign. Some of the specific subcomponents of the luminaire system are detailed in the list below.

- **Luminaire**: The lights that illuminate the sign. The luminaire sits at the end of the luminaire arm or on the luminaire rail, pointed toward the sign panel's reflective side.
- **Luminaire Arm**: The arms carry the luminaire system, extending from the sign panel hangers, positioning the luminaires toward the front of the sign. The arms are typically the same material and beam type as the hangers. The luminaire arms may be connected to the hangers via a welded gusset plate, perimeter welded to one another, or bolted together.
- **Luminaire Rail**: The luminaire rail spans across the luminaire arms, with the luminaires and conduit typically positioned on the luminaire rail.

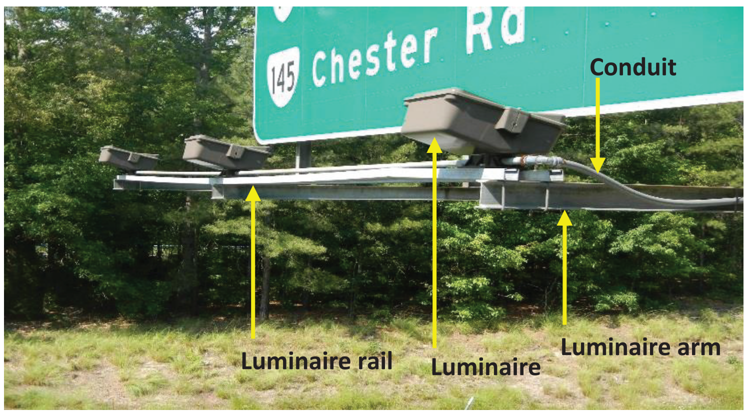


Photo 1.5 *Sign panel luminaire system*

1.2.1e *Sign Panel: Variable Message Signs (VMS)*

The VMS is a special kind of sign panel that uses light emitting elements activated at variable times to display configurable messages. These panels typically have integrated structural components that make up the body of the panel and house the electronic components. It is common for VMS structures to have internal enclosures that may be walked in to perform electrical component maintenance. These internal areas are typically locked and are not usually accessed for structural inspections.

The type of light emitting element varies significantly and continues to become more advanced with evolving technology. Some of the various configurations are discussed in the list below.

- **Disc**: The sign panel consists of individual discs arranged in rows and columns, with each disc having both a reflective and non-reflective surface. Messages are displayed by altering the position of the two surfaces.
- **Light Emitting Diode (LED)**: The sign panel consists of LEDs arranged in rows and columns. Messages are displayed by altering the on and off state of the LEDs. This is very similar to a bulb matrix, but the LEDs are much smaller than the bulbs, allowing for greater resolution of the message. This greater resolution even allows for moving messages, such as an arrow pointing/expanding to one direction.
- **Fiber Optic**: The sign panel consists of fiber optic bundles arranged in rows and columns along with shutter devices that can block the light output. Messages are displayed by altering the shutter state, thereby controlling which light is visible.
- **Bulb**: Sometimes called Bulb Matrix, the sign panel consists of light bulbs arranged in rows and columns. Messages are displayed by altering the on and off state of the bulbs.
- **Hybrid LED-Disc**: The sign panel consists of a LED-Disc hybrid system. Messages are displayed by altering the state of both the LEDs and discs.
- **Hybrid LED-Fiber Optic**: The sign panel consists of a LED-Fiber Optic hybrid system. Messages are displayed by altering the state of both the LEDs and fiber optics.

Photo 1.6 *VMS panel, LED type with internal walkway*

1.2.1f <u>*Sign Panel: Walkway*</u>

Walkways consist of members that form a frame for grating to rest on, providing walkable access to the structure. Some walkways have a railing that may be movable, pivoting into a deployed position as needed. Walkways are primarily maintenance aids and can often be accessed from the supporting space frame. In the past, walkways were installed on many types of sign structures. However, due to safety concerns, walkways are being removed from all but VMS structures. Some of the specific subcomponents of the walkway system are detailed in the list below.

- **Railing**: A safety enclosure that protects personnel using the walkway from falling. It consists of a handrail, a midrail, posts, and toeboard, each of which is detailed in the list below.
  - **Handrail**: The top horizontal member that run parallel to the walkway.
  - **Midrail**: The rail approximately midway between the handrail and the platform.
  - **Posts**: The vertical members that support the rails.
  - **Toeboard**: The plate that runs parallel to the walkway, attached between the posts.
- **Platform**: The working space or walking surface. This typically consists of open grid metal grating.

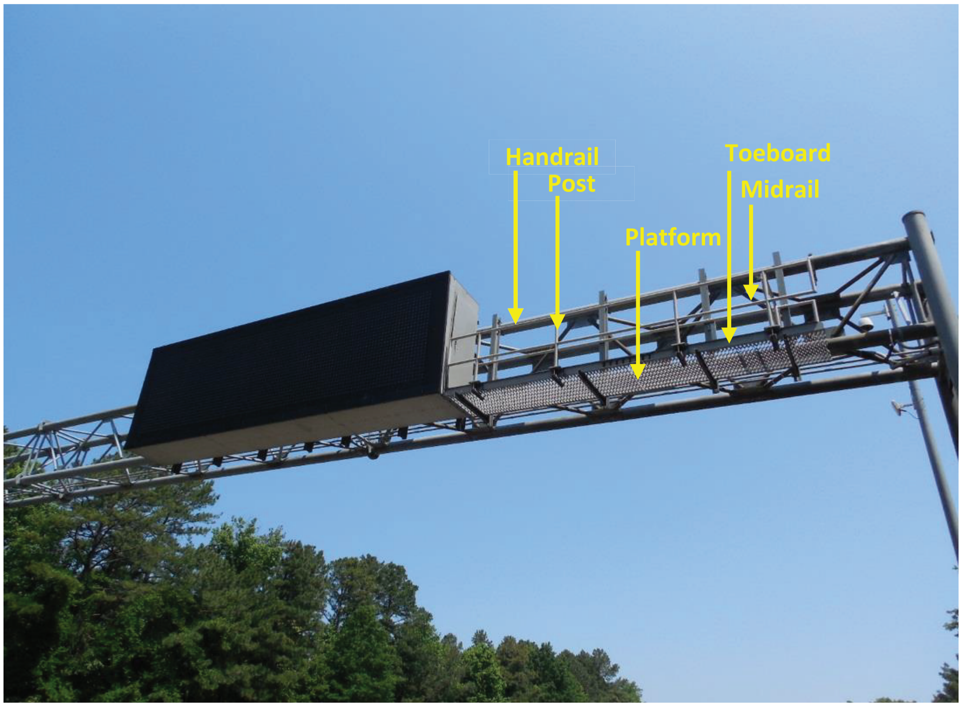


Photo 1.7 *Overhead span with walkway*

1.2.1g *Horizontal Support: Single Chord*

The single chord overhead span sign structure spans the roadway and supports the sign panels. Two types of single chord overhead span structures exist, which are detailed in the bulleted list below. For numbering convention and orientation of the structure, refer to Section 4.6.3.

- **Chord and Pole Structure**: Consists of a single horizontal member (the chord), typically a tubular shape, that is supported at each end by a vertical support consisting of a single pole.
- **Monotube Structure**: Consists of a single horizontal tubular shape (the chord) that bends at each end so that the chord transitions into vertical supports, thereby creating a continuous structure with integrated poles.

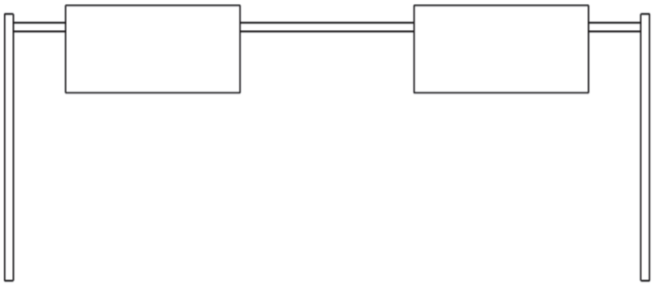


Figure 1.5 *Overhead Span, Single Chord and Pole Structure*

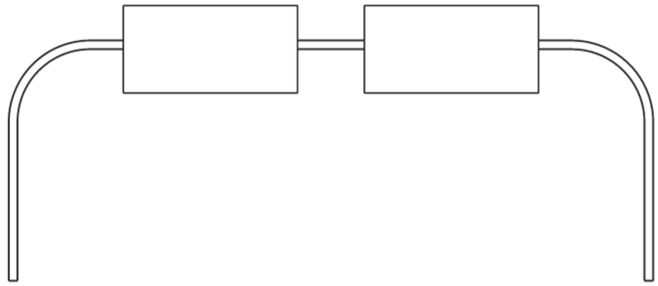


Figure 1.6 *Overhead Span, Monotube Structure*

Photo 1.8 *Overhead span, single chord and pole structure*

Photo 1.9 *Overhead span, monotube structure*

1.2.1h *Horizontal Support: Two Chord Truss*

The two chord overhead span sign structure consists of two horizontal members (the chords), with bracing between the chords consisting of vertical and diagonal members. These members form a truss; since all members are within a two-dimensional plane, this truss type is typically called a plane truss. The truss is typically constructed of tubular or angular shapes. The truss is supported at each end by a vertical support consisting of a single pole. For numbering convention and orientation of the structure, refer to Section 4.6.3.

Some of the specific subcomponents that make up a truss, as well as some common truss nomenclature is provided in the list below. Note that several of these terms may be combined to more accurately describe the truss; for example, a vertical plane Pratt truss.

- **Truss**: A combination of main members (the chords) and smaller members. The main members span the longitudinally greatest distance. The smaller members brace the main members; these may connect the larger members vertically, horizontally, or diagonally.
- **Plane Truss**: A truss in which all members lay within a two-dimensional plane.
- **Space Truss**: A truss in which some or part of members lay outside a two-dimensional plane.
- **Horizontal Truss**: A truss in which the major longitudinal direction is horizontal.
- **Vertical Truss**: A truss in which the major longitudinal direction is vertical.
- **End Frame**: A truss typically found at an end of a structure, such as the two-pole vertical truss that makes up the vertical support of some ancillary structures.
- **Panel Point**: A point at which several members intersect.
- **Pratt Truss**: A truss that, moving toward the center of the structure, has downward sloping diagonals, similarly to the Figure 1.7, for the two-chord truss. The diagonals are subjected to tensile loads.
- **Warren Truss**: A truss that, moving toward the center of the structure, has alternating downward and upward sloping diagonals, similarly to the Figure 1.8, for the tri-chord truss. The diagonals are subjected to alternating tensile and compressive loads.
- **Vierendeel Truss**: A truss in which the members form rectangular rather than triangular openings, lacking diagonal members. Members are subjected to bending loads.

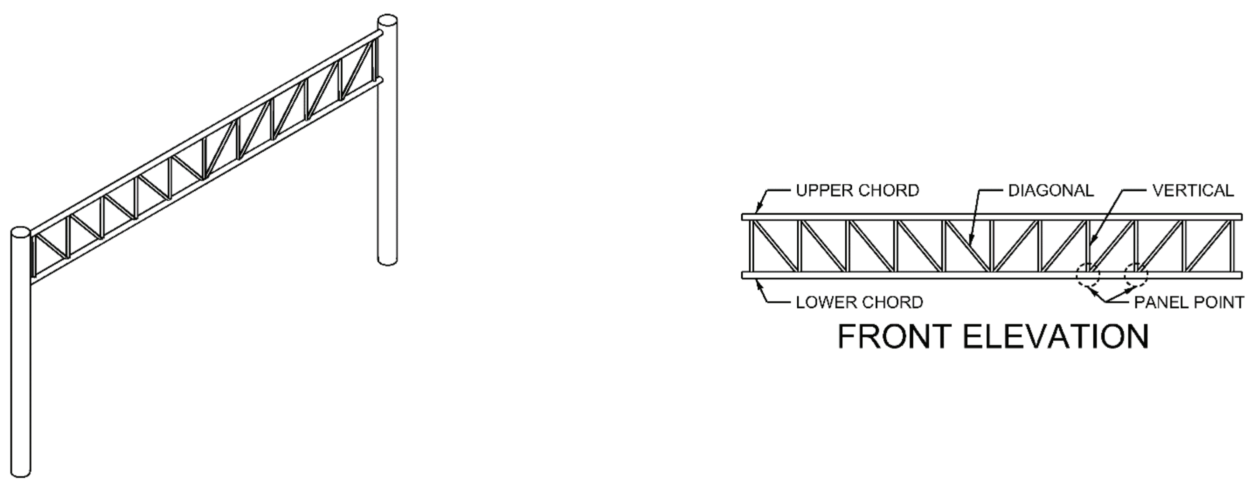


Figure 1.7 *Overhead Span, Two Chord Plane Truss*

1.2.1i *Horizontal Support: Tri-Chord Truss*

The tri-chord overhead span sign structure consists of three horizontal members (the chords), with bracing between the chords consisting of vertical and diagonal members. These members form a truss; since not all members are within a two-dimensional plane, this truss type is typically called a space truss. The truss is typically constructed of tubular or angular shapes. The truss is supported at each end by a vertical support consisting of a single pole, or a two-pole plane truss. For a list of trussing nomenclature, refer to Section 1.2.1h. For numbering convention and orientation of the structure, refer to Section 4.6.3.

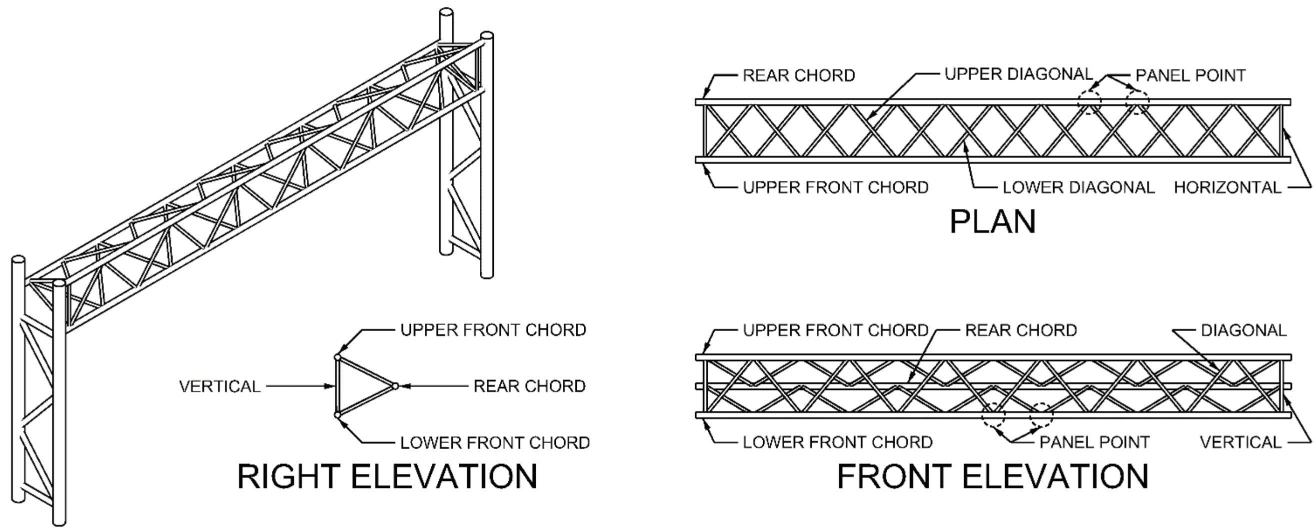


Figure 1.8 *Overhead Span, Tri-Chord Space Truss*

1.2.1j *Horizontal Support: Four Chord Truss*

The four chord overhead span sign structure consists of four horizontal members (the chords), with bracing between the chords consisting of vertical, horizontal, and diagonal members. These members form a truss; since not all members are within a two-dimensional plane, this truss type is typically called a space truss. The truss is typically constructed of tubular or angular shapes. The truss is supported at each end by a vertical support consisting of a single pole, or a two-pole plane truss. For a list of trussing nomenclature, refer to Section 1.2.1h. For numbering convention and orientation of the structure, refer to Section 4.6.3.

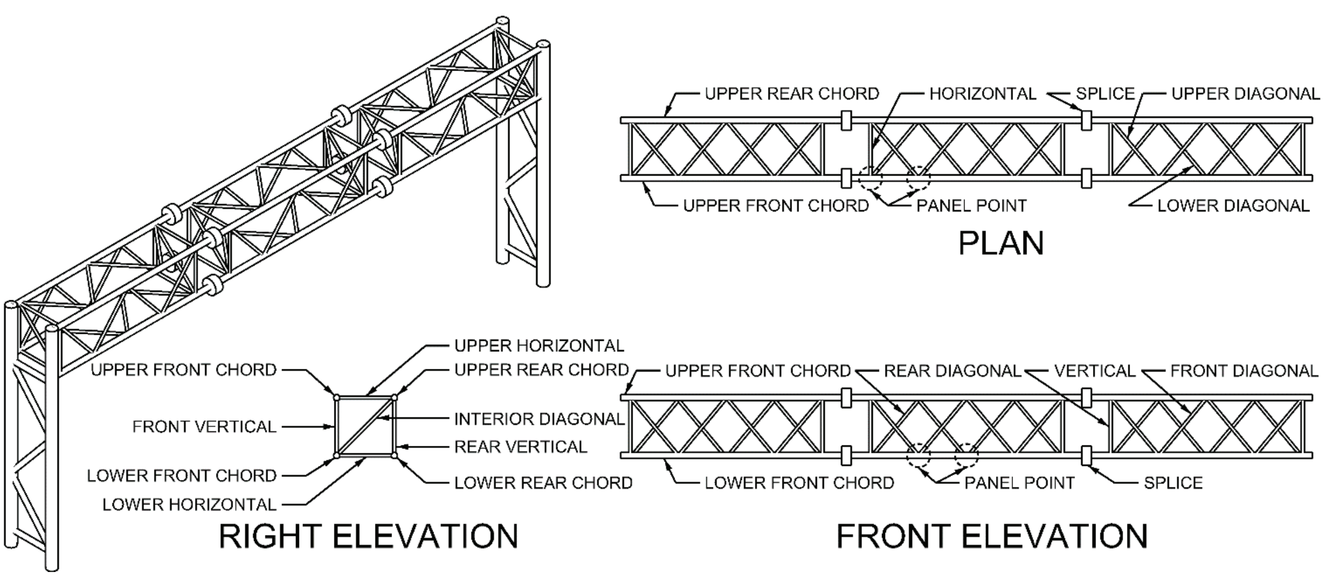


Figure 1.9 *Overhead Span, Four Chord Space Truss*

1.2.1k Horizontal Support: Other Attachments to Chord

It is common for the horizontal supports to have attachments. These may be smaller signals, cameras, sensors, or other items. They consist of the attachment and the connection to the horizontal support. Most commonly, the connection is made through metal straps that wrap around the horizontal support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness.

- **Sensor**: A broad term that may include items used to measure various data such as day or night cycle, speed, or whether a car is approaching the signal.
- **Camera**: A specific type of sensor used to capture video footage or photographs of the surrounding area.
- **Antenna**: An attachment that is used to transmit sensor data.
- **Signal**: A specific device that is used to communicate a message to control traffic.
- **Dampener**: An attachment that helps dissipate excess vibrations. The components are called dampeners, but the proprietary name may be damper.

Photo 1.10 *Chord Attachments to Horizontal Support*

1.2.1l Horizontal Support: Chord Splices

Long overhead span structures are formed by joining multiple chord or truss sections. For round chords, splice flanges are welded to the chords at the end of each of the sections. The sections are field bolted together at the splice flanges. For angle chords, the splices are made by bolting or welding the chords to a short section of angle that overlaps each chord section.

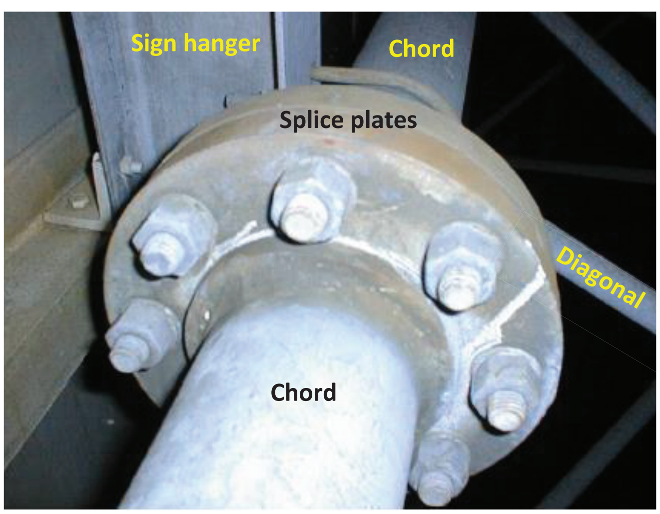


Photo 1.11 *Round chord splice connection*

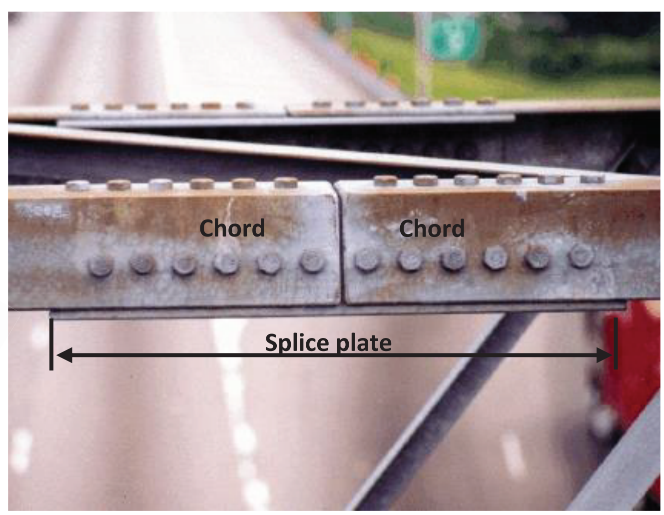


Photo 1.12 *Angle chord splice connection*

1.2.1m Vertical Support: Chord to Vertical Support Connection

Seated Type

The various chord configurations are supported by vertical supports or poles through differing connection details, some of which are seated types. A seated configuration involves the carried component bearing or sitting directly on the carrying component such that the majority of the load is transferred directly to the carrying component rather than the load transferring through connection hardware. The two components are still secured with clamps or u-bolts, but this connection hardware carries a minor portion of the load.

It is notable that seated type connections are more robust than unseated connections, which are detailed in the next section. This is due to the main structural members carrying the load directly and generally being heavier than any connection hardware that may be used in the unseated type connections.

Several common seated type chord to vertical support connections are discussed in the list below.

- **Seated on Strut of Vertical Support**: This simple truss support consists of the chord resting on the strut, typically an angle, which runs between the two poles of a vertical plane truss (end frame). The chord is clamped to the angle with u-bolts, locknuts, and flat washers. Between the chord and the angle, there may be a bent plate washer or a saddle shim, and any needed insulation between the dissimilar metals, such as neoprene or other fabric.
- **Seated on Chair**: This simple truss support consists of the chord resting on a seat. The seat is made up of welded plates and is welded or bolted to the vertical support pole. The chord is clamped to the seat with u-bolts, locknuts, and flat washers. Between the chord and the seat, there may be a bent plate washer or a saddle shim, and any needed insulation between the dissimilar metals, such as neoprene or other fabric.
- **Seated on Pole**: This simple truss support consists of the chord resting on a seat, which is centered on top of the pole. The seat is made up of welded plates and is welded or bolted to the top center of the vertical support pole. The chord is clamped to the seat with u-bolts, locknuts, and flat washers. Between the chord and the seat, there may be a bent plate washer or a saddle shim, and any needed insulation between the dissimilar metals, such as neoprene or other fabric.

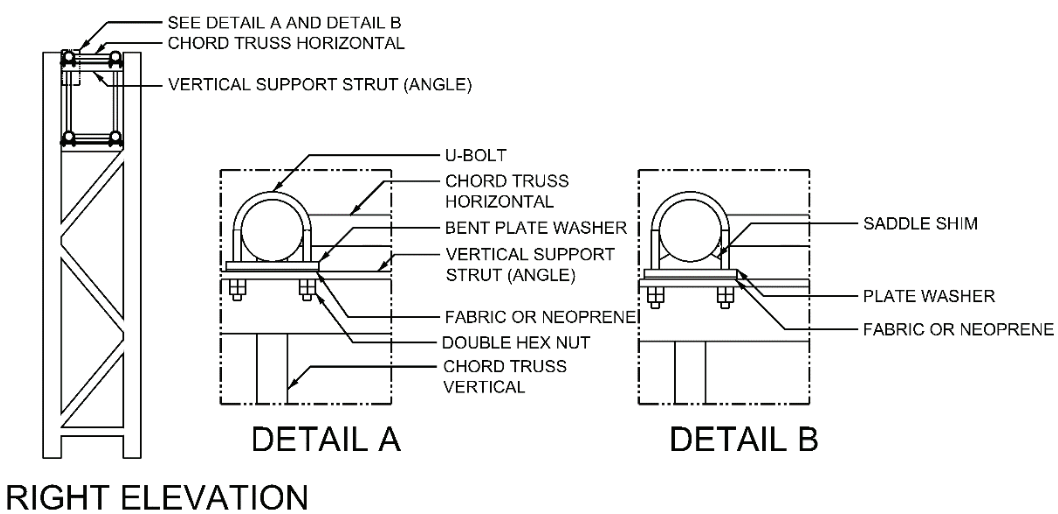


Figure 1.10 *Simple Truss Support, Seated on Strut of Vertical Support*

Photo 1.13 *Simple truss support, seated on strut of vertical support*

Photo 1.14 *Simple truss support, seated on chair*

Photo 1.15 *Simple truss support, seated on pole*

Unseated Type

The various chord configurations are supported by vertical supports or poles through differing connection details, some of which are unseated types. An unseated configuration involves the carried component bolted or welded to the carrying component such that the load is fully transferred to the carrying component via the connection hardware.

Several common unseated type chord to vertical support connections are discussed in the list below.

- **Gusseted Box Flange Plate**: This connection consists of a box gusset that is shaped to fit the pole and welded to the pole. A flange plate is welded to the other side of the box gusset. A second flange plate is welded to the chord. The two flange plates are butted up and bolted together. This configuration exists at each chord.
- **Pinned**: This connection consists of two clamp assemblies, with one around the pole, and one around the chord. The clamp consists of u-bolts attached to a curved plate. By tightening the bolts, the curved plate is tightened to the pole or chord. Each curved plate has loops or eyes that are welded to the plate. The eye on the pole and the eye on the chord fit up so that a pin can be installed through both eyes, thereby connecting the chord to the pole.
- **Bolted Shape**: This connection consists of one of several possible shapes (angle, T-shape) bolted to the pole and the chord bolted to the shape. This type of connection is more common to vertical support poles that are non-tubular.
- **Collar Plate, Tubular Chords**: This connection consists of a large horizontal plate welded to the pole (one at the upper chords, one at the lower chords). The large plate is typically reinforced by ribs attached to the pole and plate. The large plate extends out toward the chords. Alternately, the large plate may be two individual plates on each side of the pole, which extend out to the chords. A smaller plate is welded to each chord, (two smaller plates at the upper chords and two at the lower chords), extending inward toward the pole. The smaller collar plates are positioned to overlap the larger collar plate such that the structure is aligned properly. Once positioned correctly, the overlapping plates are bolted together.
- **Collar Plate, Angle Chords**: This connection consists of a large horizontal plate welded to the pole (one at the upper chords, one at the lower chords). The large plate is typically reinforced by ribs attached to the pole and plate. The large plate extends out toward the chords. Alternately, the large plate may be two individual plates on each side of the pole, which extend out to the chords. The chords, which are angles, are oriented so that the horizontal leg of the angle can overlap the large collar plate. The chords are positioned to overlap the larger collar plate such that the structure is aligned properly. Once positioned correctly, the overlapping angles and plate are bolted together.

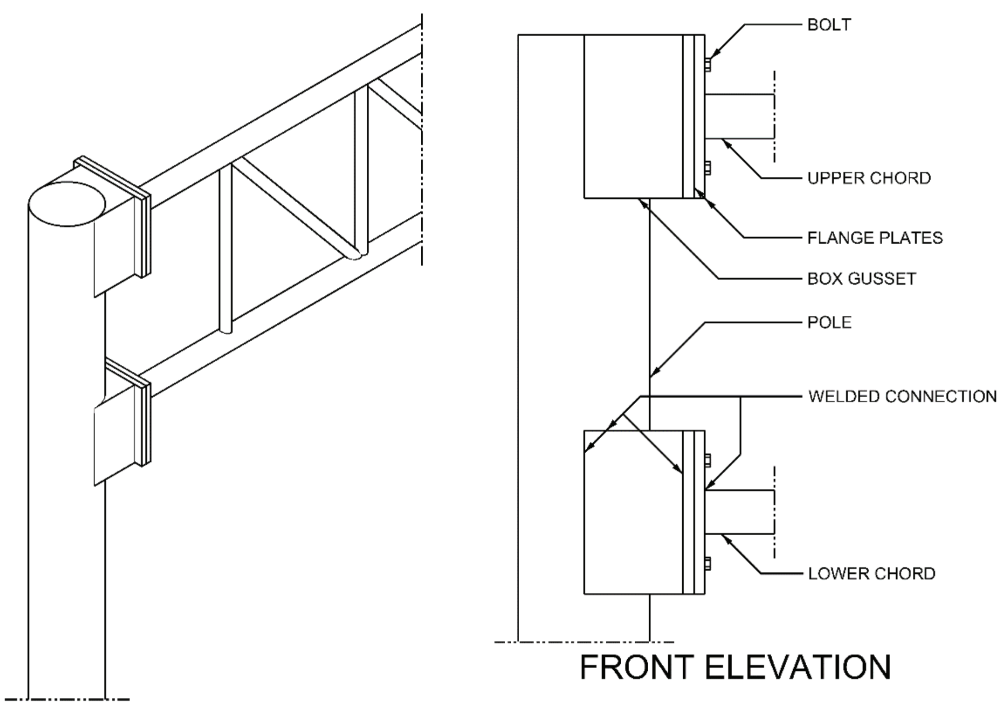


Figure 1.11 *Overhead Span Chord to Pole Connection, Gusseted Box Flange Plates*

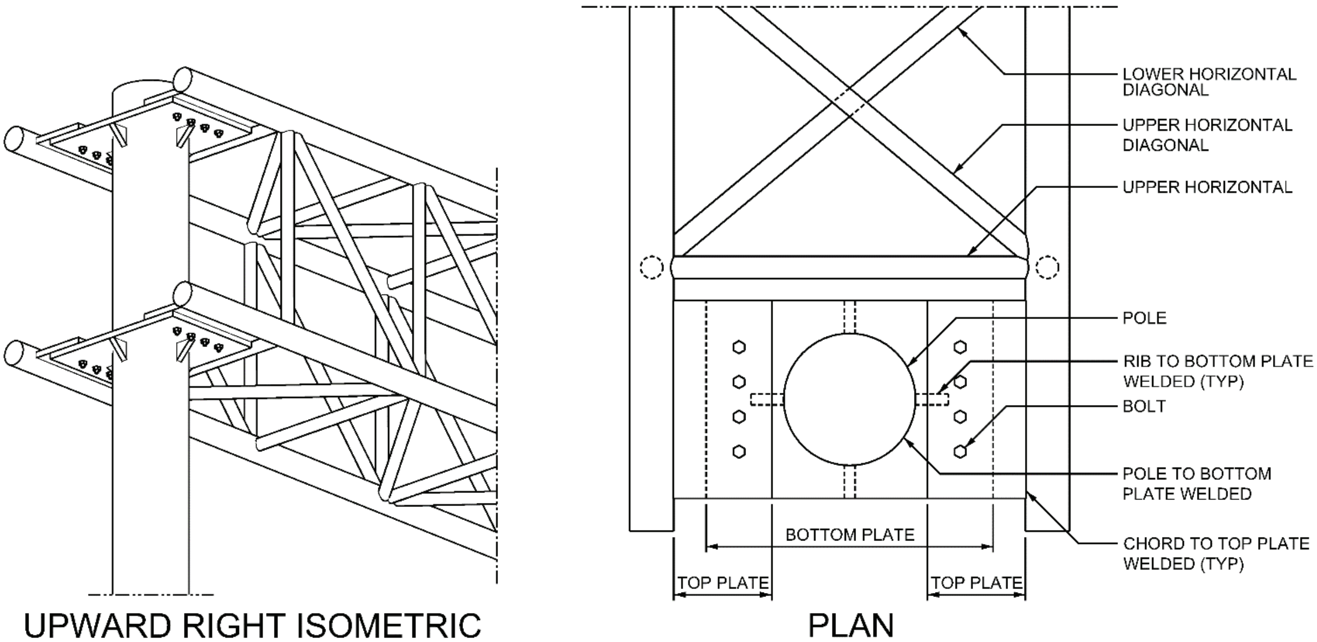


Figure 1.12 *Overhead Span Chord to Pole Connection, Collar Plate, Tubular Chords*

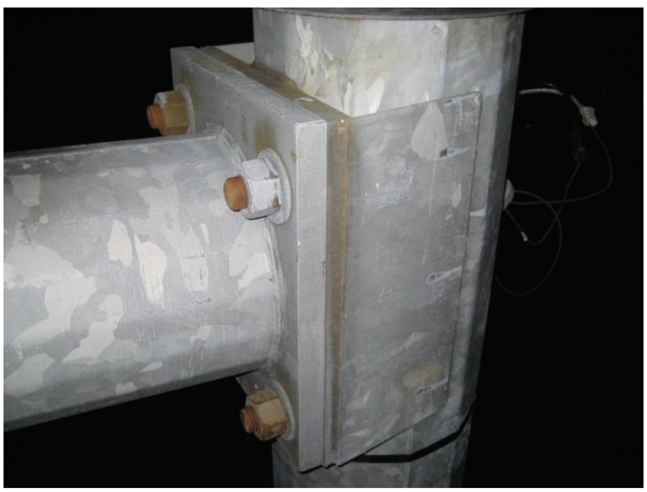


Photo 1.16 *Gusseted box flange connection*

Photo 1.17 *Collar plate, angle chords*

Photo 1.18 *Pinned connection*

Photo 1.19 *Bolted T-shape connection*

1.2.1n *Vertical Support: Attachments*

It is common for the vertical supports to have attachments. These may be smaller signs, cameras, sensors, or other items. They consist of the attachment and the connection to the vertical support. Most commonly, the connection is made through metal straps that wrap around the vertical support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. Alternatively, these connections are often made with threaded rod formed around the pole and connected to a horizontal member supporting the attachment.

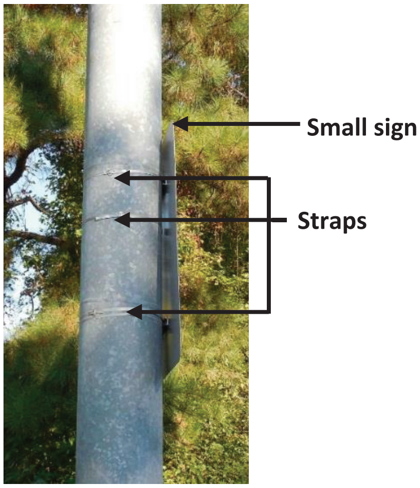


Photo 1.20 *Attachment to vertical support, straps*

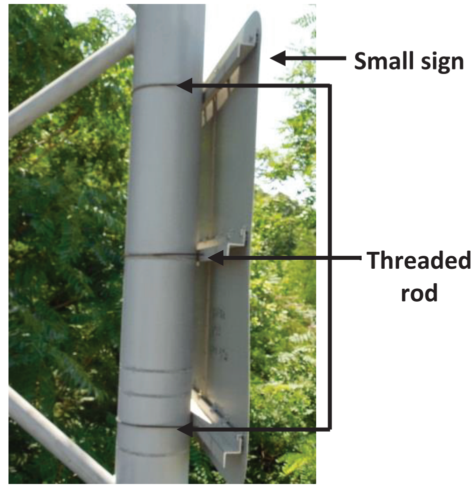


Photo 1.21 *Attachment to vertical support, threaded rod*

1.2.1o *Vertical Support: Poles or Truss*

The term pole typically refers to a single vertical support of a tubular, multi-sided, or I-beam. Vertical supports consist of a single pole or a two pole plane truss, sometimes referred to as an end frame. Both items support the structure in a similar way, elevating the horizontal portion of the structure above the roadway. The subcomponents that make up the vertical supports are briefly detailed in the list below. For numbering convention and orientation of the structure and components, refer to Section 4.6.3.

- **Base Plate**: The plate at the bottom of the pole that is welded to the perimeter of the pole. The anchor bolts (refer to foundation section) tie into the pole via the base plate. The base plate must be thick enough to resist localized deflection or warping due to design loading conditions.
- **Hand Hole**: This is an opening in the pole near the base that can be opened for electrical work or interior inspection. It is typically elliptical in shape, is surrounded by a reinforcing ring, and has a cover that is fastened in place with screws or a locking clamp assembly.
- **Cap**: This component sits on top of the poles to close it and protect the pole from water, debris, or pest intrusion.
- **Pole**: A single tubular, multi-side, or I-beam member acting as a vertical support for the overhead span.
- **Truss and Truss Members**: A vertical plane truss (end frame) oriented perpendicular to the roadway acting as a vertical support for the overhead span. It consists of two larger vertical members (poles) that may be tubular shapes or I-beams, and smaller horizontal and diagonal members that may be tubular shapes or angles. For a list of trussing nomenclature, refer to Section 1.2.1h.

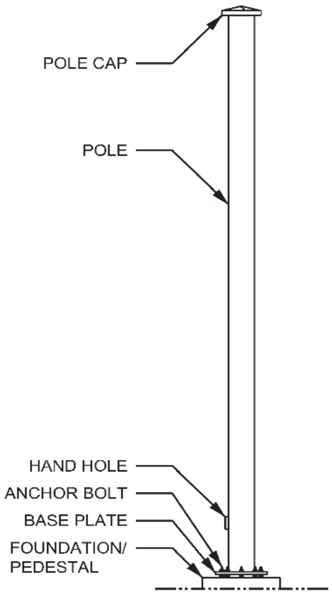


Figure 1.13 *Single Pole, Elevation*

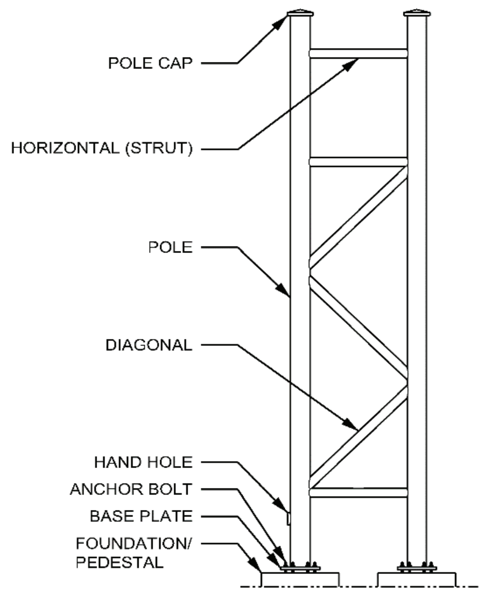


Figure 1.14 *Two Pole Truss (End Frame), Elevation*

Photo 1.22 *Single pole*

Photo 1.23 *Two pole truss (end frame)*

1.2.1p *Foundation*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure's loads, to the earth or substructure. Several specific subcomponents of the foundation and some common foundation types are discussed in the list below.

- **Anchor Bolt**: Anchor bolts are threaded rods that extend several inches above the foundation. With regards to inspection, the term "anchor bolts" generally refers to the visible component of the anchor bolt, or the portion of the anchor bolt not embedded into the foundation. However, for concrete foundations, the bolts are embedded several feet into the concrete. Some of the specific subcomponents of the anchor bolt assembly are detailed in the list below. For numbering convention of anchor bolts, refer to Section 4.6.4.
  - **Anchor Bolt**: The visible threaded rod.
  - **Leveling Nut**: The nut immediately above the foundation and below the base plate.
  - **Top Nut**: The nut immediately above the base plate.
  - **Flat Washer**: Washers that are installed between the nut and the base plate, for both the top and leveling nut.
  - **Jam Nut**: This is an additional nut that may be installed above the top nut, used to lock the anchor bolt assembly in place. This item is not shown in the figure, as it is not commonly encountered in the field.
- **Pedestal**: The pedestal is a part of the foundation. It refers generally to the upper portion of a concrete foundation, which is above ground, near the area surrounding the pole to foundation interface.
- **Spread Footing**: This foundation type is the most common for ancillary structures. It consists of a shaft made up of concrete and reinforcing steel. At the bottom of the shaft, a wider section of concrete extends outward. The foundation is covered with soil to almost the top of the shaft. An anchorage assembly is cast into the shaft.
- **Caisson**: This foundation type consists of a shaft made up of concrete and reinforcing steel. The upper portion is less high than the lower portion but has a larger diameter. The lower portion has a smaller diameter, but is much longer than the upper portion. The shaft extends deeper into the ground as compared to a spread footing. The foundation is covered with soil to almost the top of the shaft. An anchorage assembly is cast into the shaft.
- **Helical Pile or Screw Pile**: This foundation type consists of a hollow metal shaft with one or more helical plates (acting as augers) along the length, and a bolting plate capping the top of the pile. The helical plates pull the shaft into the soil when the shaft is rotated. The shaft is in the ground to almost the top of the shaft. An anchorage assembly is attached between the pole's base plate and the helical pile's cap plate.
- **Barrier Mount**: This foundation type consists of anchor bolts cast into a median or other roadway barrier, to which the vertical support component of the ancillary structure is attached.
- **Bridge Parapet**: This foundation type consists of anchor bolts cast into the bridge parapet, to which the vertical support component of the ancillary structure is attached. Note that this is not the bridge parapet mount that is discussed in Section 1.2.4, in which the structure is mounted to the side of the bridge.
- **Steel Haunch**: This foundation type is a bracket attached to a bridge girder, made to accommodate the ancillary structure. The haunch consists of multiple plates built up and typically welded together. Anchor bolts are installed in the haunch, with the ancillary structure attached to these anchor bolts.
- **Fixed Attachment**: This type is not a typical foundation, but rather, it is when a structure is partially or fully, attached to another structure. For a fixed attachment, the side that is fixed does not typically have a vertical support. Note that this is not the classic bridge parapet mounted sign discussed in Section 1.2.4.

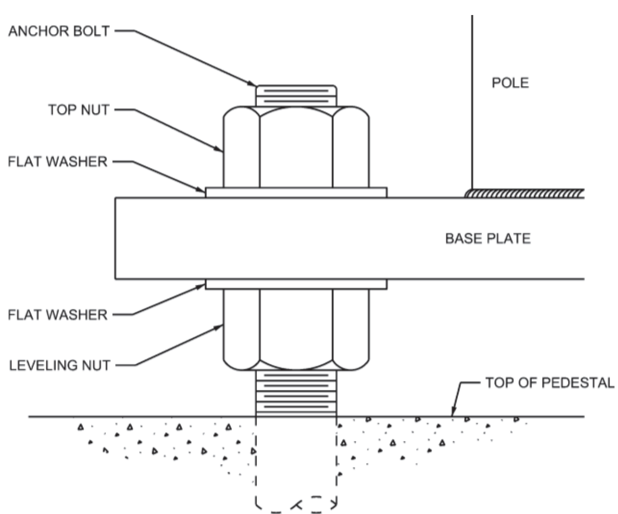


Figure 1.15 *Typical Anchor Bolt Configuration*

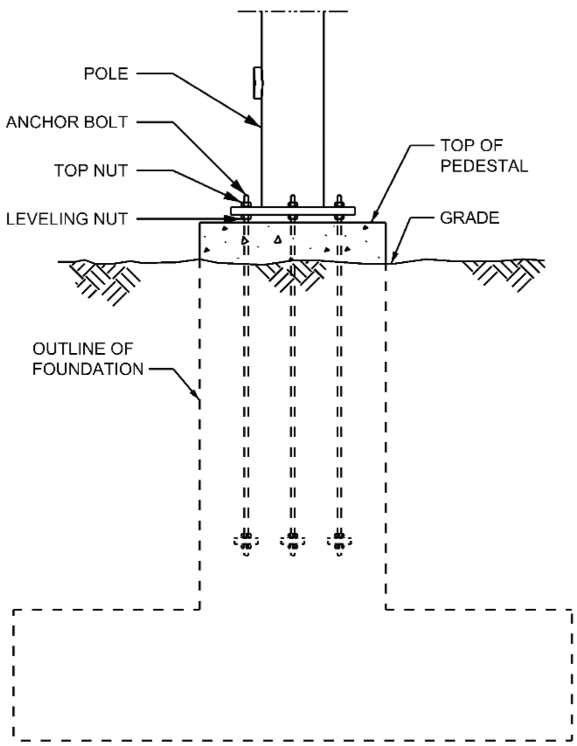


Figure 1.16 *Spread Footing*

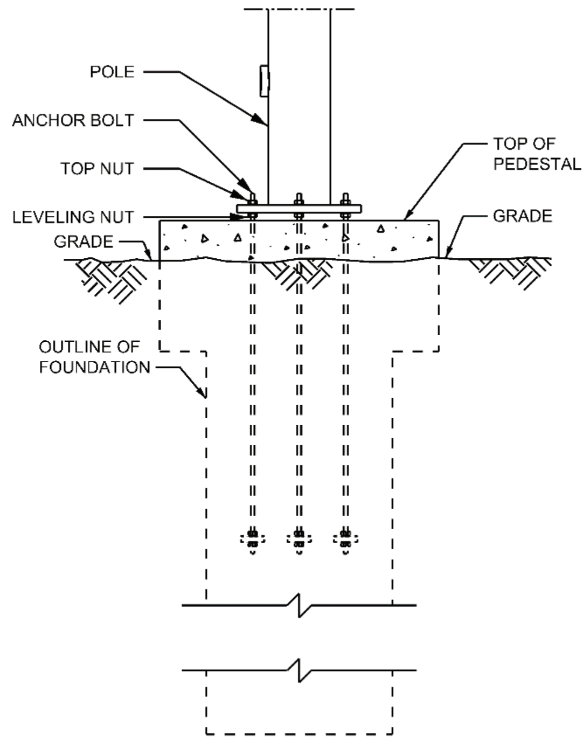


Figure 1.17 *Caisson*

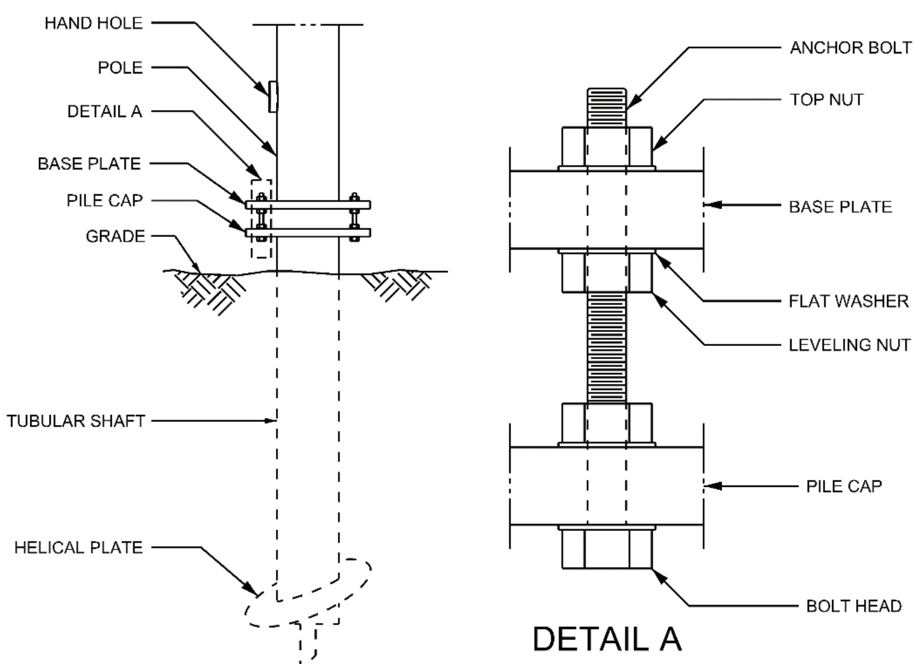


Figure 1.18 *Helical Pile*

Photo 1.24 *Overhead span with barrier mount foundation*

Photo 1.25 *Overhead span VMS with bridge parapet foundation*

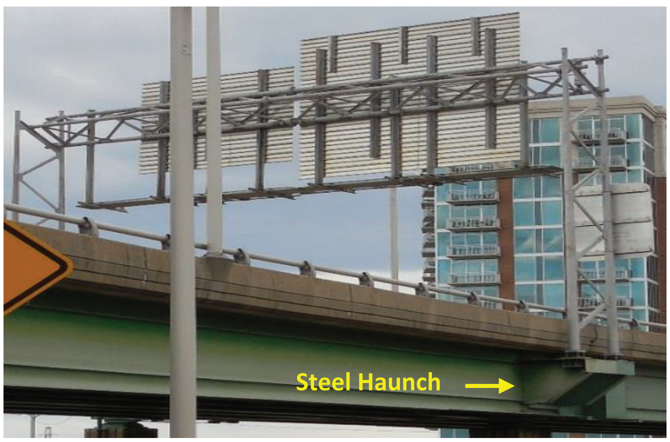


Photo 1.26 *Overhead span with steel haunch foundation*

Photo 1.27 *Steel haunch close up view*

Photo 1.28 *Overhead span with fixed attachment*

1.2.2 Cantilever

These structures have arms that overhang part of the roadway in a single direction of traffic, with a pole on one side of the structure. Depending on the structure's requirements and design, one of three configuration types may be chosen for the arm. The types are listed by the number of chords that make up the horizontal portion of the structure that overhangs the roadway. The three types of cantilever span structures are the Single Chord, Two Chord Truss and Untrussed, and Four Chord Truss.

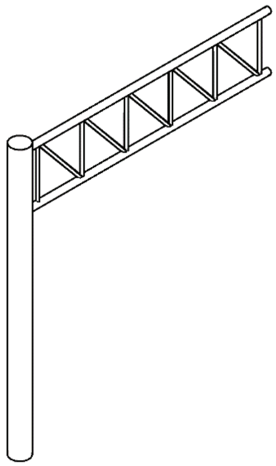


Figure 1.19 *Cantilever, Two Chord Plane Truss*

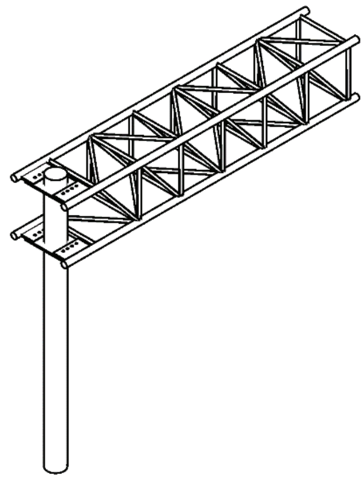


Figure 1.20 *Cantilever, Four Chord Space Truss*

Photo 1.29 *Cantilever, two chord plane truss*

Photo 1.30 *Cantilever, four chord space truss*

The cantilever structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Sign panels
- Horizontal supports
- Vertical supports
- Foundation

1.2.2a <u>Sign Panel: Zee Bar Type</u>

The sign panel is attached to the chord. It displays information on the side facing traffic and has support elements on the side away from traffic, where it connects to the superstructure. For additional details, refer to Section 1.2.1a.

1.2.2b *<u>Sign Panel: Extruded Type</u>*

The sign panel is attached to the chord. It displays information on the side facing traffic and has support elements on the side away from traffic, where it connects to the superstructure. For additional details, refer to Section 1.2.1b.

1.2.2c *<u>Sign Panel: Connection to Superstructure</u>*

Sign panels connect to the support structure, or superstructure, via the hangers. For tubular superstructure members, the hanger to support structure connection is typically made with stainless steel U-bolts, nuts, and flat washers. The connection may also be made using a clamp type setup. For angular superstructure members, the connection may be made using steel through bolts, nuts, and washers.

1.2.2d *<u>Sign Panel: Luminaire System</u>*

The luminaire system illuminates the sign and extends from the bottom of the hangers, out beyond the front of the sign. For additional details, refer to Section 1.2.1d.

1.2.2e *<u>Sign Panel: Variable Message Signs (VMS)</u>*

The VMS is a special kind of sign panel that uses light emitting elements activated at variable times to display configurable messages. These panels typically have integrated structural components that make up the body of the panel and house the electronic components. It is common for VMS structures to have internal enclosures that may be walked in to perform electrical component maintenance. These internal areas are typically locked and are not usually accessed for structural inspections. For additional details, refer to Section 1.2.1e.

1.2.2f *<u>Sign Panel: Walkway</u>*

Walkways consist of members that form a frame for grating to rest on, providing walkable access to the structure. Some walkways have a railing that may be movable, pivoting into a deployed position as needed. Walkways are primarily maintenance aids and can often be accessed from the supporting space frame. In the past, walkways were installed on many types of sign structures. However, due to safety concerns, walkways are being removed from all but VMS structures. For additional details, refer to Section 1.2.1f.

1.2.2g *<u>Horizontal Support: Single Chord</u>*

The single chord cantilever sign structure consists of a single horizontal member (the chord), typically a tubular shape, that spans the roadway and supports the sign panels. The horizontal portion of the structure is supported at one end by a vertical support consisting of a single pole. For numbering convention and orientation of the structure and components, refer to Section 4.6.3.

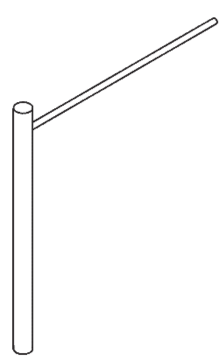


Figure 1.21 *Cantilever, Single Chord*

1.2.2h *Horizontal Support: Two Chord*

The two chord cantilever sign structure consists of two horizontal members (the chords), with or without bracing between the chords consisting of vertical and diagonal members. The bracing members form a truss; since all members are within a two dimensional plane, this truss type is typically called a plane truss. The truss is typically constructed of tubular or angular shapes. The truss is supported at one end by a vertical support consisting of a single pole. For a list of trussing nomenclature, refer to Section 1.2.1h. For numbering convention and orientation of the structure and components, refer to Section 4.6.3.

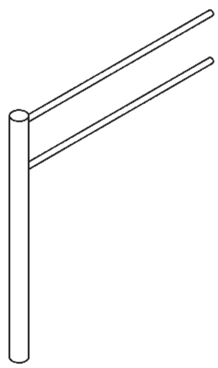


Figure 1.22 *Cantilever, Two Chord, Untrussed*

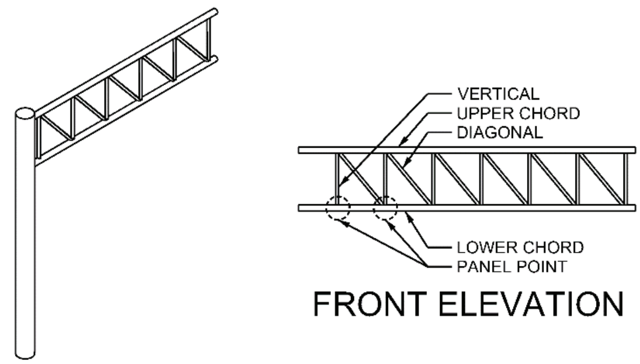


Figure 1.23 *Cantilever, Two Chord Plane Truss*

1.2.2i *Horizontal Support: Tri-Chord Truss*

This type of configuration is not typical for this type of structure.

1.2.2j *Horizontal Support: Four Chord Truss*

The four chord cantilever sign structure consists of four horizontal members (the chords), with bracing between the chords consisting of vertical, horizontal, and diagonal members. These members form a truss; since not all members are within a two dimensional plane, this truss type is typically called a space truss. The truss is typically constructed of tubular or angular shapes. The truss is supported at one end by a vertical support consisting of a single pole. For a list of trussing nomenclature, refer to Section 1.2.1h. For numbering convention and orientation of the structure and components, refer to Section 4.6.3.

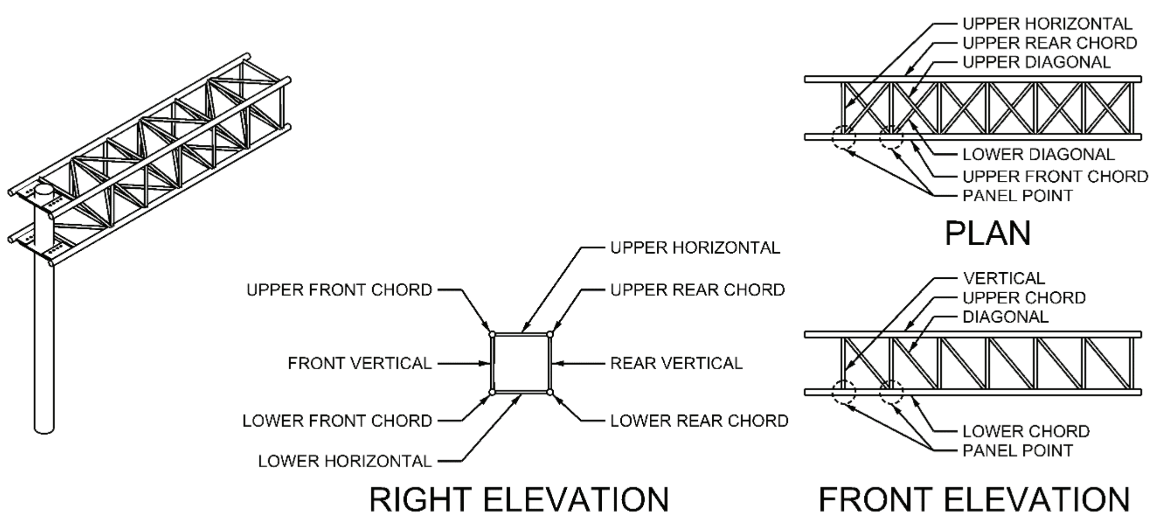


Figure 1.24 *Cantilever, Four Chord Space Truss*

1.2.2k *Horizontal Support: Other Attachments to Chord*

It is common for the horizontal supports to have attachments. These may be smaller signals, cameras, sensors, or other items. They consist of the attachment and the connection to the horizontal support. Most commonly, the connection is made through metal straps that wrap around the horizontal support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. For additional details, refer to Section 1.2.1k.

1.2.2l *Horizontal Support: Chord Splices*

Long cantilever structures are formed by joining multiple chord or truss sections. For round chords, splice flanges are welded to the chords at the end of each of the sections. The sections are field bolted together at the splice flanges. For angle chords, the splices are made by bolting or welding the chords to a short section of angle that overlaps each chord section. Refer also to Photos 1.11 and 1.12.

1.2.2m *Vertical Support: Chord to Pole Connection*

The various chord configurations are supported by poles through differing connection details, mostly depending on the number of chords. Some of the various configurations are discussed in the list below.

- **Gusseted Box Flange Plate**: This connection consists of a box gusset that is shaped to fit the pole and welded to the pole. A flange plate is welded to the other side of the box gusset. A second flange plate is welded to the chord. The two flange plates are butted up and bolted together. This configuration exists at each chord.
- **Collar Plate, Tubular Chords**: This connection consists of a large horizontal plate welded to the pole (one at the upper chords, one at the lower chords). The large plate is typically reinforced by ribs attached to the pole and plate. The large plate extends out toward the chords. Alternately, the large plate may be two individual plates on each side of the pole, which extend out to the chords. A smaller plate is welded to each chord, (two smaller plates at the upper chords and two at the lower chords), extending inward toward the pole. The smaller collar plates are positioned to overlap the larger collar plate such that the structure is aligned properly. Once positioned correctly, the overlapping plates are bolted together.
- **Collar Plate, Angle Chords**: This connection consists of a large horizontal plate welded to the pole (one at the upper chords, one at the lower chords). The large plate is typically reinforced by ribs attached to the pole and plate. The large plate extends out toward the chords. Alternately, the large plate may be two individual plates on each side of the pole, which extend out to the chords. The chords, which are angles, are oriented so that the horizontal leg of the angle can overlap the large collar plate. The chords are positioned to overlap the larger collar plate such that the structure is aligned properly. Once positioned correctly, the overlapping angles and plate are bolted together.

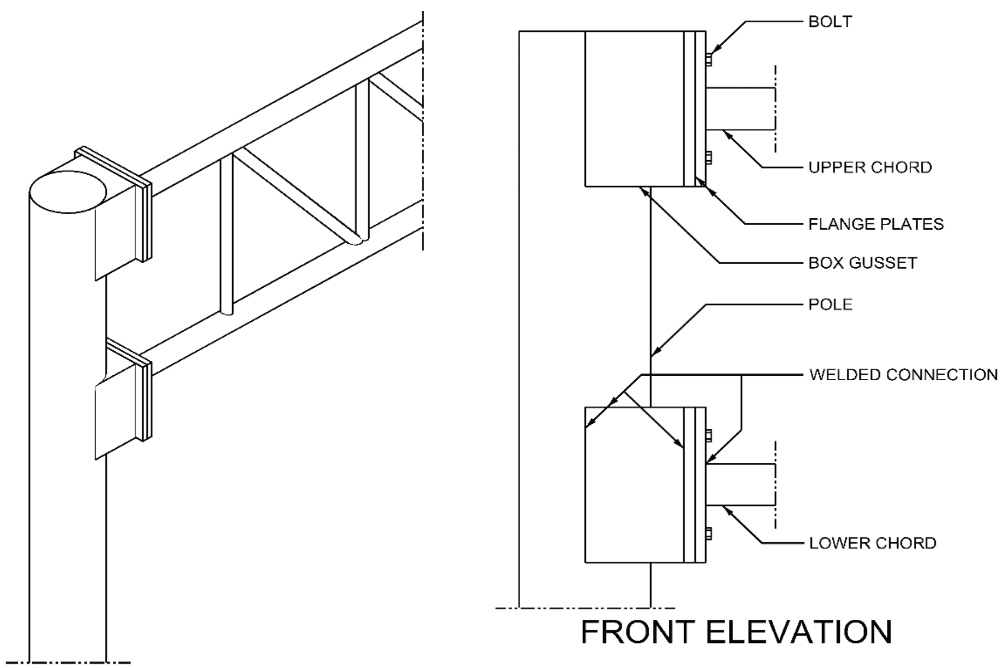


Figure 1.25 *Cantilever Chord to Pole Connection, Gusseted Box Flange Plates*

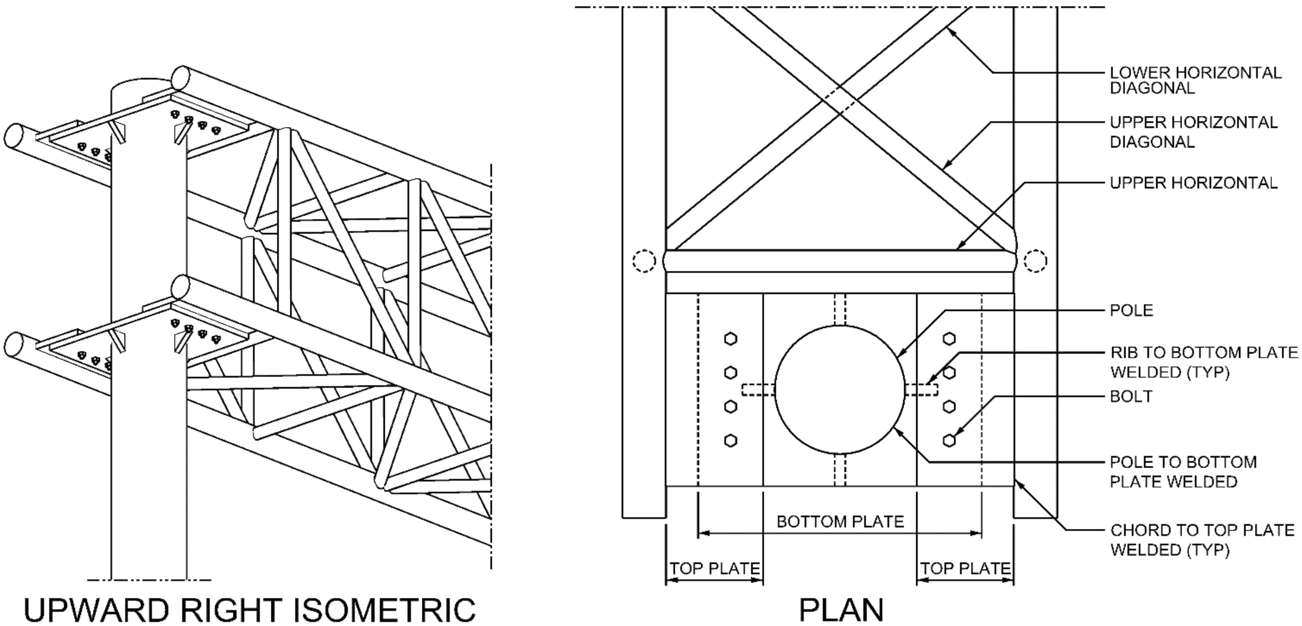


Figure 1.26 *Cantilever Chord to Pole Connection, Collar Plate, Tubular Chords*

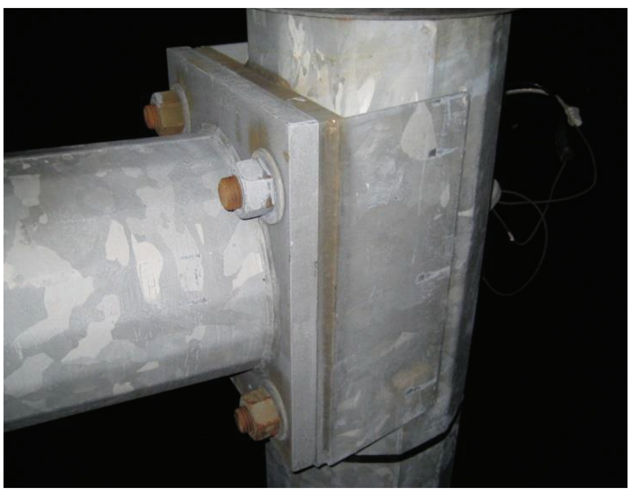


Photo 1.31 *Gusseted box flange connection*


Photo 1.32 *Collar plate, angle chords*

1.2.2n *Vertical Support: Attachments*

It is common for the vertical supports to have attachments. These may be smaller signs, cameras, sensors, or other items. They consist of the attachment and the connection to the vertical support. Most commonly, the connection is made through metal straps that wrap around the vertical support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. Alternatively, these connections are often made with threaded rod formed around the pole and connected to a horizontal member supporting the attachment. Refer also to photos 1.20 and 1.21.

1.2.2o *Vertical Support: Poles*

The term pole typically refers to a single vertical support of a tubular or multi-sided shape. Vertical supports most commonly consist of a single pole. For additional details, refer to Section 1.2.1o.

1.2.2p *Foundation*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure’s loads, to the earth or substructure. For additional details, refer to Section 1.2.1p.

1.2.3 Butterfly

The butterfly structure shares many features with the cantilever, but has arms on either side of the pole. The arms may be of differing sizes and lengths. Depending on the structure's requirements and design, one of three configuration types may be chosen. The types are listed by the number of chords that make up the horizontal portion of the structure that overhangs the roadway. The three types of butterfly span structures are the Single Chord, Two Chord Truss or Untrussed, and Four Chord Truss.

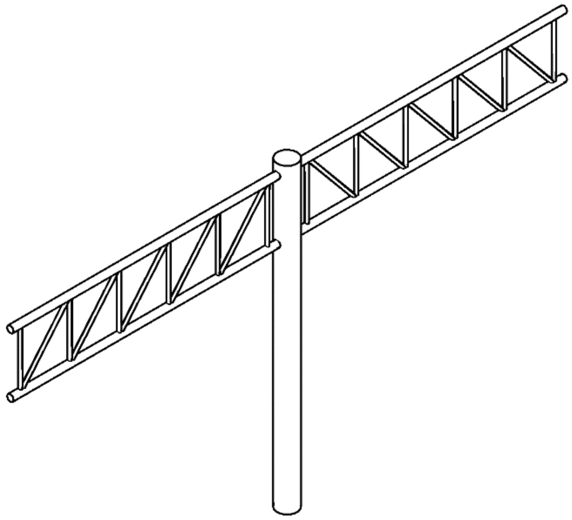


Figure 1.27 *Butterfly, two chord planar truss*

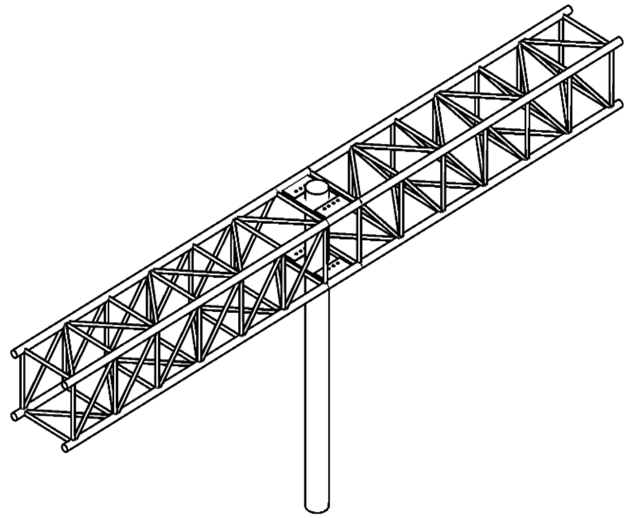


Figure 1.28 *Butterfly, four chord box truss*

Photo 1.33 *Butterfly, two chord planar truss*

Photo 1.34 *Butterfly, four chord box truss*

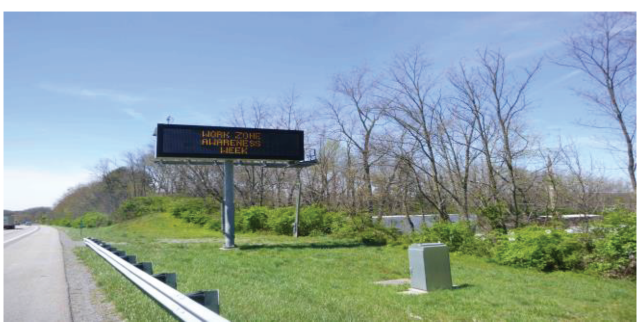


Photo 1.35 *Butterfly, with walkway*

Photo 1.36 *Butterfly, two chord un-trussed*

The butterfly structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Sign panels
- Horizontal supports
- Vertical supports
- Foundation

1.2.3a *Sign Panel: Zee Bar Type*

The sign panel is attached to the chord. It displays information on the side facing traffic and has support elements on the side away from traffic, where it connects to the superstructure. For additional details, refer to Section 1.2.1a.

1.2.3b *Sign Panel: Extruded Type*

The sign panel is attached to the chord. It displays information on the side facing traffic and has support elements on the side away from traffic, where it connects to the superstructure. For additional details, refer to Section 1.2.1b.

1.2.3c *Sign Panel: Connection to Superstructure*

Sign panels connect to the support structure, or superstructure, via the hangers. For tubular superstructure members, the hanger to support structure connection is typically made with stainless steel U-bolts, nuts, and flat washers. The connection may also be made using a clamp type setup. For angular superstructure members, the connection may be made using steel through bolts, nuts, and washers.

1.2.3d *Sign Panel: Luminaire System*

The luminaire system illuminates the sign and extends from the bottom of the hangers, out beyond the front of the sign. For additional details, refer to Section 1.2.1d.

1.2.3e *Sign Panel: Variable Message Signs (VMS)*

The VMS is a special kind of sign panel that uses light emitting elements activated at variable times to display configurable messages. These panels typically have integrated structural components that make up the body of the panel and house the electronic components. It is common for VMS structures to have internal enclosures that may be walked in to perform electrical component maintenance. These internal areas are typically locked and are not usually accessed for structural inspections. For additional details, refer to Section 1.2.1e.

1.2.3f *Sign Panel: Walkway*

Walkways consist of members that form a frame for grating to rest on, providing walkable access to the structure. Some walkways have a railing that may be movable, pivoting into a deployed position as needed. Walkways are primarily maintenance aids and can often be accessed from the supporting space frame. In the past, walkways were installed on many types of sign structures. However, due to safety concerns, walkways are being removed from all but VMS structures. For additional details, refer to Section 1.2.1f.

1.2.3g *Horizontal Support: Single Chord*

The single chord butterfly sign structure consists of a single horizontal member (the chord), typically a tubular shape, that spans the roadway and supports the sign panels. The horizontal portion of the structure is supported at by a vertical support consisting of a single pole. The pole is typically located in the center of the structure in a balanced span configuration. For numbering convention and orientation of the structure and components, refer to Section 4.6.3.

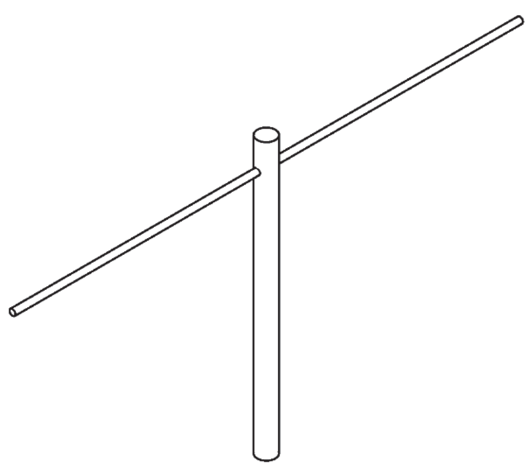


Figure 1.29 *Butterfly, Single Chord*

1.2.3h *Horizontal Support: Two Chord Truss*

The two chord butterfly sign structure consists of two horizontal members (the chords), with bracing between the chords consisting of vertical and diagonal members. These members form a truss; since all members are within a two dimensional plane, this truss type is typically called a plane truss. The truss is typically constructed of tubular or angular shapes. The truss is supported by a vertical support consisting of a single pole. The pole is typically located in the center of the structure in a balanced span configuration. For a list of trussing nomenclature, refer to Section 1.2.1h. For numbering convention and orientation of the structure and components, refer to Section 4.6.3.

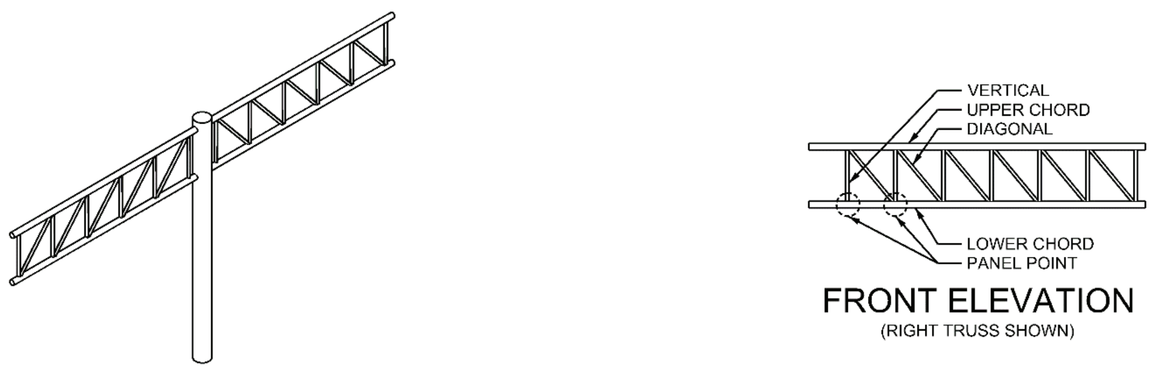


Figure 1.30 *Butterfly, Two Chord Planar Truss*

1.2.3i *Horizontal Support: Tri-Chord Truss*

This type of configuration is not typical for this type of structure.

1.2.3j *Horizontal Support: Four Chord Box Truss*

The four chord butterfly sign structure consists of four horizontal members (the chords), with bracing between the chords consisting of vertical, horizontal, and diagonal members. These members form a truss; since not all members are within a two dimensional planar, this truss type is typically called a space truss. The truss is typically constructed of tubular or angular shapes. The truss is supported by a vertical support consisting of a single pole. The pole is typically located in the center of the structure in a balanced span configuration. For a list of trussing nomenclature, refer to Section 1.2.1j. For numbering convention and orientation of the structure and components, refer to Section 4.6.3.

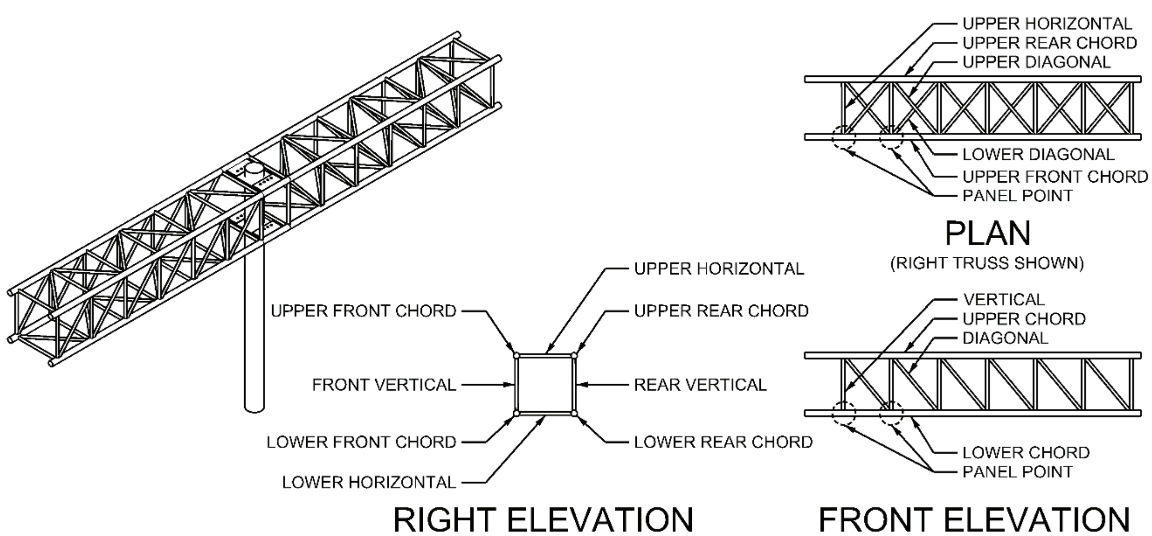


Figure 1.31 *Butterfly, Four Chord Space Truss*

1.2.3k *Horizontal Support: Other Attachments to Chord*

It is common for the horizontal supports to have attachments. These may be smaller signals, cameras, sensors, or other items. They consist of the attachment and the connection to the horizontal support. Most commonly, the connection is made through metal straps that wrap around the horizontal support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. For additional details, refer to Section 1.2.1k.

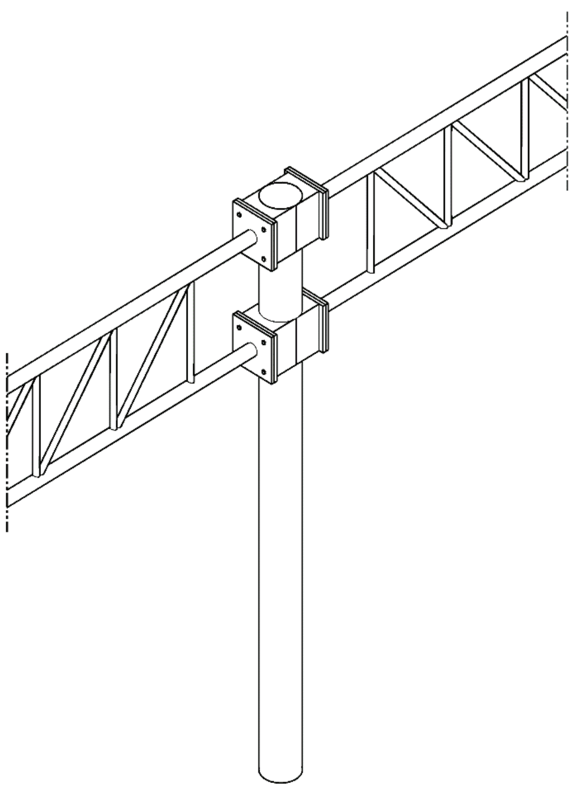
1.2.3l *Horizontal Support: Chord Splices*

Long butterfly structures are formed by joining multiple chord or truss sections. For round chords, splice flanges are welded to the chords at the end of each of the sections. The sections are field bolted together at the splice flanges. For angle chords, the splices are made by bolting or welding the chords to a short section of angle that overlaps each chord section. Refer also to Photos 1.11 and 1.12.

1.2.3m *Vertical Support: Chord to Pole Connection*

The various chord configurations are supported by poles through differing connection details, mostly depending on the number of chords. Some of the various configurations are discussed in the list below.

- **Gusseted Box Flange Plate**: This connection consists of a box gusset that is shaped to fit the pole and welded to the pole. A flange plate is welded to the other side of the box gusset. A second flange plate is welded to the chord. The two flange plates are butted up and bolted together. This configuration exists at each chord.
- **Collar Plate, Tubular Chords**: This connection consists of a large horizontal plate welded to the pole (one at the upper chords, one at the lower chords). The large plate is typically reinforced by ribs attached to the pole and plate. The large plate extends out toward the chords. Alternately, the large plate may be two individual plates on each side of the pole, which extend out to the chords. A smaller plate is welded to each chord, (two smaller plates at the upper chords and two at the lower chords), extending inward toward the pole. The smaller collar plates are positioned to overlap the larger collar plate such that the structure is aligned properly. Once positioned correctly, the overlapping plates are bolted together.
- **Collar Plate, Angle Chords**: This connection consists of a large horizontal plate welded to the pole (one at the upper chords, one at the lower chords). The large plate is typically reinforced by ribs attached to the pole and plate. The large plate extends out toward the chords. Alternately, the large plate may be two individual plates on each side of the pole, which extend out to the chords. The chords, which are angles, are oriented so that the horizontal leg of the angle can overlap the large collar plate. The chords are positioned to overlap the larger collar plate such that the structure is aligned properly. Once positioned correctly, the overlapping angles and plate are bolted together.



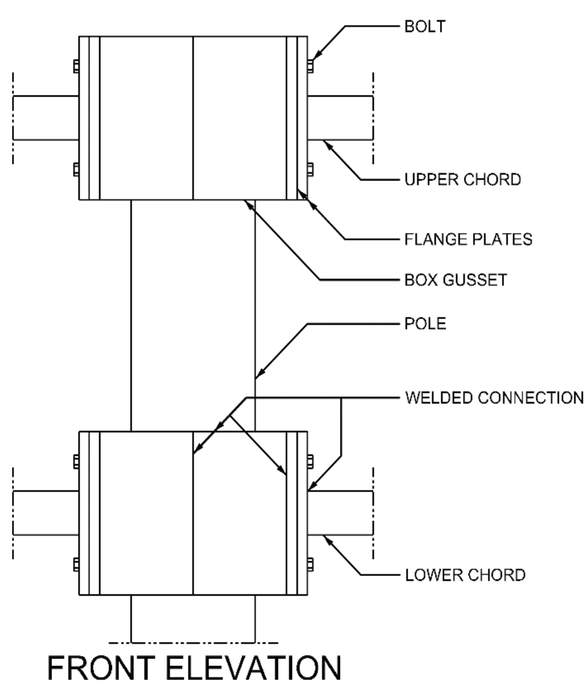


Figure 1.32 *Butterfly Chord to Pole Connection, Gusseted Box Flange Plates*

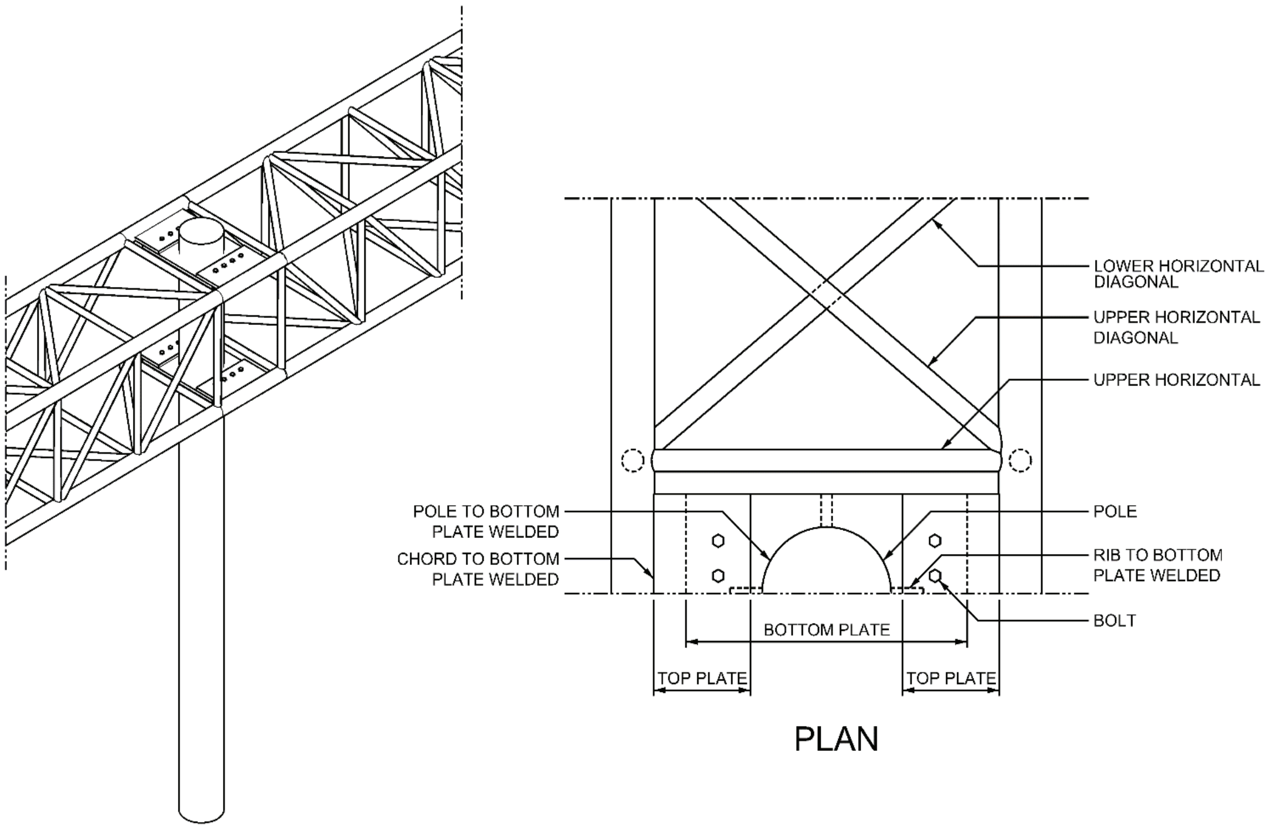


Figure 1.33 *Butterfly Chord to Pole Connection, Collar Plate, Tubular*

1.2.3n *Vertical Support: Attachments*

It is common for the vertical supports to have attachments. These may be smaller signs, cameras, sensors, or other items. They consist of the attachment and the connection to the vertical support. Most commonly, the connection is made through metal straps that wrap around the vertical support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. Alternatively, these connections are often made with threaded rod formed around the pole and connected to a horizontal member supporting the attachment. Refer also to Photos 1.20 and 1.21.

1.2.3o *Vertical Support: Poles*

The term pole typically refers to a single vertical support of a tubular or multi-sided shape. Vertical supports most commonly consist of a single pole. For additional details, refer to Section 1.2.10.

1.2.3p *Foundation*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure's loads, to the earth or substructure. For additional details, refer to Section 1.2.1p.

1.2.4 Bridge Parapet Mount Signs

Bridge parapet mount signs consist of a sign panel and framing made up tubular shapes, angles, I-beams, or T-sections. The structure is typically attached to the bridge beams/girders and parapets via bolted or clamped connections. Connections to steel bridges should never be made by welding.

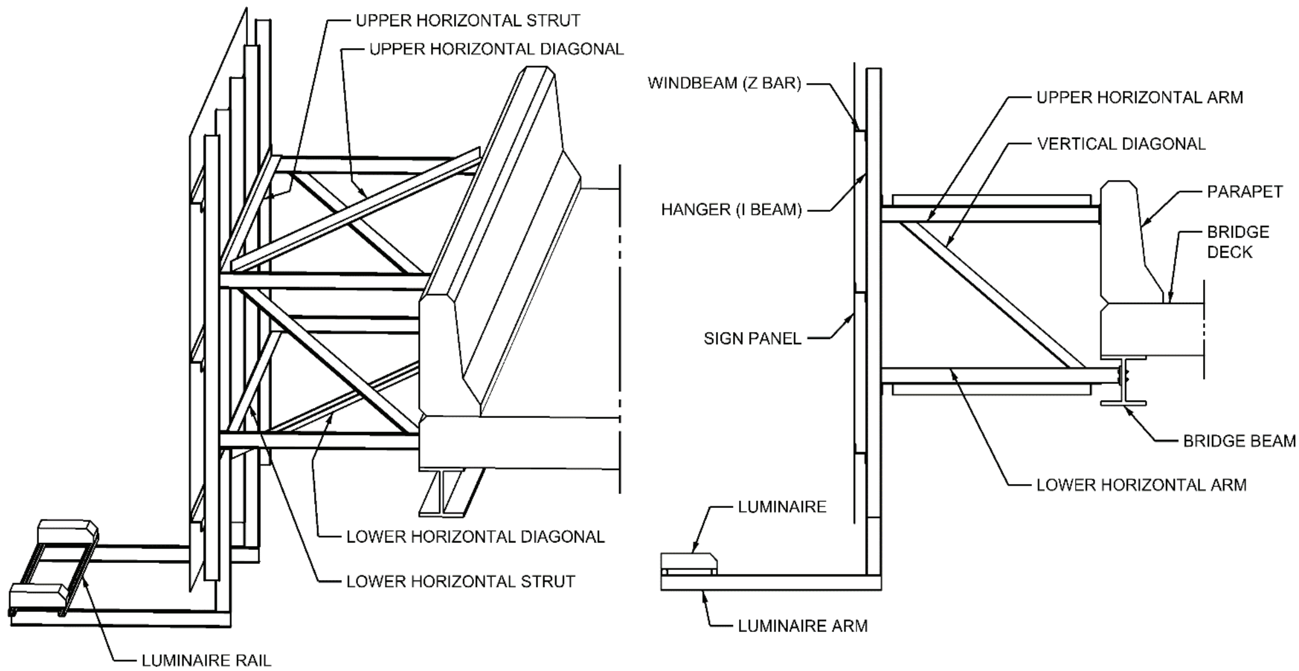


Figure 1.34 *Bridge Parapet Mount Signs*

Photo 1.37 *Bridge parapet mount sign*

Photo 1.38 *Bridge parapet mount sign, side view*

The bridge parapet mount sign structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Sign panels
- Framing members
- Attachment to bridge

1.2.4a <u>Sign Panel: Zee Bar Type</u>

The sign panel is attached to the chord. It displays information on the side facing traffic and has support elements on the side away from traffic, where it connects to the superstructure. For additional details, refer to Section 1.2.1a.

1.2.4b <u>Sign Panel: Extruded Type</u>

The sign panel is attached to the chord. It displays information on the side facing traffic and has support elements on the side away from traffic, where it connects to the superstructure. For additional details, refer to Section 1.2.1b.

1.2.4c *Sign Panel: Connection to Framing Members*

The sign panels are typically connected to the support structure by through bolting the hangers to the framing members.

1.2.4d *Sign Panel: Luminaire System*

The luminaire system illuminates the sign and extends from the bottom of the hangers, out beyond the front of the sign. For additional details, refer to Section 1.2.1d.

1.2.4e *Sign Panel: Variable Message Signs (VMS)*

The VMS is a special kind of sign panel that uses light emitting elements activated at variable times to display configurable messages. For additional details, refer to Section 1.2.1e.

Photo 1.39 *Bridge parapet mount VMS*

Photo 1.40 *Bridge parapet mount VMS, rear view*

1.2.4f *Sign Panel: Walkway*

These items are not typical for this type of structures.

1.2.4g *Framing Members: Framing*

The members that make up the framing consist of angles, wide flanges, or T-sections. The more robust members typically connect to the bridge directly and the smaller members provide bracing between the larger members. The framing may be considered a single bay truss, with verticals, horizontals, and diagonals. The members are connected via bolting or welding.

1.2.4h *Attachment to Bridge: Parapet Anchorage*

The framing members are attached to the bridge parapet via anchorages or through bolts. Anchorages are connection hardware specifically used to attach to concrete components such as the parapet. There are several types of anchorages that may be encountered; a few of these are briefly detailed in the list below.

- **Adhesive Anchorage**: This type of anchorage consists of fastener components (usually threaded rods) that are inserted through the end plate of the sign framing and into predrilled holes in the parapet. The fasteners are attached to the parapet, typically using an epoxy adhesive that bonds with the fastener components and the concrete, thereby securing the anchorage in place.
- **Expansion Anchorage**: This type of anchorage consists of expansion fasteners that are inserted through the end plate of the sign framing and driven into predrilled holes in the parapet. As the fasteners (usually anchor bolts) are tightened, the expandable portion of the anchorage spreads outward, thereby securing the anchorage in place.
- **Through Bolt**: This type of anchorage consists of bolts that are inserted through a metal clamp plate, predrilled holes in the parapet, and through the end plate of the sign framing. Nuts are placed on the end plate side of the bolts and the through bolted assembly is tightened, thereby securing the anchorage in place.

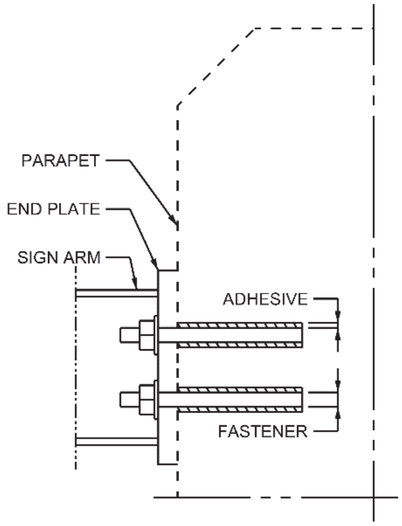


Figure 1.35 *Adhesive Anchorage*

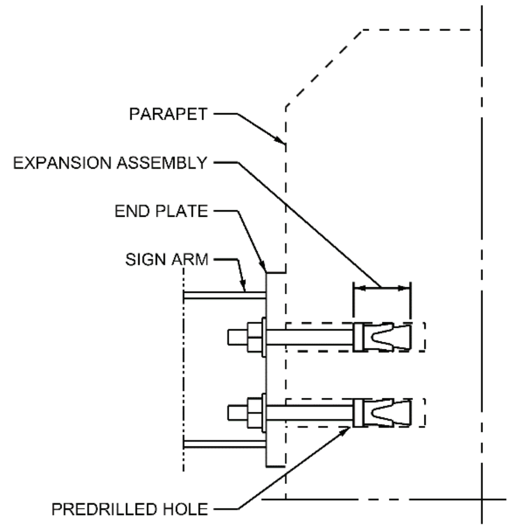


Figure 1.36 *Expansion Anchorage*

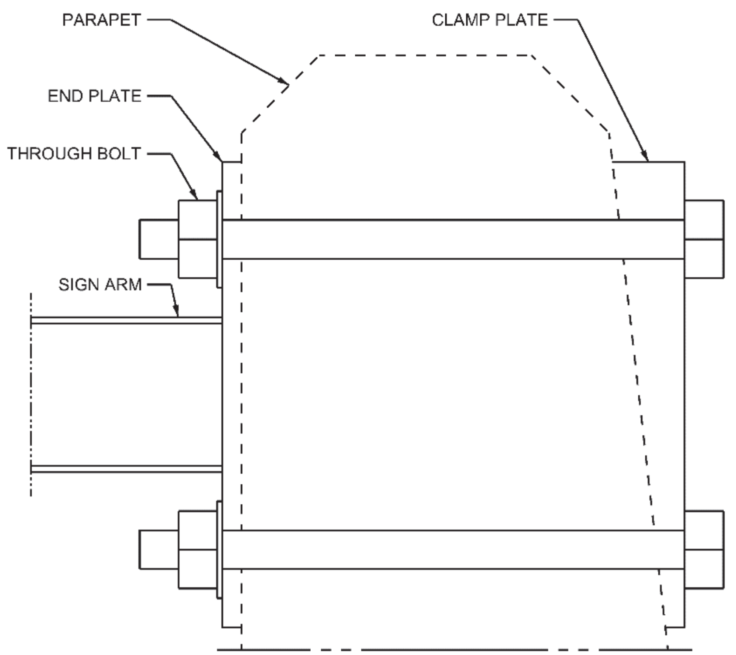


Figure 1.37 *Parapet Through Bolt*

1.2.4i *Attachment to Bridge: Beam/Girder Connection*

The framing members are attached to the bridge beams/girders via bolted connections or saddle clamps. These connections should not normally be welded to steel girders, but this is sometimes encountered. The connection types are detailed in the list below.

- **Bolted**: This type of connection consists of bolts that are inserted through predrilled holes in the bridge beam/girder and through the end plate of the sign framing. Nuts are placed on the bolts and the through bolted assembly is tightened, thereby securing the anchorage in place.
- **Saddle Clamp**: This type of connection consists of several plates. The two main plates are shaped to fit the contour of the bridge beam/girder. One of the two main plates is welded to the sign beam, functioning as an end plate, and attaching to the front side of the beam; this plate is the front clamp. The other main plate wraps around the back of the beam; this is the rear clamp. The two main plates, once positioned correctly on the beam, are bolted together, thereby securing the clamp in place.
- **Welded**: This type of connection consists of the sign beam end plate welded directly to the bridge beam/girder. It should be noted this connection is typically field welded and results in an AASHTO Fatigue Category E' classification for the bridge beam/girder.

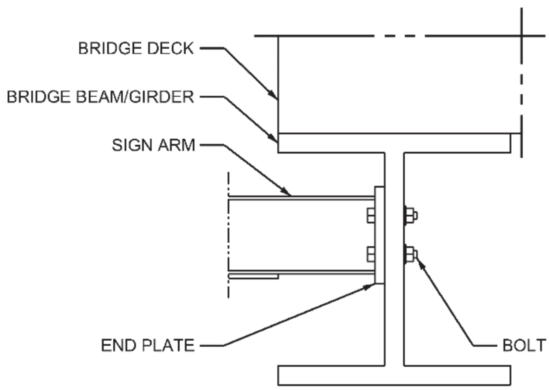


Figure 1.38 *Attachment to Bridge Beam, Through Bolt*

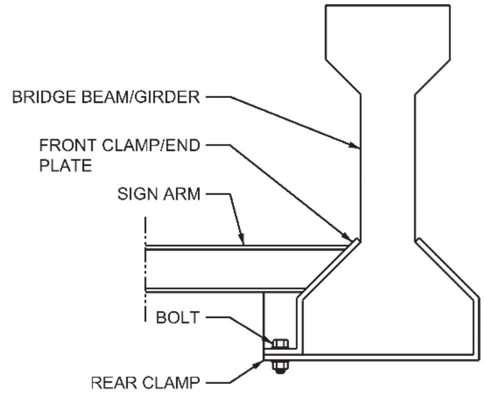


Figure 1.39 *Attachment to Bridge Beam, Saddle Clamp*

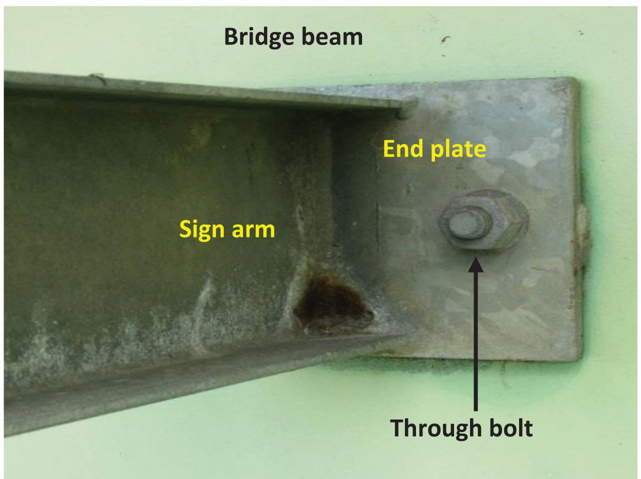


Photo 1.41 *Attachment to bridge beam, through bolt*

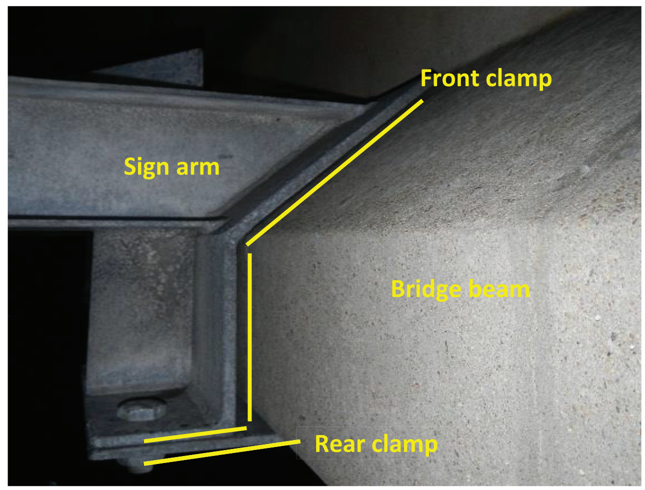


Photo 1.42 *Attachment to bridge beam, saddle clamp, front view*

Photo 1.43 *Attachment to bridge beam, saddle clamp, rear view*

1.3 Traffic Signal Structures

Traffic signal structures typically consist of four main components: the traffic signal heads that are used to communicate a message to control traffic, the horizontal portion of the structure that carries the traffic signal heads and is generally located over traffic, the vertical supports adjacent to the roadway that carry the horizontal components of the structure, and the foundation that anchors the vertical supports and so, also anchors the structure overall.

The traffic signals heads may have various configurations with horizontal or vertical lights, one or multiple lights per signal head, backer plates, varying connection hardware, and so on. The lights are arranged and displayed in accordance with the regulatory message they are intended to communicate to traffic, which is determined by the Department's Traffic Engineering Division.

The horizontal components of the structure, which the traffic signals are attached to, provide structural support for the signal heads over the roadway. The three main types are mast arms, span wires, and overhead spans. The type of horizontal support typically determines the nomenclature of the structure.

The vertical supports provide structural support for the horizontal components of the structure. The vertical supports also extend the traffic signals upward, creating clearance between traffic on the roadway and the bottom of the traffic signal. These vertical supports are typically single poles.

The foundation provides structural support for the vertical supports. The majority of the foundation is below ground. The foundation transfers the loads that act on the structure to the ground.

Signal structures may have various components associated with them (e.g. traffic sensor cameras, luminaires, detector loops in pavement, controller cabinet). The operational functionality of these components is not a part of a structural safety inspection. However, any obvious or notable deficiencies should be documented. All components of any attachments to the horizontal or vertical supports shall be inspected for overall structural integrity and general safety (e.g. signal housing, connection hardware to superstructure, conduit housing wiring, exposed wiring).

While general nomenclature and other various structure details will be discussed within this chapter, numbering and orientation of specific structures, components, and elements will be covered in Section 5.6.

1.3.1 Mast Arm

These structures have one or more cantilevered arms (mast arms) that may overhang part of the roadway in one or more directions of traffic. The arms extend out from a pole adjacent to the roadway. Each arm may have one or more traffic signal heads attached. Often, other attachments (e.g. traffic sensor cameras, signs, or vibration dampeners) can be found on the mast arms.

Depending on the structure's requirements and design, a configuration type is chosen for the structure. The types are determined by the number of arms that are attached to the pole. The two most common types of traffic signal mast arm structures are the Single Mast Arm and Double Mast Arm.

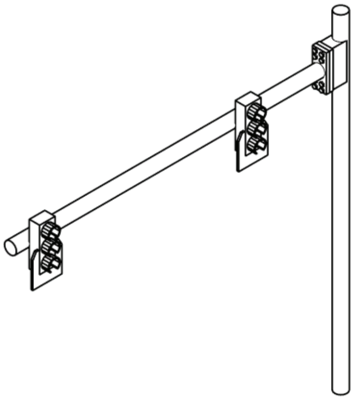


Figure 1.40 *Mast Arm, Single Arm*

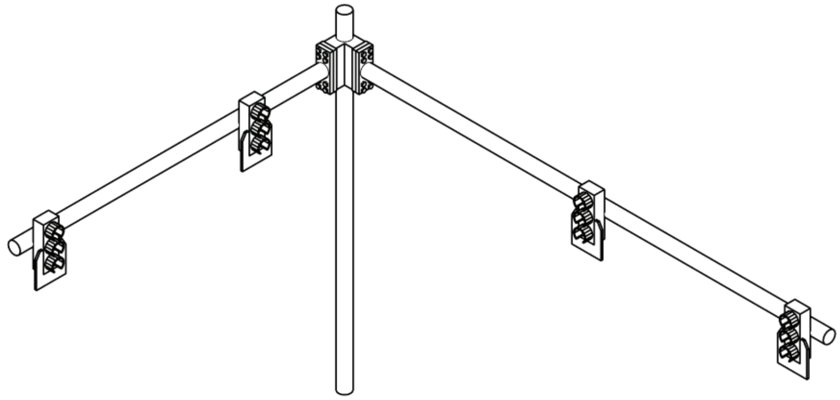


Figure 1.41 *Mast Arm, Double Arm*

Photo 1.44 *Mast arm, single arm*

Photo 1.45 *Mast arm, double arm*

The mast arm structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Attachments
- Horizontal supports
- Vertical supports
- Foundation

1.3.1a *Attachments: Traffic Signal Head*

Signal Heads are the main type of attachment for traffic signal structures. They typically consist of three lights in a vertical configuration, though they may have anywhere from one to five or even more lights. The lights and electronics are housed in an enclosure. Each light has a signal visor and the signal head overall has a backplate. The signal heads attach to the mast arm via strap or clamp systems, with the most common being the orbital bracket. For numbering convention and orientation of the structure and components, refer to Section 5.6.3.

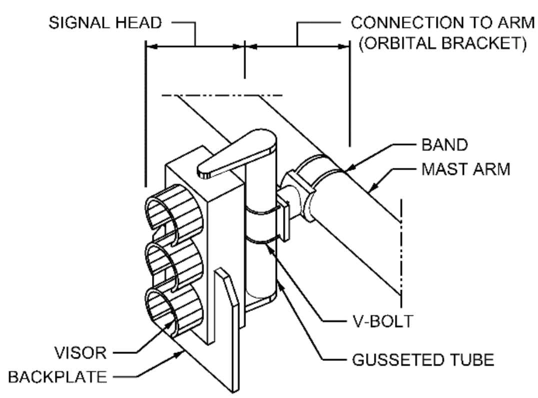


Figure 1.42 *Traffic Signal Head*

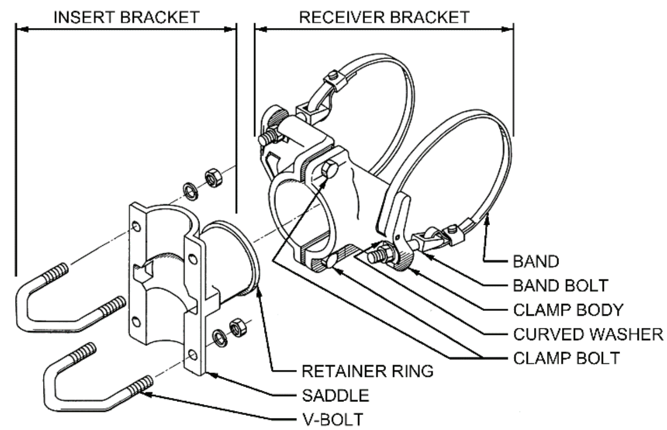


Figure 1.43 *Orbital Bracket*

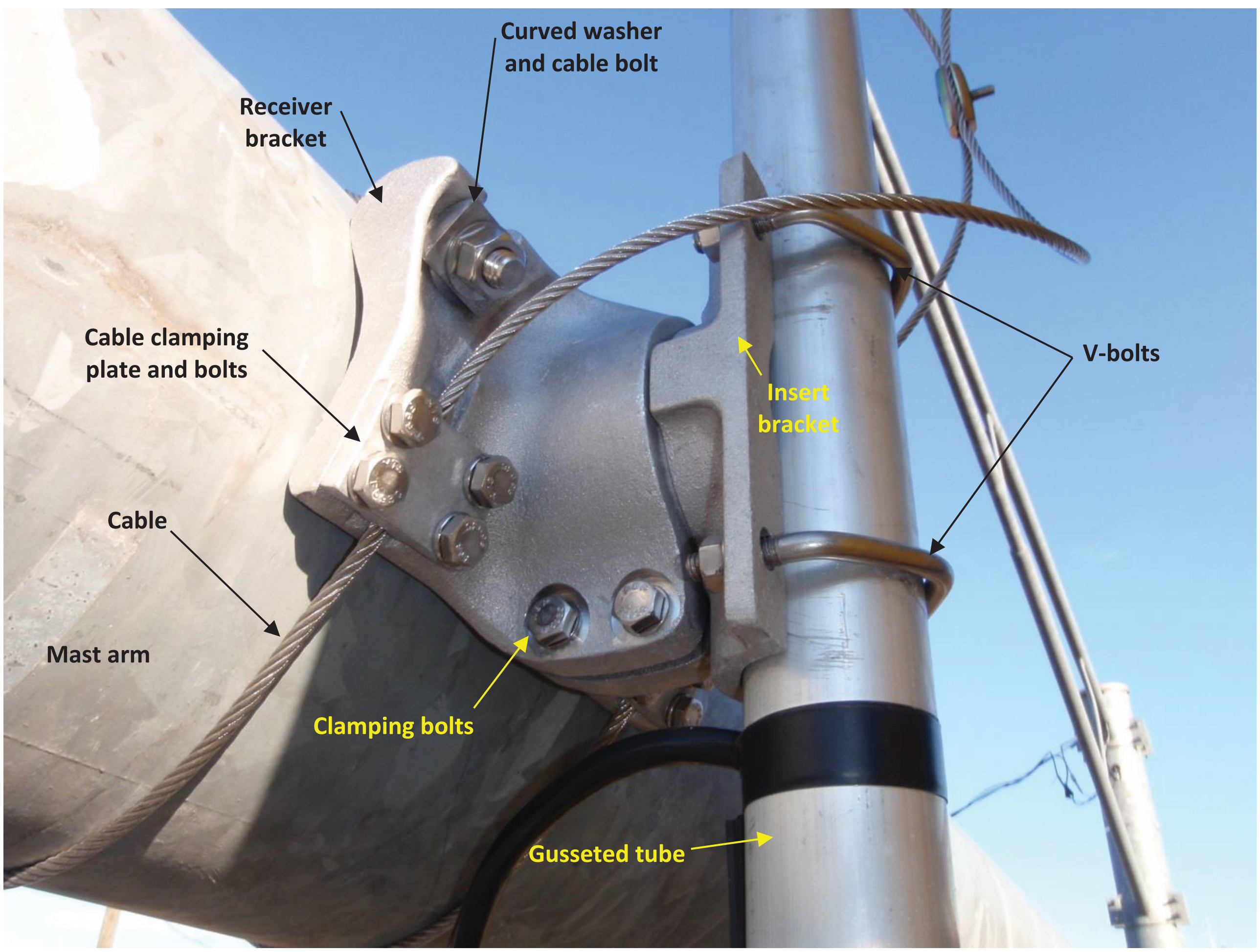


Photo 1.46 *Typical orbital bracket*

1.3.1b *Horizontal Support: Mast Arm*

The mast arm is similar to the single chord sign structures previously covered. The arm is a tubular section that extends the attachments out away from the pole, to where the attachments are most effective, which is over the roadway. Depending on the requirements and design, the arm may be cambered so as not to deflect noticeably. The term camber refers to the curvature manufactured into the member that is shaped oppositely of the anticipated deflection curvature. For numbering convention and orientation of the structure and components, refer to Section 5.6.3.

1.3.1c *Horizontal Support: Other Attachments to Mast Arm*

Besides the signal head, other attachments may be found on the mast arm. Some examples include informational signs, dampeners, cameras, sensors, etc. These items may be attached via a strap or clamp system. Some specific attachments are discussed in the list below. For numbering convention and orientation of the structure and components, refer to Section 5.6.3.

- **Sensor**: A broad term that may include items used to measure various data such as day or night cycle, speed, or whether a car is approaching the signal.
- **Camera**: A specific type of sensor used to capture video footage or photographs of the surrounding area.
- **Antenna**: An attachment that is used to transmit sensor data.
- **Sign**: A panel typically made of aluminum, which displays information such as street names.
- **Dampener**: An attachment that helps dissipate excess vibrations. The components are called dampeners, but the proprietary name may be damper.

Photo 1.47 *Traffic cameras*

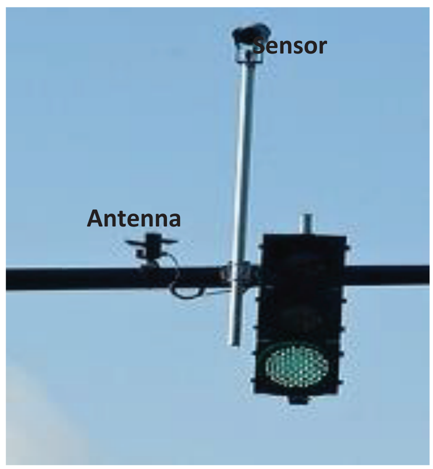


Photo 1.48 *Sensor and antenna*

Photo 1.49 *Stockbridge dampener*

1.3.1d *Horizontal Support: Mast Arm Splices*

Long mast arms are sometimes made up of multiple sections spliced together. Two common types of splicing are the welded splice and the slip joint splice. The welded splice consists of two mast arm sections butt welded together. The slip joint consists of the section nearest the pole slipping over the section further from the pole. The sections are tapered to be narrower progressing away from the pole. One or more bolts are installed through the entire diameter of the overlapping portions of the mast arm sections. This bolted connection, along with the friction that develops between the two sections, keeps the arm acting monolithically.

1.3.1e *Vertical Support: Mast Arm to Pole Connection*

The mast arm connects to the pole via a gusseted box flange plate connection. The connection is similar to the single or two chord cantilever sign structure. The connection consists of a box gusset that is shaped to fit the pole and welded to the pole. A flange plate is welded to the other side of the box gusset. A second flange plate is welded to the mast arm. The two flange plates are butted up and bolted together. This configuration, using four or eight bolts, is typical for each mast arm, single or double.

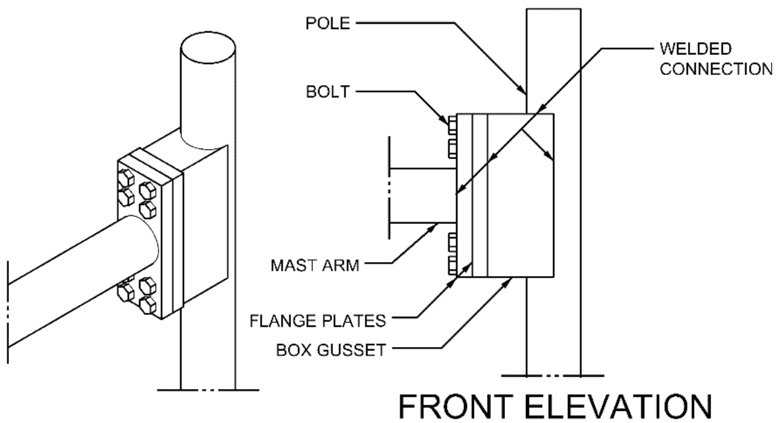


Figure 1.44 *Mast arm to pole connection*

1.3.1f *Vertical Support: Attachments*

It is common for the vertical supports to have attachments. These may be smaller signs, cameras, sensors, or other items. They consist of the attachment and the connection to the vertical support. Most commonly, the connection is made through metal straps that wrap around the vertical support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. Alternatively, these connections are often made with threaded rod formed around the pole and connected to a horizontal member supporting the attachment. Refer also to Photos 1.20 and 1.21.

1.3.1g *Vertical Support: Poles*

The term pole typically refers to a single vertical support of a tubular or multi-sided shape. Vertical supports consist of a single pole. For additional details, refer to Section 1.2.1o.

1.3.1h *Foundation*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure’s loads, to the earth or substructure. For additional details, refer to Section 1.2.1p. For numbering convention of the anchor bolts, refer to Section 5.6.4.

1.3.2 Span Wire

These structures have wires strung over one or more directions of traffic. The span wires are strung between two poles, tensioned, and then clamped down. This allows them to carry the traffic signals and other attachments. A thinner section of wire, called the sway wire, is attached at the poles and to the bottoms of the signal heads, preventing the signals from swaying excessively.

The wires are connected to the poles with special bolts that have loops on the end rather than a bolt head; these bolts are called thimble eye bolts. The wire loops through the eye on the bolt and is then run along itself. The wire is clamped down against itself once the appropriate tension is achieved. Said tension is determined by the design and anticipated amount of cable sag at the midpoint. The clamping device is typically a bolt clamp or a compression dead end clamp.

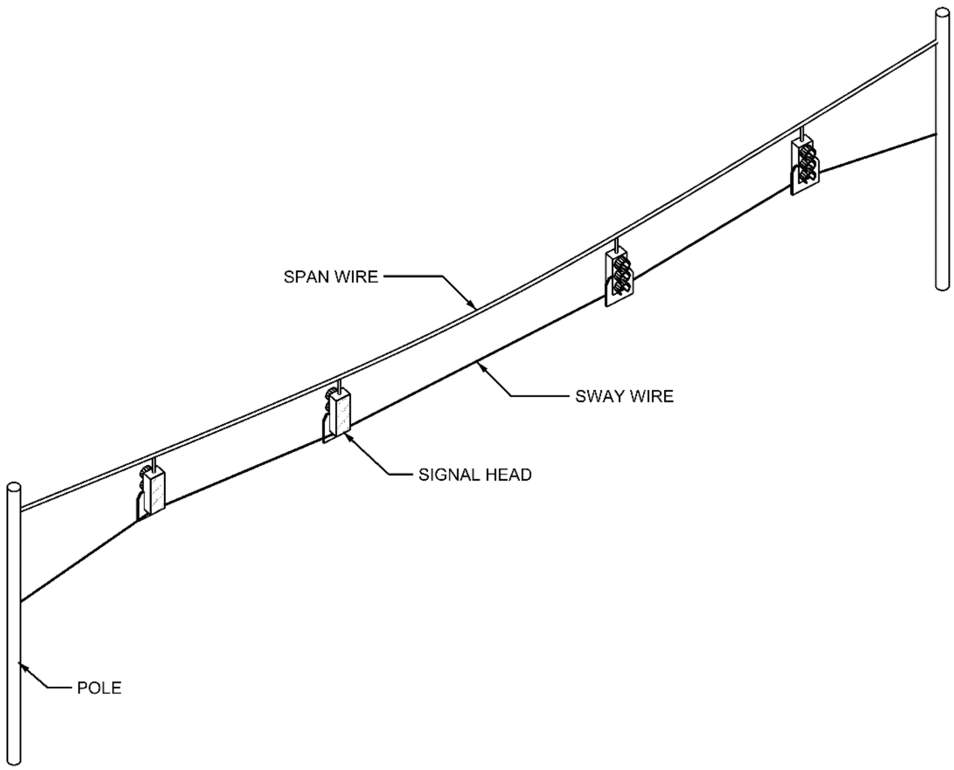


Figure 1.45 *Span Wire Traffic Signal Structure*

Photo 1.50 *Traffic signal span wire*

Photo 1.51 *Traffic signal span wire*

The span wire structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Attachments
- Horizontal supports
- Vertical supports
- Foundation

1.3.2a <u>*Attachments: Traffic Signal Head*</u>

Signal Heads are the main type of attachment for traffic signal structures. They typically consist of three lights in a vertical configuration, though they may have anywhere from one to five or even more lights. The lights and electronics are housed in an enclosure. Each light has a signal visor and the signal head overall has a backplate. For additional details, refer to Section 1.3.1a. The signal heads attach to the span wire through various configurations, some of which may include the signal head attaching to a leveling pipe, or some other leveling assembly, which in turn connects to a span wire clamp at the wire. For numbering convention and orientation of the structure and components, refer to Section 5.6.3.

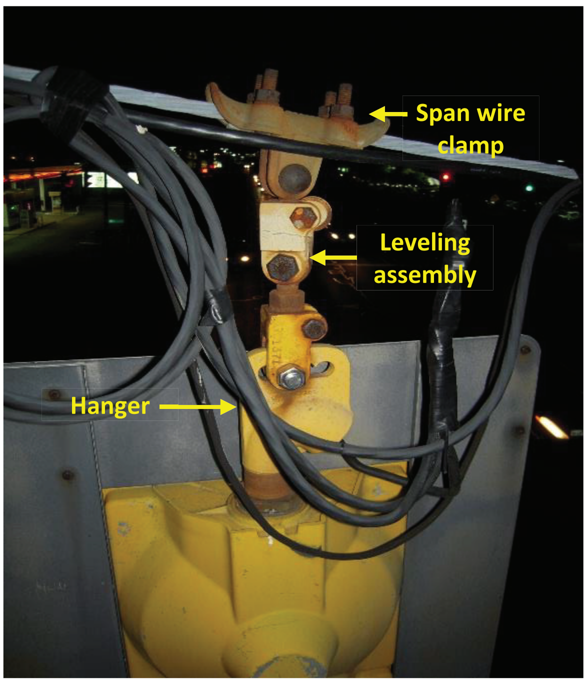


Photo 1.52 *Span wire clamp*

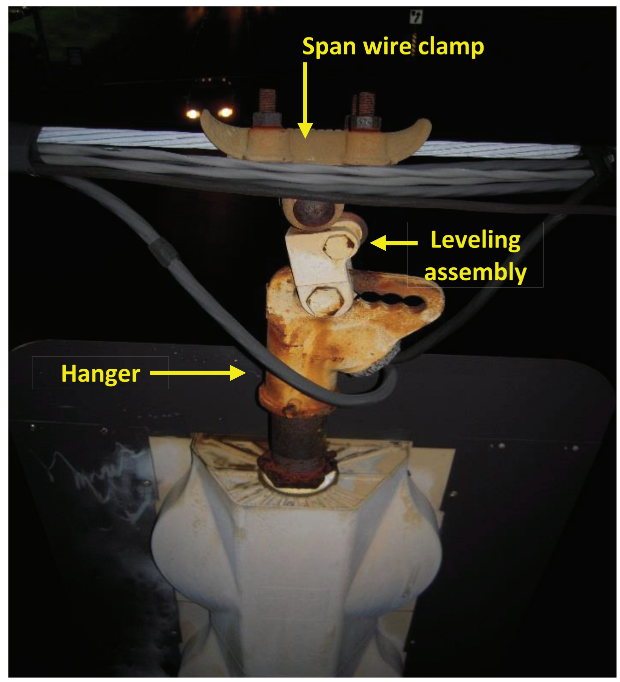


Photo 1.53 *Leveling pipe assembly*

1.3.2b <u>*Horizontal Support: Span Wire*</u>

The span wire is typically a zinc coated high strength steel wire strand or cable, of a specific diameter ranging from 1/4” to 5/8” diameter. The cable is tensioned as needed and then secured to itself through clamps, locking in the cable tension.

1.3.2c <u>*Horizontal Support: Sway Wire*</u>

The sway wire is typically a zinc coated steel wire strand or cable, of a specific diameter ranging from 1/4” to 5/8” diameter. The sway wire may also be referred to as tether wire. The sway wire attaches to the bottom of the signal heads and the poles and minimizes the amount of sway that may develop in the signal heads due to wind.

1.3.2d <u>*Horizontal Support: Other Attachments to Span Wire*</u>

Besides the signal head, other attachments may be found on the mast arm. Some examples include informational signs, dampeners, cameras, sensors, etc. These items may be attached via a strap or clamp system. For additional details, refer to Section 1.3.1c. For numbering convention and orientation of the structure and components, refer to Section 5.6.3.

1.3.2e *Vertical Support: Span Wire to Pole Connection*

The span wire is connected directly to the pole. The pole has a thimble eye bolt attached to it. A thimble eye bolt is a high strength bolt that has, for the bolt head, an opening similar to the eye of a threaded needle, but obviously much larger. The wire is looped through this eye and the wire is then attached to itself. Two clamps, of the two or three bolt variety, attach the wire to itself. The wire is thereby connected to the pole. Less commonly, mostly on older structures, the connection consists of two separate components, the eye bolt and a separate thimble on the cable at the point of attachment.

1.3.2f *Vertical Support: Sway Wire to Pole Connection*

The sway wire is connected to the pole similarly to the span wire. As there is typically less tension in the sway wire, only one clamp is used to secure the wire to itself.

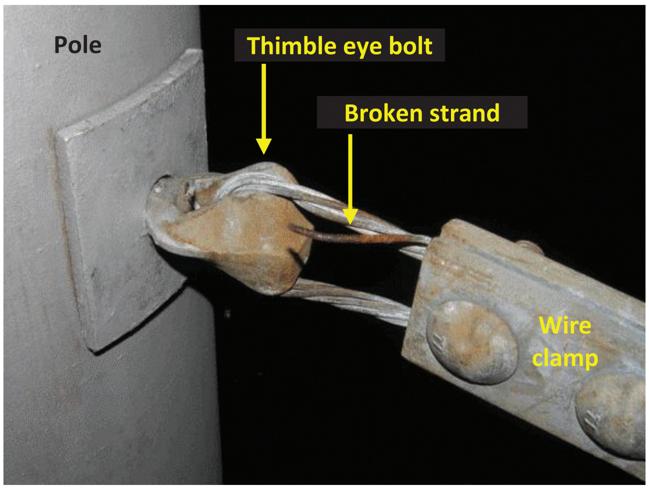


Photo 1.54 *Span wire to pole attachment*

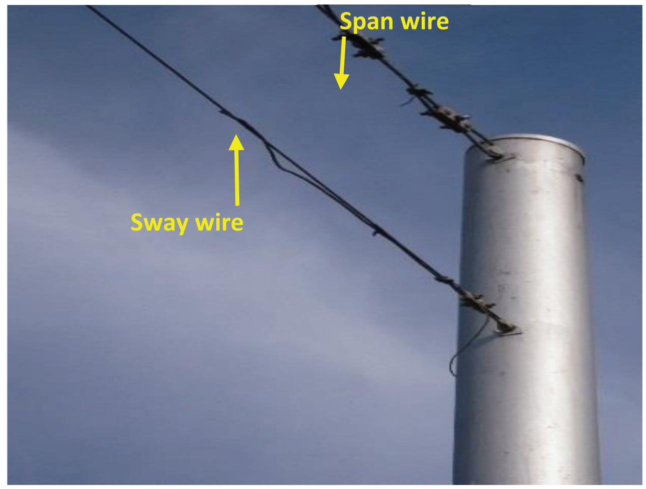


Photo 1.55 *Span/Sway wire to pole attachment*

1.3.2g *Vertical Support: Attachments*

It is common for the vertical supports to have attachments. These may be smaller signs, cameras, sensors, or other items. They consist of the attachment and the connection to the vertical support. Most commonly, the connection is made through metal straps that wrap around the vertical support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. Alternatively, these connections are often made with threaded rod formed around the pole and connected to a horizontal member supporting the attachment. Refer also to photos 1.20 and 1.21.

