7 STEEL STRAIN POLE

7.1 Definitions

Steel strain poles are span wire structures supporting signals, lighting, cameras, or other appurtenances. They may be constructed in a box span, diagonal span, or other type of configuration. The poles may be round or multi-sided and are supported on a drilled shaft concrete foundation. Steel strain poles are distinguished from embedded steel poles by use of anchor bolts to transfer load from the pole to the concrete foundation.

7.1.1 INVENTORY ITEMS

The inspector shall identify the foundation and pole type. All strain poles should be constructed of steel but may be round or multi-sided. The steel strain poles are typically galvanized but are sometimes painted over the galvanizing. All steel strain poles should be constructed on a concrete drilled shaft foundation with an elevated base plate connected to the concrete foundation with four or six anchor bolts (some in service strain poles may have four anchor bolts while the current MDOT standards specify the use of six anchor bolts). Identify whether the pole is part of a configuration of poles and span wires such as a box span, if it is a single span between two poles, or if it is a single stand-alone pole. When a span wire is present, half of the span wire and whatever is attached to that half is assigned to each pole. The pole may support a variety of attachments, both directly and indirectly, including span wires, luminaires and luminaire arms, signs, signals, cameras, and other ITS infrastructure. The quantity and type of these attachments and their connections to the structure should be noted. The types of connections may include bands, clamps, or brackets. Non-structural attachments such as signs, signals, and cameras receive ratings under Miscellaneous Arm, Bracket, and Attachment, and should be reported appropriately if they pose a safety risk. The connections of these attachments to the structure are to be rated.

The inspector shall note the presence of any non-typical attachments that may not have been approved or been part of the original purpose or function of the pole and confirm any pre-populated inventory data while recording information that is not already documented. It may not be possible to record or verify all measurements exactly due to access limitations; estimate and use experience and best judgement to record data to the most accurate extent possible.

Take photos of the required inventory items listed in Section 7.2.2. A complete list of inventory items is provided in the Ancillary Structures Data Dictionary.

7.1.2 ELEMENTS

Steel strain poles are divided into three components: Foundation, Vertical Structure, and Horizontal Structure.

Foundation is further divided into elements: Concrete Foundation and Anchor Bolts and Leveling Nuts.

Vertical Structure is further divided into elements: Base Plate, Vertical Support Column (Upright), and Vertical Structure Connections.

Horizontal Structure is further divided into elements: Span Wire, Span Wire Attachment Connections, Luminaire and Luminaire Arm, and Miscellaneous Arm, Bracket, and Attachment.

Elements are assigned a condition state described in Section 7.7 based on the distresses identified in each element.

The following guidelines for consistent location notation provide the framework for rating a strain pole element in accordance with the condition rating tables:

- **Vertical Structure Locations** – Distress locations along the vertical support are referenced by using offsets measured from the base plate as measured in feet and prominent features (e.g., span wire connection).
- **Horizontal Element Locations** – Distress locations along the span wire, luminaire arm, or miscellaneous arm or bracket length are referenced by using offsets measured from the vertical support end. For span wires, half of the total span wire length is assigned to each vertical support, along with any attachments along that length.
- **Attachments on Span Wires or Arm Members** – Attachments are identified in relationship to directionality (e.g., North/South, East/West, Right End/Left End looking at front of signal or sign, or Right/Left looking upstation or downstation).
- **Other** – When possible, identify other elements in relation to the defined elements above. Otherwise, photograph location and document distress. Annotate drawings and photos, as necessary.

Table 7-1: Steel Strain Pole Components and Elements

Component	Element	Element Code	Unit of Measure
Foundation	Concrete Foundation	17101	Each
Foundation	Anchor Bolts and Leveling Nuts	17102	Each bolt and nut unit
Vertical Structure	Base Plate	17201	Each
Vertical Structure	Vertical Support Column (Upright)	17202	Length, feet
Vertical Structure	Vertical Structure Connections	17203	Each
Horizontal Structure	Span Wire	17301	Each
Horizontal Structure	Span Wire Attachment Connections	17302	Each
Horizontal Structure	Luminaire and Luminaire Arm	17303	Each
Horizontal Structure	Miscellaneous Arm, Bracket, and Attachment	17304	Each

7.1.3 COMPONENTS

Steel strain poles are divided into three main components: Foundation, Vertical Structure, and Horizontal Structure.

Component ratings for steel strain poles are based on the following:

- ***Foundation*** – Consider the structure's foundation effect on overall stability of the steel strain pole structure. Include concrete condition, soil erosion, and anchor bolt/nuts condition and tightness.
- ***Vertical Structure*** – Consider if the vertical structure may have damage that compromises the structural capacity such as fractures, significant twisting or kinking, impact damage, corrosion, section loss, cracked welds, or stress cracks in the metal.
- ***Horizontal Structure*** – Consider fractures in welds or base metal, corrosion, section loss, vertical clearance, or advanced deterioration as critical to the overall horizontal structure.

A representation of the rating structure for steel strain poles is provided in Figure 7-1. A graphic indicating components and elements is in Figure 7-2.