1.3.2h *Vertical Support: Poles*

The term pole typically refers to a single vertical support of a tubular or multi-sided shape for steel or aluminum structures and a cylindrical shape for timber or concrete structures. Vertical supports consist of a single pole. For additional details, refer to Section 1.2.1n.

1.3.2i *Vertical Support: Pole Anchorage*

Timber poles may have additional wire and rigging to secure the poles. This extra rigging provides additional lateral support to the pole by providing a force to act opposite of the tension on the span wire; achieved by placing an anchor in the ground adjacent to the pole, connected to the pole via a tensioned cable.

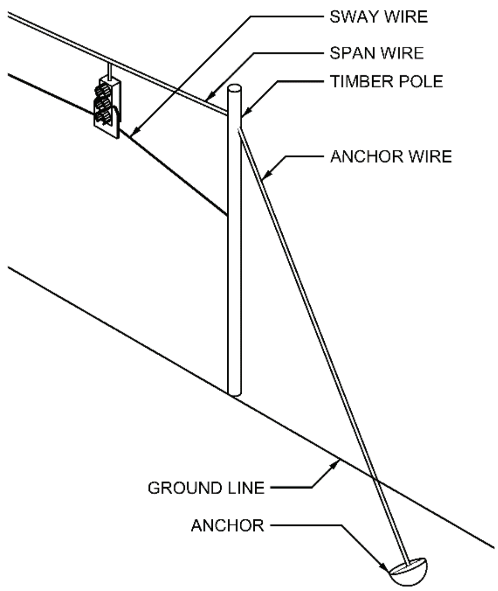


Figure 1.46 *Timber Pole Anchorage*

1.3.2j *Foundation*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure's loads, to the earth or substructure. For additional details, refer to Section 1.2.1p. For numbering convention of the anchor bolts, refer to Section 5.6.4.

Note that timber or concrete poles are typically embedded directly into the soil and therefore do not have a foundation.

1.3.3 Overhead Span

The traffic signal overhead span is almost identical to the sign overhead span structure, save for the signal heads and other attachments. These structures span the roadway, with poles on both sides of the structure. They may span the roadway in one or more directions of traffic, with poles on the outside edges of the roadway. Overhead spans may also span a single direction of traffic, with one pole in the median and one on the outside edge of the roadway. Depending on the structure's requirements and design, one of four configuration types may be chosen. The types are listed by the number of chords that make up the horizontal portion of the structure that spans the roadway. The four types of overhead span structures are the Single Chord, Two Chord, Tri-Chord, and Four Chord.

Photo 1.56 *Overhead span, single chord, traffic signal*

Photo 1.57 *Overhead span, four chord, traffic signal*

Since the majority of traffic signal structures are not over interstate roads, the span is typically lesser than the similar overhead span sign structures. Therefore, the strength of the overhead span structure is less frequently required, making this structure type uncommon for traffic signal structures.

The overhead span structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Attachments
- Horizontal supports
- Vertical supports
- Foundation

1.3.3a Attachments: Traffic Signal Head

Signal Heads are the main type of attachment for traffic signal structures. They typically consist of three lights in a vertical configuration, though they may have anywhere from one to five or even more lights. The lights and electronics are housed in an enclosure. Each light has a signal visor and the signal head overall has a backplate. The signal heads attach to the chord via strap or clamp systems, with the most common being the orbital bracket. For additional details, refer to Section 1.3.1a. For numbering convention and orientation of the structure and components, refer to Section 5.6.3.

1.3.3b Horizontal Support: Single Chord

The single chord overhead span traffic signal structure spans the roadway and supports the signal heads and attachments. Two types of single chord overhead span structure exist, which are detailed in the bulleted list below. For numbering convention and orientation of the structure, refer to Section 4.6.3.

- **Chord and Pole Structure**: Consists of a single horizontal member (the chord), typically a tubular shape, that is supported at each end by a vertical support consisting of a single pole.
- **Monotube Structure**: Consists of a single horizontal tubular shape (the chord) that bends at each end so that the chord transitions into vertical supports, thereby creating a continuous structure with integrated poles.

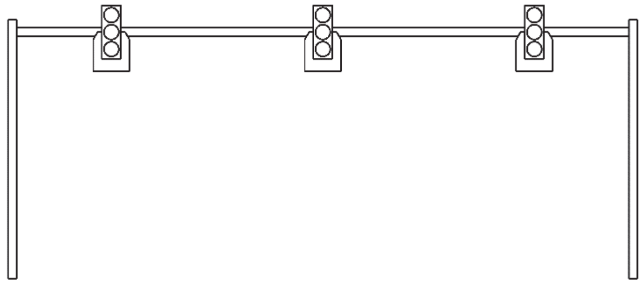


Figure 1.47 *Traffic Signal Overhead Span, Single Chord and Pole Structure*

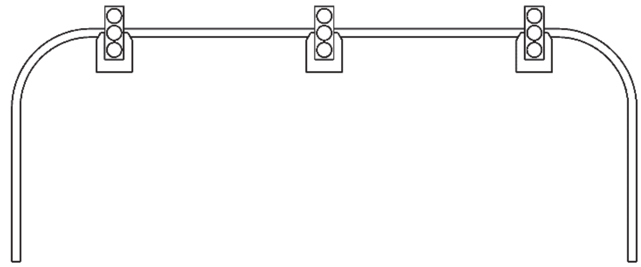


Figure 1.48 *Traffic Signal Overhead Span, Monotube Structure*

1.3.3c *<u>Horizontal Support: Two Chord Truss</u>*

The two chord overhead span traffic signal structure consists of two horizontal members (the chords), with bracing between the chords consisting of vertical and diagonal members. These members form a truss; since all members are within a two dimensional plane, this truss type is typically called a plane truss. The truss is typically constructed of tubular or angular shapes. The truss is supported at each end by a vertical support consisting of a single pole. For a list of trussing nomenclature, refer to Section 1.2.1h. For numbering convention and orientation of the structure and components, refer to Section 4.6.3.

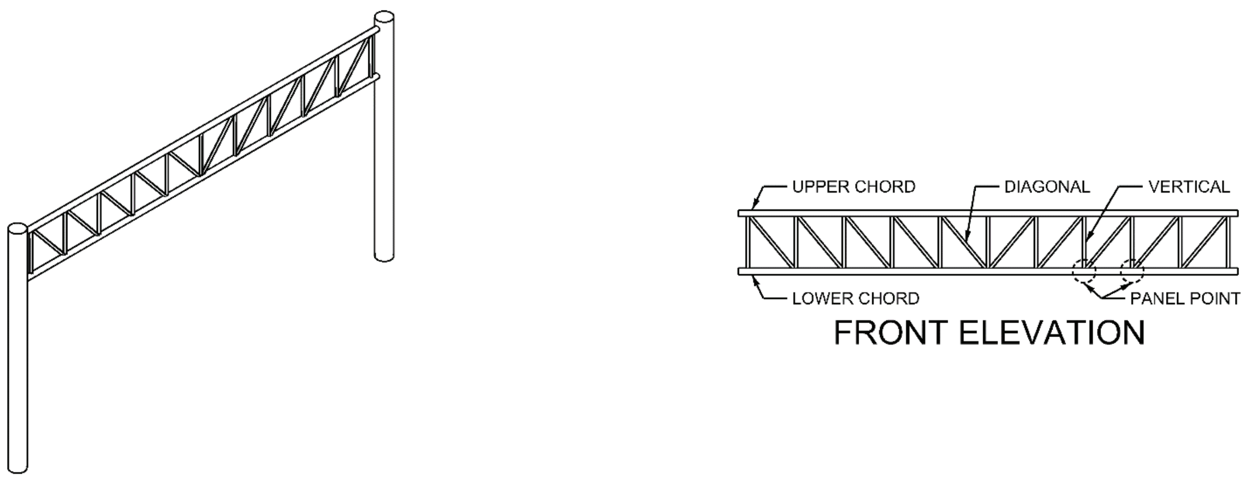


Figure 1.49 *Overhead Span Traffic Signal Structure, Two Chord Plane Truss*

1.3.3d *Horizontal Support: Tri-Chord*

The tri-chord overhead span traffic signal structure consists of three horizontal members (the chords), with bracing between the chords consisting of vertical and diagonal members. These members form a truss; since not all members are within a two dimensional plane, this truss type is typically called a space truss. The truss is typically constructed of tubular or angular shapes. The truss is supported at each end by a vertical support consisting of a single pole, or a two pole plane truss. For a list of trussing nomenclature, refer to Section 1.2.1h. For numbering convention and orientation of the structure, refer to Section 4.6.3.

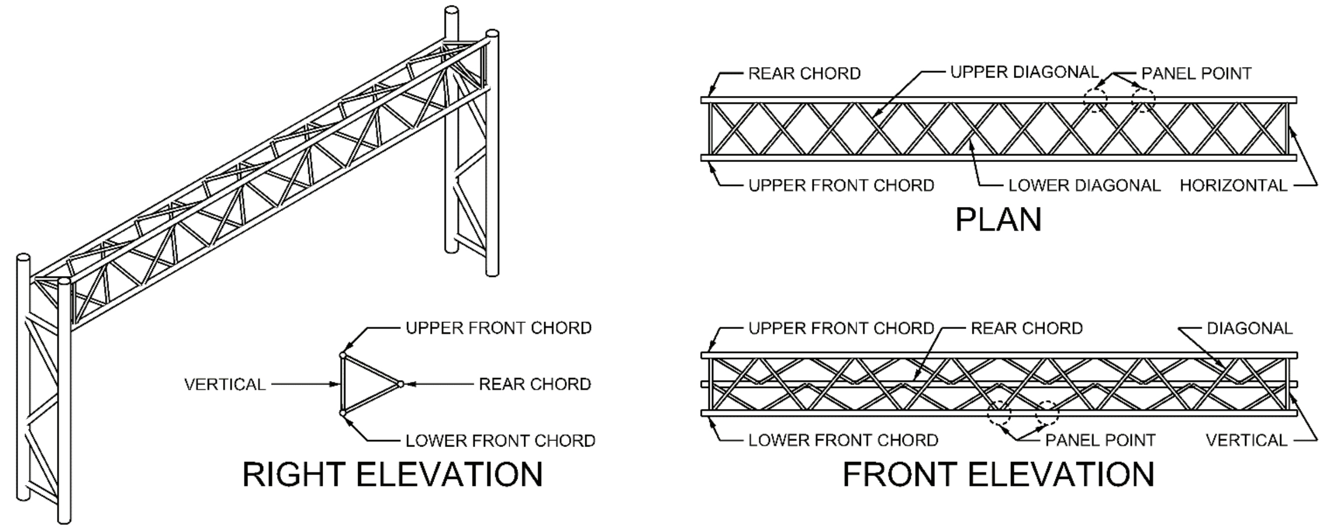


Figure 1.50 *Overhead Span Traffic Signal Structure, Tri-Chord Space Truss*

1.3.3e *Horizontal Support: Four Chord*

The four chord overhead span traffic signal structure consists of four horizontal members (the chords), with bracing between the chords consisting of vertical, horizontal, and diagonal members. These members form a truss; since not all members are within a two dimensional plane, this truss type is typically called a space truss. The truss is typically constructed of tubular or angular shapes. The truss is supported at each end by a vertical support consisting of a single pole, or a two pole plane truss. For a list of trussing nomenclature, refer to Section 1.2.1h. For numbering convention and orientation of the structure, refer to Section 4.6.3.

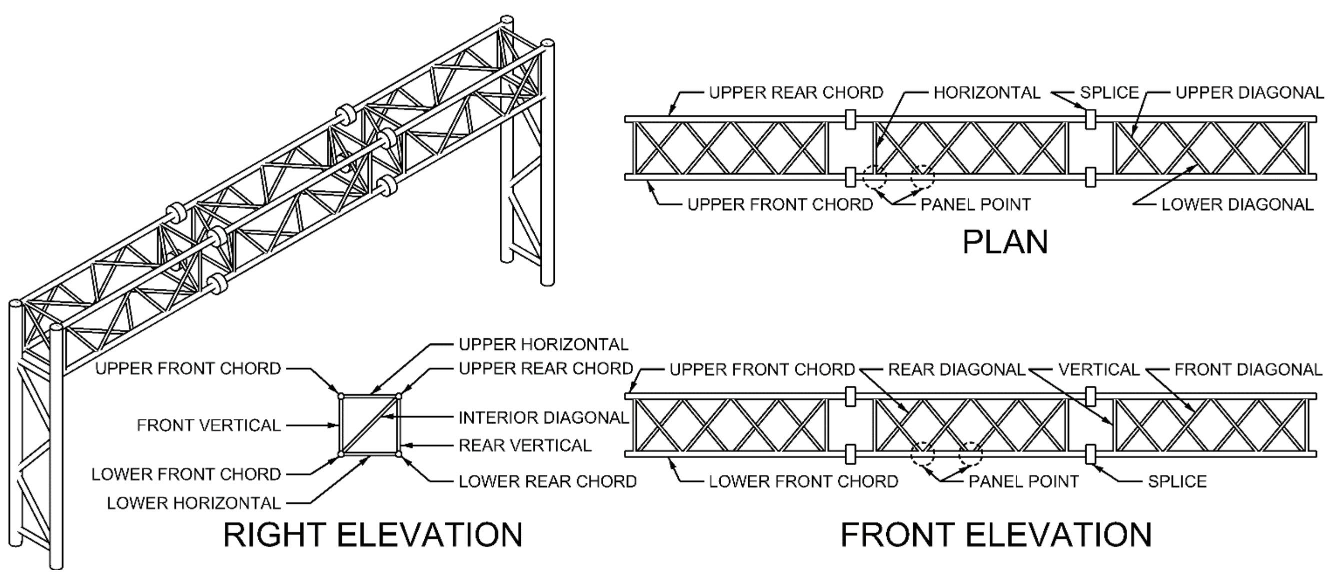


Figure 1.51 *Overhead Span Traffic Signal Structure, Four Chord Space Truss*

1.3.3f *Horizontal Support: Other Attachments to Chord*

Besides the signal head, other attachments may be found on the mast arm. Some examples include informational signs, dampeners, cameras, sensors, etc. These items may be attached via a strap or clamp system. For additional details, refer to Section 1.3.1c. For numbering convention and orientation of the structure and components, refer to Section 5.6.3.

1.3.3g *Horizontal Support: Chord Splices*

Long overhead span structures are formed by joining multiple chord or truss sections. For round chords, splice flanges are welded to the chords at the end of each of the sections. The sections are field bolted together at the splice flanges. For angle chords, the splices are made by bolting or welding the chords to a short section of angle that overlaps each chord section. Refer also to Photos 1.11 and 1.12.

1.3.3h *Vertical Support: Chord to Vertical Support Connection*

Seated Type

The various chord configurations are supported by vertical supports or poles through differing connection details, some of which are seated types. A seated configuration involves the carried component bearing or sitting directly on the carrying component such that the majority of the load is transferred directly to the carrying component rather than the load transferring through connection hardware. The two components are still secured with clamps or u-bolts, but this connection hardware carries a minor portion of the load.

It is notable that seated type connections are more robust than unseated connections, which are detailed in the next section. This is due to the main structural members carrying the load directly and generally being heavier than any connection hardware that may be used in the unseated type connections.

For additional details, refer to Section 1.2.1m, Seated Type.

Unseated Type

The various chord configurations are supported by vertical supports or poles through differing connection details, some of which are unseated types. An unseated configuration involves the carried component bolted or welded to the carrying component such that the load is fully transferred to the carrying component via the connection hardware.

For additional details, refer to Section 1.2.1m, Unseated Type.

1.3.3i *Vertical Support: Attachments*

It is common for the vertical supports to have attachments. These may be smaller signs, cameras, sensors, or other items. They consist of the attachment and the connection to the vertical support. Most commonly, the connection is made through metal straps that wrap around the vertical support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. Alternatively, these connections are often made with threaded rod formed around the pole and connected to a horizontal member supporting the attachment. Refer also to photos 1.20 and 1.21.

1.3.3j *Vertical Support: Poles or Truss*

The term pole typically refers to a single vertical support of a tubular, multi-sided, or I-beam. Vertical supports consist of a single pole or a two pole plane truss, sometimes referred to as an end frame. Both items support the structure in a similar way, elevating the horizontal portion of the structure above the roadway. For additional details, refer to Section 1.2.1o. For numbering convention and orientation of the structure and components, refer to Section 4.6.3.

1.3.3k *Foundation*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure's loads, to the earth or substructure. For additional details, refer to Section 1.2.1p. For numbering convention of the anchor bolts, refer to Section 5.6.4.

1.4 Pole Structures

Pole structures typically consist of only three main components, differing from the previous structure types in that they have no or only minor horizontal components. The three main components are: the pole attachments that have a wide range of functionality, the vertical supports adjacent to the roadway that carry the attachments, and the foundation that anchors the vertical supports and so also anchors the structure overall.

The pole attachments vary greatly, with each having unique functionality. The type of attachment typically determines the nomenclature of the structure. The possible attachments, and so naming of the structures, includes conventional luminaires, offset luminaires, high mast lights, cameras, and cell towers. All of these will be covered in the sections that follow.

The vertical supports provide structural support for the attachments of the structure, also elevating the attachments to where they have acceptable functionality. These vertical supports are usually single poles, but may also be a more robust truss support.

The foundation provides structural support for the vertical supports. The majority of the foundation is below ground. The foundation transfers the loads that act on the structure to the ground.

While general nomenclature and other various structure details will be discussed within this chapter, numbering and orientation of specific structures, components, and elements will be covered in Section 6.6.

1.4.1 Conventional Luminaires

These structures have one or two cantilevered arms that may overhang part of the roadway. The arms extend out from a pole adjacent to the roadway. Each arm has one luminaire head attached at the end. The luminaire provides illumination to the surrounding roadway.

Depending on the structure's requirements and design, one of several configuration types may be chosen for the structure. The types are determined by the number of mounts that are attached to the pole and the number of chords that make up the mount's arm.

- **Single Arm vs. Dual Arm**: The arm consists of the entirety of the element projecting from the pole. The quantity of luminaire arms determines whether it is single or dual arm.
- **Single Chord vs. Double Chord**: This is determined by whether the luminaire arm consists of one or two horizontal members or chords.

The combination of these configurations allow for four types of structures, namely the single arm single chord, single arm double chord, dual arm single chord, and dual arm double chord.

The conventional luminaire structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Luminaire
- Vertical supports
- Foundation

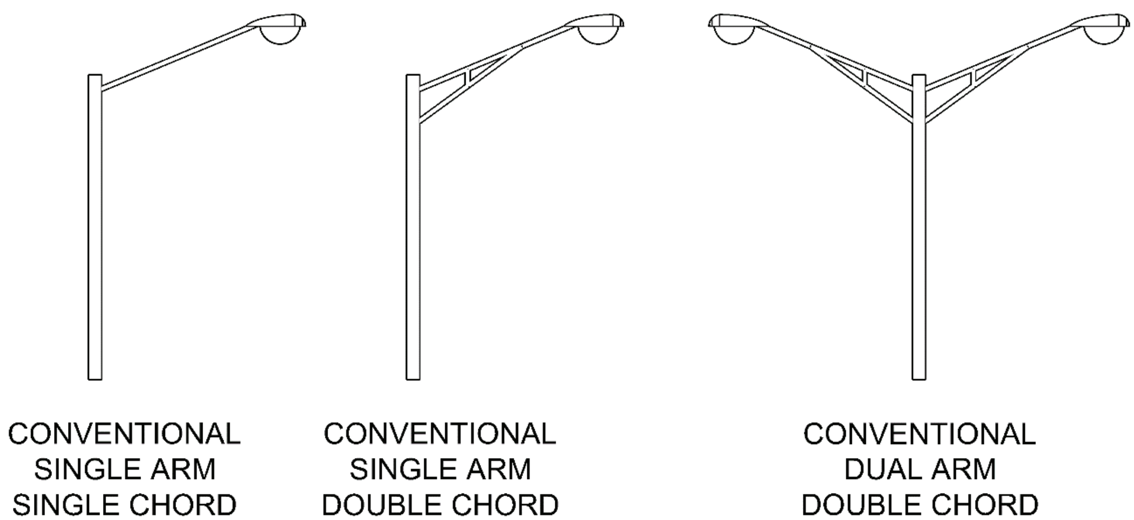


Figure 1.52 *Conventional Luminaires*

Photo 1.58 *Luminaire, singe arm, single chord*

Photo 1.59 *luminaire, single arm, double chord*

1.4.1a *Luminaire: Luminaire Head*

The luminaire head is attached at the end of the arm. It serves to house the electrical components, connect the luminaire head to the arm, and sometimes, control the activation of the luminaire. The bottom of the housing pivots about the back of the head, allowing the head to be opened for maintenance. Some of the specific subcomponents of the luminaire head are detailed in the list below. For numbering convention and orientation of the structure and components, refer to Section 6.6.3.

- **Housing**: An enclosure that houses the electronics, light emitting element, wiring, hinge, and attachment bracket.
- **Lens Cover**: a plastic or glass lens cover that allows light to pass through. The attachment to the housing varies.
- **Hinge and Latch**: The hinge is the point about which the luminaire head pivots when the latch in the front is released, allowing the assembly to open for servicing. The hinge is typically toward the pole side of the luminaire head.
- **Attachment Bracket**: The bolted clamp bracket assembly that connects the luminaire head to the arm.
- **Light Emitting Element**: A bulb or LED element that emits light to the roadway below.
- **Light Sensor**: A light sensor or photoelectric control may be present at the top of the head to control activation of the light. Alternately, several luminaire structures may be controlled by a single control unit.
- **Waterproofing**: The gaskets and seals that keep water from penetrating into the housing. One location where a seal may be found is between the housing and the lens cover.

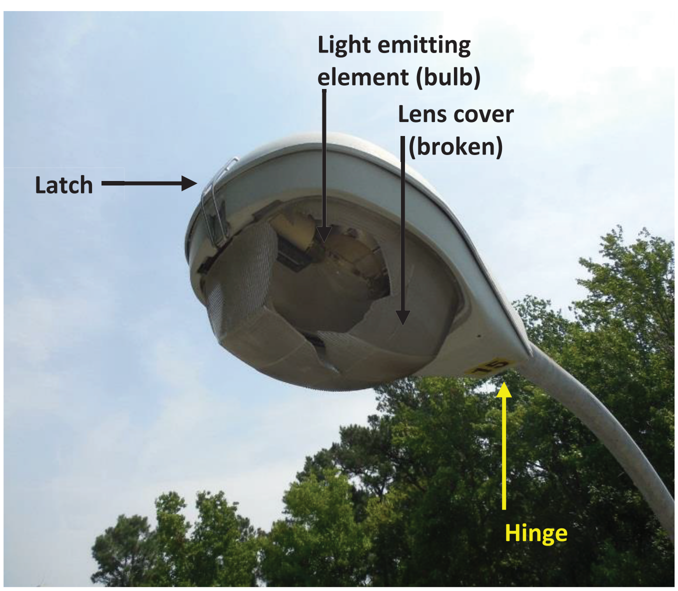


Photo 1.60 *Luminaire housing exterior*

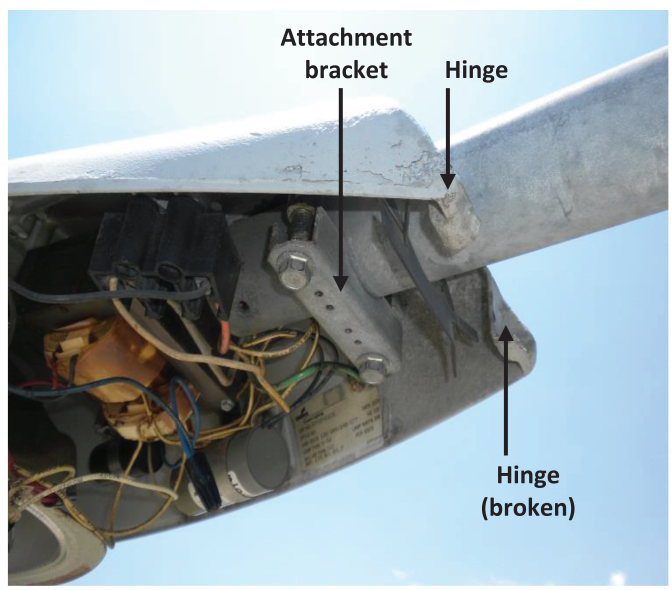


Photo 1.61 *Luminaire housing interior*

1.4.1b *Luminaire: Arm*

The arm is the member that connects the luminaire housing to the pole. The pole may have a single or a double arm. The arm consists of horizontal members called chords, which are in a single chord or a double chord configuration. In some double chord configurations, there may exist a vertical strut bracing the two horizontal chords. The length of the arm may vary significantly depending on the illumination requirements.

1.4.1c *Luminaire: Arm to Pole Connection*

The connection between the arm and the pole may consist of a welded connection, a bolted connection, or other configurations. The arm is connected at both the upper and lower chord.

Photo 1.62 *Luminaire arm to pole connection, bolted*

Photo 1.63 *Luminaire arm to pole connection, hooked*

Photo 1.64 *Luminaire arm to timber pole connection, through bolted*

1.4.1d *Vertical Support: Attachments*

It is common for the vertical supports to have attachments. These may be smaller signs, cameras, sensors, dampeners or other items. They consist of the attachment and the connection to the vertical support. Most commonly, the connection is made through metal straps that wrap around the vertical support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. Alternatively, these connections are often made with threaded rod formed around the pole and connected to a horizontal member supporting the attachment. Refer also to photos 1.20 and 1.21.

1.4.1e *Vertical Support: Poles*

The term pole typically refers to a single vertical support of a tubular or multi-sided shape for steel or aluminum structures and a cylindrical shape for timber or concrete structures. Vertical supports consist of a single pole. For additional details, refer to Section 1.2.1o.

1.4.1f *Vertical Support: Breakaway Bases*

Breakaway bases are federally mandated for structures within a certain distance of the roadway, therefore many luminaire poles have breakaway bases. These are sometimes referred to as frangible bases. A frangible material is one that will yield or break apart with relative ease, usually to act sacrificially in the event the frangible material components and another component are in a condition where they exchange excessive force. By the frangible component yielding, it should minimize damage to the non-frangible component. An example would be a car striking a light pole with a frangible base. Upon impact, the pole would fall over more easily and so would not stop the car as abruptly as a non-frangible base would, thereby potentially minimizing injury to the driver.

Transformer Base

The most common type of breakaway base is the transformer base. This base consists of a box like enclosure that sits between the foundation and the pole. We consider the transformer base a part of the pole overall, but it is connected to the pole via a bolted connection. The transformer base is also connected to the anchor bolts that protrude from the foundation. The transformer base typically has a door or hatch that opens to allow maintenance and inspection of the interior of the base.

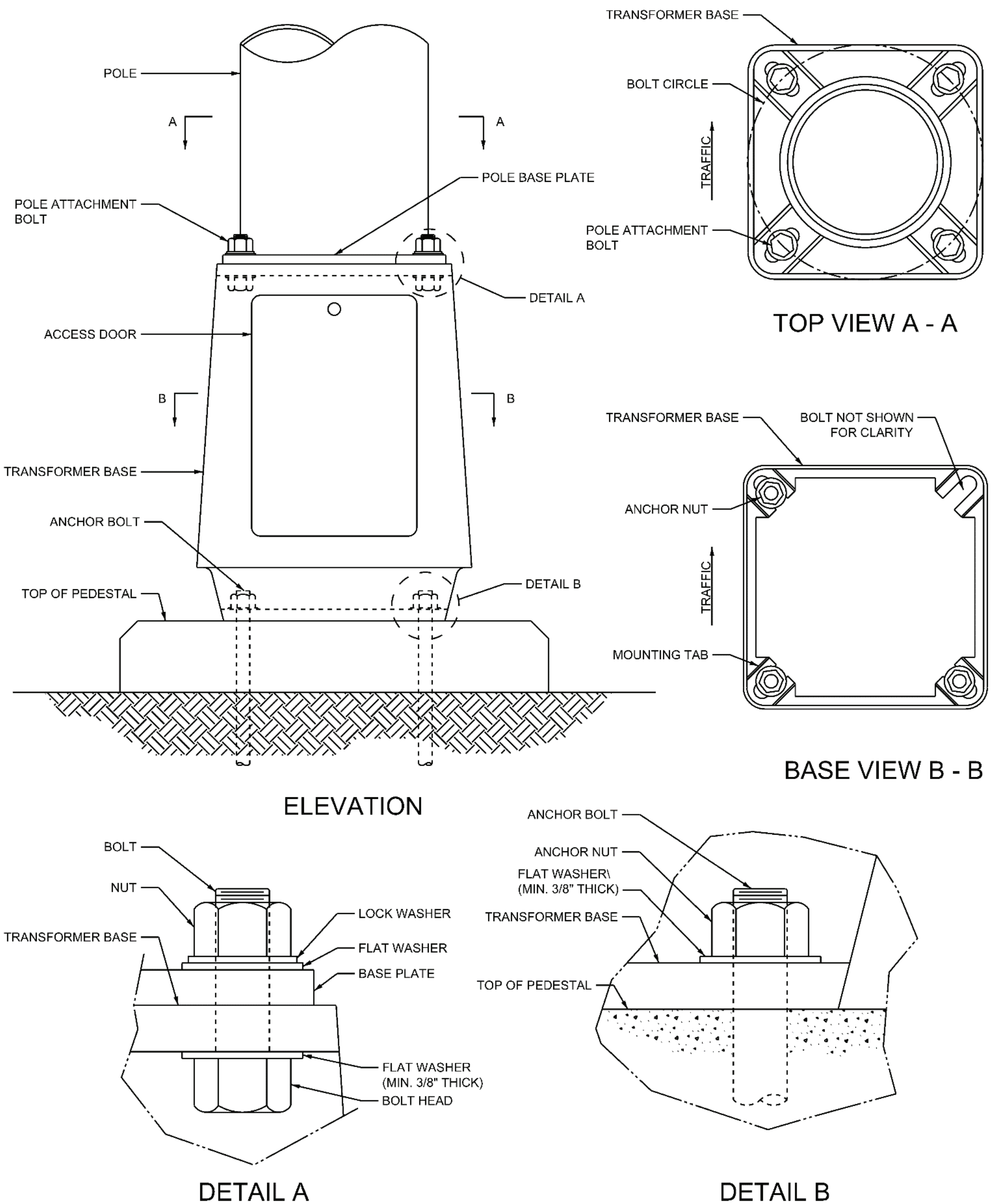


Figure 1.53 *Typical Transformer Base*

Photo 1.65 *Transformer base exterior*

Photo 1.66 *Transformer base interior*

Breakaway Coupler

Another type of breakaway system is the anchor bolt coupler. This system consists of an attachment that connects the anchor bolts to the pole base plate. The coupler is made of frangible material or has been designed to be of a frangible configuration. To protect the wiring and couplers, a protective cover (skirt) is installed around the perimeter of the foundation to pole base plate gap.

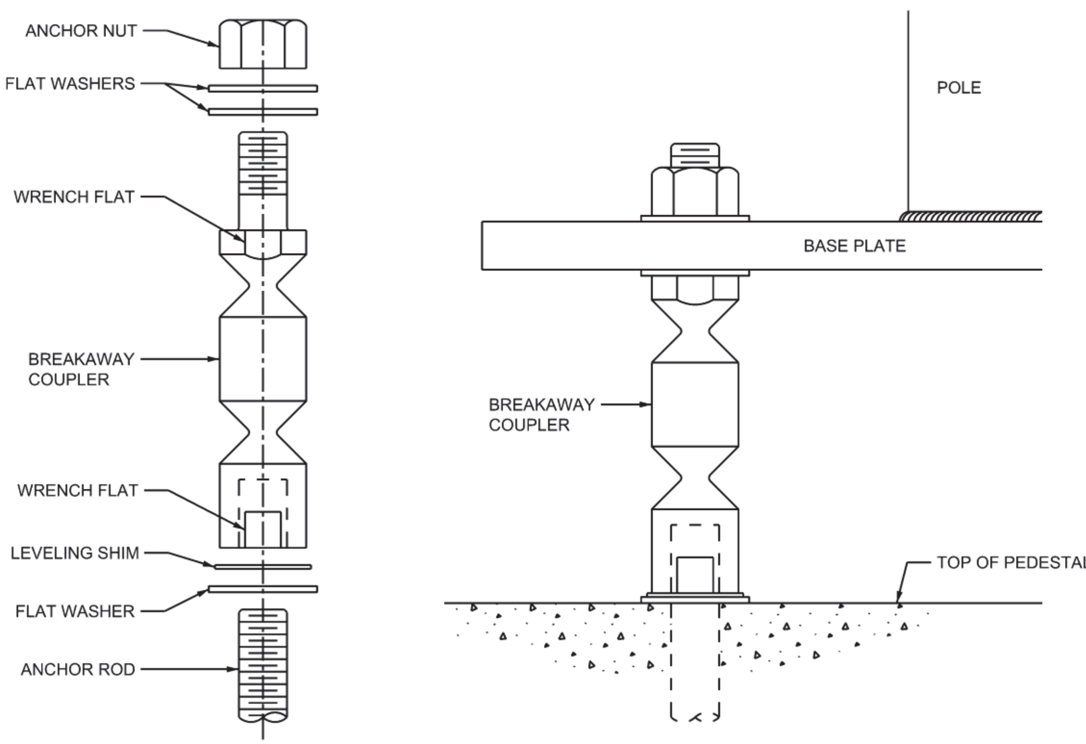


Figure 1.54 *Typical Steel Double Neck Coupler Assembly*

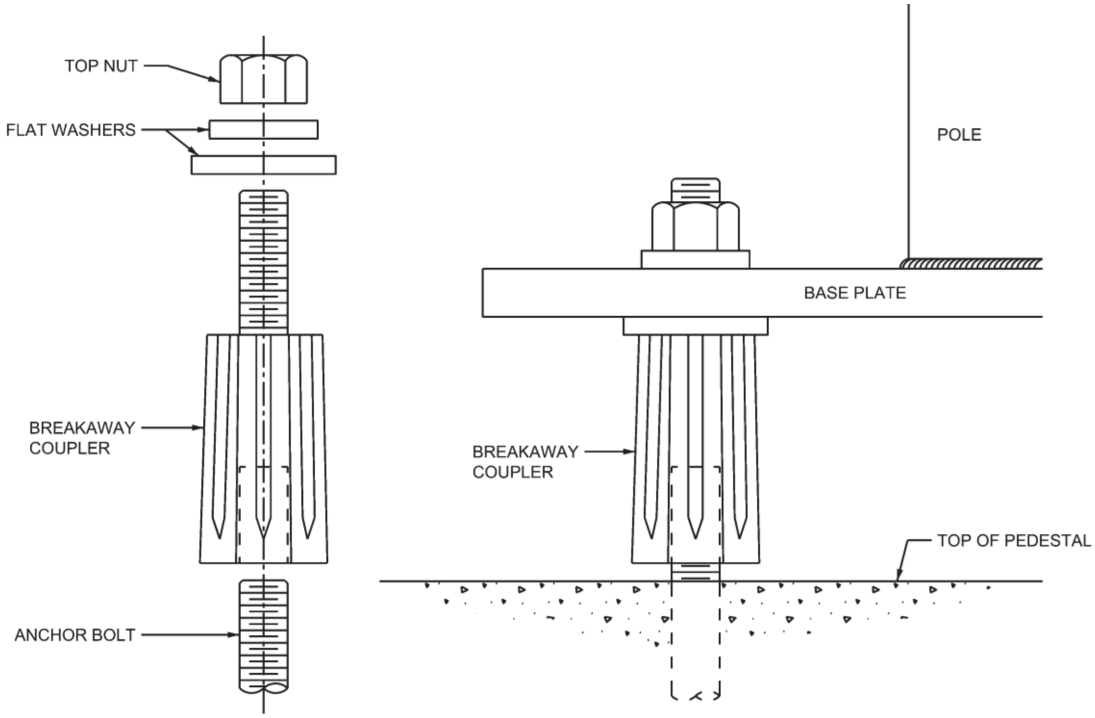


Figure 1.55 *Typical Cast Aluminum Coupler Assembly*

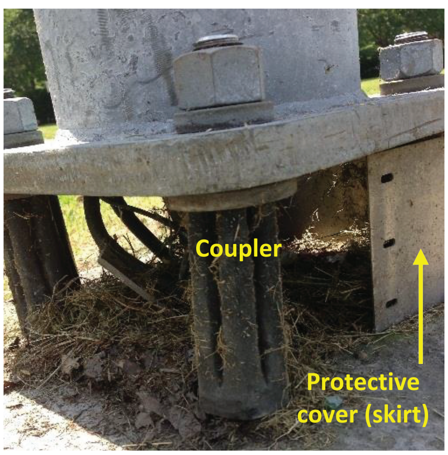


Photo 1.67 *Cast aluminum breakaway coupler*

Photo 1.68 *Steel double neck coupler*

1.4.1g *<u>Foundation</u>*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure's loads, to the earth or substructure. For additional details, refer to Section 1.2.1p. For numbering convention of the anchor bolts, refer to Section 6.6.4.

Note that timber or concrete poles are typically embedded directly into the soil and therefore do not have a foundation.

1.4.2 Offset Luminaires

These structures have short offset brackets that extend the luminaire head away from the pole. As such, the luminaires do not overhang the roadway, remaining adjacent to the roadway along with the pole. The offset bracket may have a mount for one, two, or four luminaire heads. The luminaire provides directional illumination to the surrounding roadway.

There is a large amount of variety for this type of structure. Typically, most varieties have one, two, or four offset mounts for luminaire heads. The nomenclature for the structure is determined by the quantity of luminaire head attachments. Therefore, the structures are named as single mount, dual mount, or quad mount offset luminaire structures.

The offset luminaire structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Luminaire
- Vertical supports
- Foundation

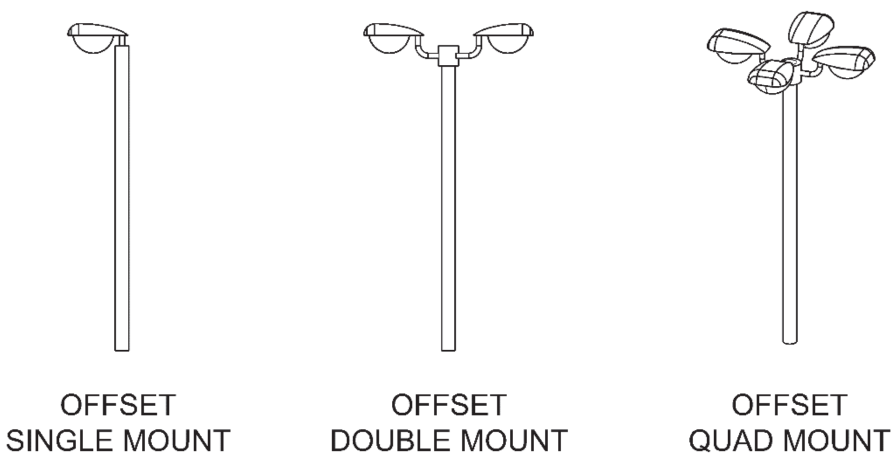


Figure 1.56 *Offset Luminaires*

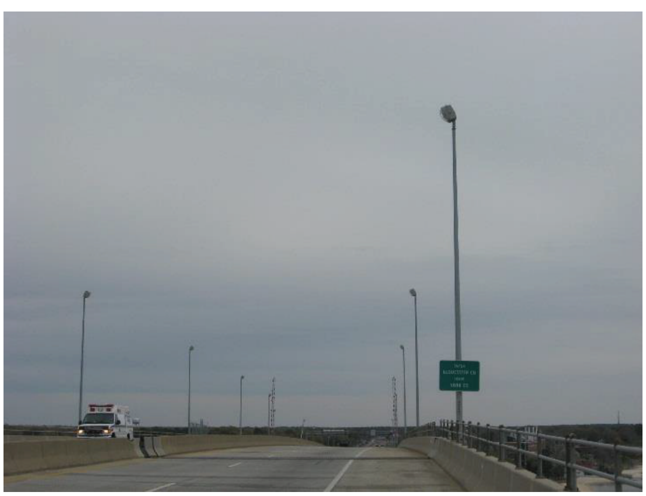


Photo 1.69 *Offset luminaire, single mount*

Photo 1.70 *Offset luminaire, quad mount*

1.4.2a *Luminaire: Luminaire Head*

The luminaire head is attached at the end of the bracket or to the pole. It serves to house the electrical components, connect the luminaire head to the pole, and sometimes, control the activation of the luminaire. The bottom of the housing pivots about the back of the head, allowing the head to be opened for maintenance. For additional details, refer to Section 1.4.1a. For numbering convention and orientation of the structure and components, refer to Section 6.6.3.

1.4.2b *Luminaire: Luminaire to Pole Connection*

A single mount offset luminaire is typically connected to the pole via the tenon. The tenon is a connection adaptor between the pole and the luminaire. For offset luminaires with more than one mount, a short mounting arm provides an offset from the pole, with each of the mounting arms connecting to a central member. This central member is then connected to the pole via the tenon.

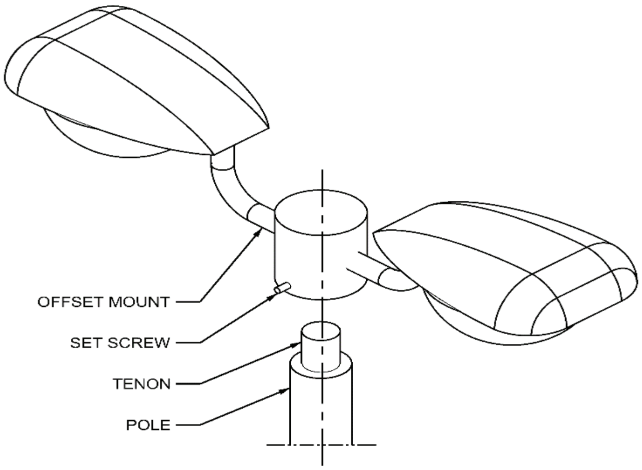


Figure 1.57 *Offset Mounting Bracket*

Photo 1.71 *Offset luminaire, dual mount*

1.4.2c *Vertical Support: Attachments*

It is common for the vertical supports to have attachments. These may be smaller signs, cameras, sensors, dampeners, or other items. They consist of the attachment and the connection to the vertical support. Most commonly, the connection is made through metal straps that wrap around the vertical support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. Alternatively, these connections are often made with threaded rod formed around the pole and connected to a horizontal member supporting the attachment. Refer also to photos 1.20 and 1.21.

1.4.2d *Vertical Support: Poles*

The term pole typically refers to a single vertical support of a tubular or multi-sided shape for steel or aluminum structures and a cylindrical shape for timber or concrete structures. Vertical supports consist of a single pole. For additional details, refer to Section 1.2.1o.

1.4.2e *Vertical Support: Breakaway Bases*

Breakaway bases are federally mandated for structures within a certain distance of the roadway, therefore many luminaire poles have breakaway bases. These are sometimes referred to as frangible bases. A frangible material is one that will yield or break apart with relative ease, usually to act sacrificially in the event the frangible material components and another component are in a condition where they exchange excessive force. By the frangible component yielding, it should minimize damage to the non-frangible component. An example would be a car striking a light pole with a frangible base. Upon impact, the pole would fall over more easily and so would not stop the car as abruptly as a non-frangible base would, thereby potentially minimizing injury to the driver. For additional details, refer to Section 1.4.1f.

1.4.2f *Foundation*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure's loads, to the earth or substructure. For additional details, refer to Section 1.2.1p. For numbering convention of the anchor bolts, refer to Section 6.6.4.

Note that timber or concrete poles are typically embedded directly into the soil and therefore do not have a foundation.

1.4.3 High Mast Lights

High Mast Light (HML) structures have great height, usually exceeding 55'. They carry a luminaire ring that has several luminaire heads providing high output illumination to a large area around the structure. The luminaire ring can typically be lowered for maintenance and inspection purposes. There is no horizontal support component to the structure and as such, the luminaires do not overhang the roadway, remaining adjacent to the roadway along with the pole. The vertical support of the structure may be made up of several sections that slide into one another; the interfaces of these sections are called slip joints.

The high mast light structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Luminaire Ring
- Vertical supports
- Foundation

Photo 1.72 *High mast light*

1.4.3a *Luminaire Ring*

Each luminaire head is attached to a luminaire ring. This is essentially a ring like structure that can be lowered up and down. Access to the luminaire heads is usually limited due to the height of the structures. For this reason, and to allow for maintenance and inspection procedures, the ring may be lowered with either an internal or external winch system. The ring also contains a centering system that minimizes the chance of the ring becoming stuck on the pole.

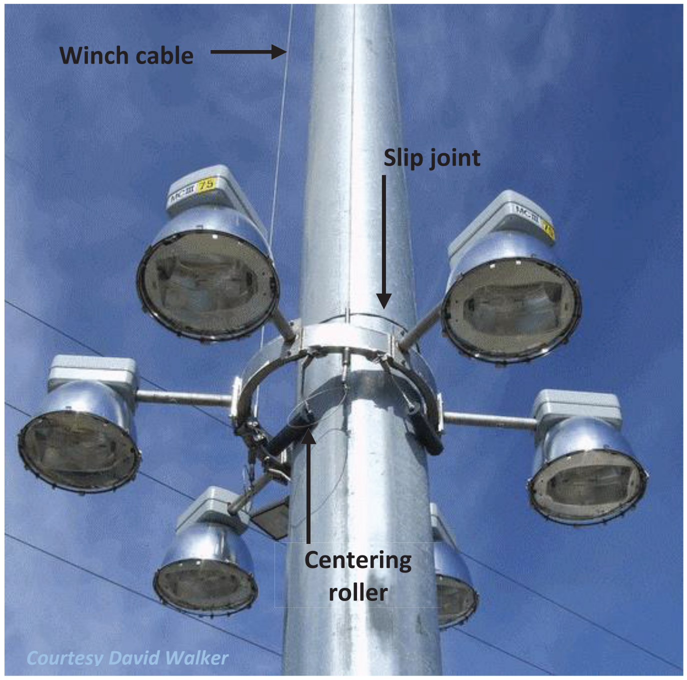


Photo 1.73 *High mast light luminaire ring being lowered*

1.4.3b *Luminaire Ring: Luminaire Ring to Pole Connection*

The luminaire ring is connected to the pole via the winch system, suspended by wires. When the ring is fully raised, a locking mechanism engages, securing the ring in place.

1.4.3c *Vertical Support: Attachments*

It is not common for vertical supports of high mast lights to have attachments as they would interfere with lowering and raising the luminaire ring.

1.4.3d *Vertical Support: Poles*

The term pole typically refers to a single vertical support of a tubular or multi-sided shape. Vertical supports consist of a single pole. For additional details, refer to Section 1.2.1o.

Additionally, due to the height of these poles, they may be comprised of several long sections. These sections are attached to one another via a butt weld or slip joints. Slip joints consist of the higher pole section slipping over the lower pole section. The sections are tapered to be narrower progressing up the pole. Due to these factors, the overlapping sections of a slip joint fit tightly together. The friction that develops between the two sections keeps the pole acting monolithically.

The hand hole for these structures is also much larger since it provides access to the winching system.

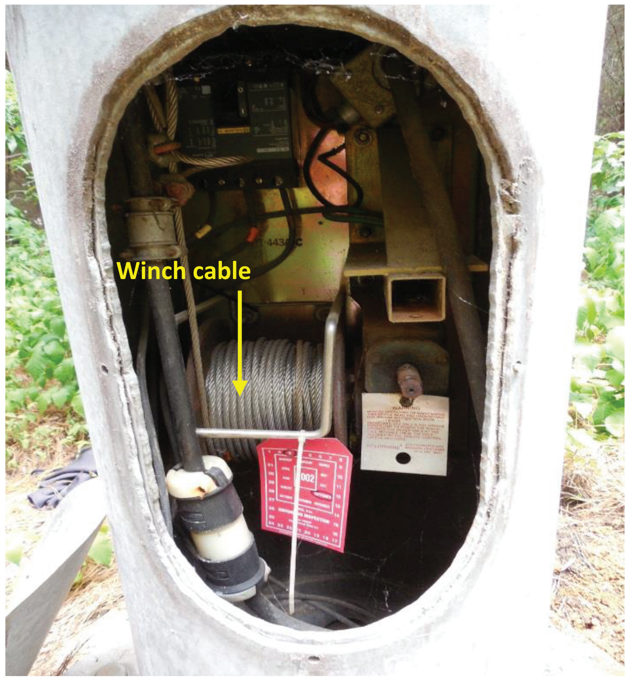


Photo 1.74 *High mast light pole hand hole*

1.4.3e *Foundation*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure's loads, to the earth or substructure. For additional details, refer to Section 1.2.1p. For numbering convention of the anchor bolts, refer to Section 6.6.4.

1.4.4 Camera Poles

These structures carry cameras that are used to monitor traffic, notify driver assistance personnel, and notify emergency services if needed. They consist of a camera, a camera housing, the attachment to the pole, the pole, and the foundation. They may also have a circular walkway that may be accessed for maintenance procedures. Typically, the cameras have short offsets that extend the camera slightly away from the pole. As such, the cameras do not overhang the roadway, remaining adjacent to the roadway along with the pole.

There is a fair amount of variety in these structures, from varying camera types to presence or lack of walkways, but the main focus of the structures remain consistent throughout all variations.

The camera structures will be discussed by major components, which include the items in the bulleted list below. These major components may have various configurations, but all perform essentially the same function. Many of the major components consist of several subcomponents. The subcomponents also require significant attention and so similarly, they will be identified and discussed in the sections below.

- Camera
- Vertical supports
- Foundation

Photo 1.75 *Camera pole with walkway*

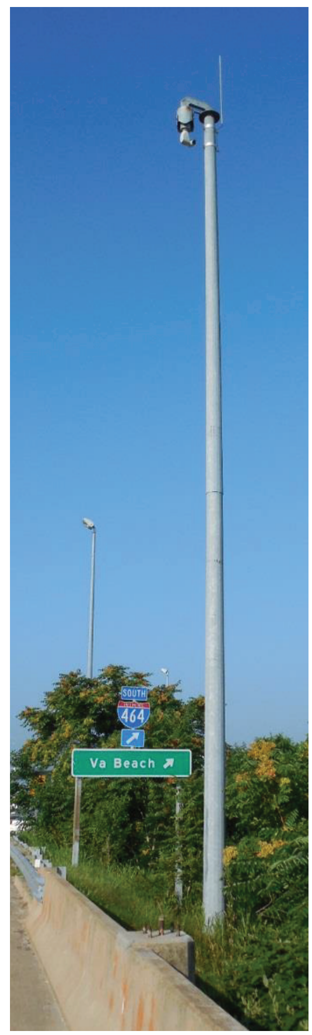


Photo 1.76 *Camera pole without walkway*

1.4.4a *Camera: Camera Assembly*

The camera functions to capture and transmit video footage or photographs of the surrounding area. The camera assembly consists of several components. Some of the specific subcomponents of the camera housing are detailed in the list below.

- **Camera**: The camera functions to capture and transmit video footage or photographs of the surrounding area.
- **Lens Cover**: a plastic or glass lens cover that allows light to pass.
- **Housing**: The housing protects the camera from environmental factors such as moisture or animal intrusion. It houses the electronics, wiring, connection to the bracket, and if present, the motor controlling the orientation of the camera.
- **Motor Unit**: The camera housing may be motorized, allowing the camera to pivot as needed by the controller.
- **Waterproofing**: The gaskets and seals that keep water from penetrating into the housing. One location where a seal may be found is between the housing and the lens cover.
- **Antenna**: An attachment that allows transmission of the images obtained by the camera.
- **Bracket**: The arm that connects the housing to the pole.

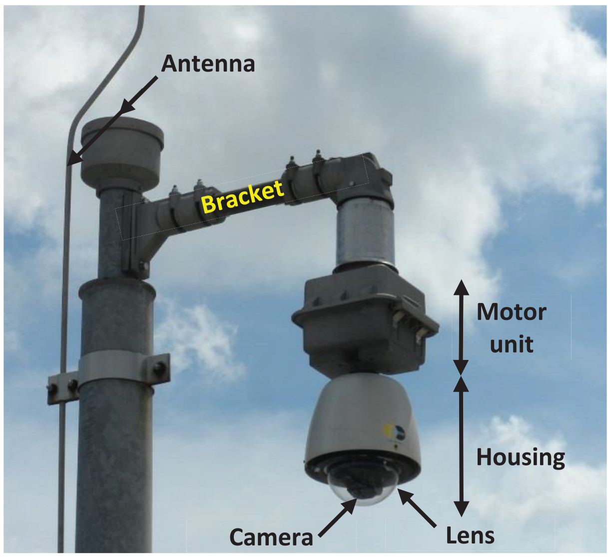


Photo 1.77 *Camera configuration*

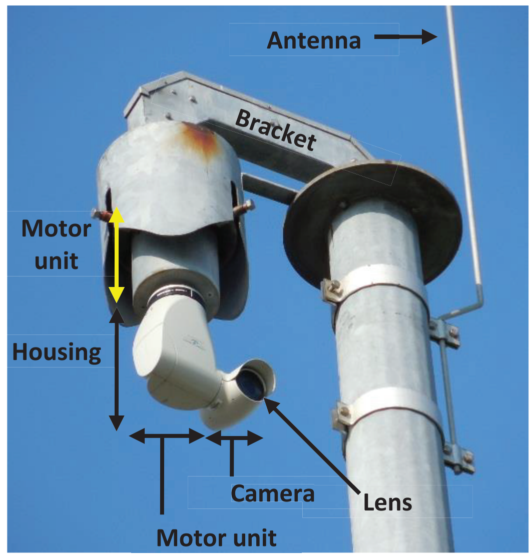


Photo 1.78 *Camera configuration*

1.4.4b *Camera: Camera to Pole Connection*

The camera housing may attach to the top of the pole directly, or may be mounted to a short offset bracket. The connection between the various components may be bolted, clamped, or welded.

1.4.4c *Vertical Support: Attachments*

It is common for the vertical supports to have attachments. These may be smaller signs, cameras, sensors, antennas or other items. They consist of the attachment and the connection to the vertical support. Most commonly, the connection is made through metal straps that wrap around the vertical support and are bolted or clamped, locking the straps in place in the correct location and the correct tightness. Alternatively, these connections are often made with threaded rod formed around the pole and connected to a horizontal member supporting the attachment. Refer also to photos 1.20 and 1.21.

1.4.4d *Vertical Support: Walkway*

Camera poles sometimes have walkways at the top of the structure. These are typically circular in arrangement, going around the perimeter of the pole. Due to this configuration and the appearance, the walkways are sometimes referred to as a crow's nest. Walkways consist of members that form a frame for grating to rest on, providing walkable access. These walkways typically have railings. Walkways are inspection and maintenance aids. Some of the specific subcomponents of the walkway system are detailed in the list below.

- **Railing**: A safety enclosure that protects personnel using the walkway from falling. It consists of a handrail, a midrail, posts, and toeboard, each of which is detailed in the list below.
  - **Handrail**: The top horizontal member that run parallel to the walkway.
  - **Midrail**: The rail approximately midway between the handrail and the platform.
  - **Posts**: The vertical members that support the rails.
  - **Toeboard**: The plate that runs parallel to the walkway, attached between the posts.
- **Platform**: The working space or walking surface. This typically consists of open grid metal grating.
- **Rung**: The vertical supports typically have integrated rungs that function as a ladder, providing access to the walkway at the top.
- **Fall Arrest System**: The vertical supports typically have a fall arrest system. This fall arrest system may be a wire, a notched pipe, or a T-beam and the appropriate "follower device" to which the climbing harness lanyard is attached.

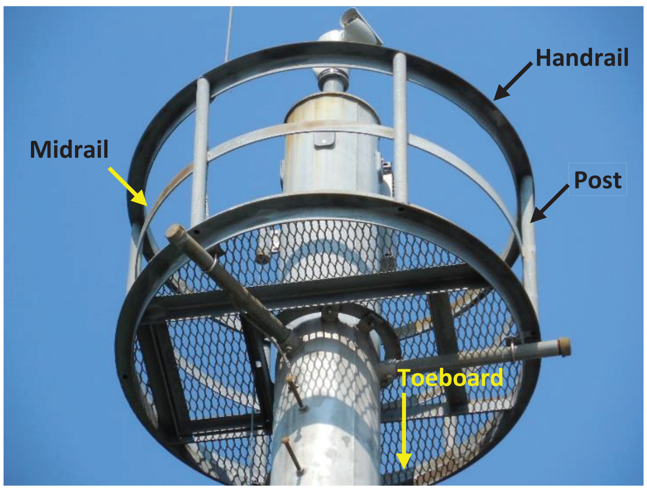


Photo 1.79 *Camera walkway (crow's nest)*

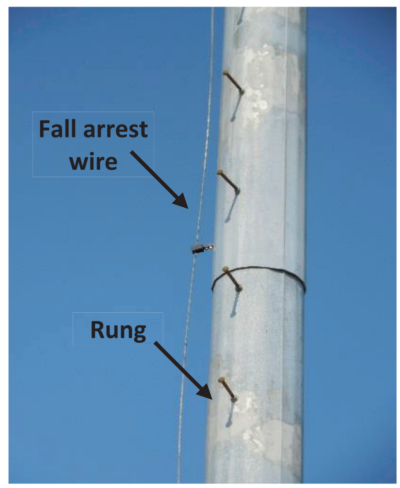


Photo 1.80 *Integrated rungs and fall arrest system*

1.4.4e *Vertical Support: Poles*

The term pole typically refers to a single vertical support of a tubular or multi-sided shape. Vertical supports consist of a single pole. For additional details, refer to Section 1.2.1o.

Additionally, these poles may be higher than other structures, and so may be comprised of multiple sections. These sections are attached to one another via a butt weld or slip joints. Slip joints consist of the higher pole section slipping over the lower pole section. The sections are tapered to be narrower progressing up the pole. Due to these factors, the overlapping sections of a slip joint fit tightly together. The friction that develops between the two sections keeps the pole acting monolithically.

1.4.4f *Foundation*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure's loads, to the earth or substructure. For additional details, refer to Section 1.2.1p. For numbering convention of the anchor bolts, refer to Section 6.6.4.

1.4.5 Cell Towers

Cell towers are not typically managed by the Department, except in cases where they are either owned by the Department or there is a specific right of way lease agreement involving the Department. Due to the towers' great height and relative proximity to the roadway, the cell towers' potential impact to the roadway warrants the structure being inspected by the Department on a case by case basis. However, inspections will be limited to the bases.

Cell towers discussed above consist of vertical supports that either are a single monopole or are trussed. Cell towers have foundations that are similar to the other structures that have been discussed.

Photo 1.81 *Cell tower, truss pole*

Photo 1.82 *Cell tower, monopole*

1.4.5a *Foundation*

The foundation is the portion of the structure below the base plate, including the anchor bolts that attaches the pole, and transmits the structure's loads, to the earth or substructure. For additional details, refer to Section 1.2.1p. For numbering convention of the anchor bolts, refer to Section 6.6.4.

Though these structures are considerably taller than most of the structures covered previously, their foundations are very similar, but significantly larger. Even the trussed tower has similar foundations, with one foundation at each of the three to four legs.

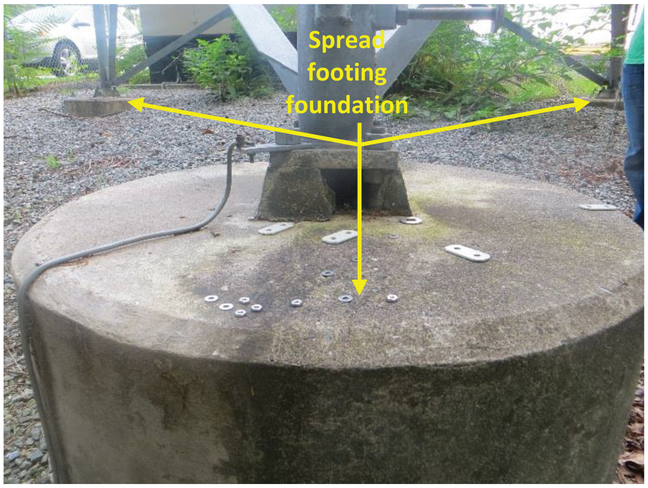


Photo 1.83 *Trussed Cell tower with multiple foundations*

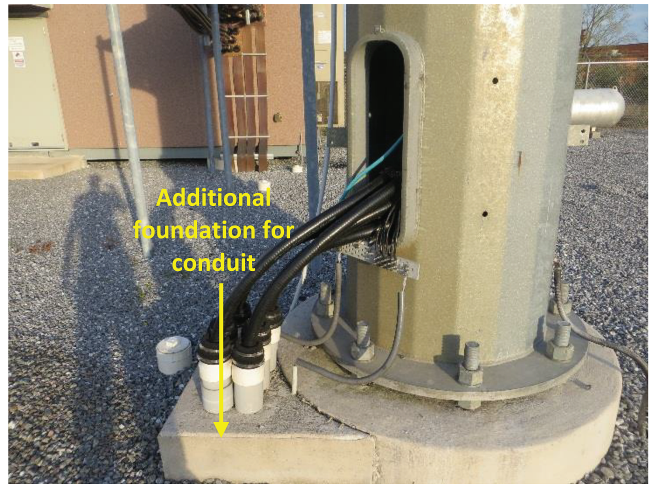


Photo 1.84 *Monopole Cell tower with large foundation*

CHAPTER 2. INSPECTION PLANNING AND PREPARATION

2.1 Introduction

Planning and preparing for the inspection of traffic ancillary structures is critical to the safety and success of any inspection operation. Prior to any inspection a number of factors, including safety, have to be taken into account and incorporated into the inspection plan. The following section will address the inspection team's necessary qualifications, the types of inspections to be performed, and what is necessary to perform these inspections.

2.2 Personnel

2.2.1 Qualifications

The inspection of ancillary structures has many similarities to the inspection of highway bridges. The qualifications for bridge inspection personnel as given in the National Bridge Inspection Standards (23 CFR 650) are summarized below with special modifications for ancillary structures.

- ***Program Manager****:* The Program Manager is in charge of the scoping, overall scheduling, cost control, quality assurance, and inventory data management of the Traffic Ancillary Structure Inspection Program. As such the Program Manager shall meet the following qualifications:
  - Registered as a Professional Engineer in the Commonwealth of Virginia or have a minimum of 10 years of experience in highway structure inspections (including bridges) in a responsible capacity
  - Successfully completed a Federal Highway Administration (FHWA) approved 80-hour Bridge Inspection Course
  - Successfully completed a FHWA approved Ancillary Highway Structures Inspection and Maintenance Course
  - Any additional or refresher training requirements specified by the Department.

- ***Team Leader****:* The Team Leader sets the task schedules, organizes maintenance of traffic and lane closures as necessary, provides notifications to traffic operation centers, coordinates work with other entities, and is in charge of the inspection team while in the field. The Team Leader shall meet one of the following qualification criteria:
  - Have the qualifications specified for the Program Manager; or
  - Have 5 years of experience in highway structure inspection (including bridges); or
  - Be certified as a Level III or IV Bridge Safety Inspector under the National Society of Professional Engineer's program for National Certification in Engineering Technologies (NICET); or
  - Have all of the following:
    - A bachelor's degree in engineering from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology; and
    - Successfully passed the National Council of Examiners for Engineering and Surveying Fundamentals of Engineering examination; and
    - 2 years of experience in highway structure inspection (including bridges)
  - Have all of the following:
    - An associate's degree in engineering or engineering technology from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology; and
    - 4 years of experience in highway structure inspection (including bridges)

  The Team Leader shall also meet the following qualification criteria:
  - Successfully completed a FHWA approved 80-hour Bridge Inspection Course
  - Successfully completed a FHWA approved Ancillary Highway Structures Inspection and Maintenance Course
  - Any additional or refresher training requirements specified by the Department.

- ***Team Member****:* The Team Member is responsible for supporting the Team Leader in organizing and performing the inspection.

A record of qualifications for all Program/Project Managers and Team Leaders, including consultants, performing Traffic Ancillary Structure Inspections shall be on file with the Department's Structure and Bridge Division in the Central Office. Each District shall also maintain a copy of the qualifications for the above listed personnel as well as the qualifications and certifications (ASNT Level II Technician) of any personnel performing ultrasonic testing of anchor bolts. Refer to Section 2.4.4 and Appendix C for ultrasonic testing certification and qualification requirements.

2.2.2 Team Composition

A two person team should typically be used when performing both the inventory and inspection of any ancillary structure. The team is to be comprised of a Team Leader and a Team Member. While varying conditions could potentially warrant the need for additional Team Members, it is not advised to reduce the team size to less than two people. Given the nature of the work, two people on-site enable the members to monitor each other's safety and call for assistance if something were to happen to the other Team Member. In certain circumstances and with the approval of the District Manager, Team Leaders may perform inspections as needed without assistance from the Team Member. In these instances, all VDOT health and safety regulations and work zone protection standards of practice shall be observed and safety of the Team Leader or traveling public shall not be compromised. Although it is not anticipated that this will be a common occurrence, it may be warranted on a case by case basis. Some specific examples of such situations may include when performing emergency inspections, performing ultrasonic testing behind a guardrail, providing construction support, or acceptance inspection.

2.2.3 Inspector's Judgment

The inspector is responsible for performing a thorough and detailed inspection of each and every structure assigned to him or her using both formal training and the guidance provided in this manual. Although the formal training and guidance provided within this manual gives the inspector the fundamentals necessary to conduct the full inspection of an ancillary structure, the inspector is responsible for using sound engineering judgment and experience in determining specific details or conditions that could affect the structure or the traveling public. Examples of this include defining the condition ratings for the structure and structure components, and assigning repair recommendations and priorities for those recommendations.

2.2.4 Consistency

Thorough and consistent documentation of existing conditions and component ratings is an integral part of the inspection process. Consistency allows for repeatable inspections, monitoring of various conditions, and affords the ability for querying specific structure configurations, conditions, and defects within the database. During the inspection of an ancillary traffic structure, the written and pictorial documenting of conditions should use standard statements, nomenclature, locations, numbering, etc. in order to accurately describe and rate conditions, while maintaining a high level of consistency from inspector to inspector.

For guidance on coding structure inventory data, refer to Appendix A. For a listing of common deficiencies, along with suggested ratings, recommendations and priorities, refer to Appendix B. While consistency is important, the inspector must utilize sound judgment when applying the guidance in Appendix B and assigning the appropriate ratings, recommendations, and priorities for each observed condition.

2.3 Document and Equipment Requirements

A successful ancillary traffic structure inspection requires that the inspection team have, on-site, any available design and inspection documentation related to the structure being inspected. These documents will aid in understanding as-built conditions and any changes in previously reported conditions or deficiencies. In addition to the documents, the inspection team should have with them, at each inspection, basic inspection equipment/tools in order to verify and obtain the necessary inspection information as presented in Chapters 4, 5 and 6, and in Appendix A. These typical documents and equipment include, but are not limited to, the following.

2.3.1 Documents

- **Fabrication or As-Built Structure Plans**: This information is typically necessary when performing initial/inventory inspections as defined in Section 2.4.1.
- **Latest Inspection Reports**: This information is typically used when performing any inspection, as defined in Sections 2.4.2 through 2.4.5, where an initial/inventory inspection of a structure has been performed. If a routine and base inspection has previously been performed on a structure, the previous routine and base inspection reports should be present on-site for the new inspection.
- **Virginia Work Area Protection Manual (VWAPM)**: If shoulder or lane closures are being used to perform the inspections, this manual should be on-site to ensure all closures are in accordance with the VWAPM.
- **Traffic Ancillary Structures Inventory and Inspection Manual**: This document and related appendices serve as a guide for the inspection, as well as noting how the inspections forms are to be properly completed.

2.3.2 Equipment/Tools

- **Standard Personal Protective Equipment (hard hat, steel toe shoes, safety vests and pants)**
- **Gloves**: Used as hand protection when performing inspections or specific inspection activities such as grinding, clearing bush, digging out foundations, etc.
- **Safety Glasses**: Used as eye protection when using power or hand tools for specific inspection activities such as sounding concrete or anchor bolts, grinding anchor bolts, chipping corrosion, clearing brush, etc.
- **Headlamps and Flashlights**: Used by the inspector when performing inspection of dark areas or when performing night inspections. Headlamps are particularly useful when mounted to a hardhat as it aids in keeping the inspectors hands free for handling the structure or other tools and equipment.
- **Portable Lighting**: Used to light/illuminate the work zone and structure during nighttime inspection work.
- **Hand-held GPS**: Used to obtain and verify the GPS coordinates of the structure in the field. The unit is to be WAAS-capable and able to provide accuracy to within 6' to 10'.
- **Digital Camera**: Used to take photographs of required items or deficiencies. The camera shall be capable of time and date stamping the photographs. A camera that is capable of taking voice captions may be beneficial.
- **Shovel**: Used for uncovering pedestals, base plate, etc.
- **Machete/Bush Axe**: Used for removing undergrowth.
- **Mason Hammer**: Used for checking tightness of top and leveling nuts, sounding anchor bolts for possible cracks or debonding from the concrete, sounding the concrete pedestals for delamination, removal of rust scale and sounding of other structure elements for possible internal corrosion and section loss.
- **4' Level**: Used for checking plumbness of non-tapered vertical supports/poles and checking levelness of other components.
- **Plumb Bob**: Used for checking tapered and non-tapered vertical support/pole plumbness and bowing.
- **Nylon string**: Used for determining and measuring sag or any other distortion to a chord or other member.
- **Laser Distance Measuring Tool**: Used to measure clearances and span lengths.
- **25' Tape Measure**: Used for measuring sign dimensions, anchor bolt diameters, base plate standoff distances, and deficiency sizes, etc.
- **Folding Ruler**: Used for measuring some sign dimensions, anchor bolt diameters, base plate standoff distances, deficiency sizes, and used as a scale in photographs.
- **Calipers**: Used for measuring diameter or thickness of smaller structure components, such as anchor bolts, and component section losses.
- **Feeler or Taper Gauge**: Used for measuring gaps between parts or pieces such as gaps between top nuts and base plates.
- **Ultrasonic Thickness Testing Machine**: Used for measuring thickness of components where access to one side is restricted (e.g. pole wall thickness).
- **Angle Grinder**: Used for grinding the tops of anchor bolts to level the surfaces and remove any coating.
- **Spray Paint**: Used for painting structure numbers to vertical supports/poles of structures and parapets for bridge parapet-mounted structures.
- **Paint Remover**: Used for removing excess spray paint or overspray created by painting structure numbers on structures.
- **Number and Letter Stencils**: Used for establishing and applying structure numbers to vertical supports/poles of structures and parapets for bridge parapet-mounted structures.
- **Stencil Template**: Used for aligning, securing, and framing structure numbers and letters (described above) in a vertical or horizontal orientation, and to prevent overspray on the structure during the painting process.
- **Cold Galvanizing Compound**: Used for painting the tops of anchor bolts or other surfaces following the grinding and ultrasonic testing to minimize or prevent corrosion.
- **Mechanics Mirror**: Used for inspecting areas that are difficult to access through normal hands-on inspection methods. The mirror affords a visual inspection of the areas. If the mirror is to be used inside hand holes or other potentially electrically active locations, the mirror shall have an electrically insulated handle.
- **Electrically Insulated Borescope**: Used for inspecting the interior areas of vertical supports/poles, chords, etc. that cannot be inspected through conventional means due to limited accessibility or live electrical components within the areas.
- **Tablet/Smartphone:** Tablet with Mobile HMMS Data Collection Application
- **Magnet**: Used for determining the material of a structure, securing the end of a string line when measuring sag or distortion of a vertical support/pole or horizontal support/truss, etc.
- **Drones**: Used to observe locations to be inspected that are otherwise not available for hands-on inspection from a high reach manlift. Drone options include but are not limited to a remote operated climbing drone, or a remote operated drone (Unmanned Aerial Vehicle, UAV).

- **Wrenches and Screw Drivers**: Used for removal of anchor bolt covers, hand hole covers, and transformer base access covers.
- **Drill**: Used for drilling grout pads in determining the presence of leveling nuts and assessment of timber vertical supports/poles.
- **Awl or Ice Pick**: Used for detecting and quantifying the depth of softwood and decay present in timber vertical supports/poles.
- **Resistograph**: Instrument that uses drilling resistance for determining the presence and depth of any softwood, decay, and cavities within timber vertical supports/poles.
- **Timber Coring Kit**: Used for sampling and determining the presence of interior decay and cavities within timber vertical supports/poles.
- **High Powered Spotting Scope (20x-50x Magnification)**: Used for performing visual inspections of high mast lights.
- **High Powered Binoculars (10x-15x Magnification)**: Used for performing visual inspections of upper portions of offset luminaires.
- **Generator**: Used for powering various corded power tools or equipment including lights for night inspections, drills for drilling of grout pads, and grinders for ultrasonic testing of anchor bolts.
- **Extension Cord**: Used for powering tools or equipment when accessibility is limited due to structure location or obstructions.
- **First Aid Kit**: Used for addressing minor on-site injuries. A kit should be available in each inspection vehicle at all times**.**
- **Portable Lighting**: Used for lighting the structure and the work zone when performing night inspections, and used for lighting larger areas on the structure for inspection.
- **Rags, Painters Tape, Duct Tape**: Rags are used for various activities including wiping or cleaning paint, dirt, or grime from areas or elements, painters tape is used for taping stencils to the stencil template, and duct tape is used for variety of conditions.
- **Dye Penetrant Testing Kit**: Used for performing NDT on suspected cracks in welds and metal members.
- **Magnetic Particle Testing Kit**: Used for performing NDT on suspected cracks in welds or steel members.
- **Cellular Phone**: Used for contacting and communicating with various entities for the purpose of coordination or reporting personnel or inspection emergencies or critical conditions.
- **Two Way Radios**: Used for communication between the inspectors during the inspection process, specifically when one inspector is performing inspections from an aerial lift or bucket.

The above basic equipment/tools are needed to perform the inspection after access to the structure has been obtained. The type of access equipment needed for each ancillary traffic structure is dependent on the structure location. For the various types of access equipment that may be needed for a given structure, refer to Section 2.6.1.

2.4 Types of Inspections

Ancillary traffic structures require several types of inspection methods, some of which are scheduled and some which are required due to an event to the structure (high wind, impact damage, etc.). This section describes the various types of inspections.

2.4.1 Initial/Inventory Inspection

Initial/Inventory Inspections are typically performed following the installation of a new ancillary structure or replacement of an existing structure. These inspections are intended to facilitate entering the structure into the statewide inventory and will serve as the baseline for the as-built condition of the structure. This inspection type involves locating and assigning a number to the structure, obtaining all general information on the structure, and a 100% visual and tactile inspection of the structure components (pedestal, vertical supports/poles, horizontal supports/superstructure/mast arm, and attachments).

For guidance on coding structure inventory data, refer to Appendix A. For a listing of common deficiencies, along with suggested ratings, recommendations and priorities, refer to Appendix B.

2.4.2 Regular Inspection

Regular inspections are typically performed on in-service ancillary structures at a specified interval, refer to Section 2.4.7. This inspection type consists of verifying all basic structure data recorded during the Initial/Inventory Inspection and performing a 100% visual and tactile inspection of all visible and accessible structure components (pedestal, vertical supports/poles, horizontal supports/superstructure/mast arm, and attachments). The components are inspected for changes in previously reported conditions and development of new conditions. For this inspection type, the previous inspection report/findings should be on-site for referencing purposes.

For guidance on coding structure inventory data, refer to Appendix A. For a listing of common deficiencies, along with suggested ratings, recommendations and priorities, refer to Appendix B.

2.4.3 Base Inspections

Base inspections are used to ensure the safety of structure bases and anchor bolts, and are typically performed on in-service ancillary structures at a specified interval, refer to Section 2.4.7. This inspection type consists of a 100% visual and tactile inspection of the lower portions of the structure and includes:

- Hand holes
- Pole from the hand hole to the base plate
- Pole to base plate weld
- Base plate
- Anchor bolts, top nuts, and leveling nuts
- Concrete pedestal

In addition to the visual and tactile inspection, ultrasonic testing (UT) of the anchor bolts is required for some structure types in order to determine the overall length of each anchor bolt and, more importantly, if cracks or breaks exist within the bolts.

Due to the limited scope of base inspections, not all inventory data fields are required to be coded. For guidance on coding structure inventory data, refer to Appendix A. For a listing of common deficiencies, along with suggested ratings, recommendations and priorities, refer to Appendix B.

2.4.4 Ultrasonic Inspections

Ultrasonic Inspections consist primarily of ultrasonic testing (UT) of anchor bolts; however, the testing could also include ultrasonic material thickness testing of horizontal supports/trusses or vertical supports/poles if the observed conditions (exterior/interior corrosion, pitting, etc.) warrant it. UT is typically performed as part of the routine and base inspections for the ancillary traffic structures, per the inspection frequencies defined in Section 2.4.7.

The ultrasonic testing of anchor bolts (UT) involves using sound waves to examine the internal conditions of each anchor bolt. Each anchor bolt shall be evaluated using UT, in accordance with the Department's "Procedure for Ultrasonic Testing of Anchor Rods" located in Appendix C. UT is performed to detect the presence of cracks or breaks and determine the overall length of each anchor bolt. It is used because a majority of each bolt is embedded within the concrete pedestal and cannot be visually inspected. The information and results obtained during the testing are to be recorded on the Department's "Anchor Bolt Ultrasonic Testing Report" template located in Appendix C. Note that the referenced report shall be attached as a photograph in the database software; refer to Appendix A, Item CRDOC01.

The critical crack length is less than what is detectible with UT, so any indication may be critical. <u>Any indication could be a serious condition and should be reported immediately to the District Manager.</u>

The photographs below show an inspector performing UT on the anchor bolts of a cantilever sign structure, and the display of a UT Machine showing an indication in an anchor bolt.

Photo 2.1 *Ultrasonic testing of an anchor bolt*

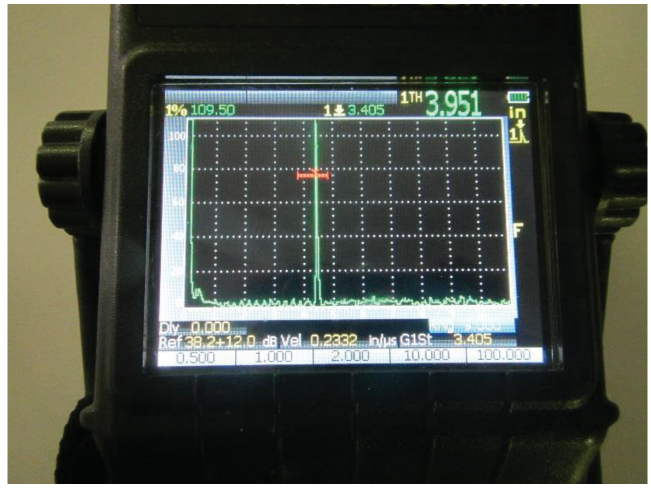


Photo 2.2 *Ultrasonic testing of an anchor bolt with an indication at 3.9" below top of the bolt*

Although UT is performed primarily as part of the routine and base inspections, it can be used as part of special inspections including:

- Construction inspections
- Construction acceptance Inspections
- Damage inspections
- Post-storm event inspections

Regardless of the inspection type requiring UT of the anchor bolts, the testing is to be completed by an inspector who, at a minimum, has been certified by the American Society of Non-destructive Testing (ASNT) as a Level II Technician in UT and has been qualified by VDOT's Material Division in VDOT's UT Procedures for performing UT on anchor bolts. For specific details on qualification and testing requirements, refer to Appendix C.

As mentioned above, the ultrasonic testing is not limited to the UT of anchor bolts and could include thickness testing on vertical supports/poles depending on conditions encountered during the inspection which are discussed in Chapters 4, 5, and 6. Ultrasonic material thickness readings can be performed by personnel having no ASNT certification as the testing process and equipment operation requires minimal training. Since a number of conditions can affect the readings such as pitting, pole diameter, and pack rust, the testing personnel should be familiar with, or be directly supervised by someone who is familiar with ultrasonic material thickness testing operations. This ensures personnel have the knowledge to handle these situations in the field to prevent erroneous data. The process and method for performing ultrasonic material thickness testing is discussed in Sections 4.3.3m, 5.3.3m, and 6.3.3p for sign, traffic signal, and pole structures, respectively.

2.4.5 Special Inspections

Special inspections encompass a variety of inspection types that are dependent upon the need as determined by the Department. In planning a special inspection, the Team Leader should understand the goal of the inspection to help determine the elements requiring inspection and the equipment needed to obtain the information during the inspection. The following are examples of special inspections and their definitions:

- **Damage Inspections**: Inspection of damage to a structure due to impact or collision.
- **Post-Storm Inspections**: Inspection of a structure following a storm event such as a hurricane or high wind event in order to determine the presence of any damage.
- **Construction Acceptance Inspections**: Inspection of a structure following erection in order to determine if the structure was constructed and erected properly prior to acceptance by the Department.
- **Work Accomplishment Inspections**: Inspection of various structure components or elements for proper installation, repair, or replacement. In addition, the inspection may require examination of existing components or elements for impacts resulting from the installation, repair, or replacement activities.

- **Monitoring:** Special inspection to monitor structural damage, a structural deficiency, or any other feature of a structure that needs to be inspected on a specific frequency. Monitoring inspections are typically performed more frequently than the regular inspection. Only those features requiring the monitoring inspection need to be inspected. A cursory inspection shall be performed of other components and elements (with an emphasis on those in fair or poor condition) while inspectors are on site.

Equipment requirements for special inspections, as stated above, are dependent on the type of inspection and the information required by the inspection. Examples of special inspection equipment include:

- **Access Equipment**: Bucket truck/van, manlift, ladder
- **Maintenance of Traffic**: For MOT information and requirements, refer to Section 2.5.
- **Non-destructive Testing (NDT)**: Special testing on specific components, elements, or connections to determine quality or possible damage. Possible NDT methods include:
    - Magnetic particle testing equipment (welds)
    - Ultrasonic testing equipment (anchor bolts, vertical supports/poles)
    - Eddy current testing equipment (aluminum structure welds)
    - Dye penetrant testing equipment (all material welds or members)

2.4.6 Night Inspection Operations

For various reasons, typically involving traffic volume at peak traffic hours or special events, the Department may require some structures to be inspected at night. Night inspections present additional risks and these risks should be addressed when developing the job safety analysis (JSA) for the inspection work. Some of the more prevalent risks associated with night inspections include:

- Reduced vision and reaction times of drivers
- Reduced work zone and inspector visibility
- Driver fatigue
- Inspector fatigue
- Impaired drivers

In many cases, some of the above risks can be addressed during the inspection scheduling process, possibly through adjustment of inspection times and dates. For example, beginning inspections an hour later may result in significantly reduced traffic flows and subsequent exposure to the public. The scheduling, however, will be dictated by lane closure restrictions established by each District. The Team Leader is responsible for obtaining the District’s lane closure restriction schedules.

Regardless of the identified risks, all personnel performing night inspections are required to wear high visibility/reflective apparel in accordance with the latest edition of the Virginia Work Area Protection Manual (VWAPM) at all times.

In addition, the inspection team should plan to have effective lighting, which may include ground lighting. Lighting should be sufficient to illuminate the work area and structure, minimize poor visibility, maximize safety, and minimize impact to the traveling public. Consideration shall be given to placement and movement of the lights to properly illuminate all areas of the structure being inspected to eliminate shadows and provide the best possible visual inspection conditions.

Photo 2.3 *Typical view of night inspection operation*

2.4.7 Frequencies of Inspections

All ancillary structures are scheduled for inspections at recommended intervals. The frequency with which each structure is scheduled for inspection varies by structure type and material. The following tables detail the recommended inspection intervals for the different types of ancillary structures. Adjustments to interval durations should consider a structure's type, material, condition, and design features such as welded chord member connections, non-redundant anchors, or non-thru bolted bridge parapet mounted sign structure anchorages. Interval durations for structures rated in poor condition should not be increased beyond the recommend intervals below.

2.4.7a <u>Recommended Frequencies: Sign Structures</u>

Traffic Ancillary Structures – Sign Structures				
Structure Type	**Recommended Intervals (months)**			
	Initial/ Inventory	**Regular**	**NDT**	**Base Inspection**
			UT	
Cantilever	UT	48	24	24
Overhead Span	UT	72	36	36
Butterfly	UT	48	24	24
VMS/CMS, Cantilever	UT	48	24	24
VMS/CMS, Span	UT	72	36	36
Bridge Parapet Mounted	-	24	-	-

Key: VMS/CMS: Variable Message Sign/Changed Message Sign, NDT: Non-Destructive Testing, UT: Ultrasonic Testing

<u>Notes:</u>

1. Regular inspection is a full inspection that includes a base inspection.
2. UT shall be performed on each anchor bolt when a Regular or Base Inspection is performed. UT shall be performed on every anchor bolt that connects the pole base plate to the foundation on all foundations of any anchor bolt pattern.
3. Dye Penetrant (PT), Magnetic Particle (MT), or other NDT may be performed if visual inspection identifies a need to perform them.
4. District Managers may inspect structures more frequently based on condition assessment.
5. Bridge Parapet Mounted structures should have regular inspections performed concurrently with regular Bridge Safety Inspections as scheduling permits.
6. All aluminum sign structures shall have a Regular Inspection frequency not to exceed 24 months.

2.4.7b <u>Recommended Frequencies: Traffic Signal Structures</u>

Traffic Ancillary Structures – Signal Support Structures				
Structure Type	**Recommended Inspection Intervals (months)**			
	Initial/ Inventory	**Regular**	**NDT**	**Base Inspection**
			UT	
Cantilever	UT	48	48	48
Overhead Span	UT	48	48	48
Span Wire	UT	48	48	48

Key: NDT: Non-Destructive Testing, UT: Ultrasonic Testing

<u>Notes:</u>

1. Regular inspection is a full inspection that includes a base inspection.
2. UT shall be performed on each anchor bolt when a Regular or Base Inspection is performed. UT shall be performed on every anchor bolt that connects the pole base plate to the foundation on all foundations of any anchor bolt pattern.
3. Dye Penetrant (PT), Magnetic Particle (MT), or other NDT may be performed if visual inspection identifies a need to perform them.
4. District Managers inspect structures more frequently based on condition assessment.

2.4.7c *Recommended Frequencies: Light and Camera Structures*

Traffic Ancillary Structures – Light & Camera Support Structures				
Structure Type	**Recommended Inspection Intervals (months)**			
	Initial/ Inventory	**Regular**	**NDT**	**Base Inspection**
			UT	
High-Mast Light	UT	48	24	24
High-Mast Light, Weathering Steel	UT	24	24	24
Camera Pole	UT	48	-	48
Luminaires (Light Poles, Breakaway and Non-Breakaway)	-	48	-	48

Key: NDT: Non-Destructive Testing, UT: Ultrasonic Testing

Notes:

1. Regular inspection is a full inspection that includes a base inspection.
2. UT shall be performed on each anchor bolt when a Regular or Base Inspection is performed. UT shall be performed on every anchor bolt that connects the pole base plate to the foundation on all foundations of any anchor bolt pattern.
3. Dye Penetrant (PT), Magnetic Particle (MT), or other NDT may be performed if visual inspection identifies a need to perform them.
4. District Managers may inspect structures more frequently based on condition assessment.

2.5 Maintenance of Traffic (MOT)

2.5.1 Shoulder Closures

Shoulder closures are acceptable for any type of ancillary traffic structure inspection work when standard width shoulders exist that can safely accommodate maintenance of traffic and inspection equipment while not affecting a travel lane. Should the possibility exist that any equipment could encroach upon, or affect, a travel lane, a standard lane closure shall be used. When using a shoulder closure the operation shall be in accordance and compliance with the latest edition of the VWAPM.

The photographs below present views of shoulder closures.

Photo 2.4 *Shoulder closure*

Photo 2.5 *Shoulder closure*

2.5.2 Lane Closures

Where inspection procedures have the potential to impact a travel lane, lane closures are required. Additionally, working over live traffic is strictly prohibited by the Department. The two basic types of lane closures used for ancillary traffic inspections include static and mobile or short duration. Both the static and mobile or short duration closure operations can be applied to a single or double lane. Mobile or short duration closures can be used for a large portion of the inspection work; however, the VWAPM limits the amount of time the work crew can be in one location when using these operations. Therefore, static closures may be necessary for the inspection of four chord or tri-chord-truss sign structures due to the potential amount of time required to thoroughly inspect the trussing and panel points. Furthermore, static closures may be required due to special conditions, such as tying into an existing contractor's lane closure or performing inspection on special facilities (e.g. tunnels or bridges). In such locations, the closure is required to begin beyond the approaches or openings and extend over or through the structure in order to maintain traffic flow to one side/lane for the length of the structure. Any inspection planned for a special facility should be coordinated with the facility to ensure that it can be accommodated and is compliant with the facility's requirements.

When planning the inspection, the number of lanes to be closed needs to be determined and compared against the District's lane closure restrictions for the roadway on which the inspections are scheduled. The type of lane closure required will be dependent on the anticipated inspection duration for each lane. The VWAPM provides guidance on the arrangement of various static and mobile or short duration lane closures that are applicable to a large majority of Virginia's roadways. However, a number of interstates and limited access highways have greater than four lanes, necessitating closures that require special planning, preparation, and approval by the Department prior to implementation. It should be noted that State Police may be required as part of lane closures in some Districts.

All lane closure operations shall comply with the latest edition of the VWAPM.

The photographs below present views of a static and mobile lane closure, respectively.

Photo 2.6 _Static lane closure_

Photo 2.7 _Mobile lane closure_

2.5.3 Police-Assisted Lane Closures

Police-assisted lane closures can be a safe and efficient means for performing traffic signal inspections along with work zone signing, as well as providing a higher level of work zone visibility as part of lane closures for inspection of other structure types as an enhancement to the temporary traffic control. Police assistance is generally provided by off-duty Virginia State Police (VSP) officers assigned to an Area Office within the District in which the structure inspections are occurring. The various Area Office locations and contact information can be found at VSP's website.

When planning and scheduling police-assisted lane closures for traffic signal inspections, it is recommended that two officers be requested in order to maximize the effectiveness and visibility of the closure. Availability of two officers is heavily dependent on VSP activities and officer schedules. When planning inspection work, the appropriate State Police Division Office should be contacted a minimum of two weeks in advance to allow time for off-duty officers to sign up for the requested inspection dates. As previously stated, the State Police are off-duty when assisting with lane closures but are still on-call. As such, if an emergency arises within their area of responsibility the police would be called to respond, thereby suspending inspection work until their return, necessitating additional maintenance of traffic resources, or rescheduling the work.

Police-assisted lane closures are an option for performing traffic signal inspections and augmenting conventional traffic control for increased visibility; however, the ability to use police-assistance for lane closures and maintenance of traffic is at the discretion of the District Manager and the District Traffic Engineer.

2.5.4 Closure Restrictions

Before planning inspection work requiring lane closures, the Team Leaders should determine which lane closure restrictions apply to the roadways on which the work is to be performed. High traffic roadways (interstates, US highways and some State routes) will often times have restrictions that lane closures can only be conducted during nighttime hours. In general, nighttime closure hours are between 9 P.M. and 5 A.M; however, these hours will vary depending on the roadway and the maximum number of lanes that can be closed at specific times. For example, a roadway with four lanes of travel in one direction might allow for single lanes between 9 P.M to 5 A.M., but a double lane closures may only be allowed between 11 P.M. and 2 A.M due to the lessened traffic flows during that time. <u>Prior to inspection, Team Leaders are to check with the local VDOT District to determine what closure restrictions are applicable to the specific roadways requiring ancillary structure inspections.</u>

2.6 Access

When planning the inspection of ancillary structures, the Team Leader should review previous structure reports and locations of the structures to determine if special access requirements exist. This section addresses typical conditions or locations that may require special access methods and equipment.

2.6.1 Access Equipment

Special equipment may be necessary in order to perform and/or complete the inspection of certain ancillary traffic structures. This equipment is based on the location of the structure and can include:

- **Bucket Truck**: Truck-mounted aerial lifts will be used to perform the majority of inspections.
- **Underbridge Inspection Unit (Snooper)**: May be used for structures located where a conventional bucket truck cannot be used to access the foundation structure. One example of this equipment usage would be to inspect a steel haunch type foundation for an overhead span sign structure mounted on a bridge.
- **Manlift/Scissor Lift**: May be used for accessing and inspecting structures that cannot be adequately accessed using a bucket truck. One example of this equipment usage may be the inspection of luminaires located off of the roadway where the reach required to access the structure is beyond the limits of a conventional bucket truck (i.e. the reach of the bucket truck is not sufficient to reach the structure for inspection).
- **Robotic Inspection Devices**: Unmanned Aerial Systems (UAS, drones) or climbing robots may be used to reach the location in question.

Photo 2.8 *HML inspection with remote operated drone*

Photo 2.9 *HML closeup Inspection of luminaires with remote operated drone*

- **Compressors and Pneumatic Wrenches**: May be required for inspecting the bases and anchor bolts for structures located within a median barrier, such as overhead sign structures and luminaires. To inspect the bases and anchor bolts for these types of structures one barrier plate would require removal. Refer to the photo below for a view of a structure mounted within a median barrier and the protective barrier plate that may require removal.

Photo 2.10 *Ancillary structure in barrier with barrier plates*

2.6.2 Special Access Requirements

Special Access Requirements will be necessary for the inspection of certain ancillary structures. Examples of some typical structures are presented below.

- **Structures located behind a sound wall**: Structures located behind sounds walls can be difficult to access and in many cases sound walls have access doors that require a key to unlock. Coordination with the local VDOT District can assist in gaining access through access doors in the sound wall.
- **Structures located in railroad or light rail right-of-ways**: Structure located within railroad or light rail right-of-ways require permits and special access training from the owner of the right-of-way. Coordination with the owner can define the requirements of access to the structure.
- **Structures located on a VDOT Special Facility (tunnels and bridges)**: The inspection team shall coordinate with the facility and may be required to obtain special permitting or background checks prior to arrival on-site. In addition, structures located at the facilities may require special access equipment.
- **Structures located within weigh stations**: Structures within weigh stations, primarily luminaires, will often times be located on or near the scales within the station. Coordination is required to inspect the structures without interfering with the stations operations.
- **Structures on movable bridges**: Structures located on the swing or lift span of the bridge require coordination with the bridge operator to ensure that the inspection work is not interfering with the bridge operations.
- **Poles and foundations located within a median barrier**: Structure foundations located within the median of a roadway can be enclosed within a steel plate that has to be removed to allow inspection. These plates may require specific removal equipment that should be present on site at the time of inspection.
- **Structures located behind pedestrian fencing**: Structures can be located behind fencing that may prohibit access. The structure may require special lift equipment to access or planning may be necessary to approach the structure from behind the fencing.

In addition to the above mentioned examples of when special access might be required, additional scenarios may present themselves in the field, which require alternative or modified methods of accessing all portions of the structures. If a structure cannot safely be inspected with the equipment and traffic control that is available on-site, the inspection should be terminated until a solution can be determined which would allow the inspection to be completed.

The photographs below present views of some of the structures that require special access requirements.

Photo 2.11 *Sign structure with right pole behind a sound wall*

Photo 2.12 *Conventional luminaires over the scales at a weigh station*

Photo 2.13 *Conventional luminaire behind a sound wall*


Photo 2.14 *Luminaires located within a VDOT Special Facility*

CHAPTER 3. MATERIALS AND RELATED DEFICIENCIES

3.1 Introduction

A qualified inspector must know and understand the properties and characteristics of the different materials that comprise the structures. This chapter will discuss the most common materials that are used in ancillary structures, describe the typical deficiencies associated with each, and consider the causes of the deficiencies.

3.2 Concrete

Concrete is commonly used for the pedestals and foundations of overhead sign structures, traffic signal structures, and luminaire structures. It can also be used as part of the anchorage connecting a bridge mounted sign, traffic signal, or luminaire structure. Concrete has high compressive strength but low shear and tensile strengths. The shear strength of unreinforced concrete is approximately 12% to 13% of the compressive strength, and the tensile strength is approximately 10%. The tensile and shear strengths can be increased by the addition of reinforcing steel or other materials that are placed into the concrete form during casting. Concrete can have a long service life; however, the durability may be affected by the proportions of the concrete mixture, the amount of concrete covering the reinforcing steel, the climate or environment in which the concrete is located, and the chemicals to which the concrete may be exposed.

Inspectors should be knowledgeable about the various types of deficiencies and deterioration associated with concrete components of traffic ancillary structures. In addition, there should be basic understanding as to the possible causes of the deficiencies in order to determine the potential significance of the deficiency to the structure. The list presented below provides typical types of deficiencies and deterioration found with traffic ancillary structure concrete components.

- **Honeycombing**: Voids on the surface of the concrete resulting due to poor consolidation during concrete placement. Honeycombing can typically be identified by exposed aggregate with missing cement paste and may include exposed reinforcing steel. This is an as-built condition and not the result of deterioration.
- **Scaling**: Gradual disintegration of a concrete surface due to the failure of the cement paste caused by chemical attack or freeze thaw cycles. Scaling is characterized by exposed aggregate with missing cement paste.
- **Spalling**: Depression in concrete with exposed aggregate caused by a separation and loss of a layer of the surface concrete, revealing a fracture parallel with or slightly inclined to the surface. Spalls are typically caused by impact damage, or corrosion of the internal reinforcing steel or embedded steel components. Spalls may contain exposed reinforcing steel or portions of embedded steel components.
- **Delamination**: Surface separation of concrete into layers typically caused by corrosion of internal reinforcing steel or embedded steel components, or freeze/thaw cycles. Delamination is characterized by a hollow or dull sound when struck by a hammer.
- **Cracking**: Fissure or separation in the concrete surface (not typically through the concrete) which can be caused by overstress, impact, corrosion of internal reinforcing steel or embedded steel components, improper curing, freeze-thaw cycles, or differential settlement (pedestals). Cracks can have a vertical, horizontal, or diagonal orientation, or can be multidirectional as with map cracking. Rust staining, efflorescence, and exudation may be present in the cracks. Cracks may be structural or superficial.
- **Efflorescence**: Chalk-like deposit on the concrete surface, typically located along a crack or in areas of cracking (map cracking) caused by crystallization of salts brought to the surface by moisture seepage through the concrete.
- **Exudation**: Liquid or viscous gel-like material (containing calcium and lime) discharged through a pore, crack, or opening in the surface of concrete, typically associated with the formation of brittle stalactites. Exudation is typically located along cracks and creates a buildup of brittle material that releases moisture when broken or punctured.
- **Paste Softening**: Softening of the concrete surface due to the reaction between carbon dioxide in the air and the cement paste. Paste softening is typically characterized by the ability to scrape away the concrete surface with minimal effort that exposes the underlying aggregate.
- **Abrasion**: Wearing, grinding, or scraping away of the concrete surface due to friction usually by sand, gravel, or stones carried by wind or water, or by mechanical means.
- **Reinforcing Steel Corrosion**: General disintegration of metal through oxidation. Corrosion causes internal stresses in the concrete that can result in spalling, cracking, and delamination. If the steel is not exposed, corrosion may be evidenced by rust staining along cracks in the surface of the concrete.

The photographs below present views of typical deficiencies encountered with concrete.

Photo 3.1 *Spall due to impact damage*

Photo 3.2 *Crack*

Photo 3.3 *Map cracking with efflorescence*

Photo 3.4 *Spalling with exposed reinforcing steel*

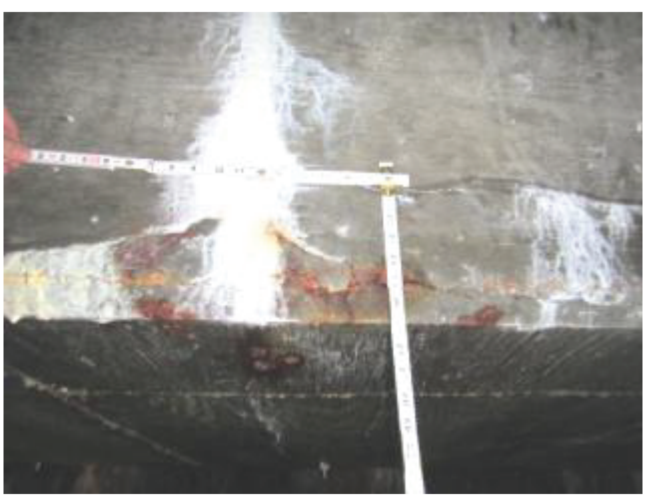


Photo 3.5 *Cracking with exudation and rust straining*

Photo 3.6 *Delamination and spalling*

3.3 Timber

Timber is not widely used as a material for traffic ancillary structures; however, it is used primarily with ground-mounted luminaire structures and span wire type traffic signal structures. Timber is strong, with a high strength to weight ratio, it is economical, readily available in many locations, easy to fabricate and construct, resistant to deicing agents, and resistant to damage from freezing and thawing. Timber can have a long service life, especially if chemically treated; however, the durability may be affected by the climate or environment in which the timber is located, and the chemicals to which the timber may be exposed.

Inspectors should be knowledgeable about the various types of deficiencies and deterioration associated with timber components of traffic ancillary structures. In addition, there should be basic understanding as to the possible causes of the deficiencies in order to determine the potential significance of the deficiency to the structure. The list presented below provides typical types of deficiencies and deterioration found with traffic ancillary structure timber components.

- **Decay**: Untreated timber as well as the heart/center of treated timber is susceptible to damage from fungi and parasitic organisms that gain access through defects or imperfections in the wood such as checks, splits, shakes and knots. The most common characteristic of timber decay is white and black areas of rot. The following three conditions need to be present for decay to take place in timber:
    - *Moisture*: A moisture content of at least 20% is required within timber to promote fungal growth and as the moisture content increases, so does the growth. Moisture enters the timber through checks, shakes, splits, and knots.
    - *Temperature*: The optimum temperature for fungal growth (causing decay) occurs between 75° and 85° Fahrenheit. The fungi become dormant at temperatures below 32° and die off at temperatures exceeding 120° Fahrenheit.
    - *Oxygen*: A sufficient amount of oxygen must be present within the timber for decay to survive.
- **Check**: Separation of the wood fibers, normally occurring perpendicular to the annual growth rings, and parallel to the grain direction.
- **Split**: Advanced check that extends completely through the timber component.
- **Shake**: Separation of the wood fibers parallel to the grain that occurs between the annual growth rings.
- **Knot**: Separation of the wood fibers where a limb joined the trunk of the tree. A knot may be small or large, round or elongated.
- **Fire damage**: Deterioration due to fire or excessive heat. Fire damage is characterized by loss of material and blackening or charring of the wood surface.
- **Insect damage**: Damage caused by termites, powder post beetles, or carpenter ants eating the wood fibers. The damage from these insects is usually on the inside of the member and is hard to detect. Small holes and dust may be visible on the exterior of the member suggesting an insect infestation. This may be characterized by a hollow or dull sound when struck by a hammer.

Refer to the figure below for typical timber deficiencies, locations, and orientations.

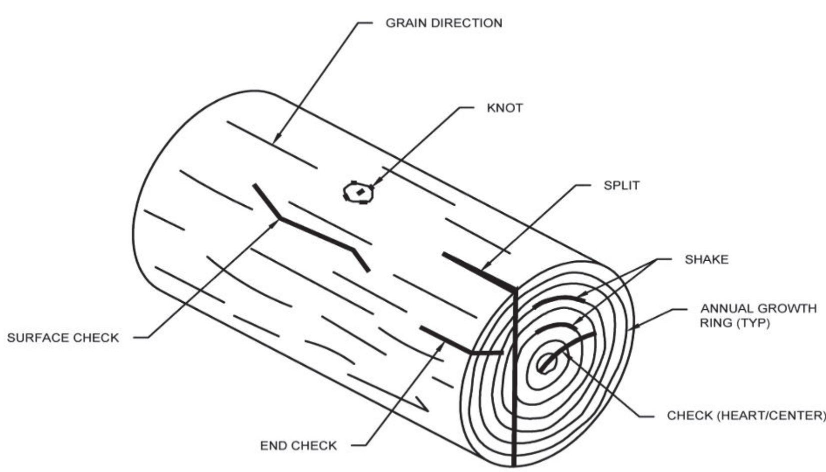


Figure 3.1 *Typical Timber Defects*

The photographs below present views of typical deficiencies encountered with timber.

Photo 3.7 *Check*

Photo 3.8 *Split*

Photo 3.9 *Shake (in growth ring)*

Photo 3.10 *Rot (white rot)*

Photo 3.11 *Decay*

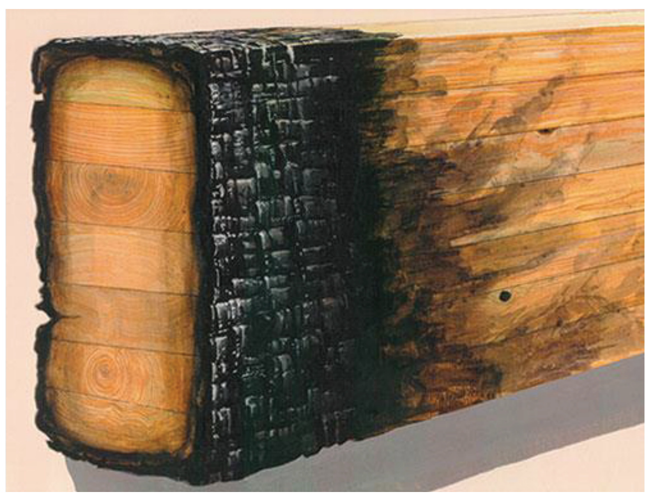


Photo 3.12 *Fire damage*

Photo 3.13 *Insect damage (termite)*

Photo 3.14 *Insect damage (carpenter ant)*

Photo 3.15 *Insect damage (powder post beetles)*

3.4 Steel

Steel is widely used as a material for ancillary structures due to its high tensile, compressive, and shear strengths. Steel components in traffic ancillary structures are typically mild carbon steel, which are galvanized or painted. Steel can have a long service life, especially if properly protected; however, the durability may be affected by the climate or environment in which the steel is located, the chemicals to which the steel may be exposed, and the type of loading to which it is subjected.

Inspectors should be knowledgeable about the various types of deficiencies and deterioration associated with steel components of traffic ancillary structures. In addition, there should be a basic understanding as to the possible causes of the deficiencies in order to determine the potential significance of the deficiency to the structure. The list presented below provides typical types of deficiencies and deterioration found with traffic ancillary structure steel components.

- **Corrosion**: General disintegration of metal through oxidation characterized by an orange or orange-brown color. Advance corrosion is characterized by a dark brown or black color and is usually accompanied by material loss. Corrosion may also be due to galvanic corrosion between dissimilar metals in contact with one another, refer to Section 3.8.
- **Buckling or Out of Plane Distortion**: Bend, kink, or other deformation of a structural member in a plane other than that which the member was designed to resist, typically caused by overstressing or impact.
- **Cracking**: Fissure or separation in the material that can be the result of overstress, impact, or fatigue.
- **Break or Fracture**: Fissure or separation through the full cross section of a member or component that can be caused by overstressing, impact, or fatigue. The breaks can either be ductile (generally proceeded by local plastic deformation (distortion) providing some visual warning of the impending failure) or brittle (occurs with no warning and without prior plastic deformation).
- **Fire Damage**: Deterioration due to fire or excessive heat. Fire damage is characterized by deformation or buckling due to overheating of the steel. Temperature thresholds affecting steel commonly used in ancillary structures are as follows:
  - 400°F: starts to affect strength
  - Above 1000°F: major loss of strength
- **Coating Failure**: Failure of the protective coating, such as paint or galvanizing, on a steel member, exposing the underlying steel. Coating failure can be attributed to improper coating application techniques, constant exposure to moisture, numerous cycles of wetting and drying, or heavy exposure to salts and other chemicals. In galvanized structures, the failure of galvanizing is characterized by a light brown color on the surface of the member. In painted structures, the coating failure is characterized by peeling/blistering of the paint.

The photographs below present views of typical deficiencies encountered with steel.

Photo 3.16 *Corrosion with no section loss*

Photo 3.17 *Corrosion with pitting*

Photo 3.18 *Corrosion with heavy pitting and section loss*

Photo 3.19 *Crack*

Photo 3.20 *Out of plane distortion*

Photo 3.21 *Fire damage and out of plane distortion*

Photo 3.22 *Coating failure with blistering paint*

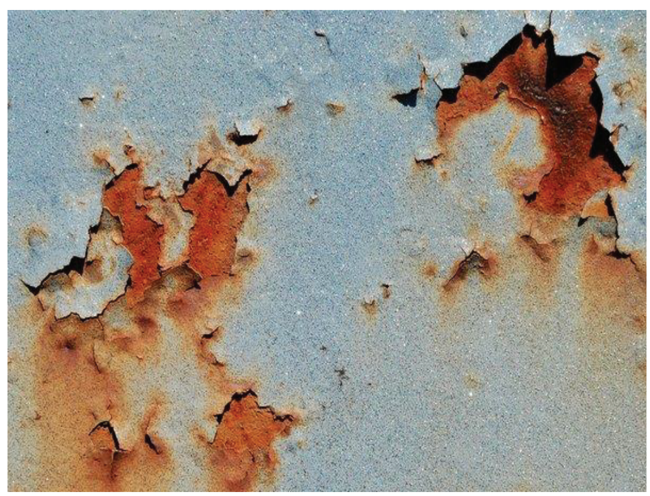


Photo 3.23 *Coating failure with peeling paint with underlying corrosion*

Photo 3.24 *Coating failure of galvanizing*

Photo 3.25 *Break*

3.5 <u>Stainless Steel</u>

Stainless steel is commonly used for connection hardware in traffic ancillary structures. Stainless steel, like mild steel has high tensile, compressive, and tensile strength, but can be more brittle than mild steel. Stainless steel is resistant to corrosion and section loss and does not require a protective coating.

The inspector should be aware of the various types of deficiencies and deterioration associated with stainless steel. In addition, an understanding should be present as to the cause of the deficiencies and the significance they can have on the structure. The following list provides the most common types of deficiencies and deterioration found with stainless steel.

- **Buckling or Out of Plane Distortion**: A bend, kink, or other deformation of a structural member in a plane other than that which the member was designed to resist, typically caused by overstressing or impact. This type of deficiency has the same appearance as that of steel buckling or out of plane distortion, refer to Section 3.4 for images.
- **Cracking**: Fissure or separation in the material that can be the result of overstress, impact, or fatigue.
- **Break or Fracture**: Fissure or separation through the full cross section of a member or component that can be caused by overstressing, impact, or fatigue. Breaks in stainless steel are more common than in carbon steel as stainless steel is typically more brittle.

The photographs below present views of typical deficiencies encountered with stainless steel.

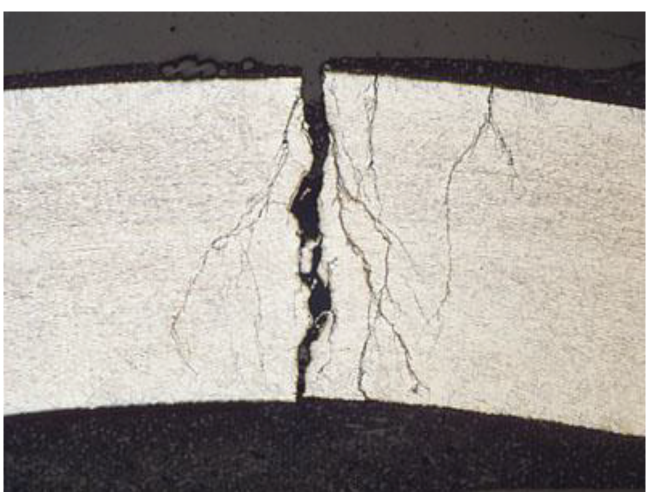


Photo 3.26 *Break*

Photo 3.27 *Broken stainless steel bolt*

3.6 Weathering Steel

Weathering steel is less widely used as a material for ancillary structures. Similar to mild steel, it is a suitable material for use in ancillary structures due to its high tensile, compressive, and shear strength. When exposed to the atmosphere, weathering steel develops a protective oxide film (patina), which seals and protects the steel from further corrosion. This oxide film is actually an intended layer of surface rust, which protects the member from further corrosion and loss of material thickness. Therefore, it is important for the inspector to distinguish between the protective layer of rust and advanced corrosion that can lead to section loss. The frequency of surface wetting and drying cycles determines the oxide film's texture and protective nature. The protective film will not form if weathering steels remain wet for long periods. Weathering steel can have a long service life; however, the durability can be affected by the climate or environment in which the steel is located, the chemicals to which the steel may be exposed, and the type of loading to which it is subjected.

Inspectors should be knowledgeable about the various types of deficiencies and deterioration associated with weathering steel components of traffic ancillary structures. In addition, there should be basic understanding as to the possible causes of the deficiencies in order to determine the potential significance of the deficiency to the structure. The list presented below provides typical types of deficiencies and deterioration found with traffic ancillary structure steel components.

- **Corrosion**: The general disintegration of metal through oxidation characterized by an orange or orange-brown color. Advance corrosion is characterized by a dark brown or black color and is usually accompanied by material loss. Corrosion may also be due to galvanic corrosion between dissimilar metals in contact with one another, refer to Section 3.8.
- **Buckling or Out of Plane Distortion**: A bend, kink, or other deformation of a structural member in a plane other than that which the member was designed to resist, typically caused by overstressing or impact. This type of deficiency has the same appearance as that of steel buckling or out of plane distortion, refer to Section 3.4 for images.
- **Cracking**: Fissure or separation in the material that can be the result of overstress, impact, or fatigue.
- **Break or Fracture**: Fissure or separation through the full cross section of a member or component that can be caused by overstressing, impact, or fatigue. The breaks can either be ductile (generally proceeded by local plastic deformation (distortion) providing some visual warning of the impending failure) or brittle (occurs with no warning and without prior plastic deformation).
- **Fire Damage**: Deterioration due to fire or excessive heat. Fire damage is characterized by deformation or buckling due to overheating of the steel. Temperature thresholds affecting steel commonly used in ancillary structures are as follows:
  - 400°F: starts to affect strength
  - Above 1000°F: major loss of strength

  This type of deficiency has the same appearance as that of mild steel fire damage, refer to Section 3.4 for images.

The photographs below present views of typical deficiencies encountered with the weathering steel.

Photo 3.28 *Protective oxide film (patina)*

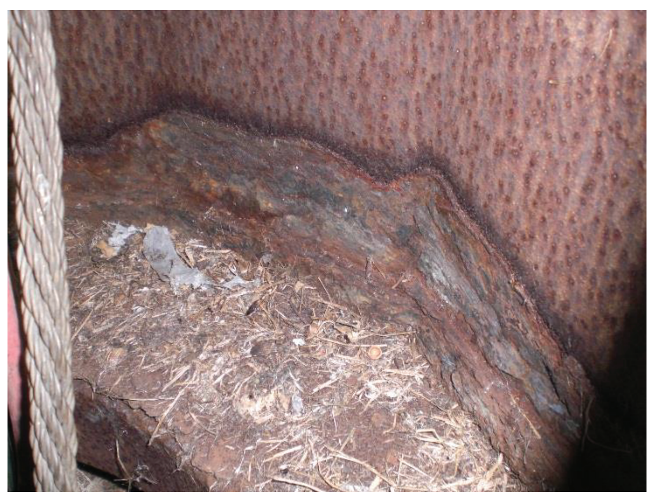


Photo 3.29 *Corrosion with section loss*

Photo 3.30 *Corrosion and section loss/break at base of high mast light*

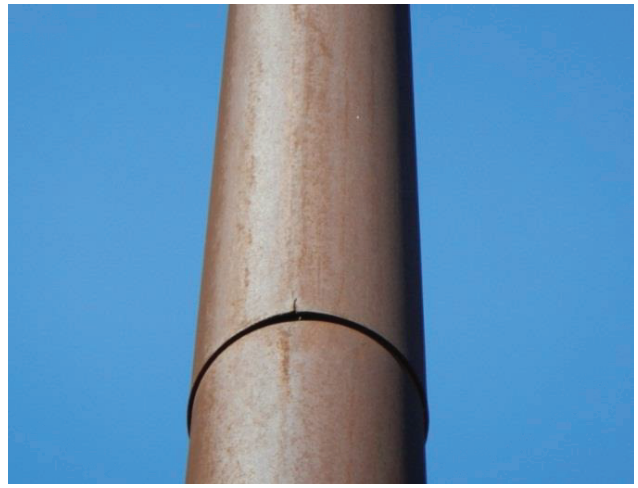


Photo 3.31 *Crack at high mast light pole slip joint*

3.7 Aluminum

Aluminum is a widely used material for luminaires and sign structures and traffic signals. Aluminum has moderate tensile, compressive, and shear strengths and weighs approximately one third as much as steel; however, it is highly susceptible to fatigue and fatigue-related cracking. Aluminum is highly resistant to atmospheric corrosion and is typically uncoated; however, it can be anodized or powder-coated to increase corrosion resistance in aggressive atmospheres such as marine environments.

The inspector should be aware of the various types of deficiencies and deterioration associated with aluminum. In addition, an understanding should be present as to the cause of the deficiencies and the significance they can have on the structure. The following list provides the most common types of deficiencies and deterioration found with aluminum.

- **Buckling or Out of Plane Distortion**: Bend, kink, or other deformation of a structural member in a plane other than that which the member was designed to resist, typically caused by overstressing or impact.
- **Cracking**: Fissure or separation in the material that can be the result of overstress, impact, or fatigue.
- **Break**: Fissure or separation through the full cross section of a member or component that can be caused by overstressing, impact, or fatigue. Breaks in aluminum are generally brittle (occurs with no warning and without prior plastic deformation).
- **Rupture**: Complete separation of parts typically located in members or welds. Ruptures are typically characterized by protrusion of the material away from the source of the rupture and with tearing. They may be caused by freezing of trapped water or compression in short members.
- **Fire Damage**: Deterioration due to fire or excessive heat. Fire damage is characterized by deformation or buckling due to overheating of the aluminum. Temperature thresholds affecting aluminum commonly used in ancillary structures are as follows:
  - 200°F: starts to affect strength.
  - Above 400°F: major loss of strength.
- **Coating Failure**: Failure of the protective coating, such as paint or powder coating, on an aluminum member, exposing the underlying aluminum. Coating failure can be attributed to improper coating application techniques, constant exposure to moisture, numerous cycles of wetting and drying, or heavy exposure to salts and other chemicals.

The photographs below present views of typical deficiencies encountered with aluminum.

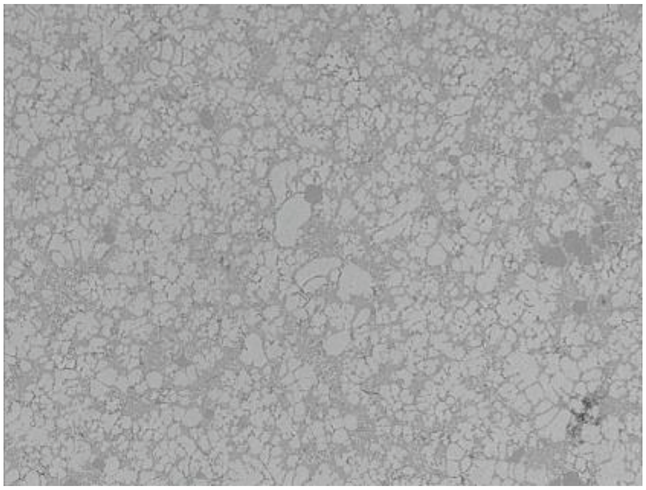


Photo 3.32 *Powder coating failure*

Photo 3.33 *Crack*

Photo 3.34 *Break*

Photo 3.35 *Rupture*

3.8 <u>Dissimilar Metals (Galvanic Corrosion)</u>

When corrosion is encountered during an ancillary structure inspection, the inspector needs to be able to determine if the corrosion is caused or accelerated by the presence of dissimilar metals. The accelerated corrosion of one type of metal due to contact with a different type of metal, in a corrosive environment, is referred to Galvanic Corrosion.

In the Galvanic Corrosion process, two metals (one more noble and one less noble) are in contact with one another in the presence of an electrolyte (such as salt water). The electrolyte aids in establishing an electrical circuit between the metals. The circuit causes the less noble/less corrosion resistant metal (anode) to sacrifice itself to the more noble/more corrosion resistant metal (cathode). The pace or progress of the corrosion is based on the number of metals separating the two aforementioned metals in the galvanic series. The galvanic series is presented below.

Magnesium	Active (Anode)
Zinc	↑
Galvanized Steel	
Aluminum/Aluminum Alloys	
Mild Steel	
Cast Iron	
Lead	
Brass	
Copper	
Bronze	
Monel (Nickel-Copper Alloy)	
Nickel	
Stainless Steel	
Silver	
Titanium	
Gold	
Graphite	
Platinum	Noble (Cathode)

Figure 3.2 *Galvanic Series Chart for Basic Metals*

In ancillary structures, galvanic corrosion is limited by the few materials commonly used in fabrication and construction. The most significant reactions occur between stainless steel and aluminum/zinc/galvanized steel. The chart above demonstrates that the number of metals between aluminum/zinc/galvanized steel (less noble) and stainless steel (more noble) is 8-9, indicating a difference significant enough that any of the above three metals would sacrifice to stainless steel. <u>However, it should be noted that although the aluminum/zinc/galvanized steel would typically sacrifice itself to the stainless steel, the size/area of the three materials plays a significant role in slowing or reducing the rate of galvanic action</u>.

The most common materials used in the fabrication and construction of traffic ancillary structures includes painted mild steel, galvanized steel, stainless steel, and aluminum. These materials are typically used in the following components:

- **Painted Mild Steel**: Poles, mast arms, chords, and base plates.
- **Galvanized Steel**: Poles, mast arms, chords, trussing, base plates, hangers, hanger U-bolts, bolted structural connections, anchor bolts, and miscellaneous fasteners.
- **Stainless Steel**: Sign panel to windbeam fasteners, windbeam to hanger fasteners, pole to transformer base bolts, and miscellaneous fasteners.
- **Aluminum**: Sign panels, backing strips, windbeams, and occasionally anchor bolt top nuts.

Figure 3.3 below provides guidance on the various types of base metals (larger components) and fastener metals (smaller components) used in traffic ancillary structures, and the susceptibility of galvanic corrosion between the metals. For example, a stainless steel U-bolt used to attach a sign hanger to a galvanized steel chord would likely result in a significant increase in localized corrosion of the chord. However, a stainless steel bolt used as a connection to an aluminum windbeam would likely result in a marginal increase in localized corrosion of the wind beam.

	Fastener Metal				
Base Metal	**Zinc & Galvanized Steel**	**Aluminum & Aluminum Alloys**	**Steel & Cast Iron**	**Brasses, Copper, Bronze, Monel**	**Stainless Steel**
Zinc & Galvanized Steel	A	B	B	C	C
Aluminum & Aluminum Alloys	A	A	B	C	B
Steel & Cast Iron	AD	A	A	C	B
Brasses, Copper, Bronze, Monel	ADE	AE	AE	A	B
Stainless Steel	ADE	AE	AE	AE	A

A, Corrosion of base metal is not increased by the fastener
B, Corrosion of base metal is marginally increased by the fastener
C, Corrosion of base metal may be markedly increased by the fastener
D, Plating on fastener is rapidly consumed
E, Corrosion of fastener is increased by the base metal

Figure 3.3 *Galvanic Corrosion Susceptibility Chart for Base and Fastener Materials Commonly Used in the Construction of Traffic Ancillary Structures*

The photographs below present views of dissimilar metals conditions typically present in traffic ancillary structures.

Photo 3.36 *Galvanic corrosion of strap bolt and zinc strap pin due to stainless steel strap, nut and washer*

Photo 3.37 *Galvanic corrosion of galvanized steel anchor rod to stainless steel nut*

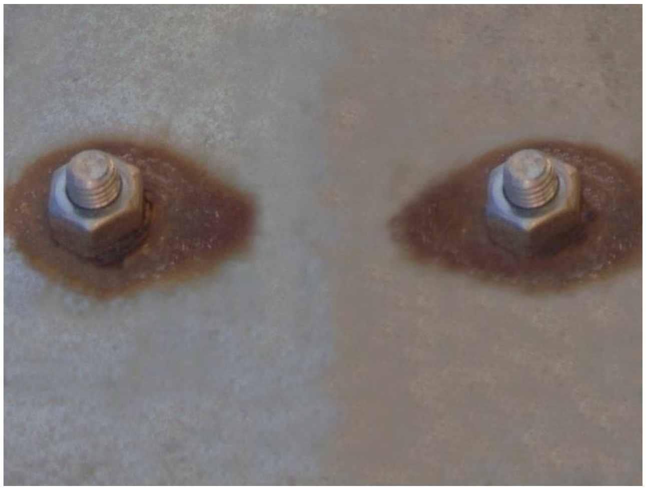


Photo 3.38 *Localized galvanic corrosion of galvanized steel plate due to stainless steel bolts*

Photo 3.39 *Galvanic corrosion of galvanized washer due to stainless steel bolt assembly*

3.9 Other Materials

The inspector should be aware that other materials, such as fiberglass and reinforced plastics, may exist in traffic ancillary structures as member or component repairs or replacements. These are an atypical and emergent technology, and as such, they are not covered in depth in this manual.

The photographs below present views of repair using “other materials”.

Photo 3.40 *Application of fiberglass repairs to sign structure*

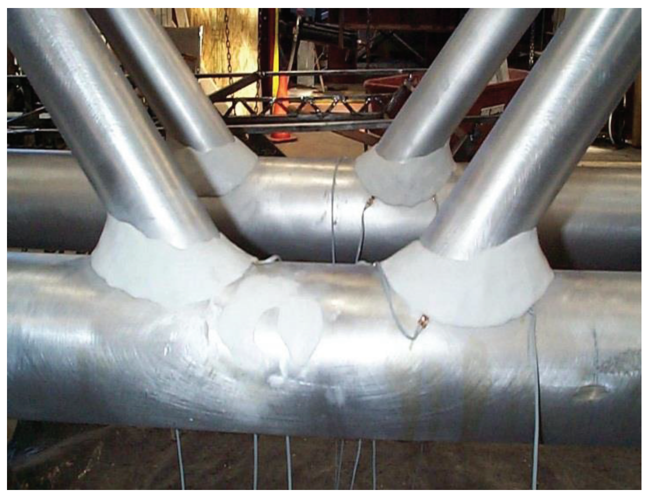


Photo 3.41 *Fiber reinforced plastic repairs to sign structure*

CHAPTER 4. SIGN INSPECTION PROCEDURES

4.1 Introduction

A qualified inspector must understand a variety of considerations, including hazardous and potentially hazardous conditions that could affect the safety of the inspector and the traveling public, the inspection sequencing, guidelines and procedures, the typical defects and deficiencies that may be encountered during the inspection, and those conditions that could or would require immediate action. This chapter sets forth to define policies, guidelines, and procedures for the safe and thorough inspection of sign structures.

4.2 Safety

Safety of the inspectors and the traveling public is paramount when performing daytime and nighttime inspection of sign structures. As such, the inspector shall, as part of the planning and preparation process, perform a job safety analysis in order to identify the typical safety hazards and mitigate risk for both the inspection team and the traveling public. It should be noted that special conditions could arise during the inspection that were not identified as part of the safety analysis. Should a hazardous safety condition arise during the inspection that was not anticipated or expected, the inspection operation shall be halted until the condition is addressed. If the condition cannot be addressed on site, the inspection operation shall be postponed until said condition is or can be addressed.

4.2.1 General Safety

The following general safety policies are provided to assist inspection personnel in mitigating risk during the inspections.

- Inspectors and other personnel working within a work zone shall wear at a minimum, hard hat, safety shoes, and high visibility safety apparel that meet the requirements of the latest edition of the Virginia Work Area Protection Manual (VWAPM). As necessary, other safety equipment such as safety glasses and gloves should be used.
- All overhead inspection activities shall be limited to areas over travel lanes that are closed to traffic.
- Maintenance of Traffic (MOT) procedures shall be in accordance with the latest edition of the VWAPM.
- Inspection vehicles shall be located as far off the travel lane as possible when performing shoulder or median work.
- Inspection vehicles shall be equipped with high intensity rotating, oscillating, or flashing strobe lights.
- Inspectors shall assume all wires are energized and the inspector shall not come in contact with any wiring on or inside a structure.
- The inspector shall consider all wiring, conduits, junction boxes, and all other components of the lighting system to be energized and operational unless specifically informed in writing by the District Operations Maintenance Manager that the system is nonfunctional and not energized; also, special consideration should be given to the identification of small cellular installations. The inspector shall follow all VDOT and OSHA guidance for working around and near electrical hazards.
- Inspection operations shall not be conducted in inclement weather unless deemed necessary due to an observable emergency condition; refer to Section 4.4. Should inspection operations be underway on a specific structure at the time of inclement weather, the operations may continue until the structure is completed or roadway conditions become hazardous to the traveling public. In both cases, the operation shall be terminated until the inclement weather passes from the area.

4.2.2 Climbing and Aerial Lift Safety

All inspection personnel shall have successfully completed an OSHA-approved “Fall Protection” course/class, which fulfills the requirements of OSHA 1926.503. In addition, the following aerial lift and climbing safety policies are provided to assist inspection personnel in mitigating risks associated with aerial lift or climbing inspections.

- When in/on an aerial lift, the inspector shall wear an OSHA-approved fall protection harness attached to a secure tie off point with an OSHA-approved lanyard. VDOT personnel operating any aerial device must be certified (3-year certification) through the VDOT Maintenance Training Academy and operate the equipment in accordance with VDOT Safety and Health Division Aerial Lifting Device Operations Procedure SSP# 1910.67.
- Inspectors shall use caution and follow VDOT and OSHA Guidance when operating an aerial lift around power lines. The inspector shall maintain a minimum safe distance of 10’, or as required by OSHA 1926.1408, which provides minimum safe, distances based on a known line voltage, from any overhead utility wires located on or in close proximity of the structure within the work zone.
- Lifting equipment, whether ladders, bucket lifts, or scaffolding, should be properly secured to the ground with brakes, blocks, outriggers, etc. prior to climbing.

- Climbing shall be restricted to only those areas where access by aerial lift is not possible, does not provide adequate inspection, or where a critical deficiency is suspected and a more detailed or special inspection (non-destructive testing) is necessary to investigate the suspected critical deficiency.
- The inspector shall wear an OSHA-approved fall protection harness attached securely to a main load carrying member (e.g. chord) with an OSHA-approved lanyard. One hundred percent (100%) tie off shall be maintained at all times, using two lanyards.
- The inspector should have three positive points of contact at all times when moving through the structure (both hands and one foot or both feet and one hand in contact with the members).
- All safety equipment used for climbing shall be inspected for expiration dates, as well as defects that could alter their strength. Defective, damaged, and out of date units or components shall be destroyed and discarded to prevent reuse. The VDOT Maintenance Training Academy Certification, mentioned above, teaches personnel the proper procedures for inspecting harnesses and lanyards.
- Only one person shall be on the structure at a time. Take as few items as possible when climbing; all necessary items are to be adequately tied-off to the inspector to prevent falling.
- Climbing shall not be performed if the inspector is fatigued and/or mentally distracted.
- Climbing should not be performed if the structure is wet from rain or dew.
- Boots, ladders, bucket lifts, and scaffolding should be kept free of oil and grease.
- All inspectors shall be properly trained in the inspection process, fall protection, climbing techniques, and the use of all climbing equipment in accordance with OSHA 1926 Subpart M.
- Climbing and aerial inspection activities shall not be conducted in inclement weather or a sustained wind speed of 30 miles per hour (mph) or greater. Should inclement weather and/or the aforementioned wind speeds develop during climbing and aerial inspection activities, all activities shall be terminated until the inclement weather passes and/or the sustained wind speed drops below 30 mph.

4.2.3 Nighttime Safety

Whenever night inspections are required, the inspectors must take steps to ensure adequate illumination of the inspection surfaces and visibility of the inspection personnel. Lights can be worn by the inspectors, mounted on the inspection bucket, or ground-mounted. The Team Leader must determine which method(s) of illumination will provide the best view of the inspection surfaces. Consideration shall be given to placement and movement of the lights to properly illuminate all areas of the structure being inspected to eliminate shadows and provide the best possible visual inspection conditions. Lights must be positioned so that they will not be a distraction or impairment to on-coming motorists or pedestrians. Extreme caution should be used during night operations due to the reduced visibility of the inspection personnel to on-coming traffic. VDOT approved high visibility apparel is always required but can be especially important at night.

4.3 Inspection Procedures

4.3.1 Arrival on Site

Upon arriving on-site, the inspection team should verify that the structure number and physical location is correct. If the available information conflicts, the inspector shall investigate to determine how to proceed. Possible conflicting circumstances may involve newly installed structures, incorrectly marked structures, structures that have been removed from the field and not from the database, or arrival at an incorrect location. Inspection operations shall not continue until the conflict has been resolved.

After the correct structure is verified, the Team Leader shall contact the appropriate Smart Traffic or Traffic Operations Center prior to commencing MOT activities. Once the MOT or lane closure is established, the inspection team shall verify that any established MOT operation is in conformance with the latest edition of the VWAPM or specifically prepared MOT Plan by performing a drive through of the MOT or lane closure prior to beginning inspections. During the drive through, the Team Leader should be cognizant of the impact that the MOT operations has on traffic flow. If the MOT is not in conformance with the VWAPM or the specific MOT plan, inspection operations shall not commence until the MOT is in conformance.

4.3.2 Field Inspection

The field inspection of a sign structure consists of inventorying and inspecting the structure. The inventory component requires verification of asset attribute information. The inspection component requires a comprehensive, detailed inspection of the entire sign structure consisting of a 100% hands-on examination of each component, member, fastener, and weld on the structure. The inspections should document any defects or deficiencies including dents, damage, corrosion, material section loss, loose and missing fasteners, broken or cracked welds, and any other conditions that could affect the functionality or integrity of the structure immediately or long term. In addition to the hands-on examination, the inspector(s) should use forms of non-destructive testing (NDT) during the inspection to verify any suspected structural deficiencies. These forms of NDT to be used include:

- Liquid/Dye Penetrant or Magnetic Particle Testing at locations of suspected surface cracks.
- Ultrasonic Testing to detect cracks in anchor bolts.
- Ultrasonic Thickness Testing utilizing corrosion thickness gages to determine remaining thickness for structural members where thickness cannot be readily verified by other means, or where visible corrosion exists.

In the event the inspector is unable to perform the required or necessary testing due to the lack of equipment or lack of qualifications, the inspector should contact the District Manager who may involve the Materials Division to arrange to have the necessary tests performed. All personnel performing NDT shall be qualified by the Department's Material Division, Structures Group, for the specific NDT to be performed.

4.3.3 Typical Field Inspection Sequence and Operations

The field inspection sequence of a sign structure is important to provide organization throughout the inventory and inspection process, and to ensure that all elements are inspected, and associated findings are recorded accurately. The items below provide recommended sequencing of the field inspection, as well as specific items to be inventoried and inspected.

4.3.3a *Inventory*

Inventory information related to the as-built configuration of the structure does not typically vary from inspection to inspection unless corrective maintenance, structure modifications, or retrofit work has been completed. This information should be gathered at the initial inspection, verified, and updated as necessary at each subsequent inspection. For a detailed list of specific inventory items that are to be recorded, and guidance on coding, refer to Appendix A, Inventory and Inspection Coding.

4.3.3b *Inspection*

The sign structure should be inspected to determine its overall condition as well as the condition of the individual components. All deficiencies should be fully quantified by describing the defect type (corrosion, section loss, spall, crack, etc.), location, and size (length, width, depth, etc.). For example, the location of exposed reinforcing steel should be noted, as well as the severity of any corrosion that has taken place. If the corrosion has caused section loss, the section loss should be quantified. Furthermore, all inspection notes should be reviewed for accuracy and completeness while on-site. For a detailed rating guide, that includes a list of the common deficiencies and recommendations, refer to Appendix B, Common Deficiencies, Ratings, Recommendations, and Priorities.

4.3.3c *Documentation*

Documentation consists of writing/recording field findings. Documentation should be as specific, clear, and concise as possible without providing unnecessary details, yet should accurately and thoroughly describe the observed deficiency. Some information may be implied, such as by which section of the report an item is recorded. Documentation includes both terms of qualification (i.e. severity of a deficiency) and quantification (number of items or area of a deficiency). Deficiencies that have dimensions are typically detailed in terms of width x length/height, or if more applicable, surface area. Other dimensions that may be recorded include depth, percentage of section loss, a distance from a reference point, or other language locating the finding. The various possible components of detailing should be used as needed. A few examples are included below.

- Dent in pole, 2" long x 1" wide x up to 1/2" deep, 5' high above base plate.
- 10% to 20% section loss on leveling nuts and washers at Anchor Bolt 1 and 2.
- Area of spalling, 5 SF x up to 1" deep, at top of pedestal.
- Crack, 1/8" wide, originating at Anchor Bolt 1-4 and extending 2' down pedestal face.

4.3.3d *Photographs*

Photographs are to be taken to provide a representation of the overall condition of the structure. As such, several basic photographs should be taken at each inspection. These photographs are to be taken such that each view is maximized within the frame of the photograph. These photographs include:

- The front view of the structure
- Typical view of each sign panel
- Typical view of a pedestal/base (as applicable)
- Typical view of the chord to pole connection (as applicable)
- Rear view of the structure

Photos are required of all deficiencies or conditions resulting in an element rating of poor or critical, however, can be included for other conditions and/or reasons where further clarification may be needed to define the conditions or reasons. When placed in the report, the photograph shall also have an appropriate caption containing verbiage describing the deficiency or condition represented. If possible, all photographs should be reviewed in the field to ensure that the views and/or deficiencies are clearly depicted. In the event that photographs, or commentary do not, or cannot, adequately/accurately describe the deficiency, the inspector should sketch the deficiency in detail to the extent necessary to accurately depict the deficiency.

New photographs shall be taken at each inspection for inclusion in the updated report. Old photographs shall not be reused without permission from the District Manager. All photographs shall have date stamps.

For instruction on which inventory and inspection photos are to be included in the database and report, refer to Appendix A, Section A.7.

The photographs below present the basic inventory photos to be taken at the start of the inspection.

Photo 4.1 *Front View*

Photo 4.2 *Sign #1 (top) and Sign #2 (bottom)*

Photo 4.3 *Sign #3*

Photo 4.4 *Sign #4 (top) and Sign #5 (bottom)*

Photo 4.5 *View of base*

Photo 4.6 *View of chord to pole connection*

Photo 4.7 *Rear view*

Typical Field Inspection Sequence and Operations (Continued)

The following presents the recommended inspection sequence and procedures, as well as recording of typical findings. Although extensive, the following information is not meant or intended to be all encompassing as variations in structure types and details will occur.

4.3.3e *Overall Alignment*

The entire sign structure should be examined "from a distance" looking for obvious deficiencies or problems. The inspector should check for:

- Gross damage to the structure and its supports from collisions.
- Visually noticeable sagging of the truss of overhead span structures.
- Vertical and horizontal alignment of the sign panels, superstructure, and poles/vertical supports.

4.3.3f *Vertical Clearance*

Vertical clearance from the lowest point of the structure (e.g. chord, sign panel, hanger, luminaire/walkway support) to the highest point of the roadway over each paved shoulder and each lane should be measured. The minimum clearance and the respective lane of the clearance for each direction of travel should be recorded. Clearances greater than 25' should be recorded as such without specific measurements taken at each location.

4.3.3g *Foundation: Erosion / Undermining / Settlement / Drainage*

These deficiencies should be visually assessed. The inspector should inspect and document the following conditions:

- Location of the pedestal relative to the immediate area around the pedestal.
  - If the top of the pedestal is buried less than 12" below grade, remove the dirt/fill until the top of the pedestal is exposed, inspect and document that the pedestal was buried and uncovered for inspection.
  - If the top of the pedestal is located under a walkway or sidewalk, or buried below grade 12" or more, document the condition. The buried condition is to be reported for excavation by VDOT maintenance crews. Notice shall be provided to the District Manager; refer to guidelines in Section 4.3.4. However, if conditions warrant immediate excavation, the condition should be reported immediately. An inspection should be performed as soon as possible following excavation. Conditions that would warrant immediate excavation include observable corrosion and/or section loss.
- Erosion or undermining around the pedestal faces. Any areas of undermining should be probed and documented to determine depth and extent.
- Any indications of movement or rotation of the foundation should be measured and documented. Movement or rotation of a pedestal could be indicative of an underlying foundation or soil issue.
- Standing water or indications of poor drainage should be noted and depth of water measured.
- The pedestal is located in a swale or drainage ditch. A pedestal located in a swale or drainage ditch could periodically be submerged resulting in corrosion, debris accumulation, or damage of the submerged areas.

4.3.3h *Foundation: Concrete Pedestal (or Median Barrier, Bridge Parapet)*

All loose debris and vegetation should be removed. The pedestal should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Cracking: All cracking should be documented, and special attention should be given to cracks propagating from anchor bolts. Any rust staining present along the cracks should be documented. The cracking could indicate overloading of the bolts or appreciable corrosion on the embedded portions of the anchor bolts.
- Delamination: Sound the pedestal with a hammer to detect locations of delamination. The delaminated areas will give a hollow sound when tapped with a hammer.
- Spalling, Honeycombing, Scaling: All spalling, honeycombing, and scaling should be documented. Any exposed reinforcing should be documented along with any associated section loss.
- Impact damage. Document that impact damage exists and any deficiencies associated with it, which may include any of the above.

4.3.3i *Foundation: Steel Haunch*

A haunch is a steel bracket attached to a bridge girder and made to accommodate the ancillary structure, and typically consists of multiple plates built up and welded together. For a detailed description and photograph of a steel haunch foundation, refer to Section 1.2.1p. The haunch should be visually and tactilely inspected from an aerial lift (bucket or platform) or underbridge inspection unit (snooper). The inspector should inspect and document the following conditions:

- For anchor bolt inspection guidance, refer to Section 4.3.3k Foundation: Anchor Bolts.
- Coating loss (paint or galvanizing), corrosion, section loss, etc.
    - If corrosion is observed on the haunch assembly, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
    - If corrosion is observed on connection hardware, the amount and extent of section loss should be determined and documented.
- Localized areas of distressed painted or coated surfaces. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.
- Condition of the welded connections. The welds should be inspected for cracking, especially at points of intersecting welds, and incomplete or excessively-ground welds as they create stress risers. The location and size of the crack(s) is to be documented.
- Condition of the bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, beveled washers or extra washers. Document percent engagement if less than 100%.
- Corrosion and cracking around any burned or rough-cut holes. Burned or rough-cut holes are stress risers and special attention should be given to these areas.
- Distortion of the haunch assembly. Distortion could be indicative of overloading, damage during erection or improper welding procedures during fabrication.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical concrete pedestal and steel haunch deficiencies and conditions that could be encountered in the field.

Photo 4.8 *Map cracking with efflorescence and exudation in pedestal*

Photo 4.9 *Spall in pedestal*

Photo 4.10 *Standing water around base of pole located in swale/drainage ditch*

Photo 4.11 *Pedestal buried over 12" deep*

Photo 4.12 *Overgrowth of vegetation on pedestal*

Photo 4.13 *Scaling on top of pedestal*

Photo 4.14 *Cracks in pedestal extending out from anchor bolts*

Photo 4.15 *Erosion and undermining around back side of pedestal*

Photo 4.16 *Areas of honeycombing in pedestal*

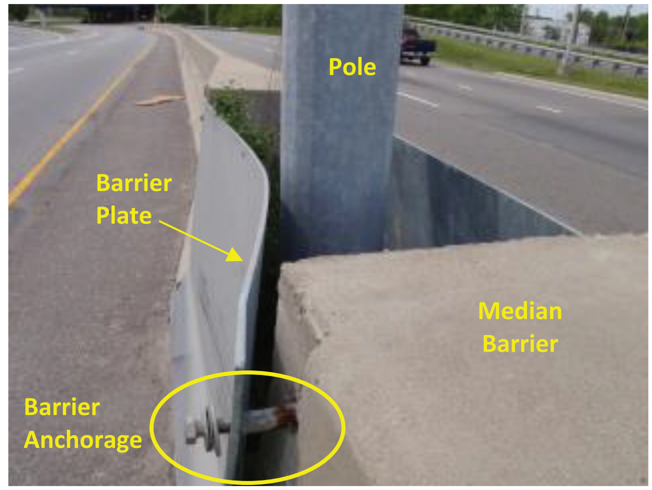


Photo 4.17 *Damaged median barrier plate with failed/pulled out barrier anchorage*
(Luminaire structure shown for illustrative purposes only)

Photo 4.18 *Corrosion of steel haunch*

Photo 4.19 *Coating failure and corrosion on steel haunch members and connection hardware*

4.3.3j *Foundation: Grout Pads*

All loose debris and vegetation should be removed. The grout pad should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Partial (minor cracking and/or section loss) or full (section loss, heavy cracking, etc.) deterioration of the existing grout pad. Deterioration results in water/moisture retention within the grout pad and possible corrosion of the partially or unexposed anchor bolts. Note the level of deterioration. If the grout pad is deteriorated to the extent that it can be removed easily with hand tools, first verify the existence of leveling nuts (refer to Section 4.3.3k), and then remove the grout pad and note that it was removed by the inspector.
- Moisture leaking from the grout pad that indicates moisture/water retention and possible corrosion of the partially exposed or unexposed anchor bolts. The moisture could be leaking from under the grout pad or from cracks and/or areas of section loss in the grout pad.
- Document the maximum thickness of each grout pad. The height is representative of the height from bottom of the base plate to the top of the pedestal; for further discussion, refer to Section 4.3.3k.

The photographs below present various typical grout deficiencies and conditions that could be encountered in the field.

Photo 4.20 *Partially deteriorated grout pad*

Photo 4.21 *Deteriorated grout pad with moisture leakage*

4.3.3k *Foundation: Anchor Bolts*

All loose debris and vegetation should be removed. Anchor bolts, washers, and nuts should be visually and tactilely inspected if accessible (not obscured by a grout pad). For numbering convention of the anchor bolts, refer to Section 4.6.4. The inspector should inspect and document the following conditions:

- Document any deviation, excess or missing components, from the typical configuration; refer to Figure 4.1. Some examples may include material other than mild steel (i.e. stainless steel or aluminum), the presence of lock washers, beveled washers, lock or jam nuts, extra washers, and missing nuts and washers.

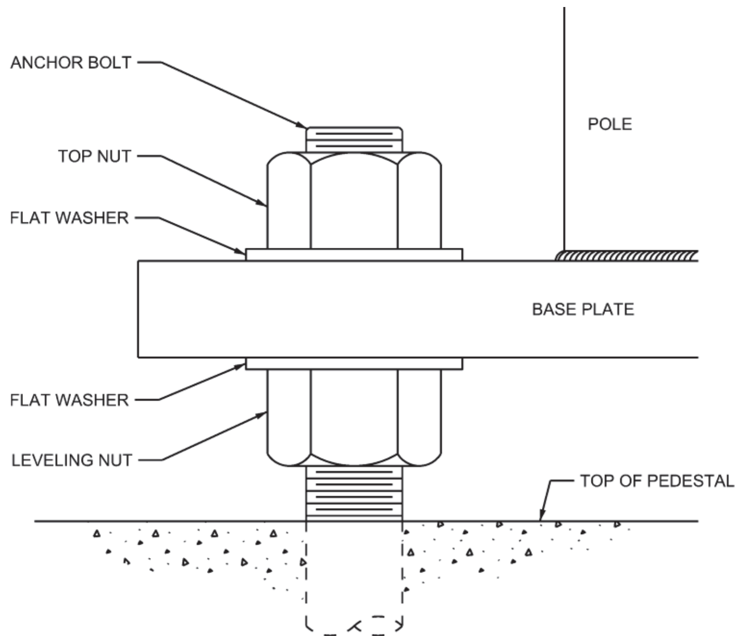


Figure 4.1 *Typical Anchor Bolt Configuration*

- Presence of any tack welds or other welds on anchor bolt assemblies. Welding to bolts can change the material characteristics and result in a loss in bolt strength.
- Corrosion, loss of galvanizing, section loss, etc. of the anchor bolts, washers, and nuts. If section loss is present on the anchor bolts and/or nuts, all rust scale should be removed from the area and calipers should be used to measure the remaining diameter of the anchor bolts or flat-to-flat distance on the nuts.
- Inadequately sized flat washers or lack of flat or plate washers for enlarged holes in base plates. Enlarged holes reduce the amount of bearing area of the top nut and/or leveling nut on the base plate.
- Adequate engagement of top nut. Less than 100% engagement of the top nut reduces the ability of the anchor bolt to develop its full load carrying capacity. Document percent engagement if less than 100%.

- Loose or inadequately tightened top nuts and leveling nuts. These two deficient conditions of the nuts are recognized as having a negative impact on the effectiveness and longevity of the anchor bolts, and ultimately, the structure as a whole.
    - Loose nuts increase the stresses in the adjacent bolts and allow additional impact stresses on the bolt(s) having the loose nut(s). A loose nut can be identified by the following criteria:
        - The nut is not in contact with the washer or base plate. In this case, there is a uniform gap between the nut and the washer or base plate. This condition could represent a "frozen" nut or a loose nut that could be turned by hand.
        - The washer between the nut and base plate moves by hand. This condition could represent a "frozen" nut or a loose nut that could be turned by hand.
    - Inadequately tightened nuts increase the stresses in the adjacent bolts and because they are not fully tightened, the nuts may become loose over time. This condition is considered less severe as compared to a loose nut. An inadequately tightened nut is defined as less than snug tight and can be identified by the following criteria:
        - It is not loose (as defined above).
        - The nut is in contact with the base plate.
        - The nut and/or washer moves when struck with a hammer. The sides of each nut should be struck 2-3 times with a 16-ounce hammer in the nut-tightening or clockwise direction when looking down on the nut from above. The force should be consistent between strikes to prevent false indications that the nut is inadequately tightened.
- Plumbness of the anchor bolts. Out of plumb anchor bolts (slope that exceeds 1:40) could result in increased bending stresses in the anchor bolts. If one or more anchor bolts are visually out of plumb, measure the slopes of the affected bolts. The measurements are to be taken and documented as follows, refer also to Figure 4.2:
    - Measure the plumb vertical distance or height, V, of the bolt above the top of concrete.
    - Measure the horizontal distance, H, from the centerline of the bolt at the top of concrete to the centerline of the bolt at the top of the bolt.

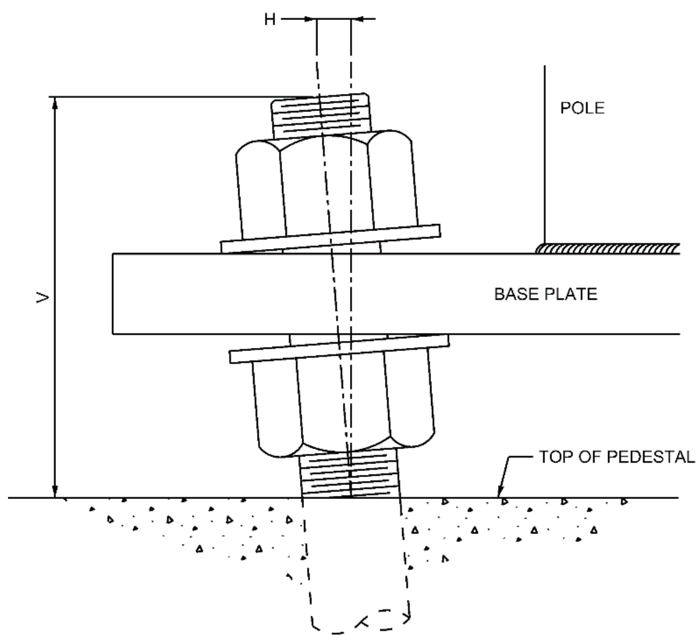


Figure 4.2 *Measurement Methodology for Out of Plumb Anchor Bolts*

Improperly seated top nuts on the base plate. Improper seating of top nuts can reduce the bearing area of the nut on the base plate and can consequently reduce the load capacity of the bolts. If the top nuts are not in full contact with the base plate and a gap exists between the bottom of the nut and the top of the base plate at one or more locations, the largest gap for each nut is to be measured and documented. The measurement, D (refer to Figure 4.3), is to be taken from the top of the washer, or base plate if no washer exists, to the highest point above the base plate along the bottom of the nut. These measurements should be taken using a feeler or taper gauge.

- The table below is used to simplify the ratings for improperly seated top and leveling nuts, and for out of plumb anchor bolts.

		Gap, D (in.)			
		1/16	**1/8**	**3/16**	**1/4**
		0.0625	**0.125**	**0.1875**	**0.25**
Bolt Diameter, d (in.)	**1.00**	0.063	0.125	0.188	0.250
	1.25	0.050	0.100	0.150	0.200
	1.50	0.042	0.083	0.125	0.167
	1.75	0.036	0.071	0.107	0.143
	2.00	0.031	0.063	0.094	0.125
	2.25	0.028	0.056	0.083	0.111
	2.50	0.025	0.050	0.075	0.100
	2.75	0.023	0.045	0.068	0.091
	3.00	0.021	0.042	0.063	0.083

(green)	**DO NOT REPORT**
(yellow)	**D/d >= 0.04**
(red)	**D/d >= 0.08**

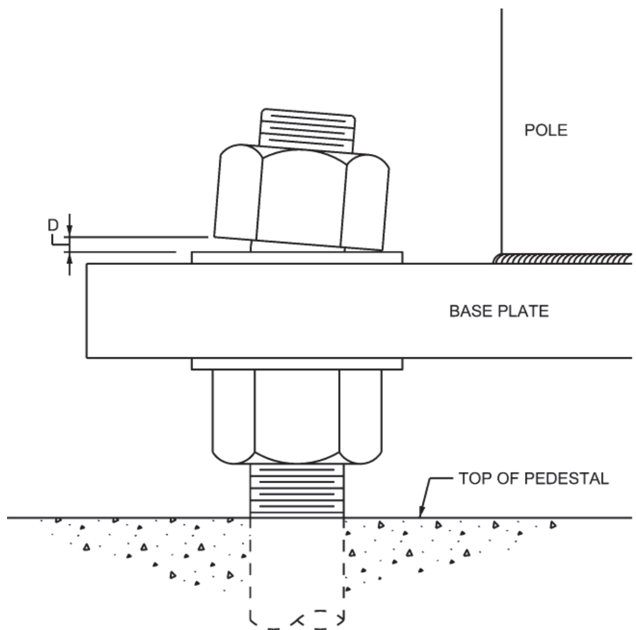


Figure 4.3 *Measurement Methodology for Improperly Seated Nuts*

- Presence of a leveling nut if a grout pad is present. To determine if a leveling nut is present, the inspector can 'probe' the grout pad by using a 1/4" masonry bit to drill a hole in the grout pad. The hole should be drilled toward the anchor rod and in a direction that would intersect a leveling nut, if one is present. The inspector shall take all precautions not to hit the anchor bolt and to minimize damage to the leveling nut, if one exists. A measurement taken from the top nut to the outside of the base plate will give the inspector a dimension to be used to minimize damage to the leveling nut or the anchor bolt. Whether a leveling nut is present or not the hole in the grout shall be filled with caulk prior to leaving the site. If the grout is deteriorated and in poor condition the inspector may be able to remove a section of grout rather than drill a hole. For the method of verifying the presence of a leveling nut, refer to Figure 4.4. A structure with a deteriorated grout pad and no leveling nut is a serious condition and should be reported immediately to the District Manager. The presence of, or lack of, a leveling nut shall be noted in the report.

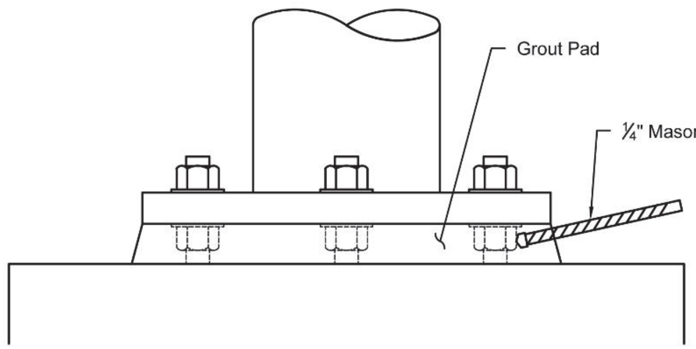


Figure 4.4 *Method for Drilling Grout Pad to Determine Existence of Leveling Nuts*

- Hidden or unobservable cracks within the anchor bolts. Cracks, regardless of size, decrease the load capacity of the bolts and could increase stresses in the surrounding bolts. The top of the bolts should be tapped and sounded with the hammer for any hollow sounds that could indicate the presence of a crack. If a hollow sound is present, an ultrasonic test should be conducted to investigate the presence and location of a crack. Ultrasonic testing of all anchor rods is required at each regular inspection and each base inspection; for guidelines, refer to Chapter 2.
- Distance between the bottom of the base plate and the top of the pedestal, H (refer to Figure 4.5). Base plates that exceed a clear height above the pedestal of two bolt diameters induce stresses that were not accounted for during design and could reduce the load capacity and fatigue life of the anchor bolts. The maximum measured distance between the bottom of the base plate and the top of the pedestal should be documented for each base plate of a structure as differing heights could impact any recommendations pertaining to lowering of the structure

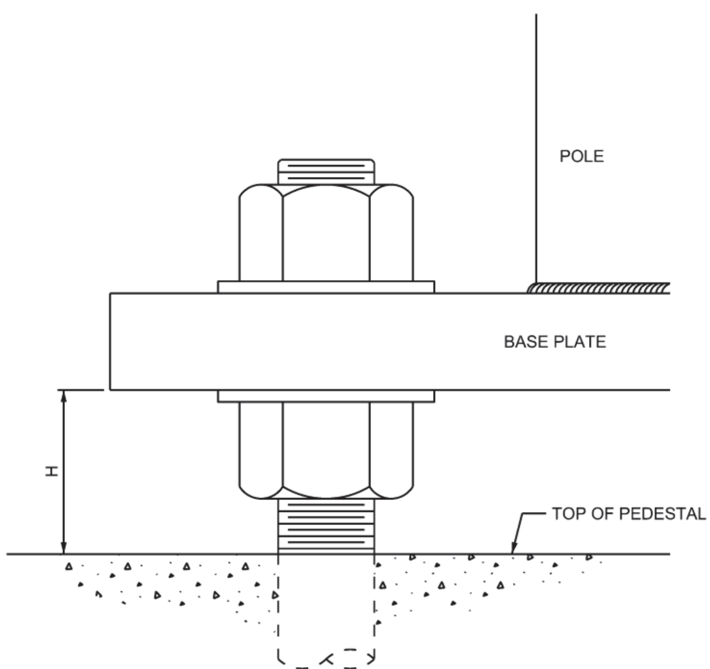


Figure 4.5 *Measurement Methodology for Base Plate Distance Above Pedestal*

The photographs below present various typical anchor bolt deficiencies and conditions that may be encountered in the field.

Photo 4.22 *Loose top nut*

Photo 4.23 *Heavy corrosion and section loss on anchor bolt below leveling nut*

Photo 4.24 *Top nut 50% engaged*

Photo 4.25 *Top nut improperly seated on base plate*

__Photo 4.26__ Loose leveling nut

__Photo 4.27__ Excessive top of pedestal to bottom of base plate height

__Photo 4.28__ Out of plumb anchor bolt

__Photo 4.29__ Oversized base plate hole and inadequately sized flat washer under top nut

__Photo 4.30__ Corroded and broken anchor bolt

__Photo 4.31__ Loose top nut and missing flat washer

4.3.3l <u>*Vertical Supports: Base Plates*</u>

All loose debris and vegetation should be removed from under and around the base plate. Base plates should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc. If an area of corrosion is observed or suspected, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
- Distress around enlarged holes for the anchor bolts. Holes are sometimes enlarged to facilitate installation of the base plate, due to improper installation/setting of anchor bolts during construction.
- Distortion of the base plate. Distortion could be indicative of overloading, damage during erection or improper welding procedures during fabrication.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical base plate deficiencies and conditions that could be encountered in the field.

Photo 4.32 *Distorted/bowed base plate*

Photo 4.33 *Corrosion and section loss on base plate*

4.3.3m *Vertical Supports: Poles and Trussing*

The poles and trussing should be visually and tactilely inspected. Hand hole covers, if present, shall be removed to the extent possible without damaging the cover and attachment screws. The upper portions of the poles are to be inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on the outside of the pole, the area should be thoroughly cleaned of any rust scale and the amount and extent of section loss should be determined and documented.
  - If corrosion is observed on the inside of the pole, the outside of the pole should be sounded with a hammer to detect "thin" areas in the pole. An electrically insulated borescope may be used to visually inspect the inside of the pole. The use of a borescope is to be documented. Thickness testing utilizing corrosion thickness gages shall be performed to determine the amount and extent of section loss. Obtain three random readings at 3' above the base and average the three to determine the pole's thickness. At a minimum, thickness testing utilizing corrosion thickness gages should be performed at the 12, 3, 6, and 9 o'clock positions around the circumference of the pole. The readings are to be taken on the pole immediately above the top of the base plate to pole weld, and at 3" and 6" above the top of the base plate; refer to Figure 4.6. All readings should be recorded in decimal inches to three decimal place accuracy (Ex. 0.030"). Readings should be recorded in table format and included in the database as a photograph. For an example chart format, refer to Figure 4.7.

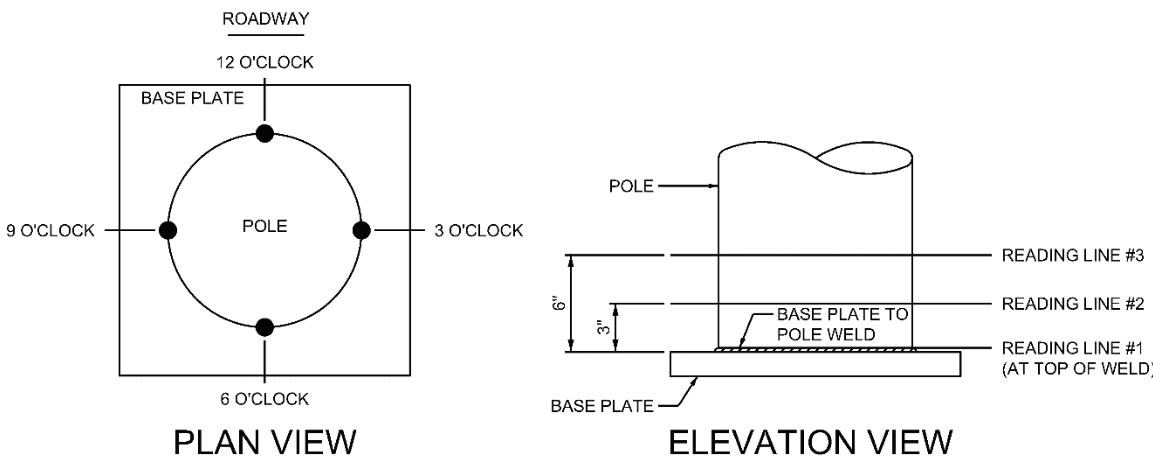


Figure 4.6 *Measurement Methodology for Pole Corrosion Thickness Gage Readings, Plan and Elevation*

Structure Number: 0630048

Reference Thickness: 0.119"

Pole Thickness Readings				
Height Above Base	**12:00**	**3:00**	**6:00**	**9:00**
0"	Note 4	Note 4	Note 4	0.153"
3"	0.134"	0.141"	0.140"	0.132"
6"	0.122"	0.123"	0.122"	0.119"

Notes:
1. 12:00 referenced to roadway.
2. Readings include coating thickness.
3. Reference thickness taken approximately 36" above hand hole.
4. No reading due to pitting.

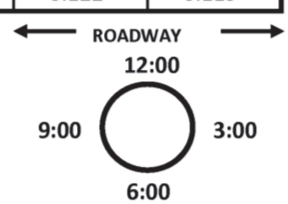


Figure 4.7 *Measurement Methodology for Pole Corrosion Thickness Gage Readings, Example Thickness Chart*

- Corrosion thickness gage utilization guidelines:
  - Ensure that the corrosion thickness gage has been tested, properly calibrated and has full charge.
  - Ensure the right couplant and check the expiration date.
  - It is important to clean and prepare the test surface of the pole and select enough locations and procure accurate readings.
    - For a galvanized steel surface with surface rust, clean using wire brush to ensure smooth surface.
    - If the surface has pitting/corrosion, a grinder can be used carefully without compromising the wall or gouging surface to smooth out the test area. A grinder can also be used carefully to remove the patina and/or pitting to expose a smooth surface to test.
    - For painted poles, observe defects in paints such as cracks, paint loss, discoloration and use a hammer to sound for weak areas. Ensure that the corrosion thickness gage is capable of reading through paint.
    - Use a hammer to tap the pole at various locations to identify weak areas and prepare the test area using cleaning tools.
    - Open the hand-hole to access and ensure that the inside of the base is inspected with a borescope/mirror and flashlight. Observe for internal pitting/rust and moisture. Focus on tapping these areas on the outside and clean the areas to test.
    - Make sure to document all measurements and take photos to complete documentation.
    - Use the tabular format as shown in 4.3.3m to measure section loss.
    - Make sure that the original wall thickness is accurately measured at several random locations at about 3' from base.
    - If a variation in excess of 25% is observed to readings at the same location (at 3, 6, 9 and 12 'O' Clock), the readings shall be checked for validity by the Team Leader.
    - For critical condition readings, ensure many readings are taken and documented and the District Manager is immediately informed, and action taken for ensuring safety to public.

- Localized areas of distressed painted or coated surfaces such as at connections, attachments, pole bases, etc. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.
- Out of plumb or leaning vertical supports/poles (not related to pedestal movement). Poles that are out of plumb or leaning can be indicative of damage or adjustments made during erection and can increase bending stresses in the poles. Any observable leaning of the vertical supports should be measured and the direction of the lean documented. The measurement could be obtained by lowering a plumb bob from the top of the support within a few inches of the base plate and taking a horizontal measurement, D, from the base of the support to the plumb bob line. Alternatively, a level could be used to measure the amount of lean of a non-tapered pole over the known length of the level, L. For the method for measuring leaning poles, refer to Figures 4.8 and 4.9.

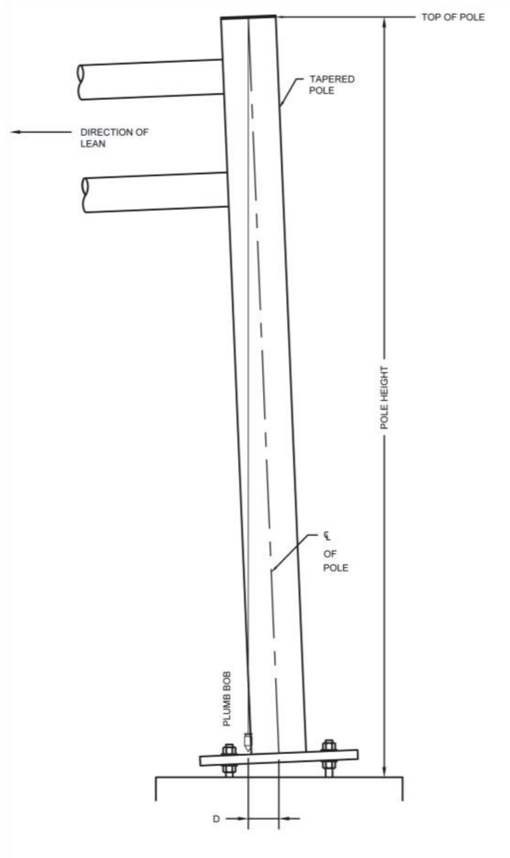


Figure 4.8 *Measurement Methodology for Leaning or Out of Plumb Tapered Poles*

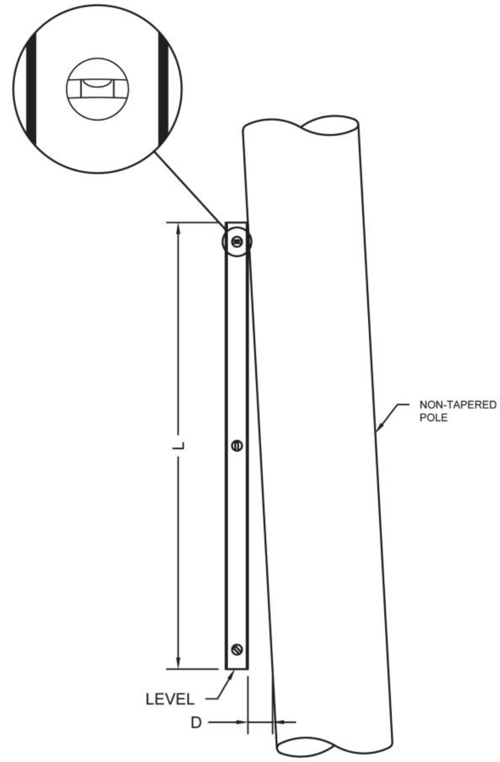


Figure 4.9 *Measurement Methodology for Leaning or Out of Plumb Non-Tapered Poles*

- Bowing of the poles. An observable bowing of the vertical supports could be indicative of an overstress condition, inadequate support size or section, improper fabrication, or damage incurred by vehicle impact, and should be measured and the direction of the bow documented. The measurements should be performed by stretching a line from the top of the support to the face of pole above the base plate and measuring the maximum bow. In the case of a localized area of bowing due to impact, the line or straight edge should be stretched across the area and rested against the plumb or vertical portions of the support on both sides of the area. For the method for measuring bowed poles, refer to Figure 4.10.

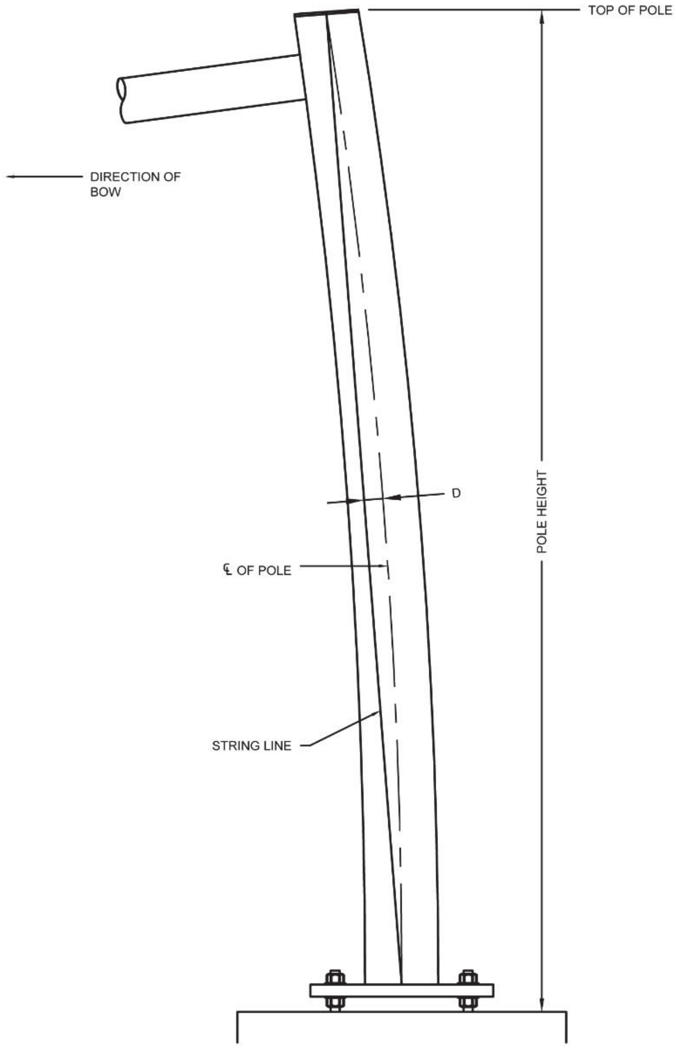


Figure 4.10 *Measurement Methodology for Bowed Poles*

- Dents and ruptures in round or faceted vertical supports/poles. Dents and ruptures can reduce the load carrying capacity of the pole or poles as they could significantly reduce the cross section of the pole or poles. The depth of the dent or rupture does not affect the rating, as it is a function of the wall thickness that, like the material, is highly variable. The depth of the dent should be measured with a ruler; however, getting more complete or accurate information on the depth of the dent could require specialized equipment that is impractical. Nevertheless, the depth of any dent or rupture, as measured with the ruler, along with descriptions of any tears or punctures within the dent or rupture, should be recorded during the inspection. The following measurements (refer to Figure 4.11) are to be taken and documented.
    - **H**: Horizontal measurement of the dent or rupture.
    - **V**: Vertical measurement of the dent or rupture.
    - **d**: Depth of the dent or rupture at the deepest point of the dent.
    - **C**: Circumference of the support immediately above or below the affected area.
    - **D**: Distance from top of the base plate to the center/middle of the dent.

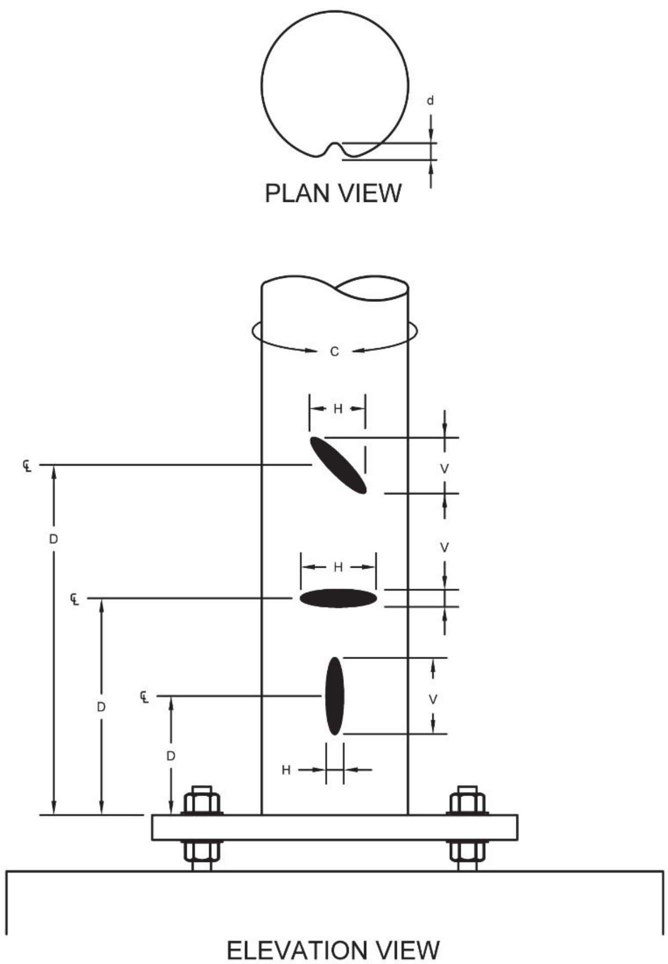


Figure 4.11 *Measurement Methodology for Dents and Ruptures in Round or Faceted Poles*

- Corrosion or loose rust scale around weep holes. Corrosion and rust scale may be indicative of corrosion of the inside of the pole and should be investigated as described previously in this section.
- Corrosion and cracking around any burned or rough-cut holes. Burned or rough-cut holes are stress risers and special attention should be given to these areas.

- Condition of the welded connections. The welds should be closely inspected for cracking, especially at points of intersecting welds and incomplete or excessively ground welds, as they create stress risers. Special attention should be given to the pole to base plate weld due to the high stresses at this location. The location and size of any weld crack is to be documented. Suspected cracks should be verified by NDT.
- Condition of the bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of split washers, beveled washers or extra washers. Document percent engagement if less than 100%. For poles, these conditions are typically encountered at the bolted trussing members connecting two vertical supports.
- Condition of the splices. Splices should be inspected for loose or missing components, cracked welds, and under engaged nuts. Document percent engagement if less than 100%. Suspected cracks should be verified by NDT.
- Conditions of, in, and around the hand holes and covers. The hand hole covers should be removed to the extent possible and inspected for looseness of the cover and missing or sheared bolts securing the cover. Any cover that cannot be removed shall be documented. Missing or loose hand hole covers allow for water and debris infiltration, and animal infestation. Any debris present within the hand hole is not to be removed by the inspector; the condition is to be reported for removal by VDOT maintenance crews. Notice shall be provided to the District Manager; refer to guidelines in Section 4.3.4. However, if conditions warrant immediate removal of the debris, the condition should be reported immediately. Conditions that would warrant immediate debris removal include observable corrosion, damage, and/or section loss in the pole and around the hand hole. An inspection should be performed as soon as possible following removal of the debris.
- Cracks or breaks in the hand hole opening and opening weld, and cracks in the pole around the hand hole. Special attention shall be given to the splice weld in the hand hole reinforcing ring. Cracks or breaks in the hand hole opening and welds can potentially serve as a means for crack propagation in the pole. Suspected cracks should be verified by NDT.
- Condition of pole caps. Loose or missing caps allow water intrusion and animal infestation and should be documented.
- Condition of electrical ports. Damage to the ports and missing, loose, or damaged port caps allow for water infiltration and animal infestation and should be documented.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical pole deficiencies and conditions that could be encountered in the field.

Photo 4.34 *Pole extension and splice*

Photo 4.35 *Missing hand hole cover*

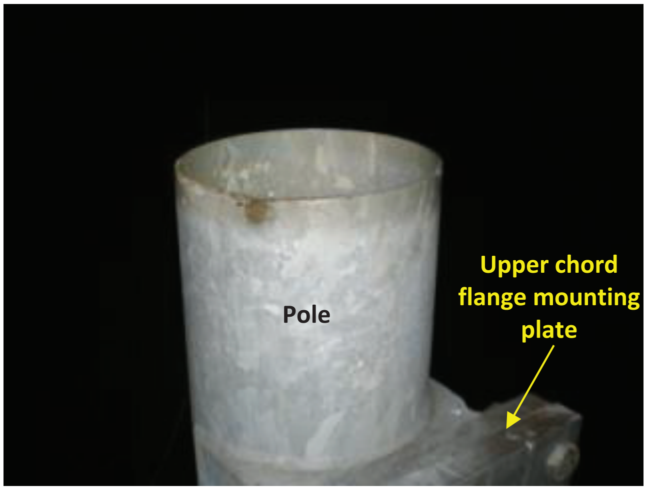


Photo 4.36 *Missing pole cap*

Photo 4.37 *Bowed/Bent pole (I-beam)*

Photo 4.38 *Leaning poles (I-beam)*

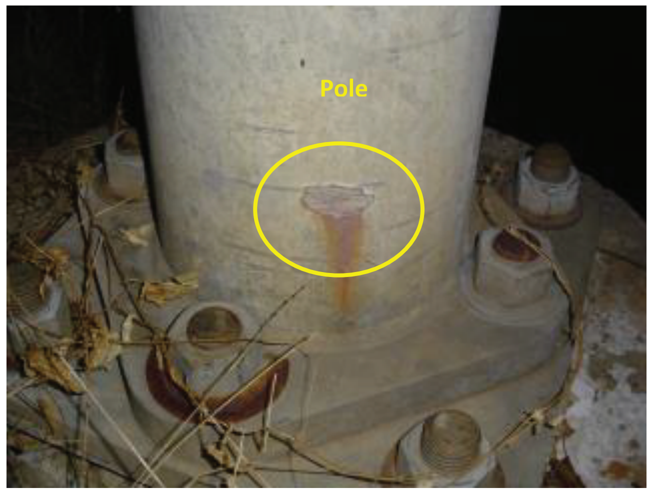


Photo 4.39 *Minor impact damage/dent in pole with damaged galvanizing and corrosion*

Photo 4.40 *Overgrowth of vegetation around pole*

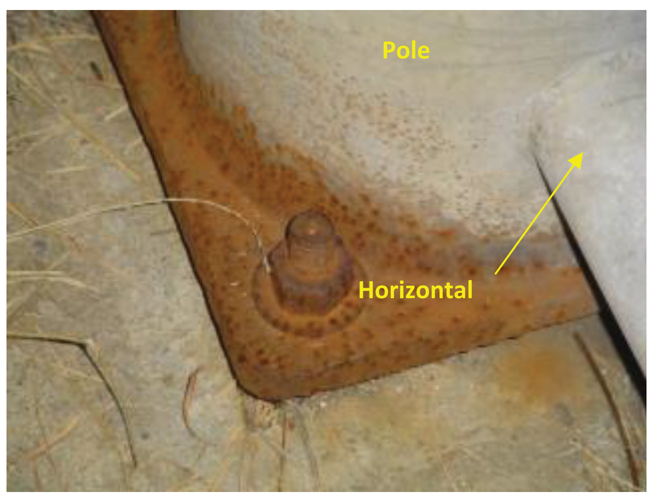


Photo 4.41 *Light corrosion of base plate to pole weld*

Photo 4.42 *Impact damage to pole trussing diagonal*

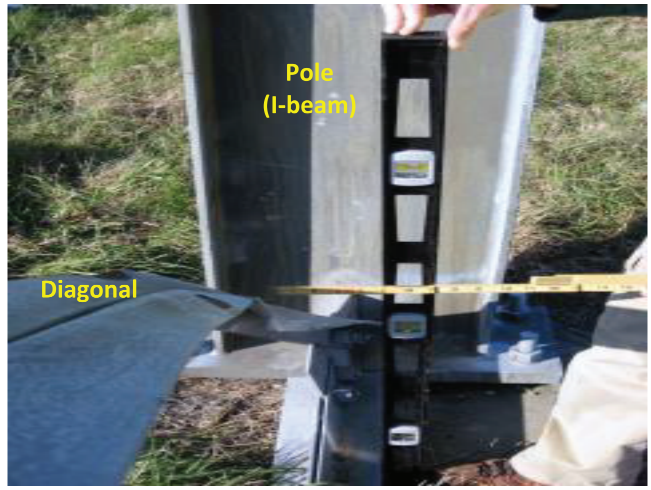


Photo 4.43 *Measuring impact damage to pole diagonal*

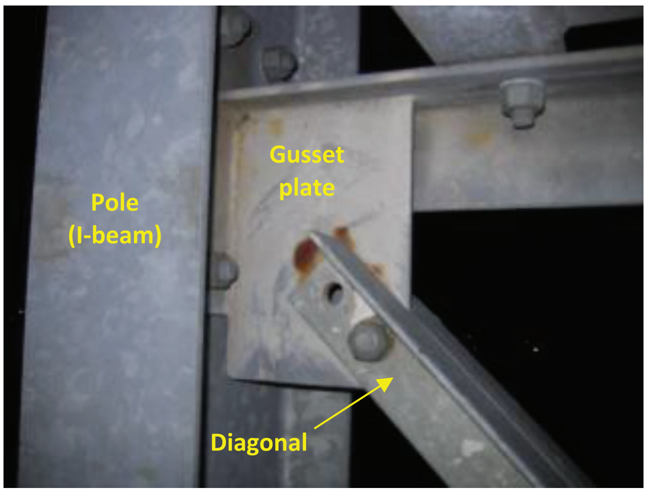


Photo 4.44 *Missing bolt at diagonal member to gusset plate connection on pole (I-beam)*

Photo 4.45 *8-bolt pedestal to 4-bolt pole extension retrofit*

Photo 4.46 *4-bolt pedestal to 8-bolt base plate retrofit*

Photo 4.47 *Buried pole and horizontal truss with heavy corrosion and section loss*

4.3.3n *Vertical Supports: Attachments to Pole*

Components such as small informational signs, cameras, sensors or other items are often attached to the poles. These attachments should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Condition of electrical conduit and/or electrical or control boxes attached to the pole(s). The conduit should be visually inspected for missing components, breaks, exposed wiring, and corrosion and section loss of connector and attachments. In addition, the conduit and wiring entry and exit points in the poles should be inspected for the presence of rubber grommets or seals. Electrical or control boxes and their pole attachments should be inspected for corrosion and section loss. If any exposed wiring is present, inspectors are to take caution and avoid contact.
- Condition of the component. The component should be inspected for functionality and deficiencies documented.
- Condition of the component attachment. The attachments should be inspected and documented for section loss and missing or loose hardware.

The photograph below presents a typical pole attachment deficiency and condition that could be encountered in the field.

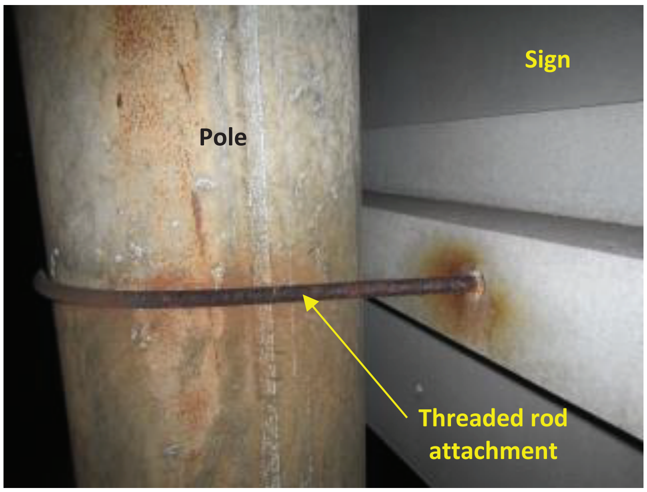


Photo 4.48 *Corroded sign to pole connection hardware*

4.3.3o *Vertical Support: Chord to Pole Connections*

The chord to pole connections should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If corrosion is observed on the connection assembly, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented. If the section loss cannot be measured by conventional methods, then thickness testing shall be performed utilizing corrosion thickness gages to determine the amount and extent of section loss.
  - If corrosion is observed on the connection hardware the amount and extent of section loss should be determined and documented. It should also be documented if the corrosion is caused by the presence of dissimilar metals. For guidance on dissimilar metals, refer to Section 3.8.
- Localized areas of distressed painted or coated surfaces. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.
- Condition of the welded connections. The welds should be inspected for cracking, especially at points of intersecting welds, and incomplete or excessively ground welds as they create stress risers. The location and size of the crack(s) is to be documented.
- Condition of the bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, beveled washers or extra washers. Document percent engagement if less than 100%. For vertical support to chord connections, special attention should be given to flange mounting plate and collar plate connections, as they are less redundant than seated connections.
- Gaps in flange mounting plates or collar plates on cantilevered structures. Gaps could increase stresses in the connection bolts.

- Bent or distressed collar plate and collar plate ribs on cantilever spans.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.
- Deteriorated or missing neoprene bearing pads under the pillow blocks or saddle shims on overhead spans. Neoprene pads can provide a barrier between dissimilar metals and absorb impact and vibration of the horizontal support.
- Missing or undersized saddle shims or bent plate washers on overhead spans. Missing or undersized saddle shims can increase the bearing stresses on the chords.

The photographs below present various typical chord to pole connection deficiencies and conditions that could be encountered in the field.

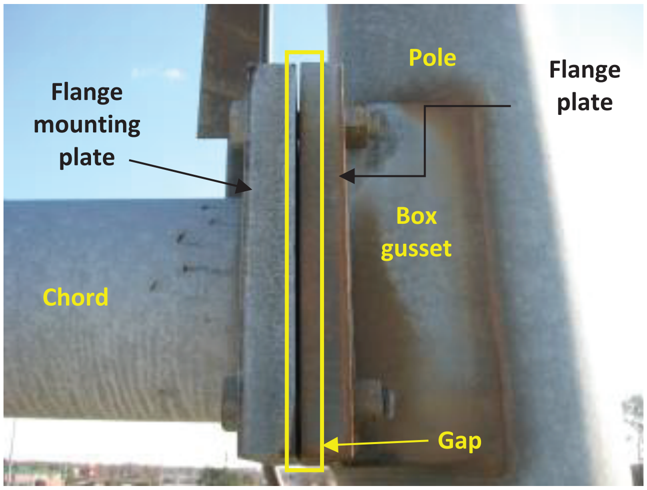


Photo 4.49 *Gap in flange mounting plates of chord to pole connection*

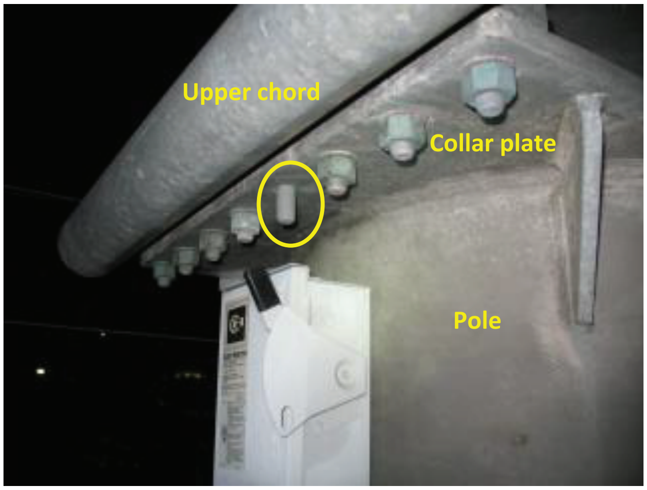


Photo 4.50 *Missing nut on collar plate bolt at upper chord to pole connection*

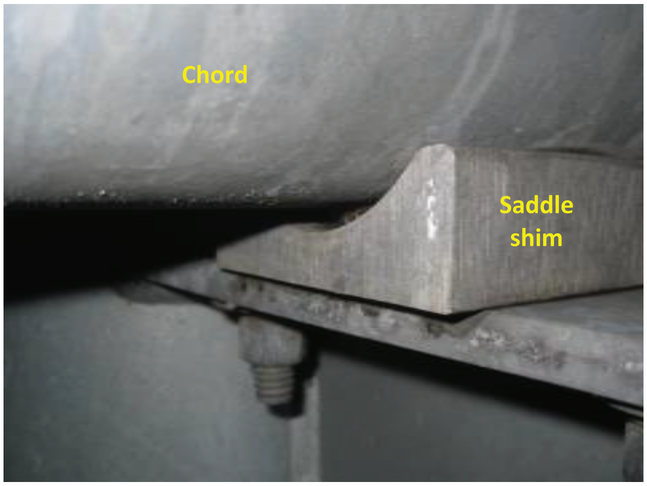


Photo 4.51 *Undersized saddle shim at chord to pole connection*

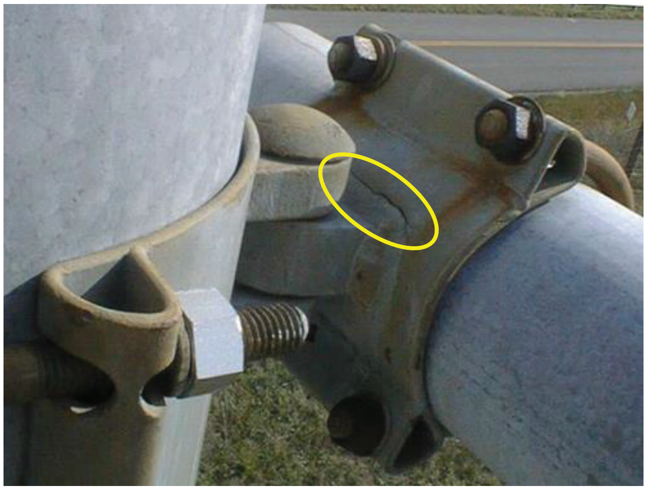


Photo 4.52 *Cracked weld at single chord to pole connection*

4.3.3p <u>*Horizontal Support: Chords and Trussing of Overhead Span, Cantilever, and Butterfly Structures*</u>

The chords and trussing should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on the outside of the chord components, the area should be thoroughly cleaned of any rust scale and the amount and extent of section loss should be determined and documented.
  - If corrosion is suspected on the inside of the chord components, the outside of the component should be sounded with a hammer to detect "thin" areas. Thickness testing shall be performed utilizing corrosion thickness gages to determine the amount and extent of section loss.
- Excessive sagging of the truss. Observable excessive sagging could be the result of overstressing/overloading, inadequate member size, or damage resulting from vehicle impact, and should be measured and documented. A laser distance measuring device could be used to determine the amount of sag in a truss. This method would entail stationing an inspector at the point of observable maximum sag, S, with a light-colored panel or board placed on the top of the top chord. The laser would be place on the top of a level resting at the end of the top chord, at the support. The level would be straightened, or leveled, and the laser shot to the light-colored panel or board. The inspector stationed at the board or panel would then mark the panel and the distance could be measured from the bottom of the board or panel to the mark. If the laser was placed any distance above the chord, that distance shall be subtracted from the total distance. The remaining measurement would be the maximum amount of sag. Though less practical, the measurements could also be performed by stretching a string line between the vertical supports and measuring the height between the string and the top chord at the point of observable maximum sag; refer to Figure 4.12. It should be noted that the string may need to be positioned a constant height above the chord at each pole in order to prevent interference by any splice flanges.

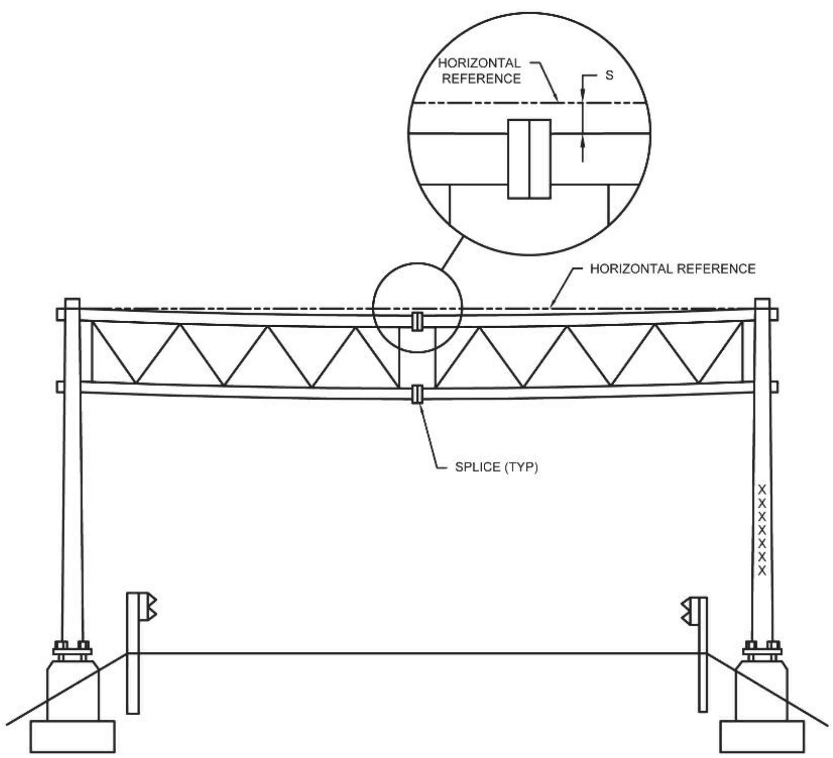


Figure 4.12 *Measurement Methodology for Chord Sag*

- Localized areas of distressed painted or coated surfaces such as at connections, attachments, etc. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.

- Condition of the welded connections. The welds should be inspected for cracking, especially at points of intersecting welds, incomplete or excessively ground, or poor welds that can contribute to stress risers within the weld. The location and size of any weld crack is to be documented. Suspected cracks should be verified by NDT.
- Condition of the bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, beveled washers or extra washers. Document percent engagement if less than 100%. For chord assemblies, these conditions are typically encountered at the bolted trussing member connecting the chords.
- Condition of the splices. Splices should be inspected for loose or missing components, cracked welds, and under engaged nuts. Document percent engagement if less than 100%. Gaps between splice plates or flanges should also be measured and documented. Loose or missing components, or under engaged nuts increase the stresses in the splice components. Cracks in welds are indicative of overloading or overstressing of the connection. Suspected cracks should be verified by NDT.
- Corrosion or loose rust scale around weep holes. Corrosion and rust scale may be indicative of corrosion of the inside of the chords or trussing and should be investigated as described previously in this section.
- Corrosion and cracking around any burned or rough-cut holes. Burned or rough-cut holes are stress risers and special attention should be given to these areas.
- Dents, buckles, or ruptures in the chords or trussing. These conditions typically occur during erection of the structure but may also be caused by vehicular or debris impact and should be measured and documented.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.
- Condition of end caps. Loose or missing caps allow water intrusion and debris accumulation and should be documented.
- Condition of electrical conduit and/or electrical or control boxes attached to the chord assembly. The conduit should be visually inspected for missing components, breaks, exposed wiring, and corrosion and section loss of connector and attachments. In addition, the conduit and wiring entry and exit points in the chords should be inspected for the presence of rubber grommets or seals. Electrical or control boxes and their chord attachments should be inspected for corrosion and section loss. If any exposed wiring is present, inspectors are to take caution and avoid contact.
- Utility wires or cables in contact with mast arm. Document any utility wires or cables that are resting on, or in contact with the chords and trussing. Constant friction (rubbing) of the lines against the structure can cause coating failure and lead to corrosion or be energizing the structure. If utility wires or cables exist, the inspectors should maintain a minimum distance; refer to requirements in Section 4.2.

The photographs below present various typical chord and trussing deficiencies and conditions that could be encountered in the field.

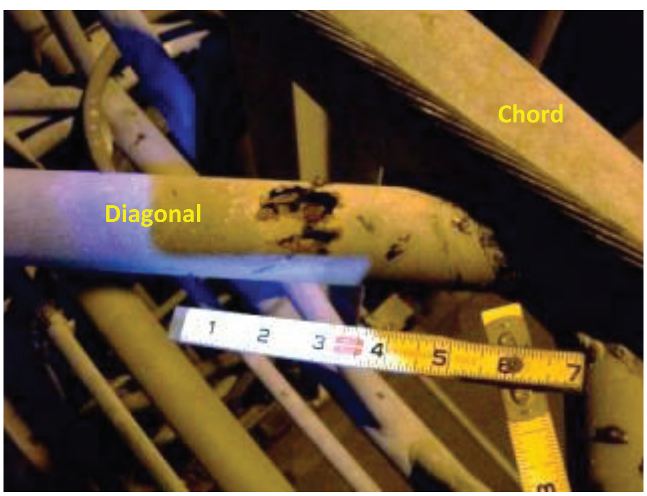


Photo 4.53 *Area of 100% section loss in upper diagonal member of chord truss*

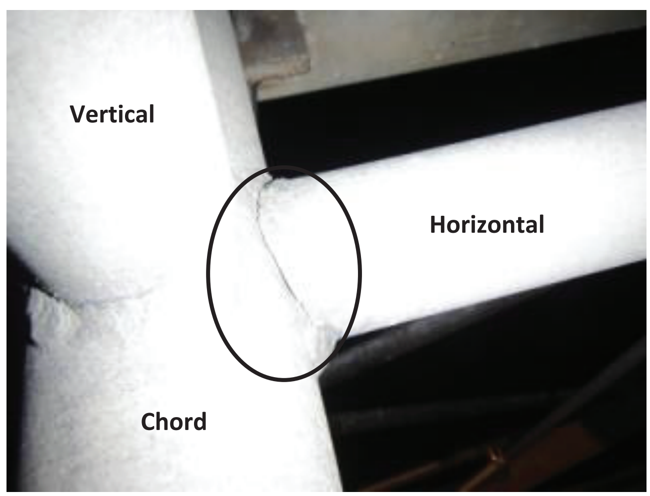


Photo 4.54 *Broken weld at horizontal truss to chord connection*

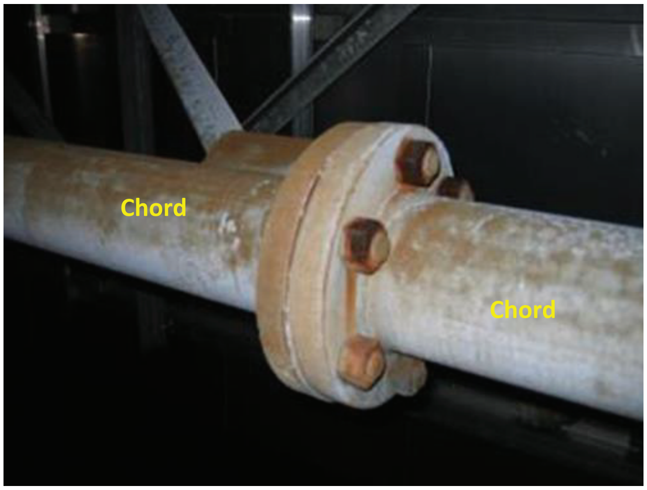


Photo 4.55 *Loss/Breakdown of galvanizing with corrosion of the chord, splice plates, and splice bolt nuts*

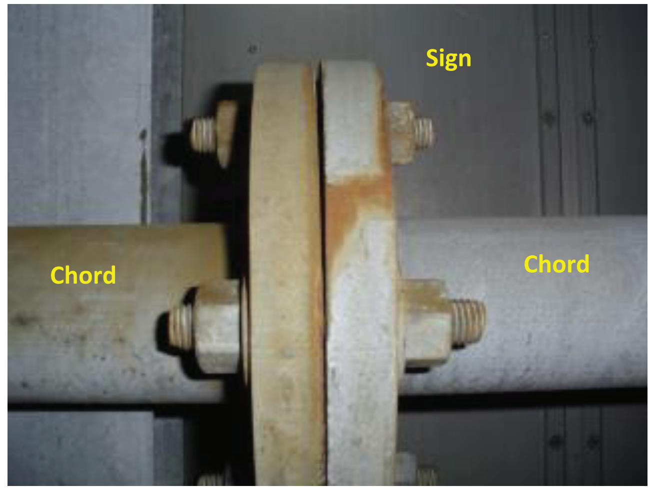


Photo 4.56 *Gap in of upper half of upper chord splice flanges and breakdown of galvanizing (brown color) with light corrosion*

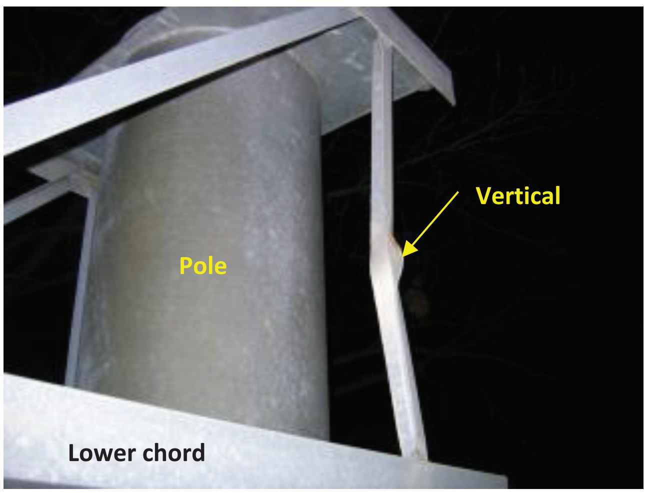


Photo 4.57 *Bent vertical truss at end of chord box truss*

Photo 4.58 *Missing diagonal truss bolt at chord panel point and bent horizontal truss*

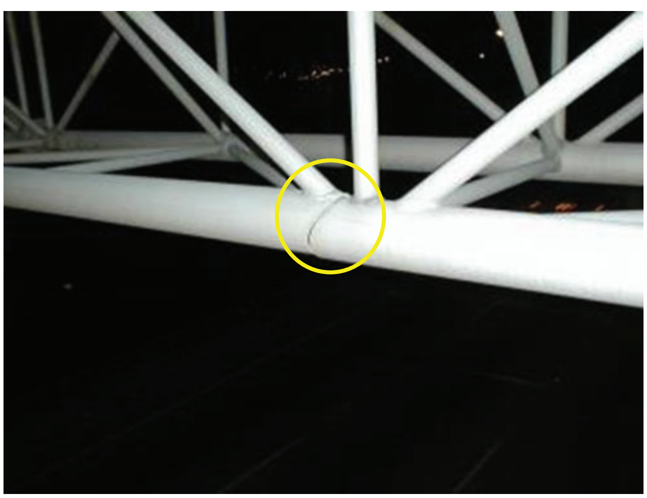


Photo 4.59 *Broken lower rear chord*

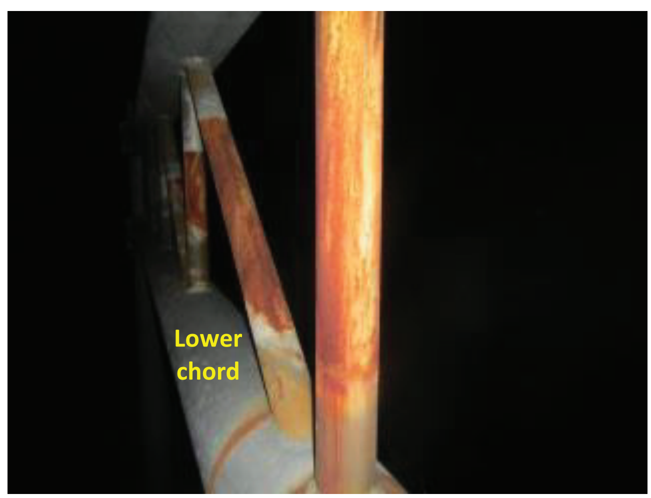


Photo 4.60 *Light corrosion on chord trussing*

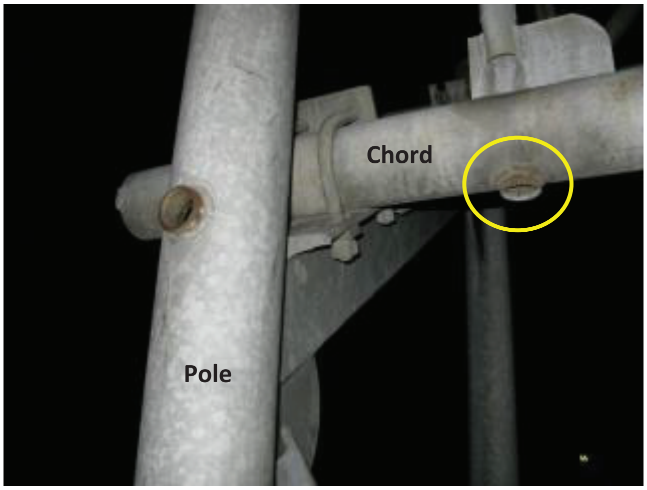


Photo 4.61 *Missing cap on chord electrical port*

Photo 4.62 *Gap in lower half of upper chord splice*

4.3.3q *<u>Horizontal Support: Bridge Parapet Mount</u>*

The bridge parapet mount structure should be visually and tactilely inspected from an aerial lift (bucket or platform) similar to the inspection of the chords and trussing of the overhead span, cantilever and butterfly structures. In addition to the conditions listed in Section 4.3.3p, the inspector should also check for:

- Condition of the parapet at the attachment. The parapet should be inspected for:
  - Cracking: All cracking should be documented, and special attention should be given to cracks propagating from the anchorages or through bolts. Cracking can be indicative of overloading, corrosion of through bolts, or the beginning of expansion or adhesive anchor failure.
  - Delamination: Sound the parapet with a hammer to detect locations of delamination. The delaminated areas will give a hollow sound when tapped with a hammer.
  - Spalling: All spalling should be documented and if there is exposed reinforcing, that should be noted along with any section loss associated with it.
  - Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above. Special attention should be given to the through bolt connections.
- Condition of the horizontal arm attachment to the parapet. The attachment should be inspected for corrosion, looseness, and pullout (anchorages). Looseness could be indicative of overloading of the connection hardware or failing of the mechanical or adhesive anchor(s). Often times the connection is performed without leaving proper edge distance and subsequent spalling may occur at the connection. Any spalling should be documented. Inspect the through bolts for signs of overstress, such as deformed washers under the nuts or embedment of the washer and/or nut within the hole (holes through the parapet may be oversized for the bolt assembly).
- Condition of the bridge beam/girder attachments. These attachments are normally bolted connections and should be inspected for corrosion, looseness, and any missing bolt assembly hardware. These connections should not normally be welded to steel girders, but this is sometimes encountered. The welds and the area of the beam/girder immediately around the weld should be inspected as previously discussed for cracking. It should be noted these are typically field welded and result in an AASHTO Fatigue Category E' classification for the bridge girder.

The photographs below present various typical bridge parapet mount structure deficiencies and conditions that could be encountered in the field.

Photo 4.63 *Spalling behind sign attachment to parapet*

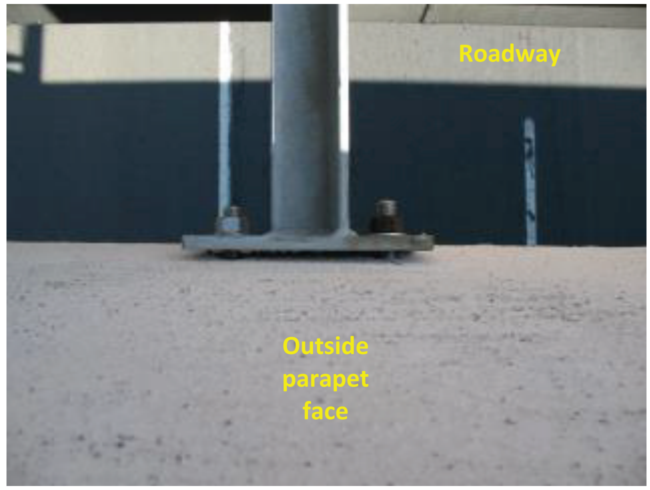


Photo 4.64 *Gap between mounting plate and parapet at sign attachment to parapet*

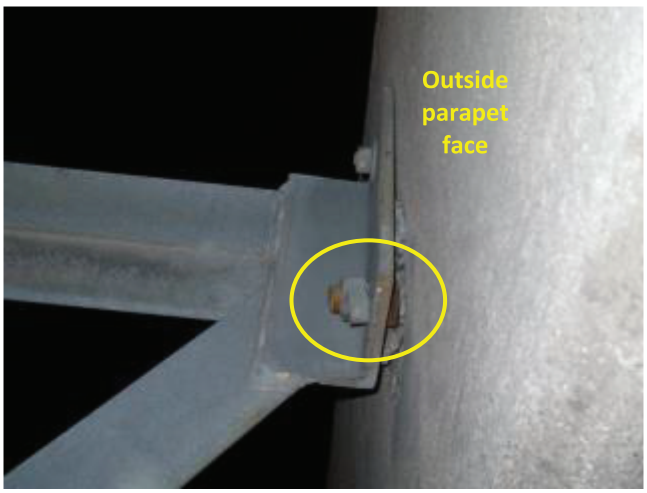


Photo 4.65 *Pull out of anchor bolt at sign attachment to parapet*

Photo 4.66 *Corrosion and minor pitting on through bolt parapet attachment plate (traffic side of parapet)*

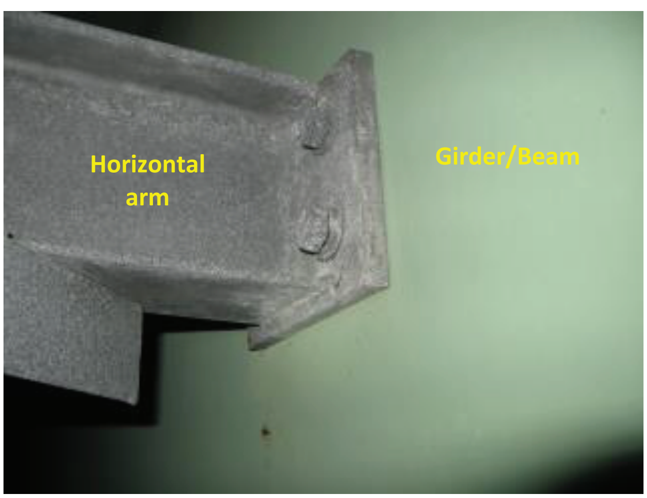


Photo 4.67 *Loose bolt at lower horizontal arm to girder/beam connection*

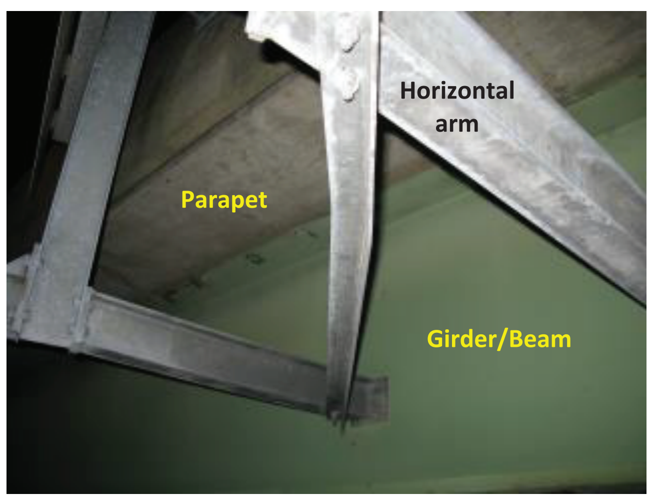


Photo 4.68 *Bent horizontal diagonal*

4.3.3r *Sign Panel: Attachments to Superstructure*

The sign panel attachments to the superstructure should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on the hangers, windbeams, and attachment components, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
- Condition of hangers and windbeams. Hangers and windbeams should be inspected for cracks or breaks in the members or at locations of previous weld repairs. Document location and size of the crack or break.
- Condition of hanger and windbeam splices. Splices should be inspected for loose or missing components, cracked welds and under engaged nuts. Document percent engagement if less than 100%. Gaps between splice plates or flanges should also be measured and documented. Suspected cracks should be verified by NDT.
- Loose, missing, or deformed/misaligned bolted connections or components, and under engaged nuts. Under engaged nuts are to be recorded as percent engaged.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical sign panel to superstructure attachment deficiencies and conditions that could be encountered in the field.

Photo 4.69 *Impact damage to hangers and windbeams*

Photo 4.70 *Missing windbeam to hanger connection*

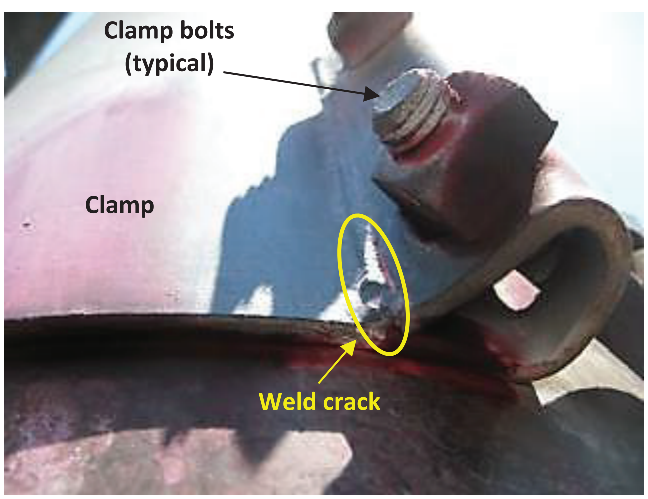


Photo 4.71 *Weld crack (verified with dye penetrant)in hanger to chord connection clamp (two chord truss)*

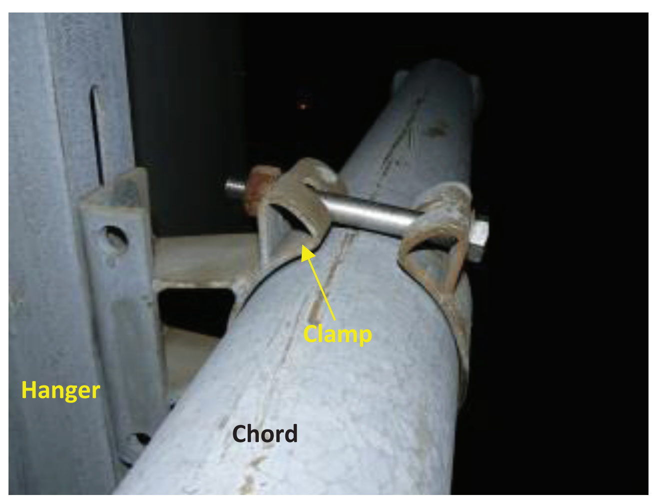


Photo 4.72 *Dissimilar metals (stainless steel bolt and galvanized clamp) at hanger to chord connection clamp (two chord truss)*

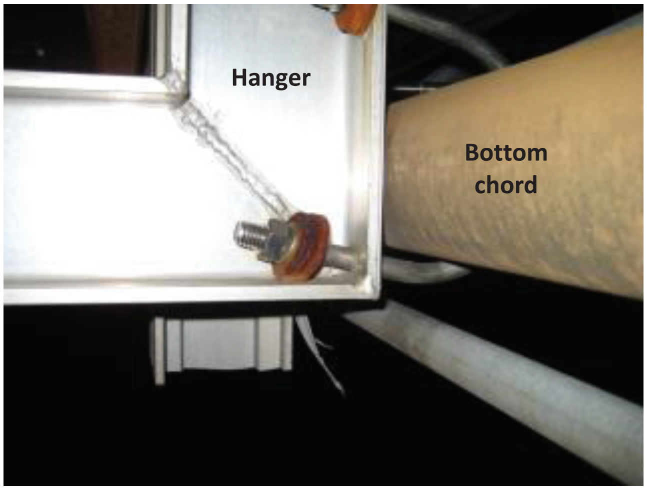


***Photo 4.73** Oversized U-bolts with dissimilar metals (stainless steel U-bolt with mild steel washers) and excess washers at hanger to chord connection*

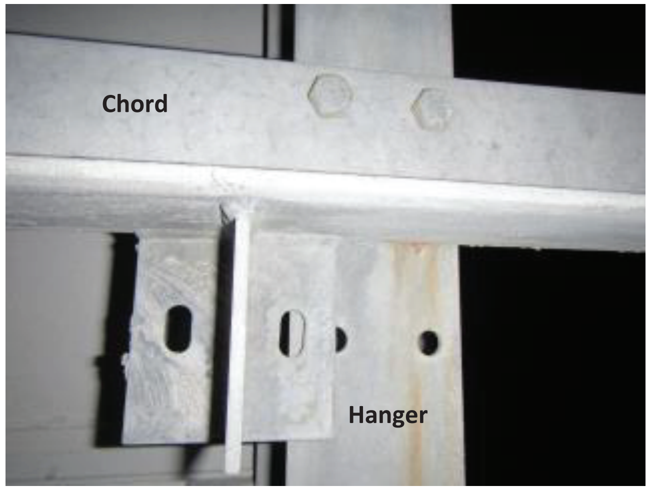


***Photo 4.74** Misaligned hanger to chord connection*

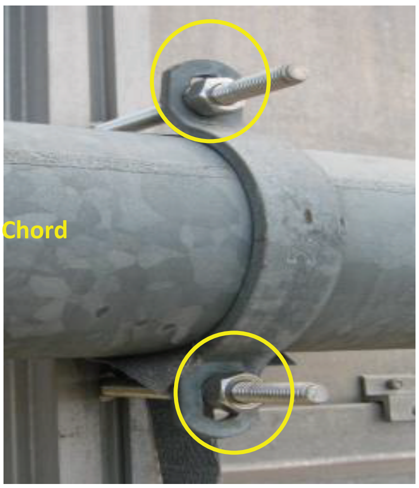


***Photo 4.75** Missing flat washers at hanger to chord connection. Lock washers too small for slotted holes.*

***Photo 4.76** Bent/Twisted hanger from impact damage*

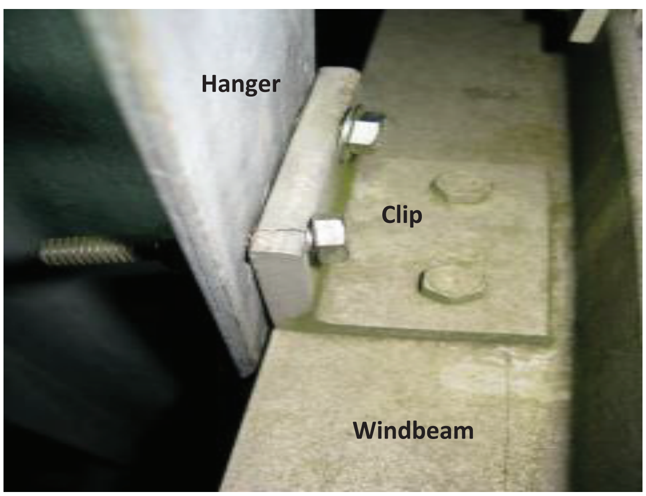


***Photo 4.77** Crack in aluminum angle clip at windbeam to hanger connection*

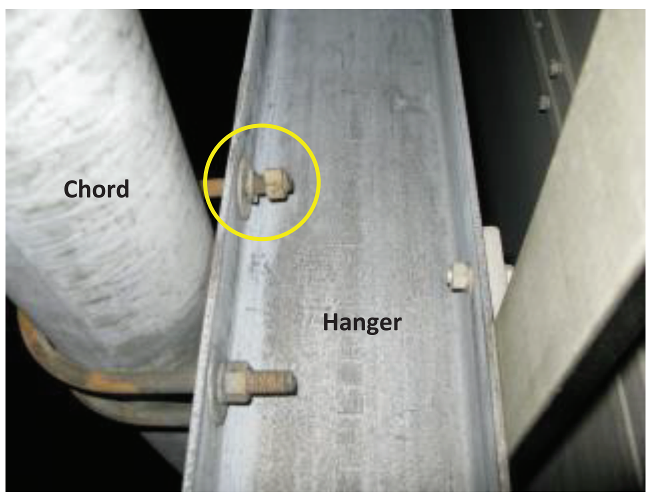


***Photo 4.78** Loose nut on hanger to chord U-bolt*

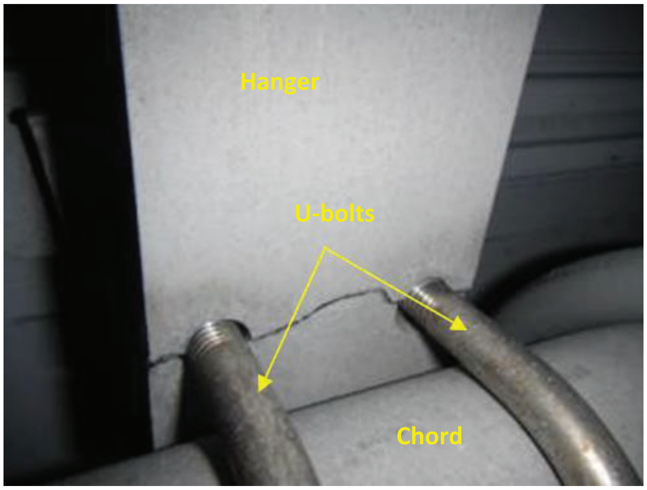


***Photo 4.79** Cracked hanger at hanger to chord connection U-bolt*

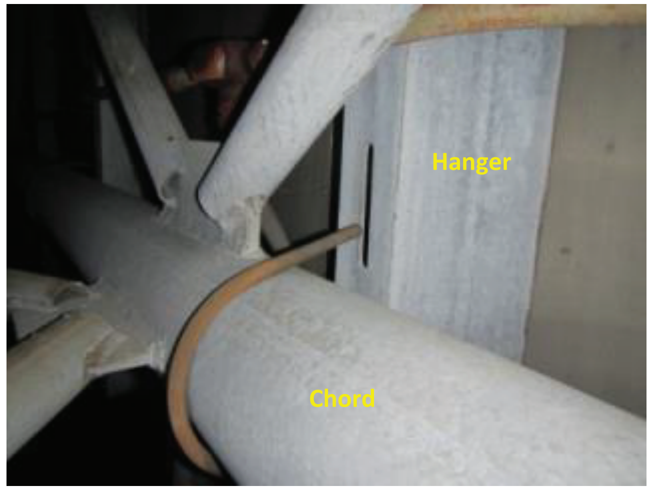


***Photo 4.80** Missing nut on hanger to chord connection U-bolt*

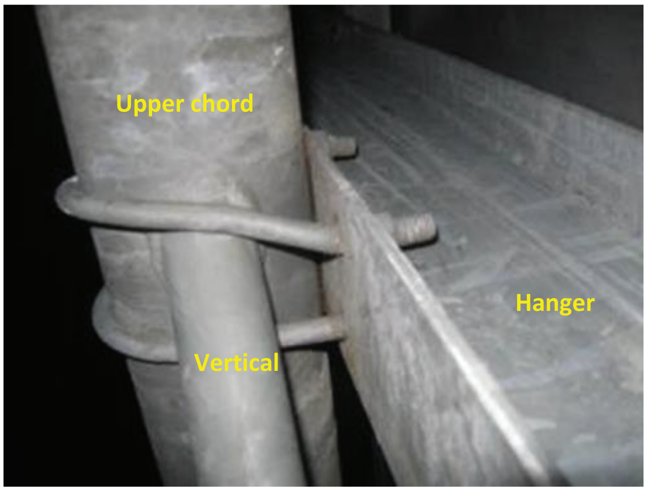


***Photo 4.81** Misaligned and bent U-bolt at hanger to chord connection*

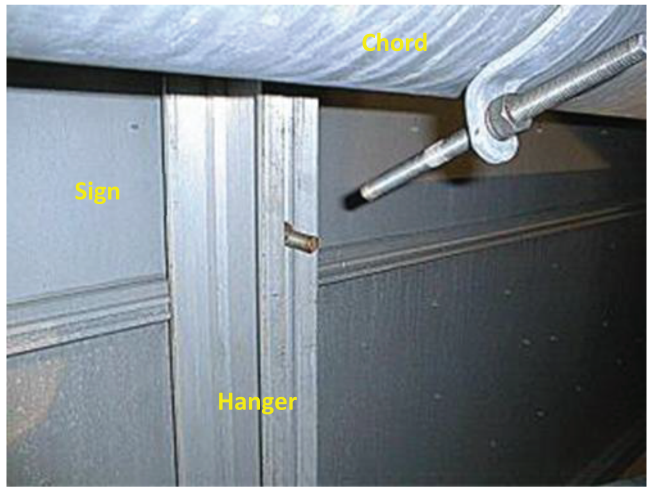


***Photo 4.82** Broken hanger to chord attachment of extruded sign panel*

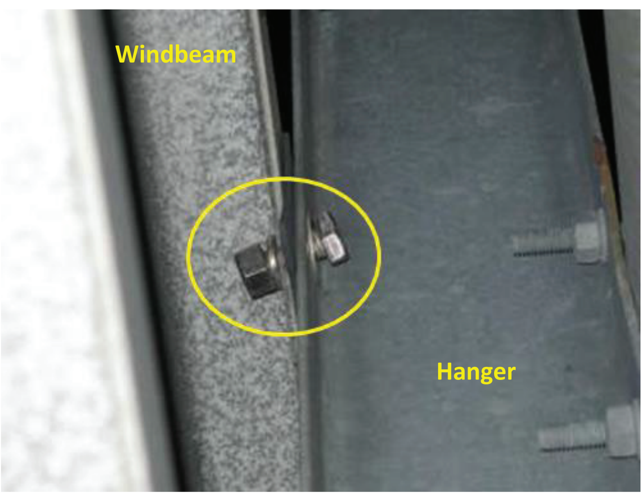


***Photo 4.83** Misaligned and loose bolt at windbeam to hanger connection*

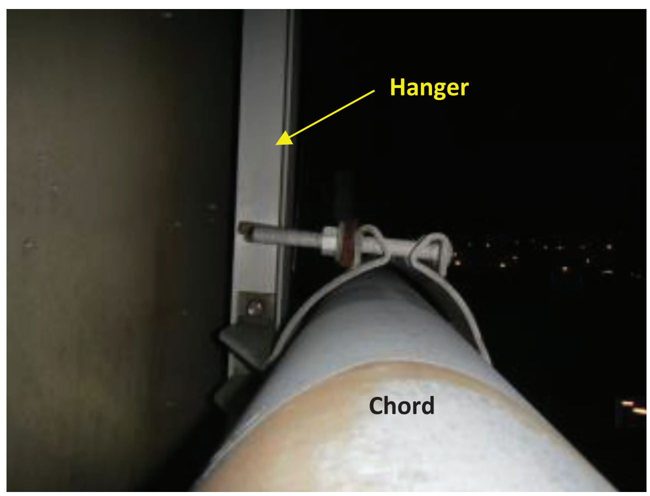


***Photo 4.84** Oversized clamp at hanger to chord connection of double arm trussed sign*

4.3.3s *<u>Sign Panel: Sign Panel Attachments</u>*

The sign panel attachments should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on the attachment components, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
- Condition of through bolts: The presence, number, and condition of through bolts between sign panels and windbeams. The number of through bolts per windbeam should be documented.
- Condition of sign clips. The sign clips should be inspected for sheared studs on the sign panels, and loose or missing stud nuts and set screws. The number of missing studs or nuts, and loose set screws per windbeam should be documented. If through bolting is present for a given sign, reporting of loose or missing sign clips is not required.
- Loose and missing backing strip nuts and studs in each backing strip. Loose or missing backing strip studs or nuts can reduce the stiffness in the edges of the sign panels and increase load in the adjacent studs within the connection. The number of loose and missing nuts and studs are to be quantified and documented for each backing strip.

The photographs below present various typical sign panel attachment deficiencies and conditions that could be encountered in the field.

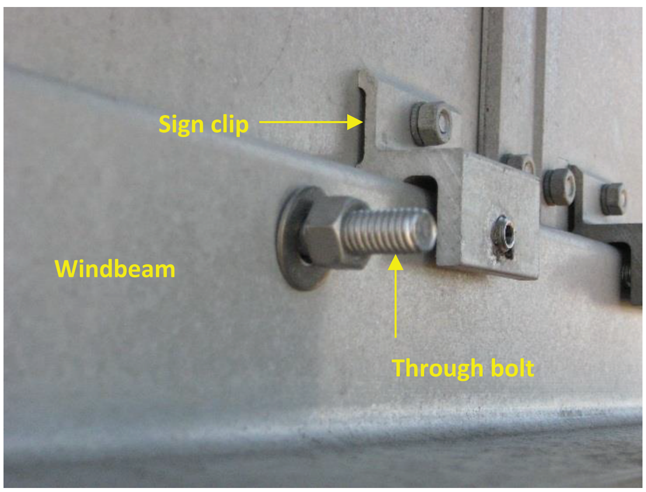


Photo 4.85 *Loose through bolt of sign to windbeam connection*

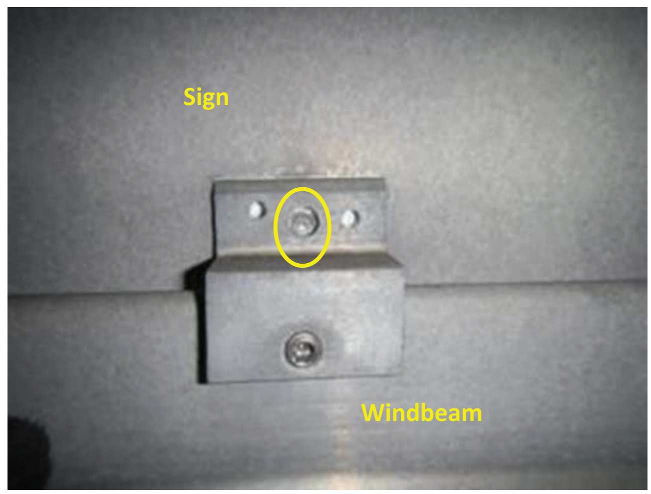


Photo 4.86 *Sheared sign clip stud at sign to windbeam connection*

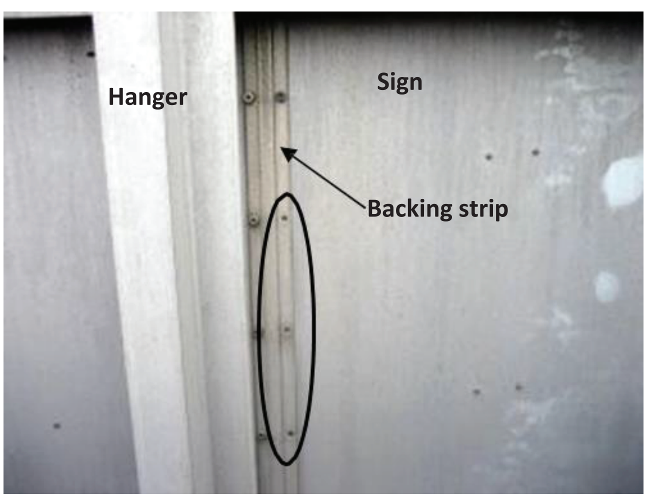


Photo 4.87 *Sheared backing strip studs*

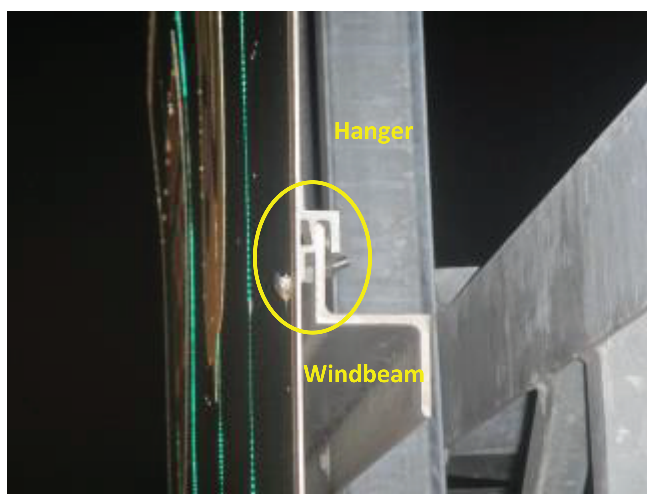


Photo 4.88 *Misaligned sign panel to windbeam through bolt*

Photo 4.89 *Loose through rivet at sign panel to windbeam connection*

4.3.3t *Sign Panel: Zee Bar Type and Extruded Type*

The sign panels should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Corrosion, section loss, etc.
  - If an area of corrosion is observed on any attachment components, the area should be thoroughly cleaned of any rust scale and the amount and extent of section loss should be determined and documented.
- Loose or missing bolts connecting extruded sections. Loose or missing connection bolts can increase the load in adjacent bolts.
- Bullet holes. Bullet holes per sign panel should be documented.
- Cracking, damage, delaminating, peeling, or crazing (network of closely spaced, fine cracks) of the reflective material. Damaged or deteriorated reflective material can affect the legibility of the sign.
- Fading of lettering. Faded lettering can affect the legibility of the sign.
- Impact damage. The affected sign, location on the affected sign, and dimensions of the impact damage are to be documented and the area photographed.

The photographs below present various typical sign panel deficiencies and conditions that could be encountered in the field.

Photo 4.90 *Peeling/Delamination of lettering on sign panel*

Photo 4.91 *Crazing/cracking of sign panel reflective material*

4.3.3u *Sign Panel: Walkways*

Walkways are being removed from all of the Department's overhead sign structures except for VMS structures. Should a walkway be present on a non-VMS structure, the inspector should notify the District Manager of the condition in a timely manner following the inspection. Walkways and safety railings are in use on VMS Structures to allow servicing of the VMS. The walkway should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on any components, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
- Condition of the safety railing. Safety railings should be inspected for damaged and misaligned members.
- Condition of the grating. The grating should be inspected for tripping hazards, uneven grating elevations, misaligned grating sections, or any condition that could pose a hazard to inspection and maintenance personnel.
- Loose, missing, or deformed/misaligned connection hardware.
- Condition of the welded connections. The welds should be inspected for cracking, especially at points of intersecting welds, incomplete or excessively ground, or poor welds that can contribute to stress risers within the weld. The location and size of any weld crack is to be documented. Suspected cracks should be verified by NDT.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical walkway deficiencies and conditions that could be encountered in the field.

Photo 4.92 *Localized corrosion on walkway handrail*

Photo 4.93 *Corrosion on walkway grating support beam and around grating hinge*

4.3.3v *Sign Panel: Luminaire System*

In general, the sign structure inspections do not cover the operational functionality of the structure's lighting or wiring; however, the inspector is required to note anything that may impact or pose a threat to the safety of the public, including motorists, pedestrians, or inspection personnel. In addition, any observed non-functioning component should be documented. The luminaire system including various attachments should be visually inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on supporting members, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
- Luminaire operation and burned out bulbs.
- Cracked, broken, cloudy luminaire covers.
- Moisture accumulation or water in luminaire housings.
- Loose, missing, or deformed/misaligned bolted connections or components, and under engaged nuts at the luminaire hanger to chord connections. Under engaged nuts are to be recorded as percent engaged.
- Condition of electrical conduit, conduit attachments, conduit connections, and conduit to track connections. The conduit should be visually inspected for missing components, breaks, exposed wiring, and corrosion and section loss of connector and attachments. The junction boxes should be inspected for missing covers and exposed and/or broken wiring.

- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical luminaire system deficiencies and conditions that could be encountered in the field.

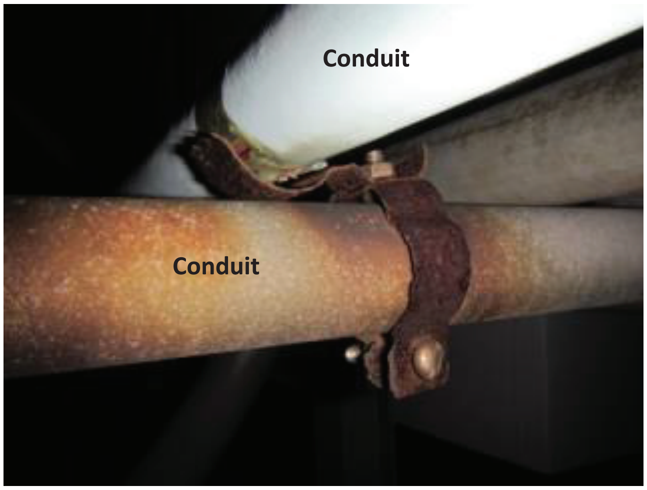


Photo 4.94 *Heavily corroded and broken conduit straps*

Photo 4.95 *Broken conduit with exposed wiring*

Photo 4.96 *Heavy corrosion and section loss on junction box with exposed wiring*

Photo 4.97 *Cracked conduit member*

Photo 4.98 *Open junction box with exposed wiring*

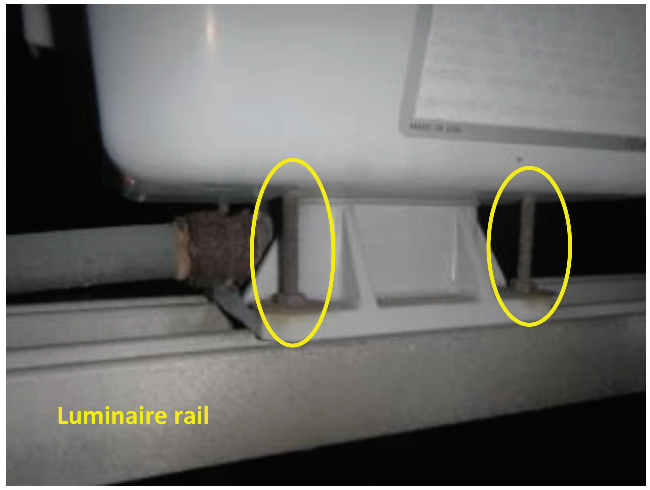


Photo 4.99 *Corroded luminaire housing to luminaire track attachment bolts*

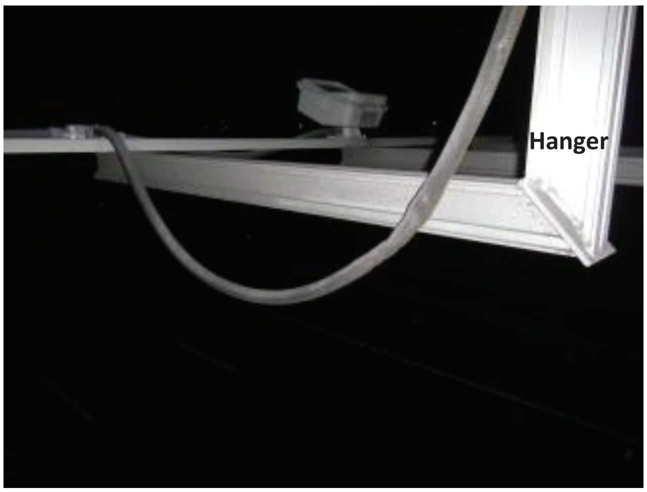


Photo 4.100 *Loose conduit hanging below hangers and reducing vertical clearance*

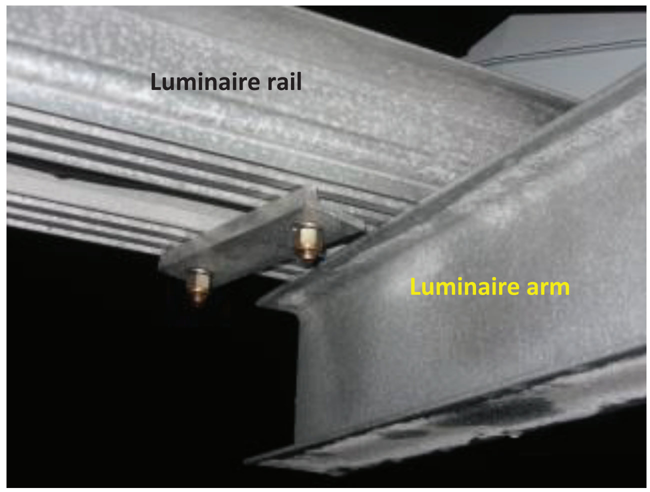


Photo 4.101 *Loose luminaire rail clip at rail to luminaire arm connection*

4.3.4 Conditions Preventing Inspection

A best attempt should always be made to complete the inspection. However, in some cases, conditions may be encountered that prevent inspection. A few examples of such conditions include structures buried more than 12", hand hole covers which cannot be removed, or excessive debris within hand holes. The condition is to be reported to the District Manager so that the condition preventing inspection can be resolved, allowing inspection to proceed. The notification shall be provided via email complete with a written description(s) and photograph(s) of the finding. The notification should be provided at the end of the week in which the finding was made, along with any similar findings made throughout the week. However, if conditions warrant immediate response, the condition should be reported immediately. Conditions that would warrant immediate response include observable corrosion, damage, and/or section loss. After resolution of the condition that was preventing inspection, an inspection should be performed as soon as possible.

4.3.5 Departure from Site

Prior to departing the site of an inspected sign structure, the Team Leader should review the inventory information and inspection findings for clarity, accuracy, and completeness. A good practice is for the inspector to prepare a basic inventory and inspection checklist prior to the inspections, to use in the field to ensure that all necessary information is captured. In addition, a walk-through of the inspection site should be made to ensure that all equipment has been collected and stored in the inspection vehicle. Lastly, the Team Leader should review the next structure and the MOT requirements with the MOT crew. Should the inspections be completed for the day or evening, the Team Leader should contact the appropriate Smart Traffic or Traffic Operations Center to notify them that inspection operations have ceased for the day or evening.

4.4 Critical and Emergency Structural Findings

Critical and Emergency findings are those findings that present an imminent structural or safety risk or immediate hazard, respectively, to the structure and/or traveling public. These conditions are further defined and discussed below.

4.4.1 Critical Findings

Critical Findings are defined as imminent conditions that could, if left unresolved, result in localized or complete failure (collapse) of the structure, or present a safety issue to the traveling public, and should be addressed within 90 days of its discovery. Should any such condition be encountered, it shall be reported to the District Manager within 24 hours of the discovery of the finding. A notification shall be provided via email complete with a written description(s) and photograph(s) of the finding.

4.4.2 Emergency Findings

Emergency Findings are defined as conditions that are deemed to pose an immediate safety risk or hazard to the structure's integrity and/or the traveling public and require immediate attention and corrective action. Should any such condition be encountered, the Team Leader shall contact the appropriate District Manager while on-site to notify them of the condition. In the case of an Emergency Finding, contact is normally initiated by telephone call and followed up the same day with email documentation of the findings, including photographs. Once contacted, the Department will work with the Team Leader to quantify and assess the situation to determine if it warrants an emergency response or can be addressed through the critical recommendation process.

4.4.3 Critical and Emergency Findings through Combination

In some cases, several less-than-critical deficiencies may exist which together may create a critical or emergency situation. As an example, a pole may be rated poor due to a dent and bowing. However, if the inspector believes that the bowing is being exacerbated by the dent, he/she may assess the overall condition as critical. The inspector shall use their judgment to identify combinations of deficiencies that would be deemed critical or emergency.

4.4.4 Common Critical Findings

The following items/criteria are typical conditions that qualify as critical conditions; however, the inspector should use sound judgment in determining if any other deficiencies, or combination of deficiencies, exist that could qualify as a critical or emergency condition. As stated above, any emergency findings shall be reported immediately to the appropriate District Manager to notify them of the condition(s).

4.4.4a Pedestal

- Observable movement or rotation.

4.4.4b Anchor Bolts

- 30% or greater section loss of 1 or more anchor bolts.
- Any anchor bolts that are broken, sheared, or cracked.
- Any anchor bolt(s) having any relevant indications detected by ultrasonic testing.
- 1 of 4, 2 of 6, or 3 of 8+ top or leveling nuts loose or missing.
- 2 of 4, 2 of 6, or 3 of 8+ top or leveling nuts which are not fully seated with a gap under the nut which has a height of 4% of the anchor bolt diameter or greater.
- 2 of 4, 2 of 6, or 3 of 8+ out of plumb anchor bolts which have a slope equal to or greater than 1:40.
- 2 of 4, 2 of 6, or 3 of 8+ anchor nuts that are less than 75% engaged.
- 1 of 4, 2 of 6, or 3 of 8+ top or leveling flat washers are missing where slotted/oversized holes exist and the nuts are embedded into the hole.

4.4.4c Grout

- Grout is deteriorated, no leveling nuts present.

4.4.4d *Poles and Base Plates*

- Structural members having one or more areas of 25% or greater section loss.
- Any cracks in the base plate, vertical stiffeners, hand hole, pole, welded joints, base plate or vertical stiffener to pole weld, truss members, or truss to pole welds where likely to propagate into the pole.
- Impact damage to any structural member in which the member is in danger of falling.
- Loose, missing, broken, or heavily deteriorated attachments to the pole (signs, cameras, sensors, etc.) in which the attachments are in danger of falling.

4.4.4e *Cantilever or Overhead Span Superstructure*

- Structural members having one or more areas of 25% or greater section loss.
- 25% or more bolts or nuts in a single chord to pole connection are loose or missing.
- 30% or more bolts or nuts in chord to pole tension connection are loose or missing.
- 30% or more bolts or nuts in chord tension splice are loose or missing.
- Any cracks in the chords, chord to pole connection plates, splice plates or welds, or truss to chord welds where likely to propagate into the chord.
- Impact damage to any structural member in which the member is in danger of falling.

4.4.4f *Bridge Parapet Mounted Structure*

- Structural members having one or more areas of 25% or greater section loss.
- Loose, missing, or broken bolts or nuts at primary structural member connections (e.g. horizontal to vertical connection).
- Any cracks in the primary structural member components welds (e.g. horizontal to vertical connection).
- Impact damage to any structural member in which the member is in danger of falling.

Attachment to Parapet

- Adhesive or expansion anchorage in the parapet is loose or missing.
- 30% or more of the total anchorage hardware to the parapet is missing or broken.
- 40% or more of the total anchorage hardware to the parapet is loose.

Attachment to Bridge Beam/Girder

- Any cracks in the bridge beam/girder at the connections.

4.4.4g *Signs and Structure Connections and Other Attachments*

- 50% or more of the sign or other attachment to chord connection bolts are loose or missing.
- 50% or more of the hanger to windbeam connection hardware is loose or missing.
- Impact damage to any sign panel in which the member is in danger of falling.
- Loose, missing, broken, or heavily deteriorated connection components of other attachments (cameras, antennae, sensors, etc.) in which the attachments are in danger of falling.

4.4.4h *Walkways and Lighting*

- Structural members having one or more areas of 50% or greater section loss.
- Loose, missing, broken, or heavily deteriorated luminaire, conduit, or rail connection hardware in which the components are in danger of falling.
- Loose, missing, broken, or heavily deteriorated walkway members, railing, connection, or grating in which the components are in danger of falling.
- Impact damage to any walkway or lighting components in which the components are in danger of falling.

4.5 Non-Structure Related Emergencies

In addition to structural emergencies (critical findings), medical emergencies are potential events which could occur during the inspection/inventory of a structure. The inspection team should be aware of the following potential emergencies:

- Vehicular accident. The close proximity to live traffic creates the potential for an accident/injury.
- Electric shock. Overhead power lines as well as energized electrical wires on the structure could cause an electric shock if inadvertently contacted. Inspection teams shall follow all pertinent VDOT and OSHA electrical safety guidelines.
- Fall hazard. The potential for a fall related injury is present with the use of aerial equipment. Similarly, to the bullet above, inspection teams shall follow all pertinent VDOT and OSHA fall protection guidelines.
- Cuts/burns. The equipment used to perform the inspections can cause cuts and or burns if an accident were to occur.

The above items are examples of emergency situations that could occur while in the field. Each structure presents its own risks. Prior to inspection, the Team Leader should address all concerns and determine a course of action should a situation arise. This typically involves a hazard analysis along with development of an emergency action plan documenting nearby emergency medical and rescue facilities along with telephone numbers. Should a piece of aerial equipment malfunction, aerial rescue may also become an emergency. All inspection vehicles should be equipped with a first aid kit. If there is an emergency, 911 should be called to assist all injured parties. It is very important that all Team Members know the location in which they are working, in order to direct emergency personnel on-site in a timely fashion. One or more inspectors shall have a mobile telephone in addition to other computer devices being used for the inspection work.

4.6 Inspection Conventions and Numbering

4.6.1 Structure Numbering and GPS Coordinates

The structure numbering convention, numbering format, size of the numbers, and location of the structure number on the sign structure, as well as the location and format for collecting and recording the GPS coordinates is presented below.

4.6.1a Structure Numbering Convention

A 11-digit structure number shall be used for the identification of all structures. The structure number consists of a 3-digit county code followed by a 5–digit structure number. Leading zeroes are used as needed. The number for each structure is to be provided by the District Manager.

4.6.1b Painting/Stenciling of Structure Numbers

1. Height of numbering: The stenciled numbers shall be 2" high and have a 1" space between the numbers.
2. Stenciling paint shall be highly durable and weatherproof with a UV inhibitor. The color of the paint shall be black or deep brown. For dark colored painted poles, light grey can be used, and yellow can be used for timber poles. As an alternative to painting the number, reflectorized panels or numbers may be applied to the structure. Reflectorized panels shall be placed in the same location that numbers would have been otherwise painted. The numbers on the reflectorized panel shall be of the same height and spacing as described for stenciling.
3. Location of 11-digit structure number:
   a. Bridge parapet mount sign structures: Number shall be placed horizontally, 2" (+/-) below the top of parapet on the face of parapet. The number shall be placed on the top rail when no parapet is present. The identification number shall be centered along the sign panel(s). The number shall not be placed on the sign. Structure numbers are required for each individual structure. Some connections to bridges have a single structural system that supports multiple signs. For this situation, a single structure number is required. For multiple signs where each sign is supported by its own structure, a structure number is required for each sign mount.
   b. All other structures: The number shall be placed at an elevation that makes the bottom number a minimum of 6" above the top of the adjacent guardrail/barrier. When no guardrail/barrier is present, the number shall be placed 36" (+/-) above the top of the anchorage. Lettering shall be placed vertically on the pole so as to be visible from oncoming traffic.
4. Existing 7-digit numbers presently located on a structure shall be replaced with the 11-digit alphanumeric code at the time of the next regular or base inspection. The three-letter prefix (alpha portion) may be stenciled at the District's discretion. See Appendix A, Section A.3.2, Item Code ATT03.

4.6.1c GPS Coordinates

For single pole structures, coordinates shall be obtained at the pole.

For overhead span structures, coordinates shall be obtained at the rightmost pole.