Figure 7-1: Rating structure for Steel Strain Poles

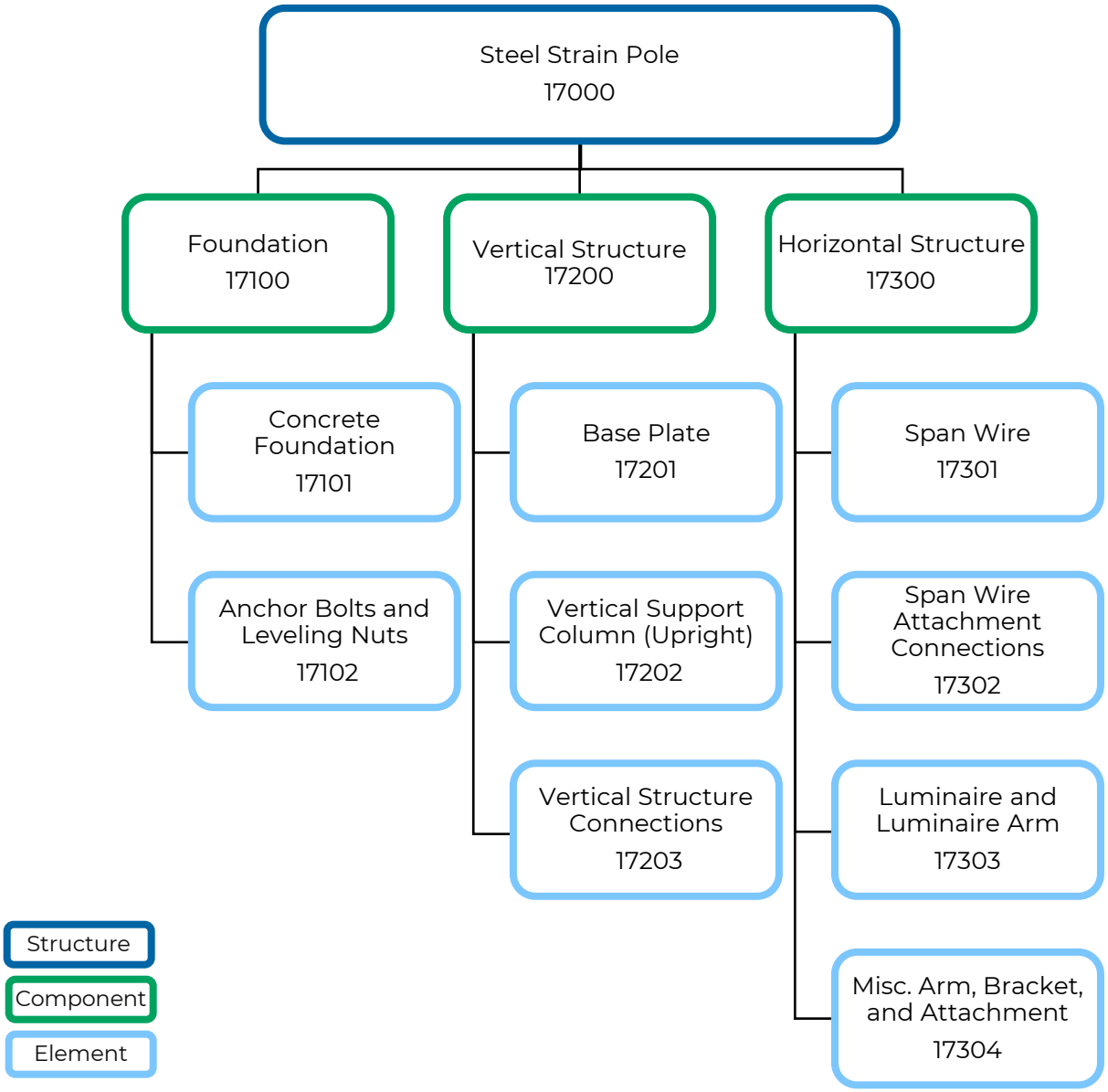
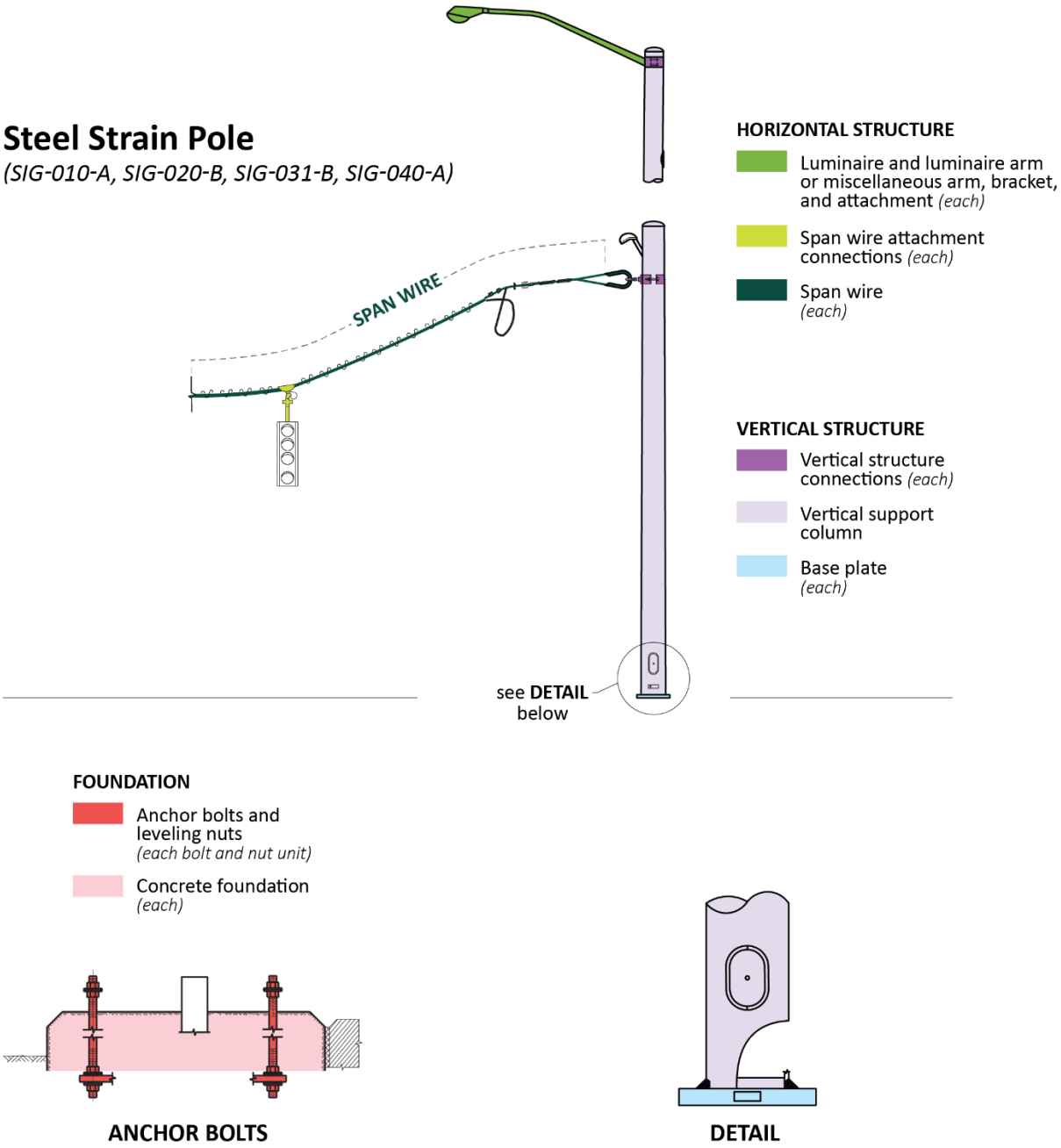