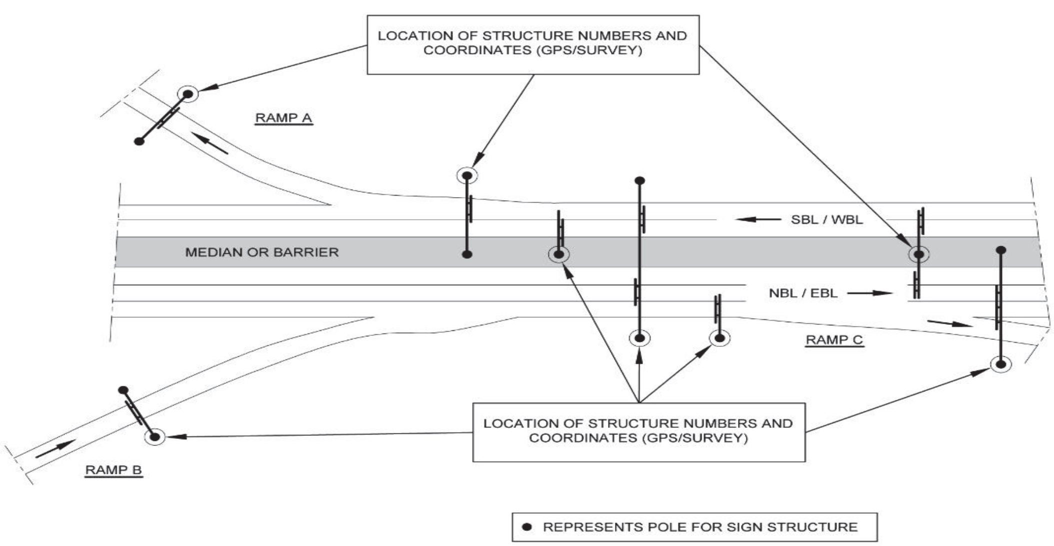
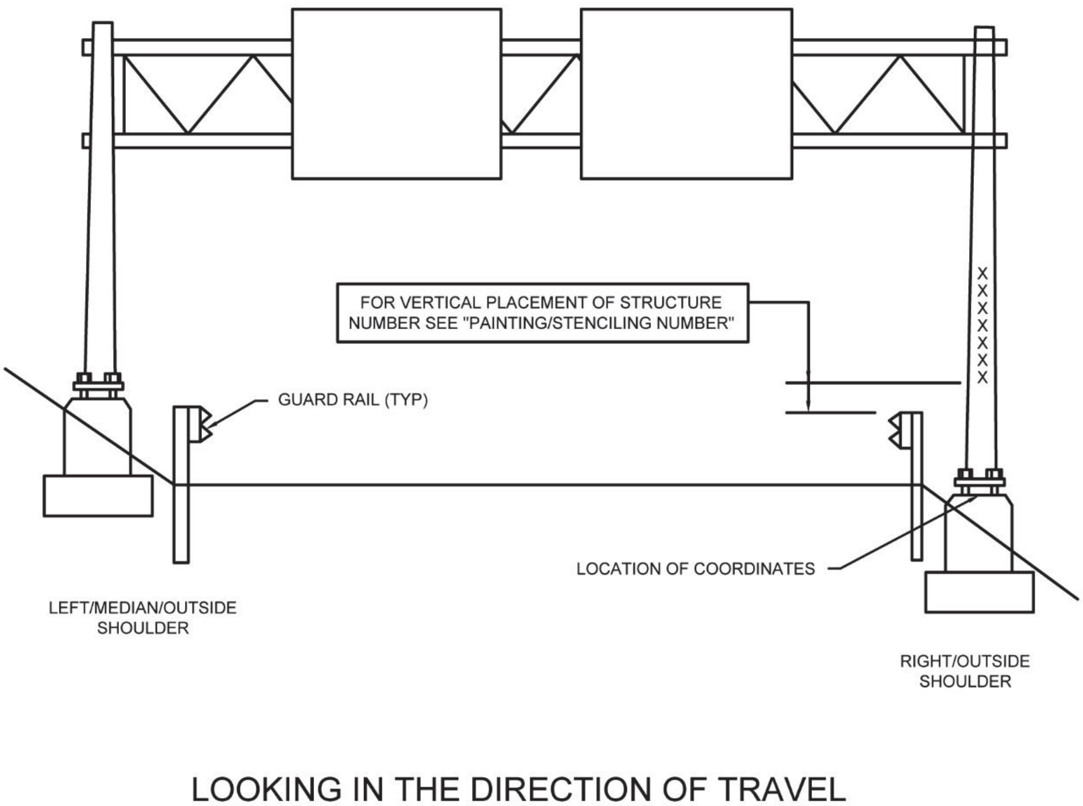


Figure 4.13 *Overhead Span Sign Structures, Number and GPS Locations, Overall (Single Direction of Traffic and Double Direction of Traffic)*



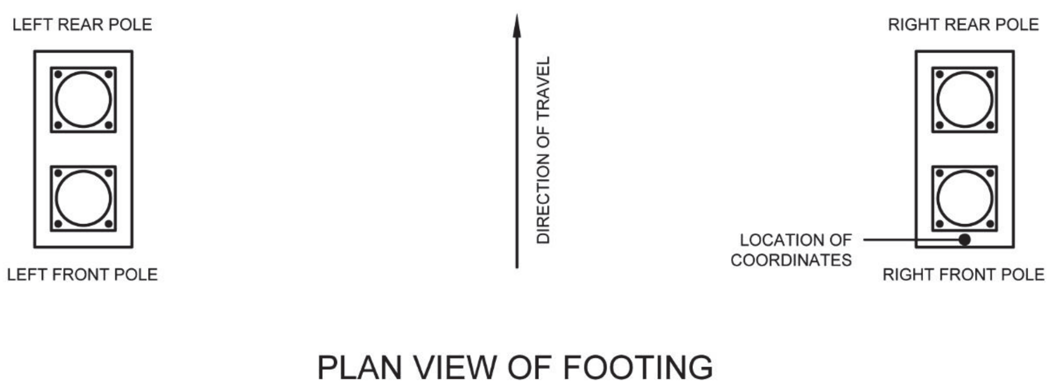


Figure 4.14 *Overhead Span Sign Structures, Number and GPS Locations, At Structure (Looking in Direction of Travel)*

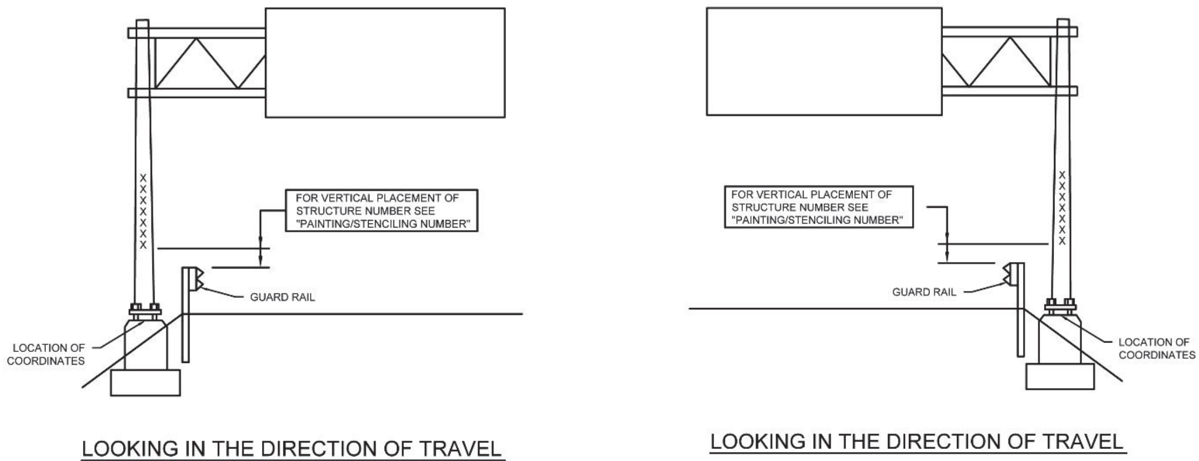


Figure 4.15 *Cantilever Sign Structures, Number and GPS Locations, At Structure (Looking in Direction of Travel)*

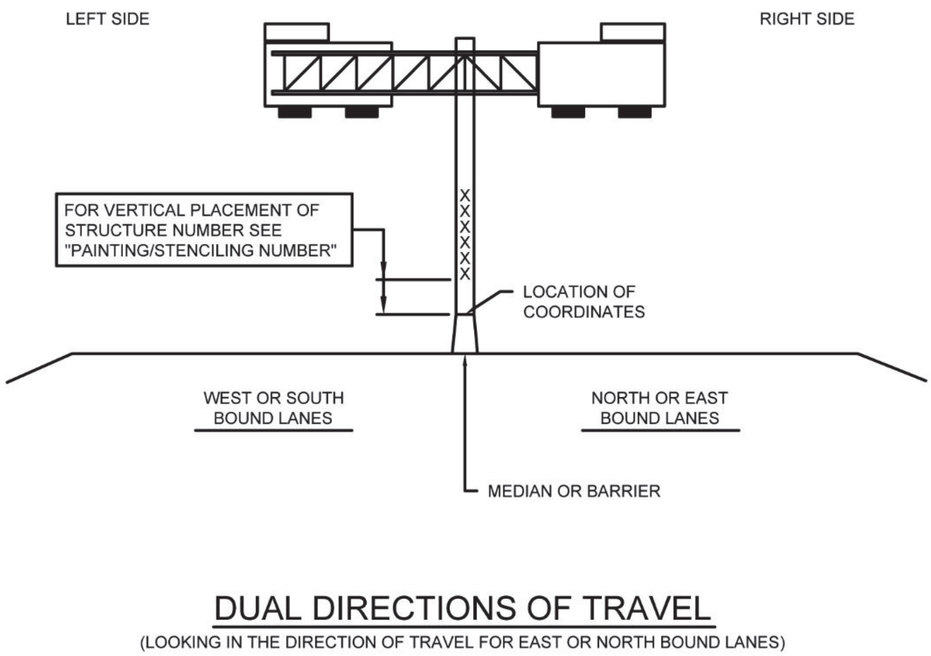
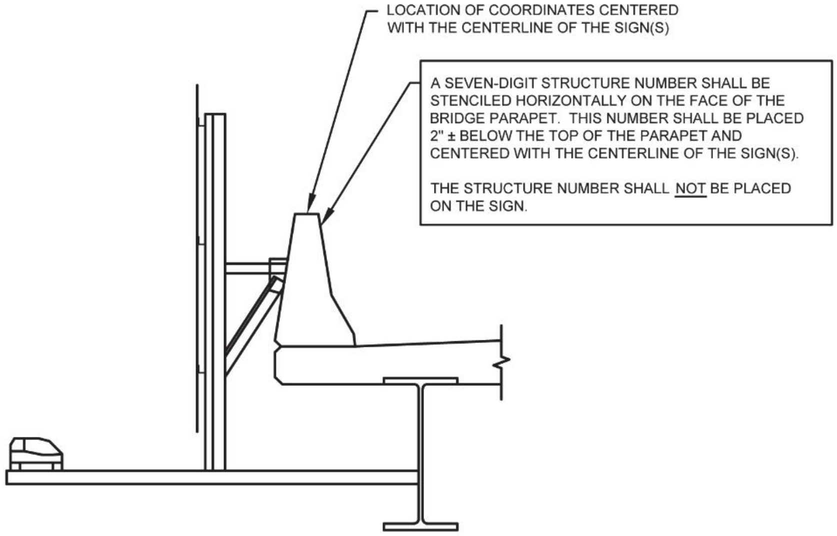


Figure 4.16 *Butterfly Sign Structures, Number, and GPS Locations, At Structure (Looking in Direction of Travel)*



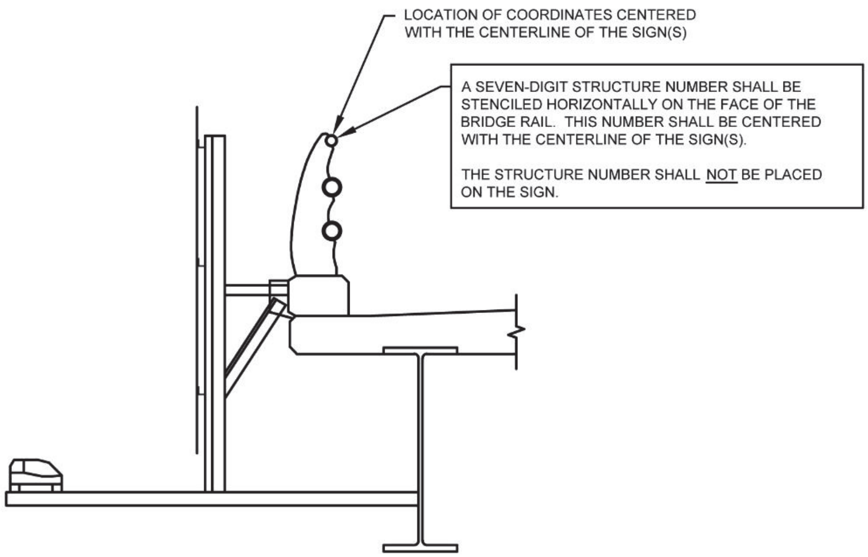


Figure 4.17 *Bridge Parapet Mount Sign Structure, Number and GPS Locations*

4.6.2 Lane Numbering

Lane numbering is critical to accurately recording inventory information and defining locations for recording various inventory and inspection findings. For the lane numbering convention to be used on sign structures typically encountered in the field, refer to Figures 4.18 through 4.20.

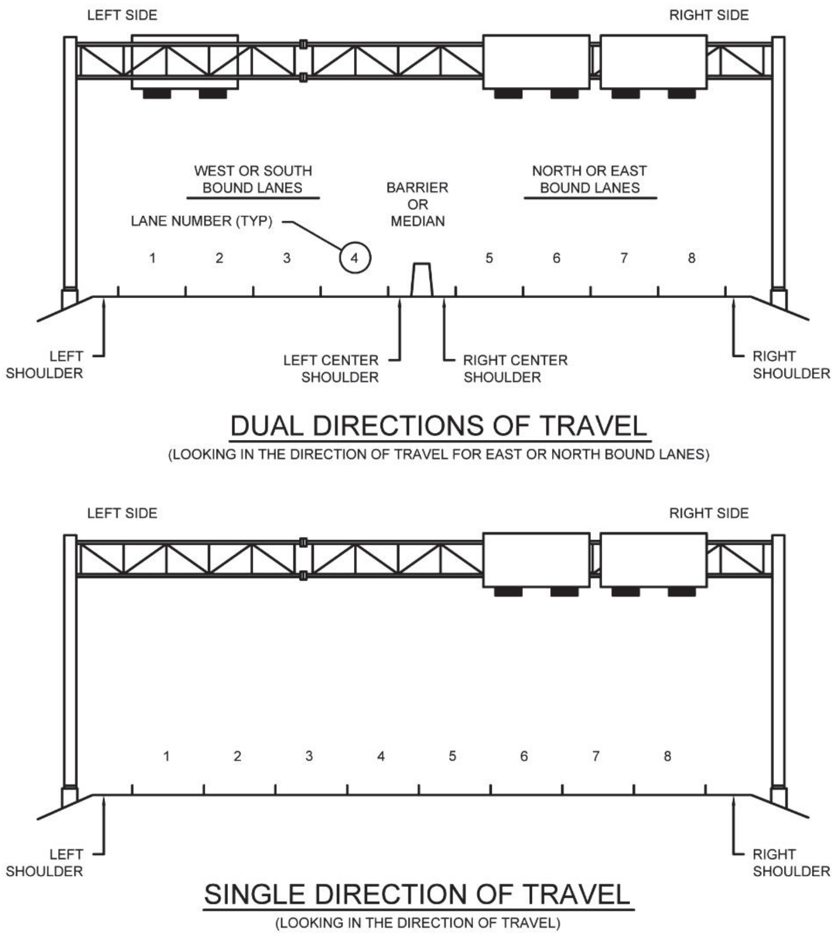


Figure 4.18 *Methodology for Lane Numbering of Overhead Span Sign Structures*

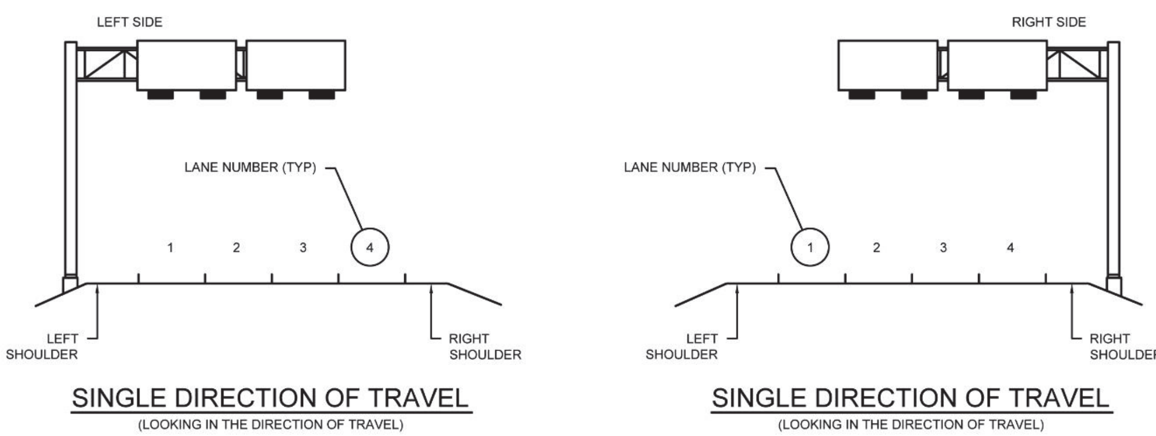


Figure 4.19 *Methodology for Lane Numbering of Cantilever Sign Structures*

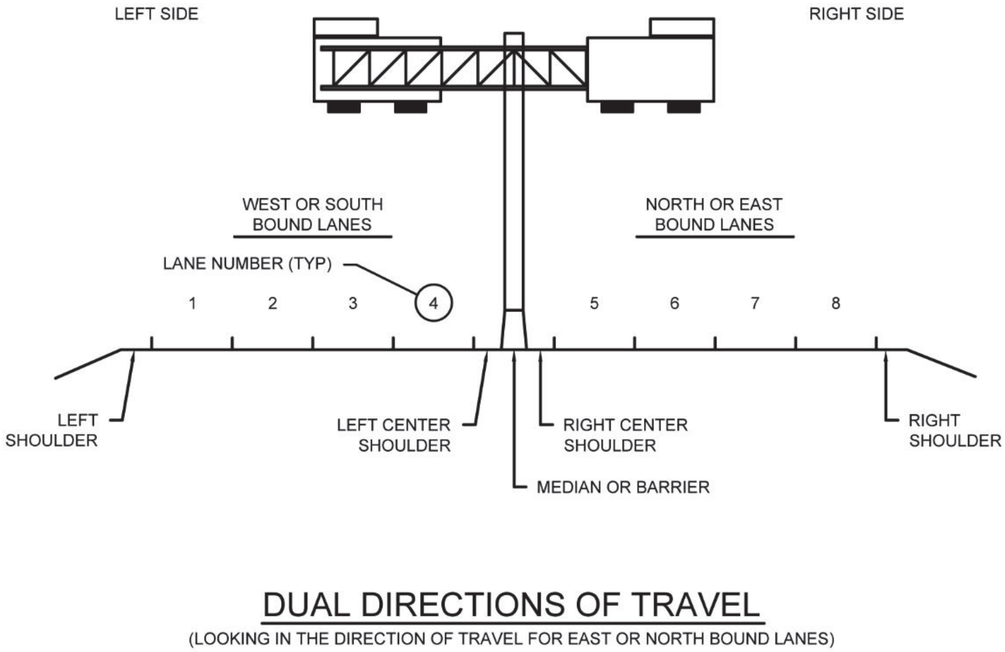


Figure 4.20 *Methodology for Lane Numbering of Butterfly Sign Structures*

4.6.3 Sign and Structure Component Inspection Numbering/Labeling Methodology

Numbering/labeling of signs and sign structure components is critical to accurately recording inventory information and defining locations for recording various inventory and inspection findings. For the numbering sign panels, the numbering begins at the top left end of the structure (looking in the primary direction of travel) and increases towards the bottom right end of the structure. Sign panels shall only be numbered if they contain windbeams and/or hangers. Sign panels that contain no windbeams and are attached to the structure with only fasteners or clamps, such as informational signs, shall not be numbered.

For structure component numbering, horizontal structure component numbering begins at the left end of the structure (looking in the primary direction of travel) and increases towards the right end of the structure. Vertical structure component numbering begins at the top of the structure and increases to the bottom of the structure. For the numbering/labeling to be used on sign structures, refer to Figures 4.21 through 4.36.

4.6.3a *<u>Sign and Sign Structure Component Numbering/Labeling Methodology</u>*

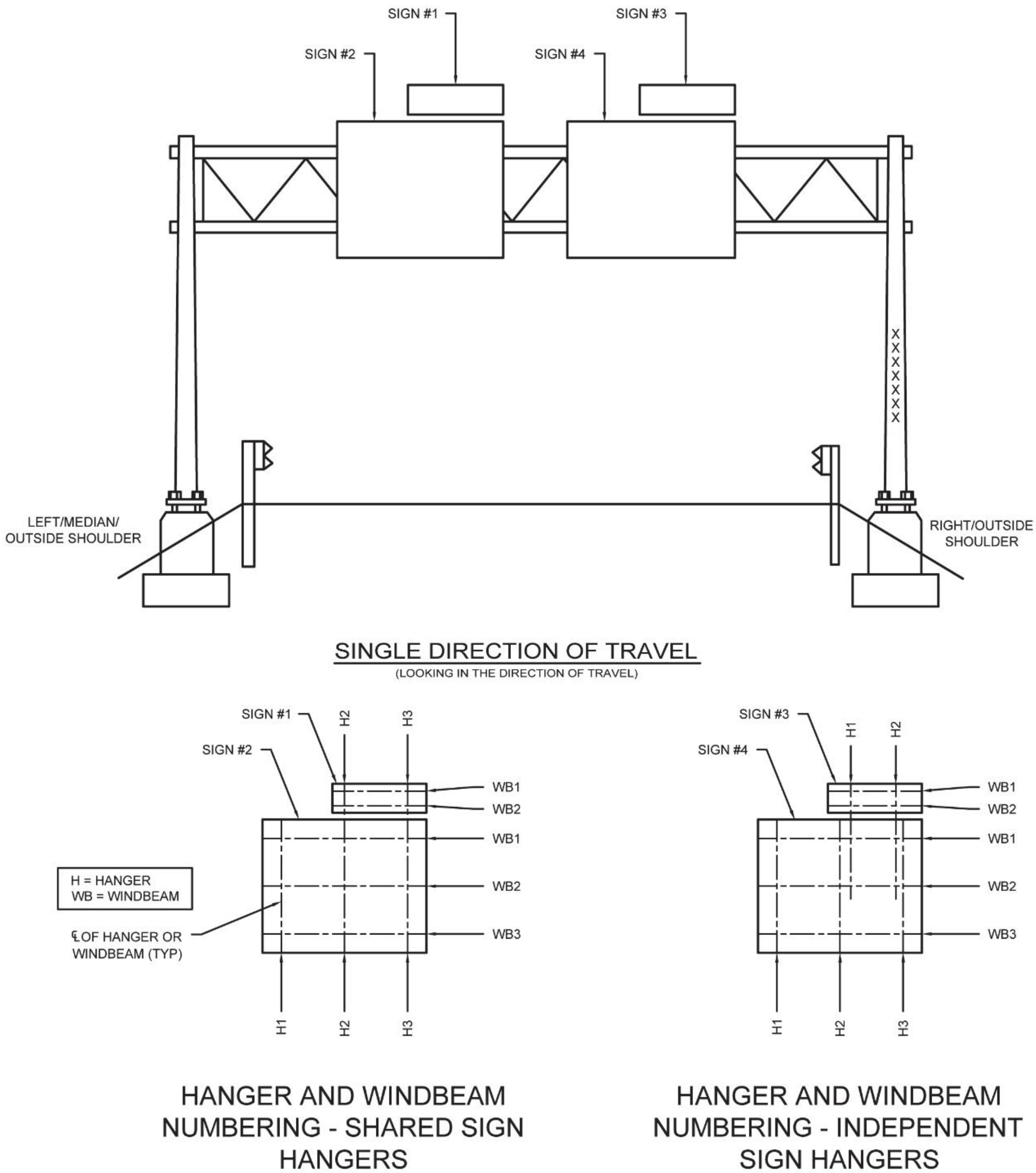


Figure 4.21 *Methodology for Sign Panel and Component (Windbeam/Hanger) Numbering of Overhead Sign Structures without a Median or Barrier*

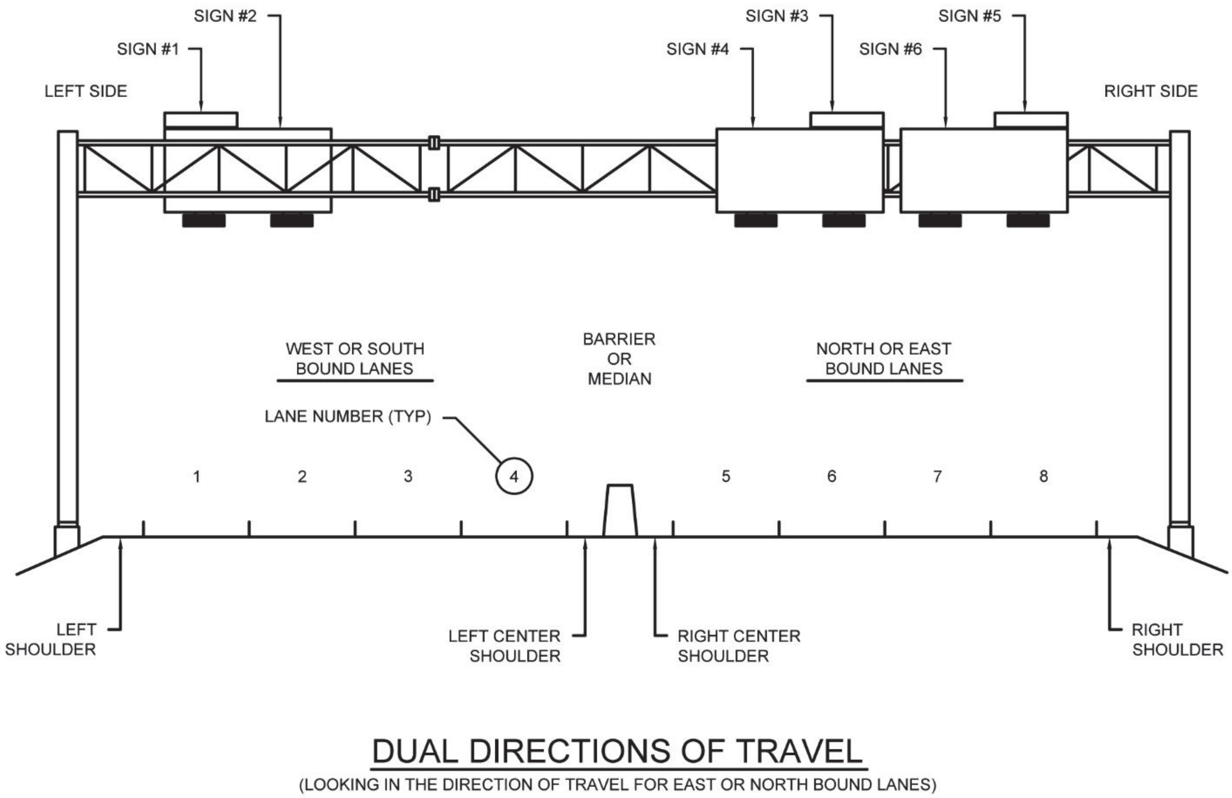


Figure 4.22 *Methodology for Sign Panel Numbering and Pole Labeling of Overhead Span Sign Structures with Median or Barrier*

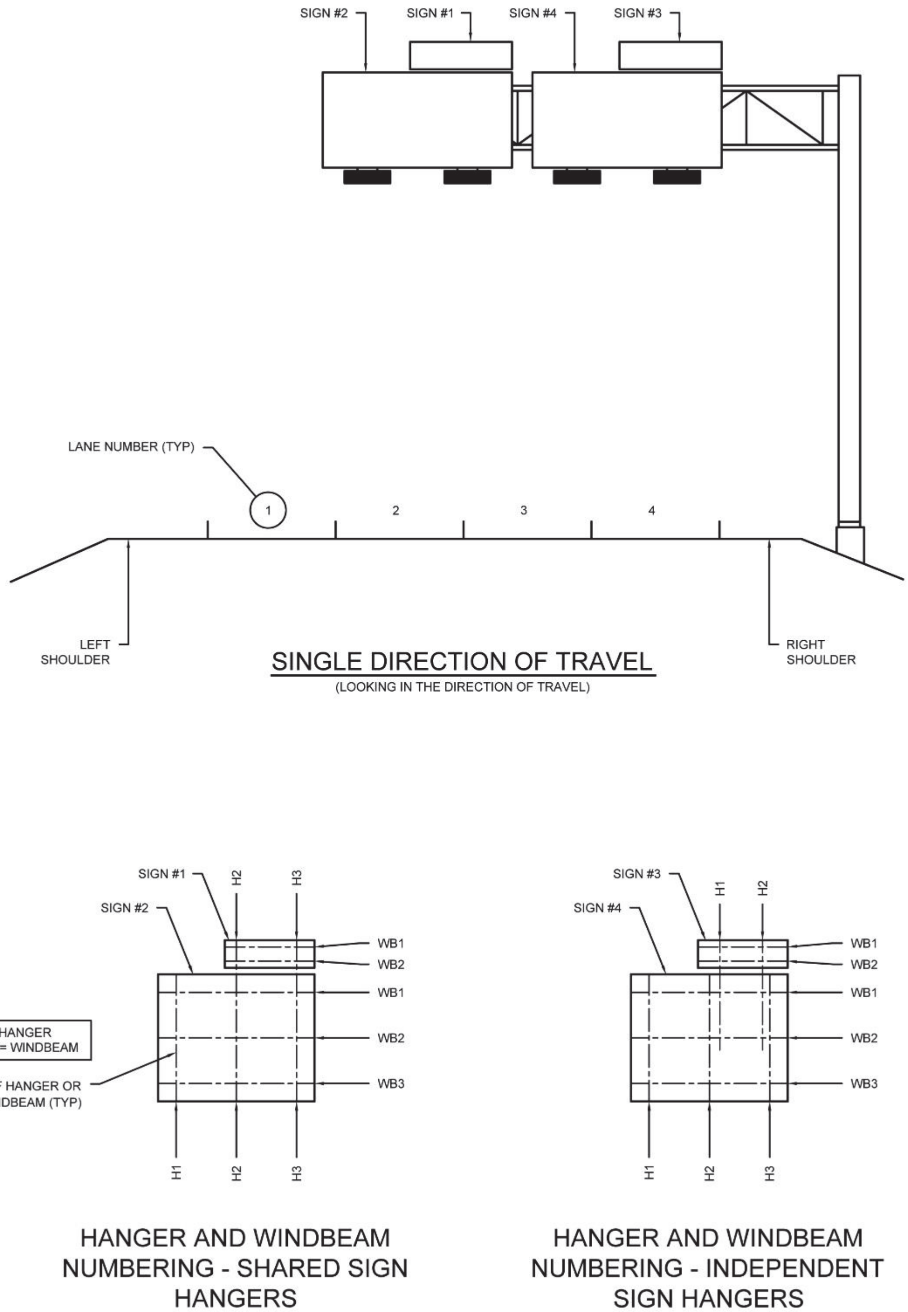
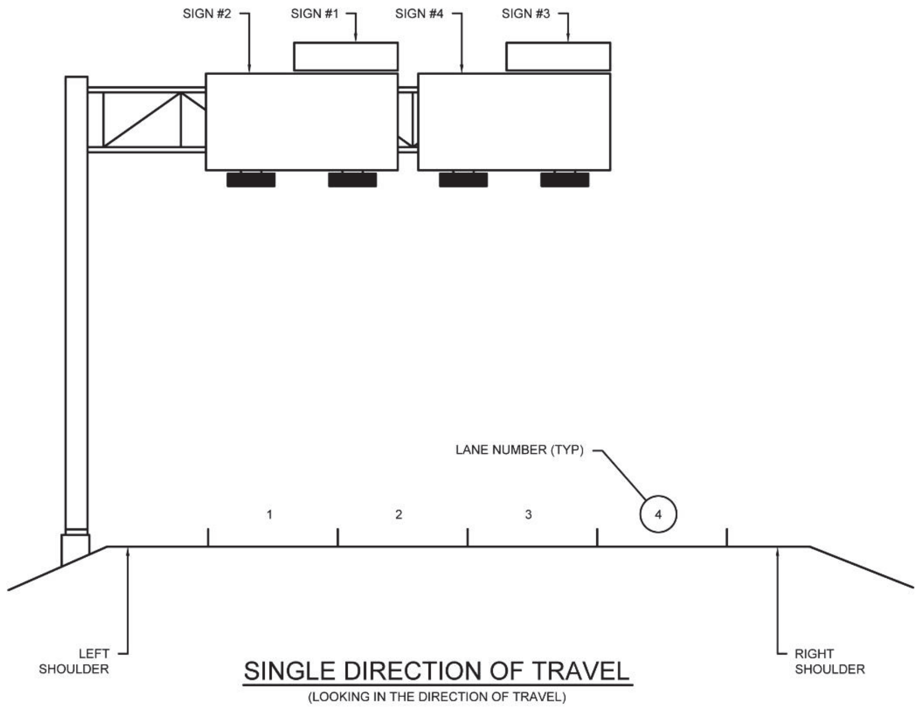


Figure 4.23 *Methodology for Sign Panel and Component (Windbeam/Hanger) Numbering of Right Side Cantilever Sign Structures without a Median or Barrier*



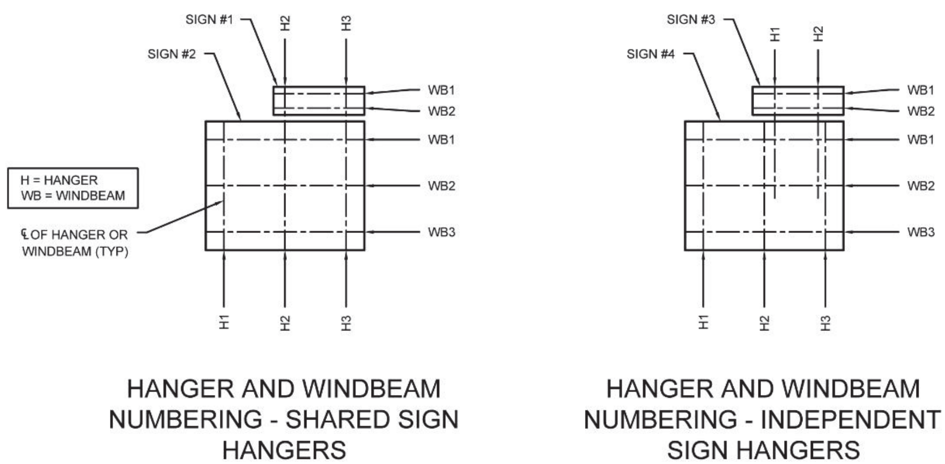
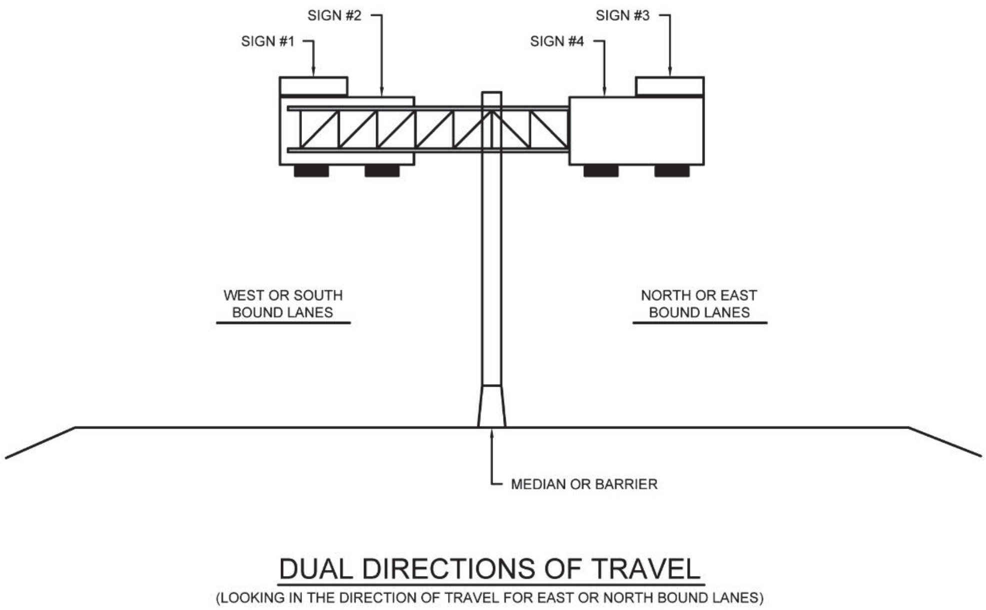
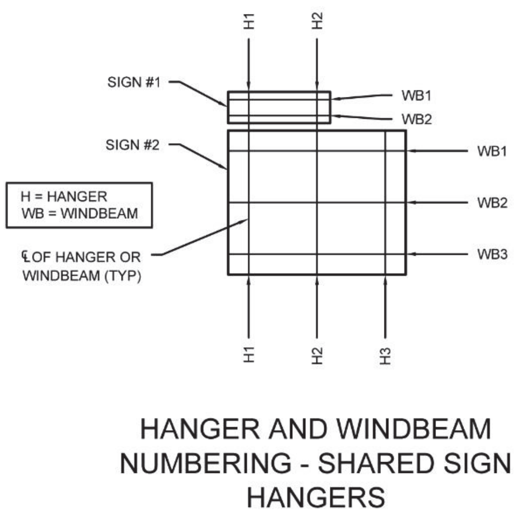


Figure 4.24 *Methodology for Sign Panel and Component (Windbeam/Hanger) Numbering of Left Side Cantilever Sign Structures without a Median or Barrier*





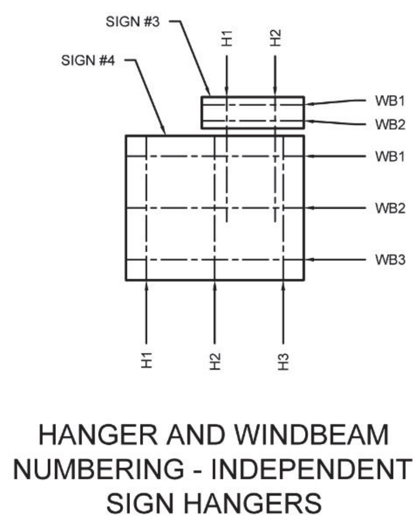


Figure 4.25 *Methodology for Sign Panel and Component (Windbeam/Hanger) Numbering of Butterfly Sign Structures without a Median or Barrier*

4.6.3b Pole Component Numbering/Labeling Methodology

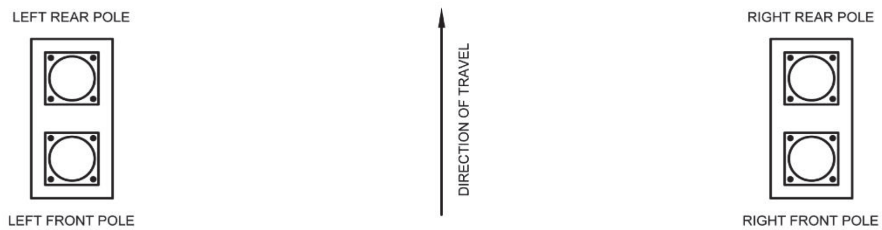


Figure 4.26 *Methodology for Pole Labeling of Overhead Span Sign Structures without a Median Barrier*

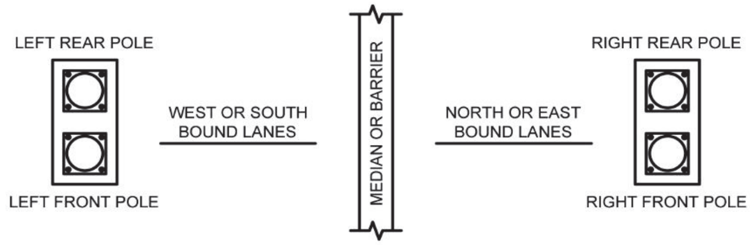


Figure 4.27 *Methodology for Pole Labeling of Overhead Span Sign Structures with a Median Barrier*

4.6.3c Panel Point Numbering/Labeling Methodology

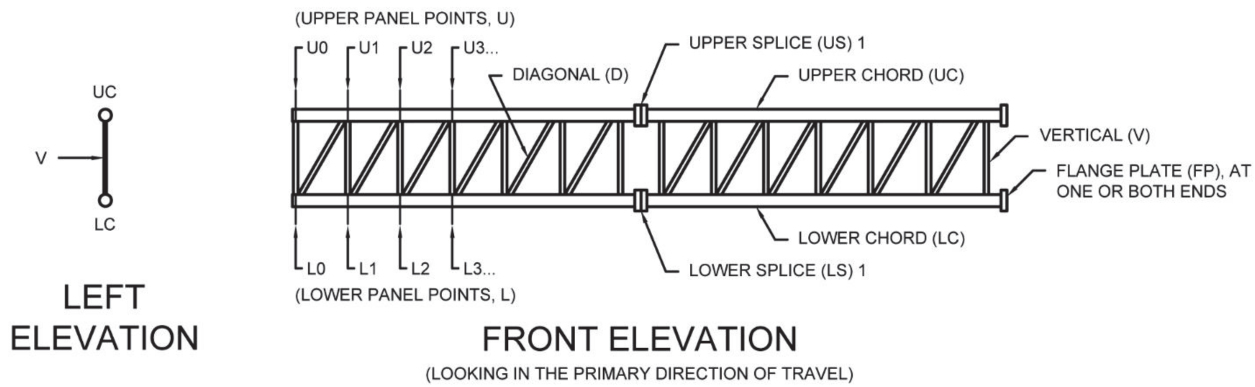


Figure 4.28 *Methodology for Panel Point Numbering and Component Labeling of Two Chord Truss Sign Structures with Splices*

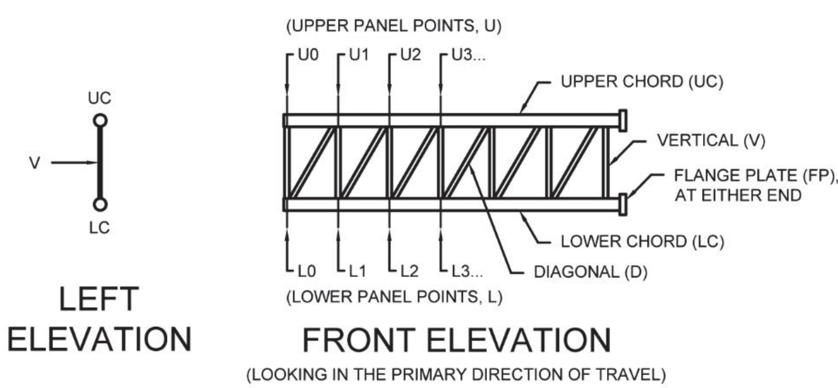


Figure 4.29 *Methodology for Panel Point Numbering and Component Labeling of Two Chord Truss Sign Structures without Splices*

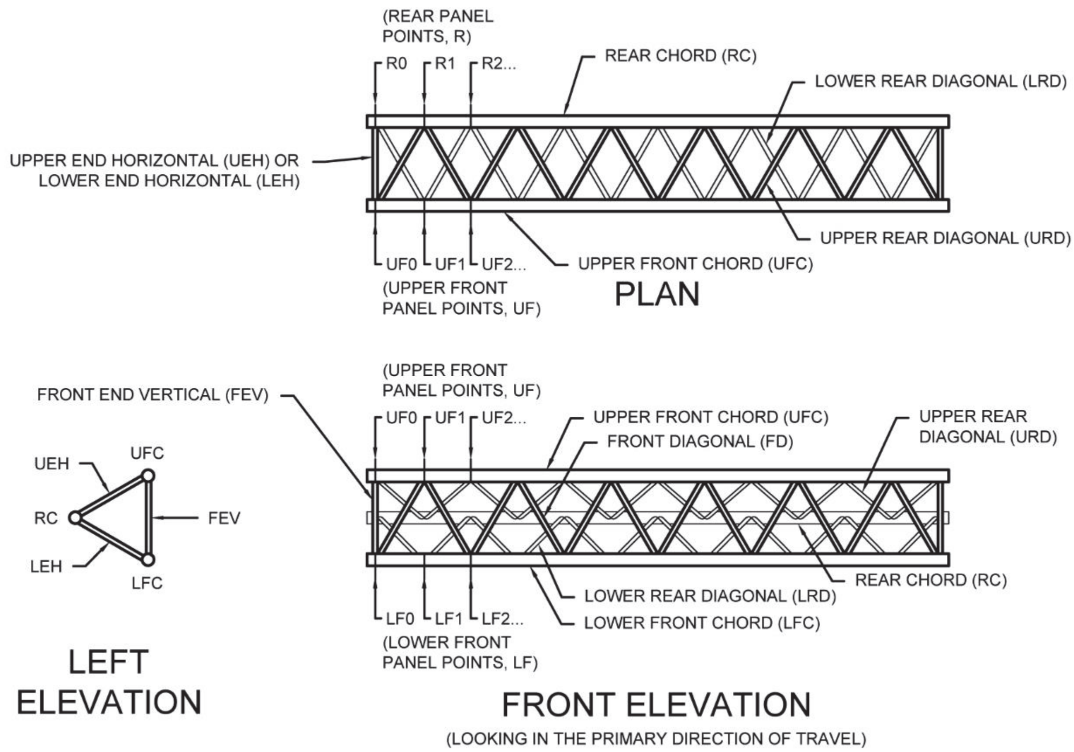


Figure 4.30 *Methodology for Panel Point Numbering and Component Labeling of Tri-Chord Truss Sign Structures without Splices*

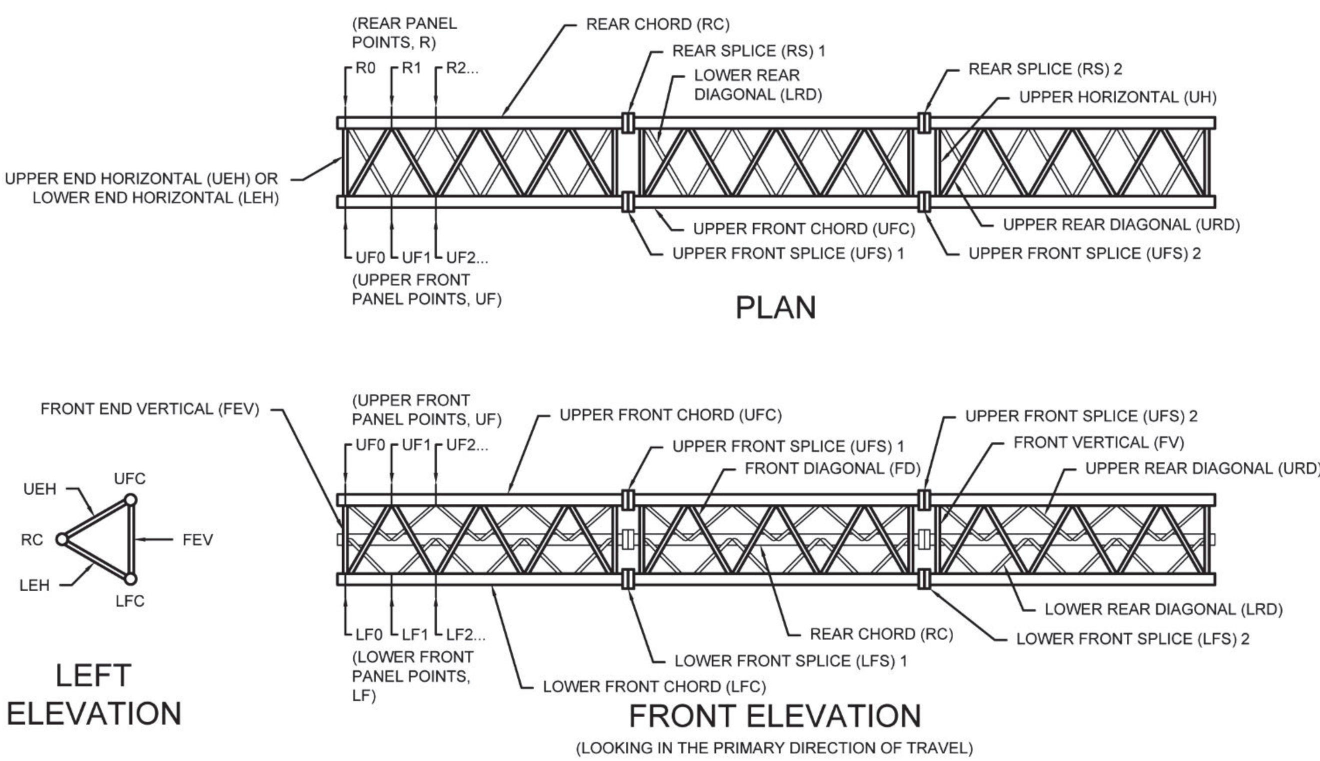


Figure 4.31 *Methodology for Panel Point Numbering and Component Labeling of Tri-Chord Truss Sign Structures with Splices*

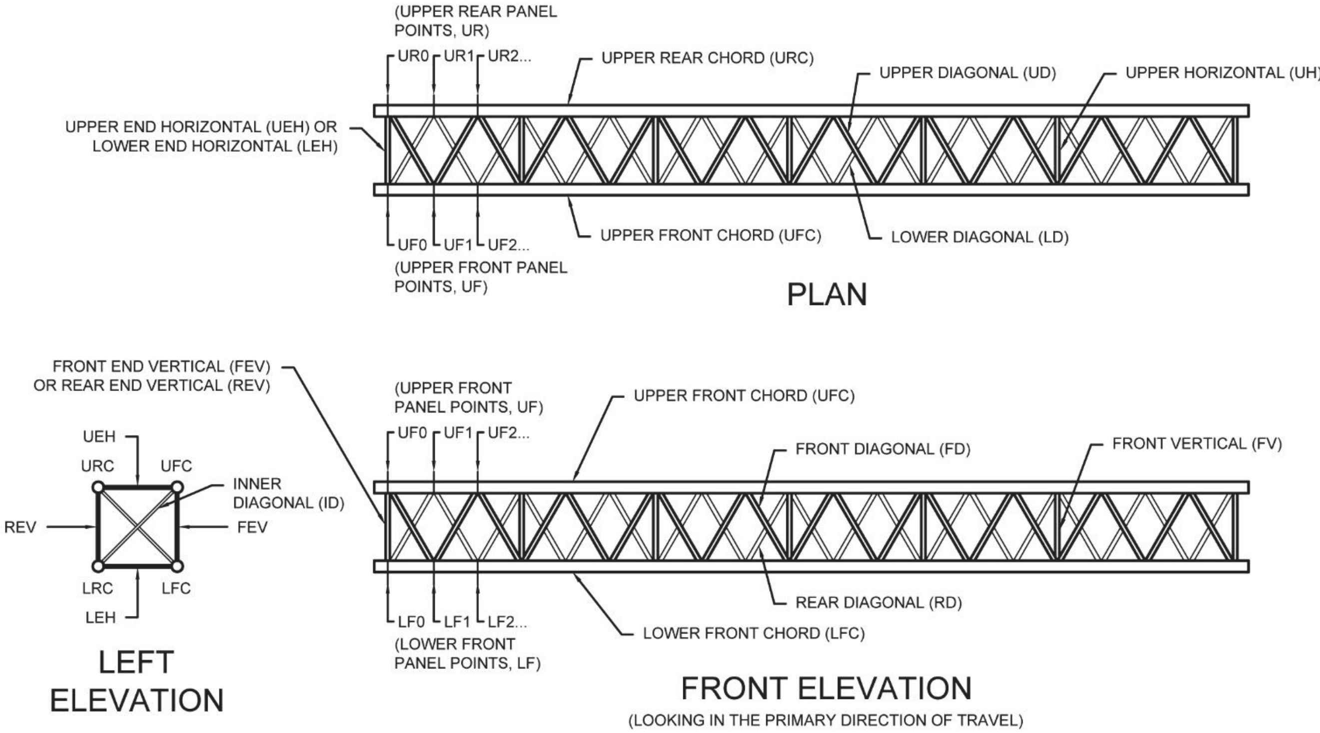


Figure 4.32 *Methodology for Panel Point Numbering and Component Labeling of Four Chord Truss Overhead Span and Cantilever Sign Structures without Splices*

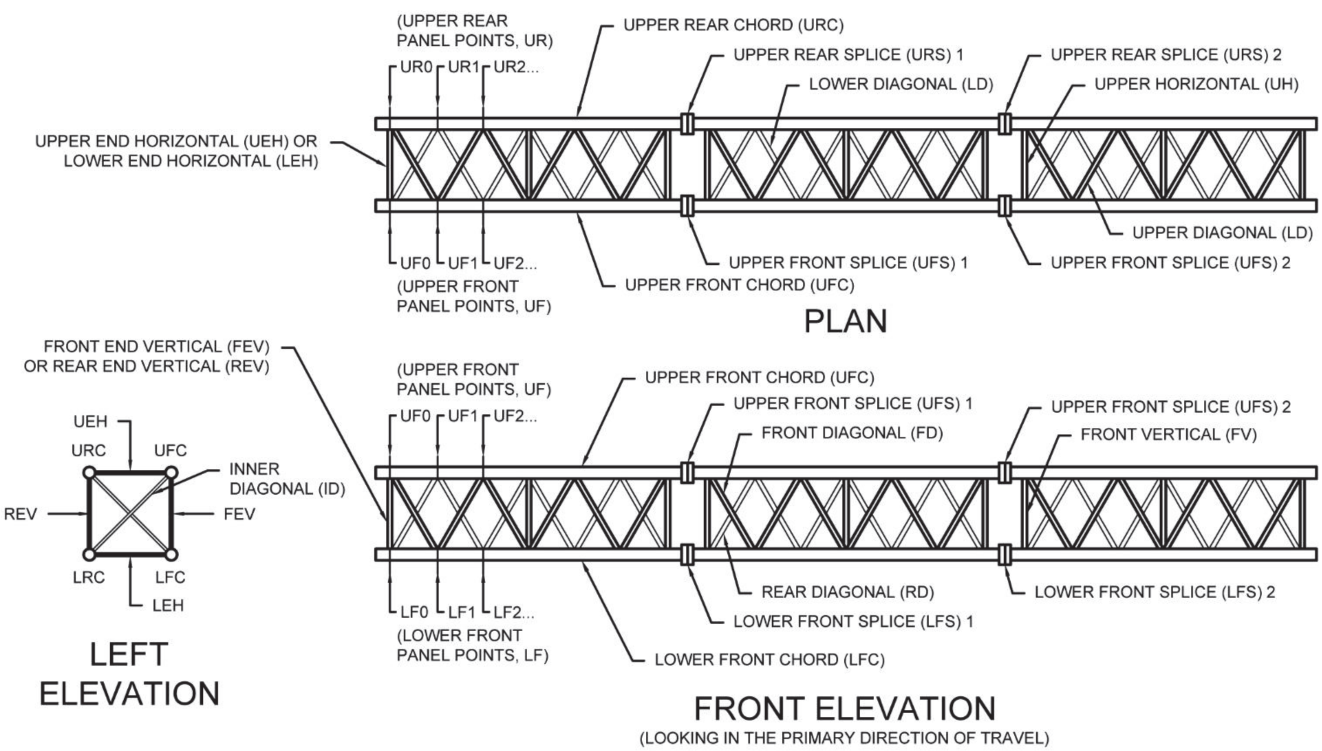


Figure 4.33 *Methodology for Panel Point Numbering and Component Labeling of Four Chord Truss Overhead and Cantilever Sign Structures with Splices*

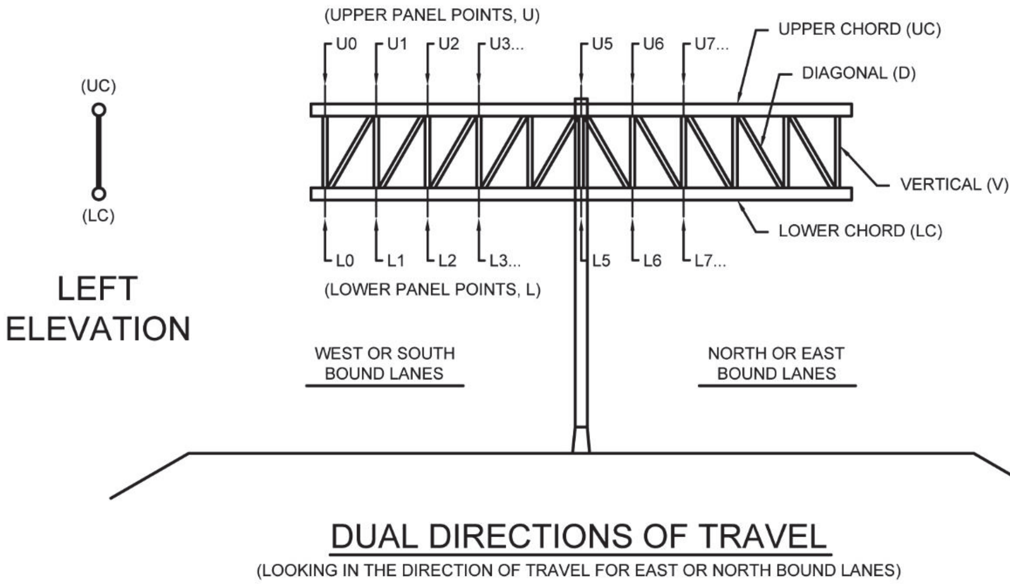


Figure 4.34 *Methodology for Panel Point Numbering and Component Labeling of Butterfly (Two Chord Truss) Sign Structures*

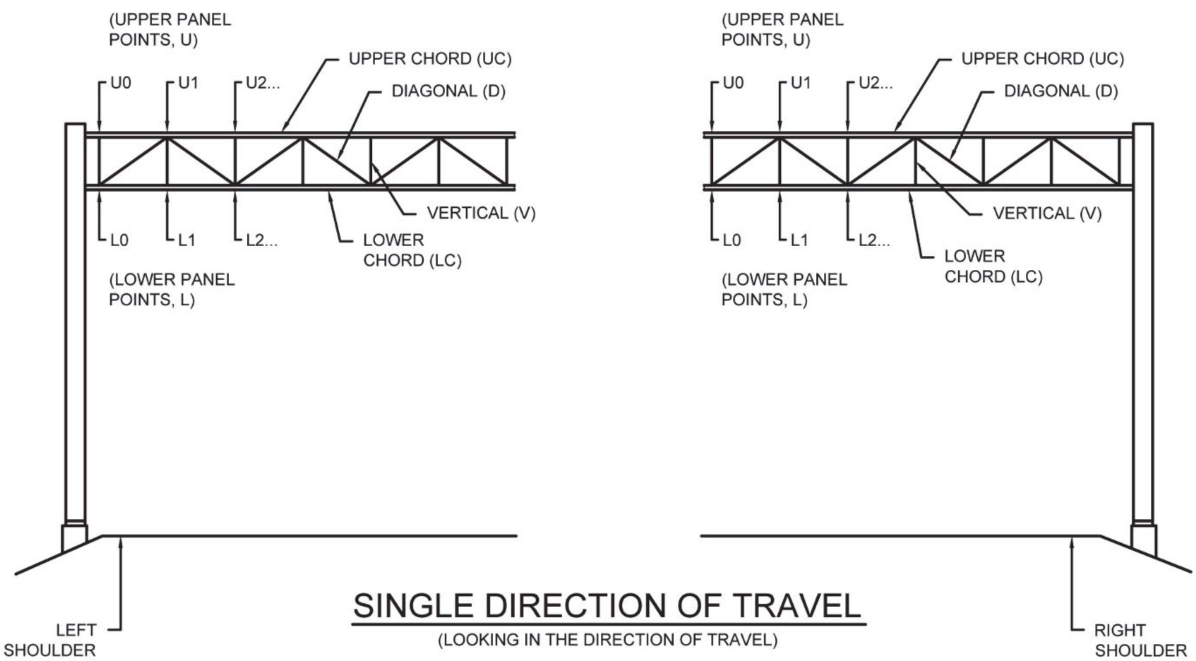


Figure 4.35 *Methodology for Panel Point Numbering and Component Labeling of Cantilever (Two Chord and Four Chord Truss) Sign Structures*

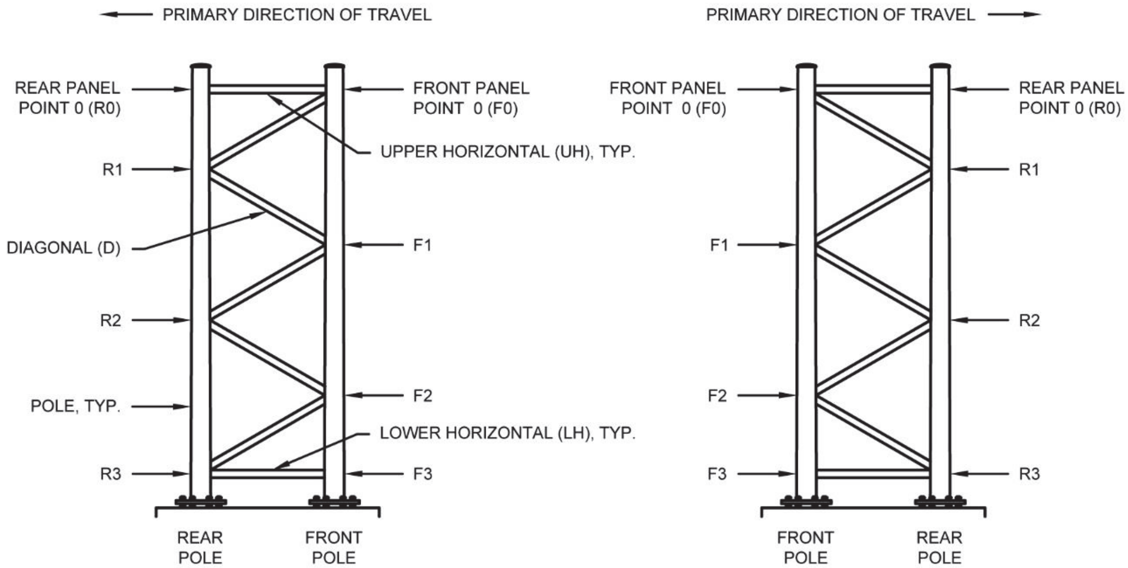


Figure 4.36 *Methodology for Panel Point Numbering of Trussed Vertical Supports (End Frames)*

4.6.4 Anchor Bolt Numbering Methodology

Anchor bolt numbering is necessary to accurately define the various defects and deficiencies encountered during the inspection of the base plate and anchor bolts, as well as indications detected through ultrasonic testing. The numbering is established by standing behind the structure looking at the roadway for the primary direction of travel. When standing behind the structure facing the roadway, the first bolt to the right of the base plate/pole centerline is labeled as Bolt No.1 and subsequent bolts are numbered consecutively in clockwise direction from Bolt No. 1. For the anchor bolt numbering system for various base plates, refer to Figure 4.37.

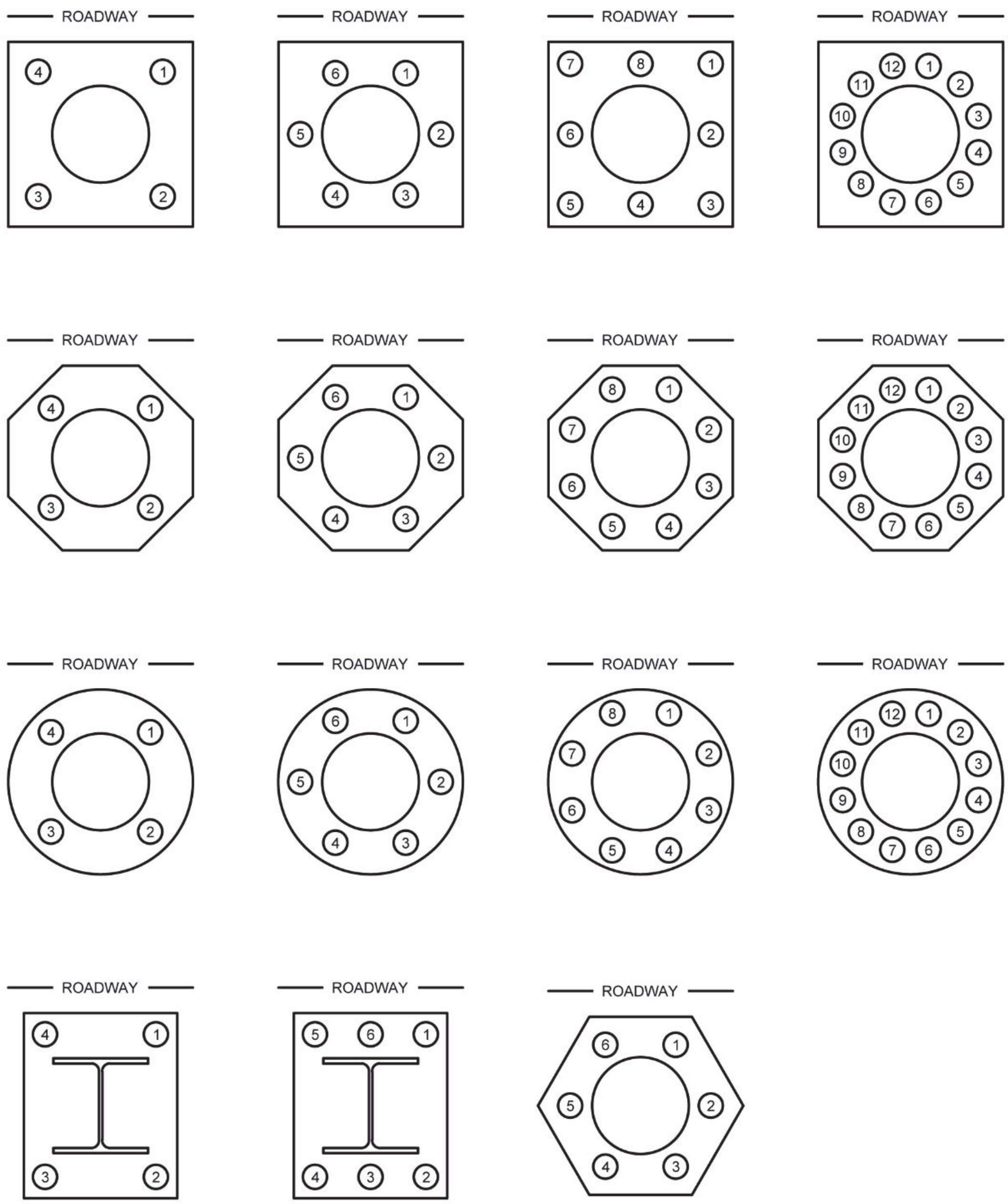


Figure 4.37 *Anchor Bolt Numbering Methodology*

CHAPTER 5. TRAFFIC SIGNAL INSPECTION PROCEDURES

5.1 Introduction

A qualified inspector must understand a variety of considerations, including hazardous and potentially hazardous conditions that could affect the safety of the inspector and the traveling public, the inspection sequencing, guidelines and procedures, the typical defects and deficiencies that may be encountered during the inspection, and those conditions that could or would require immediate action. This chapter sets forth to define policies, guidelines, and procedures for the safe and thorough inspection of traffic signal structures.

5.2 Safety

Safety of the inspectors and the traveling public is paramount when performing daytime and nighttime inspection of signal structures. As such, the inspector shall, as part of the planning and preparation process, perform a job safety analysis in order to identify the typical safety hazards and mitigate risk for both the inspection team and the traveling public. It should be noted that special conditions could arise during the inspection that were not identified as part of the safety analysis. Should a hazardous safety condition arise during the inspection that was not anticipated or expected, the inspection operation shall be halted until the condition is addressed. If the condition cannot be addressed on site, the inspection operation shall be postponed until said condition is or can be addressed.

5.2.1 General Safety

The following general safety policies are provided to assist inspection personnel in mitigating risk during the inspections.

- Inspectors and other personnel working within a work zone shall wear at a minimum, hard hat, safety shoes, and high visibility safety apparel that meet the requirements of the latest edition of the Virginia Work Area Protection Manual (VWAPM). As necessary, other safety equipment such as safety glasses and gloves should be used.
- All overhead inspection activities shall be limited to areas over travel lanes that are closed to traffic.
- Maintenance of Traffic (MOT) procedures shall be in accordance with the latest edition of the VWAPM.
- Inspection vehicles shall be located as far off the travel lane as possible when performing shoulder or median work.
- Inspection vehicles shall be equipped with high intensity rotating, oscillating, or flashing strobe lights.
- Inspectors shall assume all wires are energized and inspectors shall not come in contact with any wiring on or inside a structure.
- The inspector shall consider all wiring, conduits, junction boxes, and all other components of the lighting system to be energized and operational unless specifically informed in writing by the Regional/District Operations maintenance manager that the system is nonfunctional and not energized; also, special consideration should be given to the identification of small cellular installations. The inspector shall follow all VDOT and OSHA guidance for working around and near electrical hazards.
- Inspection operations shall not be conducted in inclement weather unless deemed necessary due to an observable emergency condition; refer to Section 5.4. Should inspection operations be underway on a specific structure at the time of inclement weather, the operations may continue until the structure is completed or roadway conditions become hazardous to the traveling public. In both cases, the operation shall be terminated until the inclement weather passes from the area.

5.2.2 Climbing and Aerial Lift Safety

All inspection personnel shall have successfully completed an OSHA-approved "Fall Protection" course/class, which fulfills the requirements of OSHA 1926.503. In addition, the following aerial lift and climbing safety policies are provided to assist inspection personnel in mitigating risks associated with aerial lift or climbing inspections.

- When in/on an aerial lift, the inspector shall wear an OSHA-approved fall protection harness attached to a secure tie off point with an OSHA-approved lanyard. VDOT personnel operating any aerial device must be certified (3-year certification) through the VDOT Maintenance Training Academy and operate the equipment in accordance with VDOT Safety and Health Division Aerial Lifting Device Operations Procedure SSP# 1910.67.
- Inspectors shall use caution and follow VDOT and OSHA Guidance when operating an aerial lift around power lines. The inspector shall maintain a <u>minimum safe distance of 10'</u>, or as required by OSHA 1926.1408, which provides minimum safe, distances based on a known line voltage, from any overhead utility wires located on or in close proximity of the structure within the work zone.
- Lifting equipment, whether ladders, bucket lifts, or scaffolding, should be properly secured to the ground with brakes, blocks, outriggers, etc. prior to climbing.

- Climbing shall be restricted to only those areas where access by aerial lift is not possible, does not provide adequate inspection, or where a critical deficiency is suspected and a more detailed or special inspection (non-destructive testing) is necessary to investigate the suspected critical deficiency.
- The inspector shall wear an OSHA-approved fall protection harness attached securely to a main load carrying member (e.g. chord) with an OSHA-approved lanyard. One hundred percent (100%) tie off shall be maintained at all times, using two lanyards.
- The inspector should have three positive points of contact at all times when moving through the structure (both hands and one foot or both feet and one hand in contact with the members).
- All safety equipment used for climbing shall be inspected for expiration dates, as well as defects that could alter their strength. Defective, damaged, and out of date units or components shall be destroyed and discarded to prevent reuse. The VDOT Maintenance Training Academy Certification, mentioned above, teaches personnel the proper procedures for inspecting harnesses and lanyards.
- Only one person shall be on the structure at a time. Take as few items as possible when climbing; all necessary items are to be adequately tied-off to the inspector to prevent falling.
- Climbing shall not be performed if the inspector is fatigued and/or mentally distracted.
- Climbing should not be performed if the structure is wet from rain or dew.
- Boots, ladders, bucket lifts, and scaffolding should be kept free of oil and grease.
- All inspectors shall be properly trained in the inspection process, fall protection, climbing techniques, and the use of all climbing equipment in accordance with OSHA 1926 Subpart M.
- Climbing and aerial inspection activities shall not be conducted in inclement weather or a sustained wind speed of 30 miles per hour (mph) or greater. Should inclement weather and/or the aforementioned wind speeds develop during climbing and aerial inspection activities, all activities shall be terminated until the inclement weather passes and/or the sustained wind speed drops below 30 mph.

5.2.3 Nighttime Safety

Whenever night inspections are required, the inspectors must take steps to ensure adequate illumination of the inspection surfaces and visibility of the inspection personnel. Lights can be worn by the inspectors, mounted on the inspection bucket, or ground-mounted. The Team Leader must determine which method(s) of illumination will provide the best view of the inspection surfaces. Consideration shall be given to placement and movement of the lights to properly illuminate all areas of the structure being inspected to eliminate shadows and provide the best possible visual inspection conditions. Lights must be positioned so that they will not be a distraction or impairment to on-coming motorists or pedestrians. Extreme caution should be used during night operations due to the reduced visibility of the inspection personnel to on-coming traffic. VDOT approved high visibility apparel is always required but can be especially important at night.

5.3 Inspection Procedures

5.3.1 Arrival on Site

Upon arriving on-site, the inspection team should verify that the structure number and physical location is correct. If the available information conflicts, the inspector shall investigate to determine how to proceed. Possible conflicting circumstances may involve newly installed structures, incorrectly marked structures, structures that have been removed from the field and not from the database, or arrival at an incorrect location. Inspection operations shall not continue until the conflict has been resolved.

After the correct structure is verified, the Team Leader shall contact the appropriate Smart Traffic or Traffic Operations Center prior to commencing MOT activities. Once the MOT or lane closure is established, the inspection team shall verify that any established MOT operation is in conformance with the latest edition of the VWAPM or specifically prepared MOT Plan by performing a drive through of the MOT or lane closure prior to beginning inspections. During the drive through, the Team Leader should be cognizant of the impact that the MOT operations has on traffic flow. If the MOT is not in conformance with the VWAPM or the District-approved-plan, inspection operations shall not commence until the MOT is in conformance.

5.3.2 Field Inspection

The field inspection of a signal structure consists of inventorying and inspecting the structure. The inventory component requires verification of asset attribute information. The inspection component requires a comprehensive, detailed inspection of the entire signal structure consisting of a 100% hands-on examination of each component, member, fastener, and weld on the structure. The inspections should document any defects or deficiencies including dents, damage, corrosion, material section loss, loose and missing fasteners, broken or cracked welds, and any other conditions that could affect the functionality or integrity of the structure immediately or long term. In addition to the hands-on examination, the inspector(s) should use forms of non-destructive testing (NDT) during the inspection to verify any suspected structural deficiencies. These forms of NDT to be used include:

- Liquid/Dye Penetrant or Magnetic Particle Testing at locations of suspected surface cracks.
- Ultrasonic Testing to detect cracks in anchor bolts.
- Ultrasonic Thickness Testing utilizing corrosion thickness gages to determine remaining thickness for structural members where thickness cannot be readily verified by other means, or where visible corrosion exists.

In the event the inspector is unable to perform the required or necessary testing due to the lack of equipment or lack of qualifications, the inspector should contact the District Manager who may involve the Materials Division to arrange to have the necessary tests performed. All personnel performing NDT shall be qualified by the Department's Material Division, Structures Group, for the specific NDT to be performed.

5.3.3 Typical Field Inspection Sequence and Operations

The field inspection sequence of a signal structure is important to provide organization throughout the inventory and inspection process, and to ensure that all elements are inspected, and associated findings are recorded accurately. The items below provide recommended sequencing of the field inspection, as well as specific items to be inventoried and inspected.

5.3.3a *Inventory*

Inventory information related to the as-built configuration of the structure does not typically vary from inspection to inspection unless corrective maintenance, structure modifications, or retrofit work has been completed. This information should be gathered at the initial inspection, verified, and updated as necessary at each subsequent inspection. For a detailed list of specific inventory items that are to be recorded, and guidance on coding, refer to Appendix A - Inventory and Inspection Coding.

5.3.3b *Inspection*

The signal structure should be inspected to determine its overall condition as well as the condition of the individual components. All deficiencies should be fully quantified by describing the defect type (corrosion, section loss, spall, crack, etc.), location, and size (length, width, depth, etc.). For example, the location of exposed reinforcing steel should be noted, as well as the severity of any corrosion that has taken place. If the corrosion has caused section loss, the section loss should be quantified. Furthermore, all inspection notes should be reviewed for accuracy and completeness while on-site. For a detailed rating guide, that includes a list of the common deficiencies and recommendations, refer to Appendix B - Common Deficiencies, Ratings, Recommendations, and Priorities.

5.3.3c *Documentation*

Documentation consists of writing/recording field findings. Documentation should be as specific, clear, and concise as possible without providing unnecessary details, yet should accurately and thoroughly describe the observed deficiency. Some information may be implied, such as by which section of the report an item is being recorded. Documentation includes both terms of qualification (i.e. severity of a deficiency) and quantification (number of items or area of deficiency). Deficiencies that have dimensions are typically detailed in terms of width x length/height, or if more applicable, surface area. Other dimensions that may be recorded include depth, percentage of section loss, a distance from a reference point, or other language locating the finding. The various possible components of detailing should be used as needed. A few examples are included below.

- Dent in pole, 2" long x 1" wide x up to 1/2" deep, 5' high above base plate.
- 10% to 20% section loss on leveling nuts and washers at Anchor Bolt 1 and 2.
- Area of spalling, 5 SF x up to 1" deep, at top of pedestal.
- Crack, 1/8" wide, originating at Anchor Bolt 1-4 and extending 2' down pedestal face.

5.3.3d *Photographs*

Photographs are to be taken to provide a representation of the overall condition of the structure. As such, several basic photographs should be taken at each inspection. These photographs are to be taken such that each view is maximized within the frame of the photograph. These photographs include:

- The front view of a mast arm or span wire structure as viewed from the primary direction of travel.
- The view of any additional mast arms or span wires, as viewed from the direction of travel (secondary route) towards the arms/wires.
- Typical view of the pedestal/base (as applicable)
- Typical view of the mast arm or span wire to pole connection (as applicable)

Photos are required of all deficiencies or conditions resulting in an element rating of poor or critical; however, can be included for other conditions and/or reasons where further clarification may be needed to define the conditions or reasons. When placed in the report, the photograph shall also have an appropriate caption containing verbiage describing the deficiency or condition represented. If possible, all photographs should be reviewed in the field to ensure that the views and/or deficiencies are clearly depicted. In the event that photographs, or commentary do not, or cannot, adequately/accurately describe the deficiency, the inspector should sketch the deficiency in detail to the extent necessary to accurately depict the deficiency

New photographs shall be taken at each inspection for inclusion in the updated report. Old photographs shall not be reused without permission from the District Manager. All photographs shall have date stamps.

For instruction on which inventory and inspection photos are to be included in the database and report, refer to Appendix A, Section A.7.

The photographs below present the basic inventory photos to be taken at the start of the inspection.

Photo 5.1 *Front view of structure with single mast arm*

Photo 5.2 *Front view of structure with span wire governing single travel direction*

Photo 5.3 *Front view of structure with two mast arms*

Photo 5.4 *Secondary view of structure with two mast arms*

Photo 5.5 *Front view of span wire governing two routes*

Photo 5.6 *Secondary view of span wire governing two routes*

Photo 5.7 *View of base*

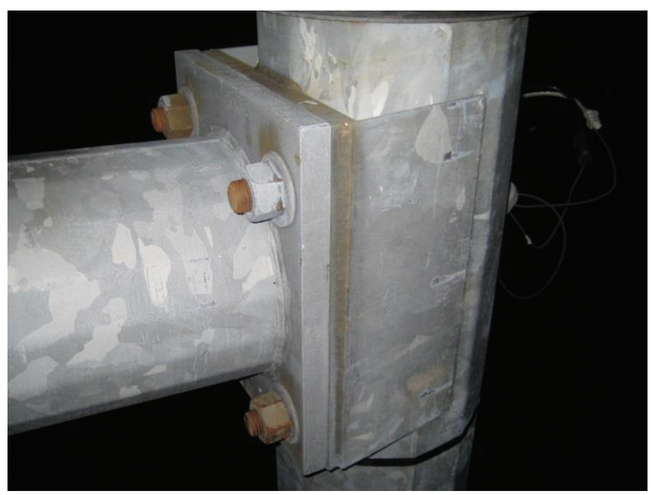


Photo 5.8 *View of mast arm to pole connection*

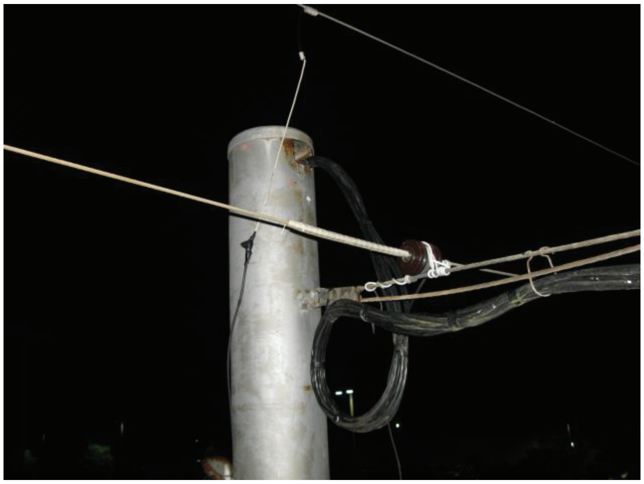


Photo 5.9 *View of span wire to pole connection*

Typical Field Inspection Sequence and Operations (Continued)

The following presents the recommended inspection sequence and procedures, as well as recording of typical findings. Although extensive, the following information is not meant or intended to be all encompassing as variations in structure types and details will occur.

5.3.3e *Overall Alignment*

The entire signal structure should be examined "from a distance" looking for obvious deficiencies or problems. The inspector should check for:

- Gross damage to the structure and its supports from collisions.
- Visually noticeable sagging of the mast arm or span wire.
- Vertical and horizontal alignment of the traffic signals, sign panels, superstructure, and poles/vertical supports.

5.3.3f *Vertical Clearance*

Vertical clearance from the lowest point of the structure (e.g. mast arm, traffic signal heads, signs, sensors, cameras, etc.) to the highest point of the roadway over each paved shoulder and each lane should be measured. The minimum clearance and the respective lane of the clearance for each direction of travel should be recorded. Clearances greater than 25' should be recorded as such, without specific measurements taken at each location.

5.3.3g *Foundation: Erosion / Undermining / Settlement / Drainage*

These deficiencies should be visually assessed. The inspector should inspect and document the following conditions:

- Location of the pedestal relative to the immediate area around the pedestal.
  - If the top of the pedestal is buried less than 12" below grade, remove the dirt/fill until the top of the pedestal is exposed, inspect and document that the pedestal was buried and uncovered for inspection.
  - If the top of the pedestal is located under a walkway or sidewalk, or buried below grade 12" or more, document the condition. The buried condition is to be reported for excavation by VDOT maintenance crews. Notice shall be provided to the District Manager; refer to guidelines in Section 5.3.4. However, if conditions warrant immediate excavation, the condition should be reported immediately. An inspection should be performed as soon as possible following excavation. Conditions that would warrant immediate excavation include observable corrosion and/or section loss.
- Erosion or undermining around the pedestal faces. Any areas of undermining should be probed and documented to determine depth and extent.
- Any indications of movement or rotation of the foundation should be measured and documented. Movement or rotation of a pedestal could be indicative of an underlying foundation or soil issue.
- Standing water or indications of poor drainage should be noted and depth of water measured.
- The pedestal is located in a swale or drainage ditch. A pedestal located in a swale or drainage ditch could periodically be submerged resulting in corrosion, debris accumulation, or damage of the submerged areas.

5.3.3h *Foundation: Concrete Pedestal (or Median Barrier, Bridge Parapet)*

All loose debris and vegetation should be removed. The pedestal should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Cracking: All cracking should be documented, and special attention should be given to cracks propagating from anchor bolts. Any rust staining present along the cracks should be documented. The cracking could indicate overloading of the bolts or appreciable corrosion on the embedded portions of the anchor bolts.
- Delamination: Sound the pedestal with a hammer to detect locations of delamination. The delaminated areas will give a hollow sound when tapped with a hammer.
- Spalling, Honeycombing, Scaling: All spalling, honeycombing, and scaling should be documented. Any exposed reinforcing should be documented along with any associated section loss.
- Impact damage. Document that impact damage exists and any deficiencies associated with it, which may include any of the above.

5.3.3i *Foundation: Steel Haunch*

A haunch is a steel bracket attached to a bridge girder and made to accommodate the ancillary structure, and typically consists of multiple plates built up and welded together. For a detailed description and photograph of a steel haunch foundation, refer to Section 1.2.1p. The haunch should be visually and tactilely inspected from an aerial lift (bucket or platform) or underbridge inspection unit (snooper). The inspector should inspect and document the following conditions:

- For anchor bolt inspection guidance, refer to Section 5.3.3k Foundation: Anchor Bolts.
- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If corrosion is observed on the haunch assembly, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
  - If corrosion is observed on connection hardware, the amount and extent of section loss should be determined and documented.
- Localized areas of distressed painted or coated surfaces. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.
- Condition of the welded connections. The welds should be inspected for cracking, especially at points of intersecting welds, and incomplete or excessively ground welds as they create stress risers. The location and size of the crack(s) is to be documented.
- Condition of the bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, beveled washers or extra washers. Document percent engagement if less than 100%.
- Corrosion and cracking around any burned or rough-cut holes. Burned or rough-cut holes are stress risers and special attention should be given to these areas.
- Distortion of the haunch assembly. Distortion could be indicative of overloading, damage during erection or improper welding procedures during fabrication.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical pedestal deficiencies and conditions that could be encountered in the field.

Photo 5.10 *Map cracking in pedestal*

Photo 5.11 *Spall in pedestal*

Photo 5.12 *Standing water around base of pole located in a swale/drainage ditch*

Photo 5.13 *Pedestal buried less than 12" deep*

Photo 5.14 *Overgrowth of vegetation on pedestal*

Photo 5.15 *Delamination on top of pedestal*

***Photo 5.16** Crack in pedestal extending out from anchor bolt*

***Photo 5.17** Erosion around back side of pedestal*

***Photo 5.18** Foundation located under brick sidewalk*

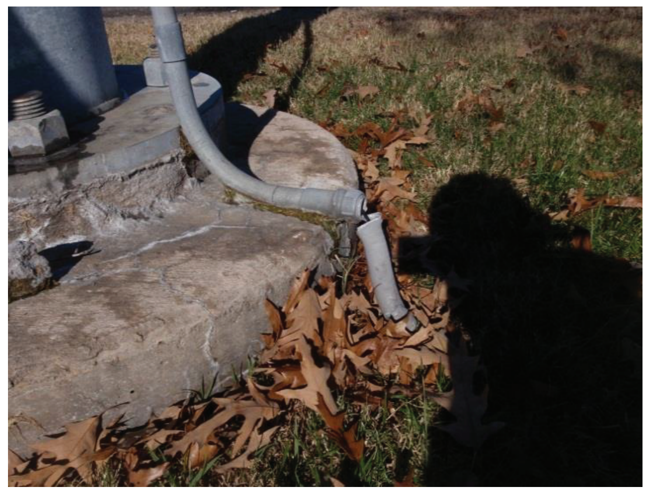


***Photo 5.19** Damaged conduit at pedestal*

***Photo 5.20** Foundation adjacent/level with concrete sidewalk, corrosion on base plate, pole, and top nuts.*

***Photo 5.21** Corrosion of steel haunch*
(Sign structure shown for illustrative purposes only)

5.3.3j *Foundation: Grout Pads*

All loose debris and vegetation should be removed. The grout pad should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Partial (minor cracking and/or section loss) or full (section loss, heavy cracking, etc.) deterioration of the existing grout pad. Deterioration results in water/moisture retention within the grout pad and possible corrosion of the partially or unexposed anchor bolts. Note the level of deterioration. If the grout pad is deteriorated to the extent that it can be removed easily with hand tools, first verify the existence of leveling nuts (refer to Section 5.3.3k), and then remove the grout pad and note that it was removed by the inspector.
- Moisture leaking from the grout pad that indicates moisture/water retention and possible corrosion of the partially exposed or unexposed anchor bolts. The moisture could be leaking from under the grout pad or from cracks and/or areas of section loss in the grout pad.
- Document the maximum thickness of each grout pad. The height is representative of the height from bottom of the base plate to the top of the pedestal; for further discussion, refer to Section 5.3.3k.

The photographs below present various typical grout deficiencies and conditions that could be encountered in the field.

Photo 5.22 *Partially deteriorated grout pad with moisture leakage*

Photo 5.23 *Deteriorated grout pad with exposed anchor bolts*

Photo 5.24 *Sound grout pad with weep hole*

5.3.3k *Foundation: Anchor Bolts*

All loose debris and vegetation should be removed. Nut covers, if present on decorative bases, should be removed prior to inspection and then reinstalled upon completion of inspection activities. Nut covers on standard bases should be removed and disposed of properly off-site. Anchor bolts, washers, and nuts should be visually and tactilely inspected if accessible (not obscured by a grout pad). For numbering convention of the anchor bolts, refer to Section 5.6.4. The inspector should inspect and document the following conditions:

- Document any deviation, excess or missing components, from the typical configuration; refer to Figure 5.1. Some examples may include material other than mild steel (i.e. stainless steel or aluminum), the presence of lock washers, beveled washers, lock or jam nuts, extra washers, and missing nuts and washers.

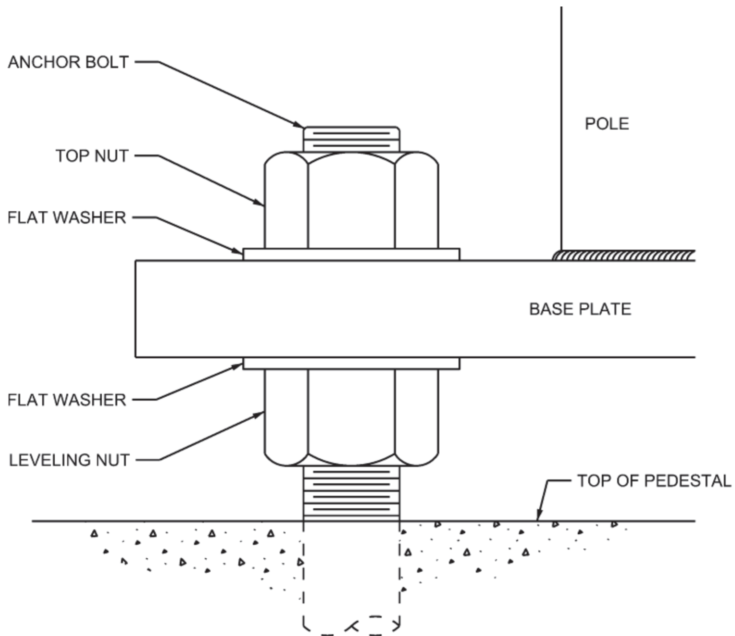


Figure 5.1 *Typical Anchor Bolt Configuration*

- Presence of any tack welds or other welds on anchor bolt assemblies. Welding to bolts can change the material characteristics and result in a loss in bolt strength.
- Corrosion, loss of galvanizing, section loss, etc. of the anchor bolts, washers, and nuts. If section loss is present on the anchor bolts and/or nuts, all rust scale should be removed from the area and calipers should be used to measure the remaining diameter of the anchor bolts or flat-to-flat distance on the nuts.
- Inadequately sized flat washers or lack of flat or plate washers for enlarged holes in base plates. Enlarged holes reduce the amount of bearing area of the top nut and/or leveling nut on the base plate.
- Adequate engagement of top nut. Less than 100% engagement of the top nut reduces the ability of the anchor bolt to develop its full load carrying capacity. Document percent engagement if less than 100%.

- Loose or inadequately tightened top nuts and leveling nuts. These two deficient conditions of the nuts are recognized as having a negative impact on the effectiveness and longevity of the anchor bolts, and ultimately, the structure as a whole.
  - Loose nuts increase the stresses in the adjacent bolts and allow additional impact stresses on the bolt(s) having the loose nut(s). A loose nut can be identified by the following criteria:
    - The nut is not in contact with the washer or base plate. In this case, there is a uniform gap between the nut and the washer or base plate. This condition could represent a "frozen" nut or a loose nut that could be turned by hand.
    - The washer between the nut and base plate moves by hand. This condition could represent a "frozen" nut or a loose nut that could be turned by hand.
  - Inadequately tightened nuts increase the stresses in the adjacent bolts and because they are not fully tightened, the nuts may become loose over time. This condition is considered less severe as compared to a loose nut. An inadequately tightened nut is defined as less than snug tight and can be identified by the following criteria:
    - It is not loose (as defined above).
    - The nut is in contact with the base plate.
- The nut and/or washer moves when struck with a hammer. The sides of each nut should be struck 2-3 times with a 16-ounce hammer in the nut-tightening or clockwise direction when looking down on the nut from above. The force should be consistent between strikes to prevent false indications that the nut is inadequately tightened.
- Plumbness of the anchor bolts. Out of plumb anchor bolts (slope that exceeds 1:40) could result in increased bending stresses in the anchor bolts. If one or more anchor bolts are visually out of plumb, measure the slopes of the affected bolts. The measurements are to be taken and documented as follows, refer also to Figure 5.2:
  - Measure the plumb vertical distance or height, V, of the bolt above the top of concrete.
  - Measure the horizontal distance, H, from the centerline of the bolt at the top of concrete to the centerline of the bolt at the top of the bolt.

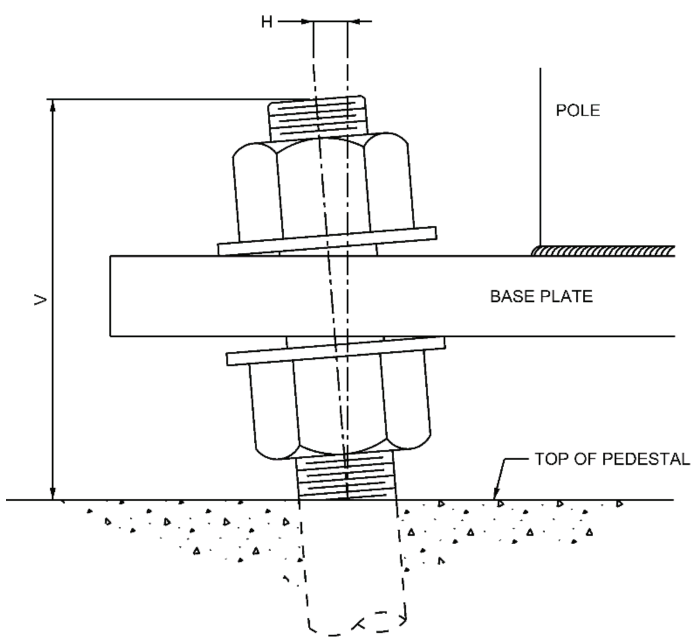


Figure 5.2 *Measurement Methodology for Out of Plumb Anchor Bolts*

- Improperly seated top nuts on the base plate. Improper seating of top nuts can reduce the bearing area of the nut on the base plate and can consequently reduce the load capacity of the bolts. If the top nuts are not in full contact with the base plate and a gap exists between the bottom of the nut and the top of the base plate at one or more locations, the largest gap for each nut is to be measured and documented. The measurement, D (refer to Figure 5.3), is to be taken from the top of the washer, or base plate if no washer exists, to the highest point above the base plate along the bottom of the nut. These measurements should be taken using a feeler or taper gauge.
- The table below is used to simplify the ratings for improperly seated top and leveling nuts, and for out of plumb anchor bolts.

	Gap, D (in.)			
Bolt Diameter, d (in.)	1/16 0.0625	1/8 0.125	3/16 0.1875	1/4 0.25
1.00	0.063	0.125	0.188	0.250
1.25	0.050	0.100	0.150	0.200
1.50	0.042	0.083	0.125	0.167
1.75	0.036	0.071	0.107	0.143
2.00	0.031	0.063	0.094	0.125
2.25	0.028	0.056	0.083	0.111
2.50	0.025	0.050	0.075	0.100
2.75	0.023	0.045	0.068	0.091
3.00	0.021	0.042	0.063	0.083

Green	DO NOT REPORT
Yellow	D/d >= 0.04
Red	D/d >= 0.08

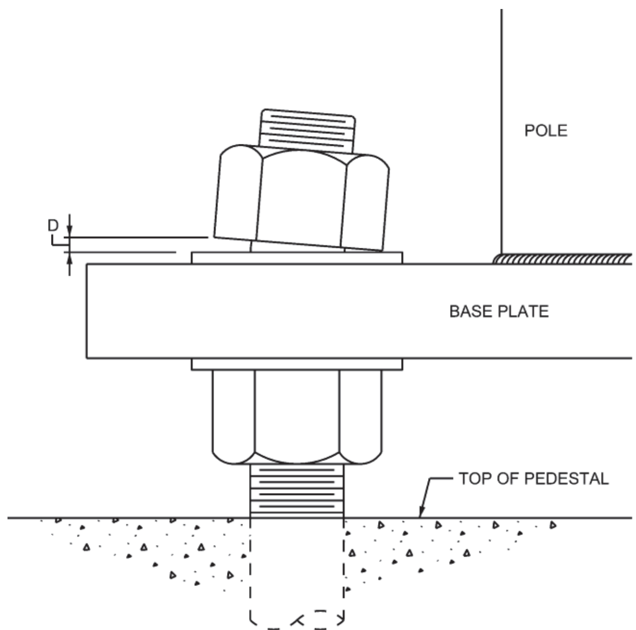


Figure 5.3 *Measurement Methodology for Improperly Seated Nuts*

- Presence of a leveling nut if a grout pad is present. To determine if a leveling nut is present, the inspector can 'probe' the grout pad by using a 1/4" masonry bit to drill a hole in the grout pad. The hole should be drilled toward the anchor rod and in a direction that would intersect a leveling nut, if one is present. The inspector shall take all precautions not to hit the anchor bolt and to minimize damage to the leveling nut, if one exists. A measurement taken from the top nut to the outside of the base plate will give the inspector a dimension to be used to minimize damage to the leveling nut or the anchor bolt. Whether a leveling nut is present or not the hole in the grout shall be filled with caulk prior to leaving the site. If the grout is deteriorated and in poor condition the inspector may be able to remove a section of grout rather than drill a hole. For the method of verifying the presence of a leveling nut, refer to Figure 5.4. A structure with a deteriorated grout pad and no leveling nut is a serious condition and should be reported immediately to the District Manager or their representative. The presence of, or lack of, a leveling nut shall be noted in the report.

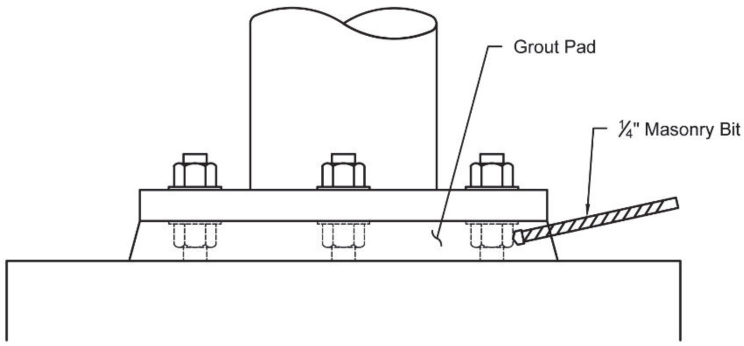


Figure 5.4 *Method for Drilling Grout Pad to Determine Existence of Leveling Nuts*

- Hidden or unobservable cracks within the anchor bolts. Cracks, regardless of size, decrease the load capacity of the bolts and could increase stresses in the surrounding bolts. The top of the bolts should be tapped and sounded with the hammer for any hollow sounds that could indicate the presence of a crack. If a hollow sound is present, an ultrasonic test should be conducted to investigate the presence and location of a crack. Ultrasonic testing of all anchor bolts is required at each regular inspection; for guidelines, refer to Chapter 2.
- Distance between the bottom of the base plate and the top of the pedestal, H (refer to Figure 5.5). Base plates that exceed a clear height above the pedestal of two bolt diameters induce stresses that were not accounted for during design and could reduce the load capacity and fatigue life of the anchor bolts. The maximum measured distance between the bottom of the base plate and the top of the pedestal should be documented for each base plate of a structure as differing heights could impact any recommendations pertaining to lowering of the structure

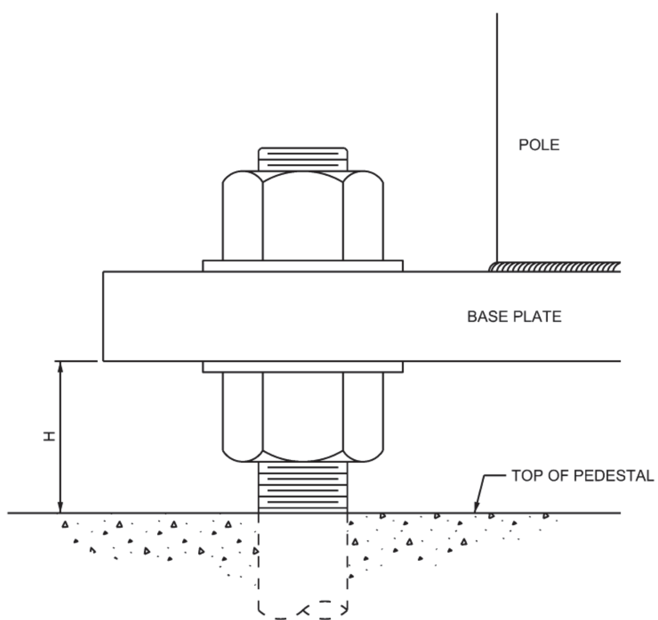


Figure 5.5 *Measurement Methodology for Base Plate Distance Above Pedestal*

The photographs below present various typical anchor bolt deficiencies and conditions that may be encountered in the field.

Photo 5.25 *Loose top nut and missing flat washer*

Photo 5.26 *Heavy corrosion and section loss on anchor bolt below leveling nut*

Photo 5.27 *Top nut 75% engaged and missing flat washer*

Photo 5.28 *Top nut improperly seated on base plate*

Photo 5.29 *Loose leveling nut and missing flat washer*

Photo 5.30 *Excessive top of pedestal to bottom of base plate height*

Photo 5.31 *Out of plumb anchor bolt with improperly seated top nut*

Photo 5.32 *Oversized hole in base plate and Inadequately sized flat washer under top nut*

5.3.3l *Vertical Supports: Base Plates*

All loose debris and vegetation should be removed from under and around the base plate. Base plates should be visually and tactilely inspected. Decorative bases or covers, if present, shall be removed to the extent possible without damaging the base or cover and attachment hardware. The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc. If an area of corrosion is observed or suspected, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
- Distress around enlarged holes for the anchor bolts. Holes are sometimes enlarged to facilitate installation of the base plate, due to improper installation/setting of anchor bolts during construction.
- Distortion of the base plate. Distortion could be indicative of overloading, damage during erection or improper welding procedures during fabrication.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.
- Any decorative bases or covers that cannot be opened/removed shall be documented. The condition is to be reported for removal by VDOT maintenance crews. Notice shall be provided to the District Manager; refer to guidelines in Section 5.3.4. However, if conditions warrant immediate removal, the condition should be reported immediately. An inspection should be performed as soon as possible following removal of the base.

The photographs below present various typical base plate deficiencies and conditions that could be encountered in the field.

Photo 5.33 *Impact damage to base plate*

Photo 5.34 *Corrosion and pitting on base plate, bottom of pole and on anchor bolt and top nut*

5.3.3m *Vertical Supports: Poles*

The pole should be visually and tactilely inspected. Hand hole covers, if present, shall be removed to the extent possible without damaging the cover and attachment screws. The upper portions of the poles are to be inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on the outside of the pole, the area should be thoroughly cleaned of any rust scale and the amount and extent of section loss should be determined and documented.
  - If corrosion is observed on the inside of the pole, the outside of the pole should be sounded with a hammer to detect "thin" areas in the pole. An electrically insulated borescope may be used to visually inspect the inside of the pole. The use of a borescope is to be documented. Thickness testing shall be performed utilizing corrosion thickness gages to determine the amount and extent of section loss. Obtain three random readings at 3' above the base and average the three to determine the pole's thickness. At a minimum, thickness testing should be performed utilizing corrosion thickness gages at the 12, 3, 6, and 9 o'clock positions around the circumference of the pole. The readings are to be taken on the pole immediately above the top of the base plate to pole weld, and at 3" and 6" above the top of the base plate; refer to Figure 5.6. All readings should be recorded in decimal inches to three decimal place accuracy (Ex. 0.030"). Readings should be recorded in table format and included in the database as a photograph. For an example chart format, refer to Figure 5.7.

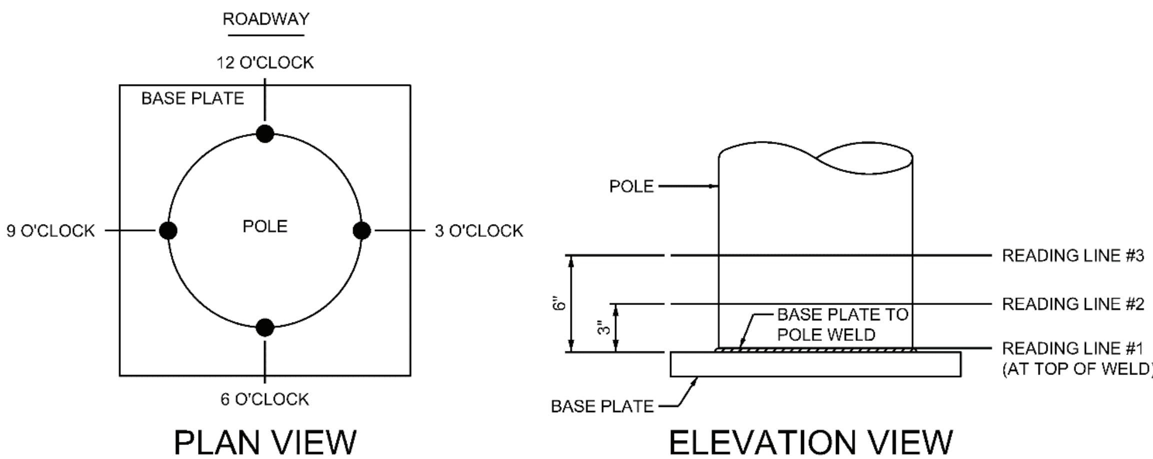


Figure 5.6 *Measurement Methodology for Pole Corrosion Thickness Gage Readings, Plan and Elevation*

Structure Number: 0630048

Reference Thickness: 0.119"

Pole Thickness Readings				
Height Above Base	**12:00**	**3:00**	**6:00**	**9:00**
0"	Note 4	Note 4	Note 4	0.153"
3"	0.134"	0.141"	0.140"	0.132"
6"	0.122"	0.123"	0.122"	0.119"

Notes:
1. 12:00 referenced to roadway.
2. Readings include coating thickness.
3. Reference thickness taken approximately 36" above hand hole.
4. No reading due to pitting.

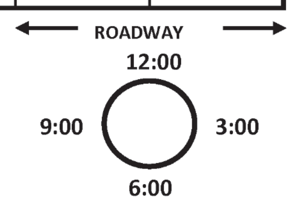


Figure 5.7 *Measurement Methodology for Pole Readings utilizing a corrosion thickness gage, Example Thickness Chart*

- Localized areas of distressed painted or coated surfaces such as at connections, attachments, pole bases, etc. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.

- Out of plumb or leaning vertical supports/poles (not related to pedestal movement). Poles that are out of plumb or leaning can be indicative of damage or adjustments made during erection and can increase bending stresses in the poles. Any observable leaning of the vertical supports should be measured and the direction of the lean documented. The measurement could be obtained by lowering a plumb bob from the top of the support within a few inches of the base plate and taking a horizontal measurement, D, from the base of the support to the plumb bob line. Alternatively, a level could be used to measure the amount of lean of a non-tapered pole over the known length of the level, L. For the method for measuring leaning poles, refer to Figures 5.8 and 5.9.

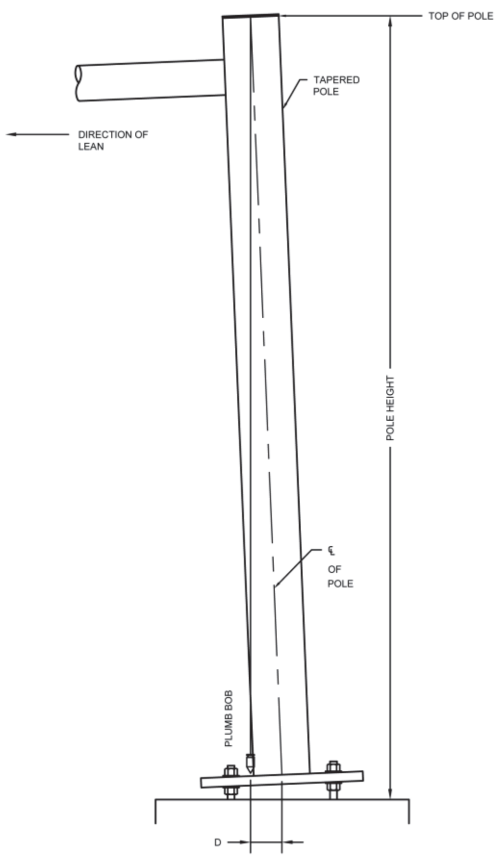


Figure 5.8 *Measurement Methodology for Leaning or Out of Plumb Tapered Poles*

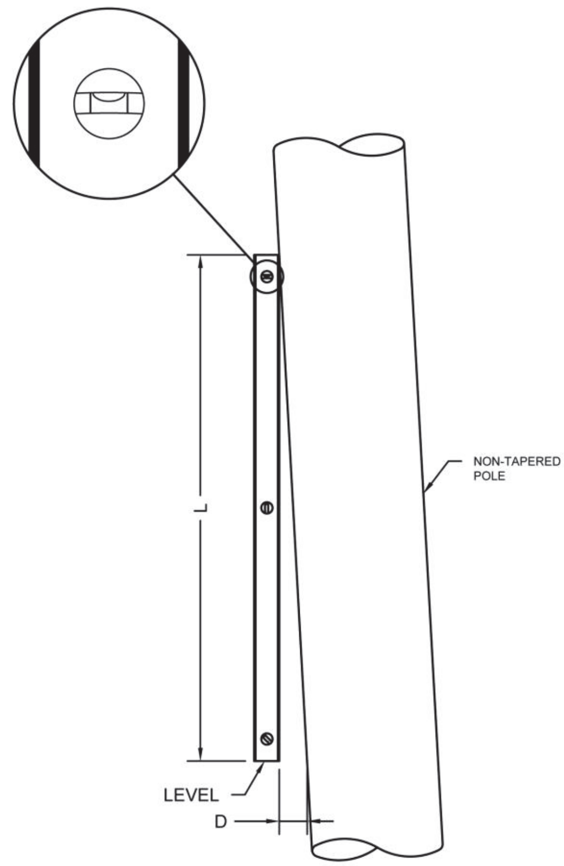


Figure 5.9 *Measurement Methodology for Leaning or Out of Plumb Non-Tapered Poles*

- Bowing of the poles. An observable bowing of the vertical supports could be indicative of an overstress condition, inadequate support size or section, improper fabrication, or damage incurred by vehicle impact, and should be measured and the direction of the bow documented. The measurements should be performed by stretching a line from the top of the support to the face of pole above the base plate and measuring the maximum bow. In the case of a localized area of bowing due to impact, the line or straight edge should be stretched across the area and rested against the plumb or vertical portions of the support on both sides of the area. For the method for measuring bowed poles, refer to Figure 5.10.

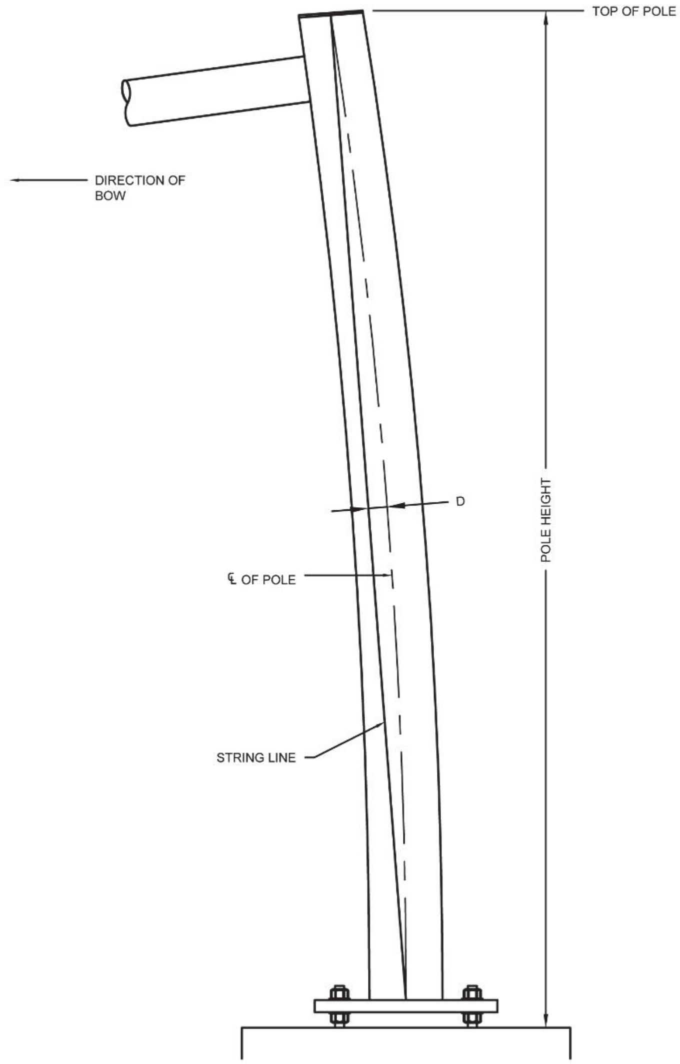


Figure 5.10 *Measurement Methodology for Bowed Poles*

- Dents and ruptures in round or faceted vertical supports/poles. Dents and ruptures can reduce the load carrying capacity of the pole or poles as they could significantly reduce the cross section of the pole or poles. The depth of the dent or rupture does not affect the rating, as it is a function of the wall thickness that, like the material, is highly variable. The depth of the dent should be measured with a ruler; however, getting more complete or accurate information on the depth of the dent could require specialized equipment that is impractical. Nevertheless, the depth of any dent or rupture, as measured with the ruler, along with descriptions of any tears or punctures within the dent or rupture, should be recorded during the inspection. The following measurements (refer to Figure 5.11) are to be taken and documented:
    - **H**: Horizontal measurement of the dent or rupture.
    - **V**: Vertical measurement of the dent or rupture.
    - **d**: Depth of the dent or rupture at the deepest point of the dent.
    - **C**: Circumference of the support immediately above or below the affected area.
    - **D**: Distance from top of the base plate to the center/middle of the dent.

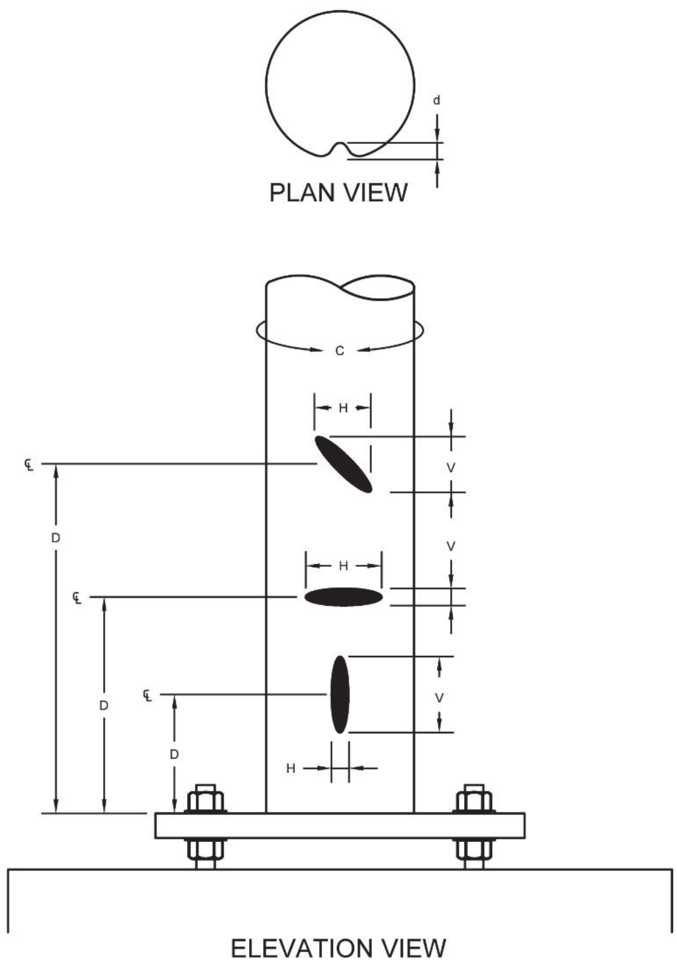


Figure 5.11 *Measurement Methodology for Dents and Ruptures in* Round or Faceted *Poles*

- Corrosion or loose rust scale around weep holes. Corrosion and rust scale may be indicative of corrosion of the inside of the pole and should be investigated as described previously in this section.
- Corrosion and cracking around any burned or rough-cut holes. Burned or rough-cut holes are stress risers and special attention should be given to these areas.

- Condition of the welded connections. The welds should be closely inspected for cracking, especially at points of intersecting welds and incomplete or excessively ground welds, as they create stress risers. Special attention should be given to the pole to base plate weld due to the high stresses at this location. The location and size of any weld crack is to be documented. Suspected cracks should be verified by NDT.
- Condition of the splices. Traffic signal structure poles are not typically spliced. However, if found splices should be inspected for loose or missing components, cracked welds, and under engaged nuts. Document percent engagement if less than 100%. Suspected cracks should be verified by NDT.
- Conditions of, in, and around the hand holes and covers. The hand hole covers should be removed to the extent possible and inspected for looseness of the cover and missing or sheared bolts securing the cover. Any cover that cannot be removed shall be documented. Missing or loose hand hole covers allow for water and debris infiltration, and animal infestation. Any debris present within the hand hole is not to be removed by the inspector; the condition is to be reported for removal by VDOT maintenance crews. Notice shall be provided to the District Manager; refer to guidelines in Section 5.3.4. However, if conditions warrant immediate removal of the debris, the condition should be reported immediately. Conditions that would warrant immediate debris removal include observable corrosion, damage, and/or section loss of the pole and around the hand hole. An inspection should be performed as soon as possible following removal of the debris.
- Cracks or breaks in the hand hole opening and opening weld, and cracks in the pole around the hand hole. Special attention shall be given to the splice weld in the hand hole reinforcing ring. Cracks or breaks in the hand hole opening and welds can potentially serve as a means for crack propagation in the pole. Suspected cracks should be verified by NDT.
- Condition of pole caps. Loose or missing caps allow water intrusion and animal infestation and should be documented.
- Condition of electrical ports. Damage to the ports and missing, loose, or damaged port caps allow for water infiltration and animal infestation and should be documented.
- Timber pole decay, checking, splitting, shakes, knots, fire damage, or insect damage. Timber poles should be checked for decay caused by insects, fungus, or other means. Decay often occurs below the ground line, so the timber pole shall be excavated at least 6" to allow adequate inspection. The timber pole should also be inspected for checking, splitting, or shakes. Any indication of fire damage should also be documented. All dimensions and extent of deficiencies should be documented.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical pole deficiencies and conditions that could be encountered in the field.

Photo 5.35 *New pole/base plate connected to previous baseplate which is buried in grout*

Photo 5.36 *Loose hand hole cover due to sheared top bolt*

Photo 5.37 *Missing hand hole cover, bent ring around hand hole*

Photo 5.38 *Loose pole cap secured with electrical tape*

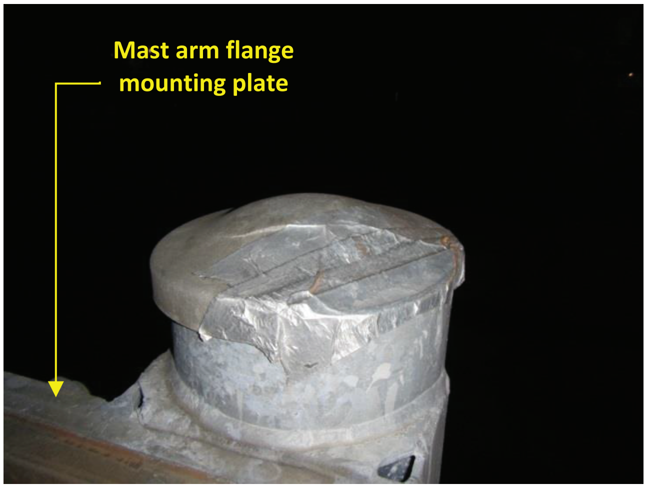


Photo 5.39 *Broken pole cap with duct tape in place over missing portion of cap*

Photo 5.40 *Out of plumb pole, note welded splice in pole near mid-height*

Photo 5.41 *Torch cut hole in pole*

Photo 5.42 *Impact damage to painted pole with corrosion on affected area*

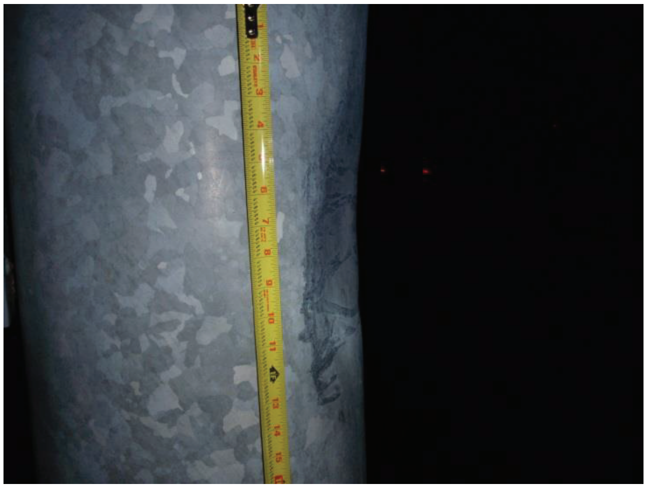


Photo 5.43 *Impact damage/dent to pole*


Photo 5.44 *Buried base plate with corrosion and pitting on base plate, base plate to pole weld and pole*

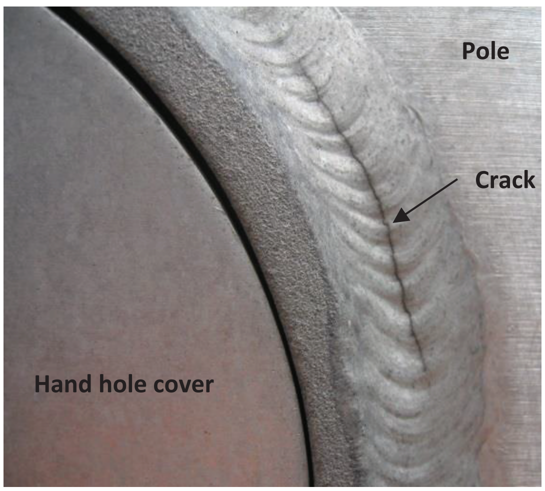


Photo 5.45 *Crack in weld at hand hole cover*

Photo 5.46 *Checking on timber pole*


Photo 5.47 *Timber pole decay below grade*


Photo 5.48 *Decay below grade, shown after pole removal*

5.3.3n *Vertical Supports: Attachments to Pole*

Components such as small informational signs, cameras, sensors, cross walk pedestrian signals, luminaire chords or other items are often attached to the poles. These attachments should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Condition of electrical conduit and/or electrical or control boxes attached to the pole(s). The conduit should be visually inspected for missing components, breaks, exposed wiring, and corrosion and section loss of connector and attachments. In addition, the conduit and wiring entry and exit points in the poles should be inspected for the presence of rubber grommets or seals. Electrical or control boxes and their pole attachments should be inspected for corrosion and section loss. If any exposed wiring is present, inspectors are to take caution and avoid contact.
- Condition of the component. The component should be inspected for functionality and deficiencies documented.
- Condition of the component attachment. The attachments should be inspected and documented for section loss and missing or loose hardware.

The photographs below present various typical pole attachment deficiencies and conditions that could be encountered in the field.

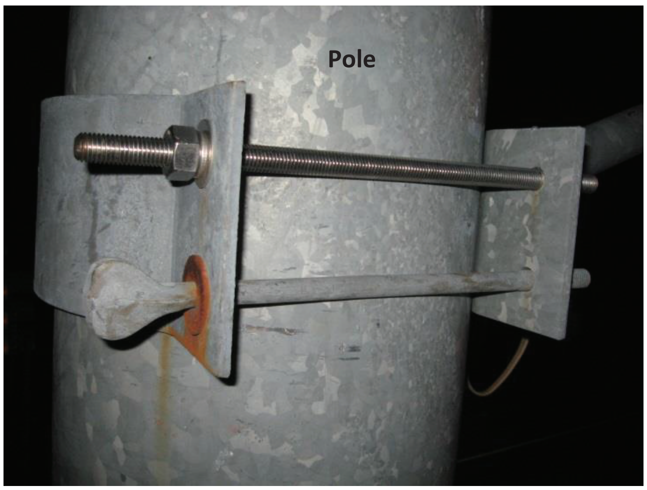


Photo 5.49 *Corroded sign to pole connection hardware*

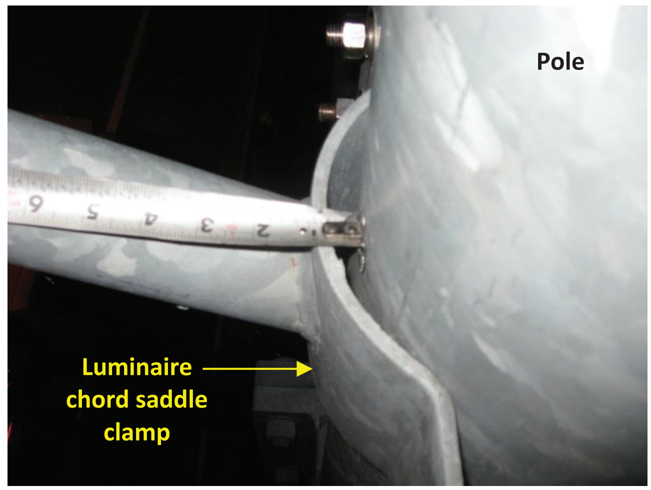


Photo 5.50 *Undersized luminaire attachment saddle clamp*

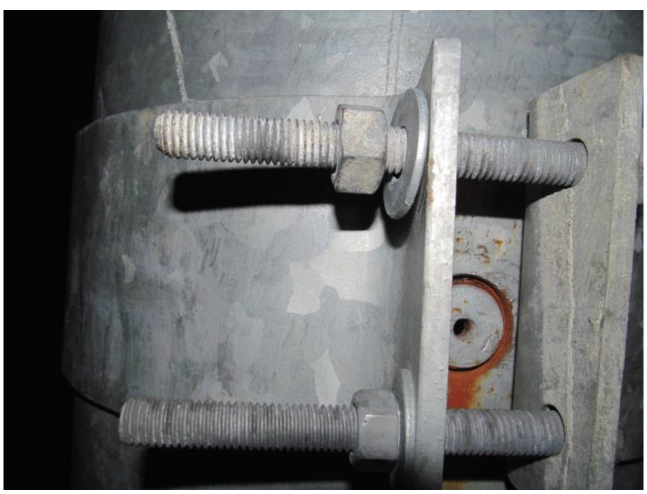


Photo 5.51 *Loose nut at luminaire attachment saddle clamp*

Photo 5.52 *Failed securing straps on control box mounted to pole*

5.3.3o *Vertical Support: Mast Arm to Pole Connections*

The mast arm to pole connections should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
    - If corrosion is observed on the connection assembly, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented. If the section loss cannot be measured by conventional methods, then thickness testing shall be performed utilizing corrosion thickness gages to determine the amount and extent of section loss.
    - If corrosion is observed on the connection hardware the amount and extent of section loss should be determined and documented. It should also be documented if the corrosion is caused by the presence of dissimilar metals. For guidance on dissimilar metals, refer to Section 3.8.
- Localized areas of distressed painted or coated surfaces. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.
- Condition of the welded connections. The welds should be inspected for cracking, especially at points of intersecting welds, and incomplete or excessively ground welds as they create stress risers. The location and size of the crack(s) is to be documented.
- Condition of the bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, beveled washers or extra washers. Document percent engagement if less than 100%. For vertical support to chord connections, special attention should be given to flange mounting plate and collar plate connections, as they are less redundant than seated connections.
- Gaps in flange mounting plates or collar plates. Gaps could increase stresses in the connection bolts.
- Bent or distressed collar plate or collar plate ribs.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical mast arm to pole connection deficiencies and conditions that could be encountered in the field.

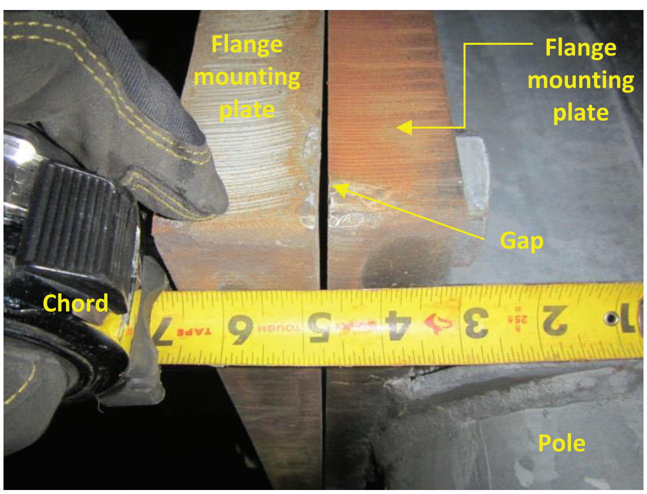


Photo 5.53 *Gap in flange mounting plates of mast arm to pole connection*

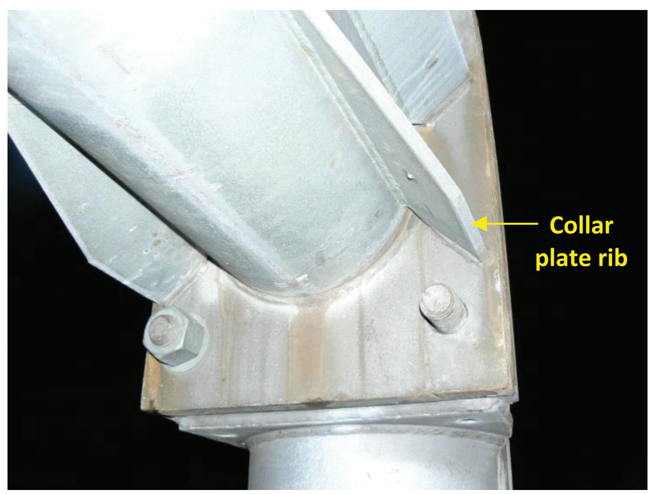


Photo 5.54 *Missing nut on flange mounting plate of mast arm to pole connection*

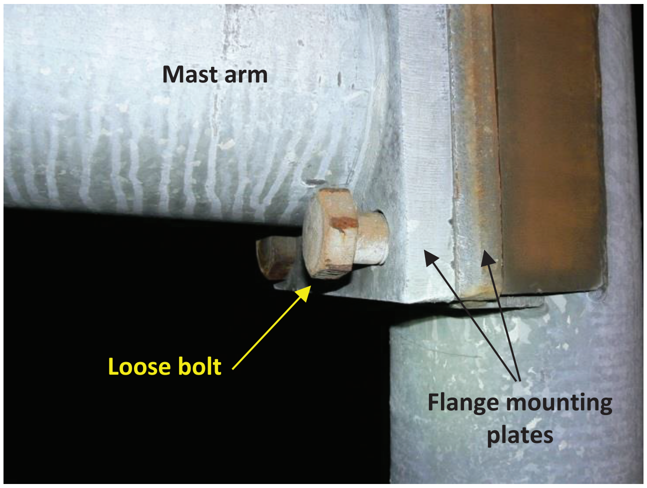


Photo 5.55 *Loose bolt at flange mounting plates of mast arm to pole connection*

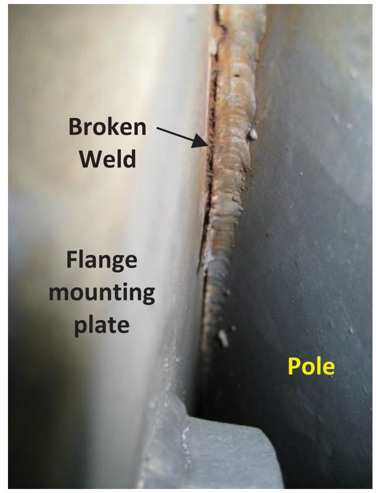


Photo 5.56 *Broken weld at flange mounting plate to pole connection*

Photo 5.57 *Oversized flat washer under bolt at flange mounting plates of mast arm to pole connection*

Photo 5.58 *Corrosion on excessive flat washers at flange mounting plates of mast arm to pole connection*

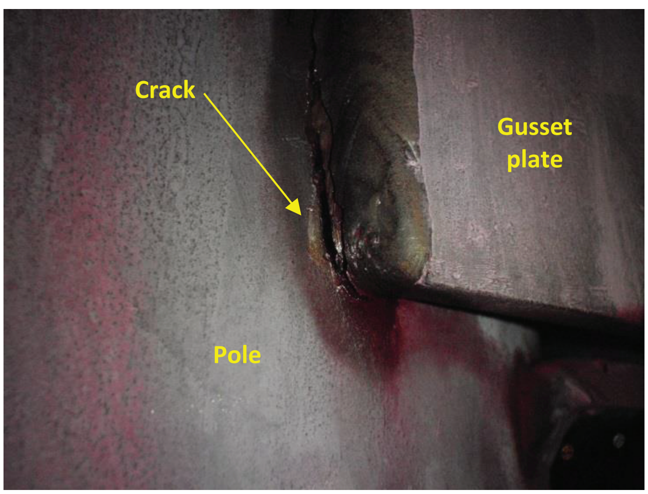


Photo 5.59 *Crack in weld at gusset plate at mast arm to pole connection*

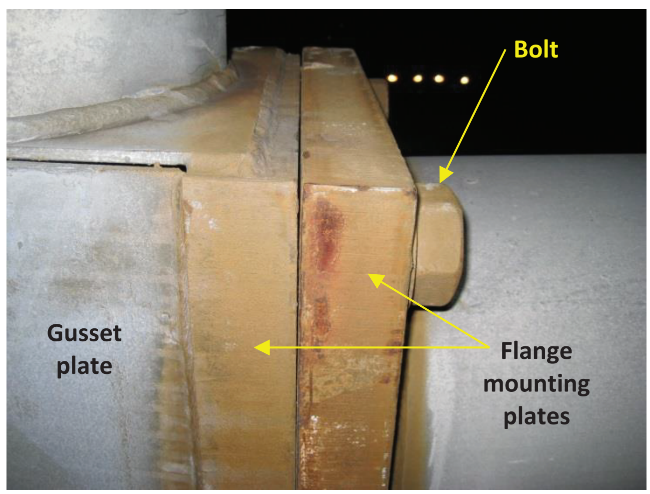


Photo 5.60 *Loss of galvanization and light corrosion on flange mounting plates, bolts and washers at mast arm to pole connection*

5.3.3p *Vertical Support: Span/Sway/Guy Wire to Pole Connection (includes Guy Wire to Anchor Connection)*

The span/sway/guy wire to pole connections should be visually and tactilely inspected from an aerial lift (bucket or platform).The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If corrosion is observed on the connection assembly, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
  - If corrosion is observed on the connection hardware the amount and extent of section loss should be determined and documented. It should also be documented if the corrosion is caused by the presence of dissimilar metals. For guidance on dissimilar metals, refer to Section 3.8.
- Span wire and sway wire at the pole connection. The wire should be inspected for broken strands that reduce the strength and capacity of the wire.
- Clamp or assembly securing the span wire and sway wire at the pole connection. The assembly or wire clamps should be inspected for loose or missing components and under engaged nuts. Document percent engagement if less than 100%. It should be documented if less than two wire clamps are present on a span wire connection.
- Eye bolt (typically at “thimble” eye bolt) used to secure the span wire and sway wire to the pole. The bolt should be inspected for evidence of overstress (cracking, bending, broken) and the nut on the backside of the pole should be inspected for tightness, engagement, cracks, etc. Washers should be present between the pole and bolt connection, on both the eye and the nut side, and the connections and should be inspected for proper size and bearing.
- Timber should be inspected at the span wire and sway wire connection. The drilled holes in the timber should be inspected where visible for evidence of decay. If decay is present, the area should be probed with an awl or pick to determine the depth of the decay. The timber connection should also be inspected for signs of wear resulting from movement of the eye bolt. Movement and subsequent wear can increase the size of the bolt hole and loosen the connection.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical span wire and sway wire to pole connection deficiencies and conditions that could be encountered in the field.

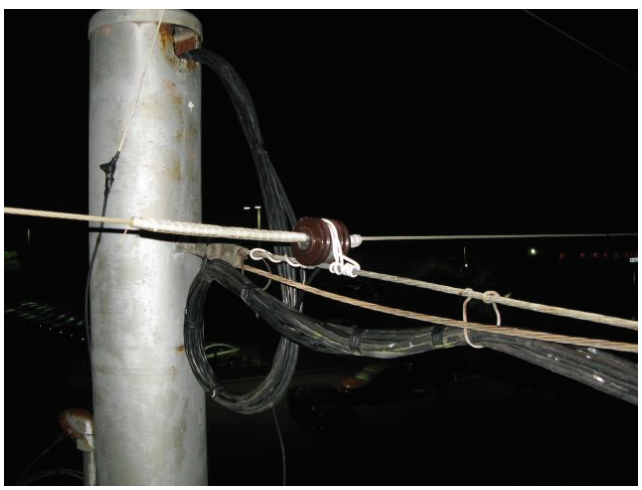


Photo 5.61 *Line attached to span wire at span wire to pole connection*

Photo 5.62 *Broken strands on span wire at connection to pole*

Photo 5.63 *Bent thimble eye bolt on timber pole due to guy wire attached on backside of bolt*

5.3.3q *Horizontal Support: Mast Arms*

The mast arms should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on the outside of the mast arm components, the area should be thoroughly cleaned of any rust scale and the amount and extent of section loss should be determined and documented.
  - If corrosion is suspected on the inside of the mast arm components, the outside of the component should be sounded with a hammer to detect "thin" areas. thickness testing shall be performed utilizing corrosion thickness gages to determine the amount and extent of section loss.
- Excessive sagging of the mast arm. Due to the length of certain mast arms (up to 70 feet), it is likely that sagging/deflection could be present. Observable excessive sagging could be the result of overstressing/overloading, inadequate member size, or damage resulting from vehicle impact, and should be measured and documented. A laser distance measuring device could be used to determine the amount of sag in a mast arm. This method would entail stationing an inspector at the end of the mast arm, the area of observable maximum sag, S, with a level and a laser distance meter. The laser would be placed on the side of a level positioned along the centerline of the mast arm. The level would be straightened, or leveled, and the laser shot to the pole/vertical support. The inspector stationed at pole/vertical support would then mark the location on the pole; the distance could be measured from the mark to the centerline of the mast arm at the connection to the pole; refer also to Figure 5.12.

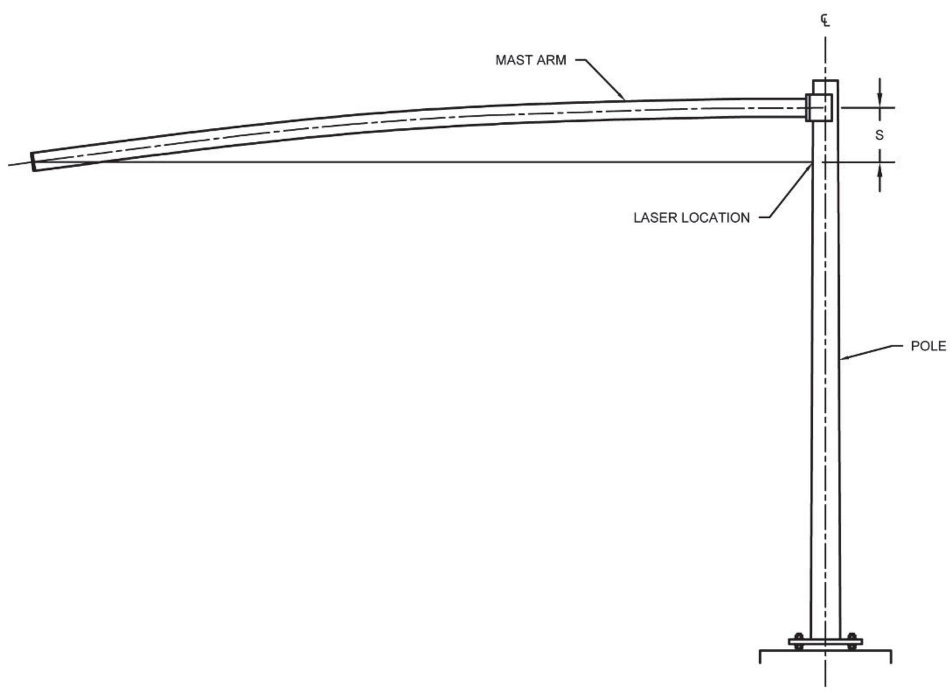


Figure 5.12 *Measurement Methodology for Mast Arm Sag*

- Localized areas of distressed painted or coated surfaces such as at connections, attachments, etc. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.
- Condition of the slip joints (if applicable). The mast arms at the slip joints should be inspected for cracking, especially at the end of the members and at the drilled bolt hole (present at slip joint connection). The location and size of any weld crack is to be documented. Suspected cracks should be verified by NDT. The slip joint bolt should be inspected for corrosion, loose or missing components, under sized bolt or under engaged nut.
- Condition of the welded joints (if applicable). The welds should be inspected for cracking, incomplete or excessively ground, or poor welds that can contribute to stress risers within the weld. The location and size of any weld crack is to be documented. Suspected cracks should be verified by NDT.

- Corrosion or loose rust scale around electrical ports (holes in mast arms electrical wiring penetrates to feed signals, sensors, cameras, etc.). Corrosion and rust scale may be indicative of corrosion of the inside of the chords or trussing and should be investigated as described previously in this section. In addition, a rubber grommet should be in place around the opening to prevent chaffing of the wiring.
- Corrosion and cracking around any burned or rough-cut holes. Burned or rough-cut holes are stress risers and special attention should be given to these areas.
- Dents, buckles, or ruptures in the mast arm. These conditions typically occur during erection of the structure but may also be caused by vehicular or debris impacts and should be measured and documented.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.
- Condition of end caps. Loose or missing caps allow water intrusion and debris accumulation and should be documented.
- Utility wires or cables in contact with mast arm. Document any utility wires or cables that are resting on, or in contact with the mast arm. Constant friction (rubbing) of the lines against the mast arm can cause coating failure and lead to corrosion or be energizing the structure. If utility wires or cables exist, the inspectors should maintain a minimum distance; refer to requirements in Section 5.2.

The photographs below present various typical mast arm deficiencies and conditions that could be encountered in the field.

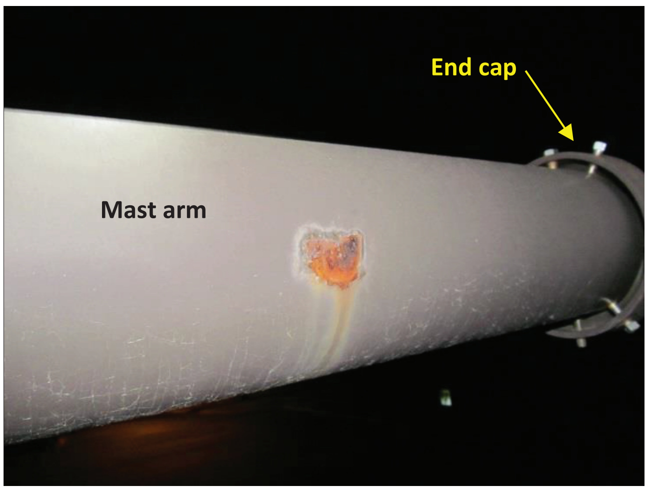


Photo 5.64 *Area of corrosion on mast arm*

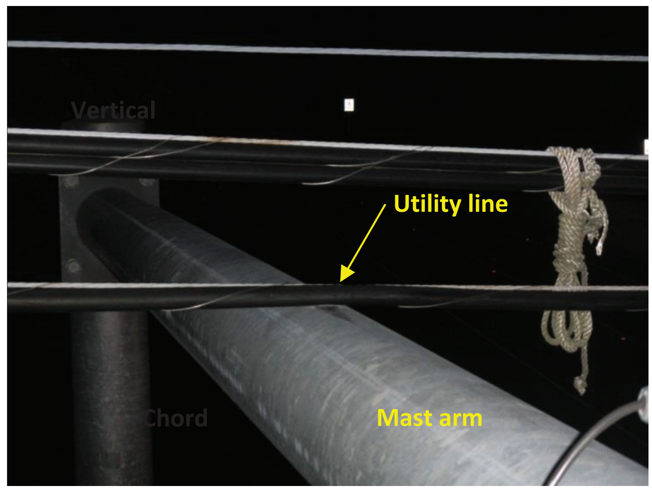


Photo 5.65 *Utility line resting on mast arm*

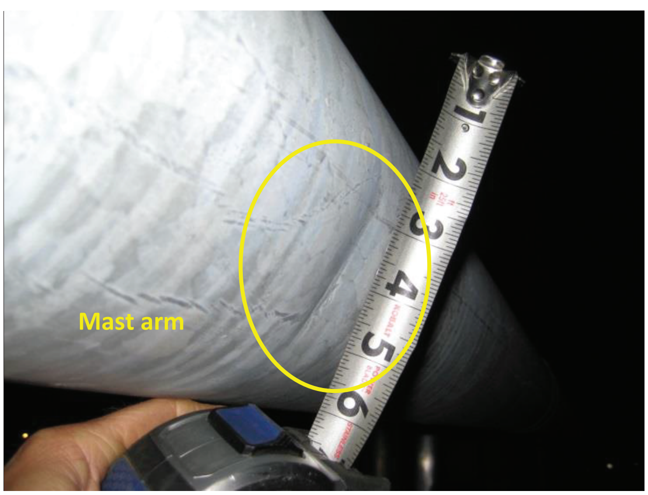


Photo 5.66 *Dent in mast arm*

Photo 5.67 *Loose, oversized (length), and undersized (diameter) bolt at bolted mast arm slip joint*

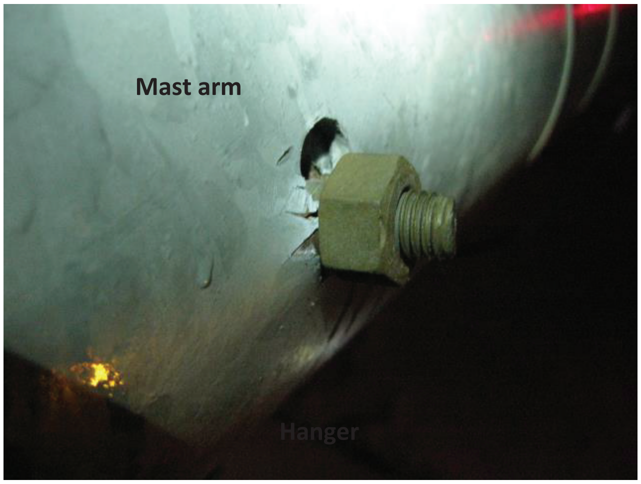


Photo 5.68 *Tear in bolt hole in mast arm at bolted slip joint*

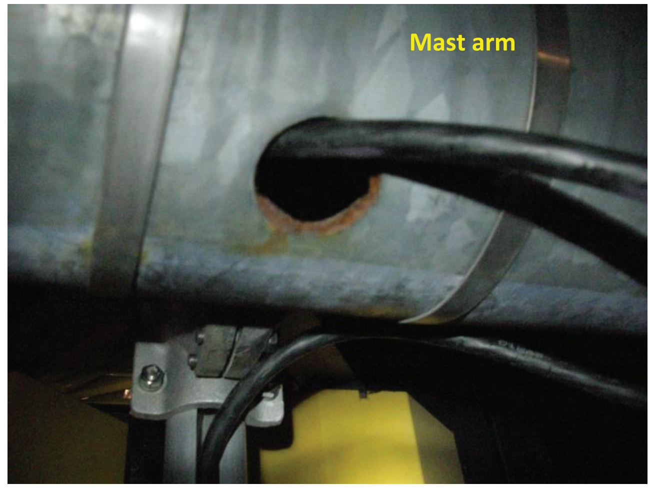


Photo 5.69 *Corrosion around electrical port and missing rubber grommet*

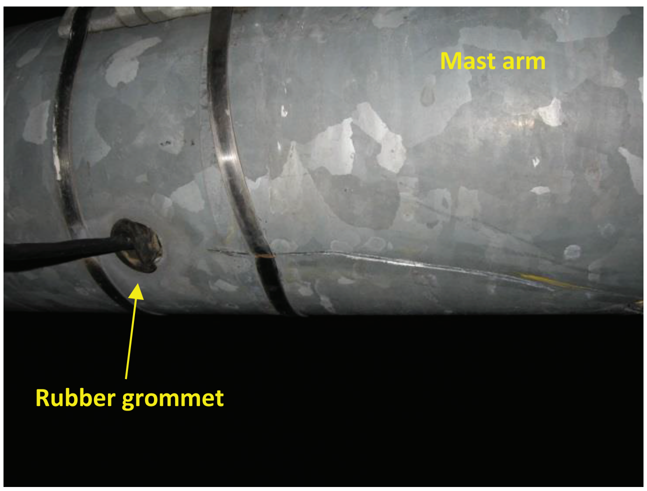


Photo 5.70 *Impact damage to mast arm*

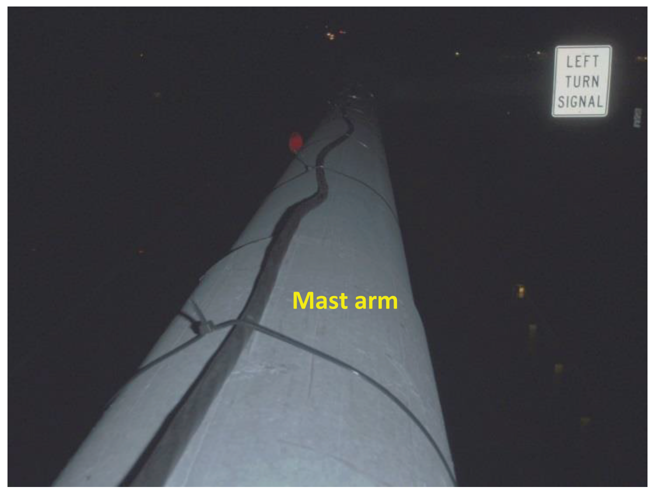


Photo 5.71 *Improperly secured cable fastened to top of mast arm*

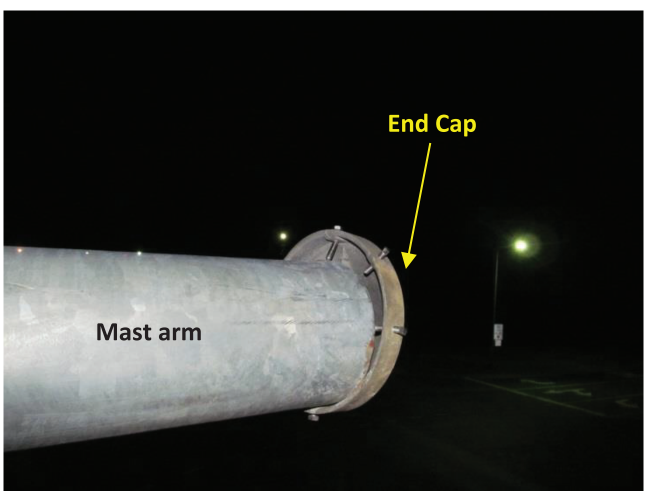


Photo 5.72 *Improperly sized and fastened end cap at end of mast arm*

Photo 5.73 *Missing end cap on mast arm with bird nesting debris inside arm*

5.3.3r *Horizontal Support: Overhead Span*

The overhead span is the same as the sign structure overhead span and in addition to applicable portions of this chapter should also be inspected in accordance with Chapter 4.

5.3.3s *Horizontal Support: Span/Sway/Guy Wire*

The span/sway/guy wire structures should be visually and tactilely inspected from an aerial lift (bucket or platform) similar to the inspection of the mast arms. The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on the span/sway/guy wire and/or components, the area should be thoroughly cleaned of any rust scale and the amount and extent of section loss should be determined and documented.
- Utility wires or cables in contact with the span/sway/guy wire. Document any utility wires or cables that are resting on, or in contact with, the span/sway/guy wire. Constant friction (rubbing) of the lines against the wire can cause coating failure and lead to corrosion, or the contact could energize the structure. If utility wires or cables exist, the inspectors should maintain a minimum distance; refer to requirements in Section 5.2.
- Condition of splices (if applicable). If two or three bolt clamps are used to splice the wire, the clamps should be inspected for corrosion, loose or missing components, or under engaged nuts.
- Condition of the span/sway/guy wire. The wires should be inspected for corrosion, breaks in the strands, kinks, etc.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical span wire and sway wire deficiencies and conditions that could be encountered in the field.

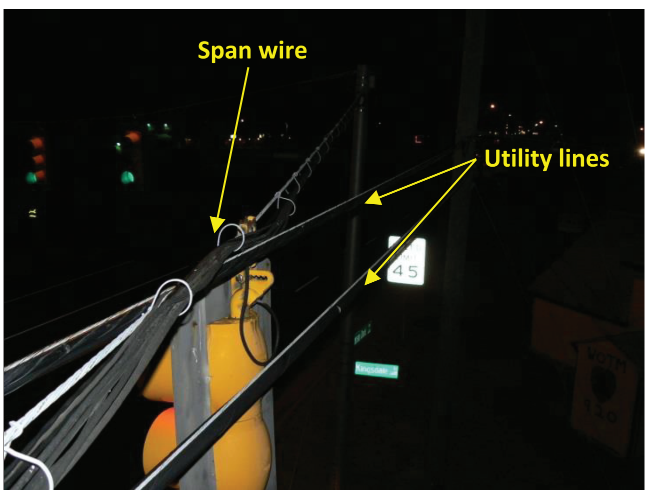


Photo 5.74 *Span wire resting on top of utility lines*

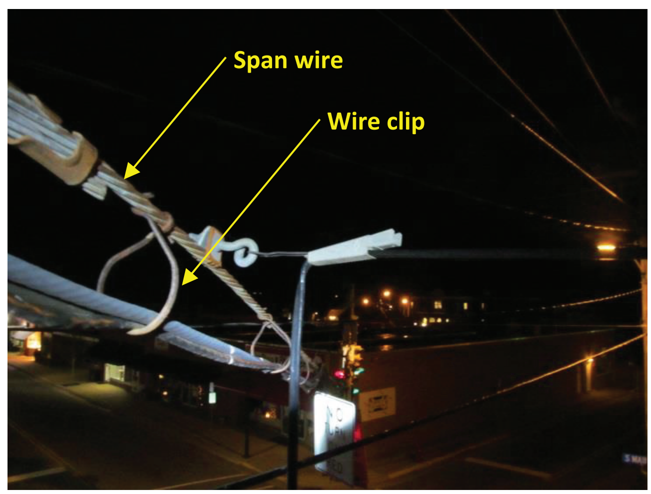


Photo 5.75 *Loss of galvanization on span wire and wire clips with light to moderate corrosion*

5.3.3t *Mast Arm: Attachments to Superstructure*

The signal head, sign, camera, sensor, etc. attachments to the mast arm should be visually and tactilely inspected from an aerial lift (bucket or platform). These are typically attached to the mast arm using an orbital mounting bracket. This bracket mounts to the mast arm and allows several axis of adjustment to properly align the signal heads, signs, etc. The inspector should inspect and document the following conditions associated with the orbital mounting brackets:

- Loss of galvanizing, corrosion, section loss, etc.
  - The orbital bracket attachment hardware is typically stainless steel; however, galvanized steel can also be found in the attachment hardware. If an area of corrosion is observed on the attachment hardware, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
  - Corrosion of the pins connecting the stainless steel band to the orbital bracket. If an area of corrosion is observed on the pin or pins, the exposed portion of the pin should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented. The pins are typically zinc plated and, as such, are highly susceptible to galvanic corrosion (dissimilar metals).

- Condition of orbital bracket (aluminum). The orbital bracket should be inspected for cracks or breaks. Cracks or breaks compromise the ability of the connection to support the intended component (signal head, sensor, camera, etc.). Document location and size of the crack or break.
- Condition of orbital bracket curved washer (aluminum). This washer connects the bolt on the stainless steel band to orbital bracket. This should be inspected for cracks or breaks. Document location and size of the crack or break.
- Loose, missing, deformed/misaligned, or broken bolted connections or components, and under engaged nuts on the orbital bracket assembly. Under engaged nuts are to be recorded as percent engaged.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.
- Document any deviation, excess or missing components, from the typical configuration; refer to Photos 5.76 and 5.77. Some examples may include material other than stainless steel or aluminum, the presence of beveled washers, lock or jam nuts, extra washers, and missing nuts and washers.

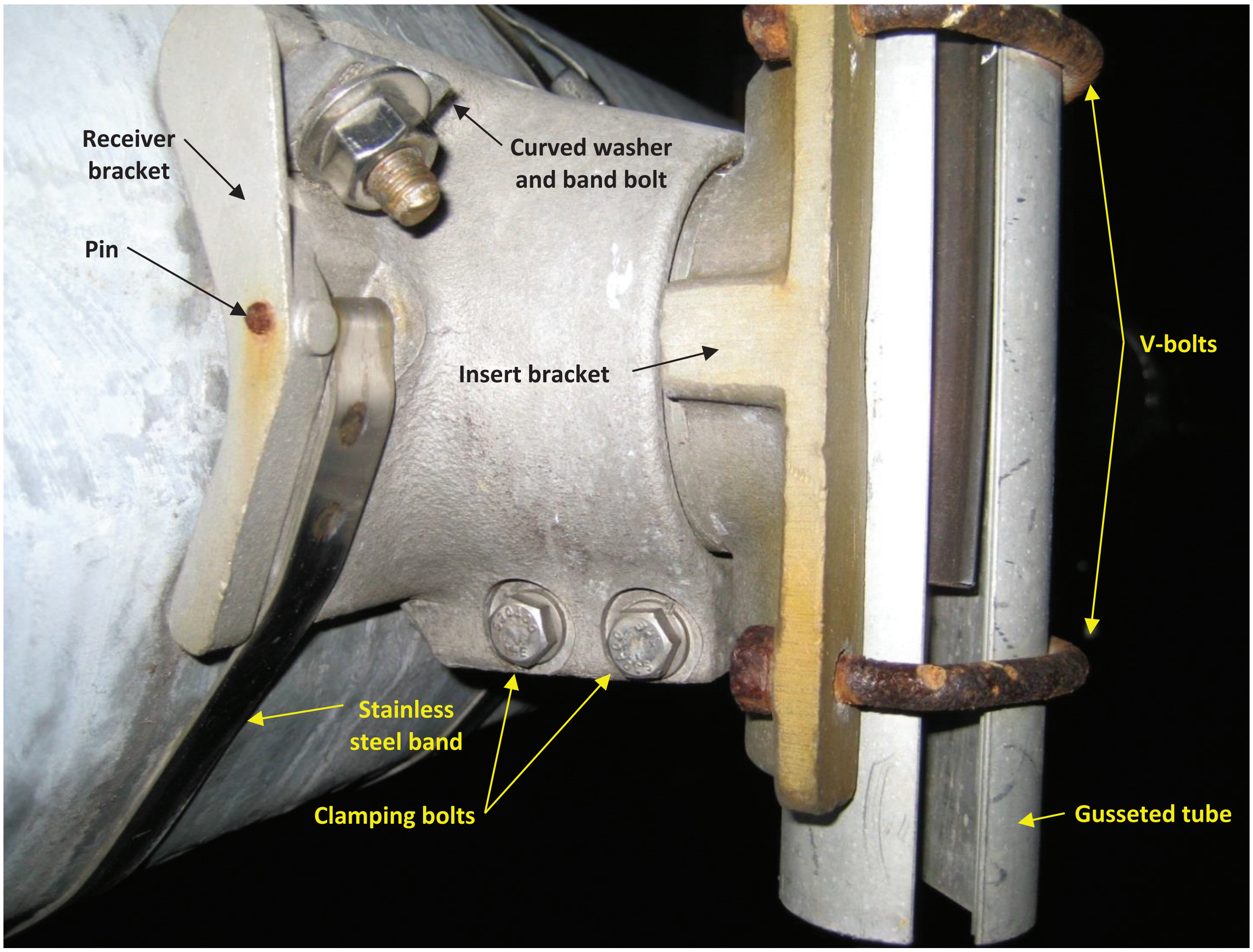


Photo 5.76 *Typical band mount orbital bracket*

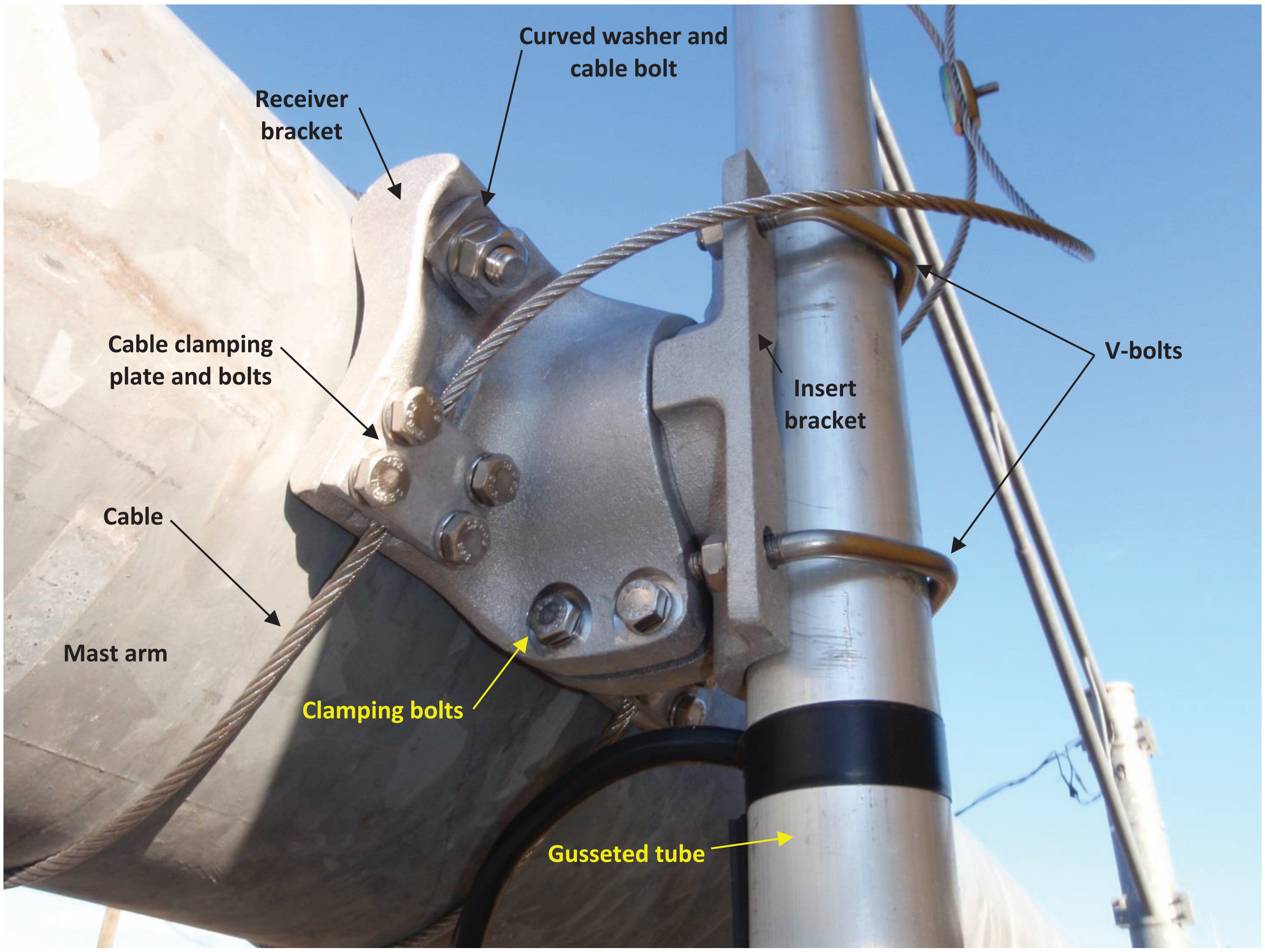


Photo 5.77 *Typical cable mount orbital bracket*

The photographs below present various typical orbital bracket deficiencies and conditions that could be encountered in the field.

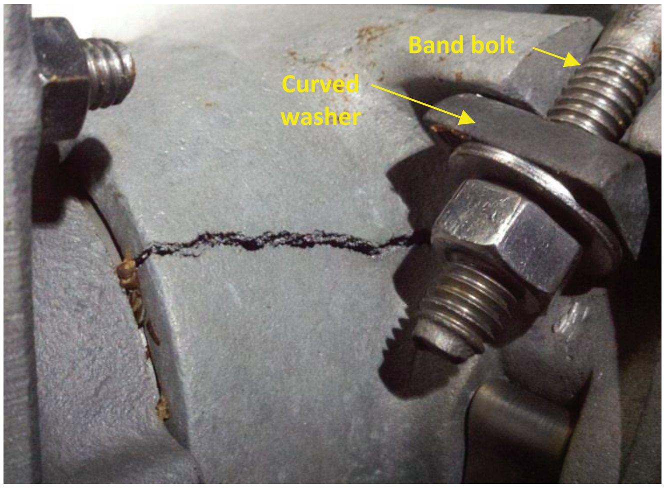


Photo 5.78 Crack in orbital bracket

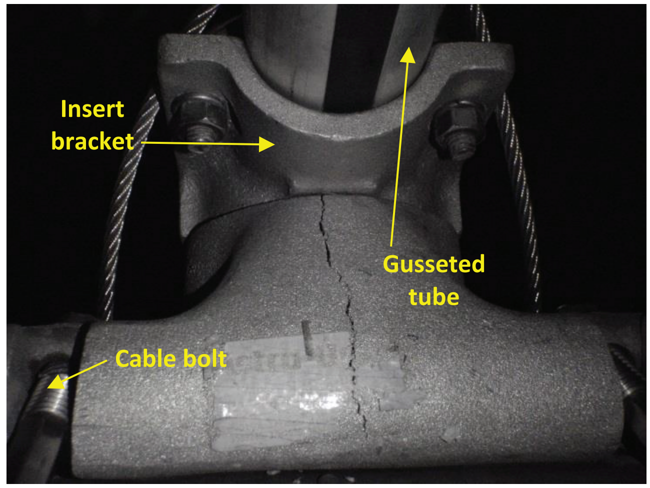


Photo 5.79 Crack in orbital bracket

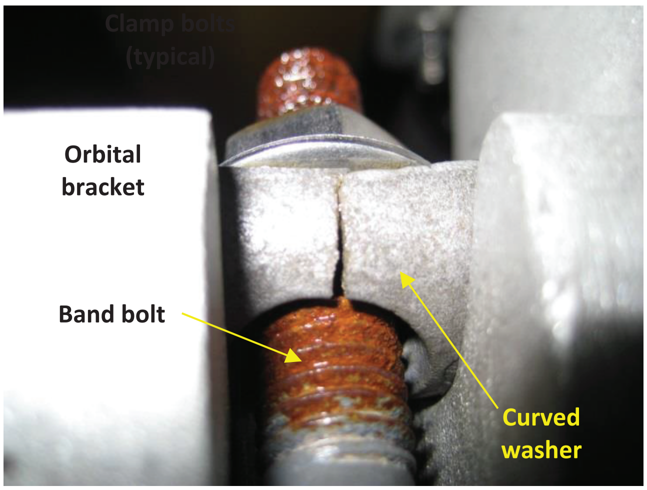


Photo 5.80 *Broken curved washer at band bolt to orbital bracket connection*

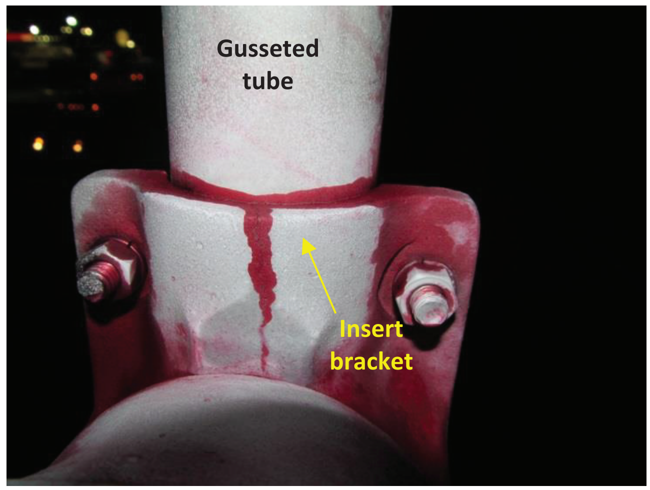


Photo 5.81 *Crack in insert bracket at gusseted tube connection on orbital bracket*

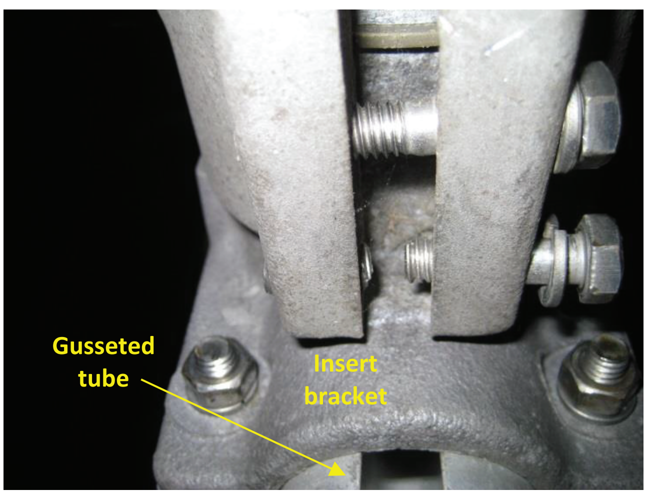


Photo 5.82 *1 of 2 clamp bolts broken at orbital bracket*

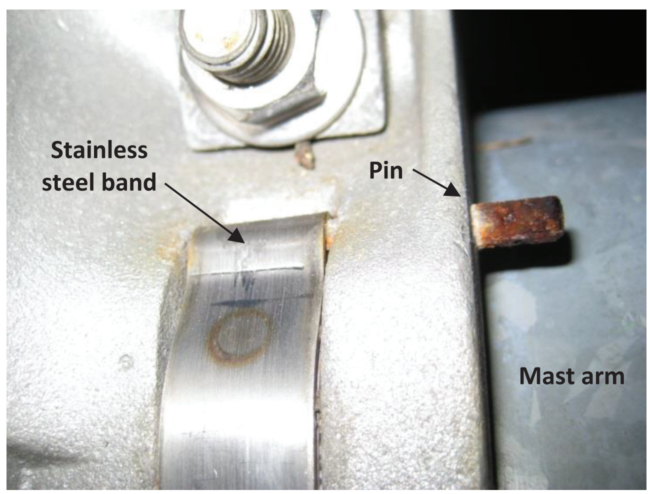


Photo 5.83 *Zinc pin not fully seated at stainless steel band connection, note corrosion on pin*

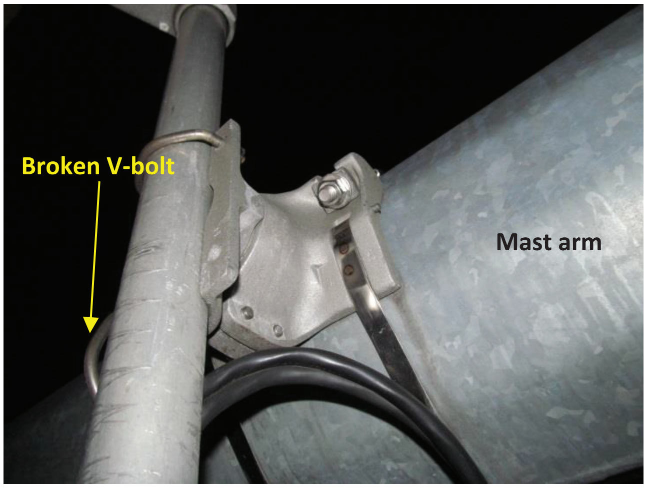


Photo 5.84 *1 of 2 V-bolts broken at gusseted tube connection to orbital bracket*

Photo 5.85 *Corrosion on non-stainless connection hardware of orbital bracket*

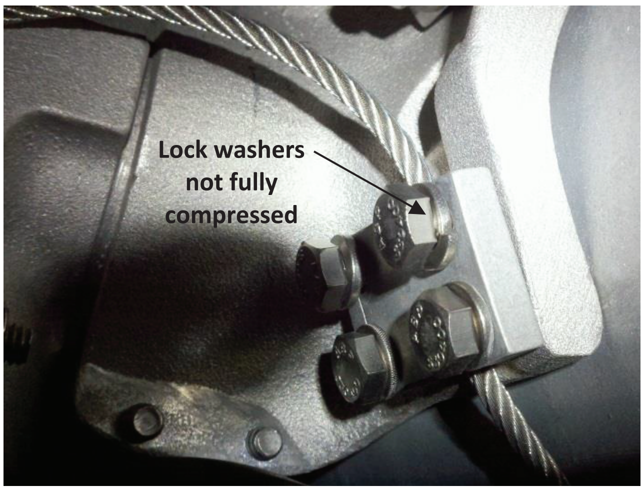


Photo 5.86 *Loose bolts at cable clamping connection to orbital bracket*

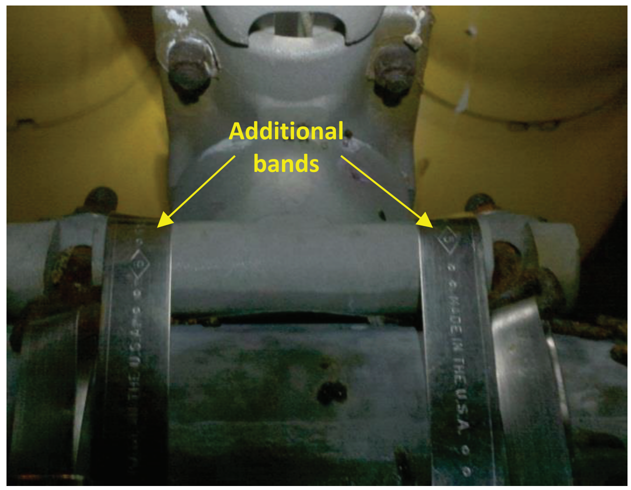


Photo 5.87 *Additional stainless steel bands installed at orbital bracket*

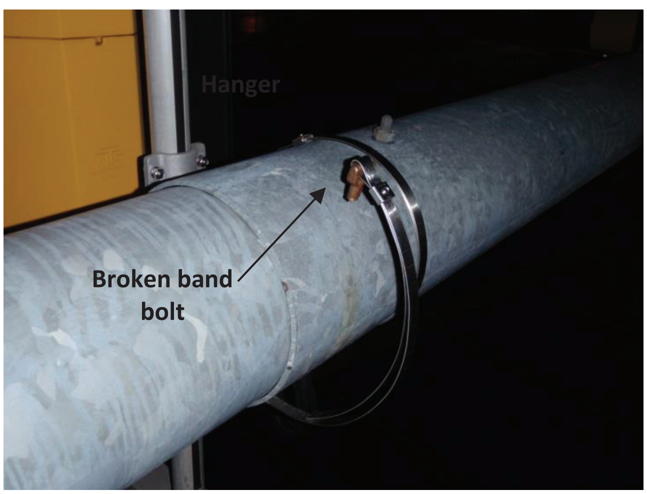


Photo 5.88 *1 of 2 broken band bolts on orbital bracket*

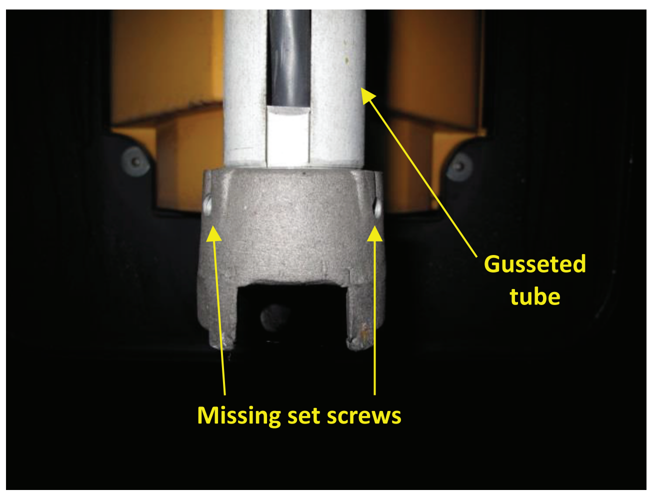


Photo 5.89 *Missing set screws at lower gusseted tube connection*

5.3.3u *Span Wire: Attachments to Superstructure*

The signal and sign attachments to the span wire should be visually and tactilely inspected from an aerial lift (bucket or platform). These are primarily attached with the use of span wire clamps. These clamps are then attached to a leveling assembly and a hanger, which is then mounted to the signal head or sign. This mounting allows vertical adjustments as well as the ability to "plumb" and properly align the signals and signs. The inspector should inspect and document the following conditions associated with the span wire clamps:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on the mounting components, the area should be thoroughly cleaned of any rust scale and the amount and extent of section loss should be determined and documented.
- Worn hardware. Due to the potential for motion of the assembly, connection hardware as well as bolt holes or slots can become worn. Document any section loss of the members due to wear.
- Loose, missing, deformed/misaligned, or broken bolted connections or components, and under engaged nuts on the attachment assembly. Under engaged nuts are to be recorded as percent engaged.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical span wire attachment deficiencies and conditions that could be encountered in the field.

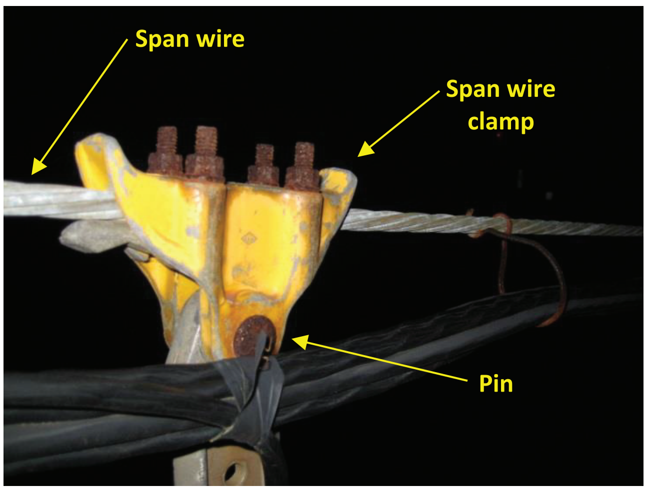


Photo 5.90 *Moderate corrosion on span wire clamp bolts and pin at leveling assembly connection*

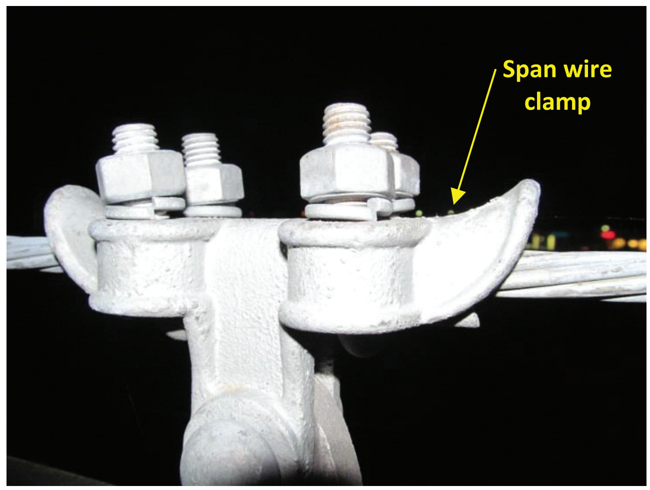


Photo 5.91 *Loose bolts at span wire clamp*

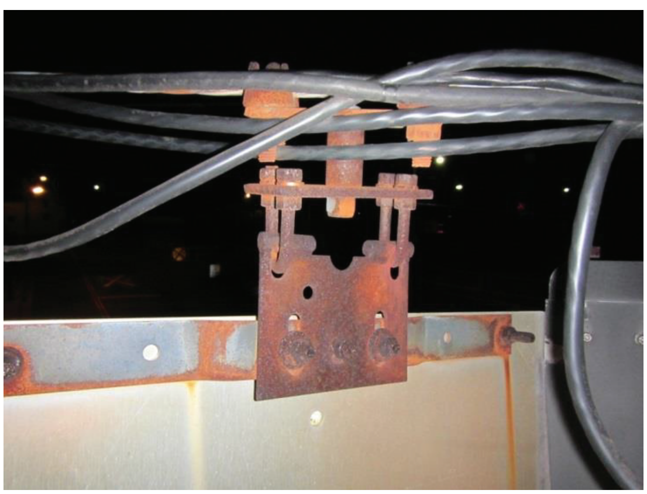


Photo 5.92 *Corrosion and wear on sign attachment hardware*

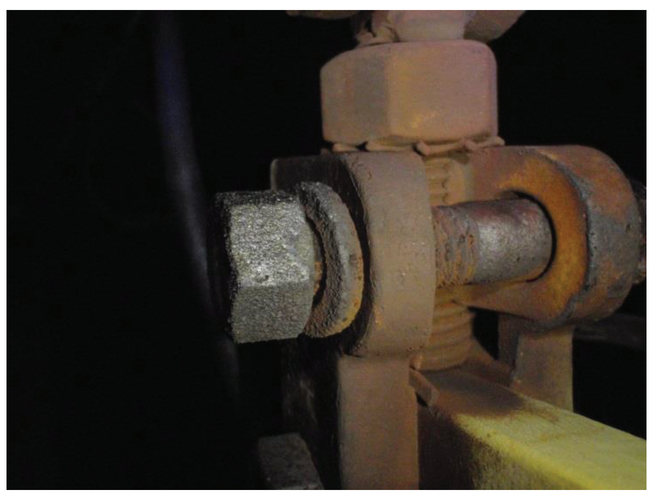


Photo 5.93 *Loose bolt at hanger assembly on signal attachment to span wire*

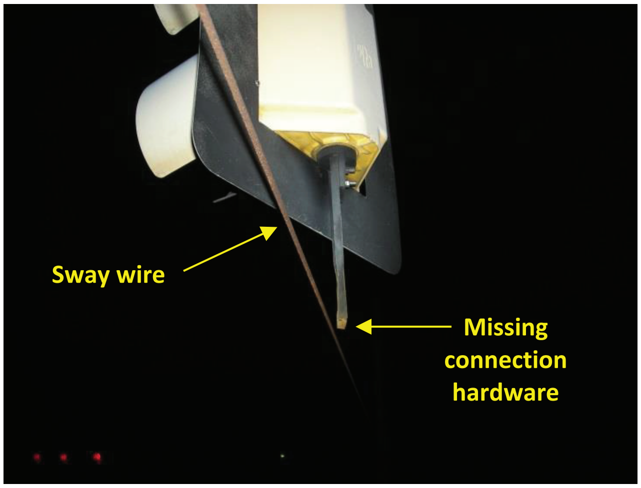


Photo 5.94 *Missing connection hardware at signal head to sway wire connection*

5.3.3v *Signals and Attachments*

In general, the traffic signal structure inspections do not cover the operational functionality of the signal heads, sensors, cameras, antennas, wiring, etc.; however, the inspector is required to note anything that may impact or pose a threat to the safety of the public, including motorists, pedestrians, or inspection personnel. In addition, any observed non-functioning component should be documented. The signal heads and signs, as well as sensors, antennas and cameras and any other component mounted to the mast arm or span wire should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint), oxidation, section loss, etc.
  - If an area of oxidation is observed on the signal heads, the area should be thoroughly cleaned, and the amount and extent of section loss should be determined and documented.
- Signal lenses. The lenses should be inspected for functionality and any defects (bullet holes, cracked lenses, etc.) should be noted).
- Signal visor and backplate. These components should be inspected for missing, loose, or broken components.
- Wing nuts securing front panel of signal heads. The nuts should be inspected for missing, loose, or broken components.
- Impact damage. The affected signal head, sign, sensor. etc., location on the affected component, and dimensions of the impact damage are to be documented and the area photographed.
- Alignment of the components. The inspector should verify that all signal heads, signs, etc. are mounted so that they are easily visible from the intended direction of travel.
- Connection hardware fastening the attachments to the arms/wires. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, beveled washers or extra washers. Document percent engagement if less than 100%.
- Bullet holes. Bullet holes per signal head or sign should be documented.
- Cracking, damage, delaminating, peeling, or crazing (network of closely spaced, fine cracks) of the reflective material of attached signs. Damaged or deteriorated reflective material can affect the legibility of the sign.
- Fading of lettering. Faded lettering can affect the legibility of the sign.
- Attachment operation and functionality.
- Cracked, broken, cloudy sensor or camera covers.
- Moisture accumulation or water in attachment housings.
- Loose, missing, or deformed/misaligned bolted connections or components, and under engaged nuts. Under engaged nuts are to be recorded as percent engaged.
- Condition of electrical conduit, conduit attachments, conduit connections. The conduit should be visually inspected for missing components, breaks, exposed wiring, and corrosion and section loss of connector and attachments. The junction boxes should be inspected for missing covers and exposed and/or broken wiring.

The photographs below present various typical signal head, sign, sensor, antenna and camera deficiencies and conditions that could be encountered in the field.

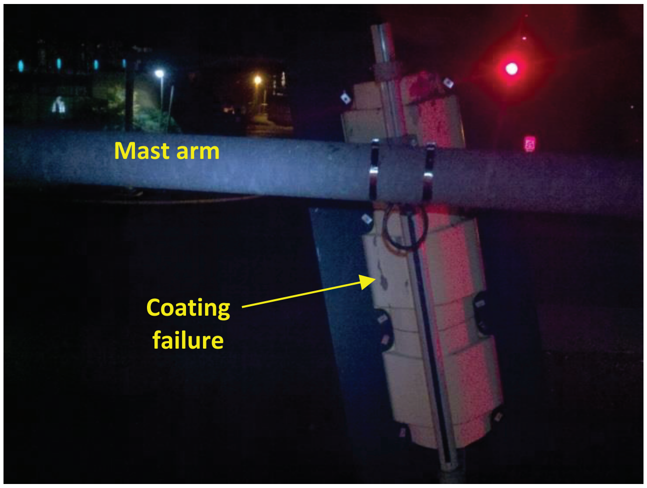


Photo 5.95 *Misaligned signal head, note coating failure on backside of signal head*

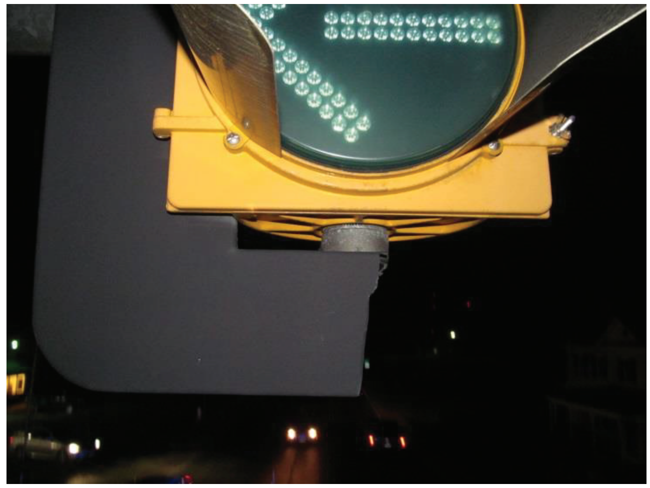


Photo 5.96 *Broken backplate on signal head*

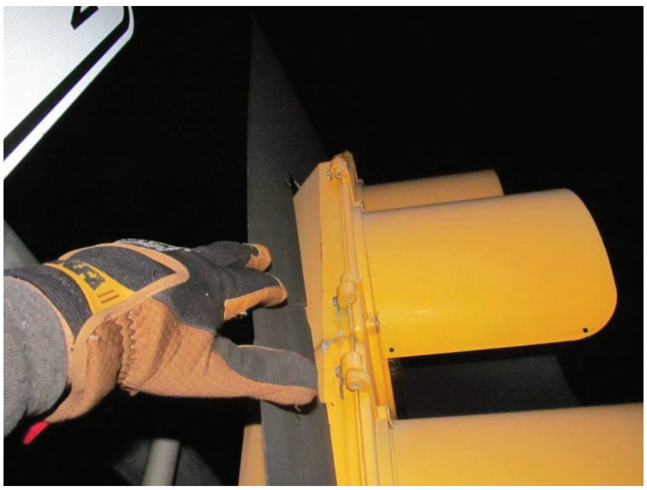


Photo 5.97 *Detached backplate on signal head*

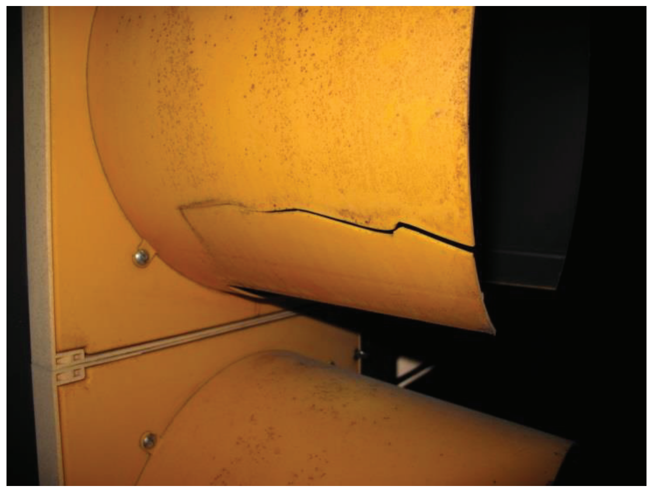


Photo 5.98 *Broken visor on signal head*

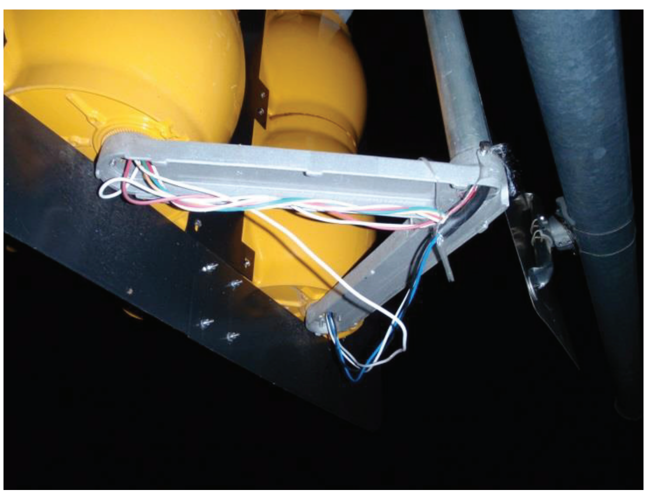


Photo 5.99 *Loose wires at bottom of signal head*

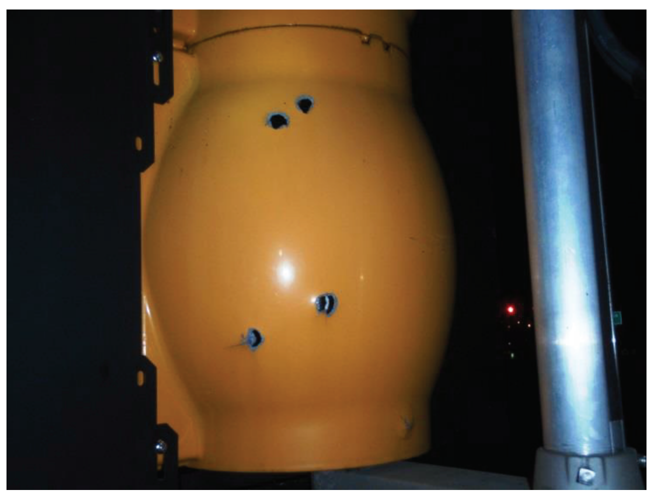


Photo 5.100 *Bullet holes in backside of signal head*

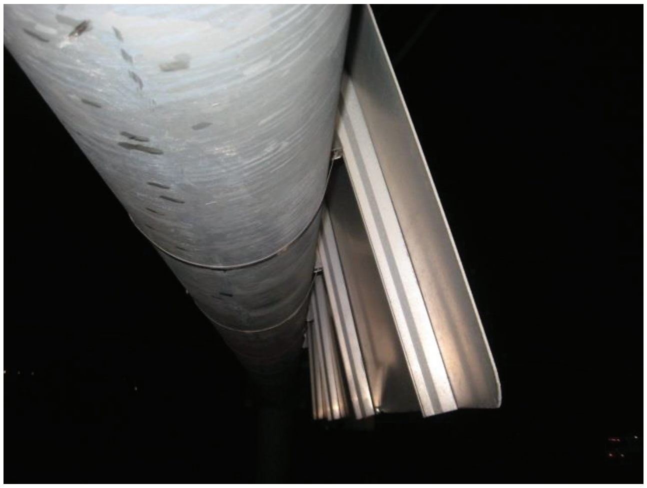


Photo 5.101 *Impact damage to sign mounted to mast arm*

Photo 5.102 *Peeling of lettering on turn arrow*

5.3.4 Conditions Preventing Inspection

A best attempt should always be made to complete the inspection. However, in some cases, conditions may be encountered that prevent inspection. A few examples of such conditions include structures buried more than 12”, hand hole covers that cannot be removed, or excessive debris within hand holes. The condition is to be reported to the District Manager so that the condition preventing inspection can be resolved, allowing inspection to proceed. The notification shall be provided via email complete with a written description(s) and photograph(s) of the finding. The notification should be provided at the end of the week in which the finding was made, along with any similar findings made throughout the week. However, if conditions warrant immediate response, the condition should be reported immediately. Conditions that would warrant immediate response include observable corrosion, damage, and/or section loss. After resolution of the condition that was preventing inspection, an inspection should be performed as soon as possible.

5.3.5 Departure from Site

Prior to departing the site of an inspected traffic signal structure, the Team Leader should review the inventory information and inspection findings for clarity, accuracy, and completeness. A good practice is for the inspector to prepare a basic inventory and inspection checklist prior to the inspections, to use in the field to ensure that all necessary information is captured. In addition, a walk-through of the inspection site should be made to ensure that all equipment has been collected and stored in the inspection vehicle. Lastly, the Team Leader should review the next structure and the MOT requirements with the MOT crew. Should the inspections be completed for the day or evening, the Team Leader should contact the appropriate Smart Traffic or Traffic Operations Center to notify them that inspection operations have ceased for the day or evening.

5.4 Critical and Emergency Structural Findings

Critical and Emergency findings are those findings that present an imminent structural or safety risk or immediate hazard, respectively, to the structure and/or traveling public. These conditions are further defined and discussed below.

5.4.1 Critical Findings

Critical Findings are defined as imminent conditions that could, if left unresolved, result in localized or complete failure (collapse) of the structure, or present a safety issue to the traveling public, and should be addressed within 90 days of its discovery. Should any such condition be encountered, it shall be reported to the District Manager within 24 hours of the discovery of the finding. A notification shall be provided via email complete with a written description(s) and photograph(s) of the finding.

5.4.2 Emergency Findings

Emergency Findings are defined as conditions that are deemed to pose an immediate safety risk or hazard to the structure's integrity and/or the traveling public and require immediate attention and corrective action. Should any such condition be encountered, the Team Leader shall contact the appropriate District Manager while on-site to notify them of the condition. In the case of an Emergency Finding, contact is normally initiated by telephone call and followed up the same day with email documentation of the findings, including photographs. Once contacted, the Department will work with the Team Leader to quantify and assess the situation to determine if it warrants an emergency response or can be addressed through the critical recommendation process.

5.4.3 Critical and Emergency Findings through Combination

In some cases, several less-than-critical deficiencies may exist which together may create a critical or emergency situation. As an example, a pole may be rated poor due to a dent and bowing. However, if the inspector believes that the bowing is being exacerbated by the dent, he/she may assess the overall condition as critical. The inspector shall use their judgment to identify combinations of deficiencies that would be deemed critical or emergency.

5.4.4 Common Critical Findings

The following items/criteria are typical conditions that qualify as critical conditions; however, the inspector should use sound judgment in determining if any other deficiencies, or combination of deficiencies, exist that could qualify as a critical or emergency condition. As stated above, any emergency findings shall be reported immediately to the appropriate District Manager to notify them of the condition(s).

5.4.4a Pedestal

- Observable movement or rotation.

5.4.4b Anchor Bolts

- 30% or greater section loss of 1 or more anchor bolts.
- Any anchor bolts that are broken, sheared, or cracked.
- Any anchor bolt(s) having any relevant indications detected by ultrasonic testing.
- 1 of 4, 2 of 6, or 3 of 8+ top or leveling nuts loose or missing.
- 2 of 4, 2 of 6, or 3 of 8+ top or leveling nuts which are not fully seated with a gap under the nut which has a height of 4% of the anchor bolt diameter or greater.
-
- 2 of 4, 2 of 6, or 3 of 8+ out of plumb anchor bolts which have a slope equal to or greater than 1:40.
- 2 of 4, 2 of 6, or 3 of 8+ anchor nuts that are less than 75% engaged.
- 1 of 4, 2 of 6, or 3 of 8+ top or leveling flat washers are missing where slotted/oversized holes exist and the nuts are embedded into the hole.

5.4.4c Grout

- Grout is deteriorated, no leveling nuts present.

5.4.4d *Poles and Base Plates*

- Structural members having one or more areas of 25% or greater section loss.
- Any cracks in the base plate, vertical stiffeners, hand hole, pole, welded joints, base plate or vertical stiffener to pole weld, truss members, or truss to pole welds where likely to propagate into the pole.
- Impact damage to any structural member in which the member is in danger of falling.
- Loose, missing, broken, or heavily deteriorated attachments to the pole (signs, cameras, sensors, etc.) in which the attachments are in danger of falling.

5.4.4e *Mast Arm/Chord Superstructure*

- Structural members having one or more areas of 25% or greater section loss.
- 25% or more bolts or nuts in a mast arm/chord to pole connection are loose or missing.
- Slip joint bolt missing with any evidence of adjacent mast arm sections slipping.
- Any cracks in the mast arms/chords, mast arm/chord to pole connection plates, splice plates or welds, or truss to chord welds where likely to propagate into the chord.
- Impact damage to any structural member in which the member is in danger of falling.

5.4.4f *Span Wire Superstructure*

- Structural members having one or more areas of 25% or greater section loss.
- 25% or more bolts or nuts in a span wire to pole connection are loose or missing.
- Span wire splice components and hardware are loose or missing.
- Sway wire is broken and is in danger of falling.
- Impact damage to any structural member in which the member is in danger of falling.

5.4.4g *Signal Heads, Signs, Cameras, Sensors, and Antennas Connections*

- Impact damage to any signal head or other attachments (signs, cameras, antennae, sensors, etc.) in which the member is in danger of falling.
- Loose, missing, broken, or heavily deteriorated components of the signal head or other attachments (signs, cameras, antennae, sensors, etc.) in which the component is in danger of falling.
- Crack or break in both curved washers at the orbital mounting bracket cable or band bolt.

5.5 **Non-Structure Related Emergencies**

In addition to structural emergencies (critical findings), medical emergencies are potential events which could occur during the inspection/inventory of a structure. The inspection team should be aware of the following potential emergencies:

- Vehicular accident. The close proximity to live traffic creates the potential for an accident/injury.
- Electric shock. Overhead power lines as well as energized electrical wires on the structure could cause an electric shock if inadvertently contacted. Inspection teams shall follow all pertinent VDOT and OSHA electrical safety guidelines.
- Fall hazard. The potential for a fall related injury is present with the use of aerial equipment. Similarly, to the bullet above, inspection teams shall follow all pertinent VDOT and OSHA fall protection guidelines.
- Cuts/burns. The equipment used to perform the inspections can cause cuts and or burns if an accident were to occur.

The above items are examples of emergency situations that could occur while in the field. Each structure presents its own risks. Prior to inspection, the Team Leader should address all concerns and determine a course of action should a situation arise. This typically involves a hazard analysis along with development of an emergency action plan documenting nearby emergency medical and rescue facilities along with telephone numbers. Should a piece of aerial equipment malfunction, aerial rescue may also become an emergency. All inspection vehicles should be equipped with a first aid kit. If there is an emergency, 911 should be called to assist all injured parties. It is very important that all Team Members know the location in which they are working, in order to direct emergency personnel on-site in a timely fashion. One or more inspectors shall have a mobile telephone in addition to other computer devices being used for the inspection work.

5.6 <u>Inspection Conventions and Numbering</u>

Prior to October 26, 2016 date, coordinates of a signal pole was collected for a single location at each intersection. This is no longer the practice. If the signal poles are not located individually, the inspectors shall use HMMS to adjust the locations for the individual poles (refer HMMS User Guide).

5.6.1 Structure and GPS Coordinates

New pole group ID's are no longer being assigned. Each signal pole should be individually located

The structure number convention, numbering format, size of the numbers, and location of the structure number on the traffic signal structure, as well as the location and format for collecting and recording the GPS coordinates is presented below.

<u>Painting/Stenciling of Structure Numbers</u>

1. *<u>Height of numbers and lettering: The stenciled numbers and letters shall be 2" high and have 1" space between letters.</u>*
2. Stenciling paint shall be highly durable and weatherproof with a UV inhibitor. The color of the paint shall be black or deep brown. For dark colored painted poles, light grey can be used, and yellow can be used for timber poles. As an alternative to painting the number, reflectorized panels or numbers may be applied to the structure. Reflectorized panels shall be placed in the same location that numbers would have been otherwise painted. The numbers on the reflectorized panel shall be of the same height and spacing as described for stenciling.
3. The 11-digit alphanumeric code shall be placed at an elevation that makes the bottom number 3' above the top of the anchorage or 6" above any barrier railing or decorative base enclosure. Lettering shall be placed vertically on the pole so as to be visible from oncoming traffic in the primary direction of travel. For example, if a pole is on US-17N, the number shall be placed so that it will be visible while traveling on US-17N.
    I. Interstates (IS)
    II. US Routes (US)
    III. Primary State Routes (VA)
    IV. Secondary State Routes (SC)

    When a traffic signal structure is located at the intersection of multiple primary routes (US Routes, State Routes) the lowest primary route number shall govern for locating the structure. For example, a traffic signal structure located at the intersection of US Route 17 Northbound and US Route 28 Northbound would be defined as being located on US Route 17 North and, as such, would have the structure number applied to the side of the structure facing US Route 17 Northbound.

    Existing 7-digit numbers presently located on a structure shall be replaced with the 11-digit alphanumeric code at the time of the next regular or base inspection. The three-letter prefix (alpha portion) may be stenciled at the district's distraction. See Appendix A, Section A.3.2, Item Code ATT03.

5.6.1a <u>GPS Coordinates</u>

Structures that do not have individual GPS coordinates shall be corrected in HMMS (see user guide)

5.6.2 Lane Numbering

Lane numbering is critical to accurately record inventory information and define locations for recording various inventory and inspection findings. All lane numbering shall be left to right looking either northbound or eastbound, based on the route labeling. When a route is not labeled, northbound and eastbound will be determined based on cardinal directions. For lane numbering conventions to be used on traffic signal structures, refer to Figures 5.13 through 5.17. Primary and secondary route designations should match the major and minor routes of the traffic signal attributes.

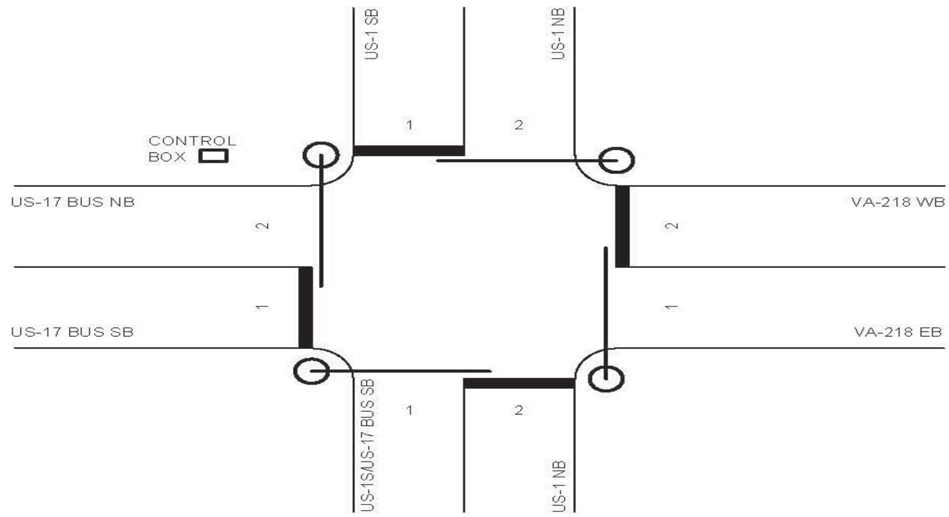


Figure 5.13 *Methodology for Lane Numbering with US-1 as the Primary Route and US-17 Bus as the Secondary Route*

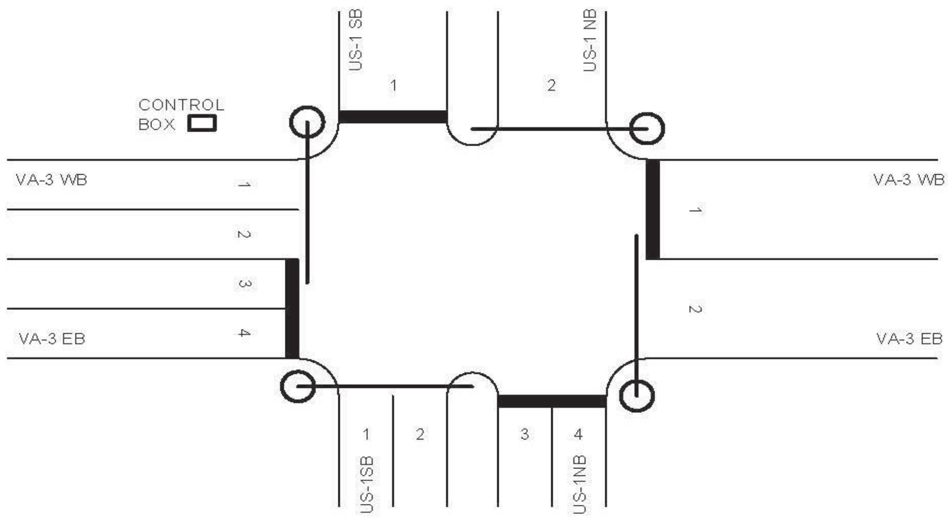


Figure 5.14 *Methodology for Lane Numbering with US-1 as the Primary Route and VA-3 as the Secondary Route*

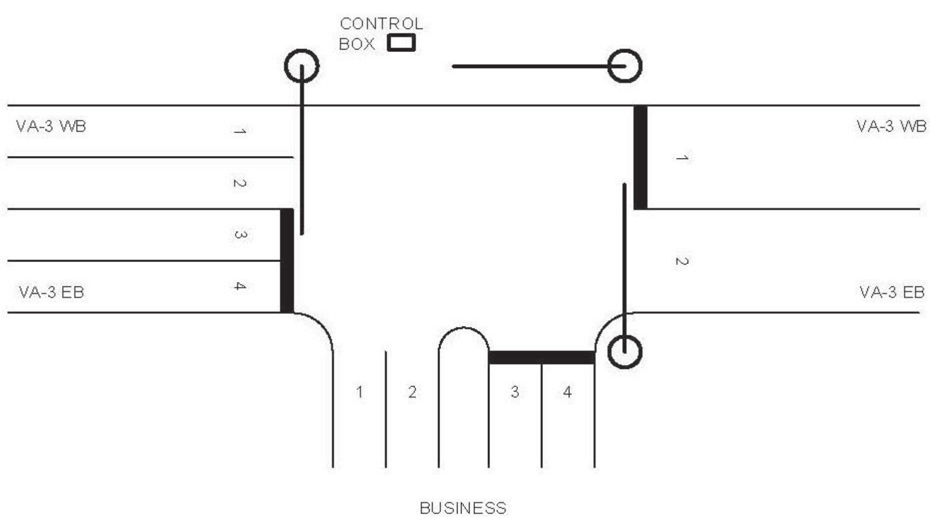


Figure 5.15 *Methodology for Lane Numbering with VA-3 as the Primary Route and the Business Entrance as the Secondary Route*

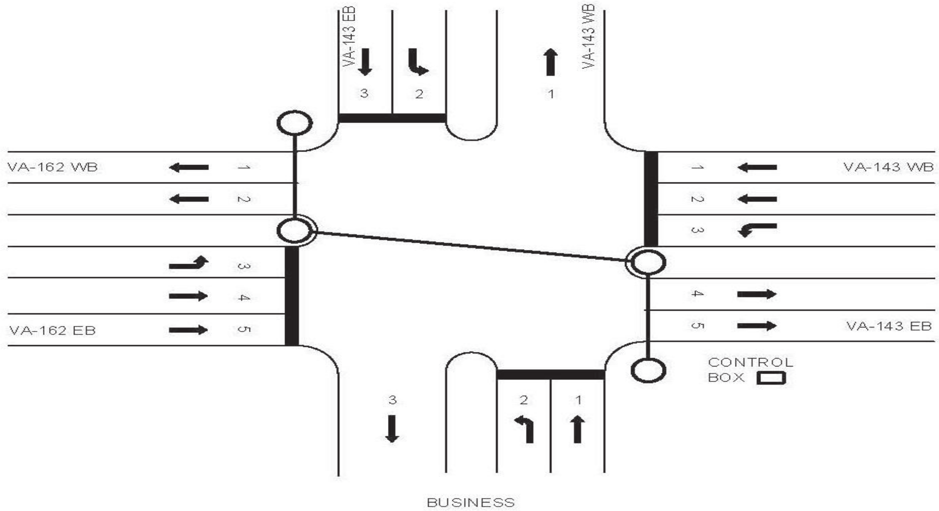


Figure 5.16 *Methodology for Lane Numbering with VA-143 as the Primary Route and VA-162 as the Secondary Route*

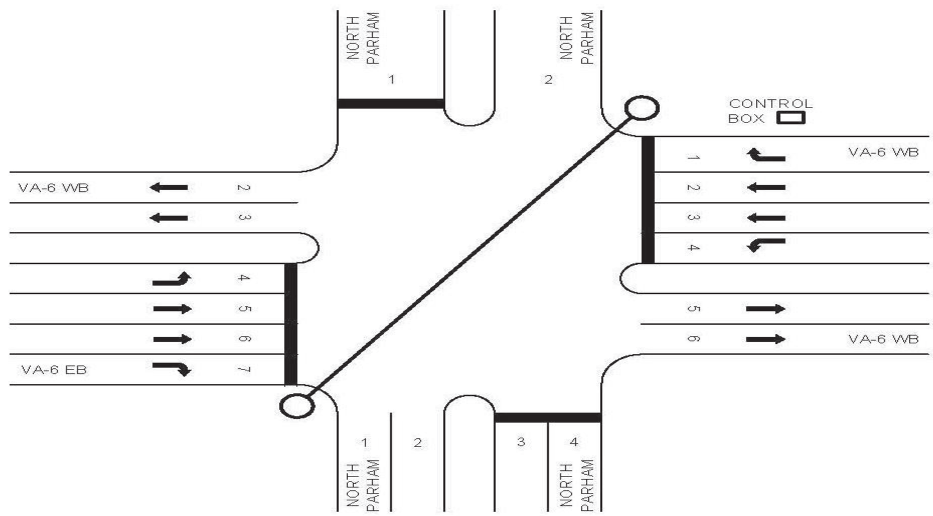


Figure 5.17 *Methodology for Lane Numbering with US-1 as the Primary Route and US-17 as the Secondary Route*

5.6.3 Traffic Signal Structure Inspection Numbering/Labeling Methodology

Numbering/labeling of traffic signal structure components (signal heads, signs, sensors, cameras) is critical to accurately record inventory information and define locations for recording various inventory and inspection findings. For numbering of each component (i.e. signal heads, sensors, cameras, signs, slip joints, etc.) the numbering begins at the pole and increase in number moving away from the pole. The first signal head, sign, sensor, etc. from the pole is labeled as number 1. When recording inventory and inspection data on structures with two mast arms or span wires, document the arm/wire to which the deficiencies/inventory information pertains.

Note that span wires will be divided at approximately the mid-span. Each half of the wire, and all components attached to that half of the wire, will be assigned to the pole nearest it. This effectively means, for labeling purposes, the span wires may be treated as mast arms. Each pole could have two "halves" of span wires associated with it.

For the numbering/labeling to be used on traffic signal structures, refer to Figures 5.18 through 5.26.

5.6.3a <u>Signal and Component Numbering/Labeling Methodology</u>

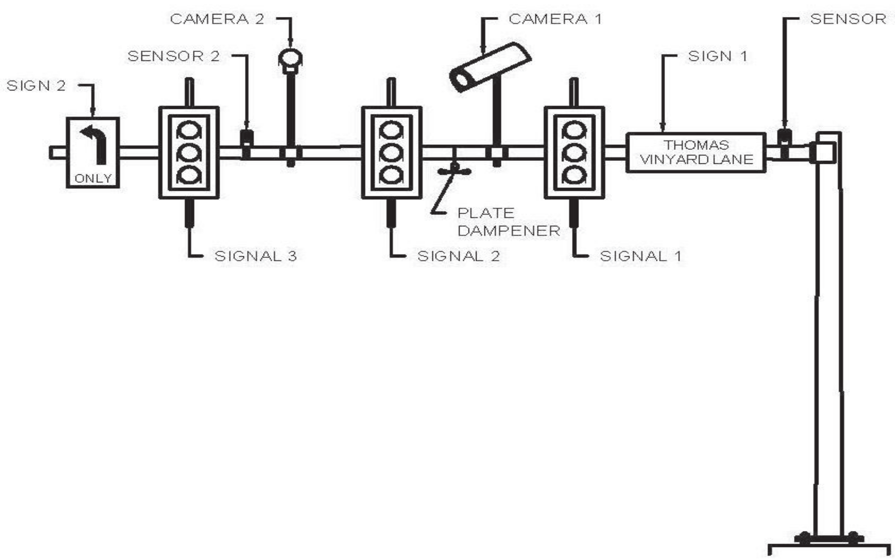


Figure 5.18 *Methodology for Signal Head and Attachment Labeling/Numbering with Pole on Right Side of Roadway*

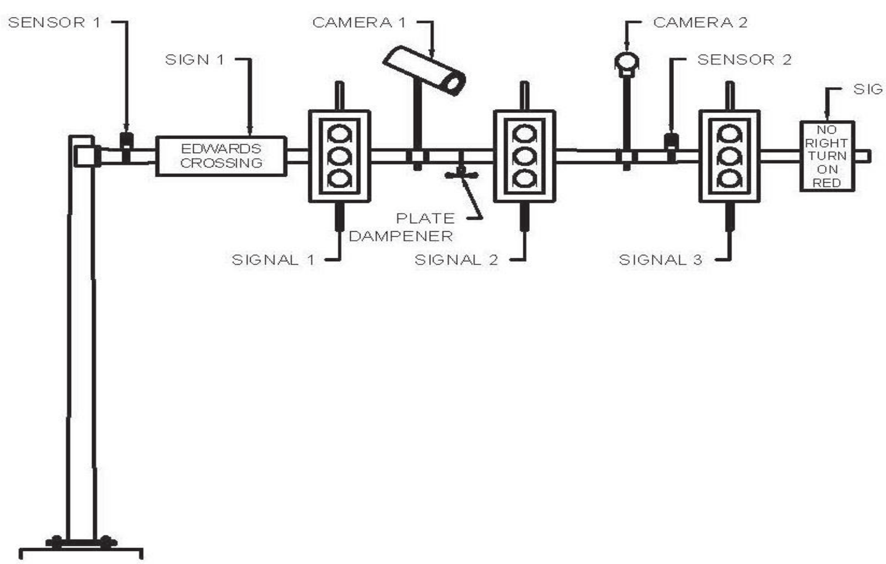


Figure 5.19 *Methodology for Signal Head and Attachment Labeling/Numbering with Pole on Left Side of Roadway*

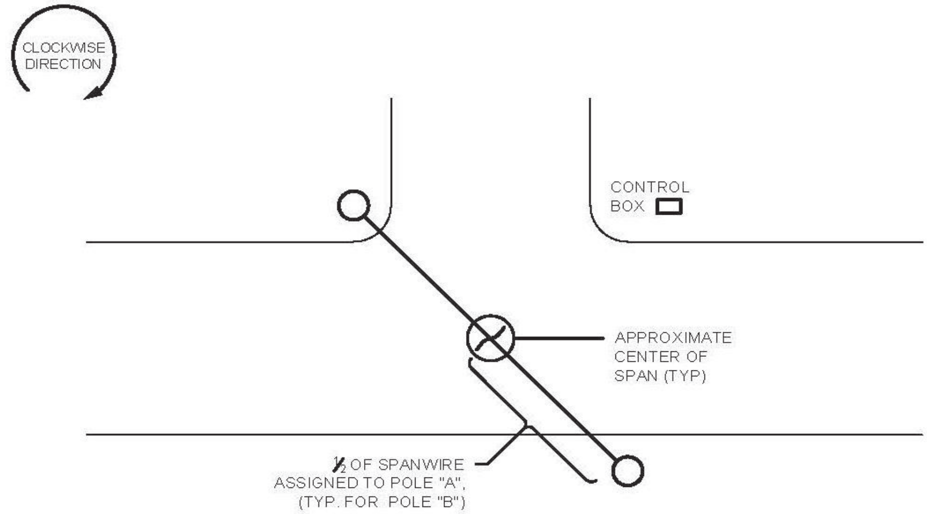


Figure 5.20 *Methodology for Two Pole Span Wire, Span Wire Distribution Plan*

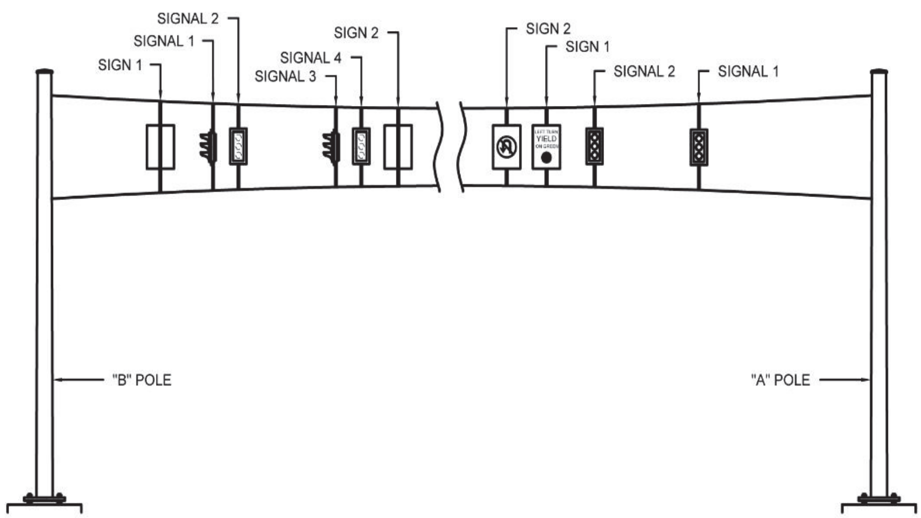


Figure 5.21 *Methodology for Two Pole Span Wire, Span Wire Distribution Elevation*

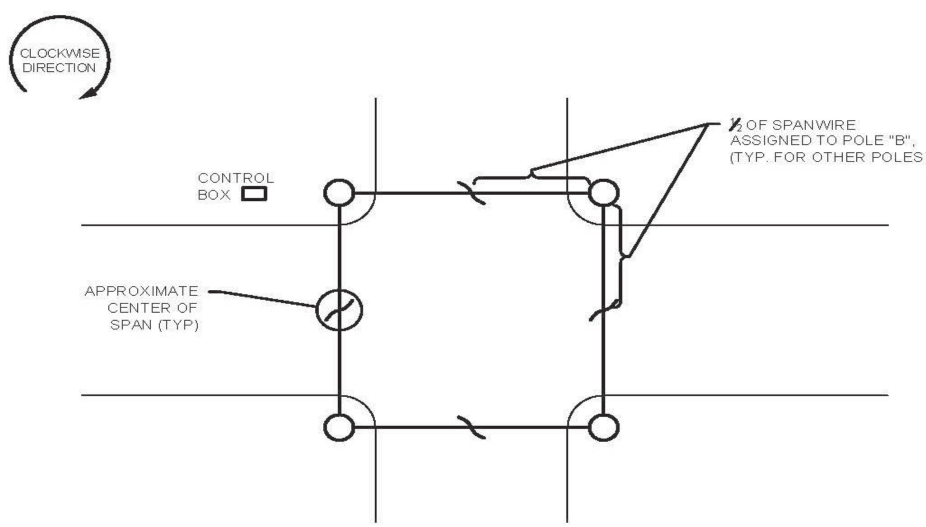


Figure 5.22 *Methodology for Four Pole Span Wire, Span Wire Distribution Plan*

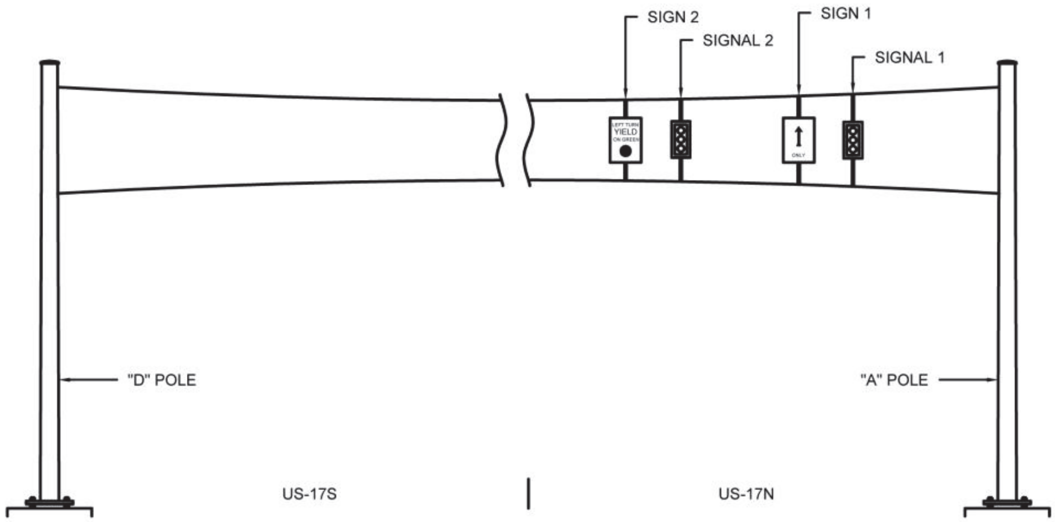


Figure 5.23 *Methodology for Four Pole Span Wire, Span Wire Distribution Elevation*

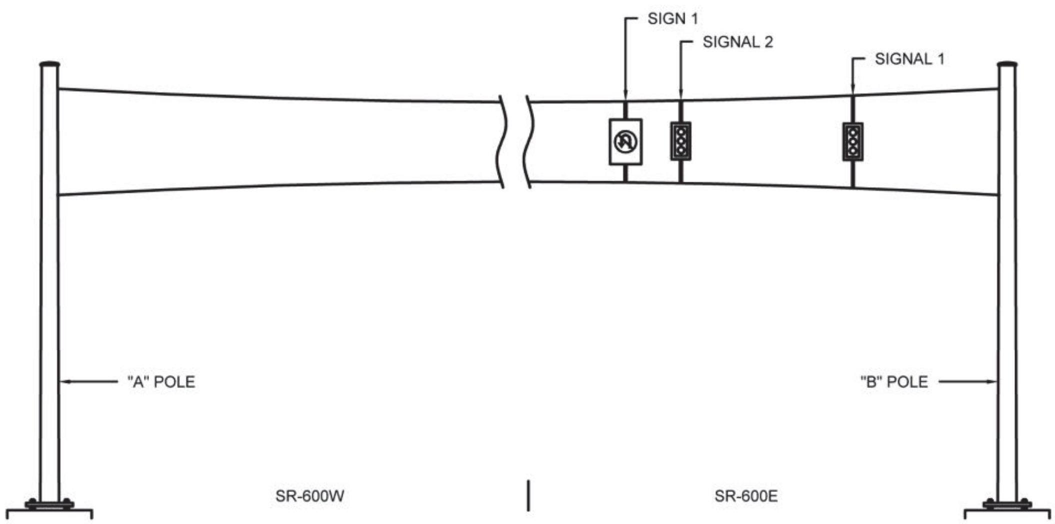


Figure 5.24 *Methodology for Four Pole Span Wire, Span Wire Distribution Elevation*

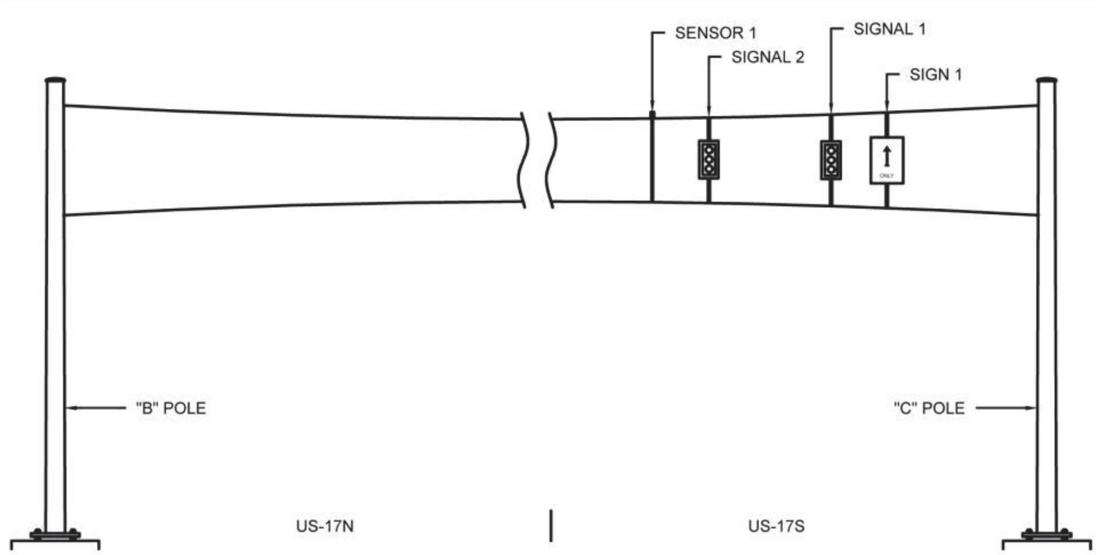


Figure 5.25 *Methodology for Four Pole Span Wire, Span Wire Distribution Elevation*

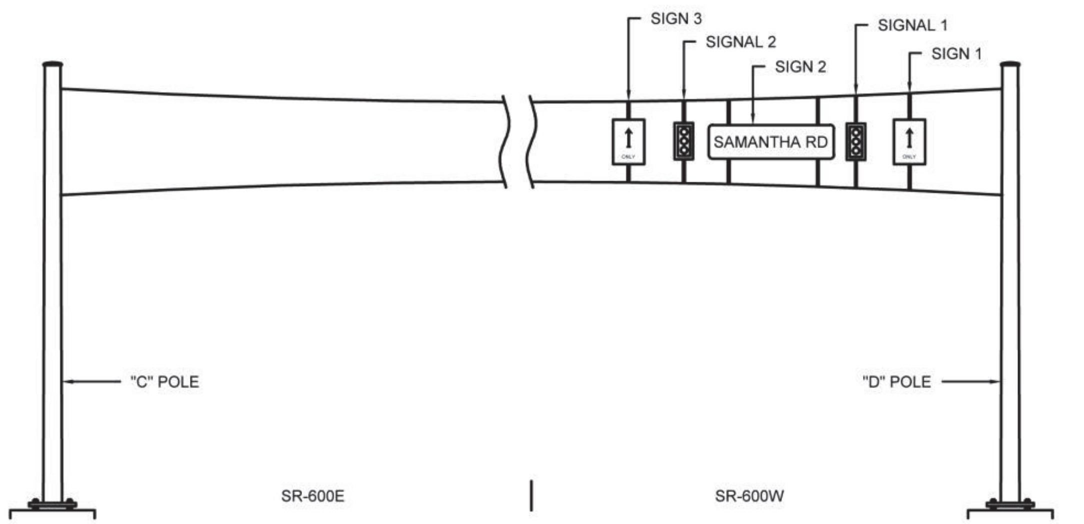


Figure 5.26 *Methodology for Four Pole Span Wire, Span Wire Distribution Elevation*

5.6.4 Anchor Bolt Numbering Methodology

Anchor bolt numbering is necessary to accurately define the various defects and deficiencies encountered during the inspection of the base plate and anchor bolts, as well as indications detected through ultrasonic testing. The numbering is established by standing behind the structure looking at the roadway for the primary direction of travel. When standing behind the structure facing the roadway, the first bolt to the right of the base plate/pole centerline is labeled as Bolt No.1 and subsequent bolts are numbered consecutively in clockwise direction from Bolt No. 1. For the anchor bolt numbering system for various base plates, refer to Figure 5.27.

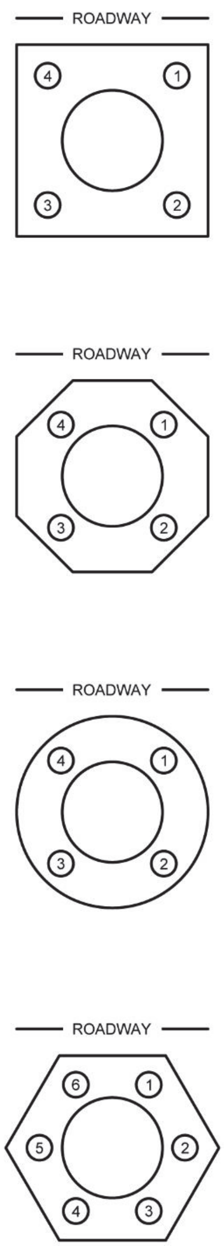


Figure 5.27 *Anchor Bolt Numbering Methodology*

CHAPTER 6. POLE INSPECTION PROCEDURES

6.1 Introduction

A qualified inspector must understand a variety of considerations, including hazardous and potentially hazardous conditions that could affect the safety of the inspector and the traveling public, the inspection sequencing, guidelines and procedures, the typical defects and deficiencies that may be encountered during the inspection, and those conditions that could or would require immediate action. This chapter sets forth to define policies, guidelines, and procedures for the safe and thorough inspection of pole structures.

6.2 Safety

Safety of the inspectors and the traveling public is paramount when performing daytime and nighttime inspection of pole structures. As such, the inspector shall, as part of the planning and preparation process, perform a job safety analysis in order to identify the typical safety hazards and mitigate risk for both the inspection team and the traveling public. It should be noted that special conditions could arise during the inspection that were not identified as part of the safety analysis. Should a hazardous safety condition arise during the inspection that was not anticipated or expected, the inspection operation shall be halted until the condition is addressed. If the condition cannot be addressed on site, the inspection operation shall be postponed until said condition is or can be addressed.

6.2.1 General Safety

The following general safety policies are provided to assist inspection personnel in mitigating risk during the inspections.

- Inspectors and other personnel working within a work zone shall wear at a minimum, hard hat, safety shoes, and high visibility safety apparel that meet the requirements of the latest edition of the Virginia Work Area Protection Manual (VWAPM). As necessary, other safety equipment such as safety glasses and gloves should be used.
- All overhead inspection activities shall be limited to areas over travel lanes that are closed to traffic.
- Maintenance of Traffic (MOT) procedures shall be in accordance with the latest edition of the VWAPM.
- Inspection vehicles shall be located as far off the travel lane as possible when performing shoulder or median work.
- Inspection vehicles shall be equipped with high intensity rotating, oscillating, or flashing strobe lights.
- Inspectors shall assume all wires are energized and inspectors shall not come in contact with any wiring on or inside a structure.
- The inspector shall consider all wiring, conduits, junction boxes, and all other components of the lighting system to be energized and operational unless specifically informed in writing by the District Operations Maintenance Manager that the system is nonfunctional and not energized; also, special consideration should be given to the identification of small cellular installations. The inspector shall follow all VDOT and OSHA guidance for working around and near electrical hazards.
- Inspection operations shall not be conducted in inclement weather unless deemed necessary due to an observable emergency condition; refer to Section 6.4. Should inspection operations be underway on a specific structure at the time of inclement weather, the operations may continue until the structure is completed or roadway conditions become hazardous to the traveling public. In both cases, the operation shall be terminated until the inclement weather passes from the area.

6.2.2 Climbing and Aerial Lift Safety

All inspection personnel shall have successfully completed an OSHA-approved “Fall Protection” course/class, which fulfills the requirements of OSHA 1926.503. In addition, the following aerial lift and climbing safety policies are provided to assist inspection personnel in mitigating risks associated with aerial lift or climbing inspections.

- When in/on an aerial lift, the inspector shall wear an OSHA-approved fall protection harness attached to a secure tie off point with an OSHA-approved lanyard. VDOT personnel operating any aerial device must be certified (3-year certification) through the VDOT Maintenance Training Academy and operate the equipment in accordance with VDOT Safety and Health Division Aerial Lifting Device Operations Procedure SSP# 1910.67.
- Inspectors shall use caution and follow VDOT and OSHA Guidance when operating an aerial lift around power lines. The inspector shall maintain a <u>minimum safe distance of 10’</u>, or as required by OSHA 1926.1408, which provides minimum safe, distances based on a known line voltage, from any overhead utility wires located on or in close proximity of the structure within the work zone.
- Lifting equipment, whether ladders, bucket lifts, or scaffolding, should be properly secured to the ground with brakes, blocks, outriggers, etc. prior to climbing.

- Climbing shall be restricted to only those areas where access by aerial lift is not possible, does not provide adequate inspection, or where a critical deficiency is suspected and a more detailed or special inspection (non-destructive testing) is necessary to investigate the suspected critical deficiency.
- The inspector shall wear an OSHA-approved fall protection harness attached securely to a main load carrying member (e.g. chord) with an OSHA-approved lanyard. One hundred percent (100%) tie off shall be maintained at all times, using two lanyards.
- The inspector should have three positive points of contact at all times when moving through the structure (both hands and one foot or both feet and one hand in contact with the members).
- All safety equipment used for climbing shall be inspected for expiration dates, as well as defects that could alter their strength. Defective, damaged, and out of date units or components shall be destroyed and discarded to prevent reuse. The VDOT Maintenance Training Academy Certification, mentioned above, teaches personnel the proper procedures for inspecting harnesses and lanyards.
- Only one person shall be on the structure at a time. Take as few items as possible when climbing; all necessary items are to be adequately tied-off to the inspector to prevent falling.
- Climbing shall not be performed if the inspector is fatigued and/or mentally distracted.
- Climbing should not be performed if the structure is wet from rain or dew.
- Boots, ladders, bucket lifts, and scaffolding should be kept free of oil and grease.
- All inspectors shall be properly trained in the inspection process, fall protection, climbing techniques, and the use of all climbing equipment in accordance with OSHA 1926 Subpart M.
- Climbing and aerial inspection activities shall not be conducted in inclement weather or a sustained wind speed of 30 miles per hour (mph) or greater. Should inclement weather and/or the aforementioned wind speeds develop during climbing and aerial inspection activities, all activities shall be terminated until the inclement weather passes and/or the sustained wind speed drops below 30 mph.
- If the structure is equipped with a proprietary fall arrest system, (e.g. wire, T-rail, notched pipe), the lanyard attachment shall be compatible with the system and shall be used as the inspector progresses up the structure.

6.2.3 Nighttime Safety

Whenever night inspections are required, the inspectors must take steps to ensure adequate illumination of the inspection surfaces and visibility of the inspection personnel. Lights can be worn by the inspectors, mounted on the inspection bucket, or ground-mounted. The Team Leader must determine which method(s) of illumination will provide the best view of the inspection surfaces. Consideration shall be given to placement and movement of the lights to properly illuminate all areas of the structure being inspected to eliminate shadows and provide the best possible visual inspection conditions. Lights must be positioned so that they will not be a distraction or impairment to on-coming motorists or pedestrians. Extreme caution should be used during night operations due to the reduced visibility of the inspection personnel to on-coming traffic. VDOT approved high visibility apparel is always required but can be especially important at night.

6.3 Inspection Procedures

6.3.1 Arrival on Site

Upon arriving on-site, the inspection team should verify that the structure number and physical location is correct. If the available information conflicts, the inspector shall investigate to determine how to proceed. Possible conflicting circumstances may involve newly installed structures, incorrectly marked structures, structures that have been removed from the field and not from the database, or arrival at an incorrect location. Inspection operations shall not continue until the conflict has been resolved.

After the correct structure is verified, the Team Leader shall contact the appropriate Smart Traffic or Traffic Operations Center prior to commencing MOT activities. Once the MOT or lane closure is established, the inspection team shall verify that any established MOT operation is in conformance with the latest edition of the VWAPM or specifically prepared MOT Plan by performing a drive through of the MOT or lane closure prior to beginning inspections. During the drive through, the Team Leader should be cognizant of the impact that the MOT operations has on traffic flow. If the MOT is not in conformance with the VWAPM or the specific MOT plan, inspection operations shall not commence until the MOT is in conformance.

6.3.2 Field Inspection

The field inspection of a pole structure consists of inventorying and inspecting the structure. The inventory component requires verification of asset attribute information. The inspection component requires a comprehensive, detailed inspection of the entire pole structure consisting of a 100% hands-on examination of each component, member, fastener, and weld on the structure. Any structures that have components that cannot be accessed for a hands-on examination shall be 100% visually inspected. The visual inspection may be performed with a high-powered optical device or by the use of a robotic inspection device such as an unmanned aerial vehicle (UAV) or climbing robots for poles structures with no chords, such as high mast light poles, camera poles, or offset luminaire poles. The inspections should document any defects or deficiencies including dents, damage, corrosion, material section loss, loose and missing fasteners, broken or cracked welds, and any other conditions that could affect the functionality or integrity of the structure immediately or long term. In addition to the hands-on examination, the inspector(s) should use forms of non-destructive testing (NDT) during the inspection to verify any suspected structural deficiencies. These forms of NDT to be used include:

- Liquid/Dye Penetrant or Magnetic Particle Testing at locations of suspected surface cracks.
- Ultrasonic Testing to detect cracks in anchor bolts.
- Ultrasonic Thickness Testing utilizing corrosion thickness gages to determine remaining thickness for structural members where thickness cannot be readily verified by other means, or where visible corrosion exists.

In the event the inspector is unable to perform the required or necessary testing due to the lack of equipment or lack of qualifications, the inspector should contact the District Manager who may involve the Materials Division to arrange to have the necessary tests performed. All personnel performing NDT shall be qualified by the Department’s Material Division, Structures Group, for the specific NDT to be performed.

6.3.2a *Inspection of High Mast Light Structures*

Because the height of these structures exceeds the reach of typical access methods, only a visual inspection is possible on certain parts of the structure. In this case, a scope or high-powered optical device shall be used. When viewing through a scope, it will be impossible to get precise dimensions, but dimensions of deficiencies should still be approximated.

To facilitate the inspection of high mast lights, a 20x - 50x spotting telescope or robotic inspection device shall be used for checking the pole, slip joints, welds, connections, luminaires, and all other superstructure parts. The high mast light will be observed from a minimum of three, but as many different viewing areas as are required to ensure 100% of the pole is inspected. It will also be acceptable to use a system that provides equal or better inspection of the poles.

If a significant deficiency is observed, other means of accessing the structure shall be used at the discretion of the District Manager, to further validate and quantify the visual finding.

6.3.2b *Inspection of Camera Poles*

Some camera pole structures have walkways or crow’s nests and may have ladders integrated into the pole, used to access the walkway. The access system ladders and walkway may only be used for inspection at the discretion of the District Manager. If no safety cage or integrated fall arrest system is available at the structure, a retractable safety line will need to be installed at the top of the structure, or near the walkway. The inspector must remain tied off to this safety line at all times. Accessing the ladder and walkway shall be considered climbing and shall be performed in accordance with climbing guidance; refer to Section 6.2.2.

6.3.3 Typical Field Inspection Sequence and Operations

The field inspection sequence of a pole structure is important to provide organization throughout the inventory and inspection process, and to ensure that all elements are inspected, and associated findings are recorded accurately. The items below provide recommended sequencing of the field inspection, as well as specific items to be inventoried and inspected.

6.3.3a *Inventory*

Inventory information related to the as-built configuration of the structure does not typically vary from inspection to inspection unless corrective maintenance, structure modifications, or retrofit work has been completed. This information should be gathered at the initial inspection, verified, and updated as necessary at each subsequent inspection. For a detailed list of specific inventory items that are to be recorded, and guidance on coding, refer to Appendix A, Inventory and Inspection Coding.

6.3.3b *Inspection*

The pole structure should be inspected to determine its overall condition as well as the condition of the individual components. All deficiencies should be fully quantified by describing the defect type (corrosion, section loss, spall, crack, etc.), location, and size (length, width, depth, etc.). For example, the location of exposed reinforcing steel should be noted, as well as the severity of any corrosion that has taken place. If the corrosion has caused section loss, the section loss should be quantified. Furthermore, all inspection notes should be reviewed for accuracy and completeness while on-site. For a detailed rating guide that includes a list of the common deficiencies and recommendations, refer to Appendix B, Common Deficiencies, Ratings, Recommendations, and Priorities.

6.3.3c *Documentation*

Documentation consists of writing/recording field findings. Documentation should be as specific, clear, and concise as possible without providing unnecessary details yet should accurately and thoroughly describe the observed deficiency. Some information may be implied, such as by which section of the report an item is recorded. Documentation includes both terms of qualification (i.e. severity of a deficiency) and quantification (number of items or area of a deficiency). Deficiencies that have dimensions are typically detailed in terms of width x length/height, or if more applicable, surface area. Other dimensions that may be recorded include depth, percentage of section loss, a distance from a reference point, or other language locating the finding. The various possible components of detailing should be used as needed. A few examples are included below.

- Dent in pole, 2” long x 1” wide x up to 1/2” deep, 5’ high above base plate.
- 10% to 20% section loss on leveling nuts and washers at Anchor Bolt 1 and 2.
- Area of spalling, 5 SF x up to 1” deep, at top of pedestal.
- Crack, 1/8” wide, originating at Anchor Bolt 1-4 and extending 2’ down pedestal face.

6.3.3d *Photographs*

Photographs are to be taken to provide a representation of the overall condition of the structure. As such, several basic photographs should be taken at each inspection. These photographs are to be taken such that each view is maximized within the frame of the photograph. These photographs include:

- The front view of the structure
- Typical view of a pedestal/base (as applicable)
- Typical view of the arm to pole connection (as applicable)
- Typical view of the main attachment (luminaire head, camera, antenna) to the structure (as applicable)

Photos are <u>required</u> of all deficiencies or conditions resulting in an element rating of poor or critical; however, can be included for other conditions and/or reasons where further clarification may be needed to define the conditions or reasons. When placed in the report, the photograph shall also have appropriate verbiage describing the deficiency or condition. If possible, all photographs should be reviewed in the field to ensure that the views and/or deficiencies are clearly depicted. In the event that photographs, or commentary do not, or cannot, adequately/accurately describe the deficiency, the inspector should sketch the deficiency to the extent necessary to accurately depict the deficiency.

New photographs shall be taken at each inspection for inclusion in the updated report. Old photographs shall not be reused without permission from the District Manager. All photographs shall have date stamps.

For instruction on which inventory and inspection photos are to be included in the database and report, refer to Appendix A, Section A.7.

The photographs below present the basic inventory photos to be taken at each inspection.

Photo 6.1 *Front view*

Photo 6.2 *View of luminaire head*

Photo 6.3 *View of camera*

Photo 6.4 *View of high mast light luminaire ring*

Photo 6.5 *View of offset luminaire heads*

Photo 6.6 *View of chord to pole connection*

Photo 6.7 *View of base*

Typical Field Inspection Sequence and Operations (Continued)

The following presents the recommended inspection sequence and procedures, as well as recording of typical findings. Although extensive, the following information is not meant or intended to be all encompassing as variations in structure types and details will occur.

6.3.3e *Overall Alignment*

The entire pole structure should be examined “from a distance” looking for obvious deficiencies or problems. The inspector should check for:

- Gross damage to the structure and its supports from collisions.
- Vertical and horizontal alignment of the superstructure including any arms and poles.

6.3.3f *Vertical Clearance*

Vertical clearance from the lowest point of the structure (e.g. arm, luminaire) to the highest point of the roadway over each paved shoulder and each lane should be measured. The minimum clearance and the respective lane of the clearance for each direction of travel should be recorded. Clearances greater than 20’ should be recorded as such, without specific measurements taken at each location.

6.3.3g *Foundation: Erosion / Undermining / Settlement / Drainage*

These deficiencies should be visually assessed. The inspector should inspect and document the following conditions:

- Location of the pedestal relative to the immediate area around the pedestal.
    - If the top of the pedestal is buried less than 12” below grade, remove the dirt/fill until the top of the pedestal is exposed, inspect and document that the pedestal was buried and uncovered for inspection.
    - If the top of the pedestal is located under a walkway or sidewalk, or buried below grade 12” or more, document the condition. The buried condition is to be reported for excavation by VDOT maintenance crews. Notice shall be provided to the District Manager; refer to guidelines in Section 6.3.4. However, if conditions warrant immediate excavation, the condition should be reported immediately. An inspection should be performed as soon as possible following excavation. Conditions that would warrant immediate excavation include observable corrosion and/or section loss.
- Erosion or undermining around the pedestal faces. Any areas of undermining should be probed and documented to determine depth and extent.
- Any indications of movement or rotation of the foundation should be measured and documented. Movement or rotation of a pedestal could be indicative of an underlying foundation or soil issue.
- Standing water or indications of poor drainage should be noted and depth of water measured.
- The pedestal is located in a swale or drainage ditch. A pedestal located in a swale or drainage ditch could periodically be submerged resulting in corrosion, debris accumulation, or damage of the submerged areas.

6.3.3h *Foundation: Concrete Pedestal (or Median Barrier, Bridge Parapet)*

All loose debris and vegetation should be removed. The pedestal should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Cracking. All cracking should be documented, and special attention should be given to cracks propagating from anchor bolts. Any rust staining present along the cracks should be documented. The cracking could indicate overloading of the bolts or appreciable corrosion on the embedded portions of the anchor bolts.
- Delamination. Sound the pedestal with a hammer to detect locations of delamination. The delaminated areas will give a hollow sound when tapped with a hammer.
- Spalling, Honeycombing, Scaling. All spalling, honeycombing, and scaling should be documented. Any exposed reinforcing should be documented along with any associated section loss.
- Impact damage. Document that impact damage exists and any deficiencies associated with it, which may include any of the above.

6.3.3i *Foundation: Steel Haunch*

A haunch is a steel bracket attached to a bridge girder, made to accommodate the ancillary structure, and typically consists of multiple plates built up and welded together. For a detailed description and photograph of a typical steel haunch foundation, refer to Section 1.2.1p. The haunch should be visually and tactilely inspected from an aerial lift (bucket or platform) or under bridge inspection unit (snooper). The inspector should inspect and document the following conditions:

- For anchor bolt inspection guidance, refer to Section 6.3.3k Foundation: Anchor Bolts.
- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If corrosion is observed on the haunch assembly, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
  - If corrosion is observed on connection hardware, the amount and extent of section loss should be determined and documented.
- Localized areas of distressed painted or coated surfaces. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.
- Condition of the welded connections. The welds should be inspected for cracking, especially at points of intersecting welds, and incomplete or excessively ground welds as they create stress risers. The location and size of the crack(s) is to be documented.
- Condition of the bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, beveled washers or extra washers. Document percent engagement if less than 100%.
- Corrosion and cracking around any burned or rough-cut holes. Burned or rough-cut holes are stress risers and special attention should be given to these areas.
- Distortion of the haunch assembly. Distortion could be indicative of overloading, damage during erection or improper welding procedures during fabrication.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical pedestal deficiencies and conditions that could be encountered in the field.

Photo 6.8 *Map cracking with efflorescence in pedestal*

Photo 6.9 *Spall in pedestal*

Photo 6.10 *Standing water around transformer base located in a swale/drainage ditch*

Photo 6.11 *Erosion of pedestal, note hand hole cover missing*

Photo 6.12 *Overgrowth of vegetation on, and erosion of, pedestal*

Photo 6.13 *Scaling on top of pedestal*

Photo 6.14 *Cracks in pedestal extending out from anchor bolts*

Photo 6.15 *Spall in bridge parapet*

Photo 6.16 *Areas of poor consolidation in pedestal (Sign structure shown for illustrative purposes only)*

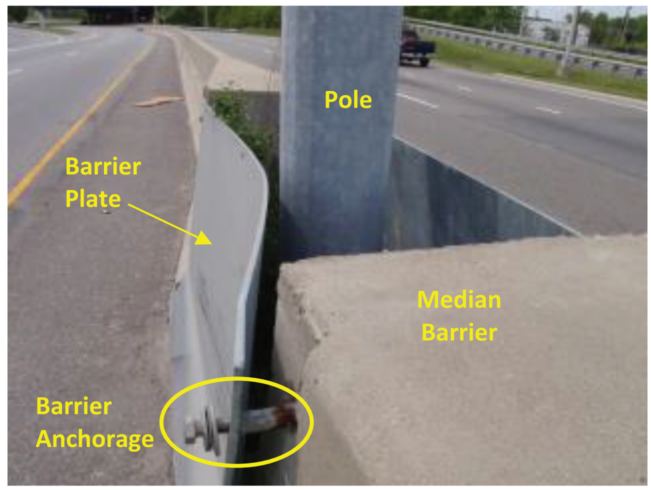


Photo 6.17 *Damaged median barrier plate with failed/pulled out barrier anchorage*

Photo 6.18 *Corrosion of steel haunch (Sign structure shown for illustrative purposes only)*

6.3.3j *Foundation: Grout Pads*

All loose debris and vegetation should be removed. The grout pad should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Partial (minor cracking and/or section loss) or full (section loss, heavy cracking, etc.) deterioration of the existing grout pad. Deterioration results in water/moisture retention within the grout pad and possible corrosion of the partially or unexposed anchor bolts. Note the level of deterioration. If the grout pad is deteriorated to the extent that it can be removed easily with hand tools, first verify the existence of leveling nuts (refer to Section 6.3.3k), and then remove the grout pad and note that it was removed by the inspector.
- Moisture leaking from the grout pad that indicates moisture/water retention and possible corrosion of the partially exposed or unexposed anchor bolts. The moisture could be leaking from under the grout pad or from cracks and/or areas of section loss in the grout pad.
- Document the maximum thickness of each grout pad. The height is representative of the height from bottom of the base plate to the top of the pedestal; for further discussion, refer to Section 6.3.3k.

The photographs below present various typical grout deficiencies and conditions that could be encountered in the field.


Photo 6.19 *Deteriorated grout pad*


Photo 6.20 *Deteriorated grout pad with moisture leakage*

6.3.3k *Foundation: Anchor Bolts*

All loose debris and vegetation should be removed. Nut covers, if present on decorative bases, should be removed prior to inspection and then reinstalled upon completion of inspection activities. Nut covers on standard bases should be removed and disposed of properly off-site. Anchor bolts, washers, and nuts should be visually and tactilely inspected if accessible (not obscured by a grout pad). For numbering convention of the anchor bolts, refer to Section 6.6.4. The inspector should inspect and document the following conditions:

- Document any deviation, excess or missing components, from the typical configuration; refer to Figure 6.1. Some examples may include material other than mild steel (i.e. stainless steel or aluminum) the presence of lock washers, beveled washers, lock or jam nuts, extra washers, and missing nuts and washers.