Figure 7-2: Elements and components for Steel Strain Pole (adapted from MDOT Standards SIG-010A, SIG-020-B, SIG-031-B, SIG-040-A)



7.2 Inventory Record Photographs

Inventory photos are captured during a routine inspection, saved as part of the inventory database, and follow the naming convention in *Table 7-2*.

Steel Strain Pole Required Photos:

- General view of the entire pole

- Each foundation (if applicable)
- General view of guy wires (if applicable)
- Structure number stenciled on support
- Manufacturer plate (if applicable)

Table 7-2: Steel Strain Pole Photograph Naming Convention

*The # in photo naming convention should reflect the sequential number ranging from 1-x. One image is acceptable if all connections can be captured in a single image that provides enough detail to determine connection type and bolts/nuts. If this level of detail cannot be obtained in a single image, multiple photos are necessary to provide required level of visibility.

Photo Name	Description
SSPole_Entire	Entire steel strain pole
SSPole_Foundation	Foundation
SSPole_VH#*_Connection	Vertical to horizontal connection
SSPole_Lum	Luminaire and luminaire arm
SSPole_ID	Old ID and new structure number
SSPole_Attachment Name	Replace “Attachment Name” with attachment or appurtenance (e.g., sensor, camera, etc.)

7.3 Inspector Minimum Technical Qualifications

At least one member of the field inspection crew shall possess the following certifications and training:

- A minimum experience of two projects with a minimum of 10 structures total inspecting pole structures. Bolt inspection experience on cantilever or truss structures, or other ancillary structure type. Multiple structure types shall have been inspected as part of the total project experience.
- Ancillary structures inspection procedures training.
- Working knowledge of inspection tools, their use, application, and limitations for the structure type being inspected.
- Experience with anticipated material types such as concrete or steel. Internal training will address inspection procedures for all anticipated material types.
- Ultrasound qualification – Current training in straight beam ultrasonic testing.
- Magnetic Particle Test (MT) – If a follow-up MT inspection is required for verification, then ASNT Level II (or per TC-1A) MT certified Level II is required.
- Dye Penetrant Test (PT) – If a follow-up PT inspection is required for verification, then ASNT Level II (or per TC-1A) PT certified Level II is required.
- If a follow up UT inspection is needed for the weld, ASNT Level II (ASNT or per ASNT TC-1A guidelines) is required.

7.4 Routine Inspection

Steel strain poles are used to support signs, signals, and other appurtenances, most commonly on non-freeway routes. Damage or deterioration of steel strain pole structures may impact function or safety.

In many cases, steel strain poles are installed at intersections, where they comprise a cable box span or other geometric configuration. They are supported on drilled shaft foundations and connected to the foundations with either four or six anchor bolts.

Steel strain pole standard inspection frequency is once every 4 years, unless otherwise identified for more frequent inspection.