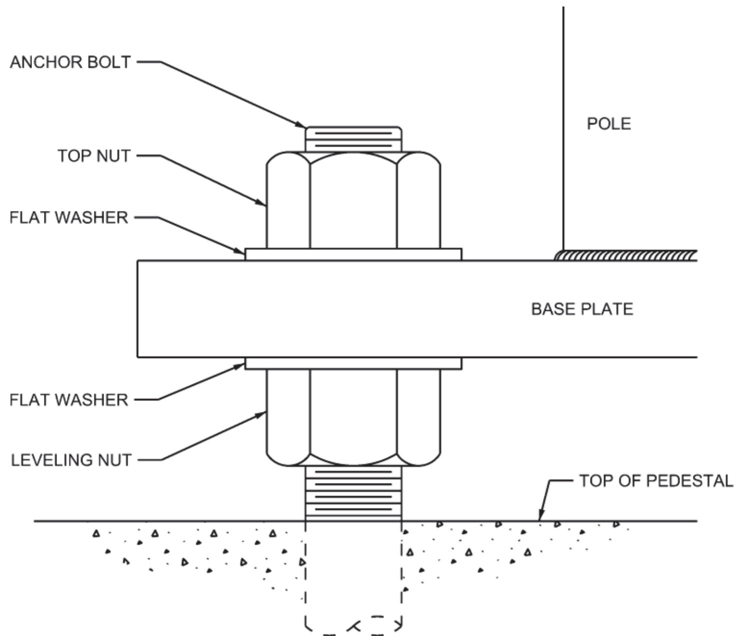


Figure 6.1 *Typical Anchor Bolt Configuration*

- Presence of any tack welds or other welds on anchor bolt assemblies. Welding to bolts can change the material characteristics and result in a loss in bolt strength.
- Corrosion, loss of galvanizing, section loss, etc. of the anchor bolts, washers, and nuts. If section loss is present on the anchor bolts and/or nuts, all rust scale should be removed from the area and calipers should be used to measure the remaining diameter of the anchor bolts or flat-to-flat distance on the nuts.
- Inadequately sized flat washers or lack of flat washers or plate washers for enlarged holes in base plates. Enlarged holes reduce the amount of bearing area of the top nut and/or leveling nut on the base plate.
- Adequate engagement of top nut. Less than 100% engagement of the top nut reduces the ability of the anchor bolt to develop its full load carrying capacity. Document percent engagement if less than 100%.

- Loose or inadequately tightened top nuts and leveling nuts. These two deficient conditions of the nuts are recognized as having a negative impact on the effectiveness and longevity of the anchor bolts, and ultimately, the structure as a whole.
  - Loose nuts increase the stresses in the adjacent bolts and allow additional impact stresses on the bolt(s) having the loose nut(s). A loose nut can be identified by the following criteria:
    - The nut is not in contact with the washer or base plate. In this case, there is a uniform gap between the nut and the washer or base plate. This condition could represent a “frozen” nut or a loose nut that could be turned by hand.
    - The washer between the nut and base plate moves by hand. This condition could represent a “frozen” nut or a loose nut that could be turned by hand.
  - Inadequately tightened nuts increase the stresses in the adjacent bolts and because they are not fully tightened, the nuts may become loose over time. This condition is considered less severe as compared to a loose nut. An inadequately tightened nut is defined as less than snug tight and can be identified by the following criteria:
    - It is not loose (as defined above).
    - The nut is in contact with the base plate.
    - The nut and/or washer moves when struck with a hammer. The sides of each nut should be struck 2-3 times with a 16-ounce hammer in the nut-tightening or clockwise direction when looking down on the nut from above. The force should be consistent between strikes to prevent false indications that the nut is inadequately tightened.
- Plumbness of the anchor bolts. Out of plumb anchor bolts (slope that exceeds 1:40) could result in increased bending stresses in the anchor bolts. If one or more anchor bolts are visually out of plumb, measure the slopes of the affected bolts. The measurements are to be taken and documented as follows, refer also to Figure 6.2:
  - Measure the plumb vertical distance or height, V, of the bolt above the top of concrete.
  - Measure the horizontal distance, H, from the centerline of the bolt at the top of concrete to the centerline of the bolt at the top of the bolt.

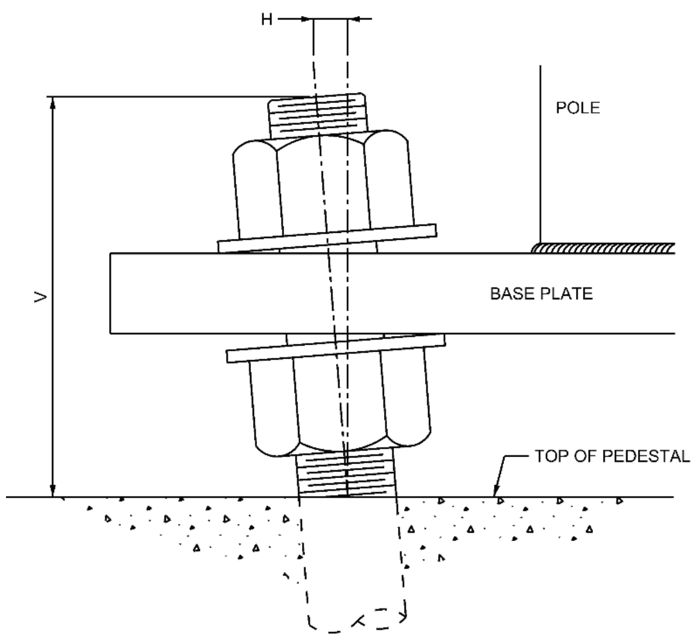


Figure 6.2 *Measurement Methodology for Out of Plumb Anchor Bolts*

- Improperly seated top nuts on the base plate. Improper seating of top nuts can reduce the bearing area of the nut on the base plate and can consequently reduce the load capacity of the bolts. If the top nuts are not in full contact with the base plate and a gap exists between the bottom of the nut and the top of the base plate at one or more locations, the largest gap for each nut is to be measured and documented. The measurement, D (refer to Figure 6.3), is to be taken from the top of the washer, or base plate if no washer exists, to the highest point above the base plate along the bottom of the nut. These measurements should be taken using a feeler or taper gauge.
- The table below is used to simplify the ratings for improperly seated top and leveling nuts, and for out of plumb anchor bolts.

Bolt Diameter, d (in.)	Gap, D (in.) 1/16 0.0625	1/8 0.125	3/16 0.1875	1/4 0.25
1.00	0.063	0.125	0.188	0.250
1.25	0.050	0.100	0.150	0.200
1.50	0.042	0.083	0.125	0.167
1.75	0.036	0.071	0.107	0.143
2.00	0.031	0.063	0.094	0.125
2.25	0.028	0.056	0.083	0.111
2.50	0.025	0.050	0.075	0.100
2.75	0.023	0.045	0.068	0.091
3.00	0.021	0.042	0.063	0.083

(green)	**DO NOT REPORT**
(yellow)	**D/d >= 0.04**
(red)	**D/d >= 0.08**

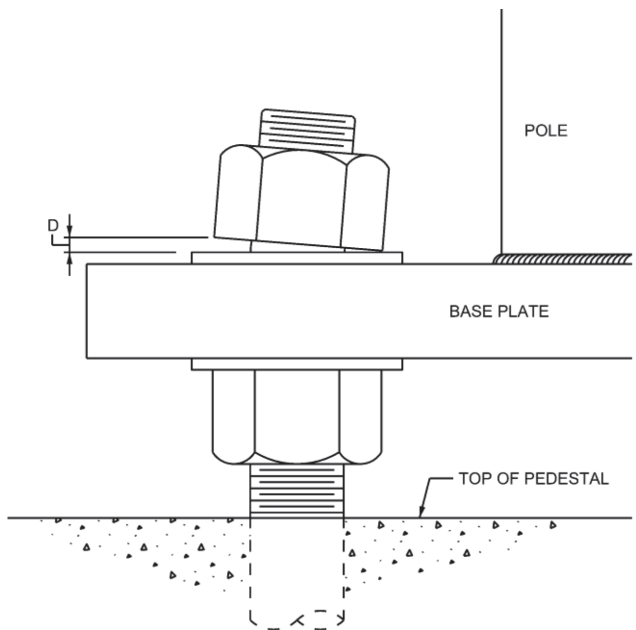


Figure 6.3 *Measurement Methodology for Improperly Seated Nuts*

- Presence of a leveling nut if a grout pad is present. To determine if a leveling nut is present, the inspector can 'probe' the grout pad by using a 1/4" masonry bit to drill a hole in the grout pad. The hole should be drilled toward the anchor rod and in a direction that would intersect a leveling nut, if one is present. The inspector shall take all precautions not to hit the anchor rod and to minimize damage to the leveling nut, if one exists. A measurement taken from the top nut to the outside of the base plate will give the inspector a dimension to be used to minimize damage to the leveling nut or the anchor rod. Whether a leveling nut is present or not the hole in the grout shall be filled with caulk prior to leaving the site. If the grout is deteriorated and in poor condition the inspector may be able to remove a section of grout rather than drill a hole. For the method of verifying the presence of a leveling nut, refer to Figure 6.4. A structure with a deteriorated grout pad and no leveling nut is a serious condition and should be reported immediately to the District Manager. The presence of, or lack of, a leveling nut shall be noted in the report.

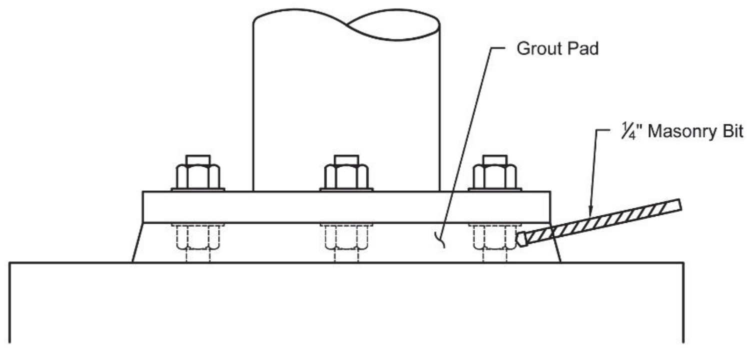


Figure 6.4 *Method for Drilling Grout Pad to Determine Existence of Leveling Nuts*

- Hidden or unobservable cracks within the anchor bolts. Cracks, regardless of size, decrease the load capacity of the bolts and could increase stresses in the surrounding bolts. The top of the bolts should be tapped and sounded with the hammer for any hollow sounds that could indicate the presence of a crack. If a hollow sound is present, an ultrasonic test should be conducted to investigate the presence and location of a crack. UT testing is required only for high mast lights, but UT may also be performed for other poles structures as determined necessary, and at the discretion of the Districts. For additional guidelines, refer to Chapter 2.
- Distance between the bottom of the base plate and the top of the pedestal, H (refer to Figure 6.5). Base plates that exceed a clear height above the pedestal of two bolt diameters induce stresses that were not accounted for during design and could reduce the load capacity and fatigue life of the anchor bolts. The maximum measured distance between the bottom of the base plate and the top of the pedestal should be documented for each base plate of a structure as differing heights could affect any recommendations pertaining to lowering of the structure.

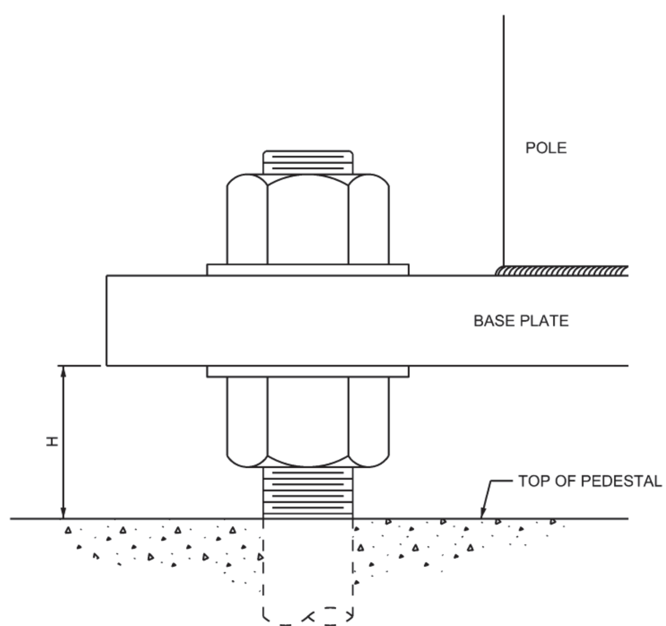


Figure 6.5 *Measurement Methodology for Base Plate Distance Above Pedestal*

The photographs below present various typical anchor bolt deficiencies and conditions that may be encountered in the field.

Photo 6.21 *Loose top nut and bent anchor bolt*

Photo 6.22 *Heavy corrosion and section loss to anchor bolt and nut inside transformer base*

Photo 6.23 *Top nuts less than 100% engaged*

Photo 6.24 *Top nut not fully seated on base plate*

Photo 6.25 *Missing anchor bolt assembly in transformer base*

Photo 6.26 *Out of plumb anchor bolt and loose top nut*

Photo 6.27 *Oversized hole in base plate and inadequately sized flat washer under top nut*

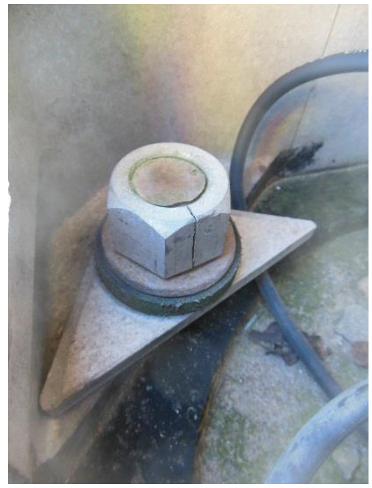


Photo 6.28 *Cracked nut*

6.3.3l *Foundation: Breakaway Couplers*

All loose debris and vegetation should be removed. Breakaway couplers should be visually and tactilely inspected if accessible (not buried). Protective skirts or covers, if present, shall be removed to the extent possible without damaging the skirt and attachment hardware. Numbering convention of the couplers will be similar to anchor bolts, refer to Section 6.6.4. The inspector should inspect and document the following conditions:

- Document any deviation, excess or missing components, from the typical configuration. The typical configuration of the coupler varies depending on the manufacturer. The coupler assembly may include shims and flat washers below the coupler, the coupler body that attaches to the anchor bolt, the anchor bolt itself, flat washers above and below the base plate, and a top nut. These components in the various possible configurations will be referred to collectively as the "coupler assembly" or just "assembly". For a drawing of a common coupler assembly, refer to Figures 6.6 and 6.7. Some examples of deviations from the typical configuration may include the presence of lock washers, beveled washers, lock or jam nuts, extra washers, and missing nuts and washers.

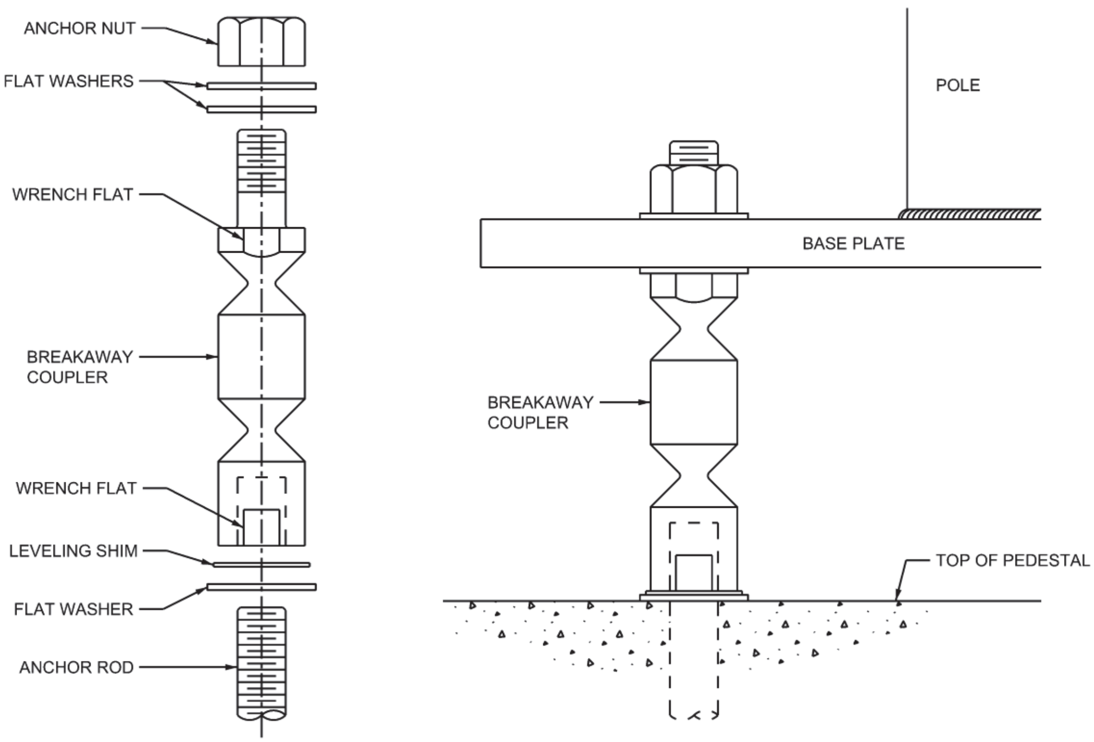


Figure 6.6 *Typical Steel Double Neck Coupler Assembly*

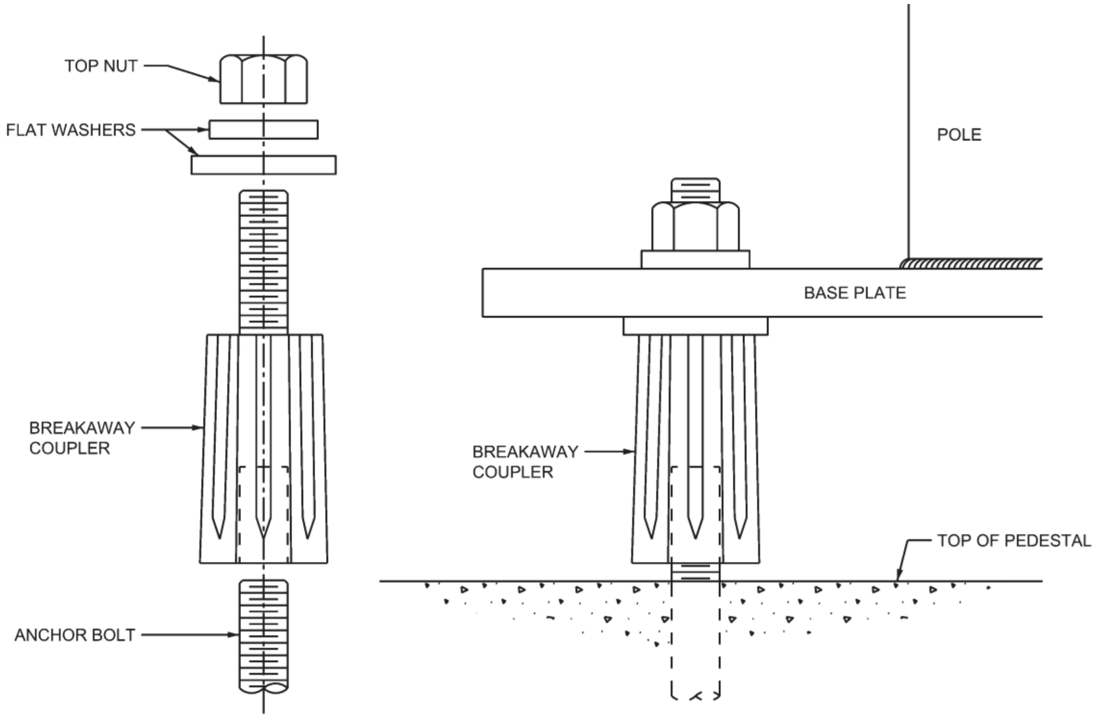


Figure 6.7 *Typical Cast Aluminum Coupler Assembly*

- Presence of any tack welds or other welds on coupler assemblies. Welding can change the material characteristics and result in a loss of strength.
- Corrosion, loss of galvanizing, section loss, etc. of the coupler assembly. If section loss is present, all rust scale should be removed from the area and calipers should be used to measure the remaining diameter of the anchor bolts, couplers, or flat-to-flat distance on the nuts. The breakaway couplers are particularly susceptible to issues concerning dissimilar metals. This is because the coupler assembly is made up of several components (shims, washers, protective cover, the coupler itself), which may be of dissimilar metals that are in contact with one another. Several of the coupler assembly components may also be in contact with the anchor bolts and the pole base plate, each of which may also be made of dissimilar metals. For guidance on dissimilar metals, refer to Section 3.8.
- Inadequately sized flat washers or lack of flat washers for enlarged holes in base plates. Enlarged holes reduce the amount of bearing area of the top nut and/or coupler on the base plate.
- Adequate engagement of top nut. Less than 100% engagement of the top nut reduces the ability of the coupler assembly to develop its full load carrying capacity. Document percent engagement if less than 100%.

- Plumbness of the coupler assembly. Out of plumb coupler assemblies (slope that exceeds 1:40) could result in increased stresses.

  If one or more assemblies are visually out of plumb, measure the slopes of the affected couplers. The measurements are to be taken and documented as follows; refer also to Figure 6.8:
  - Measure the plumb vertical distance or height, V, of the assembly at the start of the misalignment.
  - Measure the horizontal distance, H, from the centerline of the coupler at the start of the misalignment to the centerline of the top of the assembly.

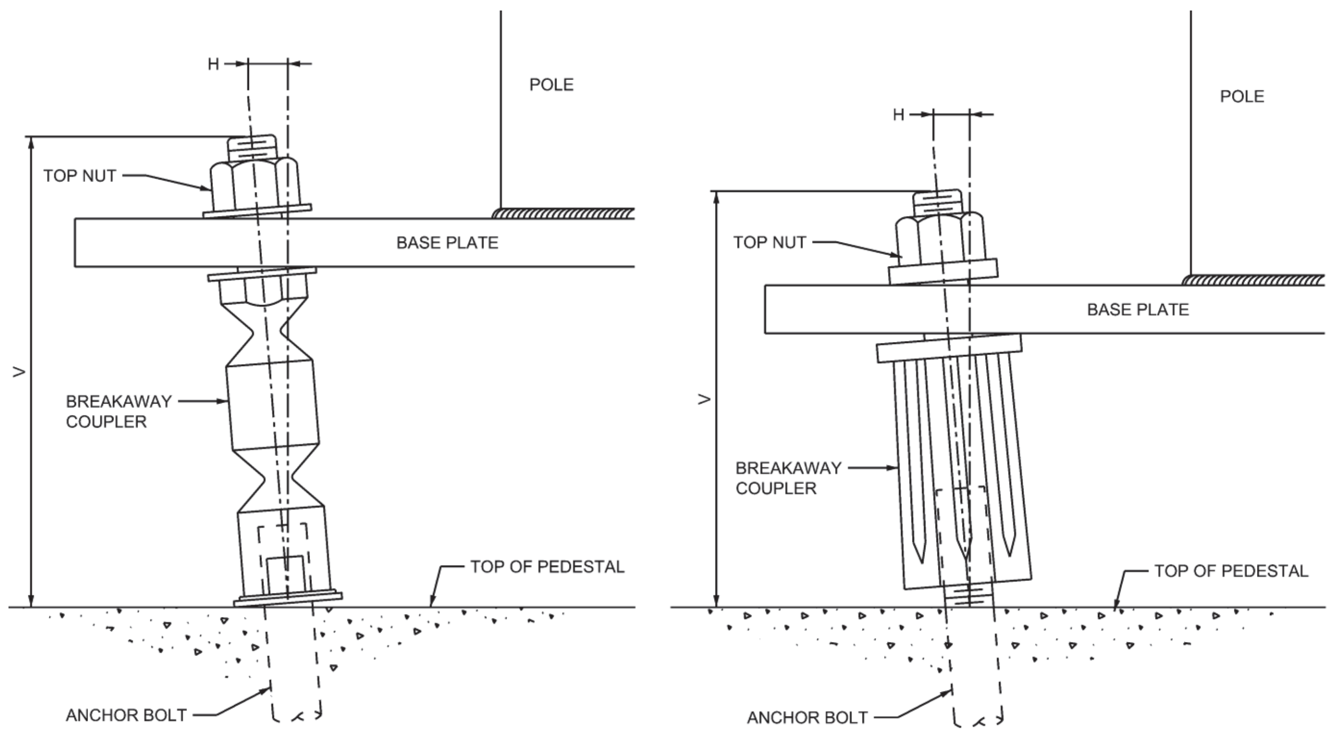


Figure 6.8 *Measurement Methodology for Out of Plumb Coupler Assembly*

- Improperly seated top nut/couplers on the base plate. Improper seating of top nut/couplers can reduce the bearing area of the nut/coupler on the base plate and can consequently reduce the load capacity of the coupler assembly.

  Improper seating of top nut/coupler assemblies could also be indicative of improperly tensioned coupler assembly components. Since the coupler has a much lower yield point than the anchor bolt and other hardware, if misaligned, fully tensioning the assembly could yield or fracture the assembly. This condition is more of a concern with cast aluminum couplers as the material is more brittle.

  If one or more assemblies are visually noted to be improperly seated, measure the gaps between the affected couplers. The measurement, D (refer to Figure 6.9), is to be taken and documented as follows, using a feeler or taper gauge.
  - The measurement, D, is to be taken from the washer, or base plate if no washer exists, to the greatest point from the base plate along the bottom of the nut.

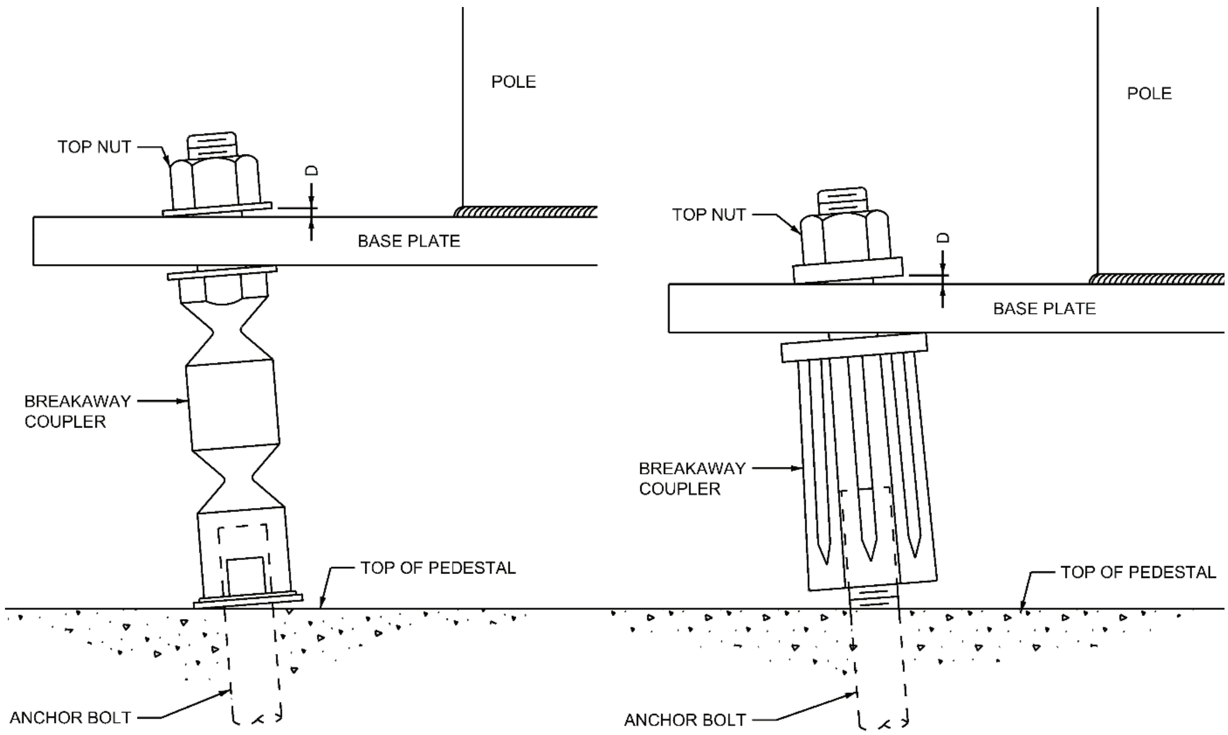


Figure 6.9 *Measurement Methodology for Improperly Seated Nut/Coupler*

- Loose or inadequately tightened top nut. These two deficient conditions of the nuts are recognized as having a negative impact on the effectiveness and longevity of the anchor bolts, and ultimately, the structure as a whole.
  - Loose nuts increase the stresses in the adjacent assemblies and allow additional impact stresses on the assemblies having the loose nut. A loose nut can be identified by the following criteria:
    - The nut is not in contact with the washer or base plate. In this case, there is a uniform gap between the nut/coupler or washer and the base plate. This condition could represent a “frozen” nut/coupler or a loose nut/coupler that could be turned by hand.
    - The washer between the nut and base plate moves by hand. This condition could represent a “frozen” nut or a loose nut that could be turned by hand.
  - Inadequately tightened nut increases the stresses in the adjacent bolts and because they are not fully tightened, the nuts may become loose over time. This condition is considered less severe as compared to a loose nut. An inadequately tightened nut is less than snug tight and can be identified by the following criteria.
    - It is not loose (as defined above).
    - The nut is in contact with the base plate.
    - The nut or washer moves when struck with a hammer. The sides of each nut should be struck 2-3 times with a 16-ounce hammer in the nut-tightening or clockwise direction when looking down on the nut from above. The force should be consistent between strikes.

- Torque control nuts. Some couplers have top nuts that have a necked section in the middle. The upper portion will separate from the lower portion at the neck when proper torque is applied to the torque control nut, leaving only the lower portion in place. In some cases, the upper and lower portions may not have separated.
- Cracks within the coupler assembly. Cracks, regardless of size, decrease the load capacity of the assembly and could increase stresses in the surrounding couplers. Cast aluminum couplers typically crack at approximately mid-height and steel couplers typically crack at the necked portion. The coupler should be given a thorough visual inspection for any cracking.
- Maximum distance between top of pedestal and bottom of couplers. For steel double necked couplers, there shall be no distance between the top of the pedestal and the bottom of the coupler. For cast aluminum couplers, the distance shall be less than or equal to 3/8”. For coupler types not shown in Section 6.3.3l, the distance shall be per the manufacturer’s recommendations.

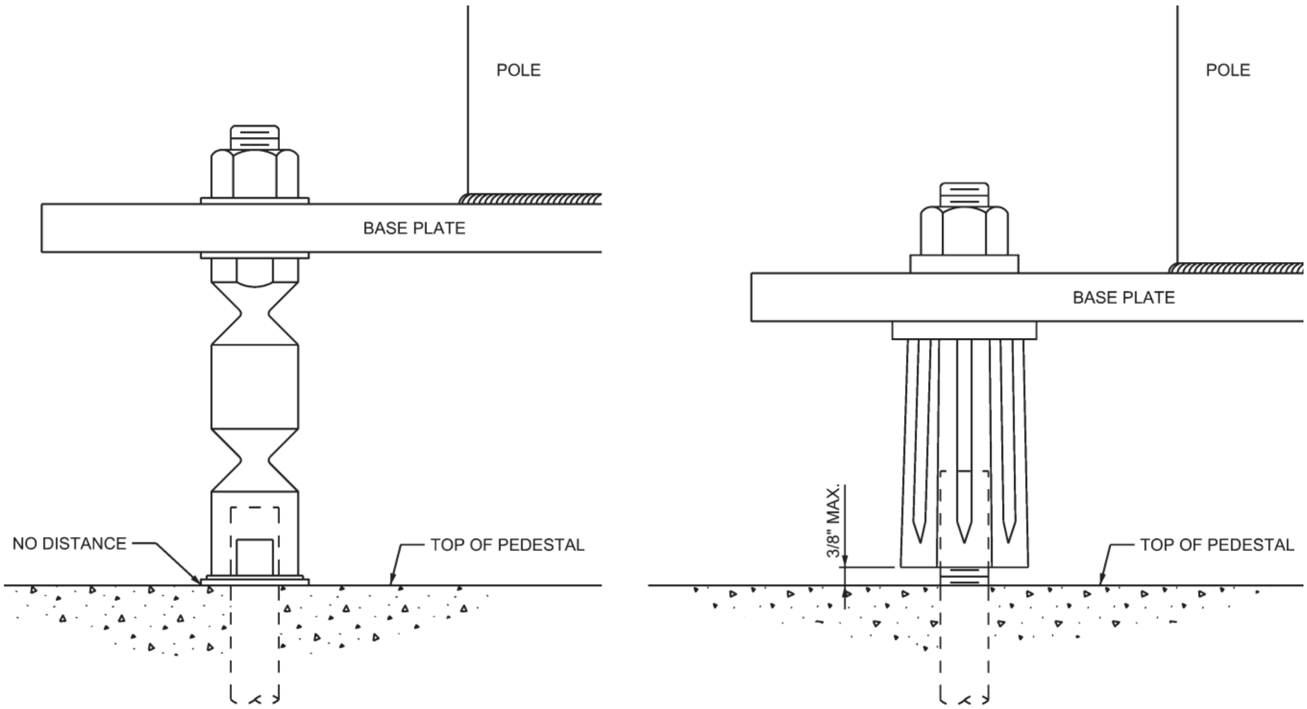


Figure 6.10 *Distance between Top of Pedestal and Bottom of Coupler*

- Any protective skirts that cannot be removed shall be documented. The condition is to be reported for removal by VDOT maintenance crews. Notice shall be provided to the District Manager; refer to guidelines in Section 6.3.4. However, if conditions warrant immediate removal of the protective skirt, the condition should be reported immediately.
- Protective skirts should be checked for loose, missing, or damaged components.

The photographs below present various typical anchor deficiencies and conditions that may be encountered in the field.

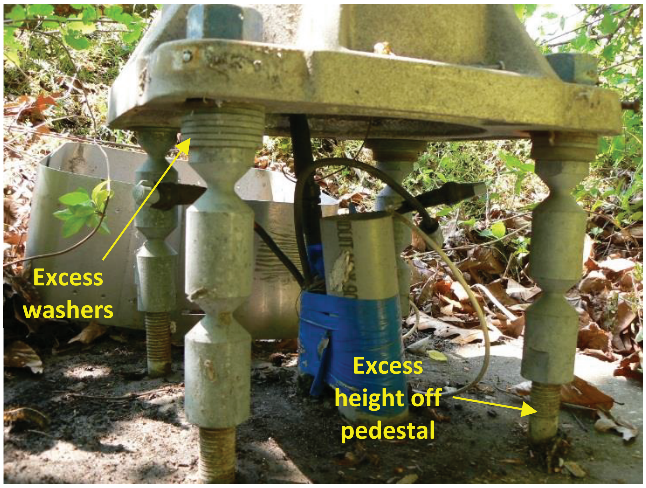


Photo 6.29 *Coupler with excess washers and excess height off pedestal*

Photo 6.30 *Coupler broken*

Photo 6.31 *Protective skirt damaged and top nut loose*

6.3.3m *Vertical Supports: Transformer Base*

All loose debris and vegetation should be removed from under and around the transformer base. Transformer bases should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Document any deviation, excess or missing components, from the typical configuration. The typical configuration of the transformer base varies depending on the manufacturer. The transformer base assembly may include shims, flat washers, thick washers, lock washers, nuts, the anchor bolts, and bolts making up the transformer base to base plate connection. These components in the various possible configurations will be referred to collectively as the “transformer base assembly” or just “transformer base”. For a drawing of a common transformer base assembly, refer to Figure 6.11. Some examples of deviations from the typical configuration may include the presence of lock washers, beveled washers, lock or jam nuts, extra washers, and missing nuts and washers.

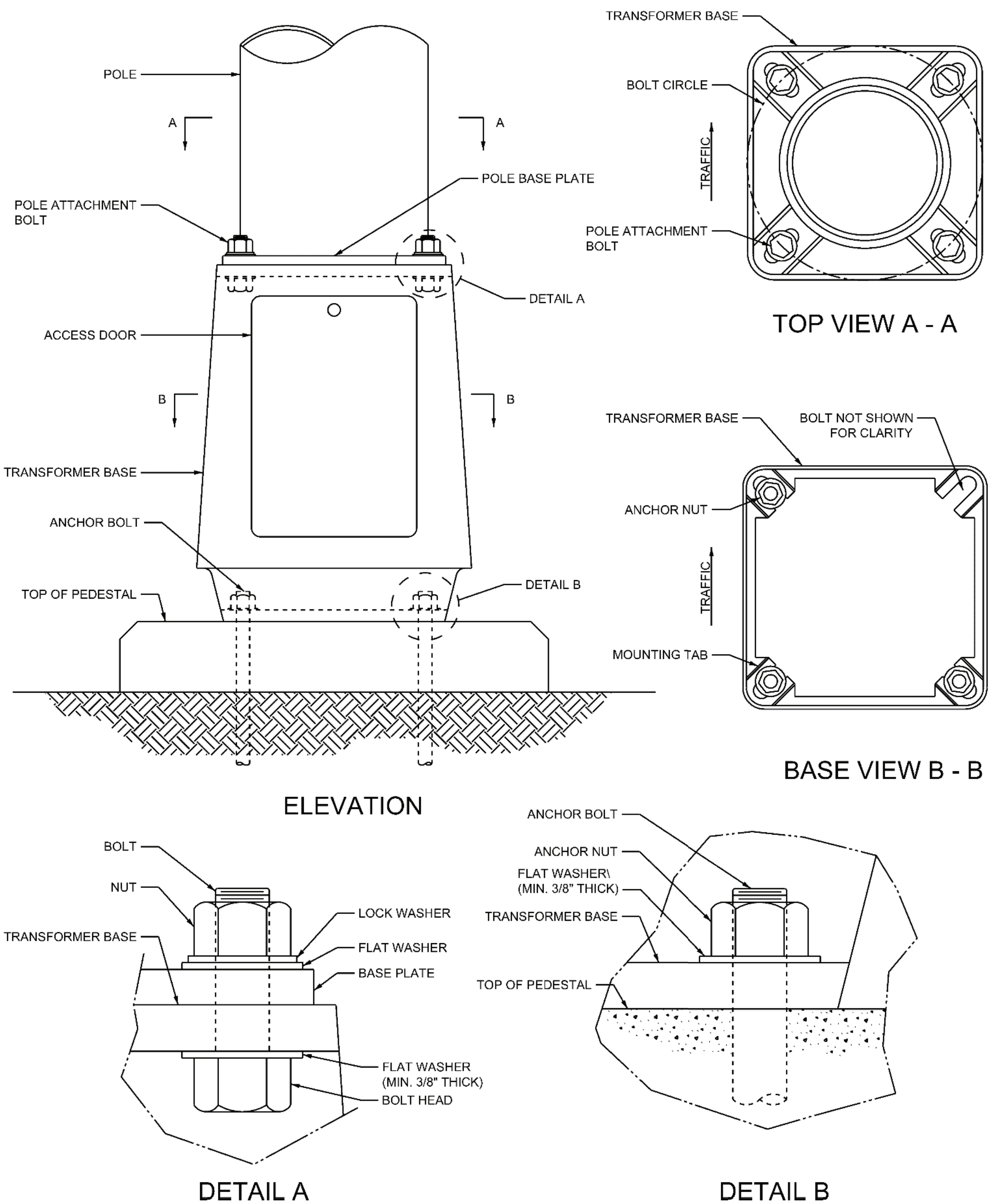


Figure 6.11 *Typical Transformer Base*

- Condition of the welded connections. The welds should be closely inspected for cracking, especially at points of intersecting welds and incomplete or excessively ground welds, as they create stress risers. The location and size of any weld crack is to be documented. Suspected cracks should be verified by NDT.
- Coating loss (paint or galvanizing), corrosion, section loss, etc. of the transformer base. If section loss is present, all rust scale should be removed from the area and calipers should be used to measure the remaining dimensions of the affected components. The transformer base is particularly susceptible to issues concerning dissimilar metals. This is because the base is made up of several components (access door, hinges, shims, washers, bolts), which may be of dissimilar metals that are in contact with one another. Several of the base components may also be in contact with the anchor bolts and the pole base plate, each of which may also be made of dissimilar metals. For guidance on dissimilar metals, refer to Section 3.8.
- Condition of the transformer base to base plate bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, improperly sized washers, beveled washers, or extra washers. Document percent engagement if less than 100%. Looseness of the bolts should be checked by rocking the pole. If excess movement is observed, the bolts can typically be visually observed as loose. Document that there is excess movement when rocked and document any hardware that was observed to be loose.
- Torque control nuts. Some transformer bases have top nuts that have a necked section in the middle. The upper portion will separate from the lower portion at the neck when proper torque is applied to the torque control nut, leaving only the lower portion in place. In some cases, the upper and lower portions may not have separated.
- Any access door that cannot be opened shall be documented. The condition is to be reported for removal by VDOT maintenance crews. Notice shall be provided to the District Manager; refer to guidelines in Section 6.3.4. However, if conditions warrant immediate removal, the condition should be reported immediately. An inspection should be performed as soon as possible following removal of the access door. After removal of the access door, a visual inspection of the interior of the transformer base is required. The inspector shall treat all interior wiring as if energized and recognize the potential electrical hazard. If tactile or other inspection methods are necessary inside the transformer base, electrically insulated tools / equipment along with proper personal protective equipment (PPE) shall be utilized in accordance with VDOT and OSHA standards.
- Debris in and around the transformer base access door. The access door should be opened to the extent possible and inspected for looseness of the door and missing or sheared bolts securing the door. Missing or loose doors allow for water and debris infiltration, and animal infestation. Any debris present within the transformer base is not to be removed by the inspector; the condition is to be reported for removal by VDOT maintenance crews. Notice shall be provided to the District Manager; refer to guidelines in Section 6.3.4. However, if conditions warrant immediate removal of the debris, the condition should be reported immediately. Conditions that would warrant immediate debris removal include observable corrosion, damage, and/or section loss. An inspection should be performed as soon as possible following removal of the debris.
- Distress around the anchor bolts. Special attention should be given to the transformer base in the immediate vicinity of the anchor bolts, as this is a location of high stress. The area should be checked for cracking or other signs of distress. Specifically, the mounting tabs/flanges of transformer bases commonly exhibit cracking of the brittle aluminum due to over tightening of more ductile steel bolts. This condition is even more likely with a foundation that is not level.
- Distortion of the transformer base. Distortion could be indicative of overloading, damage during erection, or improper welding procedures during fabrication.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various deficiencies and conditions that could be encountered in the field.

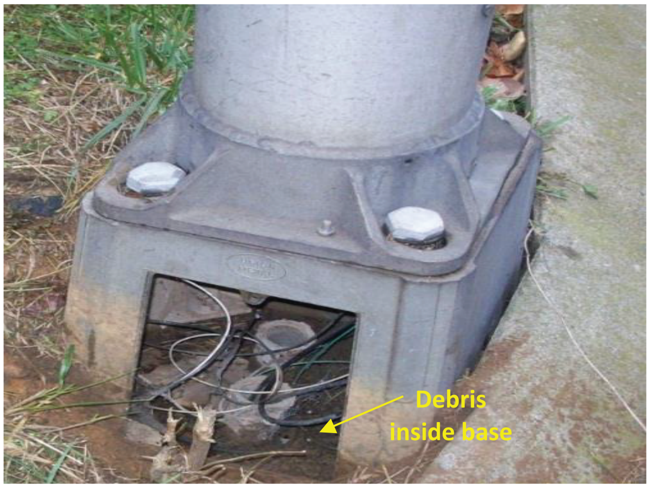


Photo 6.32 *Transformer base filled with debris*

Photo 6.33 *Transformer base with crack at bottom adjacent to anchor bolt*

Photo 6.34 *Transformer base with impact damage*

Photo 6.35 *Torque control component installed upside down and not separated from nuts*

Photo 6.36 *Improperly sized, incorrect, and excess washers*

Photo 6.37 *Improperly sized washer embedded into slot*

6.3.3n *Vertical Supports: Base Plates*

All loose debris and vegetation should be removed from under and around the base plate. Base plates should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc. If an area of corrosion is observed or suspected, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
- Distress around enlarged holes for the anchor bolts. Holes are sometimes enlarged to facilitate installation of the base plate, due to improper installation/setting of anchor bolts during construction.
- Distortion of the base plate. Distortion could be indicative of overloading, damage during erection or improper welding procedures during fabrication.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical base plate deficiencies and conditions that could be encountered in the field.

Photo 6.38 *Broken base plate at anchor bolt*

Photo 6.39 *Corrosion of base plate*

6.3.3o *Vertical Supports: Slip Joint*

The slip joint should be visually and tactilely inspected where possible.

- Coating loss (paint or galvanizing), corrosion, section loss, etc. If an area of corrosion is observed or suspected, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented. If only visual observation is possible, the inspector should document the approximate dimensions of the corrosion.
- Cracking at the slip joint. Any crack at the slip joint should be documented.

The photograph below presents a typical slip joint deficiency that could be encountered in the field.

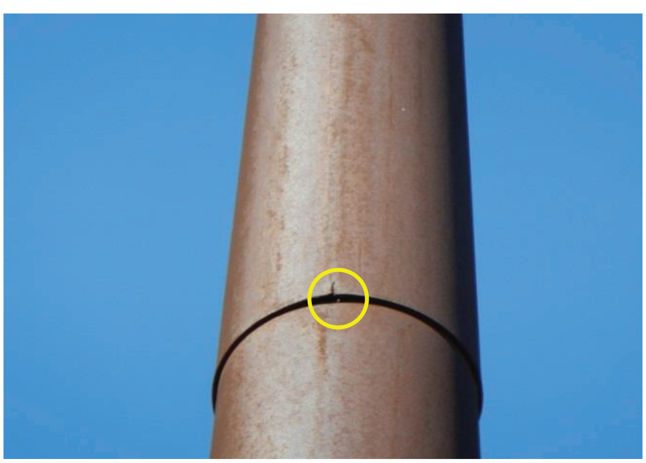


Photo 6.40 *Crack at slip joint*

Photo 6.41 *Crack at slip joint*

6.3.3p *Vertical Supports: Poles*

The poles should be visually and tactilely inspected. Hand hole covers, if present, shall be removed to the extent possible without damaging the cover and attachment screws. The upper portions of the poles are to be inspected from an aerial lift (bucket or platform) or visually through use of a scope. The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
    - If an area of corrosion is observed on the outside of the pole, the area should be thoroughly cleaned of any rust scale and the amount and extent of section loss should be determined and documented.
    - If corrosion is observed on the inside of the pole, the outside of the pole should be sounded with a hammer to detect "thin" areas in the pole. An electrically insulated borescope may be used to visually inspect the inside of the pole. The use of a borescope is to be documented. Thickness testing shall be performed utilizing corrosion thickness gages to determine the amount and extent of section loss. Readings should be recorded in decimal inches to three decimal places accuracy (Ex. 0.030"). Readings should be recorded in table format and included in the database as a photograph. For an example chart format, refer to Figure 6.14.
        - For high mast lights, obtain three random readings at 3' above the base and average the three to determine the pole's thickness. At a minimum, thickness testing should be performed utilizing corrosion thickness gages at the 12:00, 1:30, 3:00, 4:30, 6:00, 7:30, 9:00, and 10:30 o'clock positions around the circumference of the pole. The readings are to be taken on the pole at 1.5" and 6" above the top of the base plate; refer also to Figure 6.12. Other readings may be required at the discretion of the inspector.
        - For other structures, thickness testing shall be performed utilizing corrosion thickness gages to determine the amount and extent of section loss. Obtain three random readings at 3' above the base and average the three to determine the pole's thickness. At a minimum, thickness testing should be performed utilizing corrosion thickness gages at the 12, 3, 6, and 9 o'clock positions around the circumference of the pole. The readings are to be taken on the pole immediately above the top of the base plate to pole weld, and at 3" and 6" above the top of the base plate; refer to Figure 6.13. Other readings may be required at the discretion of the inspector.

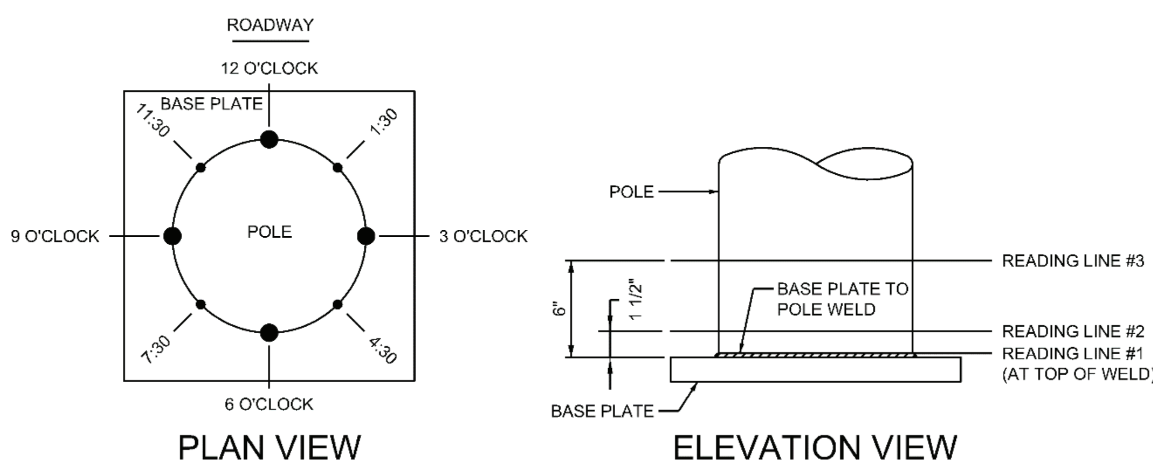


Figure 6.12 *Measurement Methodology for High Mast Light Corrosion Thickness Gage Readings, Plan and Elevation*

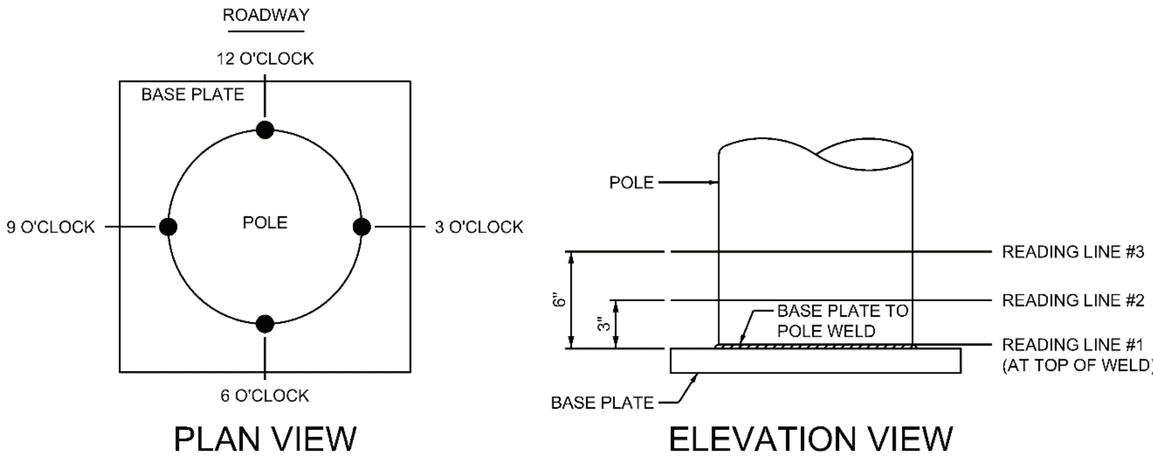


Figure 6.13 *Measurement Methodology for Pole* Corrosion Thickness Gage *Readings, Plan and Elevation*

Structure Number: 0630048

Reference Thickness: 0.119"

Pole Thickness Readings				
Height Above Base	**12:00**	**3:00**	**6:00**	**9:00**
0"	Note 4	Note 4	Note 4	0.153"
3"	0.134"	0.141"	0.140"	0.132"
6"	0.122"	0.123"	0.122"	0.119"

Notes:

1. 12:00 referenced to roadway.
2. Readings include coating thickness.
3. Reference thickness taken approximately 36" above hand hole.
4. No reading due to pitting.

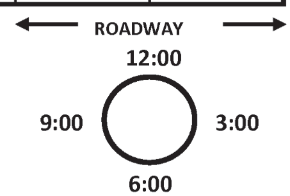


Figure 6.14 *Measurement Methodology for Pole* Corrosion Thickness Gage *Readings, Example Thickness Chart*

- Localized areas of distressed painted or coated surfaces such as at connections, attachments, pole bases, etc. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.

- Out of plumb or leaning vertical supports/poles (not related to pedestal movement). Poles that are out of plumb or leaning can be indicative of damage or adjustments made during erection and can increase bending stresses in the poles. Any observable leaning of the vertical supports should be measured and the direction of the lean documented. The measurement could be obtained by lowering a plumb bob from the top of the support within a few inches of the base plate and taking a horizontal measurement, D, from the base of the support to the plumb bob line. Alternatively, a level could be used to measure the amount of lean of a non-tapered pole over the known length of the level, L. For the method for measuring leaning poles, refer to Figures 6.15 and 6.16.

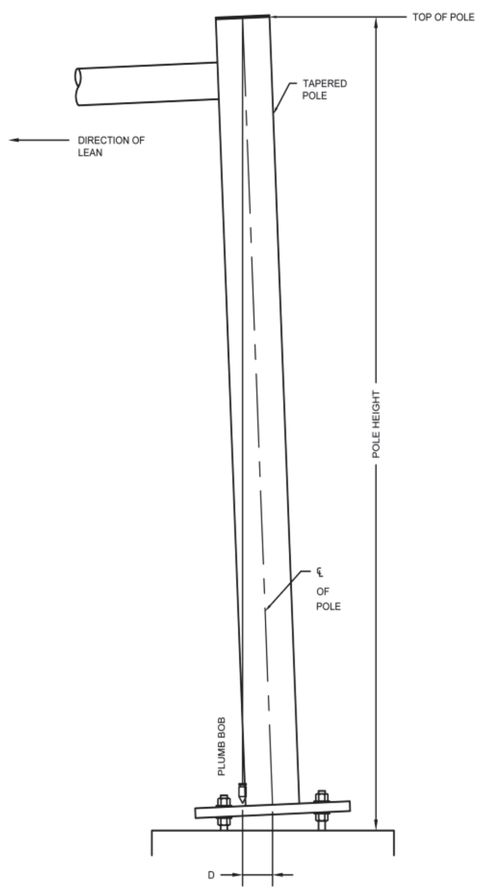


Figure 6.15 *Measurement Methodology for Leaning or Out of Plumb Tapered Poles*

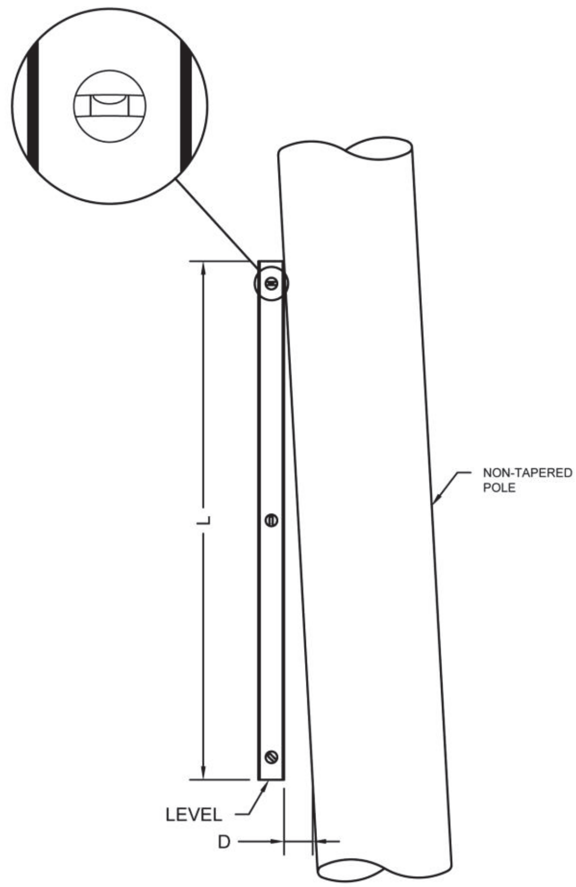


Figure 6.16 *Measurement Methodology for Leaning or Out of Plumb Non-Tapered Poles*

- Bowing of the poles. An observable bowing of the vertical supports could be indicative of an overstress condition, inadequate support size or section, improper fabrication, or damage incurred by vehicle impact, and should be measured and the direction of the bow documented. The measurements should be performed by stretching a line from the top of the support to the face of pole above the base plate and measuring the maximum bow. In the case of a localized area of bowing due to impact, the line or straight edge should be stretched across the area and rested against the plumb or vertical portions of the support on both sides of the area. For the method for measuring bowed poles, refer to Figure 6.17.

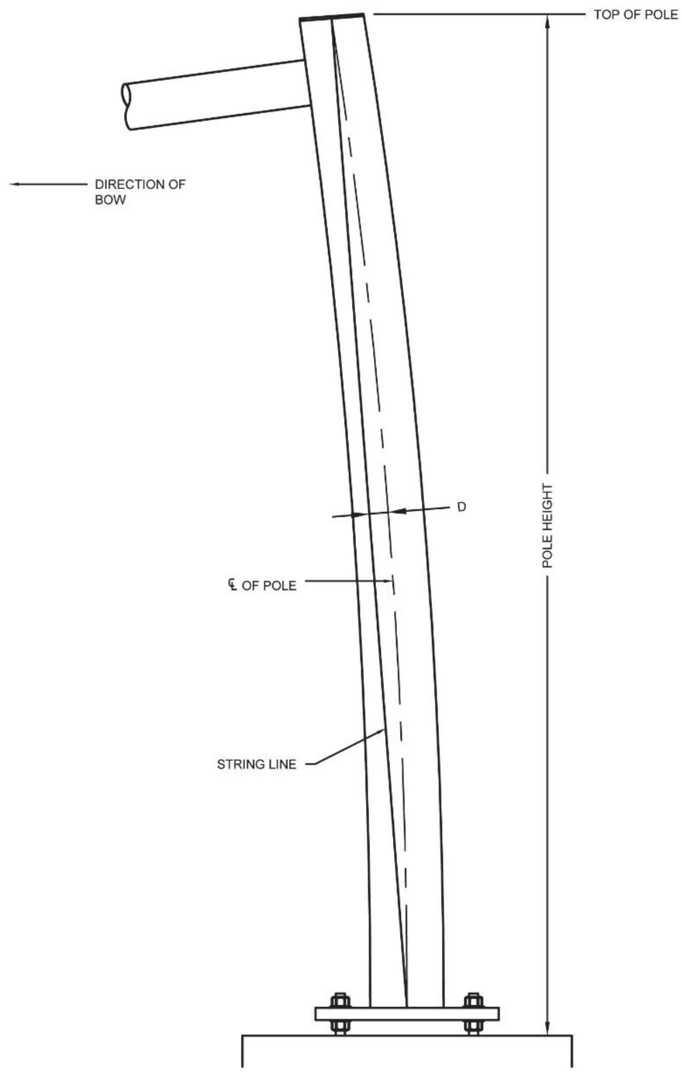


Figure 6.17 *Measurement Methodology for Bowed Poles*

- Dents and ruptures in round vertical supports/poles. Dents and ruptures can reduce the load carrying capacity of the pole or poles as they could significantly reduce the cross section of the pole or poles. The depth of the dent or rupture does not affect the rating, as it is a function of the wall thickness that, like the material, is highly variable. The depth of the dent should be measured with a ruler; however, getting more complete or accurate information on the depth of the dent could require specialized equipment that is impractical. Nevertheless, the depth of any dent or rupture, as measured with the ruler, along with descriptions of any tears or punctures within the dent or rupture, should be recorded during the inspection. The following measurements (refer to Figure 6.18) are to be taken and documented.
    - **H**: Horizontal measurement of the dent or rupture.
    - **V**: Vertical measurement of the dent or rupture.
    - **d**: Depth of the dent or rupture at the deepest point of the dent.
    - **C**: Circumference of the support, immediately above or below the affected area.
    - **D**: Distance from top of the base plate to the center/middle of the dent.

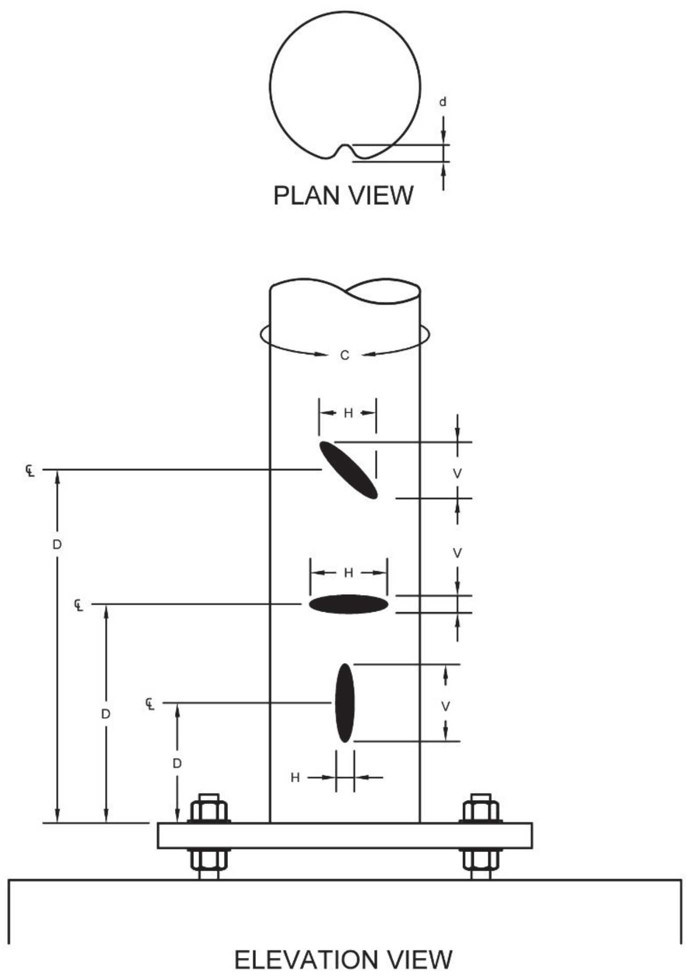


Figure 6.18 *Measurement Methodology for Dents and Ruptures in* Round or Faceted *Poles*

- Corrosion or loose rust scale around weep holes. Corrosion and rust scale may be indicative of corrosion of the inside of the pole and should be investigated as described previously in this section.
- Corrosion and cracking around any burned or rough-cut holes. Burned or rough-cut holes are stress risers and special attention should be given to these areas.

- Condition of the welded connections. The welds should be closely inspected for cracking, especially at points of intersecting welds and incomplete or excessively ground welds, as they create stress risers. Special attention should be given to the pole to base plate weld due to the high stresses at this location. The location and size of any weld crack is to be documented. Suspected cracks should be verified by NDT.
- Condition of the splices. Pole structures are not typically spliced. However, if found splices should be inspected for loose or missing components, cracked welds, and under engaged nuts. Document percent engagement if less than 100%. Suspected cracks should be verified by NDT.
- Conditions of, in, and around the hand holes and covers. The hand holes should be removed to the extent possible and inspected for looseness of the cover and missing or sheared bolts securing the cover. Any cover that cannot be removed shall be documented. Missing or loose hand hole covers allows for water and debris infiltration, and animal infestation. Any debris present within the hand hole/pole is not to be removed by the inspector; the condition is to be reported for removal by VDOT maintenance crews. Notice shall be provided to the District Manager; refer to guidelines in Section 6.3.4. However, if conditions warrant immediate removal of the debris, the condition should be reported immediately. Conditions that would warrant immediate debris removal include observable corrosion, damage, and/or section loss of the pole and around the hand hole. An inspection should be performed as soon as possible following removal of the debris.
- Cracks or breaks in the hand hole opening and opening weld, and cracks in the pole around the hand hole. Special attention shall be given to the splice weld in the hand hole reinforcing ring. Cracks or breaks in the hand hole opening and welds can potentially serve as a means for crack propagation in the pole. Suspected cracks should be verified by NDT.
- Condition of pole caps. Loose or missing caps allow water intrusion and animal infestation and should be documented.
- Condition of electrical ports. Damage to the ports and missing, loose, or damaged port caps allow for water infiltration and animal infestation and should be documented.
- Timber pole decay, checking, splitting, shakes, knots, fire damage, or insect damage. Timber poles should be checked for decay caused by insects, fungus, or other means. Decay often occurs below the ground line, so the timber pole shall be excavated at least 6” to allow adequate inspection. The timber pole should also be inspected for checking, splitting, or shakes. Any indication of fire damage should also be documented. All dimensions and extent of deficiencies should be documented.
- High mast light pole winching system at hand hole. High mast lights may have a winching system that is used to raise or lower the luminaire ring. This winching system is typically accessed at the hand hole. The inspector should check for any signs of corrosion, deterioration, or damage.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various typical pole deficiencies and conditions that could be encountered in the field.

Photo 6.42 *Pole holding water, released on loosening of hand hole cover*

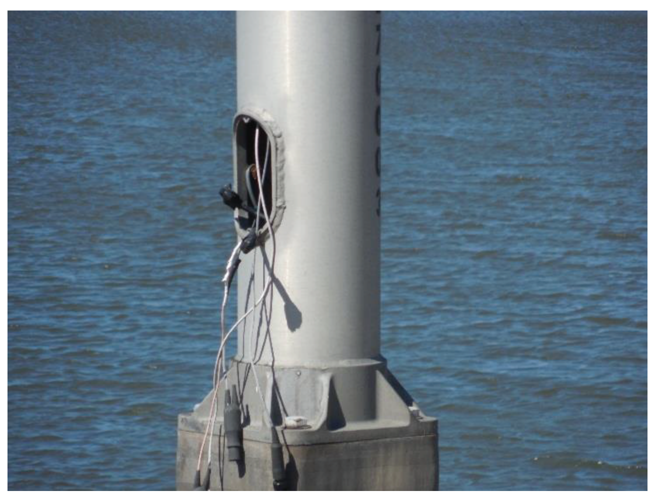


Photo 6.43 *Missing hand hole cover with wires exposed*

Photo 6.44 *Missing pole cap*

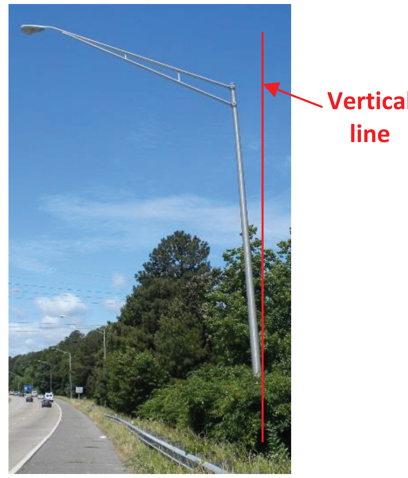


Photo 6.45 *Leaning pole*

Photo 6.46 *Impact damage to pole*

Photo 6.47 *Leaning pole*

Photo 6.48 *Crack in weld at hand hole cover extending into pole*

Photo 6.49 *Crack in weld at hand hole cover*

Photo 6.50 *Corrosion at base of pole*

Photo 6.51 *8-bolt pedestal to 4-bolt pole extension retrofit*

Photo 6.52 *Timber pole decay below grade*

Photo 6.53 *Timber pole decay and splitting*

Photo 6.54 *Decay below grade, shown after pole removal*

6.3.3q *Vertical Supports: Attachments to Pole*

Components such as small informational signs, cameras, sensors, dampers or other items are often attached to the poles. These attachments should be visually and tactilely inspected. The inspector should inspect and document the following conditions:

- Condition of electrical conduit and/or electrical or control boxes attached to the pole(s). The conduit should be visually inspected for missing components, breaks, exposed wiring, and corrosion and section loss of connector and attachments. In addition, the conduit and wiring entry and exit points in the poles should be inspected for the presence of rubber grommets or seals. Electrical or control boxes and their pole attachments should be inspected for corrosion and section loss. If any exposed wiring is present, inspectors are to take caution and avoid contact.
- Condition of the component. The component should be inspected for functionality and deficiencies documented.
- Condition of the component attachment. The attachments should be inspected and documented for section loss and missing or loose hardware.

The photograph below presents various typical pole attachment deficiencies and conditions that could be encountered in the field.

Photo 6.55 *Corroded sign to pole connection hardware*

6.3.3r *Vertical Support: Chord to Pole Connections*

The chord to pole connections should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If corrosion is observed on the connection assembly, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented. If the section loss cannot be measured by conventional methods, then thickness testing shall be performed utilizing corrosion thickness gages to determine the amount and extent of section loss.
  - If corrosion is observed on the connection hardware the amount and extent of section loss should be determined and documented. It should also be documented if the corrosion is caused by the presence of dissimilar metals. For guidance on dissimilar metals, refer to Section 3.8.
- Localized areas of distressed painted or coated surfaces. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.
- Condition of the welded connections. The welds should be inspected for cracking, especially at points of intersecting welds, and incomplete or excessively ground welds as they create stress risers. The location and size of the crack(s) is to be documented.
- Condition of the bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, beveled washers or extra washers. Document percent engagement if less than 100%.
- Gaps in mounting plates or collar plates. Gaps could increase stresses in the connection bolts.

- Bent or distressed collar plate.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.

The photographs below present various deficiencies and conditions that could be encountered in the field.

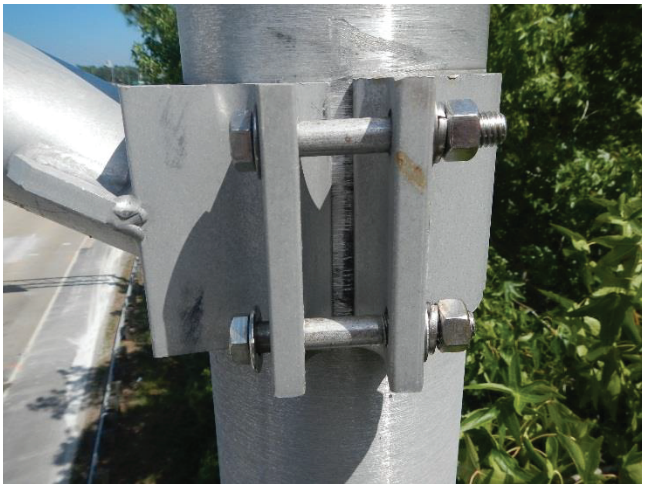


Photo 6.56 *Loose chord collar connection bolt*

Photo 6.57 *Chord to pole connection corrosion*

Photo 6.58 *Chord to timber pole missing and loose lag bolts*

Photo 6.59 *Chord to timber pole connection plate cracked, bolt missing, wiring exposed*

Photo 6.60 *Lower chord to pole connection cracked/broken*

6.3.3s *Horizontal Support: Conventional Luminaire Arm and Offset Luminaire Bracket*

The arms and brackets should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on the outside of the components, the area should be thoroughly cleaned of any rust scale and the amount and extent of section loss should be determined and documented.
  - If corrosion is suspected on the inside of the components, the outside of the component should be sounded with a hammer to detect “thin” areas. Thickness testing shall be performed utilizing corrosion thickness gages to determine the amount and extent of section loss.
- Localized areas of distressed, painted, or coated surfaces, such as at connections, attachments, etc. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.
- Condition of the welded connections. The welds should be inspected for cracking, especially at points of intersecting welds, incomplete or excessively ground, or poor welds that can contribute to stress risers within the weld. The location and size of any weld crack is to be documented. Suspected cracks should be verified by NDT.
- Condition of the bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, beveled washers or extra washers. Document percent engagement if less than 100%.
- Condition of set screws. Set screws should be inspected for loose or missing components,
- Corrosion and cracking around any burned or rough-cut holes. Burned or rough-cut holes are stress risers and special attention should be given to these areas.
- Dents, buckles, or ruptures in the components. These conditions typically occur during erection of the structure but may also be caused by vehicular or debris impact and should be measured and documented. Aluminum arms will often rupture due to the expansion of accumulated water freezing inside the arm.
- Impact damage. Document any observable impact damage that exists, and any deficiencies associated with it, which may include any of the above.
- Condition of end caps. Loose or missing caps allow water intrusion and debris accumulation and should be documented.
- Condition of electrical conduit and/or electrical or control boxes attached to the components. The conduit should be visually inspected for missing components, breaks, exposed wiring, and corrosion and section loss of connector and attachments. In addition, the conduit and wiring entry and exit points in the components should be inspected for the presence of rubber grommets or seals. Electrical or control boxes and their chord attachments should be inspected for corrosion and section loss. If any exposed wiring is present, inspectors are to take caution and avoid contact.

The photographs below present various deficiencies and conditions that could be encountered in the field.

Photo 6.61 *Lower chord member and weld along strut cracked*

Photo 6.62 *Lower chord cracked/ruptured along bottom*

Photo 6.63 *Lower chord member to strut weld cracked*

Photo 6.64 *Sheared tenon set screw with corrosion*

6.3.3t *<u>Horizontal Support: High Mast Light Luminaire Ring</u>*

The high mast luminaire ring should be visually inspected with a high-powered optical device (scope) or robotic inspection device. The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc. should be documented.
- Imbalance or misalignment of the luminaire ring.
- Missing reflector rings.
- Missing, damaged, or loose components.

The photographs below present various deficiencies and conditions that could be encountered in the field.

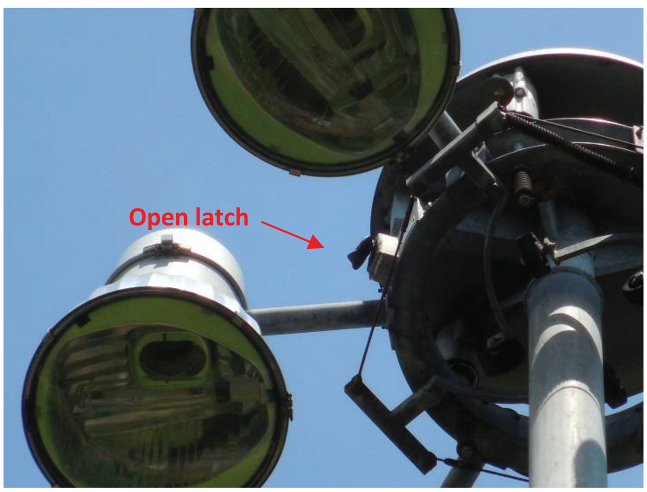


Photo 6.65 *Open latch on luminaire ring*

Photo 6.66 *Missing luminaire lens on luminaire ring*

6.3.3u *<u>Horizontal Support: Camera Pole Bracket</u>*

The camera pole bracket should be visually and tactilely inspected from an aerial lift (bucket or platform) or from the access system. The inspector should inspect and document the following conditions as feasible based on the structure configuration and climbing allowance:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
  - If an area of corrosion is observed on the outside of the chord components, the area should be thoroughly cleaned of any rust scale and the amount and extent of section loss should be determined and documented.
  - If corrosion is suspected on the inside of the chord components, the outside of the component should be sounded with a hammer to detect "thin" areas. Thickness testing shall be performed utilizing corrosion thickness gages to determine the amount and extent of section loss.
- Localized areas of distressed painted or coated surfaces such as at connections, attachments, pole bases, etc. Cracks or splits in painted surfaces could be indicative of an overstressed section warranting additional investigation and NDT at

these areas. This condition could also be a result of weathering or chemical contamination (i.e. deicing salts). The inspector will need to use sound engineering judgment to determine the possible cause. This may, if warranted based on severity and affected area, involve additional coating evaluation such as adhesion testing or paint sampling for lab work.

- Condition of the welded connections. The welds should be inspected for cracking, especially at points of intersecting welds, incomplete or excessively ground, or poor welds that can contribute to stress risers within the weld. The location and size of any weld crack is to be documented. Suspected cracks should be verified by NDT.
- Condition of the bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, and presence of lock washers, beveled washers or extra washers. Document percent engagement if less than 100%.
- Corrosion and cracking around any burned or rough-cut holes. Burned or rough-cut holes are stress risers and special attention should be given to these areas.
- Dents, buckles, or ruptures in the components. These conditions typically occur during erection of the structure but may also be caused by vehicular or debris impact and should be measured and documented.
- Condition of electrical conduit and/or electrical or control boxes attached to the chord assembly. The conduit should be visually inspected for missing components, breaks, exposed wiring, and corrosion and section loss of connector and attachments. In addition, the conduit and wiring entry and exit points in the chords should be inspected for the presence of rubber grommets or seals. Electrical or control boxes and their chord attachments should be inspected for corrosion and section loss. If any exposed wiring is present, inspectors are to take caution and avoid contact.

6.3.3v *Access System: Camera Poles*

The access system should be visually inspected from an aerial lift (bucket or platform) or from the access system itself. The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
    - If an area of corrosion is observed on any components, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
- Horizontal alignment of safety railings.
- Bent or damaged safety railings.
- Tripping hazards, uneven grating elevations, misaligned grating sections, or any condition that could pose a hazard to inspection and maintenance personnel.
- Loose, missing, or deformed/misaligned bolted grating connections or components, and under engaged nuts. Under engaged nuts are to be recorded as percent engaged.
- Distress in the welds of walkway supports, kick plates, safety railing sections, and safety rail attachments to the walkway. The welds should be inspected for cracking, especially at points of intersecting welds, and incomplete or excessively ground welds. The location and size of the crack(s) is to be documented. Suspected cracks should be verified by NDT.
- Ladder rungs. Any missing or damaged ladder rungs or foot pegs. The inspector should inspect these components prior to using the access system.
- Fall arrest system. The fall arrest system should be inspected for missing, damaged, or loose components that could create a safety hazard. The inspector should inspect these components prior to using the access system.
- Impact damage. The location and dimensions of the impact damage are to be documented and the area photographed.

6.3.3w *Luminaire Head: Conventional or Offset Luminaire Pole*

In general, the pole inspections do not cover the structure's lighting or wiring; however, the inspector is required to note anything that may impact or pose a threat to the safety of the public, including motorists, pedestrians, or inspection personnel. The luminaire head should be visually and tactilely inspected from an aerial lift (bucket or platform). The inspector should inspect and document the following conditions:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
    - If an area of corrosion is observed on the luminaire head, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
- Luminaire operation and burned out bulbs.
- Moisture accumulation or water presence.
- Lens components loose, missing, cracked, clouded, or damaged.
- Reflector components loose, missing, or damaged.
- Hinge components loose, missing, or damaged.
- Latch components loose, missing, or damaged.
- Weathering seal components loose, missing, or damaged.

- Light sensor components loose, missing, or damaged.
- Loose, missing, deformed, or misaligned connection hardware or set screws, and under engaged nuts at the luminaire head to arm or bracket connections. Under engaged nuts are to be recorded as percent engaged.
- Condition of electrical conduit or wring if visible. The conduit/wiring should be inspected for missing components, breaks, exposed wiring, and corrosion and section loss of connector and attachments. The junction boxes should be inspected for missing covers and exposed and/or broken wiring.
- Impact damage. The location and dimensions of the impact damage are to be documented and the area photographed.

The photographs below present various deficiencies and conditions that could be encountered in the field.

Photo 6.67 *Luminaire head lens broken*

Photo 6.68 *Luminaire head loose*

Photo 6.69 *Photo sensor broken*

Photo 6.70 *Hinge broken*

6.3.3x *Camera: Camera Pole Structures*

The camera should be visually and tactilely inspected from an aerial lift (bucket or platform) or from the access system. The inspector should inspect and document the following conditions as feasible based on the structure configuration and climbing allowance:

- Coating loss (paint or galvanizing), corrosion, section loss, etc.
    - If an area of corrosion is observed on the camera housing, the area should be thoroughly cleaned of all rust scale and the amount and extent of section loss should be determined and documented.
- Moisture accumulation, water presence, and/or fogged camera lens.
- Cover components loose, missing, cracked, clouded, or damaged.
- Weathering seal components loose, missing, or damaged.
- Loose, missing, deformed, or misaligned connection hardware or set screws, and under engaged nuts at the camera to bracket connections. Under engaged nuts are to be recorded as percent engaged.
- Condition of electrical conduit or wring if visible. The conduit/wiring should be inspected for missing components, breaks, exposed wiring, and corrosion and section loss of connector and attachments. The junction boxes should be inspected for missing covers and exposed and/or broken wiring.
- Impact damage. The location and dimensions of the impact damage are to be documented and the area photographed.

6.3.4 Conditions Preventing Inspection

A best attempt should always be made to complete the inspection. However, in some cases, conditions may be encountered that prevent inspection. A few examples of such conditions include structures buried more than 12”, transformer bases with access doors that cannot be removed, or excessive debris within hand holes or transformer bases. The condition is to be reported to the District Manager so that the condition preventing inspection can be resolved, allowing inspection to proceed. The notification shall be provided via email complete with a written description(s) and photograph(s) of the finding. The notification should be provided at the end of the week in which the finding was made, along with any similar findings made throughout the week. However, if conditions warrant immediate response, the condition should be reported immediately. Conditions that would warrant immediate response include observable corrosion, damage, and/or section loss. After resolution of the condition that was preventing inspection, an inspection should be performed as soon as possible.

6.3.5 Departure from Site

Prior to departing the site of an inspected pole structure, the Team Leader should review the inventory information and inspection findings for clarity, accuracy, and completeness. A good practice is for the inspector to prepare a basic inventory and inspection checklist prior to the inspections, to use in the field to ensure that all necessary information is captured. In addition, a walk-through of the inspection site should be made to ensure that all equipment has been collected and stored in the inspection vehicle. Lastly, the Team Leader should review the next structure and the MOT requirements with the MOT crew. Should the inspections be completed for the day or evening, the Team Leader should contact the appropriate Smart Traffic or Traffic Operations Center to notify them that inspection operations have ceased for the day or evening.

6.4 Critical and Emergency Structural Findings

Critical and Emergency findings are those findings that present an imminent structural or safety risk or immediate hazard, respectively, to the structure and/or traveling public. These conditions are further defined and discussed below.

6.4.1 Critical Findings

Critical Findings are defined as imminent conditions that could, if left unresolved, result in localized or complete failure (collapse) of the structure, or present a safety issue to the traveling public, and should be addressed within 90 days of its discovery. Should any such condition be encountered, it shall be reported to the District Manager within 24 hours of the discovery of the finding. A notification shall be provided via email complete with a written description(s) and photograph(s) of the finding.

6.4.2 Emergency Findings

Emergency Findings are defined as conditions that are deemed to pose an immediate safety risk or hazard to the structure's integrity and/or the traveling public and require immediate attention and corrective action. Should any such condition be encountered, the Team Leader shall contact the appropriate District Manager while on-site to notify them of the condition. In the case of an Emergency Finding, contact is normally initiated by telephone call and followed up the same day with email documentation of the findings, including photographs. Once contacted, the Department will work with the Team Leader to quantify and assess the situation to determine if it warrants an emergency response or can be addressed through the critical recommendation process.

6.4.3 Critical and Emergency Findings through Combination

In some cases, several less-than-critical deficiencies may exist which together may create a critical or emergency situation. As an example, a pole may be rated poor due to a dent and bowing. However, if the inspector believes that the bowing is being exacerbated by the dent, he/she may assess the overall condition as critical. The inspector shall use their judgment to identify combinations of deficiencies that would be deemed critical or emergency.

6.4.4 Common Critical Findings

The following items/criteria are typical conditions that qualify as critical conditions; however, the inspector should use sound judgment in determining if any other deficiencies, or combination of deficiencies, exist that could qualify as a critical or emergency condition. As stated above, any emergency findings shall be reported immediately to the appropriate District Manager to notify them of the condition(s).

6.4.4a Pedestal

- Observable movement or rotation.

6.4.4b Anchor Bolts

- 30% or greater section loss of 1 or more anchor bolts.
- Any anchor bolts that are broken, sheared, or cracked.
- Any anchor bolt(s) having any relevant indications detected by ultrasonic testing.
- 2 of 4 top or leveling nuts loose or missing (luminaire not on a transformer base).
- Excessive movement of the transformer base or 2 of 4 anchor nuts seen moving when the pole is rocked.
- 1 of 4, 2 of 6, or 3 of 8 top or leveling nuts loose or missing (high mast light, camera, cell tower).
- 3 of 4 top or leveling nuts inadequately tightened (luminaire not on a transformer base).
- 2 of 4, 2 of 6, or 3 of 8+ top or leveling nuts which are not fully seated with a gap under the nut which has a height of 4% of the anchor bolt diameter or greater.
- 2 of 4, 2 of 6, or 3 of 8+ out of plumb anchor bolts which have a slope equal to or greater than 1:40.
- 2 of 4, 2 of 6, or 3 of 8+ anchor nuts that are less than 75% engaged.
- 1 of 4, 2 of 6, or 3 of 8+ top or leveling flat washers are missing where slotted/oversized holes exist and the nuts are embedded into the hole.
- 2 of 4 transformer base to anchor bolt connections are not fully engaged, are misaligned, or are undersized.
- Any breakaway couplers broken, sheared, or cracked.
- Transformer base cracked or broken and in danger of collapse.

6.4.4c Grout

- Grout is deteriorated, no leveling nuts present.

6.4.4d *Poles and Base Plates*

- Structural members having one or more areas of 25% or greater section loss (20% or greater for weathering steel).
- Any cracks in the base plate, vertical stiffeners, hand hole, pole, welded joints, slip joints, or base plate or vertical stiffener to pole weld.
- Impact damage to any structural member in which the member is in danger of falling.
- Loose, missing, broken, or heavily deteriorated attachments to the pole (signs, cameras, sensors, etc.) in which the attachments are in danger of falling.
- 3 of 4 transformer base to pole nuts are less than 75% engaged.
  3 of 4 transformer base to pole bolts are loose or missing.

6.4.4e *Superstructure*

- Structural members having one or more areas of 25% or greater section loss.
- 25% or more bolts or nuts in chord to pole connection are loose or missing.
- Any cracks in the arm to pole connection plates.
- Impact damage to any structural member in which the member is in danger of falling.

6.4.4f *Luminaire, Camera and Structure Connections and Other Attachments*

- Structural members having one or more areas of 25% or greater section loss.
- Impact damage to any components in which the member is in danger of falling.
- Loose, missing, broken, or heavily deteriorated connection components of the luminaire, camera, and other attachments (cameras, antennae, sensors, etc.) in which the attachments are in danger of falling.

6.4.4g *Walkways and Lighting*

- Structural members having one or more areas of 50% or greater section loss.
- Loose, missing, broken, or heavily deteriorated walkway members, railing, connection, or grating which could result in a failure affecting the traveling public.
- Impact damage to any walkway components that could result in the failing of one or more components of the systems.

6.5 Non-Structure Related Emergencies

In addition to structural emergencies (critical findings), medical emergencies are potential events which could occur during the inspection/inventory of a structure. The inspection team should be aware of the following potential emergencies:

- Vehicular accident. The close proximity to live traffic creates the potential for an accident/injury.
- Electric shock. Overhead power lines as well as energized electrical wires on the structure could cause an electric shock if inadvertently contacted. Inspection teams shall follow all pertinent VDOT and OSHA electrical safety guidelines.
- Fall hazard. The potential for a fall related injury is present with the use of aerial equipment. Similarly, to the bullet above, inspection teams shall follow all pertinent VDOT and OSHA fall protection guidelines.
- Cuts/burns. The equipment used to perform the inspections can cause cuts and or burns if an accident were to occur.

The above items are examples of emergency situations that could occur while in the field. Each structure presents its own risks. Prior to inspection, the Team Leader should address all concerns and determine a course of action should a situation arise. This typically involves a hazard analysis along with development of an emergency action plan documenting nearby emergency medical and rescue facilities along with telephone numbers. Should a piece of aerial equipment malfunction, aerial rescue may also become an emergency. All inspection vehicles should be equipped with a first aid kit. If there is an emergency, 911 should be called to assist all injured parties. It is very important that all Team Members know the location in which they are working, in order to direct emergency personnel on-site in a timely fashion. One or more inspectors shall have a mobile telephone in addition to other computer devices being used for the inspection work.

6.6 Inspection Conventions and Numbering

6.6.1 Structure Numbering and GPS Coordinates

The structure numbering convention, numbering format, size of the numbers, and location of the structure number on the pole structure, as well as the location and format for collecting and recording the GPS coordinates is presented below.

6.6.1a Structure Numbering Convention

A seven-digit structure number shall be used for the identification of all structures. The structure number consists of a 3-digit county code followed by a 4–digit structure number. Leading zeroes are used as needed. The number for each structure is to be provided by the District Manager.

6.6.1b Painting/Stenciling of Structure Numbers

1. Height of lettering: The stenciled numbers shall be 2 inches in height and 1 inch between letters.
2. Stenciling paint shall be highly durable and weatherproof with a UV inhibitor. The color of the paint shall be black or deep brown. For dark colored painted poles, light grey can be used, and yellow can be used for timber poles. As an alternative to painting the number, reflectorized panels or numbers may be applied to the structure. Reflectorized panels shall be placed in the same location that numbers would have been otherwise painted. The numbers on the reflectorized panel shall be of the same height and spacing as described for stenciling.
3. The 11-digit alphanumeric code shall be placed at an elevation that makes the bottom number 3' above the top of the anchorage or 6" above any barrier railing or decorative base enclosure. Lettering shall be placed vertically on the pole so as to be visible from oncoming traffic in the primary direction of travel. For example, if a pole is on US-17N, the number shall be placed so that it will be visible while traveling on US-17N.
4. Existing 7-digit numbers presently located on a structure shall be replaced with the 11-digit alphanumeric code at the time of the next regular or base inspection. The three-letter prefix (alpha portion) may be stenciled at the district's discretion. See Appendix A, Section A.3.2, Item Code ATT03.

6.6.1c GPS Coordinates

For pole structures, coordinates shall be obtained at the pole.

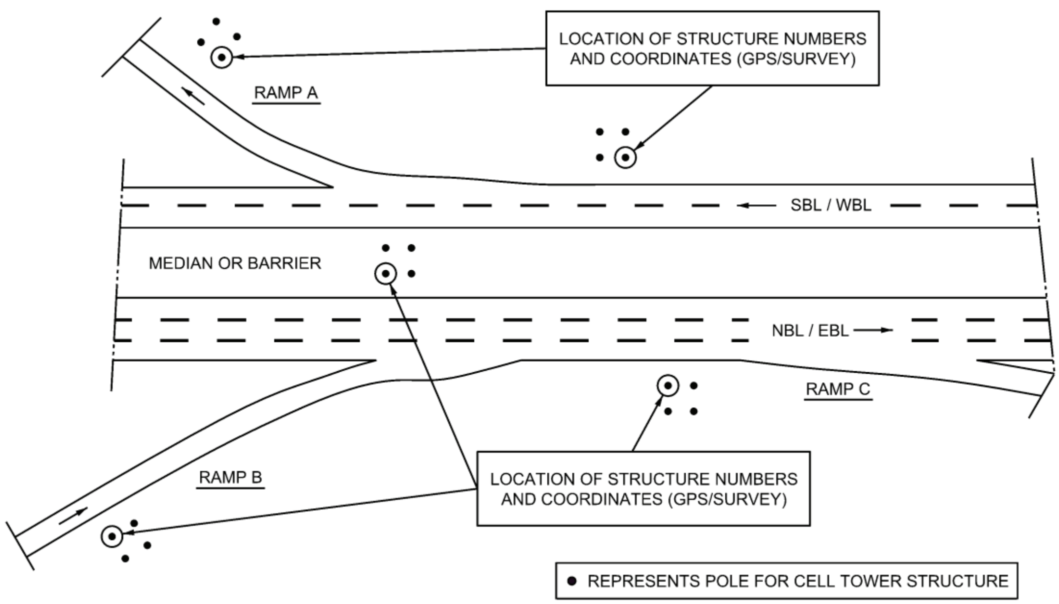


Figure 6.19 *Cell Tower Structures (Multi-Pole Shown), Number and GPS Locations (Single Direction of Traffic and Double Direction of Traffic)*

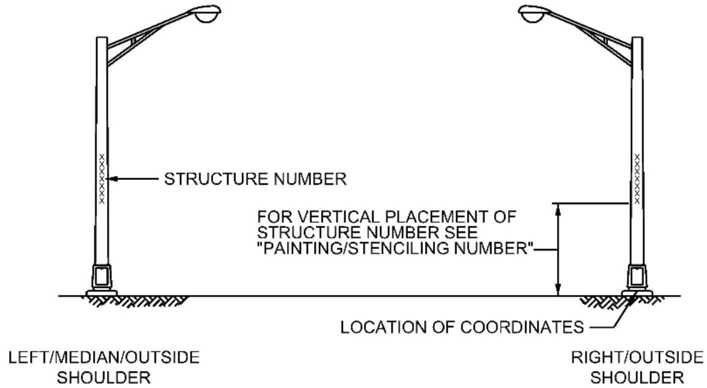


Figure 6.20 *Pole Structures, Number and GPS Locations, At Structure*
(Looking in Direction of Traffic)

6.6.2 Lane Numbering

Lane numbering is critical to accurately record inventory information and define locations for recording various inventory and inspection findings. For lane numbering convention to be used on pole structures, refer to Figure 6.21.

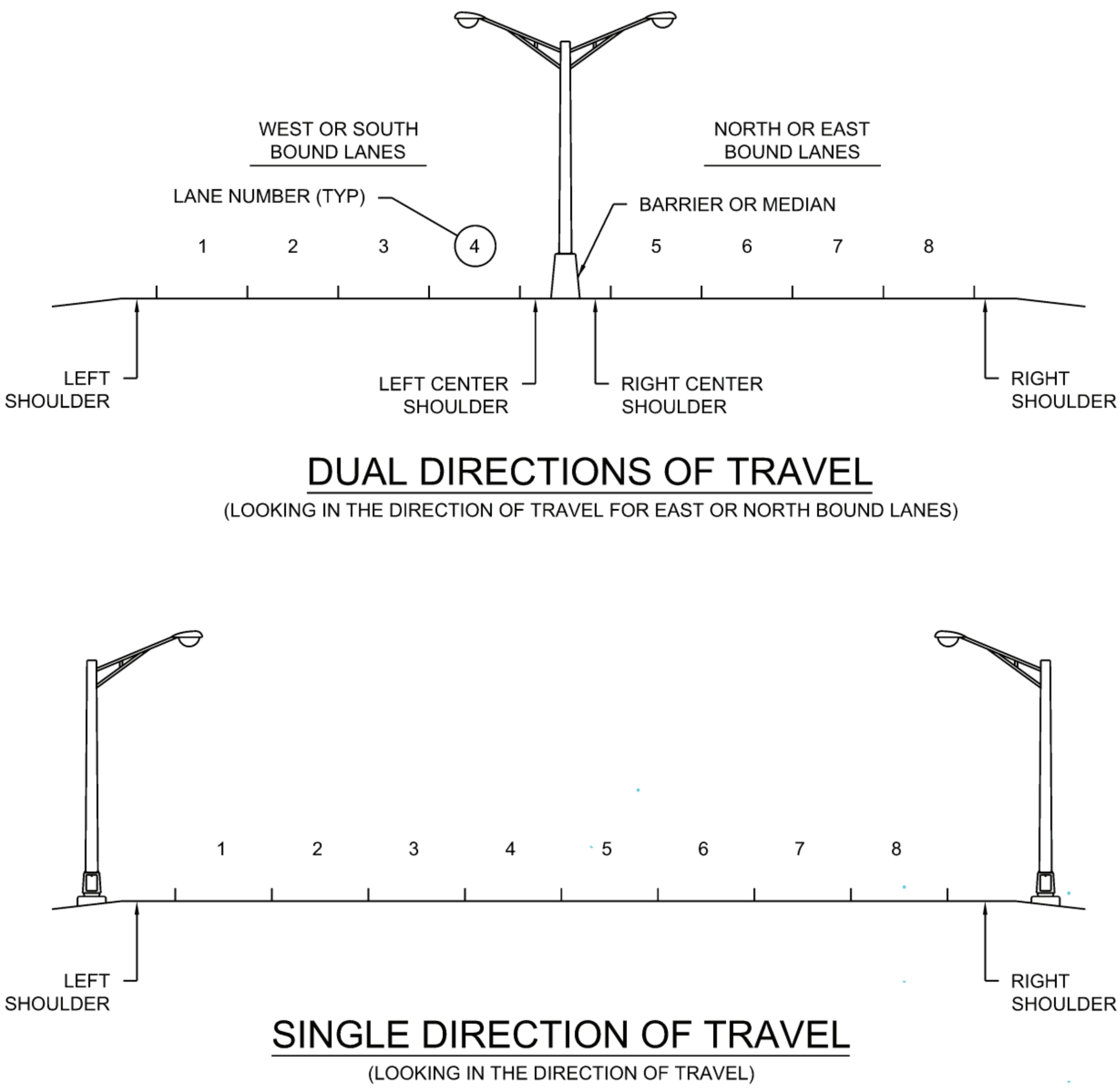


Figure 6.21 Methodology for Lane Numbering

6.6.3 Pole Structure and Inspection Numbering/Labeling Methodology

Numbering/labeling of pole structure components is critical to accurately record inventory information and define locations for recording various inventory and inspection findings. For structure component numbering, horizontal structure component numbering begins at the left end of the structure (looking in the primary direction of travel) and increases towards the right end of the structure. Vertical numbering of the structure components begins at the top of the structure and increases to the bottom of the structure.

6.6.3a *Luminaire Head Numbering/Labeling Methodology*

The numbering is established by standing behind the structure looking at the roadway for the primary direction of travel. In case of multiple directions of travel, the numbering is relative to the northbound or eastbound lanes. When standing behind the structure facing the roadway, the first component to the right of the base plate/pole centerline is labeled as Component 1 and subsequent components are numbered consecutively in clockwise direction from Component 1, refer to Figure 6.22.

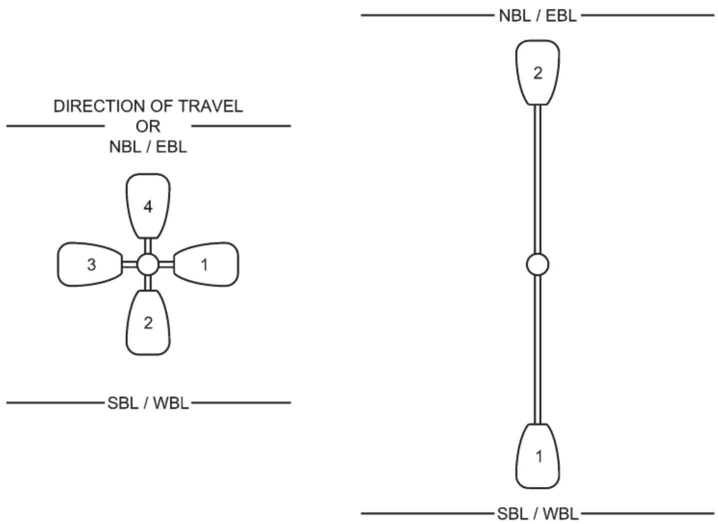


Figure 6.22 *Methodology for Luminaire Head Numbering*

6.6.3b *Cell Tower Base Numbering/Labeling Methodology*

The numbering is established by standing behind the structure looking at the roadway for the primary direction of travel. In case of multiple directions of travel, the numbering is relative to the northbound or eastbound lanes. When standing behind the structure facing the roadway, the first component to the right of the base plate/pole centerline is labeled as Component 1 and subsequent components are numbered consecutively in clockwise direction from Component 1, refer to Figure 6.23.

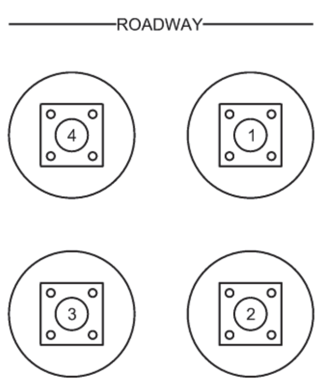


Figure 6.23 *Methodology for Cell Tower Base Numbering and Pole Labeling*

6.6.4 Anchor Bolt Numbering Methodology

Anchor bolt numbering is necessary to accurately define the various defects and deficiencies encountered during the inspection of the base plate and anchor bolts, as well as indications detected through ultrasonic testing. The numbering is established by standing behind the structure looking at the roadway for the primary direction of travel. In case of multiple directions of travel, the numbering is relative to the northbound or eastbound lanes. When standing behind the structure facing the roadway, the first bolt to the right of the base plate/pole centerline is labeled as Bolt No.1 and subsequent bolts are numbered consecutively in clockwise direction from Bolt No. 1. For the anchor bolt numbering system for various base plates, refer to Figure 6.24.

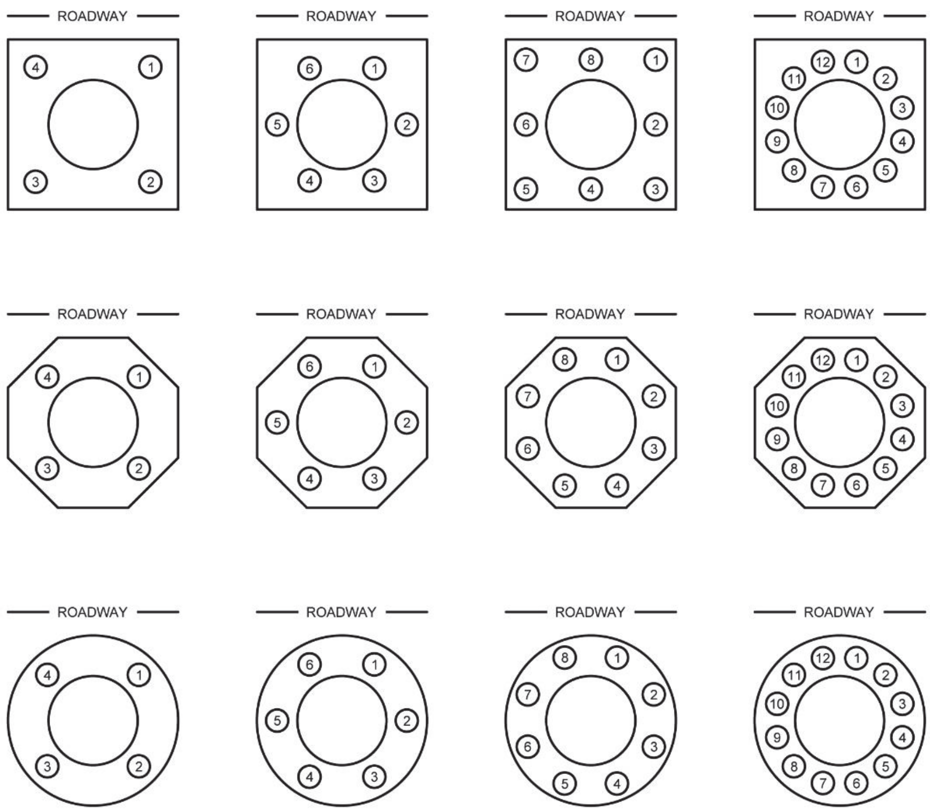


Figure 6.24 *Anchor Bolt Numbering Methodology*

APPENDIX A. HMMS STRUCTURE INVENTORY AND INSPECTION CODING

This portion of the manual will provide coding guidance for findings being entered into the “VDOT HMMS” software. The goal of this appendix is to streamline the inspection coding, inspection reporting and for the data to be properly formatted and standardized by providing correct and consistent procedures. Meeting these goals is essential so that the reports become more standardized and the database becomes more consistent. This standardization and consistency will facilitate evaluation of the reports and querying of the database. These critical factors will allow administration of the traffic ancillary structure program to be as effective and efficient as possible.

The appendix will follow the general arrangement as outlined below.

Introduction
The following page will introduce the methodology used to provide information for each field in the software and reports.

The applications are to be used in conjunction with the HMMS VUEworks User Guide and the HMMS MobileVUE User Guide.

Software and Report Mapping

We will begin by mapping out each data field that exists within the software, providing each data field an abbreviated name or code that we will reference in Coding Guidance and Appendix B.

Coding Guidance

Having established the field codes, names and locations, we can begin providing guidance for each of the structure’s elements. We will lay out all the structure’s various elements and provide tables that identify common traits accordingly, such as the typical formatting of the field. Each element will have a brief discussion regarding some of the intricacies involved with the element; some of which may include information on obtaining the required information, what each digit in a number represents, and so on. Additionally, some elements may have several appropriate entries depending on the structure’s details. Guidance will be provided on how to code each item; guidance will include expected degrees of accuracy, explicit phrasing, preset choices or descriptions of elements, and other specific details.

A.1 Introduction

In the following sections, items will be mapped, and coding guidance will be provided for each of the mapped items. Various details may be provided (e.g. degrees of accuracy required, location of measurements to be taken), but several traits are common to all items that are to be recorded. The coding guidance will be presented in both tabular and discussion forms, as illustrated in the example below. We will break down each of the items in the example to describe the information that is being presented.

Example:

	Item Code	Software Title	(b) Ancillary Structure Number	TAB	(d) Details	Applicability
(a)	DET09	Typ. Format	(c) Pre-populated field	INV or INSP	(e) Inventory	(f) S, TS, P

(g) This is the structure number. The structure number consists of a 3-digit county code followed by a 5-digit structure number. The last five digits should be unique to the structure within that county. Some overlap may exist between various structure types. The existing number typically stenciled on the structure, except for traffic signals is a 7-digit number; refer to Note B. This number will be replaced with an 8-digit structure number during future inspections.

Note A
Standard statements have been provided for several fields in Appendix A and are intended to provide uniformity in reporting throughout the ancillary program. The statements should be used where applicable but can be modified if necessary.

The items in [square brackets] are meant to serve as an example of what might fit in that portion of the statement. Items in [square brackets] should be updated to make the overall statement as accurate as possible, and the brackets erased. If none of the provided statements are applicable, minimally modify one of the provided statements until it is applicable.

Items in {*curly brackets*} are meant to serve as notes that are not to be included in the database software or report but serve only to provide additional information. **(h)**

Example Mapping:

(a) *Item Code*: This is the abbreviated code or name of the relevant coding item. It is taken directly from the mapping sections, where each of the software and database fields was mapped out. The item code is typically the initials of the software tab along with the number of the item as it appears. In the example, DET stands for Details, and the 09 represents that it is the eighth field under the software tab.

(b) *HMMS Software Title*: This is the title of the relevant coding item, as it appears in the software.

(c) *Typical Format*: This indicates the typical or common formatting of the relevant coding item. Many data fields have a set number of allowable characters, a very specific sequence, and so on. As such, many items must be entered along very specific sequences. Such items will be followed by the word "Fixed" indicating there is set formatting. Other items, though sometimes still requiring specific sequences, will be of a more variable nature; here, this box in the table will include the word "Varies". In the example, the item is a set 8-digit number; all structures will have the same number of digits. The characters will be labeled as follows.
- Alphabetic Characters: A.
- Numeric Characters: N.
- Either Alphabetic or Numeric Characters: E.

(d) *Tab*: This is the correlating tab in the software program.

(e) *INV or INSP*: This indicates whether the relevant coding item is an inventory or inspection item. Typically, inventory items do not vary between inspections and remain the same throughout multiple inspections. Inspections items typically vary between inspections, though they may also carry over from inspection to inspection once a condition is discovered. In the example, the item is an inventory item.

(f) *Applicability*: This indicates the structure applicability of the relevant coding item. Many items pertain to all the structures, but some apply only to Signs (S), some only to Traffic Signals (TS), and some only to Pole Structures (P).

(g) *Discussion*: This is a brief discussion of the relevant coding item. Various details may be provided here, such as the level of accuracy required, location of measurements to be taken, and so on.

(h) *Note*: Some coding may include special notes to point out specific exceptions or special criteria.

Note A

Standard statements have been provided for several fields in Appendix A and are intended to provide uniformity in reporting throughout the ancillary program. The statements should be used where applicable but can be modified if necessary.

The items in [square brackets] are meant to serve as an example of what might fit in that portion of the statement. Items in [square brackets] should be updated to make the overall statement as accurate as possible, and the brackets erased. If none of the provided statements are applicable, minimally modify one of the provided statements until it is applicable.

Items in {*curly brackets*} are meant to serve as notes that are not to be included in the database software or report but serve only to provide additional information.

Note B

Data Field Use and Type of Inspection

Several types of inspections exist, each of which has varying inventory and inspection requirements. The items being recorded, the data fields being coded, and the recommendations being made all vary based on the inspection type. The list below provides guidance for which items must be recorded for which inspection types.

- *Base Inspection*: This is a partial inspection of the structure, from the top of the hand hole down. Verify and record the highlighted data fields shown in the tables below.
- Initial/Inventory: This is a full inspection of a new structure. Verify and record all data fields as needed and as required per the guidance in this appendix.
- Not Applicable: To be used at the discretion of DSBSIE.
- Other: This is an inspection of the structure that does not fall into any other listed inspection type.
- *Regular Inspection*: This is a full inspection of the structure. Verify and record all data fields as needed and as required per the guidance in this appendix. (This is the most common selection. Choose this if none of the below apply.)
- Special – Catastrophic Event: This is an inspection of the structure after a catastrophic event has occurred. Possible events could be fire, wind or storm, quakes, blasts or others.
- Special Damage: This is an inspection of the structure after damage has occurred to a structure.
- Special – Unscheduled: To be used for all inspections that are not regularly scheduled. For the established inspection frequencies, refer to Section 2.4.7
- Special – Work Accomplished: This is an inspection of a modified or repaired structure that does not establish a new routine inspection.
- Ultrasonic Testing (UT): This testing is included in the above inspections as required.

A.2 Work Orders Details Tab

A.2.1 Mapping: Work Orders Details Tab

Do not edit these [ ] fields, they auto-populate from the Attributes fields. All edits are to be done in the Attribute fields.

Only Verify and record the [ ] highlighted data fields shown in the tables below for base inspections.

Work Order Details				
Sign	Traffic Signal Poles	Pole	Label	Do Not Edit
ID	ID	ID	DET01	
Assigned To	Assigned To	Assigned To	DET02	
Location	Location	Location	DET03	
Description	Description	Description	DET04	
Assignment District	Assignment District		DET05	
		Location Description	DET06	
Begin Date / Time	Begin Date / Time	Begin Date / Time	DET07	
Location Description	Location Description		DET08	
Ancillary Structure Number	Ancillary Structure Number		DET09	
Associated Bridge Structure No.	Associated Bridge Structure No.	Associated Bridge Structure No.	DET10	
		Ancillary Structure Number	DET11	
Structure Type			DET12	
	Signal Pole Group ID		DET13	
District Name (Base Map)	District Name (Base Map)	District Name (Base Map)	DET14	
County Name (Base Map)	County Name (Base Map)	County Name (Base Map)	DET15	
County Code (FIPS Code)	County Code (FIPS Code)	County Code (FIPS Code)	DET16	
City Name (Base Map)	City Name (Base Map)	City Name (Base Map)	DET17	
City Code (FIPS Code)	City Code (FIPS Code)	City Code (FIPS Code)	DET18	
Town Name (Base Map)	Town Name (Base Map)	Town Name (Base Map)	DET19	
Town Code (FIPS Code)	Town Code (FIPS Code)	Town Code (FIPS Code)	DET20	
Non-TED Maintained	Non-TED Maintained	Non-TED Maintained	DET21	
Maintenance Responsibility	Maintenance Responsibility	Maintenance Responsibility	DET22	
	Regular Inspection Frequency		DET23	
Inspection Type	Inspection Type	Inspection Type	DET24	
	Reviewer		DET25	
Lead Inspector	Lead Inspector	Lead Inspector	DET26	
	Secondary Inspector	Secondary Inspector	DET27	
		Reviewer	DET28	
Regular Inspection Frequency		Regular Inspection Frequency	DET29	
Contract No.	Contract No.	Contract No.	DET30	
Secondary Inspector			DET31	
Reviewer			DET32	
	Work Performed Since Last Inspection		DET33	
Letter of Agreement No.	Letter of Agreement No.	Letter of Agreement No.	DET34	
Work Performed Since Last Inspection		Work Performed Since Last Inspection	DET35	

Work Order Details				
Sign	Traffic Signal Poles	Pole	Label	Do Not Edit
Recommendation 1	Recommendation 1	Recommendation 1	DET36	
Recommendation 1 Priority	Recommendation 1 Priority	Recommendation 1 Priority	DET37	
Recommendation 1 Comments	Recommendation 1 Comments	Recommendation 1 Comments	DET38	
Recommendation 2	Recommendation 2	Recommendation 2	DET36	
Recommendation 2 Priority	Recommendation 2 Priority	Recommendation 2 Priority	DET37	
Recommendation 2 Comments	Recommendation 2 Comments	Recommendation 2 Comments	DET38	
Recommendation 3	Recommendation 3	Recommendation 3	DET36	
Recommendation 3 Priority	Recommendation 3 Priority	Recommendation 3 Priority	DET37	
Recommendation 3 Comments	Recommendation 3 Comments	Recommendation 3 Comments	DET38	
Recommendation 4	Recommendation 4	Recommendation 4	DET36	
Recommendation 4 Priority	Recommendation 4 Priority	Recommendation 4 Priority	DET37	
Recommendation 4 Comments	Recommendation 4 Comments	Recommendation 4 Comments	DET38	
Recommendation 5	Recommendation 5	Recommendation 5	DET36	
Recommendation 5 Priority	Recommendation 5 Priority	Recommendation 5 Priority	DET37	
Recommendation 5 Comments	Recommendation 5 Comments	Recommendation 5 Comments	DET38	
Recommendation 6	Recommendation 6	Recommendation 6	DET36	
Recommendation 6 Priority	Recommendation 6 Priority	Recommendation 6 Priority	DET37	
Recommendation 6 Comments	Recommendation 6 Comments	Recommendation 6 Comments	DET38	
	Location Sheet (Attach Document)		DET39	
	Underclearance Sheet (Attach Documents)		DET40	
Sketches (Attach Documents)	Sketches (Attach Documents)	Sketches (Attach Documents)	DET41	
Underclearance Sheet (Attach Documents)		Underclearance Sheet (Attach Documents)	DET42	
Location Sheet (Attach Document)		Location Sheet (Attach Document)	DET43	
Other (Attach Documents)	Other (Attach Documents)	Other (Attach Documents)	DET44	
Open/Closed	Open/Closed		DET45	
End Date / Time	End Date / Time	End Date / Time	DET46	
		Open/Closed	DET47	
Save	Save	Save	DET48	

A.2.2 Coding Guidance: Work Order Header and Details Tab

Item Code	**Software Title**	ID	**TAB**	Details	**Applicability**
DET01	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data field is the unique work order identification auto-generated at the time of assigning structures for inspections. In the web-based HMMS application, this field is in the work order header.

Item Code	**Software Title**	Assigned To	**TAB**	Details	**Applicability**
DET02	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data field is the person or role currently assigned to the work order. In the web-based HMMS application, this field is in the work order header.

Item Code	**Software Title**	Location	**TAB**	Details	**Applicability**
DET03	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data is auto-populated from the Attributes entry of the previous inspection. In the web-based HMMS application, this field is in the work order header.

Item Code	**Software Title**	Description	**TAB**	Details	**Applicability**
DET04	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data field is used to populate the structure number and GPS coordinates for external use. *GPS shall be recorded in decimal format. In the web-based HMMS application, this field is in the work order header.

Item Code	**Software Title**	Assignment District	**TAB**	Details	**Applicability**
DET05	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS

This data field is the VDOT District in which the structure is located. Note that the mobile app currently has “List” “instead of District”.

Item Code	**Software Title**	Location Description	**TAB**	Details	**Applicability**
DET06 & DET08	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data is auto-populated from the Attributes entry of the previous inspection.

Item Code	**Software Title**	Begin Date / Time	**TAB**	Details	**Applicability**
DET07	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data field shows the beginning date and time of the work order
. In the web-based HMMS application, this field is in the work order header.

Item Code	**Software Title**	Location Description	**TAB**	Details	**Applicability**
DET08	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data is auto-populated from the Attributes entry of the previous inspection.

Item Code	**Software Title**	Ancillary Structure Number	**TAB**	Details	**Applicability**
DET09 & DET11	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data is auto-populated from the Attributes entry of the previous inspection.

Item Code	**Software Title**	Associated Bridge Structure No.	**TAB**	Details	**Applicability**
DET10	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data is auto-populated from the Attributes entry of the previous inspection. It shows the bridge number on which the structure is located.

Item Code	**Software Title**	Ancillary Structure Number	**TAB**	Details	**Applicability**
DET11	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data is auto-populated from the Attributes entry of the previous inspection.

Item Code	**Software Title**	Structure Type	**TAB**	Details	**Applicability**
DET12	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S

This data field designates the type of sign structure.

Item Code	**Software Title**	Signal Pole Group ID	**TAB**	Details	**Applicability**
DET13	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	TS

This data is auto-populated from the Attributes entry of the previous inspection.

Item Code	**Software Title**	District Name (Base Map)	**TAB**	Details	**Applicability**
DET14	**Typ. Format**	Auto-populated field	**INV or INSP**	Inventory	S, TS, P

This data field is the VDOT District in which the structure is located based on its GPS coordinates.

Item Code	Software Title	County Name (Base Map)	TAB	Details	Applicability
DET15	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data field is the county in which the structure is located based on its GPS coordinates.

Item Code	Software Title	County Code (FIPS Code)	TAB	Details	Applicability
DET16	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data field is the 5-didgit code for the county in which the structure is located. The first 2 digits are 51, the federal code for Virginia, and the last three digits are the federal code for the county.

Item Code	Software Title	City Name (Base Map)	TAB	Details	Applicability
DET17	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data field is the city in which the structure is located based on its GPS coordinates.

Item Code	Software Title	City Code (FIPS Code)	TAB	Details	Applicability
DET18	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data field is the 5-didgit code for the city in which the structure is located. The first 2 digits are 51, the federal code for Virginia, and the last three digits are the federal code for the city.

Item Code	Software Title	Town Name (Base Map)	TAB	Details	Applicability
DET19	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data field is the town in which the structure is located based on its GPS coordinates.

Item Code	Software Title	Town Code (FIPS Code)	TAB	Details	Applicability
DET20	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data field is the 7-didgit code for the town in which the structure is located. The first 2 digits are 51, the federal code for Virginia, and the last five digits are the federal code for the town.

Item Code	Software Title	Non-TED Maintained	TAB	Details	Applicability
DET21	Typ. Format	Check box	INV or INSP	Inventory	S, TS, P

Check this box only if structure is not managed by District Traffic/Operations.

Item Code	Software Title	Maintenance Responsibility	TAB	Details	Applicability
DET22	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data is auto-populated from the Attributes entry of the previous inspection.

Item Code	Software Title	Regular Inspection Frequency	TAB	Details	Applicability
DET23 & DET29	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data is auto-populated from the Attributes entry of the previous inspection.

Item Code	Software Title	Inspection Type	TAB	Details	Applicability
DET24	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

This data field is the inspection type that is being performed. Several choices are below along with criteria for each choice.

• Base	• Special – Catastrophic Event
• Initial/Inventory	• Special Damage
• Not Applicable	• Special – Unscheduled
• Other	• Special – Work Accomplished
• Regular: regular inspections.	• Special - Monitoring

Item Code	Software Title	Reviewer	TAB	Details	Applicability
DET25, DET28 & DET32	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is the QC / QA person that performed the review of inspection data. If consultants performed the inspection, the name of the consultant reviewer would be used.

Item Code	Software Title	Lead Inspector	TAB	Details	Applicability
DET26	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is the Lead Inspector that performed the inspection as entered in ATT74. It must be entered in the DET26 field to appear in the inspection report.

Item Code	Software Title	Secondary Inspector	TAB	Details	Applicability
DET27 & DET31	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is the Additional Inspector that performed the inspection as entered in ATT75. It must be entered in the DET27 or DET31 field to appear in the inspection report.

Item Code	Software Title	Reviewer	TAB	Details	Applicability
DET28	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

See DET25 for information details.

Item Code	Software Title	Regular Inspection Frequency	TAB	Details	Applicability
DET29	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data is auto-populated from the Attributes entry of the previous inspection.

Item Code	Software Title	Contract No.	TAB	Details	Applicability
DET30	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is a ten-character alphanumeric field that references the master contract for the current letter of agreement you are working on associated with a specific RFP. (Example: SB2016-06-15)

Item Code	Software Title	Secondary Inspector	TAB	Details	Applicability
DET31	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

See DET27 for information details.

Item Code	Software Title	Reviewer	TAB	Details	Applicability
DET32	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

See DET25 for information details.

Item Code	Software Title	Work Performed Since Last Inspection	TAB	Details	Applicability
DET33 & DET35	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is work that was performed on the structure since the last Regular, Base, or Work Completed inspection.

Item Code	Software Title	Letter of Agreement No.	TAB	Details	Applicability
DET34	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is an alphanumeric field that references letter of agreement you are working on associated with a specific master contract. (Example: LOA9)

Item Code	Software Title	Work Performed Since Last Inspection	TAB	Details	Applicability
DET35	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

See DET33 for information details.

Item Code	Software Title	Recommendation / Priority / Comments 1 through 8	TAB	Details	Applicability
DET36 **DET37** **DET38**	**Typ. Format**	Drop down list Drop down list Text field	**INV or INSP**	Inventory	S, TS, P

Note C

Repair Recommendation Priority

There are several levels of priorities related to repair recommendations. Due to finite resources, not all repairs can be performed at once, and so the repairs must be ranked by urgency. The list below outlines the various levels and associated timelines.

- L, 1-Low: To include repairs in the maintenance schedule for elements/components that may not appear to have significant change in condition till next cycle.
- M, 2-Medium: To include repairs in the maintenance schedule for elements/components that may appear to affect some change in condition till next cycle and could affect performance.
- H, 3-High: To include repairs in the maintenance schedule for elements/components that may appear to effect significant change in condition till next cycle and could affect safety and performance.
- C, 4-Critical / E. 5-Emergency: Follow the procedure below for Critical/Emergency Findings. Use the Critical coding in the recommendation priority, do not use the coding Emergency.

Note D

There are 8 sets of recommendations fields. Each set of related recommendation information has three fields, Recommendation, Recommendation Priority, and Recommendation Comments.

- All of the "Recommendation" fields numbered 1 through 8 have a drop down list of standard recommendations from **Appendix B**. If there are no recommendations, select "No Recommendations" from the drop down list in Recommendation 1. If there are recommendations that do not match one of the standards recommendations, or if there are more than 8 recommendations, select "Other", and provide a description in the "Recommendation Comments"**.**
- All of the "Priority" fields numbered 1 through 8 are drop down lists. If there are no recommendations, leave blank. Refer to **Note C** for ways to order priority ratings.
- All of the "Comments" fields numbered 1 through 8 can be used to provide detailed information on the nature and location of the deficiency(s) associated with the recommendation. If there are no recommendations, do not enter any comments.

Item Code	Software Title	Recommendation 1-8	TAB	Details	Applicability
DET36	**Typ. Format**	Drop down list	**INV or INSP**	Inventory	S, TS, P

All of the "Recommendation" fields (1 – 8) have a drop down list of standard recommendations from **Appendix B**. See **Note D**.

Item Code	Software Title	Recommendation 1-8 Priority	TAB	Details	Applicability
DET37	**Typ. Format**	Drop down list	**INV or INSP**	Inventory	S, TS, P

All the "Priority" fields numbered 1 through 8 are drop down lists. **See Notes C and D.**

Item Code	Software Title	Recommendation 1-8 Comments	TAB	Details	Applicability
DET38	**Typ. Format**	Text field	**INV or INSP**	Inventory	S, TS, P

All of the "Recommendation Comments" fields numbered 1 through 8 can be filled out. "Recommendation Comments" are used to provide detailed information If there are no recommendations, do not enter any comments.

- All Critical and Emergency conditions will have "District Manager notified." after the applicable recommendation.

Item Code	Software Title	Location Sheet (Attach Document)	TAB	Details	Applicability
DET39 & DET43	**Typ. Format**	Check box	**INV or INSP**	Inventory	S, TS, P

This box is typically left unchecked unless a location sheet is being added as a separate attachment. If required, location sheets, it shall be entered under the Documents tab.

Item Code	Software Title	Underclearance Sheet (Attached Document)	TAB	Details	Applicability
DET40 & DET42	Typ. Format	Check Box	INV or INSP	Inventory	S, TS, P

This box is typically left unchecked unless additional clearance data, such as a sketch, is being added as a separate attachment. If additional clearance data is required, it shall be entered under the Documents tab.

Item Code	Software Title	Sketches (Attached Documents)	TAB	Details	Applicability
DET41	Typ. Format	Check Box	INV or INSP	Inventory	S, TS, P

This box is typically left unchecked unless a sketch is being added as a separate attachment. If required, sketches shall be entered under the Document tab.

> **Note E**
> Attachments shall be saved as JPEG (.jpg) image files and linked to the condition form. For photo insertion guidance, refer to Section **CRDOC01**
>
> In addition, the original file (Excel/Word/PDF, etc.) should be linked to the work order.

Item Code	Software Title	Underclearance Sheet (Attached Document)	TAB	Details	Applicability
DET42	Typ. Format	Check Box	INV or INSP	Inventory	S, TS, P

See DET40 for information details.

Item Code	Software Title	Location Sheet (Attach Document)	TAB	Details	Applicability
DET43	Typ. Format	Check box	INV or INSP	Inventory	S, TS, P

See DET39 for information details.

Item Code	Software Title	Other (Attached Documents)	TAB	Details	Applicability
DET44	Typ. Format	Check box	INV or INSP	Inventory	S, TS, P

This box is typically left unchecked unless an “other” attachment is included. Other items shall be entered into the database software as a photo. This box should be checked when attaching a UT report. For a UT report template, refer to Appendix C.

Item Code	Software Title	Open/Closed	TAB	Details	Applicability
DET45 & DET47	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

This data field is the Work Order status. It is used to show the status of the inspection. The status is “Open” until completion of the QA/QC process. When the inspection is ready to submit to the District Manager for acceptance, select “Hold” and reassign to the District Manager. The District Manager will change the status to “Closed” when the inspection is accepted. In the web-based HMMS application, this field is in the work order header.

Item Code	Software Title	End Date / Time	TAB	Details	Applicability
DET46	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field shows end date and time of the work order. In the web-based HMMS application, this field is in the work order header.

Item Code	Software Title	Open/Closed	TAB	Details	Applicability
DET47	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

See DET45 for information details.

Item Code	Software Title	Save	TAB	Details	Applicability
DET48	Typ. Format	Selection button	INV or INSP	Inventory	S, TS, P

This button shall be used to save changes as you enter inspection data. You may save multiple times.

A.3 Work Order Details Tab - Attributes

A.3.1 Mapping: Attributes

Only Verify and record the [highlighted] highlighted data fields shown in the tables below for base inspections.

Work Order Details - Attributes				
Business Naming Convention	MobileVue Naming Convention			Label
	Sign	Traffic Signal Poles	Pole	
OBJECT ID	OBJECTID	OBJECT ID	OBJECT ID	ATT01
STRUCTURE NUMBER ORIGINAL	STRNUM_ORIG	STRNUM_ORIG	STRNUM_ORIG	ATT02
ANCILLARY STRUCTURE NUMBER	ANCSTR NBR	ANCSTR NBR	ANCSTR NBR	ATT03
REGIONAL SIGNAL ID		REG_SIGNAL_ ID		ATT04
SIGNAL POLE / LIGHTING GROUP ID		SIGNALPPOLEGID	LIGHTINGGID	ATT05
ASSET NUMBER		ASSET_NUM		ATT06
STATUS	STATUS	STATUS	STATUS	ATT07
DISTRICT	DISTRICT	DISTRICT	DISTRICT	ATT08
MAINTENANCE JURISDICTION	MAINT_JURISDICTION	MAINT_JURISDICTION	MAINT_JURISDICTION	ATT09
ROUTE DIRECTION	ROUTE_DIR	ROUTE_DIR	ROUTE_DIR	ATT10
ROUTE ID	ROUTE_ID	ROUTE_ID	ROUTE_ID	ATT11
ROADWAY TYPE	ROADWAY_TYPE	ROADWAY_TYPE	ROADWAY_TYPE	ATT12
OWNERSHIP	OWNERSHIP	OWNERSHIP	OWNERSHIP	ATT13
MAINTENANCE RESPONSIBILITY	MAINT_RESP	MAINT_RESP	MAINT_RESP	ATT14
INSPECTION RESPONSIBILITY	INSP_RESP	INSP_RESP	INSP_RESP	ATT15
OPERATIONS RESPONSIBILITY	OPER_RESP	OPER_RESP	OPER_RESP	ATT16
STRUCTURE TYPE	STRUCT_TYP	STRUCT_TYP	STRUCT_TYP	ATT17
CONTRACTOR COMPANY ID	CONTRT_COMID	CONTRT_COMID	CONTRT_COMID	ATT18
POLE TYPE	POLE_TYP	POLE_TYP		ATT19
POLE HEIGHT	POLE_HT	POLE_HT	POLE_HT	ATT20
POLE DIAMETER	POLE_DIA	POLE_DIA	POLE_DIA	ATT21
FOUNDATION TYPE	FONDTN_TYP	FONDTN_TYP	FONDTN_TYP	ATT22
NUMBER OF ANCHOR BOLTS	NBR_ANCHRBLT	NBR_ANCHRBLT	NBR_ANCHRBLT	ATT23
DIAMETER OF ANCHOR BOLTS	DIA_ANCHRBLT	DIA_ANCHRBLT	DIA_ANCHRBLT	ATT24
POLE MATERIAL TYPE	POLE_MTR_TYP	POLE_MTR_TYP	POLE_MTR_TYP	ATT25
CHORD TYPE/PRIMARY CHORD TYPE	CHRD_TYP	PRI-CHRD_TYP	CHRD_TYP	ATT26
SPAN LENGTH/PRIMARY SPAN LENGTH	SPN_LN	PRI_SPN_LN	SPN_LN	ATT27
SECONDARY CHORD TYPE		SEC_CHRD_TYP		ATT28
SECONDARY SPAN LENGTH		SEC_SPN_LN		ATT29
DISTANCE FROM PEDESTAL TO BASE PLATE	DIST_PED_BASE	DIST_PED_BASE	DIST_PED_BASE	ATT30
WND DESIGN SPEED	WND_DSGN_SPD	WND_DSGN_SPD	WND_DSGN_SPD	ATT31
CHORD/PRIMARY ARM SPLICE TYPE	CHRD_SPL_TYP	PRI_ARM_SPL_TYP		ATT32
CHORD/ARM TO POLE ATTACHMENT TYPE	CHRD_POLEATT	PR_ARM_POLEATT	CRD_TO_POLEATT	ATT33
SECONDARY ARM SPLICE TYPE		SEC_ARM_SPL_TYP		ATT34
SECONDARY ARM TO POLE ATTACHMENT TYPE		SEC_ARM_POLEATT		ATT35
MESSAGE TYPE	MSG_TYP			ATT36
VMS TYPE	VMS_TYP			ATT37
OTHER ATTACHMENTS TO CHORD	NBR_ATTACH			ATT38
NUMBER OF SIGNS	NBR_SIGNS			ATT39
POLE SPLICE TYPE	POLE_SPLTYP	POLE_SPLTYP	POLE_SPLTYP	ATT40
OTHER ATTACHMENTS TO POLE	OTHR_ATT_POLE	OTHR_ATT_POLE	OTHR_ATT_POLE	ATT41
BASE PLATE SHAPE	BSE_PL_SHP	BSE_PL_SHP	BSE_PL_SHP	ATT42
BASE PLATE LONGITUDINAL STIFFNERS	BSE_POLE_LONGSTF	BSE_POLE_LONGSTF	BSE_POLE_LONGSTF	ATT43
HAND HOLES	HND_HOLES	HND_HOLES	HND_HOLES	ATT44
BRIDGE MOUNT ANCHOR TYPE	BRIDGE_MT_ANCH_TYP	BRIDGE_MT_ANCH_TYP		ATT45
ANCHOR BOLT MATERIAL GRADE	ANCH_BLT_MTR_GRD	ANCH_BLT_MTR_GRD	ANCH_BLT_MTR_GRD	ATT46
NUT CONFIGURATION	NUT_CONFIG	NUT_CONFIG	NUT_CONFIG	ATT47
FLAT WASHER CONFIGURATION	FLAT_CONFIG	FLAT_CONFIG	FLAT_CONFIG	ATT48
LOCK NUT CONFIGURATION	LOCK_CONFIG	LOCK_CONFIG		ATT49
BREAKAWAY BASE TYPE			BRKWY_BS_TYP	ATT50
BREAKAWAY BASE MATERIAL			BRKWY_BS_MAT	ATT51
BREAKAWAY COUPLER HEIGHT			BRKWY_CPL_HGT	ATT52
VIBRATION DAMPENER TYPE			VIB_DAMP_TYP	ATT53
PRIMARY ARM NUMBER OF SIGNS		PRI_ARM_NBR_SIG		ATT54
SECONDARY ARM NUMBER OF SIGNS		SEC_ARM_NBR_SIG		ATT55

Work Order Details - Attributes				
	MobileVue Naming Convention			
Business Naming Convention	Sign	Traffic Signal Poles	Pole	Label
OTHER ATTACHMENTS TO CHORD/PRIMARY ARM				ATT 56
OTHER ATTACHMENTS TO SECONDARY ARM		SEC_ARM_NBR_OTHRATT		ATT57
BRIDGE STRUCTURE NUMBER	BRIDGESTRUCT_NBR	BRIDGESTRUCT_NBR	BRIDGESTRUCT_NBR	ATT58
FABRICATOR	FABRICATOR	FABRICATOR	FABRICATOR	ATT59
STRUCTURE MODIFIED DATED	STRC_MOD_DT	STRC_MOD_DT	STRC_MOD_DT	ATT60
DATE ERECTED	DT_EREC	DT_EREC	DT_EREC	ATT61
TRAFFIC CONTROL REQUIREMENTS	TRAF_CONTR_REQ	TRAF_CONTR_REQ	TRAF_CONTR_REQ	ATT62
SPECIAL ACCESS REQUIREMENTS	SPEC_ACCES_REQ	SPEC_ACCES_REQ	SPEC_ACCES_REQ	ATT63
CURRENT INSPECTION DATE	CURRENT INSPECTION_DATE	CURRENT INSPECTION_DATE	CURRENT INSPECTION_DATE	ATT64
REGULAR INSPECTION DATE	REG_INSP_DT	REG_INSP_DT	REG_INSP_DT	ATT65
REGULAR INSPECTION FREQUENCY	REG_INSPEC_FREQ	REG_INSPEC_FREQ	REG_INSPEC_FREQ	ATT66
NEXT REGULAR INSPECTION DATE	NEXT_REG_INSP_DT	NEXT_REG_INSP_DT	NEXT_REG_INSP_DT	ATT67
BASE INSECTION DATE	BSE_INSP_DT	BSE_INSP_DT	BSE_INSP_DT	ATT68
BASE INSPECTION FREQUENCY	BASE_INSPEC_FREQ	BASE_INSPEC_FREQ	BASE_INSPEC_FREQ	ATT69
NEXT BASE INSPECTION DATE	NEXT_BASE_INSP_DT	NEXT_BASE_INSP_DT	NEXT_BASE_INSP_DT	ATT70
SPECIAL INSPECTION DATE	SP_INSPECTION_DATE	SP_INSPECTION_DATE	SP_INSPECTION_DATE	ATT71
SPECIAL INSPECTION FREQUENCY	SP_INSPEC_FREQ	SP_INSPEC_FREQ	SP_INSPEC_FREQ	ATT72
NEXT SPECIAL INSPECTION DATE				ATT73
LEAD INSPECTOR NAME	LEAD_INSPECTOR_NAME	LEAD_INSPECTOR_NAME	LEADINSPECTOR_NAME	ATT74
ADDITIONAL INSPECTOR NAME	ADDITIONAL_INSPECTOR_NAME	ADDITIONAL_INSPECTOR_NAME	ADDITIONAL_INSPECTOR_NAME	ATT75
LOCATION_DESCRIPTION	LOCATION_DESCRIPTION			ATT76
FAR LEFT SHOULDER CLEARANCE	FAR_LFT_SLDR_CLRNCE	FAR_LFT_SLDR_CLRNCE		ATT77
LEFT CENTER SHOULDER CLEARANCE	LFT_CNTER_SLDR_CLRNCE	LFT_CNTER_SLDR_CLRNCE		ATT78
FAR RIGHT SHOULDER CLEARANCE	FAR_RGHT_SLDR_CLRNCE	FAR_RGHT_SLDR_CLRNCE		ATT79
RIGHT CENTER SHOULDER CLEARANCE	RGHT_CNTR_SLDR_CLRNCE	RGHT_CNTR_SLDR_CLRNCE		ATT80
MINIMUM VERTICAL CLEARANCE	MIN_VERT_CLRNCE	MIN_VERT_CLRNCE		ATT81
LANE CLEARANCE 1	LANE_CLEARANCE_1	LANE_CLEARANCE_1		ATT82
LANE CLEARANCE 2	LANE_CLEARANCE_2	LANE_CLEARANCE_2		ATT83
LANE CLEARANCE 3	LANE_CLEARANCE_3	LANE_CLEARANCE_3		ATT84
LANE CLEARANCE 4	LANE_CLEARANCE_4	LANE_CLEARANCE_4		ATT85
LANE CLEARANCE 5	LANE_CLEARANCE_5	LANE_CLEARANCE_5		ATT86
LANE CLEARANCE 6	LANE_CLEARANCE_6	LANE_CLEARANCE_6		ATT87
LANE CLEARANCE 7	LANE_CLEARANCE_7	LANE_CLEARANCE_7		ATT88
LANE CLEARANCE 8	LANE_CLEARANCE_8	LANE_CLEARANCE_8		ATT89
LOCATION DESCRIPTION		LOCATION_DESCRIPTION	LOCATION_DESCRIPTION	ATT90
COMMENTS	COMMENTS	COMMENTS	COMMENTS	ATT91
GLOBAL ID	GLOBALID	GLOBALID	GLOBALID	ATT92
CREATED DATE	CREATED_DATE		CREATED_DATE	ATT93
TRAFFIC SIGNAL RELATIONSHIP ID		TA_REL_ID		ATT94
LATITUDE	LATITUDE	LATITUDE	LATITUDE	ATT95
LONGITUDE	LONGITUDE	LONGITUDE	LONGITUDE	ATT96

A.3.2 Coding Guidance: Attributes

Item Code	Software Title	OBJECT ID	TAB	Attributes	Applicability
ATT01	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data field represents the system generated identifier in GIS.

Item Code	Software Title	STRUCTURE NUMBER ORIGINAL	TAB	Attributes	Applicability
ATT02	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field shows the 7-digit structure number of structures imported from the previous database for continuity with earlier records. Do not edit. Leave blank for new structures. See **DET 09 and DET 11.**

Item Code	Software Title	ANCILLARY STRUCTURE NUMBER	TAB	Attributes	Applicability
ATT03	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This is the structure number. The structure number consists of a 3-digit state county code followed by a 5-digit sequential number. The last five digits should be unique to the structure within that county. Some overlap may exist between various structure types. The existing number typically stenciled on the structure.

These numbers will be replaced with an 11-digit alphanumeric code during future inspections. The first 3 characters represent the acronym for the specific structure type in accordance with the table.

Signs	SGN		Luminaire	LUM
Traffic Signal Poles	TSP		Camera/Other	CAM
High Mast Light	HML			

Item Code	Software Title	REGIONAL SIGNAL ID	TAB	Attributes	Applicability
ATT04	Typ. Format	Text field – **DO NOT EDIT**	INV or INSP	Inventory	TS

This data field represents the ID assigned to the Traffic Signal asset by Traffic Engineering.

Item Code	Software Title	SIGNAL POLE /LIGHTING GROUP ID	TAB	Attributes	Applicability
ATT05	Typ. Format	Text field – **DO NOT EDIT**	INV or INSP	Inventory	TS, P

This data field represents legacy data for prior intersection number and will be phased out. It shows a 7 character pole group identifier that was previously stenciled on signal poles in lieu of the structure number.

Item Code	Software Title	ASSET NUMBER	TAB	Attributes	Applicability
ATT06	Typ. Format	Text field – **DO NOT EDIT**	INV or INSP	Inventory	TS

This data field represents an ID assigned by Traffic Engineering.

Item Code	Software Title	ASSET STATUS	TAB	Attributes	Applicability
ATT07	Typ. Format	Drop down list – **DO NOT EDIT**	INV or INSP	Inventory	S, TS, P

This data field normally shows as Active. Asset Status should only be changed by Traffic Engineering. **Retiring an asset will remove the asset and all data from HMMS and should only be done by Traffic Engineering.**

Item Code	Software Title	DISTRICT	TAB	Attributes	Applicability
ATT08	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

This is the VDOT District in which the structure is located.

Bristol	Hampton Roads	Richmond
Culpeper	Lynchburg	Salem
Fredericksburg	Northern Virginia	Staunton

Item Code	Software Title	MAINTENANCE JURISDICTION	TAB	Attributes	Applicability
ATT09	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

This data field represents jurisdiction in which the structure is maintained. For structures maintained by VDOT enter the county or city in which the structure is located. For structures not maintained by VDOT, enter the responsible city, county, or town name.

Item Code	Software Title	ROUTE DIRECTION	TAB	Attributes	Applicability
ATT10	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

This field will be used to show the direction of traffic flow. (Example, N/A, N, S, E, or W)

- *N*: Designation for traffic ancillary structures serving both the northbound and southbound directions of traffic.
- *E*: Designation for traffic ancillary structures serving both the eastbound and westbound directions of traffic.

Item Code	Software Title	ROUTE ID	TAB	Attributes	Applicability
ATT11	Typ. Format	Text field, AANNNNNAAEEEE (13 Max, varies)	INV or INSP	Inventory	S, TS, P

This data field is the route ID that the structure is located along.

Examples: IS-264 EBL at the Elizabeth River Crossing becomes IS00264EBERC.
US-13 W on the Business Route becomes US13WBBU

Note F
For traffic signal structures, the route id is of the primary or main route.

{AA}NNNNNAAEEEE: Characters 1-2 are letters and represent the type of roadway per the following criteria.

- *IS*: Interstate routes.
- *US*: Primary routes such as US highways. These can typically be identified by the symbol shown at right.
- *VA*: Virginia Primary Routes typically having Route ID numbers less than 600.
- *SC*: Virginia Secondary Routes typically having Route ID numbers equal to or greater than 600
- *UR*: Urban Routes typically within City Limits
- *BU*: Business Routes typically within City Limits
- *AL*: Alternate Routes (see Traffic Counts data)
- *FR*: Frontage Roads (see Traffic Counts data)

Note G
A tool that assists in identifying roadways may be found at:

http://www.virginiadot.org/info/ct-TrafficCounts.asp

AA{NNNNN}AAEEEE: Characters 3-7 are numbers and represent the actual route number. If the number is not five digits, precede the route number with zeroes. In the example above, I-95 becomes 00095.

AANNNNN{AA}EEEE: Characters 8-9 are letters and represent the direction of the route per the following list.

- *NB*: Designation for traffic ancillary structures serving the northbound direction of traffic.
- *EB*: Designation for traffic ancillary structures serving the eastbound direction of traffic.
- *SB*: Designation for traffic ancillary structures serving the southbound direction of traffic.
- *WB*: Designation for traffic ancillary structures serving the westbound direction of traffic.
- *NS*: Designation for traffic ancillary structures serving both the northbound and southbound directions of traffic.
- *EW*: Designation for traffic ancillary structures serving both the eastbound and westbound directions of traffic.

AANNNNNAA{EEEE}: Characters 10-13 are letters or numbers. Optionally, and only as directed by the District, these last 4 characters may be used as a descriptive indicator of the structure's location, responsible operations group, responsible maintenance group, or other items. The abbreviations are to be used at the discretion of the District in which the traffic ancillary structure is located. To minimize overlap or reuse of abbreviations, the list provided below may be referenced.

#	Abbreviated.	Unabbreviated
1.	MMBT	Monitor Merrimac Bridge Tunnel
2.	ERC	Elizabeth River Crossing
3.	HRBT	Hampton Roads Bridge Tunnel
4.	CBBT	Chesapeake Bay Bridge Tunnel

Item Code	Software Title	ROADWAY TYPE	TAB	Attributes	Applicability
ATT12	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

This is the type or classification of road where the structure is located.

Interstate
Primary
Secondary

Item Code	Software Title	OWNERSHIP	TAB	Attributes	Applicability
ATT13	**Typ. Format**	Drop down list	**INV or INSP**	Inventory	S, TS, P

This is the entity that owns the structure. Another entity may be fully or partially responsible for maintenance, inspection, or operation due to physical jurisdiction or contractual maintenance agreement.

VDOT	Locality - City, County, Town	Toll Authority	Concessionaire	Dual Owner
Other State Agency	Other	Private	U.S. Government	

Item Code	Software Title	MAINTENANCE RESPONSIBILITY	TAB	Attributes	Applicability
ATT14	**Typ. Format**	Drop down list	**INV or INSP**	Inventory	S, TS, P

Enter the entity responsible for maintenance. Choose from drop down list accordingly, examples include VDOT, RMA, 395 Express Lanes, etc.

VDOT - Safety Rest Area Program	CBT - Chesapeake Bay Tunnel
VDOT TED CO	95 Express
Bristol District TED/ Ops	495 HOT Lanes
Salem District TED/ Ops	395 Express Lanes
Lynchburg District TED/ Ops	WWB - Woodrow Wilson Bridge
Richmond District TED/ Ops	Pocahontas Parkway
Hampton Roads District TED/ Ops	ERC
Staunton District TED/ Ops	Shared
Culpeper District TED/ Ops	U.S. Government
Fredericksburg District TED/ Ops	Dulles Greenway Toll
NOVA District TED/ Ops	County
DMV	City
Metropolitan Washington Airports Authority	Town
RMA	Other

Item Code	Software Title	INSPECTION RESPONSIBILITY	TAB	Attributes	Applicability
ATT15	**Typ. Format**	Drop down list	**INV or INSP**	Inventory	S, TS, P

Enter the entity responsible for inspections. Another entity may be responsible for inspections due to physical jurisdiction or contractual maintenance agreement.

VDOT - Safety Rest Area Program	CBT - Chesapeake Bay Tunnel
VDOT TED CO	95 Express
Bristol District TED/ Ops	495 HOT Lanes
Salem District TED/ Ops	395 Express Lanes
Lynchburg District TED/ Ops	WWB - Woodrow Wilson Bridge
Richmond District TED/ Ops	Pocahontas Parkway
Hampton Roads District TED/ Ops	ERC
Staunton District TED/ Ops	Shared
Culpeper District TED/ Ops	U.S. Government
Fredericksburg District TED/ Ops	Dulles Greenway Toll
NOVA District TED/ Ops	County
DMV	City
Metropolitan Washington Airports Authority	Town
RMA	Other

Item Code	Software Title	OPERATIONS RESPONSIBILITY	TAB	Attributes	Applicability
ATT16	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Enter the entity responsible for operations. Another entity may be responsible for maintenance due to physical jurisdiction or contractual maintenance agreement.

VDOT - Safety Rest Area Program	CBT - Chesapeake Bay Tunnel
VDOT TED CO	95/395 Express Lanes
Bristol District TED/ Ops	495 HOT Lanes
Salem District TED/ Ops	WWB - Woodrow Wilson Bridge
Lynchburg District TED/ Ops	Pocahontas Parkway
Richmond District TED/ Ops	ERC
Hampton Roads District TED/ Ops	Shared
Staunton District TED/ Ops	U.S. Government
Culpeper District TED/ Ops	Dulles Greenway Toll
Fredericksburg District TED/ Ops	County
NOVA District TED/ Ops	City
DMV	Town
Metropolitan Washington Airports Authority	Other
RMA	

Item Code	Software Title	STRUCTURE TYPE	TAB	Attributes	Applicability
ATT17 & ATT62	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Enter the structure type.

Signs	Traffic Signal Poles	Poles
Bridge Parapet Mount	Dual Mast Arm	Camera Poles
Butterfly	N/A	High Mast
Cantilever	Others	Luminaires
Other	Overhead Span	Other
Overhead Span	Single Mast Arm	
	Span Wire	

Item Code	Software Title	CONTRACTOR COMPANY ID	TAB	Attributes	Applicability
ATT18	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field represents the name of the contactor that erected the structure.

Item Code	Software Title	POLE TYPE	TAB	Attributes	Applicability
ATT19	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS

Enter the pole type at each end of the structure.

Double Pole End Frame	N/A	Other	Single Pole

Item Code	Software Title	POLE HEIGHT	TAB	Attributes	Applicability
ATT20	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field represents the overall pole height measured in feet to be established during inventory inspection.

- For structures having more than one pole, enter the height of the taller pole.
- Measurement to be taken from top of base plate to top of pole not including the pole cap.

Item Code	Software Title	POLE DIAMETER	TAB	Attributes	Applicability
ATT21	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field represents overall pole diameter measured in inches to be established during inventory inspection.

- This applies only to round or faceted signle pole supports. For structures having more than one pole, use the same pole that was entered for the pole height.
- Measurement to be taken at the base plate.

Item Code	Software Title	FOUNDATION TYPE	TAB	Attributes	Applicability
ATT22	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

This data field identifies the foundation type. For Bridge Parapet Mounted Sign Structures, select N/A. For other structure types mounted on bridges, select Steel Haunch, Bridge Mount, or Other. For structures attached to concrete barriers not on bridges, select Concrete barrier mount. For cantilever structures attached to walls, or span structures attached at both ends to walls, select Fixed Attachment.

Bridge Mount	Other
Concrete barrier mount	Single caisson (drilled foundation)
Double caisson (drilled foundation)	Spread footing
Fixed Attachment	Steel Haunch
Footing on other type piles	Steel helical pile
Footing on timber piles	Unknown, unavailable, cannot be determined
N/A	

Item Code	Software Title	NUMBER OF ANCHOR BOLTS	TAB	Attributes	Applicability
ATT23	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This is the total number of anchor bolts at each side of the structure connecting the foundation and the pole at the base plate.

Examples:

- Overhead span structure, two poles on each end of structure with 4 bolts at each base plate: enter “8”.
- Overhead span structure, one pole on each end of structure with 4 bolts at each base: enter “4”.
- Cantilever structure with one pole with 4 bolts: Code “4”.

Item Code	Software Title	DIAMETER OF ANCHOR BOLTS	TAB	Attributes	Applicability
ATT24	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Indicate the anchor bolt diameter measured and coded in inches, in decimal format.

> **Note H**
> If anchor bolt diameter varies in size, record the smallest anchor bolt diameter.

Item Code	Software Title	POLE MATERIAL TYPE	TAB	Attributes	Applicability
ATT25	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

This item is for comments related to the material type of the superstructure.

Aluminum	Steel
Galvanized Steel	Timber
Other	Unknown
Painted Steel	Weathering Steel

> **Note I**
> Steel automatically shows in the data base if the previous inspection was entered in the old Signs program, this should be corrected to Galvanized Steel, Painted Steel, or Weathering Steel.

Item Code	Software Title	CHORD TYPE/PRIMARY CHORD TYPE	TAB	Attributes	Applicability
ATT26	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

This item is for comments related to the chord type.

Signs	Traffic Signal Poles	Poles
Four Chord Box Truss	Other	N/A
Four Chord Vierendeel Box Truss	Single Chord (Mast arm)	Others
N/A	Span Wire	Single Chord (Includes untrussed luminaire arm)
Other	Two Chord Trussed	Two Chord Trussed (Includes two chord trussed luminaire arm)
Single Chord	Two Chord Untrussed	Two Chord Untrussed (Includes two chord untrussed luminaire arm)
Tri-Chord		
Two Chord Trussed		
Two Chord Untrussed		
Two Chord Vierendeel Truss		

Item Code	Software Title	SPAN LENGTH/PRIMARY SPAN LENGTH	TAB	Attributes	Applicability
ATT27	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

Overhead Span Structure: This is the total length of the structure measured from the inside face of pole to the inside face of pole, in feet, rounded to the nearest tenth.

Cantilever Structure: This is the total length of the structure measured from end of structure to the inside face of pole, in feet, rounded to the nearest tenth.

Offset Luminaire: Enter N for N/A.

Traffic Signal: This is the length of the mast arm or span wire over the primary route measured from the end of the structure to the inside face of pole, in feet, rounded to the nearest tenth. For an explanation of the portion of a span wire to include with a structure, refer to Section 5.6.3. Refer to ATT26 for secondary arm/wire length.

Item Code	Software Title	SECONDARY CHORD TYPE	TAB	Attributes	Applicability
ATT28	Typ. Format	Drop down list	INV or INSP	Inventory	TS

See ATT26 for information details.

Item Code	Software Title	SECONDARY SPAN LENGTH	TAB	Attributes	Applicability
ATT29	Typ. Format	Text field	INV or INSP	Inventory	TS

See ATT27 for information details.

Item Code	Software Title	DISTANCE FROM PEDESTAL TO BASE PLATE	TAB	Attributes	Applicability
ATT30	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

Indicate the measured distance from the top of the pedestal to the bottom of the base plate, in inches, measured to the nearest 1/8” and shown in decimal format.

Note J
If distance varies in size, record the highest distance.

Item Code	Software Title	WND DESIGN SPEED	TAB	Attributes	Applicability
ATT31	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is to be obtained from design calculations.

Item Code	Software Title	CHORD/PRIMARY ARM SPLICE TYPE	TAB	Attributes	Applicability
ATT32	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS

Select from the drop down list the type of splice associated with this structure.

Angle Joint	Gusset Plate
Bolted, configuration (bolt & tapped plate or welded nut)	N/A
Bolted, configuration (bolt & unwelded nut)	Other
Flange plate, circular	Slip Joint
Flange plate, square or rectangular	Welded

Item Code	Software Title	CHORD/ARM TO POLE ATTACHMENT TYPE	TAB	Attributes	Applicability
ATT33	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Select from the drop down list the type of chord to pole attachment associated with this structure.

Bolted, configuration (bolt & tapped plate or welded nut)	Other
Bolted, configuration (bolt & unwelded nut)	Simple truss support, saddle & u-bolt
Collar plate	Simple truss support, through bolt
Flange plate, circular	Thimble eye bolt
Flange plate, square or rectangular	Welded
N/A	

Item Code	Software Title	SECONDARY ARM SPLICE TYPE	TAB	Attributes	Applicability
ATT34	Typ. Format	Drop down list	INV or INSP	Inventory	TS

Select from the drop down list the type of secondary splice associated with this structure. **See ATT26 for information details.**

Item Code	Software Title	SECONDARY ARM TO POLE ATTACHMENT TYPE	TAB	Attributes	Applicability
ATT35	Typ. Format	Drop down list	INV or INSP	Inventory	TS

Select from the drop down list the type of secondary arm to pole attachment associated with this structure. **See ATT33 for information details.**

Item Code	Software Title	MESSAGE TYPE	TAB	Attributes	Applicability
ATT36	Typ. Format	Drop down list	INV or INSP	Inventory	S

Select from the drop down list the message type associated with this structure.

N/A	Standard signs	Combination standard signs and VMS
Other Combinations	Variable message (VMS)	

Item Code	Software Title	VMS TYPE	TAB	Attributes	Applicability
ATT37	Typ. Format	Drop down list	INV or INSP	Inventory	S

Select from the drop down list the VMS type associated with this structure.

Bulb	Fiber Optic	Hybrid LED	N/A
Disc	Hybrid Fiber Optic	LED	Other

Item Code	Software Title	OTHER ATTACHMENTS TO CHORD	TAB	Attributes	Applicability
ATT38	Typ. Format	Text field	INV or INSP	Inventory	S

Describe the number and type of other attachments to the chord member(s) of the structure. **Conduits should not be included in the count of attachments.**

Item Code	Software Title	NUMBER OF SIGNS	TAB	Attributes	Applicability
ATT39	Typ. Format	Text field	INV or INSP	Inventory	S

This is the number of signs attached to the overhead portion the structure. Do not include signs attached to vertical.

Item Code	Software Title	POLE SPLICE TYPE	TAB	Attributes	Applicability
ATT40	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Select from the drop down list the type of pole splice type associated with this structure.

Bolted, configuration (bolt & tapped plate or welded nuts)	Flange plate, circular	N/A	Slip Joint
Bolted, configuration (bolt & unwelded nut)	Flange plate, square or rectangular	Other	Welded

Item Code	Software Title	OTHER ATTACHMENTS TO POLE	TAB	Attributes	Applicability
ATT41	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

List the number and type of other attachments to the vertical member(s) of the structure. Include external vibration dampeners.

Item Code	Software Title	BASE PLATE SHAPE	TAB	Attributes	Applicability
ATT42	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Select from the drop down list the type of base plate shape associated with this structure. For all shapes not listed, use "Other".

Hexagon	Other	Rectangular	Square
N/A	Octagon	Round	

Item Code	Software Title	BASE PLATE LONGITUDINAL STIFFNERS	TAB	Attributes	Applicability
ATT43	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Select from the drop down list the number of base to pole longitudinal stiffeners associated with this structure. Note: Please see Chapter 6, page 6.45 of 6.49, section 6.4.4d.

Item Code	Software Title	HAND HOLES	TAB	Attributes	Applicability
ATT44	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Select from the drop down list if there are hand holes associated with this structure.

Yes	No	Other

Item Code	Software Title	BRIDGE MOUNT ANCHOR TYPE	TAB	Attributes	Applicability
ATT45	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS

Select from the drop down list the type of bridge mount associated with this structure.

Adhesive Insert	Saddle/Bracket Assembly – Beam Mounted
Expansion Anchorage	Saddle/Bracket Assembly – parapet mounted
N/A	Through Bolt, Beam Mount
Other	Through Bolt, Parapet Mount

Item Code	Software Title	ANCHOR BOLT MATERIAL GRADE	TAB	Attributes	Applicability
ATT46	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This is the number representing the yield strength of the anchor rods and may be obtained from the plans or from the manufacturer's tag on the structure.

Item Code	Software Title	NUT CONFIGURATION	TAB	Attributes	Applicability
ATT47	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Select from the drop down list the type of top and leveling nut configuration associated with this structure's anchor rods.

1 top nut, 0 leveling nut	1 top nut, 1 leveling nut confirmed by drilling	2 top nuts, 1 leveling nut confirmed by drilling	N/A
1 top nut, 1 leveling nut	2 top nuts, 0 leveling nut	2 top nuts, 1 leveling nut	Other

Item Code	Software Title	FLAT WASHER CONFIGURATION	TAB	Attributes	Applicability
ATT48	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Select from the drop down list the type of flat washer configuration associated with this structure's anchor rods.

0 top, 0 bottom	1 top, 0 bottom	N/A
0 top, 1 bottom	1 top, 1 bottom	Other

Item Code	Software Title	LOCK NUT CONFIGURATION	TAB	Attributes	Applicability
ATT49	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS

Select from the drop down list the type of lock nut configuration associated with this structure.

0 top, 0 bottom	1 top, 0 bottom	N/A
0 top, 1 bottom	1 top, 1 bottom	Other

Item Code	Software Title	BREAKAWAY BASE TYPE	TAB	Attributes	Applicability
ATT50	Typ. Format	Drop down list	INV or INSP	Inventory	P

Select from the drop down list the type of breakaway base type associated with this structure.

Coupling with Hex Nut	N/A
Coupling with Torque Control Nut	Other
Double Neck Coupling	Slip Base
Frangible Transformer Base	

Item Code	Software Title	BREAKAWAY BASE MATERIAL	TAB	Attributes	Applicability
ATT51	Typ. Format	Drop down list	INV or INSP	Inventory	P

This item is for comments related to the material type of the breakaway base.

Aluminum	Steel	Other	N/A

Item Code	Software Title	BREAKAWAY COUPLER HEIGHT	TAB	Attributes	Applicability
ATT52	Typ. Format	Text field	INV or INSP	Inventory	P

Indicate the measured distance from the top of the pedestal to the bottom of the coupler, in inches, measured to the nearest 1/8” and shown in decimal format.

Note K
If height varies in size, record the highest height.

Item Code	Software Title	VIBRATION DAMPENER TYPE	TAB	Attributes	Applicability
ATT53	Typ. Format	Drop down list	INV or INSP	Inventory	P

Select from the drop down list the type of vibration dampener type associated with this structure.

Single Phase	Double Phase	None

Item Code	Software Title	PRIMARY ARM NUMBER OF SIGNALS	TAB	Attributes	Applicability
ATT54	Typ. Format	Text field	INV or INSP	Inventory	TS

Traffic Signal: This is the number of traffic signal heads attached to the overhead portion of the structure. Do not include signal heads attached to vertical supports. For counting and numbering convention, refer to section 5.6.3. This item will typically be single digit but may reach double digits.

Item Code	Software Title	SECONDARY ARM NUMBER OF SIGNALS	TAB	Attributes	Applicability
ATT55	Typ. Format	Text field	INV or INSP	Inventory	TS

See ATT54 for information details.

Item Code	Software Title	OTHER ATTACHMENTS TO CHORD/PRIMARY ARM	TAB	Attributes	Applicability
ATT56	Typ. Format	Text field	INV or INSP	Inventory	TS

Describe the number and type of other attachments to the chord or primary mast arm of the structure. Conduits should not be included in the count of attachments.

Item Code	Software Title	OTHER ATTACHMENTS TO SECONDARY ARM	TAB	Attributes	Applicability
ATT57	Typ. Format	Text field	INV or INSP	Inventory	TS

Describe the number and type of other attachments to the secondary mast arm of the structure. Conduits should not be included in the count of attachments.

Item Code	Software Title	BRIDGE STRUCTURE NUMBER	TAB	Attributes	Applicability
ATT58	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

Bridge Number: {NNNNNNN} If the structure is on a bridge, enter the 7-digit state structure number. If the structure is not on a bridge, leave blank.

Item Code	Software Title	FABRICATOR	TAB	Attributes	Applicability
ATT59	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

The name of the structure manufacturer; abbreviate as needed. This item should typically be filled upon the initial or inventory inspection. However, if the item was not added at the initial inspection, code the field per the following guidelines.

- Enter the fabricator that manufactured the structure.
- If information is not available, code the field "Unknown".

Item Code	Software Title	STRUCTURE MODIFIED DATED	TAB	Attributes	Applicability
ATT60	Typ. Format	Selection box	INV or INSP	Inventory	S, TS, P

This is the date that the structure was last modified, if known. Otherwise, leave blank.

Item Code	Software Title	DATE ERECTED	TAB	Attributes	Applicability
ATT61	Typ. Format	Selection box	INV or INSP	Inventory	S, TS, P

This is the date that the structure was erected, if known. Otherwise, record the date of the initial or inventory inspection. If both are unknown, leave blank.

Item Code	Software Title	TRAFFIC CONTROL REQUIREMENTS	TAB	Attributes	Applicability
ATT62 & ATT17	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

This is the type of traffic control use to complete the most recent regular inspection.

Double moving/mobile closure	N/A	Single moving/mobile closure
Double stationary closure	Other	Single stationary closure
Flagging operation	Shoulder Closure	State Police Assisted Lane Closures

Item Code	Software Title	SPECIAL ACCESS REQUIREMENTS	TAB	Attributes	Applicability
ATT63	Typ. Format	Drop down list	INV or INSP	Inventory	S, TS, P

Special Access Requirements: If special access considerations are associated with the structure, provide a brief description. For additional information on special access requirements, refer to Section 2.6.2.

Area prone to flooding	Keys required	Snooper required
Barrier plates	N/A	Structure partially behind pedestrian fencing
Decorative base	Other (Describe in Overall Comments)	Structure partially behind sound wall
Dense vegetation growth	RRX ROW entry required	VDOT Special Facility or Weigh Scale

Item Code	Software Title	CURRENT INSPECTION DATE	TAB	Attributes	Applicability
ATT64	Typ. Format	Auto-populated	INV or INSP	Inventory	S, TS, P

This is the date the structure was inspected that is auto-populated from the condition form when the Show Fields box in the assets tab of the work order is unchecked and rechecked (or when the work order is saved and synced in the mobile app). Use this date to update the Regular Inspection Date ATT65, the Base Inspection Date ATT68, or the Special Inspection Date ATT71, depending on the inspection type.

Item Code	Software Title	REGULAR INSPECTION DATE	TAB	Attributes	Applicability
ATT65	Typ. Format	Selection box	INV or INSP	Inventory	S, TS, P

This is the date of the current regular inspection. If the current inspection is a regular inspection, enter the Current Inspection Date.

Item Code	Software Title	REGULAR INSPECTION FREQUENCY	TAB	Attributes	Applicability
ATT66	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is the regular inspection frequency in months per manual section 2.4.7.

Item Code	Software Title	NEXT REGULAR INSPECTION DATE	TAB	Attributes	Applicability
ATT67	Typ. Format	Selection box	INV or INSP	Inventory	S, TS, P

This is the date of the next structure regular inspection. It will be used in conjunction with regular inspection frequency, recorded in field **ATT65**.

Enter the next inspection date by adding the regular inspection frequency, recorded in field **ATT66,** to the current regular inspection date, recorded in field **ATT65**.

Item Code	Software Title	BASE INSPECTION DATE	TAB	Attributes	Applicability
ATT68	Typ. Format	Selection box	INV or INSP	Inventory	S, TS, P

This is the date of the current base inspection. If the current inspection is a base inspection, enter the Current Inspection Date here.

Item Code	Software Title	BASE INSPECTION FREQUENCY	TAB	Attributes	Applicability
ATT69	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is the base inspection frequency in months per manual section 2.4.7.

Item Code	Software Title	NEXT BASE INSPECTION DATE	TAB	Attributes	Applicability
ATT70	Typ. Format	Selection box	INV or INSP	Inventory	S, TS, P

This is the date of the next structure base inspection. It will be used in conjunction with regular inspection frequency, recorded in field **ATT66**.

Enter the next inspection date by adding the regular inspection frequency, recorded in field **ATT66,** to the current base inspection date, recorded in field **ATT68**.

Item Code	Software Title	SPECIAL INSECTION DATE	TAB	Attributes	Applicability
ATT71	Typ. Format	Selection box	INV or INSP	Inventory	S,TS, P

This data field is to record the date of any special inspection.

Item Code	Software Title	SPECIAL INSPECTION FREQUENCY	TAB	Attributes	Applicability
ATT72	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is the frequency in months assigned when the Inspection Type is Special Inspection - Monitoring. Otherwise, leave blank

Item Code	Software Title	NEXT SPECIAL INSPECTION DATE	TAB	Attributes	Applicability
ATT73	Typ. Format	Selection box	INV or INSP	Inventory	S, TS, P

This is the date of the next structure special inspection when a determination has been made to monitor components or elements of a structure. It will be used in conjunction with special inspection frequency, recorded in field **ATT72**.

Enter the next inspection date by adding the special inspection frequency, recorded in field **ATT72,** to the current special inspection date, recorded in field **ATT71**.

Item Code	Software Title	LEAD INSPECTOR NAME	TAB	Attributes	Applicability
ATT74	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is for the lead inspector. This data field is the lead inspector that performed the inspection as entered in DET26. It must also be entered in the ATT74 field to update the attributes.

Item Code	Software Title	ADDITIONAL INSPECTOR NAME	TAB	Attributes	Applicability
ATT75	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is for the Additional Inspector. This data field is the additional (secondary) inspector that performed the inspection as entered in DET27/DET31. It must also be entered in the ATT74 field to update the attributes.

Item Code	Software Title	LOCATION DESCRIPTION	TAB	Attributes	Applicability
ATT76 & ATT90	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This data field is a description of the structure location. The list below provides an illustrative example of standardized location description statements. However, many combinations are possible, and the inspector should enter a location description that is common terminology for that location.

Applic.	Standard Statement
S, TS, P	Structure is located in a [rest area / weigh station / park and ride lot...]. *{Note, this standard statement should be used in conjunction with one of the others below.}*
S, TS, P	Structure is located on bridge number [1234567], [IS-64 / US-17] (George Washington Memorial Hwy) [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV]. {Note, this standard statement should be used in conjunction with one of the others below.}
S	Structure is located on [SC-600 / IS-64...] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV] near […].
S	Structure is located on [SC-600 / IS-64....] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV], [0.5 miles / …] before [exit 278 / …].
S	Structure is located at mile marker […].
TS	Structure is located on [SC-600 (Hampton Blvd)] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV] at intersection with [VA-300 (Military Hwy)] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV].
P	Structure is located on [SC-600 / IS-64....] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV], [first / second / third...] pole on [exit / entrance...] ramp [to / from...] [New Kent rest area / Towne Point Rd...]
P	Structure is located on [SC-600 / IS-64....] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV], [first / second / third...] pole after [exit / entrance] ramp [to / from...] [New Kent rest area / Towne Point Rd...]
P	Structure is located on [SC-600 / IS-64....] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV], [first / second / third...] pole on the [left / right] side of [car / truck] [rest area...].

Item Code	Software Title	FAR LEFT SHOULDER CLEARANCE	TAB	Attributes	Applicability
ATT77	Typ. Format	Text field	INV or INSP	Inventory	S, TS

These are the minimum vertical clearance over specific lanes and shoulders, in feet, rounded to the nearest tenth.
Traffic Signals: These fields are for clearances taken over the primary route only. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	LEFT CENTER SHOULDER CLEARANCE	TAB	Attributes	Applicability
ATT78	Typ. Format	Text field	INV or INSP	Inventory	S, TS

These are the minimum vertical clearance over specific lanes and shoulders, in feet, rounded to the nearest tenth.
Traffic Signals: These fields are for clearances taken over the primary route only. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	FAR RIGHT SHOULDER CLEARANCE	TAB	Attributes	Applicability
ATT79	Typ. Format	Text field	INV or INSP	Inventory	S ,TS

These are the minimum vertical clearance over specific lanes and shoulders, in feet, rounded to the nearest tenth.
Traffic Signals: These fields are for clearances taken over the primary route only. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	RIGHT CENTER SHOULDER CLEARANCE	TAB	Attributes	Applicability
ATT80	Typ. Format	Text field	INV or INSP	Inventory	S, TS

These are the minimum vertical clearance over specific lanes and shoulders, in feet, rounded to the nearest tenth.
Traffic Signals: These fields are for clearances taken over the primary route only. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	MINIMUM VERTICAL CLEARANCE	TAB	Attributes	Applicability
ATT81	Typ. Format	Text field	INV or INSP	Inventory	S, TS

This is the minimum vertical clearance for the structure, in feet, rounded to the nearest tenth.
Traffic Signals: The structure may be over more than one route; the lowest clearance of all routes shall be coded. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	LANE CLEARANCES 1 TO 8	TAB	Attributes	Applicability
ATT82 to ATT89	Typ. Format	Text field	INV or INSP	Inventory	S, TS

These are the minimum vertical clearance over specific lanes and shoulders, in feet, rounded to the nearest tenth.
Traffic Signals: These fields are for clearances taken over the primary route only. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	LOCATION DESCRIPTION	TAB	Attributes	Applicability
ATT90	Typ. Format	Text field	INV or INSP	Inventory	TS, P

See ATT76 for information details.

Item Code	Software Title	COMMENTS	TAB	Attributes	Applicability
ATT91	Typ. Format	Text field	INV or INSP	Inventory	S, TS, P

This is equal to the lowest rating(s) of the superstructure or the foundation; in the case of a parapet mount structure, it is the overall structure rating. Include all deficiencies that drive the overall rating. It should be reported by writing the overall structure rating followed by the deficiencies.
Examples:

- Good condition (Note, no deficiencies need to be listed).
- Fair condition - Corrosion with no measurable section loss over 100% of anchor bolts.
- Poor condition – Grout present, deteriorated, leveling nuts confirmed present.
- Critical condition - 2 of 4 top nuts loose (# 2 and #4); 2 of 4 chord to pole connection bolts loose.

Item Code	Software Title	GLOBAL ID	TAB	Attributes	Applicability
ATT92	Typ. Format	Auto-populated field	INV or INSP	Inventory	S, TS, P

This data field represents the system generated identifier for the structure in GIS.

Item Code	Software Title	ASSET CREATION DATE	TAB	Attributes	Applicability
ATT93	Typ. Format	Empty field	INV or INSP	Inventory	S, P

This data field represents the date the asset was created in HMMS and will be blank for the data from the legacy data.

Item Code	Software Title	TRAFFIC SIGNAL RELATIONSHIP ID	TAB	Attributes	Applicability
ATT94	Typ. Format	Auto-populated field	INV or INSP	Inventory	TS

This data field represents the system generated identifier for the Traffic Signal asset in GIS.

Item Code	Software Title	LATITUDE	TAB	Attributes	Applicability
ATT95	Typ. Format	Auto-populated field	INV or INSP	Inventory	TS

These data fields display the coordinates of the structure from GIS. Do not edit them. Any changes in the location of a structure must be done in a mapping application such as HMMS or ESRI Collector.

Item Code	Software Title	LONGITUDE	TAB	Attributes	Applicability
ATT96	Typ. Format	Auto-populated field	INV or INSP	Inventory	TS

These data fields display the coordinates of the structure from GIS. Do not edit them. Any changes in the location of a structure must be done in a mapping application such as HMMS or ESRI Collector.

A.4 Work Order Details Tab – Condition Record

A.4.1 Mapping: Work Order Details Tab – Condition Record

Only Verify and record the [highlighted] highlighted data fields shown in the tables below for base inspections.

Work Order Details Tab – Condition Record			
Sign	**Traffic Signal**	**Pole**	**Label**
Notes	Notes	Notes	CON01
Notes 2	Notes 2	Notes 2	CON02
CLD Clearance Comments	CLD Clearance Comments		CON03
SSD General Appearance of Sign/Sign Lighting/Att.	SSD General Appearance of Signal Head/Attachments		CON04
SSD General Alignment of Structure	SSD General Alignment of Structure	SSD General Alignment of Structure	CON05
		General Appearance of Luminaire Head/Camera/Att.	CON06
SSD Attachment to Chord Connection	Sign/Signal Head/Other Att. to Chord/Arm/Wire Conn	Luminaire Head/Camera/Other Att. to Arm/Pole Conn.	CON07
SSD Walkway		SSD Walkway	CON08
PD Vertical Support Base Plate	PD Vertical Support Base plate	PD Vertical Support Base Plate	CON09
		PD Vertical Support Slip Joint	CON10
PD Vertical Support Trussing	PD Vertical Support Trussing		CON11
PD Vertical Support Welded Joints	PD Vertical Support Weld Joint		CON12
	PD Cable Attachment to Vertical Support		CON13
PD Vertical Support	PD Vertical Support	PD Vertical Support	CON14
CD Chord to Pole Connection	CD Chord/Arm/Wire to Pole Connection	CD Arm to Pole Connection	CON15
CD Chord/Arm/Wire	CD Chord/Arm/Wire	CD Luminaire Arm	CON16
CD Chord Splices	CD Chord/Arm/Wire Splices		CON17
CD Chord Trussing	CD Chord/Arm Trussing		CON18
FD Anchor Bolts	FD Anchor Bolts	FD Anchor Bolts	CON19
FD Concrete Pedestal	FD Concrete Pedestal	FD Concrete Pedestal	CON20
FD Erosion/Undermining	FD Erosion/Undermining	FD Erosion/Undermining	CON21
FD Grout	FD Grout	FD Grout	CON22
Save	Save	Save	CON23

A.4.2 Coding Guidance: Work Order Details Tab – Condition Record

Item Code	**Software Title**	Notes	**TAB**	Condition	**Applicability**
CON01	**Typ. Format**	Text field – 1024 characters maximum	**INV or INSP**	Inspection	S, TS, P

This field is used for recording additional details of inspection findings. Follow the report format, see examples below:

Examples:

Vertical crack on offset mount, more than 1/2 way. (Since there are no available sections for a cracked offset mount, this comment would be used in conjunction with selecting Loose luminaire head hardware, in danger of falling.)

or

Luminaire bulb non-functioning over Lane 1. (Since there are no available sections for a non-functioning luminaire, this comment would be used in conjunction with selecting Sign bulb/light broken.)

or

Recommendation 9 Tighten affected component(s) 1-Low

Tighten loose hand hole cover screw.

Item Code	Software Title	Notes 2	TAB	Condition	Applicability
CON02	Typ. Format	Text field – 100 characters maximum	INV or INSP	Inspection	S, TS, P

This field is used for over-flow of lane clearance comments when you have more than 8 lanes and secondary lanes.

- **More than Eight Lanes**: Where structure crosses more than eight lanes, code additional clearances. Provide the information per the standard statements shown below.

Example:

- Clearances of primary route:
  Lane 9: 15.3'

- **Not Over Traveled Roadway**: If the structure is not over a traveled portion of the roadway, note such. Provide the information per the standard statements shown below.

Example:

- N/A: Structure is located over grass shoulder
- N/A: Offset Luminaire

Traffic Signals: List the clearances over each lane of the secondary route. Provide the information per the standard statements shown below.

Example:

- Clearances over Route 600:
  Lane 1: 15.3'
  Lane 2: 14.8'

Note L
The items covered from this point forward are inspection items. The descriptions that follow will provide guidance on where to code specific component/element deficiencies.

The specific standard statements that describe the common deficiencies, the ratings, the repair recommendations, and the repair urgencies will be provided in Appendix B.

Condition Rating
The rating value indicates the condition of a component. The ratings to be used are shown in the list below.

- 70 – Good
- 50 – Fair
- 40 – Poor
- 20 – Critical*

*All critical / Emergency conditions will have "District Manager notified." after the applicable recommendation.

Item Code	Software Title	Clearance Comments	TAB	Condition	Applicability
CON03	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS

This item is for comments related to the clearance. If no comments, leave coded NR.

- **Clearance Limits**: If the minimum measured clearance is less than VDOT minimum design clearance of 15' for a mast arm, 16' for a span wire, or 17.5' for a sign luminaire assembly or sign bridge, record the deficiency in this field. Provide the information per the standard statements shown below and in Appendix B.

Example:

- Minimum measured clearance is less than Virginia Department of Transportation's minimum design clearance of 15ft for a mast arm.
- Minimum measured clearance is less than Virginia Department of Transportation's minimum design clearance of 16ft for a span wire.
- Minimum measured clearance is less than Virginia Department of Transportation's minimum design clearance of 17.5ft for a sign luminaire assembly.

Item Code	Software Title	General Appearance of Luminaire Head/Camera/Att.	TAB	Condition	Applicability
CON04 & CON06	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

General Appearance, include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities. If no comments, leave coded NR.

General Guidance and Items to be Included
Luminaire/Camera: The components including lens covers, hinges, bulbs, video cameras, etc.
Other Attachments: Other attachments such as cameras, sensors, antennas, dampeners, and small signs (without windbeams) attached to sign chords and traffic signal mast arms or span wires. Also includes luminaire if attached to a traffic signal structure.

Item Code	Software Title	General Alignment of Structure	TAB	Condition	Applicability
CON05	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Comments relating to structure leaning, rotating, out of plane distortion (OPD), or any other type of visible misalignment.

Item Code	Software Title	General Appearance of Luminaire Head/Camera/Att.	TAB	Condition	Applicability
CON06	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

See CON04 for information details.

Item Code	Software Title	Luminaire Head/Camera/Other Att. To Arm/Pole Conn.	TAB	Condition	Applicability
CON07	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. Since no selection is available for critical items, select a rating of poor; the critical condition will be reflected in the overall rating. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Luminaire / Camera Attachments: The connection hardware connecting the luminaire/camera to the arm or pole.

Item Code	Software Title	Walkway	TAB	Condition	Applicability
CON08	Typ. Format	Drop down list	INV or INSP	Inspection	S, P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. Since no selection is available for critical items, select a rating of poor; the critical condition will be reflected in the overall rating. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

Item Code	Software Title	Vertical Support Base Plate	TAB	Condition	Applicability
CON09	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

Vertical Support Base Plate Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. Since no selection is available for critical items, select a rating of poor; the critical condition will be reflected in the overall rating. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Base Plate: Includes the base plate, pole connection weld, protective skirt, etc.
Stiffeners: Includes any stiffening plates, stools, ribs connecting to the base plate, and all welds.
Transformer Bases: All components that make up the transformer base. Item does not include the anchor bolts but does include the transformer base to base plate bolts. Transformer bases are typical to luminaire poles. Note that this does not include anchor bolt couplers.

Item Code	Software Title	Vertical Support Slip Joint	TAB	Condition	Applicability
CON10	Typ. Format	Drop down list	INV or INSP	Inspection	P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Slip Joints: Typically found on high mast light pole structures and sometimes on camera pole structures.

Item Code	Software Title	PD Vertical Support Trussing	TAB	Condition	Applicability
CON11	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Trussing: Includes the vertical support trussing members and connections to the pole. Vertical support trusses are typically found on overhead span structures with multiple poles. Cell towers may also have vertical support trussing. These are sometimes referred to as End Frames.

Item Code	Software Title	PD Vertical Support Weld Joint(s)	TAB	Condition	Applicability
CON12	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS

Include inspection deficiency observations and ratings for items and components described above. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

Item Code	Software Title	PD Cable Attachment to Vertical Support	TAB	Condition	Applicability
CON13	Typ. Format	Drop down list	INV or INSP	Inspection	TS

Include inspection deficiency observations and ratings for items and components shown in the description above. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

Item Code	Software Title	Vertical Support	TAB	Condition	Applicability
CON14	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Vertical Support: Includes all additional elements not yet covered by the other Pole Data fields. Specific items include the hand hole, the pole cap, and the pole itself. Also includes other attachments to the pole, for example cameras, sensors, antennas, dampeners, and small signs.

Item Code	Software Title	Arm to Pole Connection	TAB	Condition	Applicability
CON15	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Chord/Arm to Pole Attachment: Includes all connection hardware, plates, bearing components, insulation materials, welds between elements, etc.

Item Code	Software Title	Luminaire Arm	TAB	Condition	Applicability
CON16	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Chords/Mast Arms: Includes all elements that make up the main horizontal members. Specific items include end caps and the chord/mast arm itself. Includes the vertical bracing strut that sometimes is part of the luminaire arm.

Item Code	Software Title	CD Chord Splices / CD Chord/Arm/Wire Splices	TAB	Condition	Applicability
CON17	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

Applic.	General Guidance and Items to be Included
S, TS	Splices Between Chords: Includes welds, connection hardware, plates, etc.
TS	Splices Between Span/Sway Wire: This is rare but may include clamps, connection hardware, etc.

Item Code	Software Title	CD Chord Trussing / CD Chord/Arm Trussing	TAB	Condition	Applicability
CON18	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Trussing: Includes the trussing members (verticals, horizontals, and diagonals) that make up the horizontal support, and the trussing member connections to the chords.

Item Code	Software Title	Anchor Bolts	TAB	Condition	Applicability
CON19	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Anchor Bolts: Includes the anchor bolts, washers, nuts, anchor bolt covers, etc. in all foundation types. Does not include anchorages for Bridge Parapet Mount Signs.
Anchor Bolt Breakaway Couplers

Item Code	Software Title	Concrete Pedestal	TAB	Condition	Applicability
CON20	Typ. Format	Drop down list	INV or INSP	Inspection	S , TS, P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Pedestal: Includes concrete pedestal. Also includes comments regarding the foundation/pedestal being buried.
Parapet or Median: Includes the parapet or median that supports the vertical support component of the ancillary structure. Also includes any steel plates and associated attachment hardware. Note that this does not include Bridge Parapet Mount Signs.
Bridge Girder: Includes the steel haunch assembly that supports the vertical support component of the ancillary structure. Note that this does not include Bridge Parapet Mount Signs.

Item Code	Software Title	Erosion/Undermining	TAB	Condition	Applicability
CON21	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Erosion/Undermining: Includes the immediate area surrounding the concrete pedestal.

Item Code	Software Title	Grout	TAB	Condition	Applicability
CON22	Typ. Format	Drop down list	INV or INSP	Inspection	S, TS, P

Select the lowest rating of the deficiencies entered in the comments field, which is detailed directly below. If no comments, leave coded NR.

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Grout: Includes the grout located between the concrete pedestal and the pole base plate.

Item Code	Software Title	Save	TAB	Condition	Applicability
CON23	Typ. Format	Selection button	INV or INSP	Inspection	S, TS, P

This button shall be used to save changes as you enter inspection data. You may save multiple times.

A.5 Work Order Details Tab – Parapet Mount

A.5.1 Mapping: Work Order Details Tab – Attributes Parapet Mount

These fields are listed in the Attributes for Parapet Mount but are not required to be filled in for Parapet Mount. These fields will not be explained in the Coding Guidance for Attributes Parapet Mount.

Work Order Details Tab – Attribute		
Business Naming Convention	MobileVue Naming Convention	Label
OBJECTID	OBJECTID	ATTPM01
GLOBALID*	GLOBALID	ATTPM02
Structure Number Original	STRNUM_ORIG	ATTPM03
Ancillary Structure Number	ANCSTR NBR	ATTPM04
Asset Status	STATUS	ATTPM05
District	DISTRICT	ATTPM06
Maintenance Jurisdiction	MAINT_JURISDICTION	ATTPM07
Route Directionality	ROUTE_DIR	ATTPM08
Route ID	ROUTE_ID	ATTPM09
Roadway Type	ROADWAY_TYPE	ATTPM10
Ownership	OWNERSHIP	ATTPM11
Maintenance Responsibility	MAINT_RESP	ATTPM12
Inspection Responsibility	INSP_RESP	ATTPM13
Operation Responsibility	OPER_RESP	ATTPM14
Structure Type	STRUCT_TYP	ATTPM15
Contractor Company ID	CONTRT_COMID	ATTPM16
Pole Type	POLE_TYP	ATTPM17
Pole Height	POLE_HT	ATTPM18
Pole Diameter	POLE_DIA	ATTPM19
Foundation Type	FONDTN_TYP	ATTPM20
Number of Anchor Bolts	NBR_ANCHRBLT	ATTPM21
Diameter of Anchor Bolts	DIA_ANCHRBLT	ATTPM22
Pole Material Type	POLE_MTR_TYP	ATTPM23
Chord Type	CHRD_TYP	ATTPM24
Span Length	SPN_LN	ATTPM25
Distance from Pedestal to Base Plate	DIST_PED_BASE	ATTPM26
Wind Design Speed	WND_DSGN_SPD	ATTPM27
Chord Splice Type	CHRD_SPL_TYP	ATTPM28
Chord to Pole Attachment	CHRD_POLEATT	ATTPM29
Message Type	MSG_TYP	ATTPM30
VMS Type	VMS_TYP	ATTPM31
Number of Attachments	NBR_ATTACH	ATTPM32
Number of Signs	NBR_SIGNS	ATTPM33
Pole Splice Type	POLE_SPLTYP	ATTPM34
Other Attachments to the Pole	OTHR_ATT_POLE	ATTPM35
Base Plate Shape	BSE_PL_SHP	ATTPM36
Base to Pole Longitudinal Stiffeners	BSE_POLE_LONGSTF	ATTPM37
Hand Holes	HND_HOLES	ATTPM38
Bridge Mount Anchorage Type	BRIDGE_MT_ANCH_TYP	ATTPM39

Work Order Details Tab – Attribute		
Business Naming Convention	MobileVue Naming Convention	Label
Anchor Bolt Material Grade	ANCH_BLT_MTR_GRD	ATTPM40
Nut Configuration	NUT_CONFIG	ATTPM41
Flat Washer Configuration	FLAT_CONFIG	ATTPM42
Lock Configuration	LOCK_CONFIG	ATTPM43
Chord Number of Other Attachments	CHRD_NBR_OTHRATT	ATTPM44
Bridge/Structure Number	BRIDGESTRUCT_NBR	ATTPM45
Fabricator Company ID	FABRICATOR	ATTPM46
Structure Modified Date	STRC_MOD_DT	ATTPM47
Date Erected	DT_EREC	ATTPM48
Traffic Control Requirements	TRAF_CONTR_REQ	ATTPM49
Special Access Requirements	SPEC_ACCES_REQ	ATTPM50
Inspection Date	INSPECTION_DATE	ATTPM51
Regular Inspection Date	REG_NEXT_INSP_DT	ATTPM52
Regular Inspection Frequency	REG_INSPEC_FREQ	ATTPM53
Next Regular Inspection Date	NEXT_REG_INSP_DT	ATTPM54
Base Inspection Date	BSE_INSP_DT	ATTPM55
Base Inspection Frequency	BASE_INSPEC_FREQ	ATTPM56
Next Base Inspection Date	NEXT_BASE_INSP_DT	ATTPM57
Special Inspection Date	SPECIAL_INSP_DT	ATTPM58
UT Inspection Frequency	UT_INSPEC_FREQ	ATTPM59
Next Inspection Date	NEXT_INSP_DT	ATTPM60
Lead Inspector Name	LEAD_INSPECTOR_NAME	ATTPM61
Additional Inspector Name	ADDITIONAL_INSPECTOR_NAME	ATTPM62
Location Description	LOCATION_DESCRIPTION	ATTPM63
Far Left Shoulder Clearance	FAR_LFT_SLDR_CLRNCE	ATTPM64
Left Center Shoulder Clearance	LFT_CNTER_SLDR_CLRNCE	ATTPM65
Far Right Shoulder Clearance	FAR_RGHT_SLDR_CLRNCE	ATTPM66
Right Center Shoulder Clearance	RGHT_CNTR_SLDR_CLRNCE	ATTPM67
Vertical Clearance	MIN_VERT_CLRNCE	ATTPM68
Lane Clearance 1	LANE_CLEARANCE_1	ATTPM69
Lane Clearance 2	LANE_CLEARANCE_2	ATTPM70
Lane Clearance 3	LANE_CLEARANCE_3	ATTPM71
Lane Clearance 4	LANE_CLEARANCE_4	ATTPM72
Lane Clearance 5	LANE_CLEARANCE_5	ATTPM73
Lane Clearance 6	LANE_CLEARANCE_6	ATTPM74
Lane Clearance 7	LANE_CLEARANCE_7	ATTPM75
Lane Clearance 8	LANE_CLEARANCE_8	ATTPM76
Overall Structure Comments	COMMENTS	ATTPM77
Asset Creation Date	CREATED_DATE	ATTPM78

A.5.2 Coding Guidance: Work Order Details Tab – Attributes Parapet Mount

Item Code	Software Title	OBJECT ID	TAB	Attributes	Applicability
ATTPM01	Typ. Format	Auto-populated field	INV or INSP	Inventory	PM

This data field represents the system generated identifier in GIS.

Item Code	Software Title	GLOBAL ID	TAB	Attributes	Applicability
ATTPM02	Typ. Format	Auto-populated field	INV or INSP	Inventory	PM

This data field represents the system generated identifier in GIS.

Item Code	Software Title	STRUCTURE NUMBER ORIGINAL	TAB	Attributes	Applicability
ATTPM03	Typ. Format	Text field	INV or INSP	Inventory	PM

This data field is the 7-digit structure number from the previous database. See **DET 09.**

Item Code	Software Title	ANCILLARY STRUCTURE NUMBER	TAB	Attributes	Applicability
ATTPM04	Typ. Format	Text field	INV or INSP	Inventory	PM

This is the structure number. The structure number consists of a 3-digit state county code followed by a 5-digit sequential number. The last five digits should be unique to the structure within that county. Some overlap may exist between various structure types. The existing number typically stenciled on the structure.

These numbers will be replaced with an 11-digit alphanumeric code during future inspections. The first 3 characters represent the acronym for the specific structure type. For Bridge Parapet Mount sign structures, they will be SGN.

Item Code	Software Title	STATUS	TAB	Attributes	Applicability
ATTPM05	Typ. Format	Text field – **DO NOT EDIT**	INV or INSP	Inventory	PM

This data field normally shows as Active.

Item Code	Software Title	DISTRICT	TAB	Attributes	Applicability
ATTPM06	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This is the VDOT District in which the structure is located.

Bristol	Hampton Roads	Richmond
Culpeper	Lynchburg	Salem
Fredericksburg	Northern Virginia	Staunton

Item Code	Software Title	MAINTENANCE JURISDICTION	TAB	Attributes	Applicability
ATTPM07	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This data field represents jurisdiction in which the structure is maintained. For structures maintained by VDOT, enter the county or city in which the structure is located. For structures maintained by a city, county, or town, enter the responsible city, county, or town name.

Item Code	Software Title	ROUTE DIRECTION	TAB	Attributes	Applicability
ATTPM08	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This field will be used to show the direction of traffic flow. (Example, N, S, E, or W)

- *N*: Designation for traffic ancillary structures serving both the northbound and southbound directions of traffic.
- *E*: Designation for traffic ancillary structures serving both the eastbound and westbound directions of traffic.

Item Code	Software Title	ROUTE ID	TAB	Attributes	Applicability
ATTPM09	Typ. Format	Text field, AANNNNNAAEEEE (13 Max, varies)	INV or INSP	Inventory	PM

This data field is the route ID that the structure is located along.

Examples: IS-264 EBL at the Elizabeth River Crossing becomes IS00264EBERC.
US-13 W on the Business Route becomes US13WBBU

> **Note F**
> For traffic signal structures, the route id is of the primary or main route.

{AA}NNNNNAAEEEE: Characters 1-2 are letters and represent the type of roadway per the following criteria.

- *IS*: Interstate routes.
- *US*: Primary routes such as US highways. These can typically be identified by the symbol shown at right.
- *VA*: Virginia Primary Routes typically having Route ID numbers less than 600.
- *SC*: Virginia Secondary Routes typically having Route ID numbers equal to or greater than 600
- *UR*: Urban Routes typically within City Limits
- *BU*: Business Routes typically within City Limits
- *AL*: Alternate Routes (See Traffic Counts data)
- *FR*: Frontage Roads (See Traffic Counts data)

> **Note G**
> A tool that assists in identifying roadways may be found at:
>
> http://www.virginiadot.org/info/ct-TrafficCounts.asp

AA{NNNNN}AAEEEE: Characters 3-7 are numbers and represent the actual route number. If the number is not five digits, precede the route number with zeroes. In the example above, I-95 becomes 00095.

AANNNNN{AA}EEEE: Characters 8-9 are letters and represent the direction of the route per the following list.

- *NB*: Designation for traffic ancillary structures serving the northbound direction of traffic.
- *EB*: Designation for traffic ancillary structures serving the eastbound direction of traffic.
- *SB*: Designation for traffic ancillary structures serving the southbound direction of traffic.
- *WB*: Designation for traffic ancillary structures serving the westbound direction of traffic.
- *NS*: Designation for traffic ancillary structures serving both the northbound and southbound directions of traffic.
- *EW*: Designation for traffic ancillary structures serving both the eastbound and westbound directions of traffic.

AANNNNNAA{EEEE}: Characters 10-13 are letters or numbers. Optionally, and only as directed by the District, these last 4 characters may be used as a descriptive indicator of the structure's location, responsible operations group, responsible maintenance group, or other items. The abbreviations are to be used at the discretion of the District in which the traffic ancillary structure is located. To minimize overlap or reuse of abbreviations, the list provided below may be referenced.

Abbreviated.	Unabbreviated
MMBT	Monitor Merrimac Bridge Tunnel
ERC	Elizabeth River Crossing
HRBT	Hampton Roads Bridge Tunnel
CBBT	Chesapeake Bay Bridge Tunnel

Item Code	Software Title	ROADWAY TYPE	TAB	Attributes	Applicability
ATTPM10	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This is the type or classification of road where the structure is located.

Interstate	Primary	Secondary

Item Code	Software Title	OWNERSHIP	TAB	Attributes	Applicability
ATTPM11	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This is the entity that owns the structure. Another entity may be responsible for maintenance due to physical jurisdiction or contractual maintenance agreement. See **ATT13** for the drop down list.

Item Code	Software Title	MAINTENANCE RESPONSIBILITY	TAB	Attributes	Applicability
ATTPM12	Typ. Format	Drop down list	INV or INSP	Inventory	PM

Enter the entity responsible for maintenance. Choose from drop down list accordingly, examples include VDOT, RMA, TransUrban, etc. See **ATT14** for the drop down list.

Item Code	Software Title	INSPECTION RESPONSIBILITY	TAB	Attributes	Applicability
ATTPM13	Typ. Format	Drop down list	INV or INSP	Inventory	PM

Enter the entity responsible for inspections. Another entity may be responsible for inspections due to physical jurisdiction or contractual maintenance agreement. See **ATT15** for the drop down list.

Item Code	Software Title	OPERATIONS RESPONSIBILITY	TAB	Attributes	Applicability
ATTPM14	Typ. Format	Drop down list	INV or INSP	Inventory	PM

Enter the entity responsible for operations. Another entity may be responsible for maintenance due to physical jurisdiction or contractual maintenance agreement. See **ATT16** for the drop down list.

Item Code	Software Title	STRUCTURE TYPE	TAB	Attributes	Applicability
ATTPM15	Typ. Format	Drop down list	INV or INSP	Inventory	PM

Enter the structure type. Select Bridge Parapet Mount.

Item Code	Software Title	CONTRACTOR COMPANY ID	TAB	Attributes	Applicability
ATTPM16	Typ. Format	Text field	INV or INSP	Inventory	PM

This data field represents the name of the contactor that erected to structure.

Item Code	Software Title	POLE TYPE	TAB	Attributes	Applicability
ATTPM17	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Select N/A.

Item Code	Software Title	POLE HEIGHT	TAB	Attributes	Applicability
ATTPM18	Typ. Format	Text field	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Leave blank.

Item Code	Software Title	POLE DIAMETER	TAB	Attributes	Applicability
ATTPM19	Typ. Format	Text field	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Leave blank.

Item Code	Software Title	FOUNDATION TYPE	TAB	Attributes	Applicability
ATTPM20	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Select N/A.

Item Code	Software Title	NUMBER OF ANCHOR BOLTS	TAB	Attributes	Applicability
ATTPM21	Typ. Format	Text field	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Leave blank.

Item Code	Software Title	DIAMETER OF ANCHOR BOLTS	TAB	Attributes	Applicability
ATTPM22	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Leave blank.

Item Code	Software Title	POLE MATERIAL TYPE	TAB	Attributes	Applicability
ATTPM23	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item is for comments related to the material type of the superstructure.

Aluminum	Steel
Galvanized Steel	Timber
Other	Unknown
Painted Steel	Weathering Steel

Note I
Steel automatically shows in the data base if the previous inspection was entered in the old Signs program, this should be corrected to Galvanized Steel, Painted Steel, or Weathering Steel.

Item Code	Software Title	CHORD TYPE/PRIMARY CHORD TYPE	TAB	Attributes	Applicability
ATTPM24	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Select N/A.

Item Code	Software Title	SPAN LENGTH/PRIMARY SPAN LENGTH	TAB	Attributes	Applicability
ATTPM25	Typ. Format	Text field	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Leave blank.

Item Code	Software Title	DISTANCE FROM PEDESTAL TO BASE PLATE	TAB	Attributes	Applicability
ATTPM26	Typ. Format	Text field	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Leave blank.

Item Code	Software Title	WND DESIGN SPEED	TAB	Attributes	Applicability
ATTPM27	Typ. Format	Text field	INV or INSP	Inventory	PM

This data field is to be obtained from design calculations.

Item Code	Software Title	CHORD/PRIMARY ARM SPLICE TYPE	TAB	Attributes	Applicability
ATTPM28	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Select N/A.

Item Code	Software Title	CHORD/ARM TO POLE ATTACHMENT TYPE	TAB	Attributes	Applicability
ATTPM29	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Select N/A.

Item Code	Software Title	MESSAGE TYPE	TAB	Attributes	Applicability
ATTPM30	Typ. Format	Drop down list	INV or INSP	Inventory	PM

Select from the drop down list the message type associated with this structure.

N/A	Standard signs	Combination standard signs and VMS
Other Combinations	Variable message (VMS)	

Item Code	Software Title	VMS TYPE	TAB	Attributes	Applicability
ATTPM31	Typ. Format	Drop down list	INV or INSP	Inventory	PM

Select from the drop down list the VMS type associated with this structure.

Bulb	Fiber Optic	Hybrid LED	N/A
Disc	Hybrid Fiber Optic	LED	Other

Item Code	Software Title	NUMBER OF ATTACHMENTS	TAB	Attributes	Applicability
ATTPM32	Typ. Format	Text field	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	Software Title	NUMBER OF SIGNS	TAB	Attributes	Applicability
ATTPM33	Typ. Format	Text field	INV or INSP	Inventory	PM

This is the number of signs attached to the structure.

Item Code	Software Title	POLE SPLICE TYPE	TAB	Attributes	Applicability
ATTPM34	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. Select N/A.

Item Code	Software Title	OTHER ATTACHMENTS TO POLE	TAB	Attributes	Applicability
ATTPM35	Typ. Format	Text field	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	Software Title	BASE PLATE SHAPE	TAB	Attributes	Applicability
ATTPM36	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	Software Title	BASE PLATE LONGITUDINAL STIFFNERS	TAB	Attributes	Applicability
ATTPM37	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	Software Title	HAND HOLES	TAB	Attributes	Applicability
ATTPM38	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	Software Title	BRIDGE MOUNT ANCHOR TYPE	TAB	Attributes	Applicability
ATTPM39	Typ. Format	Drop down list	INV or INSP	Inventory	PM

Select from the drop down list the type of bridge mount associated with this structure.

Adhesive Insert	Saddle/Bracket Assembly – Beam Mounted
Expansion Anchorage	Saddle/Bracket Assembly – parapet mounted
N/A	Through Bolt, Beam Mount
Other	Through Bolt, Parapet Mount

Item Code	Software Title	ANCHOR BOLT MATERIAL GRADE	TAB	Attributes	Applicability
ATTPM40	Typ. Format	Text field	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	Software Title	NUT CONFIGURATION	TAB	Attributes	Applicability
ATTPM41	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	Software Title	FLAT WASHER CONFIGURATION	TAB	Attributes	Applicability
ATTPM42	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	Software Title	LOCK NUT CONFIGURATION	TAB	Attributes	Applicability
ATTPM43	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	Software Title	CHORD/PRIMARY ARM NUMBER OF OTHER ATTACHMENTS	TAB	Attributes	Applicability
ATTPM44	Typ. Format	Text field	INV or INSP	Inventory	PM

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	Software Title	BRIDGE STRUCTURE NUMBER	TAB	Attributes	Applicability
ATTPM45	Typ. Format	Text field	INV or INSP	Inventory	PM

Bridge Number: {NNNNNNN} If the structure is on a bridge, enter the 7-digit state structure number. If the structure is not on a bridge, do not add the line.

Item Code	Software Title	FABRICATOR	TAB	Attributes	Applicability
ATTPM46	Typ. Format	Text field	INV or INSP	Inventory	PM

The name of the structure manufacturer; abbreviate as needed. This item should typically be filled upon the initial or inventory inspection. However, if the item was not added at the initial inspection, code the field per the following guidelines.

- Enter the fabricator that manufactured the structure.
- If information is not available, code the field "Unknown".

Item Code	Software Title	STRUCTURE MODIFIED DATED	TAB	Attributes	Applicability
ATTPM47	Typ. Format	Selection box	INV or INSP	Inventory	PM

This is the date that the structure was last modified, if known. Otherwise, leave blank.

Item Code	Software Title	DATE ERECTED	TAB	Attributes	Applicability
ATTPM48	Typ. Format	Selection box	INV or INSP	Inventory	PM

This is the date that the structure was erected, if known. Otherwise, record the date of the initial or inventory inspection. If both are unknown, leave blank.

Item Code	Software Title	TRAFFIC CONTROL REQUIREMENTS	TAB	Attributes	Applicability
ATTPM49	Typ. Format	Drop down list	INV or INSP	Inventory	PM

This is the type of traffic control use to complete the most recent regular inspection.

N/A	Shoulder Closure	Single stationary closure
Other	Single moving/mobile closure	Double stationary closure
State Police Assisted Lane Closures	Double moving/mobile closure	Flagging operation

Item Code	Software Title	SPECIAL ACCESS REQUIREMENTS	TAB	Attributes	Applicability
ATTPM50	Typ. Format	Drop down list	INV or INSP	Inventory	PM

Special Access Requirements: If special access considerations are associated with the structure, provide a brief description. For additional information on special access requirements, refer to Section 2.6.2. If no special access considerations are associated with the structure, do not add the line.

N/A	Area prone to flooding	Snooper required	Keys required
Other	Beware of dog	RRX ROW entry required	Barrier plates
High crime incident neighborhood	Structure partially behind sound wall	Dense vegetation growth	Decorative base plate

Item Code	Software Title	INSPECTION DATE	TAB	Attributes	Applicability
ATTPM51	Typ. Format	Selection box	INV or INSP	Inventory	PM

This is the date the structure was inspected that is auto-populated from the condition form when the work order is saved and synced.

Item Code	Software Title	REGULAR INSPECTION DATE	TAB	Attributes	Applicability
ATTPM52	Typ. Format	Selection box	INV or INSP	Inventory	S, TS, P

This is the date of the current inspection.

Item Code	**Software Title**	REGULAR INSPECTION FREQUENCY	**TAB**	Attributes	**Applicability**
ATTPM53	**Typ. Format**	Text field	**INV or INSP**	Inventory	S, TS, P

This data field is the regular inspection frequency in months per manual section 2.4.7.

Item Code	**Software Title**	NEXT REGULAR INSPECTION DATE	**TAB**	Attributes	**Applicability**
ATTPM54	**Typ. Format**	Selection box	**INV or INSP**	Inventory	S, TS, P

This is the date of the next structure inspection. It will be used in conjunction with regular inspection frequency, recorded in field **ATTPM52**.

Enter the next inspection date by adding the regular inspection frequency, recorded in field **ATTPM53** to the current inspection date, recorded infield **ATTPM52**.

Item Code	**Software Title**	BASE INSPECTION DATE	**TAB**	Attributes	**Applicability**
ATTPM55	**Typ. Format**	Selection box	**INV or INSP**	Inventory	S, TS, P

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	**Software Title**	BASE INSPECTION FREQUENCY	**TAB**	Attributes	**Applicability**
ATTPM56	**Typ. Format**	Text field	**INV or INSP**	Inventory	S, TS, P

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	**Software Title**	NEXT BASE INSPECTION DATE	**TAB**	Attributes	**Applicability**
ATTPM57	**Typ. Format**	Selection box	**INV or INSP**	Inventory	S, TS, P

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	**Software Title**	SPECIAL INSECTION DATE	**TAB**	Attributes	**Applicability**
ATTPM58	**Typ. Format**	Selection box	**INV or INSP**	Inventory	S,TS, P

This data field is to record the date of any special inspection.

Item Code	**Software Title**	UT INSPECTION FREQUENCY	**TAB**	Attributes	**Applicability**
ATTPM59	**Typ. Format**	Text field	**INV or INSP**	Inventory	S, TS, P

This item does not apply to Parapet Mounted Signs. If N/A is available to select or can be typed in do so, if not leave blank.

Item Code	**Software Title**	NEXT INSPECTION DATE	**TAB**	Attributes	**Applicability**
ATTPM60	**Typ. Format**	Selection box	**INV or INSP**	Inventory	PM

This is the date of the next structure inspection. It will be used in conjunction with regular inspection frequency, recorded in field **ATTPM54**. Enter the next inspection date by adding the regular inspection frequency to the current inspection date.

Item Code	**Software Title**	LEAD INSPECTORNAME	**TAB**	Attributes	**Applicability**
ATTPM61	**Typ. Format**	Text field– **LEAVE BLANK DO NOT EDIT**	**INV or INSP**	Inventory	PM

This data field is for the lead inspector.

Item Code	**Software Title**	ADDITIONAL INSPECTOR NAME	**TAB**	Attributes	**Applicability**
ATTPM62	**Typ. Format**	Text field– **LEAVE BLANK DO NOT EDIT**	**INV or INSP**	Inventory	PM

This data field is for the secondary inspector.

Item Code	Software Title	LOCATION DESCRIPTION	TAB	Attributes	Applicability
ATTPM63	Typ. Format	Text field	INV or INSP	Inventory	PM

This data field is a description of the structure location. The list below provides an illustrative example of standardized location description statements. However, many combinations are possible, and the inspector should enter a location description that is common terminology for that location.

Applic.	Standard Statement
S, TS, P	Structure is located in a [rest area / weigh station / park and ride lot...]. *{Note, this standard statement should be used in conjunction with one of the others below.}*
S, TS, P	Structure is located on bridge number [1234567], [IS-64 / US-17] (George Washington Memorial Hwy) [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV]. {Note, this standard statement should be used in conjunction with one of the others below.}
S	Structure is located on [SC-600 / IS-64...] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV] near […].
S	Structure is located on [SC-600 / IS-64....] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV], [0.5 miles / …] before [exit 278 / …].
S	Structure is located at mile marker […].
TS	Structure is located on [SC-600 (Hampton Blvd)] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV] at intersection with [VA-300 (Military Hwy)] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV].
P	Structure is located on [SC-600 / IS-64....] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV], [first / second / third...] pole on [exit / entrance...] ramp [to / from...] [New Kent rest area / Towne Point Rd...]
P	Structure is located on [SC-600 / IS-64....] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV], [first / second / third...] pole after [exit / entrance] ramp [to / from...] [New Kent rest area / Towne Point Rd...]
P	Structure is located on [SC-600 / IS-64....] [NBL / SBL / EBL / WBL / NBL and SBL / EBL and WBL / HOV], [first / second / third...] pole on the [left / right] side of [car / truck] [rest area...].

Item Code	Software Title	FAR LEFT SHOULDER CLEARANCE	TAB	Attributes	Applicability
ATTPM64	Typ. Format	Text field	INV or INSP	Inventory	PM

These are the minimum vertical clearance over specific lanes and shoulders, in feet, rounded to the nearest tenth.
Traffic Signals: These fields are for clearances taken over the primary route only. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	LEFT CENTER SHOULDER CLEARANCE	TAB	Attributes	Applicability
ATTPM65	Typ. Format	Text field	INV or INSP	Inventory	PM

These are the minimum vertical clearance over specific lanes and shoulders, in feet, rounded to the nearest tenth.
Traffic Signals: These fields are for clearances taken over the primary route only. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	FAR RIGHT SHOULDER CLEARANCE	TAB	Attributes	Applicability
ATTPM66	Typ. Format	Text field	INV or INSP	Inventory	PM

These are the minimum vertical clearance over specific lanes and shoulders, in feet, rounded to the nearest tenth.
Traffic Signals: These fields are for clearances taken over the primary route only. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	RIGHT CENTER SHOULDER CLEARANCE	TAB	Attributes	Applicability
ATTPM67	Typ. Format	Text field	INV or INSP	Inventory	PM

These are the minimum vertical clearance over specific lanes and shoulders, in feet, rounded to the nearest tenth.
Traffic Signals: These fields are for clearances taken over the primary route only. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	MINIMUM VERTICAL CLEARANCE	TAB	Attributes	Applicability
ATTPM68	Typ. Format	Text field	INV or INSP	Inventory	PM

This is the minimum vertical clearance for the structure, in feet, rounded to the nearest tenth.
Traffic Signals: The structure may be over more than one route; the lowest clearance of all routes shall be coded. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	LANE CLEARANCES 1 TO 8	TAB	Attributes	Applicability
ATTPM69 to ATTPM76	Typ. Format	Text field	INV or INSP	Inventory	PM

These are the minimum vertical clearance over specific lanes and shoulders, in feet, rounded to the nearest tenth.
Traffic Signals: These fields are for clearances taken over the primary route only. Do not fill unused spaces with leading zeroes.

Item Code	Software Title	COMMENTS	TAB	Attributes	Applicability
ATTPM77	Typ. Format	Text field	INV or INSP	Inventory	PM

This is equal to the lowest rating(s) of the superstructure or the foundation; in the case of a parapet mount structure, it is the overall structure rating. Include all deficiencies that drive the overall rating. It should be reported by writing the overall structure rating followed by the deficiencies.
Examples:

- Good condition (Note, no deficiencies need to be listed).
- Fair condition - Corrosion with no measurable section loss over 100% of anchor bolts.
- Poor condition – Grout present, deteriorated, leveling nuts confirmed present.
- Critical condition - 2 of 4 top nuts loose (# 2 and #4); 2 of 4 chord to pole connection bolts loose.

Item Code	Software Title	CREATED DATE	TAB	Attributes	Applicability
ATTPM78	Typ. Format	Empty field	INV or INSP	Inventory	PM

This data field represents the date the asset was created in HMMS and will be blank for the data from the legacy data.

A.6 Work Order Details Tab – Condition Record Parapet Mount

A.6.1 Mapping: Work Order Details Tab – Condition Record Parapet Mount

Work Order Details Tab – Condition Record	
Parapet Mount	**Label**
Notes	CONPM01
Notes 2	CONPM02
CLD Clearance Comments	CONPM03
PMD General Appearance of Parapet Mount	CONPM04
PMD Condition of Attachment to Bridge Beam/Girder	CONPM05
PMD Structural Members of Parapet Mount Structure	CONPM06
PMD Condition of Conn. to Sign/Signal Att.	CONPM07
PMD Condition of Parapet at Attachments	CONPM08
PMD Condition of Attachment to Parapet	CONPM09

A.6.2 Coding Guidance: Condition Report Parapet Mount

Item Code	Software Title	Notes	TAB	Condition	Applicability
CONPM01	Typ. Format	Text field – 1024 characters maximum	INV or INSP	Inspection	PM

This field is used for additional deficiency of recommendations. Follow the report format, see examples below:

Examples:
Luminaire bulb non-functioning over Lane 1. (Since there are no available sections for a non-functioning luminaire, this comment would be used in conjunction with selecting Sign bulb/light broken.)

Item Code	Software Title	Notes 2	TAB	Condition	Applicability
CONPM02	Typ. Format	Text field – 100 characters maximum	INV or INSP	Inspection	PM

This field is used for over-flow of lane clearance comments when you have more than 8 lanes and secondary lanes.

- **More than Eight Lanes**: Where structure crosses more than eight lanes, code additional clearances. Provide the information per the standard statements shown below.

Example:

- Clearances of primary route:
  Lane 9: 15.3'

- **Not Over Traveled Roadway**: If the structure is not over a traveled portion of the roadway, note such. Provide the information per the standard statements shown below.

Example:

- N/A: Structure is located over grass shoulder
- N/A: Offset Luminaire

Traffic Signals: List the clearances over each lane of the secondary route. Provide the information per the standard statements shown below.

Example:

- Clearances over Route 600:
  Lane 1: 15.3'
  Lane 2: 14.8'

Note L

The items covered from this point forward are inspection items. The descriptions that follow will provide guidance on where to code specific component/element deficiencies.

The specific standard statements that describe the common deficiencies, the ratings, the repair recommendations, and the repair urgencies will be provided in Appendix B.

Condition Rating

The rating value indicates the condition of a component. The ratings to be used are shown in the list below.

- 70 – Good
- 50 – Fair
- 40 – Poor
- 20 – Critical*

*All critical / Emergency conditions will have "District Manager notified." after the applicable recommendation.

Item Code	Software Title	Clearance Comments	TAB	Condition	Applicability
CONPM03	Typ. Format	Drop down list	INV or INSP	Inspection	PM

This item is for comments related to the clearance. If no comments, leave coded NR.

Clearance Limits: If the minimum measured clearance is less than VDOT minimum design clearance of 17.5' for a parapet with a walkway or < 19' for a parapet with sign, record the deficiency in this field. Provide the information per the standard statements shown below and in Appendix B.

Item Code	Software Title	PMD General Appearance of Parapet Mount	TAB	Condition	Applicability
CONPM04	Typ. Format	Drop down list	INV or INSP	Inspection	PM

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Sign Panels: The panels that display a message and the reflective coating.
Sign Panel Lighting: The sign panel illumination system, including structural members, utilities, and luminaires.
Comments relating to structure leaning, rotating, out of plane distortion (OPD), or any other type of visible misalignment.

Item Code	Software Title	PMD Condition of Attachment to Bridge Beam/Girder	TAB	Condition	Applicability
CONPM05	Typ. Format	Drop down list	INV or INSP	Inspection	PM

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
The attachments at the bridge beam/girder, including connection hardware and end plates of structural members, etc.

Item Code	Software Title	PMD Structural Members of Parapet Mount Structure	TAB	Condition	Applicability
CONPM06	Typ. Format	Drop down list	INV or INSP	Inspection	PM

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Structural members: This includes the main structural members that are between the bridge and the actual sign, consisting of the verticals (hangers), diagonals, struts.

Item Code	Software Title	PMD Condition of Conn. to Sign/Signal Att.	TAB	Condition	Applicability
CONPM07	Typ. Format	Drop down list	INV or INSP	Inspection	PM

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
Sign Panel Attachments: Includes the sign panel support hardware such as the windbeams, connection hardware, etc.

Item Code	Software Title	PMD Condition of Parapet at Attachments	TAB	Condition	Applicability
CONPM08	Typ. Format	Drop down list	INV or INSP	Inspection	PM

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
The concrete parapet and any reinforcing steel in the surrounding area to which the sign support members or hardware attach.

Item Code	Software Title	PMD Condition of Attachment to Parapet	TAB	Condition	Applicability
CONPM09	Typ. Format	Drop down list	INV or INSP	Inspection	PM

Include inspection deficiency observations and ratings for items and components shown in the table below. Refer to Appendix B for common deficiencies and related ratings, recommendations, and recommendation priorities.

General Guidance and Items to be Included
The attachments at the bridge parapet, including connection hardware and end plates of structural members, etc. This also includes connection angles and bolts, through bolts and inserts, plates washers, etc.
Sign Panel Attachments: Includes the sign panel support hardware such as the windbeams, connection hardware, etc.

A.7 Work Order Details Tab – Condition Report Documents

A.7.1 Mapping: Work Order Details Tab – Condition Record Documents

Work Order Details Tab – Condition Record Documents			
Sign	**Traffic Signal**	**Pole**	**Label**
Documents	Documents	Documents	CRDOC01

A.7.2 Coding Guidance: Work Order Details Tab – Condition Record Documents

Item Code	**Software Title**	Condition Record Documents	**TAB**	Condition	**Applicability**
CRDOC01	**Typ. Format**	Auto-populated field	**INV or INSP**	Inspection	S, TS, P

Chose this tab to enter photos.

All required photographs taken with a camera are to be linked directly to the database through the HMMS/VUEworks web application.

Browse for Photo on Device – **All required photographs taken with the device can be saved directly to the device and are to be linked directly to the database through the HMMS/VUEworks web application.**

All photos must have a date stamp and all photos entered into the database shall be in .jpg format.

Photo Placement:
Photographs including the jpg of the UT reports will be linked as follows in the software:
Doc Type – Photograph
Library – Photos

Photo Naming Convention: Prior to linking your photos to the software, follow the example naming convention. To make sure that the photo files go into inspection reports in the correct order, the filenames will have to include a sequential number. This includes jpegs of the UT report and sketches. This naming convention uses the full 11-character ancillary structure number as shown in ATT03, the inspection date on MMDDYYYY format, and a 2-digit sequential number (01, 02…99). The inspector can optionally add a 2 to 4 letter abbreviation for the photo or defect (FV for Front View, AB for Anchor Bolt, etc.)

Naming Convection of Individual Photo for a Single Pole Structure	Photo Represents
SGN0640332_04072019_01_FV.jpg	Front View
SGN0640332_04072019_02_RV.jpg	Rear View
SGN0640332_04072019_03_PB.jpg	Pole Base
SGN0640332_04072019_03_CP.jpg or SGN0640332_04072019_03_CP.jpg	Chord to Pole or Arm To Pole
SGN0640332_04072019_04.jpg	Deficiency
SGN0640332_04072019_05_UT.jpg	UT Report

Naming Convection of Individual Photo for a Multi Pole Structure	Photo Represents
SGN0640332_04072019_01_FV.jpg	Front View
SGN0640332_04072019_02_RV.jpg	Rear View
SGN0640332_04072019_03_LB.jpg	Left Base
SGN0640332_04072019_04_RB.jpg	Right Base
SGN0640332_04072019_05_LCP.jpg	Left Chord to Pole
SGN0640332_04072019_06_RCP.jpg	Right Chord to Pole
SGN0640332_04072019_07.jpg	Deficiency
SGN0640332_04072019_08_LUT.jpg	Left UT Report
SGN0640332_04072019_09_RUT.jpg	Right UT Report
OR	
SGN0640332_04072019_08_LFUT.jpg	Left Front UT Report
SGN0640332_04072019_09_LRUT.jpg	Left Rear UT Report

Required Photos: The following photos are required to be entered into the database, in the order they appear below and with the applicable caption names, which will appear under each photo. All photographs shall have date stamps. A caption describing the condition or deficiency represented in each photo shall be included.

Only Verify and record the highlighted data fields shown in the tables below for base inspections.

Signs

Order	Type of Photo	Photo Name
1	The front view of the structure.	Front View
2	The rear view of the structure.	Rear View
3 or	The view of the pedestal/base, or	Pole Base
3	The view of the left front pedestal/base.	Left Front Base Plate
4	The view of the left rear pedestal/base.	Left Rear Base Plate
5	The view of the right front pedestal/base.	Right Front Base Plate
6	The view of the right rear pedestal/base.	Right Rear Base Plate
7 or	The view of the chord to pole connection, or	Chord to Pole Connection
8	The view of the left chord to pole connection.	Left Chord to Pole Connection
9	The view of the right chord to pole connection.	Right Chord to Pole Connection
10-?	All deficiencies or conditions resulting in an element rating of poor or critical.	Example: Out of Plumb Anchor Bolt No. 1
?	Other conditions and/or reasons where further clarification may be needed to define the conditions or reasons.	Example: High Voltage Line in Contact with Pole
Last 1 or	The jpeg of the UT Report or	UT Report
Last 1	The jpeg of the Left Front UT Report	Left Front UT Report
Last 2	The jpeg of the Left Rear UT Report	Left Rear UT Report
Last 3	The jpeg of the Right Front UT Report	Right Front UT Report
Last 4	The jpeg of the Right Rear UT Report	Right Rear UT Report

Sign Parapet Mount

Order	Type of Photo	Photo Name
1	The front view of the structure.	Front View
2	The rear view of the structure.	Rear View
3	Bridge Attachment, Parapet Anchorage (Non-through Bolt)	Bridge Attachment, Parapet Anchorage (Non-through Bolt)
4	Bridge Beam Attachment	Bridge Beam Attachment
5-?	All deficiencies or conditions resulting in an element rating of poor or critical.	Example: Out of Plumb Anchor Bolt No. 1
?	Other conditions and/or reasons where further clarification may be needed to define the conditions or reasons.	Example: High Voltage Line in Contact with Pole

Traffic Signals

Order	Type of Photo	Photo Name
1	The primary front view of the structure.	Primary Front View
2	The primary rear view of the structure.	Primary Rear View
3	The secondary front view of the structure.	Secondary Front View
4	The secondary rear view of the structure.	Secondary Rear View
5 or	The view of the pedestal/base.	Pole Base
3 or	The view of the arm to pole connection(s) (as applicable) or	Mast Arm to Pole Connection
3	The view of the span wire to pole connection(s) (as applicable) or	Span Wire to Pole Connection
4-?	All deficiencies or conditions resulting in an element rating of poor or critical.	Example: Out of Plumb Anchor Bolt No. 1
?	Other conditions and/or reasons where further clarification may be needed to define the conditions or reasons.	Example: High Voltage Line in Contact with Pole
5	The jpeg of the Location plan	Location Plan
Last	The jpeg of the UT Report	UT Report

Poles

Order	Type of Photo	Photo Name
1	The front view of the structure.	Front View
2	The view of a pedestal/base.	Pole Base
3	The view of the arm to pole connection.	Arm to Pole Connection
4	Typical view of the main attachment (luminaire head, camera, antenna) to the structure.	Luminaire Head; Camera; Antenna
5	All deficiencies or conditions resulting in an element rating of poor or critical.	Example: Out of Plumb Anchor Bolt No. 1
6	Other conditions and/or reasons where further clarification may be needed to define the conditions or reasons.	Example: High Voltage Line in Contact with Pole
Last	The jpeg of the UT Report	UT Report

Other Attachments

The following attachments shall be entered into the database software as photos.

Order	Type of Photo	Photo Name
1	UT reports shall be entered into the database software as a photo. For a UT report template, refer to Appendix C.	UT Report
2	Location sheets shall be entered into the database software as a photo.	Location Sheet

A.8 Work Order Documents Tab

A.8.1 Mapping: Work Order Documents

Work Order Documents			
Sign	Traffic Signal	Pole	Label
Documents	Documents	Documents	WODOC01

A.8.2 Coding Guidance: Work Order Documents

Item Code	Software Title	Documents	TAB	Documents	Applicability
WODOC01	Typ. Format	Tab	INV or INSP	Inventory	S, TS, P

This field will be used to upload the pdf versions of the UT Reports and the final signed and sealed inspection report.

PDFs including the UT reports and final signed and sealed inspections reports will be linked as follows in the software:
Doc Type – Structure Inspection Report
Library – Structure Inspection Report

Report Naming Convention: Prior to linking your final inspection and UT reports to the software, follow the example naming convention. To make sure that the report files go into inspection reports in the correct order, the filenames will have to include a sequential number. This naming convention uses the full 11-character ancillary structure number as shown in ATT03, the inspection date on MMDDYYYY format, and a 2 to 4 letter abbreviation for the report.

Naming Convection of Single a Pole Structure	PDF Represents
SGN0640332_04072019_01_IR.pdf	Inspection Report
SGN0640332_04072019_02_UT.pdf	UT Report

Naming Convection of Single a Multi Pole Structure	PDF Represents
SGN0640332_04072019_01_IR.pdf	Inspection Report
SGN0640332_04072019_02_LUT.pdf	Left UT Report
SGN0640332_04072019_03_RUT.pdf	Right UT Report
OR	
SGN0640332_04072019_02_LFUT.pdf	Left Front UT Report
SGN0640332_04072019_03_LRUT.pdf	Left Rear UT Report

APPENDIX B. COMMON DEFICIENCIES, RATINGS, RECOMMENDATIONS, AND PRIORITIES

Introduction

This appendix will provide guidance for common deficiencies, ratings, recommendations, and priorities. This appendix will also facilitate consistency within the rating of Traffic Ancillary Structures.

The following list provides some general information and guidance on the items presented in this appendix.

- *Deficiency Criteria*: This is a deficiency that has been frequently noted and observed in the field and has common characteristics. Deficiencies typically have multiple levels of severity. These levels of severity control the condition rating, the associated recommendation, and the recommendation priority; all outlined below.
- *Element Rating*: This is the rating (Good, Fair, Poor, Critical, Emergency) of the component on which the deficiency is observed. Typically, the worst-case element rating will align with the "Overall Condition Rating" (70/G – Good, 50/F – Fair, 40/P – Poor, 20/C – Critical/Emergency).
  - Note that some deficiencies will not directly affect the overall rating of the structure because the deficiencies are not structural, nor do they present a falling hazard to the roadway below. Additionally, operational considerations such as sign reflectivity and/or lighting should not affect the overall rating. In these instances, code a rating of 70 G* (asterisk).
- *Recommendation Priority*: The priority (1-Low, 2-Medium, 3-High, 4-Critical and 5-Emergency) is assigned according to the most urgent recommendation within the field.
  - Recommendation priorities correspond to timelines as shown below.
    - **Low:** Includes actions to maintain the service life of structure elements and attachments. Many of these actions may be included in a preventive maintenance schedule.
    - **Medium:** Includes actions to elements/components where deterioration in condition until the next inspection cycle could affect performance. Some of these actions may be included in a preventive maintenance schedule.
    - **High:** Includes actions to elements/components where continued deterioration in condition until the next inspection cycle could be significant and could affect safety and performance.
    - **Critical/Emergency:** Follow the procedure below for Critical/Emergency Findings. Use only the Critical coding in the recommendation priority field, do not use the coding Emergency.
  - Within the recommendation comment fields, the recommendations should be listed in order of priority, from most to least urgent.
- *Recommendation*: This is the specific recommendation provided to address the deficiency. Recommendations may range from no action to correcting the deficiency, analyze for engineered solution, or replacing the structure.
  - The term "analyze for engineered solution" is used to indicate a condition where the full impact that a deficiency may have on the structure cannot be readily determined. Such a condition may prohibit issuing an appropriate repair recommendation. As such, additional investigation or an engineering analysis may be required to determine the best course of action to address the deficiency and move forward with a repair. The completed investigation or analysis shall be kept in the structure file.
  - All Critical / Emergency conditions will have "District Manager notified." after the applicable recommendation.
  - If there are no recommendations to be made, select No Recommendations from the drop down list.

Limits of Deficiency Tables

These tables are intended to provide guidance in terms of common deficiencies found and how they should be rated. The deficiency tables are not intended to be all encompassing as other deficiencies will be discovered in the field, nor are the tables intended to overrule the inspector's judgment of a deficiency. The inspector's judgment and experience should be used when assigning ratings, recommendations, and priorities of the recommendations.

As an example, when evaluating dents, the tables provide criteria for the size of the dent, but not the location of a dent. As such, the inspector must use their judgment to consider the effect the location of the dent may have on the structure.

The tables do not have the ability to guide or support the inspector when multiple deficiencies exist on a single component or element of an ancillary structure. The inspector should use engineering judgement by taking into account all deficiencies existing in a structural component or element and assigning a rating that best represents the combined condition of severity. This is accomplished by determining the overall condition of the component due to the multiple deficiencies and selecting the rating from the drop down box that best represents the overall condition. As an example, two anchor rods in an 8 anchor rod layout are out of plumb and two of the other anchor rods in the layout have top nuts that are not fully engaged. The combined condition of the four of eight anchors would determine the rating to be assigned. The criteria for one of the deficiencies would be selected to assign that rating. The deficiencies should be described in HMMS Notes and the Recommendation Comments Fields.

Where statements in the table do not accurately describe the condition observed, or the location of the observation, the Notes and Recommendations Comments fields should be used to give an accurate representation of the deficiency.

Critical/Emergency Findings

Critical Findings are defined as imminent conditions that could, if left unresolved, result in localized or complete failure (collapse) of the structure, or present a safety issue to the traveling public, and should be addressed within 90 days of its discovery. Should any such condition be encountered, it shall be reported to the District Manager **within 24 hours** of the discovery of the finding. A notification shall be provided via email complete with a written description(s) and photograph(s) of the finding.

Emergency Findings are defined as conditions that are deemed to pose an immediate safety risk or hazard to the structure's integrity and/or the traveling public and require immediate attention and corrective action. Should any such condition be encountered, the Team Leader shall **immediately** contact the appropriate District Manager while on-site to notify them of the condition. In the case of an Emergency Finding, contact is normally initiated by telephone call and followed up the same day with email documentation of the findings, including photographs. Once contacted, the Department will work with the Team Leader to quantify and assess the situation to determine if it warrants an emergency response or can be addressed through the critical recommendation process.

Deficiency Table Example

To illustrate the convention of each table, please refer to the example and instructions presented below.

Example:

CON22(a)	FD Grout(b)		
1	Grout condition(c)		
Deficiency Criteria(d)	Elem Rating HMMS(e)	Rec Priority(f)	Recommendation(g)
Not Rated			
no grout**	70/G	-	No recommendation.
not deteriorated, leveling nuts confirmed present	50/F	L	Remove grout.
deteriorated, leveling nuts confirmed present	40/P	M	Remove grout.
not deteriorated, leveling nuts confirmed absent	50/F	L	Notify District Manager.
deteriorated, leveling nuts confirmed absent	20/C	C	Retrofit affected components or remove structure. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

Instructions:

(a) *Field Code*: This is the field code where the comments will be entered. These fields are associated with specific components of the structure, as mapped in Appendix A.

(b) *Field Title*: This is the title of the field where the comments will be entered. These fields are associated with specific components of the structure, as mapped in Appendix A.

(c) *Deficiency Description*: This provides a brief and general description of the deficiency. Sometimes, variables are used to provide levels of deficiency criteria.

(d) *Deficiency Criteria:* This column represents the criteria that are used to determine the level of severity of the deficiency, which affects the condition rating, the recommendation priority, and the recommendation itself. Criteria with a double asterisk (**) are to be selected to ensure that a rating is assigned for each deficiency category. This will typically be a rating of 70/G or 70/G*.

(e) *Element Rating:* The rating of the element based on the component having the deficiency noted.

(f) *Recommendation Priority*: This is the priority level of the specific recommendation provided to address the deficiency.

(g) *Recommendation*: This is the field code where the recommendation comments will be entered. These fields are associated with specific components of the structure, as mapped in Appendix A.

Sign Structure Deficiency Criteria, Element Rating, Priority, and Recommendation

CON03 CLD Clearance Comments

1 Min. clear. < 17.5ft walkway - *Minimum measured clearance is less than Virginia Department of Transportation's minimum design clearance of 17.5' for a sign luminaire assembly or walkway.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
luminaire/walkway clear < 1ft less than min	70/G*	M	Correct clearance deficiency.
luminaire/walkway clear >= 1ft less than min	70/G*	H	Correct clearance deficiency.

2 Min. clear. < 19 ft for panel - *Minimum measured clearance is less than Virginia Department of Transportation's minimum design clearance of 19' for a sign panel.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sign panel clear < 1 ft less than min	70/G*	M	Correct clearance deficiency.
sign panel clear >= 1 ft less than min	70/G*	H	Correct clearance deficiency.

CON04 SSD General Appearance of Sign/Sign Lighting/Att.

1 Sign panel reflective material - *Sign panel reflective material is cracked/damaged/deteriorated/peeling.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sign legible	70/G	-	No recommendation.
sign not legible	70/G*	H	Replace affected components.

2 Bullet holes in sign panel

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sign legible	70/G	-	No recommendation.
legibility reduced	70/G*	M	Replace affected components.

3 Impact damage to sign panel

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling and legible	70/G*	-	No recommendation.
no danger of falling and not legible	70/G*	H	Replace affected components.
in danger of falling	20/C	C	Replace affected components. District Manager notified.

4 Corrosion of studs/bolts/clips - *Corrosion affecting studs/through bolts/clips.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 25%	50/F	L	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or Install conductive insulation between affected components.
section loss >= 25%	40/P	M	Replace affected components, Or for corrosion of dissimilar metals, Replace with non-reactive metals.

5	Backing strip studs/nuts. - *Sheared/loose/missing backing strip studs/nuts*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no broken backing strip studs/nuts.**	70/G	-	No recommendation.
sheared/loose/missing backing strip studs/nuts.	50/F	M	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

6	Retrofitted sign clips - *Loose/missing sign clip/bolts/nuts on retrofitted sign panel*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
Loose/miss thru-bolt/clip on retrofitted sign = 0	70/G	M	No recommendation.
Loose/miss thru-bolt/clip on retrofitted sign > 0	40/P	H	Replace/Repair/Tighten affected components

7	Non-retrofitted sign clip stud - *Sheared/loose/missing sign clip studs/nuts on non-retrofitted sign*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sheared studs/clip on non-retrofitted sign = 0	70/G	M	Through bolt sign panel(s).
sheared studs/clip on non-retrofitted sign > 0	40/P	H	Through bolt sign panel(s).

8	Clips on extruded type signs - *Sign clips cracked/sheared on extruded type sign*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no cracked/sheared sign clips**	70/G	-	No recommendation.
cracked/sheared sign clips	40/P	H	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

9	Coating condition - *Coating exhibits oxidation/peeling at sign lighting luminaire housing*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
luminaire housing coating has no oxidation/peeling**	70/G	-	No recommendation.
luminaire housing coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

10	Sign bulb/light broken.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sign bulb/light not broken**	70/G	-	No recommendation.
sign bulb/light broken	70/G*	M	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

11	Corrosion affecting conduit - *Corrosion affecting conduit/connection hardware/junction boxes.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss conduit/hardware at junction box	70/G	-	No recommendation.
0% < section loss < 25%	70/G*	M	Clean, prepare, and coat affected components.
section loss >= 25%	70/G*	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

12	Wiring conduit/clip/grommet - *Wiring conduit/clip/grommet loose/missing/broken/exposed wiring*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no conduit loose/missing/ broken/exposed wiring**	70/G	-	No recommendation.
conduit loose/missing/ broken/exposed wiring	70/G*	M	Replace/Repair affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

13	Sign luminaires hardware - *Connection hardware for luminaires/conduits/luminaire rail is loose/missing/broken*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
hardware loose/missing/broken, no danger of falling	70/G*	M	Replace/Tighten affected components.
hardware loose/missing/broken, in danger of falling	20/C	C	Replace/Tighten affected components. District Manager notified.

14	Impact damage to luminaires - *Impact damage to luminaires/conduits/luminaire rail*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling and functional	70/G*	-	No recommendation.
no danger of falling and not functional	70/G*	H	Replace affected components.
in danger of falling	20/C	C	Replace affected components. District Manager notified.

15	VMS – glass/ cover cracked/broken/bent/damaged		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling	70/G*	H	Replace/Repair affected components.
in danger of falling	20/C	C	Replace affected components. District Manager notified.

CON05 SSD General Alignment of Structure

1	Pole Leaning - *Pole leans a horizontal distance H" over a vertical distance V".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
horizontal/vertical < 1%	70/G	-	No recommendation.
1% <= horizontal/vertical < 2%	50/F	M	Adjust leveling/top nuts to plumb pole/base plate, or Analyze for engineered solution.
horizontal/vertical >= 2%	40/P	H	Adjust leveling/top nuts to plumb pole/base plate, or Analyze for engineered solution.

2	Base plate out of level - *Base plate out of level a vertical distance V" over a horizontal distance H".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vertical/horizontal < 1%	70/G	-	No recommendation.
1% <= vertical/horizontal < 2%	50/F	M	Adjust leveling/top nuts to plumb pole/base plate or Analyze for engineered solution.
vertical/horizontal >= 2%	40/P	H	Adjust leveling/top nuts to plumb pole/base plate, or Analyze for engineered solution.

CON07 SSD Attachment to Chord Connection

1	Corrosion of windbeam/hanger - *Corrosion affecting windbeam/hanger*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components.
25% < section loss < 50%	40/P	H	Clean, prepare, and coat affected components.
section loss >= 50%	40/P	H	Replace affected components.

2	Corrosion of sign hardware - *Corrosion affecting sign/other attachment connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or Install conductive insulation between affected components.
section loss >= 25%	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

3	Hanger/windbeam conn. hardware - *Hanger to windbeam connection hardware loose/missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
hardware loose/missing components < 25%	50/F	M	Replace/Tighten affected components.
25% <= loose/missing components < 50%	40/P	H	Replace/Tighten affected components.
50% <= loose/missing components	20/C	C	Replace/Tighten affected components. District Manager notified.

4	Sign chord connection bolts - *Sign/Other attachment to chord connection bolts loose/missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
loose/missing components < 25%	50/F	M	Replace/Tighten affected components.
25% <= loose/missing components < 50%	40/P	H	Replace/Tighten affected components.
50% <= loose/missing components	20/C	C	Replace/Tighten affected components. District Manager notified.

5	Coating condition - *Sign /chord connection coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sign /chord conn. coating has no oxidation/peeling**	70/G	-	No recommendation.
sign /chord conn. coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.**			

CON08 SSD Walkway

1	Corrosion of walkway members - *Corrosion affecting walkway members.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components.
25% <= section loss < 50%	40/P	H	Clean, prepare, and coat affected components.
section loss >= 50%	20/C	C	Replace affected components. District Manager notified.

2	Corrosion of conn. hardware - *Corrosion affecting connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Install conductive insulation between affected components, or Replace with non-reactive metals.
section loss >= 25%	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

3	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
walkway coating has no oxidation/peeling**	70/G	-	No recommendation.
walkway coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

4	Walkway member loose/damaged - *Walkway members/railing/connection/grating loose/missing/broken/have impact damage.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling	50/F	M	Replace/Repair/Tighten affected components.
in danger falling	20/C	C	Replace/Repair/Tighten affected components. District Manager notified.

CON09 PD Vertical Support Base Plate

1	Corrosion affecting base plate		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Clean, prepare, and coat or Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base plate coating has no oxidation/peeling**	70/G	-	No recommendation.
base plate coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

3	Base connection welds cracked - *Weld at base plate to pole connection/base plate vertical stiffeners cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base connection welds not cracked**	70/G	-	No recommendation.
base connection welds cracked	20/C	C	Replace/Repair affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

4	Base plate cracked/broken		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base plate not cracked/broken**	70/G	-	No recommendation.
base plate cracked/broken	20/C	C	Replace/Repair affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

5	Base plate buried		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base plate buried < 12 in. deep, accessible	50/F	L	Regrade, install retaining wall, or Relocate structure.
base plate buried > 12 in. deep, inaccessible	40/P	H	Regrade around affected components and inspect.

6	Base protective skirt missing - *Base plate protective skirt loose/damaged/missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base protective skirt loose/damaged	70/G	-	No recommendation.
base protective skirt missing	70/G*	L	Replace affected components.

7	Vegetation around/against base - *Vegetation growth around/against base plate.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vegetation around/against base plate, accessible	70/G	-	No recommendation.
vegetation around/against base plate, inaccessible	70/G*	M	Clear vegetation from on and around structure.

CON11 PD Vertical Support Trussing

1	Connection hardware corrosion - *Corrosion affecting connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 25%	50/F	M	Replace affected components.
section loss >= 25%	40/P	M	Replace affected components.

2	Corrosion of truss members - *Corrosion affecting trussing members.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

3	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vert. supp. trussing coating has no oxidation/peel**	70/G	-	No recommendation.
vert. supp. trussing coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.

**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.**

4	Hardware loose/missing/broken - *Connection hardware loose/missing/broken.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
connection hardware affected < 30%	50/F	M	Replace/Tighten affected components.
connection hardware affected >= 30%	40/P	H	Replace/Tighten affected components.

5	Connection weld cracked - *Weld at connection cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
unlikely to propagate into pole	40/P	H	Replace/Repair affected components.
likely to propagate into pole	20/C	C	Replace/Repair affected components. District Manager notified.

6	Bent truss member		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no bent truss member**	70/G	-	No recommendation.
bent truss member	50/F	L	No recommendation or Brace/ straighten affected member if necessary.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with truss members.			

CON12 PD Vertical Support Welded Joints *{Note, exclusively for welded splices in poles, not truss to pole or pole to base plate connections.}*

1	Corrosion of welded splice - *Corrosion affecting welded splice of pole sections.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Weld at splice – *Crack at welded splice of pole section.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
weld at splice not cracked**	70/G	-	No recommendation.
weld at splice cracked	20/C	C	Replace/Repair affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CON14 PD Vertical Support

1	Corrosion affecting pole		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vertical support coating has no oxidation/peeling**	70/G	-	No recommendation.
vertical support coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

3	Minor loss of galvanization - *Minor/random scrapes with localized loss of galvanization.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no scrapes or local loss of galvanization *	70/G	-	No recommendation.
minor/random scrapes, local loss of galvanization	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

4	Weld at hand hole cracked		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
weld at hand hole not cracked**	70/G	-	No recommendation.
weld at hand hole cracked	20/C	C	Repair/Replace affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with hand holes.			

5	Debris/water in pole		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no debris/water in pole**	70/G	-	No recommendation.
debris/water in pole	70/G*	M	Remove water/debris, and Correct drainage/accumulation deficiency.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

6	Pole dent with/without tear - *Dent with/without tear, sized horizontal projection H" x vertical projection V" x depth d", in pole of circumference C" and located vertical distance D' from base plate.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
pole Measure H /pole circumference C < 5%	70/G	-	No recommendation.
5% <= pole measure H/pole circumference C < 10%	50/F	M	Repair affected components.
pole measure H /pole circumference C >= 10%	40/P	H	Replace/Repair affected components or Analyze for engineered solution.

7	Vegetation around/against pole - *Vegetation growth around/against pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vegetation around/against pole, accessible	70/G	-	No recommendation.
vegetation around/against pole, inaccessible	70/G*	M	Clear vegetation from on and around structure.

8	Hand hole cover loose/missing - *Hand hole cover loose/missing/screws loose.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
loose	70/G*	L	Replace/Repair/Tighten affected components.
missing	70/G*	M	Replace affected components.

9	Pole cap loose/missing - *Pole cap loose/missing/set screws loose.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
pole cap set screws loose	70/G*	L	Tighten affected components.
pole cap loose	70/G*	L	Replace/Repair/Tighten affected components.
pole cap missing	70/G*	M	Replace affected components.

10	Open electrical ports		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
electrical ports closed **	70/G	-	No recommendation.
electrical ports open	70/G*	M	Close or cover open port
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

11	Attachment hardware corrosion - *Corrosion affecting sign/camera/sensor/attachment connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G*	-	No recommendation.
0% < section loss < 25%	70/G*	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or, Install conductive insulation between affected components.
section loss >= 25%	70/G*	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

12	Other attach. to pole loose - *Sign/Camera/Sensor/Attachment is loose/damaged/missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling and functional	70/G	L	Replace/Repair/Tighten affected components.
no danger of falling and not functional	50/F	M	Replace affected components.
in danger of falling	20/C	C	Replace affected components. District Manager notified.

CON15	CD Chord to Pole Connection

1	Corrosion of plates/saddles - *Corrosion affecting connection plates/saddle blocks.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss of conn. plates/saddles	70/G	-	No recommendation.
0% < section loss of Conn. Plates/Saddles < 15%	50/F	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or Install non-conductive insulation between affected components.
15% <= section loss of conn. plates/saddles < 25%	40/P	H	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
section loss of conn. plates/saddles >= 25%	20/C	C	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals. District Manager notified.

3	Connection hardware corrosion - *Corrosion affecting connection hardware/bolts*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss conn, hardware	70/G	-	No recommendation.
0% < section loss to conn, hardware < 25%	50/F	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
25% <= section loss to conn, hardware	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

4	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
connection coating has no oxidation/peeling**	70/G	-	No recommendation.
connection coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

5	Hardware loose/missing/broken 1 - *Connection hardware loose/missing/broken at single chord connection to pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
chord connection to pole hardware affected < 25%	40/P	H	Replace affected components.
chord connection to pole hardware affected >= 25%	20/C	C	Replace affected components. District Manager notified.

6	Hardware loose/missing/broken 2 - *Connection hardware loose/missing/broken at chord tension connection to pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
chord tension connection hardware affected < 30%	40/P	H	Replace affected components.
chord tension connection hardware affected >= 30%	20/C	C	Replace affected components. District Manager notified.

7	Hardware loose/missing/broken 3 - *Connection hardware loose/missing/broken at chord compression/saddle block connection to pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
saddle block connection to pole affected < 30%	50/F	M	Replace affected components.
saddle block connection to pole affected >= 30%	40/P	H	Replace affected components.

8	Missing flat washers - *Flat washers missing at chord connection to pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
flat washers present at chord/pole connection**	70/G	-	No recommendation.
flat washers missing at chord/pole connection	50/F	M	Repair affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

9	Multiple flat washers present - *Multiple flat washers present at chord.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
multiple flat washers not present at conn. to pole **	70/G	-	No recommendation.
multiple flat washers present at chord/pole conn.	50/F	M	Remove excess washers.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

10	Lock washers at pole conn *(Note: lock washers allowed on double clamp/saddle connections)*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
lock washers not present at chord/pole connection **	70/G	-	No recommendation.
lock washers present at chord/pole connection	50/F	M	Remove Lock washers.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

11	Chord connection plate cracked - *Chord connection plate broken/cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
chord connection plate not broken/cracked**	70/G	-	No recommendation.
chord connection plate broken/cracked	20/C	C	Replace affected components. District Manager notified.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

12	Gap between connection plates - *Gap between connection plates at chord to pole connection.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no gap between connection plates **	70/G	-	No recommendation.
gap between connection plates at chord/pole conn.	50/F	M	Tighten hardware or shim the gap.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CON16 CD Chord/Arm/Wire

1	Corrosion affecting chord		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
chord coating has no oxidation/peeling**	70/G	-	No recommendation.
chord coating has oxidation/peeling	70/G	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

3	Bent chord member - *Bent chord member; out of plane distance O" over length between points of bending L".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
tension member	50/F	-	No recommendation.
compression member, O/L < 20%; unlikely to buckle	50/F	M	No recommendation or brace/straighten affected member if necessary.
compression member, O/L >= 20%; potential to buckle	40/P	H	Brace/Straighten affected member or Replace affected components.

4	End cap loose/missing		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
loose	70/G*	L	Tighten affected components.
missing	70/G*	M	Replace affected components.

5	Open electrical ports in Chord		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
closed electrical ports**	70/G	-	No recommendation.
open electrical ports	70/G*	M	Close and cover open hole at location.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with electrical ports.			

CON17 CD Chord Splices

1	Corrosion affecting splice		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Connection hardware corrosion - *Corrosion affecting splice connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss to splice connection hardware	70/G	-	No recommendation.
0% < section loss to splice connection hardware < 25%	50/F	L	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
section loss to splice connection hardware >= 25%	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

3	Hardware loose/missing/broken 1 - *Connection hardware loose/missing in chord tension splice.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
tension splice hardware affected < 30%	40/P	H	Replace affected components.
tension splice hardware affected >= 30%	20/C	C	Replace affected components. District Manager notified.

4	hardware loose/missing/broken 2 - *Connection hardware loose/missing in chord compression splice.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
compression splice hardware affected < 30%	50/F	M	Replace affected components.
compression splice hardware affected >= 30%	40/P	H	Replace affected components.

5	Weld at splice cracked		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
weld at splice not cracked**	70/G	-	No recommendation.
weld at splice cracked	20/C	C	Replace/Repair affected components. District Manager notified.

**** If no deficiency is noted for this condition, select this item to produce an overall rating.**

CON18 CD Chord Trussing

1	Corrosion of truss members - *Corrosion affecting truss vertical/diagonal/horizontal member.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Hardware loose/missing/broken - *Connection hardware loose/missing/broken.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
hardware affected < 30%	50/F	M	Replace affected components.
hardware affected >= 30%	40/P	H	Replace affected components.

3	Truss to chord weld cracked - *Weld at truss to chord connection cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
unlikely to propagate into chord	40/P	H	Replace/Repair affected components.
likely to propagate into chord	20/C	C	Replace/Repair affected components. District Manager notified.

4	Bent truss member		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
truss member not bent.**	70/G	-	No recommendation.
bent truss member.	50/F	L	Brace/straighten affected member or Replace affected components.

**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with truss members.**

CON19 FD Anchor Bolts

1	Base plate to foundation gap - *Base plate to foundation height exceeds tolerance. Height between bottom of base plate and top of concrete pedestal is vertical distance H". Tolerance is related to anchor bolt diameter D".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
gap height H <= 2 X anchor bolt diameter D**	70/G	-	No recommendation.
2D < H <= 2D + 1 in.	50/F	L	Lower base plate for proper base to foundation gap.
H >2D + 1 in.	40/P	H	Lower base plate for proper base to foundation gap.

**** If no deficiency is noted for this condition, select this item to produce an overall rating.**

2	Corrosion of anchor nuts/bolt - *Corrosion affecting top nut/leveling nut/bolt.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
section loss of top nut/bolt < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss of top nut/bolt < 30%	40/P	H	Replace affected components.
section loss of top nut/bolt >= 30%	20/C	C	Replace affected components. District Manager notified.

3	Top/leveling nut loose/missing - *Top/leveling nuts missing/loose.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
1 nut in an 8+ bolt configuration	50/F	M	Replace/Tighten affected components.
1 nut in an 6+ bolt configuration, or 2 nuts in an 8+ bolt configuration	40/P	H	Replace/Tighten affected components.
1+ nut in a 4 bolt configuration, or 2+ nuts in a 6 bolt configuration, or 3+ nuts in an 8+ bolt configuration	20/C	C	Replace/Tighten affected components. District Manager notified.

4	Inadequately tightened nuts - *Top/leveling nuts inadequately tightened.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
1 nut in an 8+ bolt configuration	70/G	L	Tighten affected components.
1 nut in a 6 bolt configuration, OR 2 nuts in an 8+ bolt configuration	50/F	M	Tighten affected components.
1+ nut in a 4 bolt configuration, OR 2+ nuts in a 6 bolt configuration, OR 3+ nuts in an 8+ bolt configuration	40/P	H	Tighten affected components.

5	Anchor bolts broke/sheared/ckd - *Anchor bolts broken/sheared/cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
anchor bolts not broke/sheared/ckd**	70/G	-	No recommendation.
anchor bolts broke/sheared/ckd	20/C	C	Replace affected components or Remove structure. District Manager notified.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

6 and 7	Anchor nut tolerance *Top/Leveling nuts improperly seated - Top/Leveling nuts improperly seated with Maximum gap D" between nut and base plate. Gap tolerance is related to anchor bolt diameter d".* *OR* *Anchor bolts out of plumb horizontally with maximum gap D" between nut and base plate. Gap tolerance is related to anchor bolt diameter d."*			
Deficiency Criteria		Elem Rating	Rec Priority	Recommendation
D/d >= 0.04 OR D/d >= 0.08				
Not Rated				
gap does not exceed tolerance for all bolts**		70/G	-	No recommendation.
Gap exceeds tolerance				
1 nut / bolt in 8+ bolt layout		50/F	M	Correct with tapered washers or other means. See recommendation guide below.
1 nut / bolt in 4-7 bolt layout, OR 2 nuts / bolts in 8+ bolt layout		40/P	H	See recommendation guide below.
2 nuts / bolt in 4-7 bolt layout, OR 3+ nuts / bolt in 8+ bolt layout		20/C	C	**If 0.04 <= D/d < 0.08** Correct with tapered washers or other means. District Manager notified. **If D/d >= 0.08** Replace/Repair affected components or Remove structure. District Manager notified.