The acceptable tolerance for intervals of less than 24 months for the next inspection is up to two (2) months after the month in which the inspection was due. The acceptable tolerance for intervals of 24 months or greater for the next inspection is up to three (3) months after the month in which the inspection was due. Exceptions to the inspection interval tolerance due to rare and unusual circumstances should be approved by MDOT's Ancillary Structures Program Manager in advance of the inspection due date plus the above tolerances.

It is recognized that severe weather, inspector safety, inspection quality, resource optimization, technological difficulties, or other unique situations may be a reason to adjust the scheduled inspection date. In these situations, the adjusted inspection date should not extend more than two (2) months after the month the inspection was due for any inspection interval less than 24 months and not extend more than three (3) months after the month the inspection was due for any inspection interval 24 months or greater. Inspection interval tolerances are intended to provide some flexibility. When tolerances are applied, the longest time period prescribed between inspections is the applicable interval plus the prescribed tolerance. For example, a routine inspection on a 12-month interval could be performed during the 14th month if the tolerance is applied. Repeatedly applying the tolerance to the next inspection will create inspection date creep and may impact an owner's ability to perform future inspections in a timely manner due to other limitations (e.g. available resources, inspection workload, schedule, seasonal weather conditions, technological difficulties, etc.). Exceptions to inspection interval tolerances due to rare and unusual circumstances should be approved by MDOT's Ancillary Structures Program Manager in advance of the inspection due date, plus the tolerance. For example, if an inspection with an interval of 24 months is due on June 17, an exception request should be approved by MDOT's Ancillary Structures Program Manager before the end of the 3-month tolerance (i.e. September 30). However, a request for exception should be made when the potential for not meeting the tolerance becomes known to provide MDOT's Ancillary Structures Program Manager with adequate time for review and approval.

Figure 7-3: Steel strain poles with box span configuration

Figure 7-4: Steel strain poles with single diagonal span configuration

Figure 7-5: Steel strain pole with suspended/hanging box span configuration (suspension circled)

Figure 7-6: Steel strain pole (multi-sided) structure with four anchor bolts (left) and six anchor bolts (right)

Table 7-3 provides guidance for inspecting reinforced and prestressed concrete cracking.

Table 7-3: Standard Cracking Widths

Description	Reinforced Concrete	Prestressed Concrete
Hairline (HL)	<1/16” (0.0625”)	< (0.004”)
Narrow (N)	1/16” to 1/8” (0.0625” to 0.125”)	(0” to 0.009”)
Medium (M)	1/8” to 3/16” (0.125” to 0.1875”)	(0.010” to 0.030”)
Wide (W)	>3/16” > (0.1875”)	> (0.03”)

Source: FHWA Bridge Inspector’s Reference Manual (Publication No. FHWA NHI 03-001, October 2002)

7.4.1 FOUNDATION ROUTINE INSPECTION

Inspect the general site conditions and assess the global stability of the structure.

- Check around the foundation for erosion or soil displacement, and for any voids between concrete and soil.
- If sidewalk or other material covers the material surrounding the foundation check for signs of separation, settlement, or cracking at the surface.
- Check for signs of vehicle impact that may have damaged the foundation concrete or the anchor bolts.
- Inspect the foundation concrete for cracking, spalling, delamination, or other defects measuring sizes or quantities. Pay particular attention to the condition of the concrete immediately around the anchor bolts.
- Inspect the anchor bolt connections to the base plate. Measure the anchor bolt standoff distance and check for any damage or corrosion of the bolts and nuts.
- Note if any of the anchor bolts are out of vertical alignment and if any of the nuts have anything less than full bearing.
- Sound the anchor bolts and nuts to check for looseness. Note if any washers are missing, incorrectly sized, or if the lock washers are not fully compressed.
- Provide photographs for all Poor or Severe condition state defects and submit the applicable Work Rec or RFA.

7.4.1.1 Foundation Component Ratings

The steel strain pole’s foundation overall characteristics are rated on its structural condition, ability to support the vertical structure, and possible negative impact to the entire structure, its operation, or the adjacent roadway. The foundation concrete, anchor bolts, and anchor bolt connection to the pole base plate are all considered as part of the component rating. When evaluating distresses consider that different distresses and the location on the foundation at which they occur are not of equal importance to the pole’s

function. The predominant characteristic determining overall condition is stability. Consider if the foundation has stable support from the soil, solid and durable concrete, and securely fastened anchor bolt connections.

Table 7-4: Component Rating Guidelines for Steel Strain Pole Foundation

Component Rating	Condition	Material	Description
9	NEW	All	No deficiencies in any of the structural components that will affect long term performance.
8	VERY GOOD	All	All structural components are sound and functioning as designed. There may be superficial cracking or weathering of protective components and/or dirt contamination of structural components.
7	GOOD	Concrete	Insignificant cracks or moderate cracks that are sealed.
		Soil	Insignificant displacement or erosion of soil.
		Steel	Protective coating failure in very small and scattered locations.
		All	All components retain full section properties and function as designed.
6	SATISFACTORY	Concrete	Unsealed moderate-width or map cracks. Minor delamination or spalling.
		Soil	Minor displacement or erosion of soil.
		Steel	Minor damage or worn galvanizing of anchor bolt connections.
		All	Minor deterioration affecting structural components. Minor misalignment.
5	FAIR	Concrete	Moderate delamination or spalling.
		Soil	Moderate displacement or erosion of soil. Minor gaps may be present between pole and embedment material.
		Steel	Minor loss of section. Loose fasteners may be present, but the connection is in place and functioning as intended.
		All	Moderate deterioration affecting structural components including minor settlement, or impact damage. Moderate misalignment. All members continue to function as designed.
4	POOR	Concrete	Considerable cracking and spalling.
		Soil	Considerable displacement or erosion of soil.
		Steel	Less than 25% loss of section. Fasteners may be considerably deteriorated.