**** If no deficiency is noted for this condition, select this item to produce an overall rating.**

Gap, D (in.)

Bolt Diameter, d (in.)	1/16 0.0625	1/8 0.125	3/16 0.1875	1/4 0.25
1.00	0.063	0.125	0.188	0.250
1.25	0.050	0.100	0.150	0.200
1.50	0.042	0.083	0.125	0.167
1.75	0.036	0.071	0.107	0.143
2.00	0.031	0.063	0.094	0.125
2.25	0.028	0.056	0.083	0.111
2.50	0.025	0.050	0.075	0.100
2.75	0.023	0.045	0.068	0.091
3.00	0.021	0.042	0.063	0.083

(green)	**DO NOT REPORT**
(yellow)	**D/d >= 0.04**
(red)	**D/d >= 0.08**

Improperly seated top nut or leveling nut example note:

1 of 8 top/leveling nut (#3) improperly seated with 1/8" gap between top/leveling nut and base plate. (D/d>=0.04 or 0.08)

R Use tapered washers or other means to correct improperly seated top/leveling nut at anchor bolt (#3).

R Repair improperly seated top/leveling nut or replace anchor bolt (#3).

Out of plumb anchor bolt example note:

1 of 8 anchor bolts (#3) out of plumb with 1/8" gap between top nut and leveling nut and base plate. (D/d>=0.04 or 0.08)

R Use tapered washers or other means to correct improperly seated top nut and leveling nut at anchor bolt (#3).

R Repair improperly seated top nut and leveling nut or replace out of plumb anchor bolt (#3).

8	Top nut not fully engaged - *Anchor bolts short with approximate percentage E of top nut engaged.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
top nuts engaged > 75% on all anchors**	70/G	-	No recommendation.
Vertical Support consists of single pole on one side of structure. E < 75%			
1 nut in an 8+ bolt, single pole layout	50/F	M	Lower structure or retrofit short anchor bolt, or Analyze for engineered solution.
1 nut in an 4-7 bolt, single pole layout OR 2 nuts in an 8+ bolt, single pole layout	40/P	H	Lower structure or retrofit short anchor bolt, or, Analyze for engineered solution.
2+ nuts in an 4-7 bolt, single pole layout OR 3+ nuts in an 8+ bolt, single pole layout	20/C	C	Lower structure or retrofit short anchor bolt, or, Analyze for engineered solution. District Manager notified.
Vertical Support consists of two poles on one side of structure. E < 75%			
1 nut in an 8+ bolt, double pole layout	70/G	L	Lower structure or retrofit short anchor bolt, or, Analyze for engineered solution.
2+ nuts in an 8+ bolt, double pole layout	50/F	M	Lower structure or retrofit short anchor bolt, or, Analyze for engineered solution.
3+ nuts in an 8+ bolt, double pole layout	40/P	H	Lower structure or retrofit short anchor bolt, or, Analyze for engineered solution. District Manager notified.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

9	Top/leveling flat washers missing		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
standard hole, not conditional	70/G	-	No recommendation.
slotted/oversize hole, nut not embedded into hole	50/F	M	Install correctly sized flat or plate washers.
Slotted/oversize hole, nut embedded into hole. *Note:(+ indicates "or more", i.e. 8+ is 8 or more)*			
Not Rated			
1 nut in an 8+ bolt configuration, nut embedded	50/F	M	Install correctly sized flat or plate washers.
1 nut in a 6 bolt configuration, nut embedded OR 2 nuts in an 8+ bolt configuration, nut embedded	40/P	H	Install correctly sized flat or plate washers.
1+ nuts in a 4 bolt configuration, nut embedded OR 2+ nuts in a 6 bolt configuration, nut embedded OR 3+ nuts in an 8+ bolt configuration, nut embedded	20/C	C	Install correctly sized flat or plate washers. District Manager notified. District Manager notified.

10	Multiple top/leveling washers		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
multiple top/leveling washers not present**	70/G	-	No recommendation.
multiple top/leveling washers present	50/F	M	Remove excess washers.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

11	Lock washers present		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
lock washers not present**	70/G	-	No recommendation.
lock washers present	50/F	M	Remove lock washers.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

12	Anchor bolts other than steel - *Anchor bolts/nuts/washers are material other than steel.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
anchor bolts other than steel not present**	70/G	-	No recommendation.
anchor bolts other than steel present	50/F	M	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

13	Anchor bolt inaccessible - *Anchor bolt assembly buried over 12" deep, inaccessible by inspector.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
anchor bolt accessible**	70/G	-	Regrade around affected components, or, Install a retaining wall around foundation/base.
anchor bolt inaccessible	40/P	H	Excavate around affected components and inspect, and: Regrade around affected components, or, Install a retaining wall around foundation/base, or, Relocate structure.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

14	Base plate protective skirt - *Base plate protective skirt could not be removed, preventing inspection of anchor bolts.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
skirt present removed and inspected	70/G	-	No recommendation.
unable to remove skirt and not inspected	40/P	H	Remove protective skirt and inspect.

15	Ultrasonic testing of anchor bolts - *Ultrasonic testing of anchor bolts performed.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no indications found**	70/G	-	No recommendation.
indications found	20/C	C	Remove structure. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CON20	FD Concrete Pedestal		
1	Pedestal obstructed/buried - *Pedestal obstructed by sidewalk and not inspected / buried less than 12" and inspected / buried more than 12" and not inspected.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
buried < 12 in., excavated and inspected	50/F	L	Regrade around affected components, Install a retaining wall around foundation/base, or relocate structure.
obstructed/buried > 12 in., not inspected	40/P	H	Excavate around affected components and inspect. Regrade around affected components, Install a retaining wall around foundation/base, or relocate structure.

2	Crack, at corner of pedestal - *Crack, width W" x length L" on top/side/corner of pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
W <= 1/16 in.	70/G	-	No recommendation.
W > 1/16 in.	50/F	M	Seal cracks at affected components.

3	Cracks radiating from an. bolt - *Cracks, up to width W" x length L" radiating from anchor bolts.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
W <= 1/16 in.	70/G	L	Seal cracks at affected components.
1/16 in. < W < 1/8 in.	50/F	M	Seal cracks at affected components.
W >= 1/8 in.	40/P	H	Replace/Repair affected components.

4	Delamination/spalling of ped - *Delamination and spalling of pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
delamination/spall present	70/G	-	No recommendation.
delamination/spall with exposed reinforcing	50/F	M	Remove unsound concrete and repair affected components.
delamination/spall affecting anchor bolts	40/P	H	Remove unsound concrete and repair affected components.

5	Honeycombing on pedestal		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
honeycombing present	70/G	-	No recommendation.
honeycombing with exposed reinforcing	50/F	M	Repair affected components.
honeycombing affecting anchor bolts	40/P	H	Repair affected components.

6	Vege. growth at pedestal - *Vegetation growth on and around pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vegetation on and around pedestal, accessible	70/G	-	No recommendation.
vegetation on and around pedestal, inaccessible	70/G*	M	Clear vegetation from on and around structure.

CON21 FD Erosion/Undermining

1	Erosion around concrete ped - *Erosion of depth D' around concrete pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
depth “D” <= 1 ft.	70/G	-	No recommendation.
1 ft. < depth “D” < full height of pedestal	50/F	L	Regrade around affected components.
any undermining with exposed piles	40/P	M	Regrade around affected components.
any undermining with exposed spread footing	40/P	H	Regrade around affected components.

2	Drainage around pedestal		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no evidence of standing water**	70/G	-	No recommendation.
some evidence of standing water	50/F	L	Regrade around affected components.
top of pedestal submerged	40/P	M	Regrade around affected components.

**** If no deficiency is noted for this condition, select this item to produce an overall rating.**

CON22 FD Grout

1	Grout condition		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no grout**	70/G	-	No recommendation.
not deteriorated, leveling nuts confirmed present	50/F	L	Remove grout.
not deteriorated, leveling nuts confirmed absent	50/F	L	Notify District Manager.
deteriorated, leveling nuts confirmed present	40/P	M	Remove grout.
deteriorated, leveling nuts confirmed absent	20/C	C	Retrofit affected components, or, Remove structure. District Manager notified.

**** If no deficiency is noted for this condition, select this item to produce an overall rating.**

Sign Parapet Mount Structure Deficiency Criteria, Element Rating, Priority, and Recommendation

CONPM03 CLD Clearance Comments

1 Min. clear. < 17.5ft walkway - *Minimum measured clearance is less than Virginia Department of Transportation's minimum design clearance of 17.5' for a sign luminaire assembly or walkway.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
luminaire/walkway clear < 1ft less than min	70/G	M	Correct clearance deficiency.
luminaire/walkway clear >= 1ft less than min	70/G	H	Correct clearance deficiency.

2 Min. clear. < 19 ft for sign panel - *Minimum measured clearance is less than Virginia Department of Transportation's minimum design clearance of 19' for a sign panel.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sign panel clear < 1 ft less than min	70/G	M	Correct clearance deficiency.
sign panel clear >= 1 ft less than min	70/G	H	Correct clearance deficiency.

CONPM04 PMD General Appearance of Parapet Mount

1 Sign panel reflective material - *Sign panel reflective material is cracked/damaged/deteriorated/peeling.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sign legible	70/G		No recommendation.
sign not legible	70/G*	H	Replace affected components.

2 Bullet holes in sign panel.

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sign legible	70/G		No recommendation.
legibility reduced	70/G*	M	Replace affected components.

3 Impact damage to sign panel.

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling and legible	70/G*		No recommendation.
no danger of falling and not legible	70/G*	H	Replace affected components.
in danger of falling	20/C	C	Replace affected components. District Manager notified.

4	Corrosion of studs/bolts/clips - *Corrosion affecting studs/through bolts/clips.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 25%	50/F	L	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or Install conductive insulation between affected components.
section loss >= 25%	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

5	Backing strip studs/nuts. - *Sheared/loose/missing backing strip studs/nuts.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no backing strip studs/nuts. **	70/G	-	No recommendation.
sheared/loose/missing backing strip studs/nuts.	50/F	M	Replace affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

6	Retrofitted sign clips - *Loose/missing sign clip/bolts/nuts on retrofitted sign panel*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
loose/miss thru-bolt/clip on retrofitted sign = 0	70/G	M	No recommendation.
loose/miss thru-bolt/clip on retrofitted sign > 0	40/P	H	Replace/Repair/Tighten affected components

7	Non-retrofitted sign clip studs - *Sheared/loose/missing sign clip studs/nuts on non-retrofitted sign.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sheared studs/clip on non-retrofitted sign = 0	70/G	M	Through bolt sign panel(s).
sheared studs/clip on non-retrofitted sign > 0	40/G	H	Through bolt sign panel(s).

8	Extruded type sign clips - *Sign clips cracked/sheared on extruded type sign*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no cracked/sheared sign clips**	70/G		No recommendation.
cracked/sheared sign clips	40/P	H	Replace affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

9	Coating condition - *Coating exhibits oxidation/peeling at sign lighting luminaire housing*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
luminaire housing coating has no oxidation/peeling **	70/G		No Recommendation.
luminaire housing coating has oxidation/peeling	70/G	L	Clean, prepare, and coat affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.**			

10	Sign bulb/light broken. - *Bulb/light broken at sign lighting.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sign bulb/light not broken**	70/G*		No Recommendation.
sign bulb/light broken	70/G*	M	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

11	Corrosion affecting conduit - *Corrosion affecting conduit/connection hardware/junction boxes.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss conduit/hardware at junction box	70/G		No recommendation.
0% < section loss < 25%	70/G*	M	Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or Install conductive insulation between affected components.
section loss >= 25%	70/G*	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

12	Wiring conduit/clip/grommet - *Wiring conduit/clip/grommet loose/missing/broken/exposed wiring.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no conduit loose/missing/ broken/exposed wiring**	70/G*		No recommendation.
conduit loose/missing/broken/exposed wiring	70/G*	M	Replace/Repair affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

13	Sign luminaires hardware - *Connection hardware for luminaires/conduits/luminaire rail is loose/missing/broken.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
hardware loose/missing/broken, no danger of falling	70/G*	M	Replace/Tighten affected components.
hardware loose/missing/broken, in danger of falling	20/C	C	Replace/Tighten affected components. District Manager notified.

14	Impact damage to luminaires - *Impact damage to luminaires/conduits/luminaire rail.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling and functional	70/G*		No recommendation.
no danger of falling and not functional	70/G*	H	Replace affected components.
in danger of falling	20/C	C	Replace affected components. District Manager notified.

15	VMS – glass/ cover cracked/broken/bent/damaged		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling	70/G*	H	Replace/Repair affected components.
in danger of falling	20/C	C	Replace affected components. District Manager notified.

CONPM05 PMD Condition of Attachment to Bridge Beam/Girder

1	Connection hardware corrosion - *Corrosion affecting connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G		No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components.
section loss >= 25%	40/P	M	Replace affected components.

2	Hardware loose/missing. - *Connection hardware loose/missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
connection hardware affected < 30%	50/F	M	Replace affected components.
connection hardware affected >= 30%	40/P	H	Replace affected components.

3	Flat washers loose/missing.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
flat washers loose	50/F	L	Tighten affected components.
flat washers missing	50/F	M	Replace affected components.

4	Gap at connection.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no gap at connection. **	70/G	L	No Recommendations.
gap at connection.	50/F	M	Tighten hardware or shim the gap.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CONPM06 PMD Structural Members of Parapet Mount Structure

1	Corrosion of vertical posts - *Corrosion affecting horizontals/diagonals/struts/vertical posts.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G		No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Connection hardware corrosion - *Corrosion affecting connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G		No recommendation.
0% < section loss < 25%	50/F		Clean, prepare and coat affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
section loss >= 25%	40/P	M	Replace affected components. or for corrosion of dissimilar metals, Replace with non-reactive metals.

3	Coating Condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
coating has no oxidation/peeling**	70/G		No Recommendations.
coating has oxidation/Peeling	70/G	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

4	Hardware loose/missing/broken - *Connection hardware loose/missing at primary member connection.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
primary connection members not loose/missing**	70/G		No recommendation.
primary connection members loose/missing	20/C	C	Replace/Repair/Tighten affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

5	Hardware loose/missing/broken - *Connection hardware loose/missing at secondary member connections*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
secondary member hardware not loose/missing**	70/G		No recommendation.
secondary member hardware loose/missing	40/P	H	Replace/Repair/Tighten affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

6	Primary weld members cracked. - *Weld at primary members cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
primary weld members not cracked/broken**	70/G		No recommendation.
primary weld members cracked/broken	20/C	C	Replace/Repair affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

7	Secondary weld members - *Weld at secondary members cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
secondary weld members not cracked/broken	70/G		No recommendation.
secondary weld members cracked/broken	40/P	H	Replace/Repair affected components.

8	Bent member.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no bent member **	70/G		No recommendation.
bent member	50/F	L	Brace/straighten affected member if necessary.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CONPM07 PMD Condition of Conn to Sign/Signal Attachment

1	Corrosion of windbeam/hanger - *Corrosion affecting windbeam/hanger.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G		No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components.
25% < section loss < 50%	40/P	H	Clean, prepare, and coat affected components.
section loss >= 50%	40/P	H	Replace affected components.

2	Corrosion of sign hardware - *Corrosion affecting sign/other attachment connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G		No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or Install conductive insulation between affected components.
section loss >= 25%	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

3	Windbeam/hanger conn. hardware - *Hanger to windbeam connection hardware loose/missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
hardware loose/missing components < 25%	50/F	M	Replace/Tighten affected components.
25% <= loose/missing components < 50%	40/P	H	Replace/Tighten affected components.
50% <= loose/missing components	20/C	C	Replace/Tighten affected components. District Manager notified.

4	Hanger connection to framing - *Sign/Other attachment to chord connection bolts loose/missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
hardware loose/missing components < 25%	50/F	M	Replace/Tighten affected components.
25% <= loose/missing components < 50%	40/P	H	Replace/Tighten affected components.
50% <= loose/missing components	20/C	C	Replace/Tighten affected components. District Manager notified.

5	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
sign /frame conn. coating no oxidation/peeling**	70/G		No recommendation.
sign /frame conn. coating has oxidation/peeling	70/G	L	Clean, prepare, and coat affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.**			

CONPM08 PMD Condition of Parapet at Attachments

1	Crack on corner of parapet - *Crack, width W" x length L" on top/side/corner of parapet.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Crack width W" x length L"			
Not Rated			
width “W" <= 1/16 in.	70/G		No recommendation.
1/16 in. < “W in. width	50/F	M	Seal cracks at affected components.

2	Cracks radiating from attach. - *Cracks, up to width W" x length L" radiating from attachments*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
width W" x length L" radiating from attachments			
Not Rated			
width “W" < = 1/16 in.	70/G	L	Seal cracks at affected components.
1/16 in. < “W” width < 1/8 in.	50/F	M	Seal cracks at affected components.
1/8 in. <= “W” width	40/P	H	Replace/Repair affected components.

3	Parapet delamination/spalling - *Delamination and spalling of parapet.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
not affecting bolts/anchorage, no exposed reinforcing steel	70/G		No recommendation.
not affecting bolts/anchorage, with exposed reinforcing steel	50/F	M	Remove unsound concrete and repair affected components.
affecting bolts/anchorage	40/P	H	Remove unsound concrete and repair affected components.

CONPM09 PMD Condition of Attachment to Parapet

1	Connection hardware corrosion - *Corrosion affecting connection hardware*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G		No recommendation.
0% < section loss < 25%	50/F		Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or Install conductive insulation between affected components.
section loss >= 25%	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

2	Corrosion of beam end plates - *Corrosion affecting connection end plates.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G		No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

3	Connection hardware missing.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Total hardware = adhesive/expansion anchorage nuts missing			
Not Rated			
total hardware missing < 15%	50/F	M	Replace affected components.
15% <= total hardware missing < 30%	40/P	H	Replace affected components.
total hardware missing >= 30%	20/C	C	Replace affected components. District Manager notified.
total hardware missing from parapet	20/C	C	Replace affected components. District Manager notified.

4	Connection hardware loose.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
total hardware loose < 20%	50/F	M	Replace/Tighten affected components.
20% <= total hardware loose < 40%	40/P	H	Replace/Tighten affected components.
total hardware loose >= 40%	20/C	C	Replace/Tighten affected components. District Manager notified.
total hardware loose from parapet	20/C	C	Replace affected components. District Manager notified.

5	Flat washers loose/missing		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
flat washers present at parapet connection**	70/G		No recommendation.
flat washers loose/missing at parapet connection	50/F	M	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

6	Gap at connection.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no gap at connection.**	70/G		No recommendations.
gap at connection.	50/F	M	Tighten hardware or shim the gap.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

Signal Pole Structure Deficiency, Rating, Recommendation, and Priority Tables

CON03 **CLD Clearance Comments** (Minimum clearance for a traffic signal over the interstate)

1	Min. clear. < 16' interstate - *Minimum measured clearance is less than Virginia Department of Transportation's minimum design clearance of 16' for a traffic signal over the interstate.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
interstate clearance < 1 ft. less than min	70/G*	M	Correct clearance deficiency.
interstate clearance >= 1 ft. less than min	70/G*	H	Correct clearance deficiency.

2	Min. clear. < 15' for mast arm (Minimum clearance for a mast arm) - *Minimum measured clearance is less than Virginia Department of Transportation's minimum design clearance of 15' for a mast arm.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
mast arm clearance < 1 ft. less than min	70/G*	M	Correct clearance deficiency.
mast arm clearance >= 1 ft. less than min	70/G*	H	Correct clearance deficiency.

3	Min. clear. < 16' for span wire (Minimum clearance for a span wire) - *Minimum measured clearance is less than Virginia Department of Transportation's minimum design clearance of 16' for a span wire.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
span wire clearance < 1 ft. less than min	70/G*	M	Correct clearance deficiency.
span wire clearance >= 1 ft. less than min	70/G*	H	Correct clearance deficiency.

CON04 **SSD General Appearance of Signal Head/Attachments**

1	Connection hardware corrosion - *Corrosion affecting connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss to connection hardware	70/G	-	No recommendation.
0% < section loss < 25%	50/F	L	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or, Install conductive insulation between affected components.
25% <= section loss	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

2	Bullet holes in signal heads		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
signals functional	70/G*	-	No recommendation.
signals not functional	70/G*	H	Replace affected components.
Note: Functional/non-functional refer to signal operation.			

3	Impact damage to signal head		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no danger of falling and functional	70/G*	-	No recommendation.
no danger of falling and not functional	70/G*	H	Replace affected components.
in danger of falling	20/C	C	Replace affected components. District Manager notified.

4	Coating condition - *Coating exhibits oxidation/peeling at signal head/sign/antenna/camera/sensor.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
signal head/attachment with no oxidation/peeling**	70/G	-	No recommendation.
signal head/attachment with oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

5	Wiring exposed		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no exposed wires **	70/G	-	No recommendation.
exposed wires	70/G*	M	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

6	Loose/broken signal head - *Loose/Missing/Broken signal head/sign/antenna/camera/sensor components.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
head/sign/antenna/cam/sensor no danger of falling	70/G*	M	Replace/Repair affected components.
head/sign/antenna/cam/sensor in danger of falling	20/C	C	Replace/Repair affected components. District Manager notified.

CON05 SSD General Alignment of Structure

1	Pole Leaning - *Pole leans a horizontal distance H" over a vertical distance V".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
horizontal/vertical < 1%	70/G*	-	No recommendation.
1% <= horizontal/vertical < 2%	50/F	M	Adjust leveling/top nuts to plumb pole/base plate, or, Analyze for engineered solution
horizontal/vertical >= 2%	40/P	H	Adjust leveling/top nuts to plumb pole/base plate, or, Analyze for engineered solution

2	Base plate out of level - *Base plate out of level a vertical distance V" over a horizontal distance H".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
vertical/horizontal < 1%	70/G*	-	No recommendation.
1% <= vertical/horizontal < 2%	50/F	M	Adjust leveling/top nuts to plumb pole/base plate, or, Analyze for engineered solution
vertical/horizontal >= 2%	40/P	H	Adjust leveling/top nuts to plumb pole/base plate, or, Analyze for engineered solution

CON07 Sign/Signal Head/Other Att. to Chord/Arm/Wire Conn

1 Corrosion affecting hardware - *Corrosion affecting signal head/other attachment connection hardware.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
connection hardware with no section loss	70/G*	-	No recommendation.
0% < connection hardware w/section loss < 25%	50/F	M	Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or, Install conductive insulation between affected components.
connection hardware with section loss >= 25%	40/P	M	Replace affected components. or for corrosion of dissimilar metals, Replace with non-reactive metals.

2 Loose connection to span wire - *Signal head/Other attachment connection to span wire loose/missing/broken.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no danger of falling	40/P	H	Replace/Repair/Tighten affected components.
in danger of falling	20/C	C	Replace/Repair/Tighten affected components. District Manager Notified.

3 Loose connection to sway wire - *Connection to sway wire loose/missing/broken.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
loose/missing/broken but no danger of falling	70/G*	M	Replace/Repair/Tighten affected components.
loose/missing/broken and In danger of falling	50/F	M	Replace/Repair/Tighten affected components.

4 Loose connection to mast arm - *Signal head/Other attachment connection to mast arm loose/missing/broken.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no danger of falling	40/P	H	Replace/Repair/Tighten affected components.
in danger of falling	20/C	C	Replace/Repair/Tighten affected components. District Manager Notified.

5 Loose orbital bracket -*Orbital bracket cracked/loose/broken.*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no danger of falling	40/P	H	Replace/Repair/Tighten affected components.
in danger of falling	20/C	C	Replace/Repair/Tighten affected components. District Manager Notified.

6	Bracket/tube hardware loose - *Connection hardware loose/missing/broken at orbital bracket to gusseted tube.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no danger of falling	40/P	H	Replace/Repair/Tighten affected components.
in danger of falling	20/C	C	Replace/Repair/Tighten affected components. District Manager Notified.

7	Tube/signal set screws loose- *Set screws loose/missing at signal attachment/gusseted tube.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
loose/missing and not in danger of falling	50/F	M	Replace/Tighten affected components.
loose/missing and attachment in danger of falling	20/C	C	Replace/Repair/Tighten affected components.

8	Curved washers missing/broken - *Curved washers missing/broken at orbital bracket.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
affected washer = 1	40/P	H	Replace affected components.
affected washer > 1	20/C	C	Replace affected components. District Manager Notified.

9	Broken/loose/missing/wiring - *Wiring/Conduit/Clip/Grommet is exposed/loose/missing/broken.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
not loose/missing/broken**	70/G	-	No recommendation.
wiring/conduit/clip/grommet loose/missing/broken	70/G*	M	Replace/Repair affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

10	Coating condition - *Coating exhibits oxidation/peeling*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no oxidation/peeling**	70/G	-	No recommendation.
coating of conn. to arm/wire has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CON09 PD Vertical Support Base Plate

1	Corrosion affecting base plate		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss	70/G*	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
base plate coating has no oxidation/peeling**	70/G	-	No recommendation.
base plate coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.**			

3	Base connection welds cracked - *Weld at base plate to pole connection/base plate vertical stiffeners cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
base connection welds not cracked**	70/G	-	No recommendation.
base connection welds cracked	20/C	C	Replace/Repair affected components. District Manager notified.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

4	Base plate cracked/broken		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
base plate not cracked/broken**	70/G	-	No recommendation.
base plate cracked/broken	20/C	C	Replace/Repair affected components. District Manager notified
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

5	Base plate buried		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
base plate buried <12” deep, accessible	50/F	M	Regrade, install retaining wall, or, Relocate structure.
base plate buried >12” deep, inaccessible	40/P	H	Regrade around affected components and inspect.

6	Base protective skirt missing		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
base protective skirt loose/damaged	70/G	-	No recommendation.
base protective skirt missing	70/G*	L	Replace affected components.

7	Vegetation around/against base - *Vegetation growth around/against base plate.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
Vegetation around/against base plate, accessible	70/G*	L	Clear vegetation from on and around structure.
Vegetation around/against base plate, inaccessible	70/G*	M	Clear vegetation from on and around structure.

CON11 PD Vertical Support Trussing

1	Connection hardware corrosion - *Corrosion affecting connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss	70/G*	-	No recommendation.
0% < section loss < 25%	50/F	M	Replace affected components.
section loss >= 25%	40/P	M	Replace affected components.

2	Corrosion of truss members - *Corrosion affecting trussing members.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss	70/G*	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

3	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
No oxidation/peeling**	70/G	-	No recommendation.
vert. supp. trussing coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.

** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.

4	Hardware loose/missing/broken - *Connection hardware loose/missing/broken.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
connection hardware affected < 30%	50/F	M	Replace/Tighten affected components.
connection hardware affected >= 30%	40/P	H	Replace/Tighten affected components.

5	Connection weld cracked - *Weld at connection cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
unlikely to propagate into pole	40/P	H	Replace/Repair affected components.
likely to propagate into pole	20/C	C	Replace/Repair affected components. District Manager notified.

6	Bent truss member		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no bent truss member**	70/G	-	No recommendation.
bent truss member	50/F	L	No recommendation or brace/ straighten affected member if necessary.

** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with truss members.

CON12 PD Vertical Support Welded Joint

(Note, exclusively for welded splices in poles, not truss to pole connections)

1	Corrosion of welded splice - *Corrosion affecting welded splice of pole sections.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss	70/G*	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Weld at splice - *Weld at splice cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
weld at splice not cracked**	70/G	-	No recommendation.
weld at splice cracked	20/C	C	Replace/Repair affected components. District Manager notified.

** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with splices.

CON13 PD Cable Attachment to Vertical Support

(Note, exclusively for anchoring cables attached to poles, not span/sway wire connections.)

1	Connection hardware corrosion - *Corrosion affecting connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss	70/G*	-	No recommendation.
0% < section loss < 25%	50/F	M	Replace affected components.
section loss >= 25%	40/P	M	Replace affected components.

2	Hardware loose/missing/broken - *Connection hardware loose/missing/broken.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
affected components < 25%	50/F	M	Replace/Tighten affected components.
25% <= affected components < 50%	40/P	H	Replace/Tighten affected components.
affected components >= 50%	20/C	C	Replace/Tighten affected components. District Manager notified.

CON14 PD Vertical Support

1	Corrosion affecting pole		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss	70/G*	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no oxidation/peeling**	70/G	-	No recommendation.
vertical support coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

3	Minor loss of galvanization - *Minor/random scrapes with localized loss of galvanization.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no scrapes or local loss of galvanization**	70/G	-	No recommendation.
minor/random scrapes, local loss of galvanization	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

4	Weld at hand hole cracked		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
weld at hand hole not cracked**	70/G	-	No recommendation.
weld at hand hole cracked	20/C	C	Repair/Replace affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

5	Debris/water in pole		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no debris/water in pole**	70/G	-	No recommendation.
debris/water in Pole	70/G*	M	Remove water/debris, and, Correct drainage/accumulation deficiency.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

6	Pole dent with/without tear - *Dent with/without tear, sized horizontal projection H" x vertical projection V" x depth d", in pole of circumference C" and located vertical distance D' from base plate.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
pole measure H/pole circumference C < 5%	70/G	-	No recommendation.
5% <= pole measure H/pole circumference C < 10%	50/F	M	Repair affected components.
pole measure H/pole circumference C >= 10%	40/P	H	Replace/Repair affected components, or, Analyze for engineered solution.

7	Vegetation around/against pole - *Vegetation growth around/against pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
vegetation around/against pole, accessible	70/G*	M	Clear vegetation from on and around structure.
vegetation around/against pole, inaccessible	70/G*	M	Clear vegetation from on and around structure.

8	Hand hole cover loose/missing - *Hand hole cover loose/missing/screws loose.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
loose	70/G*	L	Replace/Repair/Tighten affected components.
missing	70/G*	M	Replace/Repair/Tighten affected components.

9	Pole cap loose/missing - *Pole cap loose/missing/set screws loose.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
pole cap set screws loose	70/G*	L	Repair/Tighten affected components.
pole cap loose	70/G*	L	Repair/Tighten affected components.
pole cap missing	70/G*	M	Replace affected components.

10	Open electrical ports		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
electrical ports closed**	70/G	-	No recommendation.
electrical ports open	70/G*	M	Close and cover hole in pole at location.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with electrical ports.**			

11	Timber pole split/checking - *Timber pole exhibits checking and splintering of up to width W".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
minor checking, width < 1/8 in.	70/G	-	No recommendation.
moderate checking, width > = 1/8 in.	50/F	-	No recommendation.

12	Timber pole exhibits decay - *Timber pole exhibits decay with loss of pole cross sectional area of percentage A.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
loss of cross-sectional area < 15%	50/F	-	No recommendation.
15% <= loss of cross-sectional area < 25%	40/P	H	Replace affected components.
25% <= loss of cross-sectional area	20/C	C	Replace affected components. District Manager notified.

13	Attachment hardware corrosion - *Corrosion affecting sign/camera/sensor/attachment connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss to connection hardware	70/G*	-	No recommendation.
0% < section loss to connection hardware < 25%	70/G*	M	Replace affected components.
section loss to connection hardware >= 25%	70/G*	M	Replace affected components.

14	Other attach. to pole loose - *Sign/Camera/Sensor/Attachment is loose/damaged/missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no danger of falling and functional	70/G	L	Replace/Repair/Tighten affected components.
no danger of falling and not functional	50/F	H	Replace affected components.
in danger of falling	20/C	C	Replace affected components. District Manager notified.

CON15	CD Chord/Arm/Wire to Pole Connection

1	Conn. plates/saddles corrosion - *Corrosion affecting connection plates/saddle blocks.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss of conn. plates/saddles	70/G*	-	No recommendation.
0% < section loss of conn. plates/saddles < 15%	50/F	M	Replace affected components.
15% <= section loss of conn. plates/saddles < 25%	40/P	H	Replace affected components.
section loss of conn. plates /saddles >= 25%	20/C	C	Replace affected components. District Manager notified.

3	Connection hardware corrosion - *Corrosion affecting connection hardware/bolts*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss to connection hardware	70/G*	-	No recommendation.
0% < section loss of connection hardware < 25%	50/F	M	Replace affected components.
section loss of connection hardware >= 25%	40/P	H	Replace affected components.

4	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no oxidation/peeling**	70/G	-	No recommendation.
connection coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.

**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.**

5	Hardware loose/missing/broken 1 - *Connection hardware loose/missing/broken at chord/arm/span wire connection to pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
chord connection to pole hardware affected < 25%	40/P	H	Replace affected components.
chord connection to pole hardware affected >= 25%	20/C	C	Replace affected components. District Manager notified.

6	Hardware loose/missing/broken 2 - *Connection hardware loose/missing/broken at sway wire connection to pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
sway wire conn. to pole hardware affected < 30%	50/F	M	Replace affected components.
sway wire conn. to pole hardware affected >= 30%	40/P	H	Replace affected components. District Manager notified

7	Missing flat washers - *Flat washers missing at chord/arm connection to pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
flat washers present at chord/pole connection **	70/G	-	No recommendation.
flat washers missing at chord to pole connection	50/F	M	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

8	Multiple flat washers present - *Multiple flat washers present at chord/arm.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
mult. flat washers not present at conn. to pole**	70/G	-	No recommendation.
multiple flat washers present at chord/pole conn.	50/F	M	Remove excess washers.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

9	Lock washers at pole conn - *Lock washers present at connection to pole. {Note, lock washers allowed on double clamp/saddle connections.}*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
lock washers not present at chord/pole connection **	70/G	-	No recommendation.
lock washers present at chord/pole connection	50/F	M	Remove Lock washers.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

10	Arm connection plate cracked – *Chord/mast arm connection plate broken/cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
arm connection plate not cracked**	70/G	-	No recommendation.
arm connection plate broken/ cracked	20/C	C	Replace affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

11	Gap between connection plates - *Gap between connection plates at chord/arm to pole connection.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no gap between connection plates**	70/G	-	No recommendation.
gap between connection plates	50/F	M	Tighten hardware or shim the gap.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CON16 CD Chord/Arm/Wire

1	Corrosion affecting chord/arm		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Corrosion of span/sway wire - *Corrosion affecting span wire/sway wire.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Replace affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

3	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no oxidation/peeling**	70/G	-	No recommendation.
chord/arm/wire coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

4	Bent chord member - *Bent chord member; out of plane distance O" over length between points of bending L".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
tension member	50/F	-	No recommendation.
compression member, O/L <20% unlikely to buckle	50/F	M	No recommendation, or, Brace/straighten affected member if necessary.
compression member, O/L >= 20% potential to buckle	40/P	H	Brace/straighten or replace affected components.

5	End cap loose/missing		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
loose	70/G*	L	Tighten affected components.
missing	70/G*	M	Replace affected components.

6	Sway wire broken		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no danger of falling	70/G*	H	Replace/Repair/Tighten affected components.
in danger of falling	20/C	C	Replace/Repair/Tighten affected components. District Manager notified.

7	Open electrical ports in chord		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
closed electrical ports**	70/G	-	No recommendation.
open electrical ports	70/G*	M	Close and cover open hole at location.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with electrical ports.**			

CON17 CD Chord/Arm/Wire Splices

1	Corrosion affecting splice		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss	70/G*	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
Section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Connection hardware corrosion - *Corrosion affecting splice connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss to splice connection hardware	70/G*	-	No recommendation.
0% < section loss to splice conn. hardware < 25%	50/F	L	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
section loss to splice connection hardware >= 25%	40/P	M	Replace affected components or for corrosion of dissimilar metals, Replace with non-reactive metals.

3	Hardware loose/missing/broken - *Connection hardware loose/missing in chord/arm tension splice. OR, Connection hardware loose/missing in chord/arm compression splice.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
tension splice hardware affected < 30%	40/P	H	Replace affected components.
tension splice hardware affected >= 30%	20/C	C	Replace affected components. District Manager notified.
compression splice hardware affected < 30%	50/F	M	Replace affected components.
compression splice hardware affected >= 30%	40/P	H	Replace affected components.

4	Weld at splice cracked		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
weld at splice not cracked**	70/G	-	No recommendation.
weld at splice cracked	20/C	C	Replace/Repair affected components. District Manager notified.

**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with splices.**

5	Span wire splice loose/broken - *Span wire splice component loose/missing/broken*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no span wire splice components loose/miss/broken	70/G	-	No recommendation.
any span wire splice component loose/miss/broken	20/C	C	Replace/Repair affected components. District Manager notified.

6	Slip joint bolt loose/missing		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
Loose	50/F	M	Tighten affected components.
missing, adjacent mast arm sections not slipping	40/P	H	Replace affected components
missing, adjacent mast arm sections slipping	20/C	C	Replace affected components. District Manager notified.

7	Slip joint washers missing - *Flat washers missing under slip joint thru bolt*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
without tear in mast arm, nut not embedded	50/F	L	Retrofit affected components.
without tear in mast arm, nut embedded	50/F	M	Retrofit affected components.
with tear in mast arm	40/P	H	Replace affected components.

CON18 CD Chord/Arm Trussing

1	Corrosion of truss members - *Corrosion affecting truss vertical/diagonal/horizontal member.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no section loss	70/G*	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Hardware loose/missing/broken - *Connection hardware loose/missing/broken.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
hardware affected < 30%	50/F	M	Tighten/Replace affected components.
hardware affected >= 30%	40/P	H	Tighten/Replace affected components.

3	Truss to chord weld cracked - *Weld at truss to chord connection cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
unlikely to propagate into chord	40/P	H	Replace/Repair affected components.
likely to propagate into chord	20/C	C	Replace affected components. District Manager notified.

4	Bent truss member		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no bent truss member**	70/G*	-	No recommendation.
bent truss member	50/F	L	Brace/straighten affected member if necessary.

** **If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with truss members.**

CON19 FD Anchor Bolts

1	Base plate to foundation gap - *Base plate to foundation height exceeds tolerance. Height between bottom of base plate and top of concrete pedestal is vertical distance H". Tolerance is related to anchor bolt diameter D".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
gap height H <= 2 x anchor bolt diameter	70/G*	-	No recommendation.
2D < H <= 2D + 1 in.	50/F	M	Lower base plate for proper base to foundation gap.
H > 2D + 1 in.	40/P	H	Lower base plate for proper base to foundation gap.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

2	Corrosion of anchor nuts/bolt - *Corrosion affecting top nut/leveling nut/bolt.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
section loss of anchor bolt/nut < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss of anchor bolt/nut < 30%	40/P	H	Replace affected components.
30% <= section loss of anchor bolt/nut	20/C	C	Replace affected components. District Manager notified.

3	Top/leveling nut loose/missing - *Top/leveling nuts missing/loose.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
1 nut in an 8+ bolt configuration	50/F	M	Replace/Tighten affected components.
1 nut in an 6 bolt configuration, OR 2 nuts in an 8+ bolt configuration	40/P	H	Replace/Tighten affected components
1+ nuts in a 4 bolt configuration, OR 2+ nuts in a 6 bolt configuration, OR 3+ nuts in an 8+ bolt configuration	20/C	C	Replace/Tighten affected components. District Manager notified.

4	Inadequately tightened nuts - *Top/leveling nuts inadequately tightened.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
1 nut in an 8+ bolt configuration	70G*	L	Tighten affected components.
1 nut in a 6 bolt configuration, OR 2 nuts in an 8+ bolt configuration	50/F	M	Tighten affected components
1+ nut in a 4 bolt configuration, OR 2+ nuts in a 6 bolt configuration, OR 3+ nuts in an 8+ bolt configuration	40/P	H	Tighten affected components

5	Anchor bolts broke/sheared/ckd - *Anchor bolts broken/sheared/cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
anchor bolts not broke/sheared/cracked **	70/G	-	No recommendation.
any anchor bolts broke/sheared/cracked	20/C	C	Replace affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

6 and 7	Anchor nut tolerance *Top/Leveling nuts improperly seated - Top/Leveling nuts improperly seated with Maximum gap D” between nut and base plate. Gap tolerance is related to anchor bolt diameter d”.* *OR* *Anchor bolts out of plumb horizontally with maximum gap D" between nut and base plate. Gap tolerance is related to anchor bolt diameter d.”*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
D/d >= 0.04 OR D/d >= 0.08			
Not Rated			
gap does not exceed tolerance for all bolts**	70/G	-	No recommendation.
Gap exceeds tolerance			
1 nut / bolt in 8+ bolt layout	50/F	M	Use tapered washers or other means to correct condition. See recommendation guide below.
1 nut / bolt in 4-7 bolt layout, OR 2 nuts / bolts in 8+ bolt layout	40/P	H	See recommendation guide below.
2 nuts / bolt in 4-7 bolt layout, OR 3+ nuts / bolt in 8+ bolt layout	20/C	C	**If 0.04 <= D/d < 0.08** Use tapered washers or other means to correct condition. District Manager notified. **If D/d >= 0.08** Replace/Repair affected components or remove structure. District Manager notified.

**** If no deficiency is noted for this condition, select this item to produce an overall rating.**

Gap, D (in.)

Bolt Diameter, d (in.)	**1/16** **0.0625**	**1/8** **0.125**	**3/16** **0.1875**	**1/4** **0.25**
1.00	0.063	0.125	0.188	0.250
1.25	0.050	0.100	0.150	0.200
1.50	0.042	0.083	0.125	0.167
1.75	0.036	0.071	0.107	0.143
2.00	0.031	0.063	0.094	0.125
2.25	0.028	0.056	0.083	0.111
2.50	0.025	0.050	0.075	0.100
2.75	0.023	0.045	0.068	0.091
3.00	0.021	0.042	0.063	0.083

(green)	**DO NOT REPORT**
(yellow)	**D/d >= 0.04**
(red)	**D/d >= 0.08**

Improperly seated top nut or leveling nut example note:

1 of 8 top/leveling nut (#3) improperly seated with 1/8" gap between top/leveling nut and base plate. (D/d>=0.04 or 0.08)

R Use tapered washers or other means to correct improperly seated top/leveling nut at anchor bolt (#3).

R Repair improperly seated top/leveling nut or replace anchor bolt (#3).

Out of plumb anchor bolt example note:

1 of 8 anchor bolts (#3) out of plumb with 1/8" gap between top nut and leveling nut and base plate. (D/d>=0.04 or 0.08)

R Use tapered washers or other means to correct improperly seated top nut and leveling nut at anchor bolt (#3).

R Repair improperly seated top nut and leveling nut or replace out of plumb anchor bolt (#3).

8	Top nut not fully engaged - *Anchor bolts short with approximate percentage E of top nut engaged.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
top nuts engaged > 75% on all anchors **	70/G	-	No recommendation.
Vertical support consists of single pole on one side of structure. E < 75%			
1 nut in an 8+ bolt single pole layout	50/F	M	Lower structure or retrofit short anchor bolt, or, Analyze for engineered solution.
1 nut in an 4-7 bolt single pole layout, OR 2 nuts in an 8+ bolt single pole layout	40/P	H	Lower structure or retrofit short anchor bolt, or, Analyze for engineered solution.
2+ nuts in an 4-7 bolt, single pole layout, OR 3+ nuts in an 8+ bolt, single pole layout	20/C	C	Lower structure or retrofit short anchor bolt, or, Analyze for engineered solution. District Manager notified.
Vertical support consists of two poles on one side of structure. E < 75%			
1 nut in an 8+ bolt double pole layout	70/G	-	No recommendation.
2 nuts in an 8+ bolt double pole layout	50/F	M	Lower structure or retrofit short anchor bolt, or, Analyze for engineered solution.
3+ nuts in an 8+ bolt double pole layout	40/P	H	Lower structure or retrofit short anchor bolt, or, Analyze for engineered solution.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

9	Top/leveling flat washers miss - *Top/Leveling flat washers missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
standard hole, not conditional	70G*	-	No recommendation.
slotted/oversize hole, nut not embedded into hole	50/F	M	Install correctly sized flat or plate washers.
Slotted/oversize hole, nut embedded into hole			
1 nut in an 8+ bolt configuration, nut embedded	50/F	M	Install correctly sized flat or plate washers.
1 nut in a 6 bolt configuration, nut embedded OR 2 nuts in an 8+ bolt configuration, nut embedded	40/P	H	Install correctly sized flat or plate washers.
1+ nuts in a 4 bolt configuration, nut embedded 2+ nuts in a 6 bolt configuration, nut embedded 3+ nuts in an 8+ bolt configuration, nut embedded	20/C	C	Install correctly sized flat or plate washers. District Manager notified.

10	Multiple top/leveling washers		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
multiple top/levelling washers not present**	70/G	-	No recommendation.
multiple top/levelling washers present	50/F		Remove excess washers.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

11	Lock washers present		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
lock washers not present**	70/G	-	No recommendation.
lock washers present	50/F	M	Remove lock washers.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

12	Anchor bolts other than steel - *Anchor bolts/nuts/washers are material other than steel.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
anchor bolts other than steel not present**	70/G	-	No recommendation.
anchor bolts other than steel present	50/F	M	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

13	Anchor bolt inaccessible - *Anchor bolt assembly buried over 12" deep, inaccessible by inspector.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
anchor bolt accessible**	70/G	-	Regrade around affected components, or, Install a retaining wall around foundation/base, or, Relocate structure.
anchor bolt inaccessible	40/P	H	Excavate around affected components and inspect, and: Regrade around affected components, or, Install a retaining wall around foundation/base, or, Relocate structure.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

14	Base plate protective skirt - *Base plate protective skirt could not be removed, preventing inspection of anchor bolts.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
skirt present removed and inspected	70/G	-	No recommendation.
unable to remove skirt and not inspected	40/P	H	Remove protective skirt and inspect.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with protective skirts.			

15	Ultrasonic testing of an. bolts - *Ultrasonic testing of anchor bolts performed*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no indications found**	70/G	-	No recommendation.
indications found	20/C	C	Replace affected components. District Manager notified.

CON20 FD Concrete Pedestal

1	Pedestal obstructed/buried - *Pedestal obstructed by sidewalk and not inspected / buried less than 12" and inspected / buried more than 12" and not inspected.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
buried < 12 in., excavated and inspected	50/F	L	Regrade around affected components, or, Install a retaining wall around foundation/base, or, Relocate structure.
obstructed by sidewalk or buried>12 in., not inspected	40/P	H	Excavate around affected components and inspect, and: Regrade around affected components, or, Install a retaining wall around foundation/base, or, Relocate structure.

2	Crack, at corner of pedestal - *Crack, width W" x length L" on top/side/corner of pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
W < 1/16 in.	70/G	-	No recommendation.
1/16 in. < W	50/F	M	Seal cracks at affected components.

3	Cracks radiating from an. bolt - Cracks, up to width W" x length L" radiating from anchor bolts.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
W <= 1/16 in.	70/G	L	Seal cracks at affected components.
1/16 in. < W < 1/8 in.	50/F	M	Seal cracks at affected components.
1/8 in. <= W	40/P	H	Replace/Repair affected components.

4	Delamination/spalling of ped - *Delamination and spalling of pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
delamination/spall present	70/G	-	No recommendation.
delamination/spall with exposed reinforcing	50/F	M	Remove unsound concrete and repair affected components.
delamination/spall affecting anchor bolts	40/P	H	Remove unsound concrete and repair affected components.

5	Honeycombing on pedestal		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
honeycombing present	70/G	-	No recommendation.
honeycombing with exposed reinforcing	50/F	M	Repair affected components.
honeycombing affecting anchor bolts	40/P	H	Repair affected components.

6	Vege. growth at pedestal - *Vegetation growth on and around pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
vegetation on and around pedestal, accessible	70/G*	L	Clear vegetation from on and around structure.
vegetation on and around pedestal, inaccessible	70/G*	M	Clear vegetation from on and around structure.

CON21 FD Erosion/Undermining

1	Erosion around concrete ped - *Erosion of depth D' around concrete pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
D <= 1 ft.	70/G	-	No recommendation.
1 ft. < D < full height of pedestal	50/F	L	Regrade around affected components.
any undermining with exposed piles	40/P	M	Regrade around affected components.
any undermining with exposed footing	40/P	H	Regrade around affected components.

2	Drainage around pedestal		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not rated			
no evidence of standing water**	70/G	-	No recommendation.
some evidence of standing water	50/F	L	Regrade around affected components.
top of pedestal submerged	40/P	M	Regrade around affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CON22 FD Grout

1	Grout condition		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no grout**	70/G	-	No recommendation.
not deteriorated, leveling nuts confirmed present	50/F	L	Remove grout.
not deteriorated, leveling nuts confirmed absent	50/F	L	Notify District Manager.
deteriorated, leveling nuts confirmed present	40/P	M	Remove grout.
deteriorated, leveling nuts confirmed absent	20/C	C	Retrofit affected components, or, Remove structure. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

Pole Structure Deficiency, Rating, Recommendation, and Priority Tables

CON05 SSD General Alignment of Structure

1	Pole leaning- *Pole leans a horizontal distance H" over a vertical distance V".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
horizontal/vertical < 1%	70/G	-	No recommendation.
1% <= horizontal/vertical < 2%	50/F	M	Adjust leveling/top nuts to plumb pole/base plate, or, Analyze for engineered solution.
horizontal/vertical >= 2%	40/P	H	Adjust leveling/top nuts to plumb pole/base plate, or, Analyze for engineered solution.

2	Base plate out of level- *Base plate out of level a vertical distance V" over a horizontal distance H".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vertical/horizontal < 1%	70/G	-	No recommendation.
1% <= vertical/horizontal < 2%	50/F	M	Adjust leveling/top nuts to plumb pole/base plate, or, Analyze for engineered solution.
vertical/horizontal >= 2%	40/P	H	Adjust leveling/top nuts to plumb pole/base plate, or, Analyze for engineered solution.

CON06 General Appearance of Luminaire Head/Camera/Att.

1	Connection hardware corrosion- *Corrosion affecting luminaire head/camera/other attachment connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in connection hardware	70/G	-	No recommendation.
0% < section loss < 25%	50/F	L	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or, Install conductive insulation between affected components.
section loss >= 25%	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or, Install conductive insulation between affected components.

2	Lumina head corrosion – *Corrosion affecting luminaire head.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in luminaire head	70/G	-	No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components.
section loss >= 25%	40/P	H	Replace affected components.

3	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no oxidation/peeling**	70/G	-	No recommendation.
luminaire head/camera coating oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted luminaire heads.**			

4	Wiring exposed.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no exposed wires**	70/G	-	No recommendation.
wiring exposed	70/G*	M	Replace/Repair affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating.**			

5	Loose/broken luminaire head - *Luminaire head/camera components loose/missing/broken.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling	50/F	M	Replace/Repair affected components.
in danger of falling	20/C	C	Replace/Repair affected components. District Manager notified.

CON07 Luminaire Head/Camera/Other Att. To Arm/Pole Connection

1	Corrosion affecting hardware - *Corrosion affecting luminaire head/camera/other attachment connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in connection hardware	70/G	-	No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Install conductive insulation between affected components, or, Replace with non-reactive metals.
section loss >= 25%	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

2	Mounting bracket corrosion *Corrosion affecting tenon/mounting bracket*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in mounting bracket	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Install conductive insulation between affected components, or, Replace with non-reactive metals.
15% < section loss < 25%	40/P	H	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
section loss >= 25%	20/C	C	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals. District Manager notified.

3	Mounting bracket broken - *Tenon/mounting bracket cracked/broken/loose.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
no danger of falling	70/G	L	Repair/replace/affected components.
in danger of falling	20/C	C	Repair/replace/affected components. District Manager notified.

4	Loose/missing hardware - *Mounting Bracket Hardware loose/missing/broken*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
tenon screws loose	50/F	L	Replace/Repair/Tighten affected components.
tenon screws missing	50/F	M	Replace affected components.

6	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
coating of connection has no oxidation/peeling **	70/G	-	No recommendation.
coating of connection has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.

**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.**

CON08	**SSD Walkway**		
1	Corrosion of walkway members. - Corrosion affecting walkway members.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in walkway members	70/G	-	No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components.
25% <= section loss < 50%	40/P	H	Clean, prepare, and coat affected components.
section loss >= 50%	20/C	C	Replace affected components. District Manager Notified.

2	Corrosion affecting hardware - *Corrosion affecting connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in connection hardware	70/G	-	No recommendation.
0% < section loss < 25%	50/F	M	Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Install conductive insulation between affected components, or, Replace with non-reactive metals.
section loss >= 25%	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

4	Coating condition - *Coating exhibits oxidation/peeling*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
walkway coating has no oxidation/ peeling**	70/G	-	No recommendation.
walkway coating has oxidation/ peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

5	Walkway member loose/damaged - *Walkway members/railing/connection/grating loose/missing/broken/have impact damage.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling	50/F	M	Replace/Repair/Tighten affected components.
In danger of falling	20/C	C	Replace/Repair/Tighten affected components. District Manager notified.

CON09 PD Vertical Support Base Plate

1	Corrosion affecting base plate - *Corrosion affecting base plate.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Coating condition- *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base plate coating has no oxidation/peeling**	70/G	-	No recommendation.
base plate coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

3	Base connection welds cracked - *Weld at base plate to pole connection/base plate vertical stiffeners cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base connection welds not cracked**	70/G	-	No recommendation.
base connection welds cracked	20/C	C	Replace/Repair affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

4	Base plate cracked/broken		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base plate not cracked/not broken**	70/G	-	No recommendation.
base plate cracked/broken	20/C	C	Replace/Repair affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

5	Base plate buried		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base plate buried < 12 in. accessible	50/F	L	Regrade, install retaining wall, or relocate structure.
base plate buried > 12 in. inaccessible	40/P	H	Excavate and inspect. Regrade, install retaining wall, or relocate structure.

6	Base protective skirt missing - *Base plate protective skirt missing/damaged.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base protective skirt not missing/loose/damaged**	70/G	-	No recommendation.
base protective skirt missing/loose/damaged	70/G*	L	Replace / Repair affected component.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

7	Vegetation around/against base - *Vegetation growth around/against base plate.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vegetation around/against base plate, accessible	70/G	-	No recommendation.
vegetation around/against base plate, inaccessible	70/G*	M	Clear vegetation from on and around structure.

8	Corrosion of transformer base - *Corrosion affecting transformer base*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss of transformer base	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components. Replace with non-reactive metals.
15% <= section loss < 25%	40/P	H	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
section loss >= 25%	20/C	C	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals. District Manager notified.

9	Corrosion affecting base/pole - *Corrosion affecting transformer base to pole connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss of base to pole conn. hardware	70/G	-	No recommendation.
0% < section loss < 25%	50/F	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
section loss >= 25%	20/C	C	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

10	T=base coating condition - *Coating exhibits oxidation/peeling at the transformer base.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
coating at T- base has no oxidation/peeling**	70/G	-	No recommendation.
coating at T-base has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures designed with transformer bases.**			

11	T-base cracked/broken - *Transformer base cracked/broken.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of collapse	40/P	H	Replace affected components.
in danger of collapse	20/C	C	Replace affected components. District Manager notified.

12	T-base to pole bolts loose - *Transformer base to pole bolts loose/missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
1 bolt in a 4 bolt configuration	50/F	M	Replace/Tighten affected components.
2 bolt in a 4 bolt configuration	40/P	H	Replace/Tighten affected components.
3+ bolt in a 4 bolt configuration	20/C	C	Replace/Tighten affected components. District Manager notified.

13	T-base to pole bolts short - *Transformer base to pole bolts short with approximate percentage E of nut engaged.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
E< 75%			
Not Rated			
1 bolt in a 4 bolt configuration	50/F	M	Replace short bolt with correctly sized bolts.
2 bolt in a 4 bolt configuration	40/P	H	Replace short bolt with correctly sized bolts.
3+ bolt in a 4 bolt configuration	20/C	C	Replace short bolt with correctly sized bolts. District Manager notified.

14	T-base to pole washers missing - *Transformer base to pole washers missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
standard hole, not conditional	70/G	-	No recommendation.
slotted/oversize hole, nut not embedded into hole	50/F	M	Install correctly sized flat or plate washers.
slotted/oversize hole, nut embedded into hole	40/P	H	Install correctly sized flat or plate washers.

15	T-Base/pole lock washers - *Transformer base to pole has lock washers present.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
T-base/pole lock washers not present**	70/G	-	No recommendation.
T-base/pole lock washers present	70/G	-	No recommendation.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

16	Access cover not removable - *Transformer base access cover plate could not be removed, preventing inspection of anchor bolts.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
T-base access cover removable	70/G	-	No recommendation.
T-base access cover not removable	40/P	H	Remove cover and inspect.

17	T-base access cover missing - *Transformer base access cover plate missing/won't secure.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
base access cover won't secure	70/G*	L	Replace/Repair/Tighten affected components.
base access cover missing	70/G*	M	Replace affected components.

18	Base interior has water/debris - *Transformer base interior has standing water/debris.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
T-base interior has no standing water/debris**	70/G*	-	No recommendation.
T-base interior has standing water/debris	70/G*	M	Remove water/debris and Correct drainage /accumulation deficiency.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on structures designed with transformer bases.			

CON10 PD Vertical Support Slip Joint

1	Corrosion of slip joint - *Corrosion affecting slip joint.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss affecting slip joint	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Long. crack in slip joint - *Longitudinal crack of approximate length L" at slip joint with pole diameter D" at crack location.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
crack length L" /pole diameter D"< 33%	20/C	H	Arrest crack and increase inspection frequency or replace/retrofit affected components. District Manager notified.
33% =< L/D < 50%	20/C	H	Retrofit affected components or replace structure. District Manager notified.
50% =< L/D	20/C	C	Replace affected components or replace structure. District Manager notified

CON14 PD Vertical Support

1	Corrosion affecting pole		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in pole	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 25%	40/P	H	Replace affected components.
section loss >= 25%	20/C	C	Replace affected components. District Manager notified.

2	Weathering stl. pole corrosion - *Corrosion affecting weathering steel pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in weathering steel pole	70/G	M	Clean, prepare, and coat affected components.
0% < section loss < 15%	50/F	H	Increase inspection frequency and clean, prepare, and coat affected components.
15% <= section loss <20%	40/P	H	Replace affected components.
section loss >= 20%	20/C	C	Replace affected components. District Manager notified.

3	Coating condition - *Coating exhibits oxidation/peeling*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vertical support has no oxidation/peeling**	70/G	-	No recommendation.
vertical support has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

4	Minor loss of galvanization - *Minor/random scrapes with localized loss of galvaniza*tion.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no scrapes or local loss of galvanization**	70/G	-	No recommendation.
minor/random scrapes, local loss of galvanization	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

5	Weld at hand hole cracked		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
weld at hand hole not cracked**	70/G	-	No recommendation.
weld at hand hole cracked	20/C	C	Repair/Replace affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

6	Debris/water in pole		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no debris/water in pole**	70/G	-	No recommendation.
debris/water in pole	70/G*	M	Remove water/debris and Correct drainage/accumulation deficiency.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

7	Pole dent with/without tear - *Dent with/without tear, sized horizontal projection H" x vertical projection V" x depth d", in pole of circumference C" and located vertical distance D' from base plate.*		
Deficiency Criteria			Recommendation
Not Rated			
pole measure H /pole circumference C < 5%	70/G	-	No recommendation.
5% <= pole measure H/pole circumference C < 10%	50/F	M	Repair affected components.
pole measure H /pole circumference C >= 10%	40/P	H	Replace/Repair affected components or analyze for engineered solution.

8	Vegetation around against pole - *Vegetation growth around/against pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vegetation around /against pole, accessible	70/G	-	No recommendation.
vegetation around /against pole, inaccessible	70/G*	M	Clear vegetation from on and around structure.

9	Hand hole cover loose/missing - *Hand hole cover loose/missing/screws loose.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
loose	70/G*	L	Repair/Tighten affected components.
missing	70/G*	M	Replace affected components.

10	Pole cap loose/missing - *Pole cap loose/missing/set screws loose.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
pole cap set screws loose	70/G*	L	Tighten affected components.
pole cap loose	70/G*	L	Replace/Repair/Tighten affected components.
pole cap missing	70/G*	M	Replace affected components.

11	Open electrical ports		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
closed electrical ports**	70/G	-	No recommendation.
open electrical ports	70/G*	M	Close or cover open port.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with electrical ports.**			

12	Timber pole split/checking - *Timber pole exhibits checking and splintering of up to width W".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
minor checking, width < 1/8 in.	70/G	-	No recommendation.
moderate checking, width > = 1/8 in.	50/F	-	No recommendation.

13	Timber pole exhibits decay - *Timber pole exhibits decay with loss of pole cross sectional area of percentage A.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
loss of cross-sectional area < 15%	50/F	-	No recommendation.
15% <= loss of cross-sectional area < 25%	40/P	H	Replace affected components.
loss of cross-sectional area => 25%	20/C	C	Replace affected components. District Manager notified.

14	Attachment hardware corrosion - *Corrosion affecting sign/camera/sensor/attachment connection hardware.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in attachment connection hardware	70/G*	-	No recommendation.
0% < section loss < 25%	70/G*	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or, Install conductive insulation between affected components.
section loss >= 25%	70/G*	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

15	Other attach. to pole loose - *Sign/Sensor/Other/Attachment is loose/damaged/missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no danger of falling and functional	70/G	L	Replace/Repair/Tighten affected components.
no danger of falling and not functional	50/F	M	Replace affected components.
in danger of falling	20/C	C	Replace affected components. District Manager notified.

CON15 CD Arm to Pole Connection

1	Connection plates corrosion - *Corrosion affecting connection plates.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in connection plates	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or, Install conductive insulation between affected components.
15% <= section loss < 25%	40/P	H	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
section loss >= 25%	20/C	C	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals. District Manager notified.

2	Connection hardware corrosion - *Corrosion affecting connection hardware/bolts*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss in connection hardware	70/G	-	No recommendation.
0% < section loss in connection hardware < 25%	50/F	M	Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals, or, Install conductive insulation between affected components.
section loss in connection hardware >= 25%	40/P	M	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.

3	Coating condition - *Coating exhibits oxidation/peeling.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
coating of arm/pole conn. has no oxidation/peeling**	70/G	-	No recommendation.
coating of arm/pole conn. has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

4	Hardware loose/missing/broken - *Connection hardware loose/missing/broken at arm connection to pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
chord conn. to pole hardware affected < 25%	40/P	H	Replace affected components.
chord conn. To pole hardware affected >= 25%	20/C	C	Replace affected components. District Manager notified.

5	Missing flat washers - *Flat washers missing at arm connection to pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
flat washers present at arm connection to pole**	70/G	-	No recommendation.
flat washers missing at arm connection to pole	50/F	M	Replace affected components
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

6	Multiple flat washers present - *Multiple flat washers present at arm.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no multiple flat washers at arm connection to pole**	70/G	-	No recommendation.
multiple flat washers at arm connection to pole	50/F	M	Remove excess washers.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

7	Lock washers at pole conn - *Lock washers present at connection to pole. {Note, lock washers allowed on double clamp/saddle connections.}*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
lock washers not present at arm connection to pole**	70/G	-	No recommendation.
lock washers present at arm connection to pole	50/F	M	Remove Lock washers.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

8	Arm connection plate cracked - *Arm connection plate broken/cra*cked.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
arm connection plate not broken/cracked**	70/G	-	No recommendation.
arm connection plate broken/cracked	20/C	C	Replace affected components. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

9	Gap between connection plates - *Gap between connection plates at arm to pole connection.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no gap between connection plates**	70/G	-	No recommendation.
gap between connection plates	50/F	M	Tighten hardware or shim the gap.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

10	Loose bolts to timber pole - *Through bolts loose at upper chord connection to timber pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no loose thru bolts upper chord conn. to tim. pole**	70/G	-	No recommendation.
loose thru bolts upper chord conn. to timber pole	40/P	H	Tighten affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

11	Loose lags to timber pole - *Lag bolts loose/missing/broken at lower chord connection to timber pole.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no loose lag bolts lower chord conn. to tim. pole**	70/G	-	No recommendation.
loose lag bolts lower chord conn. to timber pole	40/P	H	Tighten affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CON16 CD Luminaire Arm

1	Corrosion affecting arm		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no section loss to luminaire arm	70/G	-	No recommendation.
0% < section loss < 15%	50/F	M	Clean, prepare, and coat affected components, or for corrosion of dissimilar metals, Install conductive insulation between affected components.
15% <= section loss < 25%	40/P	H	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals.
section loss >= 25%	20/C	C	Replace affected components, or for corrosion of dissimilar metals, Replace with non-reactive metals. District Manager notified.

2	Coating condition - *Coating exhibits oxidation/peeling*.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
luminaire arm coating has no oxidation/peeling**	70/G	-	No recommendation.
luminaire arm coating has oxidation/peeling	70/G*	L	Clean, prepare, and coat affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all aluminum or painted structures.			

3	Bent chord member		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no bent chord member**	70/G	-	No recommendation.
bent chord member	50/F	L	No recommendation or replace effected member if necessary.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with chord members.			

4	Cracked/ruptured chord member.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no cracked/ruptured chord member**	70/G	-	No recommendation.
cracked/ruptured chord member	40/P	H	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with chord members.			

5	End cap loose/missing		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
loose	70/G*	L	Tighten affected components.
missing	70/G*	M	Replace affected components.

6	Chord strut broken - *Strut between upper and lower chord broken/cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no chord strut broken**	70/G	-	No recommendation.
chord strut broken	50/F	M	Replace/Repair affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with chord struts.			

7	Chord to chord weld cracked. - *Weld between upper and lower chord broken/cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
weld at chord to chord connection not cracked**	70/G	-	No recommendation.
weld at chord to chord connection cracked	40/P	H	Replace/Repair affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with chord welds.			

8	Open electrical ports in arm		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
closed electrical ports**	70/G	-	No recommendation.
open electrical ports	70/G*	M	Close or cover open port.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with electrical ports.			

CON19 FD Anchor Bolts

1	Base plate to foundation gap - *Base plate to foundation height exceeds tolerance. Height between bottom of base plate and top of concrete pedestal is vertical distance H". Tolerance is related to anchor bolt diameter D".*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
gap height H <= 2 x anchor bolt diameter D**	70/G	-	No recommendation.
2D < H <= 2D + 1 in.	50/F	M	Lower base plate for proper base to foundation gap.
H >2D + 1 in.	40/P	H	Lower base plate for proper base to foundation gap.
** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with chord welds.			

2	Corrosion of anchor nuts/bolt - *Corrosion affecting top nut/leveling nut/bolt.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
section loss < 15%	50/F	M	Clean, prepare, and coat affected components.
15% <= section loss < 30%	40/P	H	Replace affected components.
section loss >= 30%	20/C	C	Replace affected components. District Manager notified.

3	Top/leveling nut loose/missing - *Top/leveling nuts missing/loose.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Conventional and Offset Luminaire Structures Not on Transformer Bases (typically 4 bolt configuration)			
Not Rated			
1 nut in a 4 bolt configuration, luminaire	40/P	H	Replace/Tighten affected components.
2+ nuts in a 4 bolt configuration, luminaire	20/C	C	Replace/Tighten affected components. District Manager notified.
High Mast Light, Camera, and Cell Tower Structures			
1 nut in an 8+ bolt configuration, HM, CP, etc.	50/F	M	Replace/Tighten affected components.
1 nut in a 6+ bolt configuration, HM, CP, etc. OR 2 nuts in an 8+ bolt configuration, HM, CP, etc.	40/P	H	Replace/Tighten affected components.
1+ nut in a 4 bolt configuration, HM, CP, etc. OR 2+ nuts in a 6 bolt configuration, HM, CP, etc. OR 3+ nuts in an 8+ bolt configuration, HM, CP, etc.	20/C	C	Replace/Tighten affected components. District Manager notified.

4	Movement in transformer base - *Transformer base exhibits movement when rocked, due to loose anchor bolts. Anchor nuts visually observed to move when pole is rocked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
T-base movement, or 1 nut in 4 bolt config. moving	40/P	H	Replace/ tighten affected components.
excessive movement, or 2+ nuts in 4 bolt moving	20/C	C	Replace/ tighten affected components. District Manager notified.

5	Inadequately tightened nuts - Top/leveling nuts inadequately tightened.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Conventional and Offset Luminaire Structures Not on Transformer Bases *(typically 4 bolt configuration)*			
Not Rated			
1 nut in a 4 bolt configuration, luminaire	50/F	M	Tighten affected components.
2+ nuts in a 4 bolt configuration, luminaire	40/P	H	Tighten affected components.
3+ nuts in a 4 bolt configuration, luminaire	20/C	C	Tighten affected components. District Manager notified.
High Mast Light, Camera Pole, and Cell Tower Structures			
1 nut in an 8+ bolt configuration, HM, CP, etc.	70/G	L	Tighten affected components.
1 nut in a 6 bolt configuration, HM, CP, etc. OR 2 nuts in an 8+ bolt configuration, HM, CP, etc.	50/F	M	Tighten affected components.
1+ nut in a 4 bolt configuration, HM, CP, etc. OR 2+ nuts in a 6 bolt configuration, HM, CP, etc. OR 3+ nuts in an 8+ bolt configuration, HM, CP, etc.	40/P	H	Tighten affected components.

6	Anchor bolts broke/sheared/ckd - Anchor bolts broken/sheared/cracked.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no anchor bolts affected**	70/G	-	No recommendation.
any anchor bolt affected	20/C	C	Replace affected components or remove structure. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

7	Anchor bolts covers.		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
anchor bolt covers removable	70/G	-	No recommendation.
anchor bolt covers not removable	40/P	H	Remove anchor bolt covers as needed for inspection and testing.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

8 and 9	Anchor nut tolerance *Top/Leveling nuts improperly seated - Top/Leveling nuts improperly seated with Maximum gap D" between nut and base plate. Gap tolerance is related to anchor bolt diameter d".* *OR* *Anchor bolts out of plumb horizontally with maximum gap D" between nut and base plate. Gap tolerance is related to anchor bolt diameter d."*

Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
D/d >= 0.04 OR D/d >= 0.08			
Not Rated			
gap does not exceed tolerance for all bolts**	70/G	-	No recommendation.
Gap exceeds tolerance			
1 nut / bolt in 8+ bolt layout	50/F	M	Use tapered washers or other means to correct condition. See recommendation guide below.
1 nut / bolt in 4-7 bolt layout, OR 2 nuts / bolts in 8+ bolt layout	40/P	H	See recommendation guide below.
2 nuts / bolt in 4-7 bolt layout, OR 3+ nuts / bolt in 8+ bolt layout	20/C	C	**If 0.04 <= D/d < 0.08** Use tapered washers or other means to correct condition. District Manager notified. **If D/d >= 0.08** Replace/Repair affected components or remove structure. District Manager notified.

** If no deficiency is noted for this condition, select this item to produce an overall rating.

Bolt Diameter, d (in.)	Gap, D (in.) 1/16 0.0625	1/8 0.125	3/16 0.1875	1/4 0.25
1.00	0.063	0.125	0.188	0.250
1.25	0.050	0.100	0.150	0.200
1.50	0.042	0.083	0.125	0.167
1.75	0.036	0.071	0.107	0.143
2.00	0.031	0.063	0.094	0.125
2.25	0.028	0.056	0.083	0.111
2.50	0.025	0.050	0.075	0.100
2.75	0.023	0.045	0.068	0.091
3.00	0.021	0.042	0.063	0.083

Green	**DO NOT REPORT**
Yellow	**D/d >= 0.04**
Red	**D/d >= 0.08**

Improperly seated top nut or leveling nut example note:

1 of 8 top/leveling nut (#3) improperly seated with 1/8" gap between top/leveling nut and base plate. (D/d>=0.04 or 0.08)

R	Use tapered washers or other means to correct improperly seated top/leveling nut at anchor bolt (#3).
R	Repair improperly seated top/leveling nut or replace anchor bolt (#3).

Out of plumb anchor bolt example note:

1 of 8 anchor bolts (#3) out of plumb with 1/8" gap between top nut and leveling nut and base plate. (D/d>=0.04 or 0.08)

R	Use tapered washers or other means to correct improperly seated top nut and leveling nut at anchor bolt (#3).
R	Repair improperly seated top nut and leveling nut or replace out of plumb anchor bolt (#3).

10	Top nut not fully engaged - *Anchor bolts short with approximate percentage E of top nut engaged.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
top nuts engaged > 75% on all anchors**	70/G	-	No recommendation.
Anchor bolts short with approximate percentage E of top nut engaged, E < 75%			
1 nut in an 8+ bolts layout	50/F	M	Lower structure or retrofit short anchor bolt or analyze for engineered solution.
1 nut in a 4 - 7 bolts layout OR 2 nuts in an 8+ bolts layout	40/P	H	Lower structure or retrofit short anchor bolt or analyze for engineered solution.
2+ nuts in a 4 - 7 bolts layout OR 3+ nuts in a 8+ bolts layout	20/C	C	Lower structure or retrofit short anchor bolt or analyze for engineered solution. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

11	Top/leveling flat washers miss - *Top/Leveling flat washers missing.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
standard hole, not conditional	70/G	-	No recommendation.
slotted/oversize hole, nut not embedded into hole	50/F	M	Install correctly sized flat or plate washers.
Slotted/oversize hole, nut embedded into hole			
1 nut in an 8+ bolt configuration, not embedded	50/F	M	Install correctly sized flat or plate washers.
1 nut in a 6 bolt configuration, not embedded 2 nuts in an 8+ bolt configuration	40/P	H	Install correctly sized flat or plate washers.
1+ nuts in a 4 bolt configuration, nut embedded OR 2+ nuts in a 6 bolt configuration, nut embedded OR 3+ nuts in an 8+ bolt configuration, nut embedded	20/C	C	Install correctly sized flat or plate washers. District Manager notified.

12	Multiple top/leveling washers		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
multiple top/leveling washers not present**	70/G	-	No recommendation.
multiple top/leveling washers present	50/F	M	Remove excess washers.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

13	Lock washers present		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
lock washers not present**	70/G	-	No recommendation.
lock washers present	50/F	M	Remove lock washers.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

14	Anchor bolts other than steel - *Anchor bolts/nuts/washers are material other than steel.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no anchor bolts/nuts/washers other than steel**	70/G	-	No recommendation.
anchor bolts/nuts/washers other than steel	50/F	M	Replace affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

15	Anchor bolt inaccessible - *Anchor bolt assembly buried over 12" deep, inaccessible by inspector.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
anchor bolt accessible	70/G	-	No recommendation.
anchor bolt inaccessible	40/P	H	Excavate and inspect. Regrade, install retaining wall, or relocate structure.

16	Base plate protective skirt - *Base plate protective skirt could not be removed, preventing inspection of anchor bolts.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
skirt present removed and inspected	70/G	-	No recommendation.
unable to remove skirt and not inspected	40/P	H	Remove protective skirt and inspect.

17	Ultrasonic testing of an. bolts - *Ultrasonic testing of anchor bolts performed.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no indications found**	70/G	-	No recommendation.
indications found	20/C	C	Remove structure. District Manager notified.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, applicable only to High Mast Lights and Cameras.**			

18	T-base anchors not engaged - *Transformer base to anchor bolt connections (including nuts and washers) are not fully engaged/misaligned/undersized.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
1 bolt in a 4 bolt configuration	40/P	H	Replace/ Repair affected components.
2+ bolt in a 4 bolt configuration	20/C	C	Repair/Replace affected components. District Manager notified.

19	Breakaway couplings broken - *Breakaway couplings broken/sheared/cracked.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no breakaway couplings broken**	70/G	-	No recommendation.
any breakaway couplings broken	20/C	C	Replace affected components. District Manager notified.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with breakaway couplers.**			

20	Breakaway couplings too high - *Breakaway coupling assemblies too high. Height H" of coupler measured from top of pedestal to bottom of coupler.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
H <= ½ in. **	70/G		No recommendation
½ in. < H <= 1 in.	50/F	M	Retrofit/Replace affected Components.
H > 1 in.	40/P	H	Retrofit/Replace affected Components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with breakaway couplers.**			

21	Breakaway coupling not torqued - *Breakaway couplings not properly torqued; torque indicator nut still present above base plate.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
breakaway coupling torqued**	70/G	-	No recommendation.
breakaway coupling not torqued	50/F	M	Tighten affected components.
**** If no deficiency is noted for this condition, select this item to produce an overall rating, on all structures designed with breakaway couplers.**			

CON20	FD Concrete Pedestal		

1	Pedestal obstructed/buried - Buried less than 12" and inspected / *pedestal obstructed by sidewalk and not inspected / buried more than 12" and not inspected.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
buried < 12 in., excavated and inspected	50/F	L	Regrade, install retaining wall, or relocate structure.
obstructed/buried > 12 in., not inspected	40/P	H	Excavate and inspect. Regrade, install retaining wall, or relocate structure.

2	Crack, at corner of pedestal - *Crack, width W" x length L" on top/side/corner of pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
W <= 1/16 in.	70/G	-	No recommendation.
W > 1/16 in.	50/F	M	Seal cracks at affected components.

3	Cracks radiating from an. bolt - *Cracks, up to width W" x length L" radiating from anchor bolts.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
W <= 1/16 in.	70/G	L	Seal cracks at affected components.
1/16 in. < W < 1/8 in.	50/F	M	Seal cracks at affected components.
W >= 1/8 in.	40/P	H	Replace/Repair affected components.

4	Delamination/spalling of ped - *Delamination and spalling of pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
delamination/spall present	70/G	-	No recommendation.
delamination/spall with exposed reinforcing	50/F	M	Repair affected components.
delamination/spall affecting anchor bolts	40/P	H	Repair affected components.

5	Honeycombing on pedestal		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
honeycombing present	70/G	-	No recommendation.
honeycombing with exposed reinforcing	50/F	M	Remove unsound concrete and repair affected components.
honeycombing affecting anchor bolts	40/P	H	Remove unsound concrete and repair affected components.

6	Vege. growth at pedestal - *Vegetation growth on and around pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
vegetation on and around pedestal, accessible **	70/G	-	No recommendation.
vegetation on and around pedestal, inaccessible	70/G*	M	Clear vegetation from on and around structure.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CON21 Erosion/Undermining

1	Erosion around concrete ped - *Erosion of depth D' around concrete pedestal.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Erosion of Depth D’ around concrete pedestal			
Not Rated			
D <= 1 ft.	70/G	-	No recommendation.
1 ft. < D < full height of pedestal	50/F	L	Regrade around affected components.
any undermining with exposed piles	40/P	M	Regrade around affected components.
any undermining with exposed spread footing	40/P	H	Regrade around affected components.

2	Erosion at steel helical pile. - *Erosion of depth D' around steel helical pile.*		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Erosion of Depth D' around steel helical pile			
Not Rated			
D <= 1 ft.	70/G	-	No recommendation.
1 ft. < D < 2 ft.	50/F	L	Regrade around affected components.
2 ft. < D	40/P	M	Regrade around affected components.

3	Drainage around pedestal		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no evidence of standing water**	70/G	-	No recommendation.
some evidence of standing water	50/F	L	Regrade around affected components.
top of pedestal submerged	40/P	M	Regrade around affected components.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

CON22 FD Grout

1	Grout condition		
Deficiency Criteria	Elem Rating	Rec Priority	Recommendation
Not Rated			
no grout**	70/G	-	No recommendation.
not deteriorated, leveling nuts confirmed present	50/F	L	Remove grout.
not deteriorated, leveling nuts confirmed absent	50/F	L	Notify District Manager.
deteriorated, leveling nuts confirmed present	40/P	M	Remove grout.
deteriorated, leveling nuts confirmed absent	20/C	C	Retrofit affected components or remove structure. District Manager notified.
** If no deficiency is noted for this condition, select this item to produce an overall rating.			

APPENDIX C. ULTRASONIC TESTING REPORT AND PROCEDURES

Anchor Bolt Ultrasonic Testing Report Template

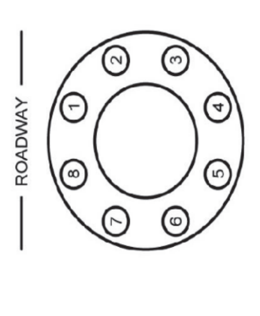
See attached "Anchor Bolt Ultrasonic Testing Report Template". Microsoft Excel files can be obtained from the Central Office. The landscape orientation ensures that the image inserted into the software is more visible in the report.

Anchor Bolt Ultrasonic Testing Report

1 of 1

Structure Number:	0010051	Instrument:	USM-GO	Number of Bolts:	8
City/County:	Accomack	db Reference Level:	41	Bolt Diameter:	1"
Structure Type:	Pole, Cell Tower	db Scanning Level:	53	Base Plate Shape:	Round
Date:	9/29/2013	Transducer Diameter:	0.5"	Base Plate Location:	Single
Inspector(s):	U.T. Inspector ({Firm})	Transducer Frequency:	5.0 Mhz		
Location:	On SR-175W (Chincoteague Rd.) at Main Street				
Other Comments:	None				

Base Plate and Bolt Layout Diagram



Note: 1st bolt always to the right of center of pole when looking from the structure towards the roadway.

Anchor Bolt (#)	Approx. Bolt Length[1] (inch)	Anchor Bolt Projection (inch)	Depth of Indication[2-3] (inch)	Indication Rating[4] (%)	Accept	Reject[5]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Notes:

[1] *ND = Not Detected*

[2] *NRI = No Relevant Indication*

[3] *CNT = Could Not Test (include reason in "Other Comments")*

[4] *___%FSH (Full Screen Height); ___dB (report only if reject criteria is met)*

[5] *Any indication above 10% FSH at scanning level*

{Firm Name or Logo}

Ultrasonic Testing of Anchor Rods

See attached "Virginia Test Method 131, Procedures for Ultrasonic Testing of Anchor Rods".

Virginia Test Method - 131

Procedure for Ultrasonic Testing of Anchor Rods - (Structures)

December 2, 2014

1. Scope

1.1 This test method outlines the procedure for ultrasonically determining discontinuities in anchor rods by the pulse echo method, using straight beam longitudinal waves induced by direct contact of the search unit with the material being tested.

2. Referenced Documents

2.1 ASTM Standards

E1 14-10 Ultrasonic Pulse Echo Straight Beam Testing by the Contact Method

3. Personnel

3.1 Personnel shall be qualified in accordance with ASNT SNT-TC-1A Level II and certified by VDOT Materials Division

4. Equipment

4.1 **Instrumentation:** Krautkramer Ultrasonic Pulse Echo Flaw Detector, Model USL58 or equivalent.

4.2 **Transducer:** 0.50 inch diameter, 5.0 Mhz Straight Beam Unit

4.3 **Couplant:** Glycerin/cellulose gum with water added for desired consistency, or equivalent.

4.4 **Reference Standard:** Reference standard material and anchor rod material should be acoustically similar.

4.5 Equipment shall be qualified in accordance with AWS D1.5 Section 6, Part C

5. Calibration

5.1 The ultrasonic unit shall be calibrated for distance on a reference standard of sufficient length and diameter to simulate the anchor rod being inspected. Sensitivity should be adjusted to a gain setting of at least 20 dB greater than that required for an 80% back-reflection from the end of the calibration standard.

5.2 Unless otherwise specified, the initial pulse and at least one back-reflection shall appear on the screen of the CRT while testing for discontinuities in material having parallel surfaces.

5.3 As a minimum, the calibration shall be checked each time there is a change in operators, when new batteries are installed, when search units are changed, when operating from one power source is changed to another power source, or when improper operation is suspected.

6. **Testing Surface**

6.1 Surfaces shall be uniform and free of loose scale and paint, discontinuities such as pits, gouges, dirt or other foreign material which can affect test results. It may be necessary to grind the top surface of the anchor rod smooth and level to insure proper acoustic coupling and transmissions.

7. **Scanning**

7.1 Apply a layer of couplant, hold the search unit in hand and move slowly over the top surface of the anchor rod.

7.2 Scanning level shall be 20dB above the calibration level as noted in 5.1.

7.3 Evaluate the first 10 inches of the anchor rod by setting the instrument range for 10" of material thickness. If there are no indications noted, reset the instrument range for 50" of material thickness. Attempt to confirm the back-reflection of the rod to determine the length of the rod and evaluate any indications in the length of the rod beyond the 10" test.

8. **Reports**

8.1 The inspector shall furnish, within 14 calendar days of the test, a report of the testing that shall include the following information: District, County, Route, Sign Structure Number, Instrument Description (Make and Model), Search Unit description (Type, Size, Frequency), Pertinent instrument settings necessary to duplicate test, Operators Name, Date of Test, and The pertinent Anchor Rod Identification Number as noted on the report (anchor rod diameter, total length of anchor rod if obtainable by back-reflection).

9. **Acceptance**

9.1 Any indications that are above 10% FSH at the prescribed scanning level shall be noted on the report, and reported to the Bridge Safety Inspection Engineer within 24 hours. The Department will make a final decision concerning the suitability of the anchor rod.

10. **Painting of Anchor Rods**

10.1 The top of the anchor rods that were ground to bare metal for inspections purposes, should be totally cleaned of couplant and painted with a zinc-rich paint.

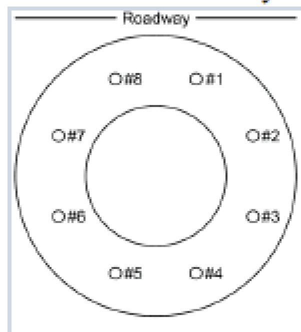
Banotz NDT Inc.
123 Example St.
Richmond, VA 23219

Structure Number:	0010051	Instrument:	USL-58
City/County:	Accomack	db Reference Level:	41
Structure Type:	Sign Structure	db Scanning Level:	53
Date:	9/29/2013	Transducer Diameter:	0.5"
Inspector(s):	U.T. Inspector	Transducer Frequency:	5.0 Mhz
Location:	On SR-175W (Chincoteague Rd.) at Main Street		

Number of Bolts:	8
Bolt Diameter:	1"
Base Plate Shape:	Round

Base Plate Location:	Single

Base Plate and Bolt Layout



Note: 1st bolt always to the right of center of pole when looking from the structure towards the roadway.

Anchor Bolt (#)	Approx. Bolt Length[1] (inch)	Anchor Bolt Projection (inch)	Depth of Indication[2-3] (inch)	Indication Rating[4] (%)	Accept	Reject[5]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Notes: [1]*ND = Not Detected* [2]*NRI = No Relevant Indication*
[3]*CNT = Could Not Test (include reason in "Other Comments")*
[4]*___%FSH (Full Screen Height); ___dB (report only if reject criteria is met)*
[5]*Any indication above 10% FSH at scanning level*

Comments:

Authorized Signature

APPENDIX D. COMMONLY USED ABBREVIATIONS

The following is a list of commonly used abbreviations that may be useful when the 255 characters per comment field are insufficient to accommodate the necessary notes. The abbreviations may also facilitate taking field notes.

General

Abbr.	Full Description	Abbr.	Full Description	Abbr.	Full Description
F	Front	R	Rear	U	Upper
L	Lower	I	Inner/Inside	O	Outer/Outside
E	End	UT	Ultrasonic Testing	MT	Magnetic Particle Testing
PT	Dye Penetrant Testing	ET	Eddy Current Testing	N/A	Not Applicable
G	Good	F	Fair	P	Poor
C	Critical	DM	District Manager	BP	Base Plate
P/BP	Pole to Base Plate Weld	AB	Anchor Bolt	TN	Top Nut
LN	Leveling Nut	FW	Flat Washer	LW	Lock Washer
Typ	Typical				

Sign Structure Components

Abbr.	Full Description	Abbr.	Full Description	Abbr.	Full Description
D	Diagonal Truss Member	V	Vertical Truss Member	EH	End Horizontal Truss Member
EV	End Vertical Truss Member	S	Splice	C	Chord
H	Hanger or Horizontal Truss Member	WB	Windbeam	BS	Backing Strip
H/C	Hanger to Chord Connection	SC	Sign Clip	LR	Luminaire Rail
C/P	Chord to Pole Connection	CFP	Chord Flange Plate	PFP	Pole Flange Plate
CP	Collar Plate	VMS	Variable Message Sign		

Traffic Signal Structure Components

Abbr.	Full Description	Abbr.	Full Description	Abbr.	Full Description
D	Orbital Bracket	MA1	Mast Arm for Primary Route/Primary Direction of Travel	MA2	Mast Arm for Secondary Route/Secondary Direction of Travel
MA1/P	Mast Arm to Pole Connection for Primary Route/Primary Direction of Travel	MA2/P	Mast Arm to Pole Connection for Secondary Route/Secondary Direction of Travel	CFP	Chord Flange Plate
PFP	Pole Flange Plate	SW1	Span Wire for Primary Route/Primary Direction of Travel	SW2	Span Wire for Secondary Route/Secondary Direction of Travel
SW1/P	Span Wire to Pole Connection for Primary Route/Primary Direction of Travel	SW2/P	Span Wire to Pole Connection for Secondary Route/Secondary Direction of Travel		

Pole Structure Components

Abbr.	Full Description	Abbr.	Full Description	Abbr.	Full Description
A	Arm	AUC	Luminaire Arm Upper Chord	ALC	Luminaire Arm Lower Chord
LH	Luminaire Head	SC	Set Screw	HML	High Mast Light

Deficiencies

Abbr.	Full Description	Abbr.	Full Description	Abbr.	Full Description
Cr	Crack	Delam	Delamination	Dia	Diameter
Eff	Efflorescence	FH	Full Height	FL	Full Length
FW	Full Width	HL	Hairline	NND	No noteworthy deficiencies
SF	Square Feet	Sp	Spall		

APPENDIX E. INSPECTION FIELD FORMS

E1. Sign Structure Inspection Form (Cantilever, Overhead Span, & Butterfly)

The form is included in the following pages.

CANTILEVER, OVERHEAD, BUTTERFLY, OTHER SIGN STRUCTURES
INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

HEADER

GPS Coordinates	**Latitude**		**Longitude**	

DETAILS

Location Description	Structure is located on

District Name		**County Name**	
City Name		**Town Name**	

Inspection Type	___ Base Inspection ___ Initial/ Inventory Inspection ___ N/A ___ Other Inspection__________________________ ___ Regular Inspection	___ Special – Catastrophic Event ___ Special – Damage Inspection ___ Special – Unscheduled Inspection ___ Special – Work Accomplished
Inspection Frequency	_____ Regular Inspection Frequency (months)	_____ Base Inspection Frequency (months)

Lead Inspector Name	
Additional Inspector Name	
Reviewer Name	

WORK PERFORMED SINCE LAST INSPECTION

___ None

Attachments	___ Underclearance Sheet ___ Location Sheet	___ Sketches ___ Other

PHOTOS THAT ARE NEEDED FOR FULL INSPECTIONS:	**PHOTOS THAT ARE NEEDED FOR BASE INSPECTIONS:**
Front View Photo # __________ Rear View Photo # __________ Left Base Photo # __________ Right Base Photo # __________ Left Chord to Pole Connection Photo # __________ Right Chord to Pole Connection Photo # __________ Deficiency # __________ Deficiency # __________ Deficiency # __________	Front View Photo # __________ Left Base Photo # __________ Right Base Photo # __________ Deficiency # __________ Deficiency # __________ Deficiency # __________

CANTILEVER, OVERHEAD, BUTTERFLY, OTHER SIGN STRUCTURES

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

RECOMMENDATIONS

RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	

CANTILEVER, OVERHEAD, BUTTERFLY, OTHER SIGN STRUCTURES

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

ATTRIBUTES

ID Number on Pole(this is the number painted on the pole).	
Route ID	
Route Direction	
Roadway Type	___ Interstate ___ Primary ___ Secondary
Structure Type	___ Butterfly ___ Cantilever ___ Other ___________________ ___ Overhead Span
Pole Type	___ Double Pole End Frame ___ Other ___ N/A ___ Single
Foundation Type	___ Bridge mount ___ Concrete barrier mount ___ Double caisson (drilled foundation) ___ Footing on other type piles ___ Footing on timber piles ___ N/A ___ Other ______________________________ ___ Single caisson (drilled foundation) ___ Spread footing ___ Steel Haunch ___ Steel helical pile ___ Unknown, unavailable, cannot be determined
Number of Anchor Bolts	
Diameter of Anchor bolts (decimal format)	
Distance from Pedestal to Base Plate	
Pole Material Type	___ Aluminum ___ Galvanized Steel ___ Other ______________________ ___ Painted Steel ___ Steel ___ Timber ___ Unknown ___ Weathering Steel
Chord Type	___ Four Chord Box Truss ___ Four Chord Vierendeel Box Truss ___ N/A ___ Other__________________________ ___ Single Chord ___ Tri-Chord ___ Two Chord Trussed ___ Two Chord Untrussed ___ Two Chord Vierendeel Truss
Span Length	
Chord Splice Type	___ Angle Joint ___ Bolted, configuration (bolt & tapped plate or welded nut) ___ Bolted, configuration (bolt & unwelded nut ___ Flange plate, circular) ___ Flange plate, square or rectangular ___ Gusset Plate ___ N/A ___ Other ________________________ ___ Slip Joint ___ Welded
Chord to Pole Attachment	___ Bolted, configuration (bolt & tapped plate or welded nut) ___ Bolted, configuration (bolt & unwelded nut) ___ Collar plate ___ Flange plate, circular ___ Flange plate, square or rectangular ___ N/A ___ Other ________________________ ___ Simple truss support, saddle & ubolt ___ Simple truss support, through bolt ___ Thimble eye bolt ___ Welded

CANTILEVER, OVERHEAD, BUTTERFLY, OTHER SIGN STRUCTURES
INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

Message Type	___ N/A ___ Other Combinations ___ Standard signs ___ Variable message (VMS) ___ Combination standard signs and VMS		
Number of Signs			
Other Attachments to Chord			
Pole Splice Type	___ Bolted, configuration (bolt & tapped plate or welded nuts) ___ Bolted, configuration (bolt & unwelded nut) ___ Flange plate, circular ___ Flange plate, square or rectangular ___ N/A ___ Other ___ Slip Joint ___ Welded		
Other Attachments to Pole			
Base Plate Shape			
Base to Pole Longitudinal Stiffeners (number of)			
Hand Holes	___ Yes ___ No ___ Other		
Nut Configuration	Top Nut		Leveling Nut
Flat Washers/ Configuration	Top		Bottom
Lock Washers/ Configuration	Top		Bottom
Bridge Structure Number		**Fabricator**	
Structure Modified Date		**Date Erected**	
Traffic Control Requirements	___ Double moving/mobile closure ___ Double stationary closure ___ Flagging operation ___ N/A ___ Other ___ Shoulder Closure ___ Single moving/mobile closure ___ Single stationary closure ___ State Police Assisted Lane Closures		
Special Access Requirements	___ Area prone to flooding ___ Barrier plates ___ Decorative base ___ Dense vegetation growth ___ VDOT Special Facility or Weigh Scale ___ Keys required ___ N/A ___ Other____________________ ___ RRX ROW entry required ___ Snooper required ___ Structure partially behind soundwall		
Far Left Shoulder Clearance		**Left Center Shoulder Clearance**	
Far Right Shoulder Clearance		**Right Center Shoulder Clearance**	
Minimum Vertical Clearance			
Lane Clearance 1		**Lane Clearance 5**	
Lane Clearance 2		**Lane Clearance 6**	
Lane Clearance 3		**Lane Clearance 7**	
Lane Clearance 4		**Lane Clearance 8**	

Structure Number: **Date of Inspection:**

OVERALL STRUCTURE COMMENTS

___ Good condition (70) ___ Fair condition (50) ___ Poor condition (40) ___ Critical condition (20) ___ Emergency condition (0)

IMPORTANT! - Photo required for any defect (other than loose bolts) that causes the Overall Superstructure Rating to receive a Poor (4) rating or worse.

Deficiencies:

Structure Number: **Date of Inspection:**

CLEARANCE CONDITION DATA

Clearance Comments:	
Min. Clear. < 17.5' walkway Min. Clear. < 19' for panel	

SUPERSTRUCTURE CONDITION DATA

General Appearance of Sign/ Sign Lighting/ Att.:	
Sign panel reflective material	
Bullet holes in sign panel.	
Impact damage to sign panel.	
Corrosion of studs/bolts/clips	
Backing strip studs/nuts.	
Retrofitted sign clips	
Non-retrofitted sign clip studs	
Clips on extruded type sign	
Coating condition	
Sign bulb/light broken	
Corrosion affecting conduit	
Impact damage to luminaires	
Wiring conduit/clip/grommet	
Sign luminaires hardware	
VMS – glass/ cover cracked/ broken/ bent/ damaged	
Impact damage to luminaires	
General Alignment of Structure:	
Pole leaning	
Base plate out of level	
Attachment to Chord Connection:	
Corrosion of wind beam/hanger	
Corrosion of sign hardware	
Hanger to wind beam connection hardware loose/missing	
Sign chord connection bolts	
Coating condition	
Walkway:	
Corrosion of walkway members	
Corrosion of connection hardware	
Coating condition	
Walkway member loose/damaged	

CANTILEVER, OVERHEAD, BUTTERFLY, OTHER SIGN STRUCTURES

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

POLE CONDITION DATA

Vertical Support Base Plate:	
Corrosion affecting base plate	
Coating condition	
Base Connection Welds Cracked	
Base plate cracked/broken	
Base plate buried > 12" deep	
Base protective skirt missing	
Vegetation around/against base	
Vertical Support Trussing:	
Connection Hardware Corrosion	
Corrosion of truss members	
Coating condition	
Hardware Loose/Missing/Broken	
Connection Weld Cracked	
Bent truss member	
Vertical Support Welded Joints:	
Corrosion of welded splice	
Weld at Splice cracked	
Vertical Support:	
Corrosion affecting pole	
Coating condition	
Minor loss of galvanization	
Weld at hand hole cracked	
Debris in pole	
Pole Dent with/without tear	
Vegetation around/against pole	
Hand Hole Cover Loose/Missing	
Pole Cap Loose/Missing	
Open electrical ports	
Attachment hardware corrosion	
Sign attachment loose/damaged	

CANTILEVER, OVERHEAD, BUTTERFLY, OTHER SIGN STRUCTURES

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

CHORD CONDITION DATA

Chord to Pole Connection:	
Corrosion of Plates/Saddles	
Connection Hardware Corrosion	
Coating condition	
Hardware Loose/Missing/Broken	
Hardware Loose/Missing/Broken	
Hardware Loose/Missing/Broken	
Missing Flat Washers	
Multiple Flat Washers Present	
Lock Washers at Pole Conn	
Chord Connection Plate Cracked	
Gap between connection plates	
Chord/ Arm/ Wire:	
Corrosion affecting chord	
Coating condition	
Bent Chord Member	
Open electrical ports in chord	
End cap loose/missing	
Chord Splices:	
Corrosion affecting splice	
Connection hardware corrosion	
Hardware Loose/Missing/Broken	
Hardware Loose/Missing/Broken	
Weld at splice cracked	
Chord Trussing:	
Corrosion of truss members	
Hardware Loose/Missing/Broken	
Truss to chord weld cracked	
Bent truss member	

CANTILEVER, OVERHEAD, BUTTERFLY, OTHER SIGN STRUCTURES

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

FOUNDATION CONDITION DATA

Anchor Bolts:	
Base plate to foundation gap	
Corrosion of anchor nuts/Bolt	
Inadequately tightened nuts	
Top/leveling nuts loose	
Top/leveling nuts missing	
Anchor bolts broke/sheared/cracked	
Top nuts improperly seated / Anchor Bolt Slope	
Top nut not fully engaged	
Top/Leveling flat washers missing	
Multiple top/leveling washers	
Lock washers present	
Anchor bolts other than steel	
Anchor bolt inaccessible	
Base plate protective skirt	
Ultrasonic testing of an. bolts	
Concrete Pedestal:	
Pedestal obstr. by sidewalk/buried	
Crack, at corner of pedestal	
Cracks, radiating from an. bolts	
Delamination/spalling of pedestal	
Honeycombing on pedestal	
Vegetation growth at pedestal	
Erosion/Undermining:	
Erosion around concrete pedestal	
Drainage around pedestal	
Grout:	
Grout condition	

E2. Bridge Parapet Mount Sign Structure Inspection Form

The form is included in the following pages.

BRIDGE PARAPET MOUNT
INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

HEADER

GPS Coordinates	**Latitude**		**Longitude**	

DETAILS

Location Description	Structure is located on

District Name		**County Name**	
City Name		**Town Name**	

Inspection Type	___ Base Inspection ___ Initial/ Inventory Inspection ___ N/A ___ Other Inspection___________________________ ___ Regular Inspection	___ Special – Catastrophic Event ___ Special – Damage Inspection ___ Special – Unscheduled Inspection ___ Special – Work Accomplished
Inspection Frequency	_____ Regular Inspection Frequency (months)	

Lead Inspector Name	
Additional Inspector Name	
Reviewer Name	

WORK PERFORMED SINCE LAST INSPECTION

___ None

PHOTOS THAT ARE NEEDED FOR FULL INSPECTIONS:	PHOTOS THAT ARE NEEDED FOR BASE INSPECTIONS:
Front View Photo # __________ Rear View Photo # __________ Bridge Attachment, Parapet Anchorage (Non-through Bolt) # __________ Bridge Beam Attachment # __________ Deficiency # __________ Deficiency # __________ Deficiency # __________	N/A

BRIDGE PARAPET MOUNT
INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

RECOMMENDATIONS

RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	

BRIDGE PARAPET MOUNT

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

ATTRIBUTES

ID Number on Pole (this is the number painted on the pole).			
Route ID			
Route Direction			
Roadway Type	___ Interstate ___ Primary ___ Secondary		
Structure Type	______ Bridge Parapet Mount		
Structure Material Type	___ Aluminum ___ Galvanized Steel ___ Other ___ Painted Steel ___ Steel ___ Timber ___ Unknown ___ Weathering Steel		
Message Type	___ N/A ___ Other Combinations ___ Standard signs ___ Variable message (VMS) ___ Combination standard signs and VMS		
VMS Type	___ Bulb ___ Disc ___ Fiber Optic ___ Hybrid Fiber Optic ___ Hybrid LED ___ LED ___ N/A ___ Other		
Number of Attachments			
Number of Signs			
Bridge Mount Anchorage Type	___ Adhesive Insert ___ Expansion Anchorage ___ N/A ___ Other ___ Saddle/Bracket Assembly – Beam Mounted ___ Saddle/Bracket Assembly – parapet mounted ___ Through Bolt, Beam Mount ___ Through Bolt, Parapet Mount		
Nut Configuration	Top Nut		Leveling Nut
Flat Washers/ Configuration	Top		Bottom
Lock Washers/ Configuration	Top		Bottom
Bridge Structure Number		**Fabricator**	
Structure Modified Date		**Date Erected**	
Traffic Control Requirements	___ Double moving/mobile closure ___ Double stationary closure ___ Flagging operation ___ N/A ___ Other ___ Shoulder Closure ___ Single moving/mobile closure ___ Single stationary closure ___ State Police Assisted Lane Closures		

BRIDGE PARAPET MOUNT
INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

Special Access Requirements	___ Area prone to flooding ___ Barrier plates ___ Decorative base ___ Dense vegetation growth ___ VDOT Special Facility or Weigh Scale	___ Keys required ___ N/A ___ Other ___ RRX ROW entry required ___ Snooper required ___ Structure partially behind soundwall	
Far Left Shoulder Clearance		**Left Center Shoulder Clearance**	
Far Right Shoulder Clearance		**Right Center Shoulder Clearance**	
Minimum Vertical Clearance			
Lane Clearance 1		**Lane Clearance 5**	
Lane Clearance 2		**Lane Clearance 6**	
Lane Clearance 3		**Lane Clearance 7**	
Lane Clearance 4		**Lane Clearance 8**	

OVERALL STRUCTURE COMMENTS

___ Good condition (70) ___ Fair condition (50) ___ Poor condition (40) ___ Critical condition (20) ___ Emergency condition (0)

IMPORTANT! - Photo required for any defect (other than loose bolts) that causes the Overall Superstructure Rating to receive a Poor (4) rating or worse.

Deficiencies:

BRIDGE PARAPET MOUNT

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

CLEARANCE CONDITION DATA

Clearance Comments:	
Min. Clear. < 17.5' walkway	
Min. Clear. < 19' for sign panel	

SUPERSTRUCTURE CONDITION DATA

Condition of Attachment to Bridge Beam/Girder:	
Corrosion affecting connection hardware	
Hardware Loose/Missing	
Flat washers Loose/Missing	
Gap at connection	
General Appearance of Parapet Mount:	
Sign panel reflective material	
Bullet holes in sign panel.	
Impact damage to sign panel.	
Corrosion of studs/bolts/clips	
Backing strip studs/nuts.	
Retrofitted sign clips	
Non-retrofitted sign clip studs	
Clips on extruded type sign	
Coating condition	
Sign bulb/light broken	
Corrosion affecting conduit	
Wiring conduit/clip/grommet	
Sign luminaires hardware	
Impact damage to luminaires	
Alignment:	
Corrosion affecting connection hardware	
Hardware Loose/Missing	
Flat washers Loose/Missing	
Gap at connection	
Structural Members of Parapet Mount Structure:	
Corrosion of vertical posts	
Corrosion of connection hardware	
Coating condition	
Hardware Loose/Missing/Broken	
Weld at Primary Member	
Weld at Secondary Member	
Bent member	

BRIDGE PARAPET MOUNT

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

SUPERSTRUCTURE CONDITION DATA

Condition of Conn to Sign/Signal Attachment:	
Corrosion of wind beam/hanger	
Corrosion of sign hardware	
Hanger connection to Framing	
Wind beam/hanger connection bolts	
Coating condition	
Condition of Parapet at Attachments:	
Crack, at corner of parapet	
Cracks, radiating from attachments	
Delamination/spalling of parapet	
Condition of Attachment to Parapet:	
Corrosion of connection hardware	
Corrosion of beam end plates	
Connection hardware missing	
Connection hardware loose	
Flat Washers Loose/Missing	
Gap at connection	

E3. Traffic Signal Pole Inspection Form

The form is included in the following pages.

SIGNAL POLE STRUCTURES
INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

HEADER

GPS Coordinates	**Latitude**		**Longitude**	

DETAILS

Location Description	Structure is located on

District Name		**County Name**	
City Name		**Town Name**	

Inspection Type	___ Base Inspection ___ Initial/ Inventory Inspection ___ N/A ___ Other Inspection___________________________ ___ Regular Inspection	___ Special – Catastrophic Event ___ Special – Damage Inspection ___ Special – Unscheduled Inspection ___ Special – Work Accomplished
Inspection Frequency	_____ Regular Inspection Frequency (months)	_____ Base Inspection Frequency (months)

Lead Inspector Name	
Additional Inspector Name	
Reviewer Name	

WORK PERFORMED SINCE LAST INSPECTION

___ None

Attachments	___ Underclearance Sheet ___ Location Sheet	___ Sketches ___ Other

PHOTOS THAT ARE NEEDED FOR FULL INSPECTIONS:	PHOTOS THAT ARE NEEDED FOR BASE INSPECTIONS:
The primary front view of the structure. Photo # __________	Primary Front View Photo # __________
The primary rear view of the structure. Photo # __________	Primary Rear View Photo # __________
The secondary front view of the structure. Photo # __________	Secondary Front View Photo # __________
The secondary rear view of the structure. Photo # __________	Secondary Rear View Photo # __________
The view of the pedestal/base. Photo # __________	Pole Base Photo # __________
The view of the arm to pole connection(s) Photo # __________	Mast Arm to Pole Connection Photo # __________
The view of the span wire to pole connection(s) Photo # __________	Span Wire to Pole Connection Photo # __________
Deficiency # __________	Deficiency # __________
Deficiency # __________	Deficiency # __________
Deficiency # __________	Deficiency # __________

Structure Number: **Date of Inspection:**

RECOMMENDATIONS

RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	

Structure Number: **Date of Inspection:**

ATTRIBUTES

ID Number on Pole (this is the number painted on the pole)	
Signal Pole Group ID	
Route ID	
Route Direction	
Roadway Type	___ Interstate ___ Primary ___ Secondary
Structure Type	___ N/A ___ Others ___ Single Mast Arm ___ Dual Mast Arm ___ Overhead Span ___ Span Wire
Pole Height (ft.)	
Pole Diameter (in.)	
Pole Type	___ Double Pole End Frame ___ Other ___ Single Pole ___ N/A
Foundation Type	___ Bridge Mount ___ Concrete barrier mount ___ Double caisson (drilled foundation) ___ Fixed Attachment ___ Footing on other type piles ___ Footing on timber piles ___ N/A ___ Other ______________________ ___ Single caisson (drilled foundation) ___ Spread footing ___ Steel Haunch ___ Steel helical pile ___ Unknown, unavailable, cannot be determined
Number of Anchor Bolts	
Diameter of Anchor bolts (decimal format)	
Distance from Pedestal to Base Plate	
Pole Material Type	___ Aluminum ___ Galvanized Steel ___ Other _________ ___ Painted Steel ___ Steel ___ Timber ___ Unknown ___ Weathering Steel
Primary Chord Type	___ Other ___ Single Chord (Mast Arm) ___ Span Wire ___ Two Chord Trussed ___ Two Chord Untrussed
Primary Span Length	
Secondary Chord Type	___ Other ___ Single Chord (Mast Arm) ___ Span Wire ___ Two Chord Trussed ___ Two Chord Untrussed
Secondary Span Length	
Distance from Pedestal to Base Plate	

Structure Number: **Date of Inspection:**

Chord/Primary Arm Splice Type	___ Angle Joint ___ Bolted, configuration (bolt & tapped plate or welded nut) ___ Bolted, configuration (bolt & unwelded nut) ___ Flange plate, circular ___ Flange plate, square or rectangular	___ Gusset Plate ___ N/A ___ Other ____________________ ___ Slip Joint ___ Welded
Chord/Primary Arm to Pole Attachment	___ Bolted, configuration (bolt & tapped plate or welded nut) ___ Bolted, configuration (bolt & unwelded nut) ___ Collar plate ___ Flange plate, circular ___ Flange plate, square or rectangular ___ N/A	___ Other ________________________ ___ Simple truss support, saddle & ubolt ___ Simple truss support, through bolt ___ Thimble eye bolt ___ Welded
Secondary Arm Splice Type	___ Angle Joint ___ Bolted, configuration (bolt & tapped plate or welded nut) ___ Bolted, configuration (bolt & unwelded nut) ___ Flange plate, circular ___ Flange plate, square or rectangular	___ Gusset Plate ___ N/A ___ Other ________________________ ___ Slip Joint ___ Welded
Secondary Arm to Pole Attachment	___ Bolted, configuration (bolt & tapped plate or welded nut) ___ Bolted, configuration (bolt & unwelded nut) ___ Collar plate ___ Flange plate, circular ___ Flange plate, square or rectangular ___ N/A	___ Other ________________________ ___ Simple truss support, saddle & ubolt ___ Simple truss support, through bolt ___ Thimble eye bolt ___ Welded
Pole Splice Type	___ Bolted, configuration (bolt & tapped plate or welded nuts) ___ Bolted, configuration (bolt & unwelded nut) ___ Flange plate, circular ___ Flange plate, square or rectangular	___ N/A ___ Other ___ Slip Joint ___ Welded
Other Attachments to Pole		
Base Plate Shape		
Base to Pole Longitudinal Stiffeners (number of)		
Hand Holes	___ Yes ___ Other ___ No	
Nut Configuration	Top Nut	Leveling Nut
Flat Washers/ Configuration	Top	Bottom
Lock Washers/ Configuration	Top	Bottom
Chord/ Primary Arm Number of Signals		
Other Attachments to Chord/Primary Arm		
Secondary Arm Number of Signals		

SIGNAL POLE STRUCTURES

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

Other Attachments of Secondary Arm			
Bridge Structure Number		**Fabricator**	
Structure Modified Date		**Date Erected**	
Traffic Control Requirements	___ Double moving/mobile closure ___ Double stationary closure ___ Flagging operation ___ N/A ___ Other	___ Shoulder Closure ___ Single moving/mobile closure ___ Single stationary closure ___ State Police Assisted Lane Closures	
Special Access Requirements	___ Area prone to flooding ___ Barrier plates ___ Decorative base plate ___ Dense vegetation growth ___ VDOT Special Facility or Weigh Scale	___ Keys required ___ N/A ___ Other ___ RRX ROW entry required ___ Snooper required ___ Structure partially behind soundwall	
Far Left Shoulder Clearance		**Left Center Shoulder Clearance**	
Far Right Shoulder Clearance		**Right Center Shoulder Clearance**	
Minimum Vertical Clearance			
Lane Clearance 1		**Lane Clearance 5**	
Lane Clearance 2		**Lane Clearance 6**	
Lane Clearance 3		**Lane Clearance 7**	
Lane Clearance 4		**Lane Clearance 8**	

OVERALL STRUCTURE COMMENTS

___ Good condition (70) ___ Fair condition (50) ___ Poor condition (40) ___ Critical condition (20) ___ Emergency condition (0)

IMPORTANT! - Photo required for any defect (other than loose bolts) that causes the Overall Superstructure Rating to receive a Poor (4) rating or worse.

Deficiencies:

Structure Number: **Date of Inspection:**

CLEARANCE CONDITION DATA

Clearance Comments:	
Min. Clear. < 16' Interstate	
Min. Clear. < 15' for mast arm	
Min. Clear. < 16' for Spanwire	

SUPERSTRUCTURE CONDITION DATA

General Appearance of Signal Head/Attachments:	
Connection Hardware Corrosion	
~~Corrosion of dissimilar metals~~	
Bullet holes in signal heads	
Impact damage to signal head	
Coating condition	
Wiring exposed	
Loose/broken Signal head	
General Alignment of Structure:	
Pole leaning	
Base plate out of level	
Sign/Signal Head/Other Attachment to Chord/Arm/Wire Connection:	
Corrosion affecting hardware	
~~Corrosion of dissimilar metals~~	
Loose connection to span wire	
Loose connection to sway wire	
Loose connection to mast arm	
Loose orbital bracket	
Bracket/tube hardware loose	
Tube/signal set screws loose	
Curved washers missing/broken	
Broken/Loose/Missing/Wiring	
Coating condition	

SIGNAL POLE STRUCTURES

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

POLE CONDITION DATA

Vertical Support Base Plate:	
Corrosion affecting base plate	
Coating condition	
Base Connection Welds Cracked	
Base plate cracked/broken	
Base plate buried	
Base protective skirt missing	
Vegetation around/against base	
Vertical Support Trussing:	
Connection Hardware Corrosion	
Corrosion of truss members	
Coating condition	
Hardware Loose/Missing/Broken	
Connection Weld Cracked	
Bent truss member	
Vertical Support Weld Joint:	
Corrosion of welded splice	
Weld at splice	
PD Cable Attachment to Vertical Support:	
Connection Hardware Corrosion	
Hardware Loose/Missing/Broken	
Vertical Support:	
Corrosion affecting pole	
Coating condition	
Minor loss of galvanization	
Weld at hand hole cracked	
Debris/Water in pole	
Pole Dent with/without tear	
Vegetation around against pole	
Hand Hole Cover Loose/Missing	
Pole Cap Loose/Missing	
Open electrical ports	
Timber pole Split/Checking	
Timber pole exhibits decay	
~~Connection~~ Hardware Corrosion	
~~Corrosion of dissimilar metals~~	
~~Attachment Loose/Damaged~~	

SIGNAL POLE STRUCTURES
INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

CHORD CONDITION DATA

Chord/Arm/Wire to Pole Connection:	
Connection Plates/ Saddles Corrosion	
~~Corrosion of dissimilar metals~~	
Connection Hardware Corrosion	
~~Corrosion of dissimilar metals~~	
Coating condition	
Hardware Loose/Missing/Broken1	
Hardware Loose/Missing/Broken2	
Missing Flat Washers	
Multiple Flat Washers Present	
Lock Washers at Pole Conn	
Arm Connection Plate Cracked	
Gap between connection plates	
Chord/Arm/Wire:	
Corrosion affecting Chord/arm	
Corrosion of Span/Sway Wire	
Coating condition	
Bent Chord Member	
End cap loose/missing	
Sway wire broken	
Chord/Arm/Wire Splices:	
Corrosion affecting splice	
Connection hardware corrosion	
~~Corrosion of dissimilar metals~~	
Hardware Loose/Missing/Broken	
Weld at splice cracked	
Span wire splice Loose/Broken	
Slip joint bolt loose/missing	
Chord/Arm Trussing:	
Corrosion of truss members	
Hardware Loose/Missing/Broken	
Truss to chord weld cracked	
Bent truss member	

SIGNAL POLE STRUCTURES
INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

FOUNDATION CONDITION DATA

Anchor Bolts:	
Base plate to foundation gap	
Corrosion of anchor bolt/nuts	
Top/leveling nuts loose/missing	
Inadequately tightened nuts	
Anchor bolts broke/sheared/cracked	
~~Top nuts improperly seated / Anchor Bolt Slope~~	
Top nut not fully engaged	
Top/Leveling flat washers missing	
Multiple top/leveling washers	
Lock washers present	
Anchor bolts other than steel	
Anchor bolt inaccessible	
Base plate protective skirt	
Ultrasonic testing of an. bolts	
Concrete Pedestal:	
Pedestal obstructed/buried	
Crack, at corner of pedestal	
Cracks, radiating from an. bolts	
Delamination/spalling of pedestal	
Honeycombing on pedestal	
Vege. growth at pedestal	
Erosion/Undermining:	
Erosion around concrete pedestal	
Drainage around pedestal	
Grout:	
Grout condition	

E4. Lighting and Camera Pole Inspection Form

The form is included in the following pages.

LUMINAIRE, HIGH MAST LIGHTING AND CAMERA POLE STRUCTURES
INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

HEADER

GPS Coordinates	Latitude		Longitude	

DETAILS

Location Description	Structure is located on

District Name		**County Name**	
City Name		**Town Name**	

Inspection Type	___ Base Inspection ___ ___ Initial/ Inventory Inspection ___ N/A ___ Other Inspection__________________________ ___ Regular Inspection	___ Special – Catastrophic Event ___ ___ Special – Damage Inspection ___ Special – Unscheduled Inspection ___ Special – Work Accomplished
Inspection Frequency	_____ Regular Inspection Frequency (months)	_____ Base Inspection Frequency (months)

Lead Inspector Name	
Additional Inspector Name	
Reviewer Name	

WORK PERFORMED SINCE LAST INSPECTION

___ None

Attachments	___ Underclearance Sheet ___ Location Sheet	___ Sketches ___ Other

PHOTOS THAT ARE NEEDED FOR FULL INSPECTIONS:	PHOTOS THAT ARE NEEDED FOR BASE INSPECTIONS:
Front View Photo # __________ Base Photo # __________ Arm to Pole Connection Photo # __________ Luminaire Head; Camera; Antenna Photo # __________ Deficiency # __________ Deficiency # __________ Deficiency # __________	Front View Photo # __________ Base Photo # __________ Deficiency # __________ Deficiency # __________ Deficiency # __________

Structure Number: **Date of Inspection:**

RECOMMENDATIONS

RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	
RECOMMENDATION _______ PRIORITY:					
1-L	2-M	3-H	4-C	5-E	

Structure Number: **Date of Inspection:**

ATTRIBUTES

ID Number on Pole (this is the number painted on the pole)	
Route Direction	
Route ID	
Asset Status (Active/ Removed)	
Roadway Type	___ Interstate ___ Primary ___ Secondary
Structure Type	___ Camera Poles ___ High Mast ___ Luminaire ___ Other
Pole Height	
Pole Diameter	
Foundation Type	___ Bridge mount ___ Concrete barrier mount ___ Double caisson (drilled foundation) ___ Footing on other type piles ___ Footing on timber piles ___ N/A ___ Others ___ Single caisson (drilled foundation) ___ Spread footing ___ Steel Haunch ___ Steel helical pile ___ Unknown, unavailable, cannot be determined
Number of Anchor Bolts	
Diameter of Anchor bolts (decimal format)	
Distance from Pedestal to Base Plate	
Pole Material Type	___ Aluminum ___ Galvanized Steel ___ Other ___ Painted Steel ___ Steel ___ Timber ___ Unknown ___ Weathering Steel
Chord Type	___ Single Chord {Includes untrussed luminaire arm} ___ Two Chord Trussed {Includes two chord trussed luminaire arm} ___ Two Chord Untrussed {Includes two chord untrussed luminaire arm} ___ Others ___ N/A ___
Span Length	
Chord to Pole Attachment	___ Bolted, configuration (bolt & tapped plate or welded nut) ___ Bolted, configuration (bolt & unwelded nut) ___ Collar plate ___ Flange plate, circular ___ Flange plate, square or rectangular ___ N/A ___ Other ___ Simple truss support, saddle & ubolt ___ Simple truss support, through bolt ___ Thimble eye bolt ___ Welded
Pole Splice Type	___ Bolted, configuration {bolt & tapped plate or welded nuts} ___ Bolted, configuration {bolt & unwelded nut} ___ Flange plate, circular ___ Flange plate, square or rectangular ___ N/A ___ Other ___ Slip Joint ___ Welded
Other Attachments to Pole	

LUMINAIRE, HIGH MAST LIGHTING AND CAMERA POLE STRUCTURES

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

Base to Pole Longitudinal Stiffeners (number of)		
Hand Holes	___ Yes ___ Other ___ No	
Nut Configuration	Top Nut	Leveling Nut
Flat Washers/ Configuration	Top	Bottom
Lock Washers/ Configuration	Top	Bottom
Breakaway Base Type	___ Slip Base ___ Coupling with Torque Control Nut ___ Coupling with Hex Nut ___ Double Neck Coupling	___ Frangible Transformer Base ___ Other ___ N/A
Breakaway Base Material	___ Aluminum ___ Other ___ Steel ___ N/A	
Breakaway Coupler Height		
Vibration Dampener Type	___ Single Phase ___ Double Phase ___ None	
Bridge Number		
Fabricator Company ID		
Structure Modified Date		
Date Erected		
Traffic Control Requirements	___ Double moving/mobile closure ___ Double stationary closure ___ Flagging operation ___ N/A ___ Other	___ Shoulder Closure ___ Single moving/mobile closure ___ Single stationary closure ___ State Police Assisted Lane Closures
Special Access Requirements	___ Area prone to flooding ___ Barrier plates ___ Decorative base plate ___ Dense vegetation growth	___ Keys required ___ N/A ___ Other ___ RRX ROW entry required ___ Snooper required

OVERALL STRUCTURE COMMENTS

Structure Number: **Date of Inspection:**

___ Good condition (70) ___ Fair condition (50) ___ Poor condition (40) ___ Critical condition (20) ___ Emergency condition (0)

IMPORTANT! - Photo required for any defect (other than loose bolts) that causes the Overall Superstructure Rating to receive a Poor (4) rating or worse.

Deficiencies:

Structure Number: **Date of Inspection:**

CLEARANCE CONDITION DATA

Clearance Comments:	
Min. Clear. < 17.5' walkway	

SUPERSTRUCTURE CONDITION DATA

General Alignment of Structure:	
Pole leaning	
Base plate out of level	
General Appearance of Luminaire Head/ Camera/Attachments:	
Connection Hardware Corrosion	
Lumina Head Corrosion	
Coating Condition	
Wiring exposed	
Loose/broken luminaire head	
Luminaire Head/Camera/Other Attachment to Arm/Pole Connection:	
Corrosion affecting hardware	
Mounting bracket corrosion	
Mounting Bracket Broken	
Loose/ missing hardware	
Coating condition	
Walkway:	
Corrosion of walkway members	
Corrosion affecting hardware	
Coating condition	
Walkway member loose/damaged	

Structure Number: **Date of Inspection:**

POLE CONDITION DATA

Vertical Support Base Plate:	
Corrosion affecting base plate	
Coating condition	
Base Connection welds cracked	
Base plate cracked/broken	
Base plate buried > 12" deep	
Base protective skirt missing	
Vegetation around/against base	
Corrosion of transformer base	
Corrosion affecting base/pole	
Transformer coating condition	
Transformer base cracked/broke	
T-base to pole bolts loose	
T-base to pole bolts short	
T-base to pole washers missing	
T-base/pole lock washers	
Access cover not removable	
T-base access cover missing	
Base interior has water/debris	
Vertical Support Slip Joint:	
Corrosion of slip joint	
Long. crack in slip joint	
Vertical Support:	
Corrosion affecting pole	
Weathering stl. pole corrosion	
Coating condition	
Minor loss of galvanization	
Weld at hand hole cracked	
Debris in pole	
Pole dent with/without tear	
Vegetation around against pole	
Hand hole cover loose/missing	
Pole cap loose/missing	
Open electrical ports	
Timber pole split/checking	
Timber pole exhibits decay	
Attachment hardware corrosion	
Other attach loose	

LUMINAIRE, HIGH MAST LIGHTING AND CAMERA POLE STRUCTURES

INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

CHORD CONDITION DATA

Arm to Pole Connection:	
Connection plates corrosion	
Connection hardware corrosion	
Coating condition	
Hardware loose/missing/broken	
Missing flat washers	
Multiple flat washers present	
Lock washers at pole conn	
Arm connection plate cracked	
Gap between connection plates	
Loose bolts to timber pole	
Loose lags to timber pole	
Luminaire Arm:	
Corrosion affecting arm	
Coating condition	
Bent chord member	
Cracked/ruptured chord member	
End cap loose/missing	
Chord strut broken	
Open electrical ports in arm	
Chord to chord weld cracked	

LUMINAIRE, HIGH MAST LIGHTING AND CAMERA POLE STRUCTURES
INSPECTION FIELD REPORT FORM

Structure Number: **Date of Inspection:**

FOUNDATION CONDITION DATA

Anchor Bolts:	
Base plate to foundation gap	
Corrosion of anchor nuts/Bolt	
Top/leveling nuts loose/ missing ***See deficiency condition guidelines**	
Movement in transformer base	
Inadequately tightened nuts	
Anchor bolts broke/sheared/cracked	
Anchor bolt covers	
Anchor nut tolerance	
Top nut not fully engaged	
Top/leveling flat washers missing	
Multiple top/leveling washers	
Lock Washers Present	
Anchor bolts other than steel	
Anchor bolt inaccessible	
Base plate protective skirt	
Ultrasonic testing of an. bolts	
T-base anchors not engaged	
Breakaway couplings broken	
Breakaway couplings too high	
Breakaway coupling not torqued	
Concrete Pedestal:	
Pedestal obstr. by sidewalk/buried	
Crack, at corner of pedestal	
Cracks, radiating from an. bolts	
Delamination/spalling of pedestal	
Honeycombing on pedestal	
Vegetation growth at pedestal	
Erosion/Undermining:	
Erosion around concrete pedestal	
Erosion at steel helical pile	
Drainage around pedestal	
Grout:	
Grout condition	