Component Rating	Condition	Material	Description
3	SERIOUS	All	Considerable deterioration or misalignment affecting structural members. Considerable impact damage. Structural review may be warranted.
		Concrete	Extensive cracking and spalling.
		Soil	Extensive displacement or erosion of soil. Large gaps may be present between pole and embedment material.
		Steel	Measurable loss of section in excess of 25%. Missing, cracked, or broken fasteners.
		All	Considerable deterioration or damage affecting structural members. Structural evaluation, is necessary to determine if the structure can continue to function without repairs.
2	CRITICAL	All	Deterioration has progressed to the point where the structure will not support design loads and emergency repairs, or removal is required.
1	IMMINENT FAILURE	All	Road is closed to traffic due to imminent failure, but corrective action may put it back in service.
0	FAILED	All	Road is closed due to condition. Notify Region and the Bureau of Bridges and Structures.

7.4.1.2 Concrete Foundation Element Condition States

Start by inspecting the condition of the soil around the foundation noting any erosion or settlement that could impact the foundation. A gap between the foundation and adjacent soil may indicate foundation movement. Inspect the concrete for cracking, spalling, and delamination noting the quantities and locations. Check for exposed or corroded reinforcing steel. Pay special attention to the concrete immediately surrounding the anchor bolts. Older foundations may be square in shape while current standards specify a circular drilled shaft. Look for signs of impact damage.

Figure 7-7: Steel strain pole square foundation with four anchor bolts (left, note misalignment), newer style drilled shaft foundation with six anchor bolts (right)

Table 7-5: Steel Strain Pole Concrete Foundation Element Distresses

Unit of Measure: Each foundation, note number of foundations within each condition state. Typically, a single foundation which will then be rated as a single condition state.

Element Number	Element	Description	Associated Distresses
17101	Concrete Foundation	Steel strain pole foundations	Cracking
			Spalling, delamination, and patching
			Exposed rebar
			Embedment erosion
			Impact damage

Details on the condition state rating schema are in Section 7.7, linked below:

Steel Strain Pole Condition State Tables

7.4.1.3 Anchor Bolts and Leveling Nuts Element Condition States

The anchor bolt connection is a key element of the steel strain pole structure and frequent location of deficiencies. The anchor bolts should be plumb with all nuts tightly affixed to the base plate and the center of the connection should be centered on the foundation. The standoff distance is the distance from the bottom of the leveling nuts and the top of the concrete foundation (or the top of sound concrete in cases of foundation deterioration).

The standoff distance is an indication of whether or not the anchor bolts are subjected to bending moment stress. For double-nut connections, if the clearance between the bottom of the leveling nuts and the top of the concrete foundation is less than or equal to one bolt diameter, bending stresses in the anchor bolts can be disregarded (AASHTO LRFD Specifications for Structural Supports, sec. 5.16.3.1). Any distance greater than one bolt diameter may be cause for concern.

Figure 7-8: Fully compressed lock washer (left), Standoff measurement for a sound foundation (middle) and standoff measurement with foundation concrete deterioration (right)

There are two types of anchor bolts used with steel strain poles – pretensioned and non-pretensioned. For pretensioned anchor bolts, flat washers should be placed between each nut and the base plate and completely cover the holes in the base plate. All washers and nuts should bear fully on the base plate around their perimeter. These anchor bolts are pretensioned using the turn of the nut method and ultrasonic testing and sounding of the anchor bolts is required. Published procedures for the sounding and UT test are provided in references found in Section 7.4.4.

For non-pretensioned anchor bolts, flat washers should be placed between each nut and the base plate, with an additional lock washer placed between the top nut and the flat washer. The flat washers and nuts should bear fully around their perimeter and the flat washers should completely cover the holes in the base plate. The lock washers should be fully compressed, which means there is no gap anywhere between the top nut and lock washer. Because these anchor bolts are not pre-tensioned, the lock washers prevent the nuts from relaxing. Ultrasonic testing and sounding of the anchor bolts are not required when lock washers are present. The top nuts shall be fully engaged on the anchor bolt, which means the top of the anchor bolt is flush or higher than the top of the nut. Inspect the connection for any signs of impact damage, including bent anchor bolts or damaged threads. Inspect the galvanizing of all components and note corrosion. Nut covers may be present covering the top nuts of the connection. These were used to protect the connection but are a detriment as they retain moisture and debris and can accelerate corrosion; they are no longer permitted.

Figure 7-9: Anchor bolt negative projection – the top of the anchor bolt is not flush or higher than the top of the nut

Figure 7-10: Steel strain pole foundation with excess standoff distance and nut covers

Table 7-6: Steel Strain Pole Anchor Bolt and Leveling Nuts Element Distresses

Unit of Measure: Each, note quantity of anchor bolt and nut units within each condition state

Element Number	Element	Description	Associated Distresses
17102	Anchor Bolts and Leveling Nuts	Anchor bolts and leveling nuts	Corrosion or coating damage
			Loose or missing anchor nut
			Cracked bolt
			Standoff distance
			Impact damage

Details on the condition state rating schema are in Section 7.7, linked below:

Steel Strain Pole Condition State Tables

7.4.2 VERTICAL STRUCTURE ROUTINE INSPECTION

Routine inspection of the vertical structure is conducted from the ground. Binoculars should be used as a visual aid for inspecting the top of the pole and connections.

- Inspect the general site conditions and assess the global stability of the structure and its operational function.
- Inspect the vertical alignment of the pole with a 4 ft level or similar. Note that some poles may be tapered and checking at several points around the perimeter at the same elevation may be necessary to obtain the complete picture of any misalignment.
- Inspect the protective coating – galvanizing, powder-coated, and/or paint and note any corrosion or section loss.
- Check the inventory label affixed to the pole facing approaching traffic for legibility. Install a new inventory number label if no label exists or the label is in poor condition.
- Check for any cracks or deformations in the steel noting the size of deficiencies.
- Check for signs of impact damage noting that impact in one location may affect the structure in other locations as well.
- Inspect any secondary support of the pole such as guy wires, guy struts, etc. Check for any corrosion and section loss, looseness or deterioration of connections, and anchorage condition.
- Inspect the connection to the pole of the horizontal structure – span wires and arms. This includes band clamps, brackets, and other bolted assemblies. Check for connections that are loose, missing, deteriorated or otherwise deficient.
- Check the welds for signs of cracking.
- Check for pole dents and buckling (refer to pole dents & buckling calculations).
- Provide photographs for all Poor or Severe condition state defects and submit the applicable Work Recs or RFAs.

7.4.2.1 Vertical Structure Component Ratings

The steel strain pole's vertical structure overall characteristics are rated on its structural condition, ability to support the horizontal structure, and possible negative impact to the entire structure, its operation, or the adjacent roadway. The base plate and base plate to pole connection, pole structure, and connections to the pole are all considered as part of the component rating. When evaluating distresses consider that different distresses and the location on the structure at which they occur are not of equal importance to the pole's function. The predominant characteristics determining overall condition are stability and resiliency. Consider if the pole has stable support in the embedment material, a robust and consistent pole cross-section, and the horizontal structure is securely fastened.

Table 7-7: Component Rating Guidelines for Steel Strain Pole Vertical Structure

Component Rating	Condition	Material	Description
9	NEW	All	No deficiencies in any of the structural components that will affect long term performance.
8	VERY GOOD	All	All structural components are sound and functioning as designed. There may be superficial cracking or weathering of protective components and/or dirt contamination of structural components.
7	GOOD	Concrete	Insignificant cracks or moderate cracks that are sealed.
		Soil	Insignificant displacement or erosion of soil.
		Steel	Protective coating failure in very small and scattered locations.
		All	All components retain full section properties and function as designed.
6	SATISFACTORY	Concrete	Unsealed moderate-width or map cracks. Minor delamination or spalling.
		Soil	Minor displacement or erosion of soil.
		Steel	Protective coating failures is limited to less than 10% of the surface area with no loss of section.
		All	Minor deterioration affecting structural components. Minor misalignment.
5	FAIR	Concrete	Moderate delamination or spalling.
		Soil	Moderate displacement or erosion of soil. Minor gaps may be present between pole and embedment material.
		Steel	Minor loss of section. Loose fasteners may be present, but the connection is in place and functioning as intended.
		All	Moderate deterioration affecting structural components including minor settlement, or impact damage. Moderate misalignment. All members continue to function as designed.
4	POOR	Concrete	Considerable cracking and spalling.
		Soil	Considerable displacement or erosion of soil.
		Steel	Protective coating failure and less than 25% loss of section. Cracks may be present. Fasteners may be loose, missing, or considerably deteriorated. Considerable impact damage.

Component Rating	Condition	Material	Description
3	SERIOUS	All	Considerable deterioration or misalignment affecting structural members. Structural review may be warranted.
		Concrete	Extensive cracking and spalling.
		Soil	Extensive displacement or erosion of soil. Large gaps may be present between pole and embedment material.
		Steel	Measurable loss of section in excess of 25%. Missing or broken fasteners or extensive cracking in pole.
		All	Considerable deterioration or damage affecting structural members. Structural evaluation is necessary to determine if the structure can continue to function without repairs.
2	CRITICAL	All	Deterioration has progressed to the point where the structure will not support design loads and emergency repairs, or removal is required.
1	IMMINENT FAILURE	All	Road is closed to traffic due to imminent failure, but corrective action may put it back in service.
0	FAILED	All	Road is closed due to condition. Notify Region and the Bureau of Bridges and Structures.

7.4.2.2 Base Plate Element Condition States

The base plate is part of the anchor bolt connection but is connected to the pole with a full penetration weld and considered part of the vertical structure along with the pole and its vertical structure connections. The base plate should be checked for warping that may have occurred during fabrication or construction, and corrosion. Pay particular attention to the weld between the base plate and pole and look for any cracks or weld deficiencies. A crack will typically appear in the galvanizing and may or may not extend into the weld metal. Additional non-destructive testing may be required to determine the extent of any cracks.

Figure 7-11: Steel strain pole base plate with six anchor bolts

Table 7-8: Steel Strain Pole Base Plate Element Distresses

Unit of Measure: Each, percentage of base plate within each condition state

Element Number	Element	Description	Associated Distresses
17201	Base Plate	Base plate for strain pole	Corrosion or coating damage
			Weld defect or crack

Details on the condition state rating schema are in Section 7.7, linked below:

Steel Strain Pole Condition State Tables

7.4.2.3 Vertical Support Column (Upright) Element Condition States

Steel strain poles are typically 30-40 ft in length and may be round or multi-sided. The poles should be checked for any vertical misalignment with a 4 ft level or similar, keeping in mind that steel strain poles may be tapered and multiple checks around the perimeter of the pole may be necessary. A hand hole is located near the base of the pole to allow for access to electrical components and there are typically additional electrical entry and exit ports higher on the pole. The handhole should be free from excess moisture and debris. The handhole cover should be securely fastened, and the hand hole frame inspected for any cracks in the welds or base metal, along with any other welded components. The poles are hot dip galvanized and may have a single or multi-coat paint system on top of the galvanizing for aesthetic treatment. Any corrosion should be noted and if there is significant corrosion, the pole wall thickness should be checked for section loss with a thickness gauge or ultrasonic testing device. Inspect the length of the pole for impact damage and cracks and note that multi-sided poles have a longitudinal weld the length of the pole.

Newly installed strain poles have fabrication tolerances for deviation from vertical, sweep, camber, and twist; initial installation inspection should take these tolerances into account for out of plumb condition state distresses.

Figure 7-12: Impact damage and missing hand hole cover (left) and graffiti/coatings repair (right)

Table 7-9: Steel Strain Pole Vertical Support Column (Upright) Element Distresses

Unit of Measure: Length, feet of vertical support within each condition state

Element Number	Element	Description	Associated Distresses
17202	Vertical Support Column (Upright)	Vertical Support (Upright) for strain pole	Corrosion or coating damage
			Weld defect or crack
			Out of plumb
			Impact damage
			Handhole defects

Details on the condition state rating schema are in Section 7.7, linked below:

Steel Strain Pole Condition State Tables

7.4.2.4 Vertical Structure Connections Element Condition States

For the vertical structure connections, element consider all connections to the pole structure. There are several different types of connections that may be present. In general, any steel portions of a connection should be securely in place, and free of corrosion, excess wear, missing pieces, cracks, or other deterioration. For attachments like cabinets and sensors the steel straps connecting the attachments are rated, and if they are failing or in some way pose a safety risk they should be noted.

Span wires are usually connected to the pole with band clamps. The two halves of the clamps are tightened against the pole with bolting assemblies on either side. Consider the typical steel deterioration modes and inspect the band clamps for any distortion or cracking which may precede a failure. Luminaire arms or other arms (for cameras or other sensors) used to connect attachments to the pole may use bracket assemblies or other types of steel connections. Consider the typical steel and fastener deterioration modes for these connections.

Figure 7-13: Steel strain pole band clamp connections for span wires

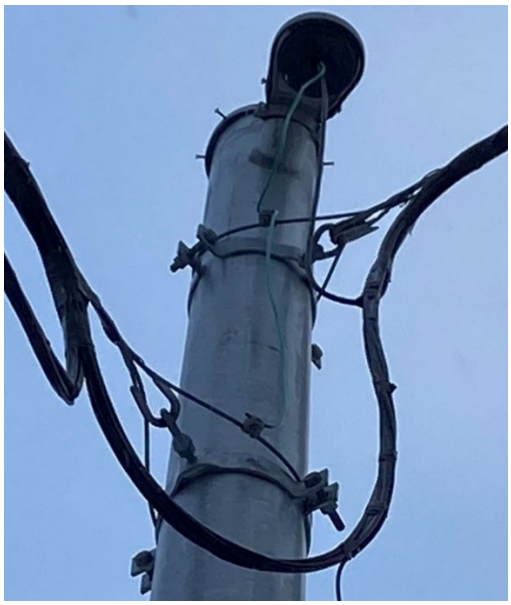


Figure 7-14: Steel strain pole bracket assembly connections for luminaire arms

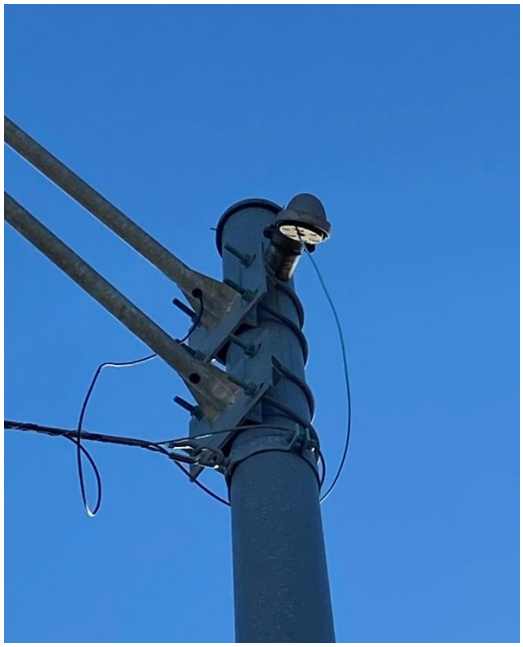


Table 7-10: Steel Strain Pole Vertical Structure Connections Element Distresses

Unit of Measure: Each connection quantity within the condition state

Element Number	Element	Description	Associated Distresses
17203	Vertical Structure Connection	Bracket assemblies, pole band clamps, stainless steel straps, or other connections to strain poles	Weld defects or cracks
			Corrosion or coating damage
			Loose, missing, or failing hardware

Details on the condition state rating schema are in Section 7.7, linked below:

Steel Strain Pole Condition State Tables

7.4.3 HORIZONTAL STRUCTURE ROUTINE INSPECTION

Routine inspection of the horizontal structure is conducted from the ground. Binoculars should be used as a visual aid.

- Inspect the vertical clearance of the horizontal structure and its attachments, the alignment, and the operational function.
- Check span wires for signs of fraying or broken strands.
- Check for corrosion or section loss on the horizontal structure.
- Inspect luminaires and luminaire arms or other miscellaneous arms or brackets for any cracked welds, or other deterioration.
- Check signals and other miscellaneous attachments to the horizontal structure for connections that are loose, missing, deteriorated or otherwise deficient.
- Provide photographs for all Poor or Severe condition state defects and submit the applicable Work Recs or RFAs.

7.4.3.1 Horizontal Structure Component Ratings

The steel strain pole's horizontal structure overall characteristics are rated on its structural condition, ability to support the connected attachments, and possible negative impact to the structure's operation and the roadway below. The span wire, arms, and the attachment connections to them are all considered as part of the component rating. When evaluating distresses consider that different distresses and the location on the structure at which they occur are not of equal importance to the horizontal structure's function. The predominant characteristic determining overall condition is resiliency. Consider if the span wire and arms have a robust and consistent cross-section, and the attachments are securely connected.

Table 7-11: Component Rating Guidelines for Steel Strain Pole Horizontal Structure

Component Rating	Condition	Material	Description
9	NEW	All	No deficiencies in any of the structural components that will affect long term performance.
8	VERY GOOD	All	All structural components are sound and functioning as designed. There may be superficial cracking or weathering of protective components and/or dirt contamination of structural components.
7	GOOD	Concrete	Insignificant cracks or moderate cracks that are sealed.
		Steel	Protective coating failure in very small and scattered locations.
		All	All components retain full section properties and function as designed.
6	SATISFACTORY	Concrete	Unsealed moderate-width or map cracks. Minor delamination or spalling.
		Steel	Pole protective coating failures is limited to less than 10% of the surface area with no loss of section. Surface corrosion with no section loss of span wire or attachment connections.
		All	Minor deterioration affecting structural components.
5	FAIR	Concrete	Moderate delamination or spalling.
		Steel	Minor loss of section. Loose fasteners may be present, but the connection is in place and functioning as intended.
		All	Moderate deterioration affecting structural components including minor settlement, or impact damage. Moderate misalignment. All members continue to function as designed.
4	POOR	Concrete	Considerable cracking and spalling.
		Steel	Up to 25% loss of section. Span wire may have minor fraying or attachments may have less than 17 ft of vertical clearance. Fasteners may be considerably deteriorated.
		All	Considerable deterioration affecting structural members. Structural review may be warranted.
3	SERIOUS	Concrete	Extensive cracking and spalling.
		Steel	Section loss in excess of 25%. Missing or broken fasteners or excess sagging of the span wire.

Component Rating	Condition	Material	Description
		All	Considerable deterioration or damage affecting structural members. Structural evaluation is necessary to determine if the structure can continue to function without repairs.
2	CRITICAL	All	Deterioration has progressed to the point where the structure will not support design loads and emergency repairs, or removal is required.
1	IMMINENT FAILURE	All	Road is closed to traffic due to imminent failure, but corrective action may put it back in service.
0	FAILED	All	Road is closed due to condition. Notify Region and the Bureau of Bridges and Structures.

7.4.3.2 Span Wire Element Condition States

For the span wire element condition consider the connection of the span wire to the pole connection – which includes the span wire, thimble, dead end, or any other portion leading to the pole band clamp. Consider wear, deterioration and portions that may be loose, distorted, or otherwise exhibiting distress. For the length of the span wire, half of each wire is assigned to each supporting pole. The wire should be inspected for corrosion, fraying, or any broken wires. Any attachment connected to the span wire should have a minimum vertical clearance to the top of pavement of 17 ft. While this may not be able to be measured, note report any vertical clearance that looks out of the ordinary.

Figure 7-15: Steel strain pole span wire supporting signals and sign

Figure 7-16: Span wire assemblies attached to steel strain pole band clamps

Table 7-12: Steel Strain Pole Span Wire Element Distresses

Unit of Measure: Each member which apply to each condition state

Element Number	Element	Description	Associated Distresses
17301	Span Wire	Span wires, thimbles, preformed dead ends	Insufficient under clearance
			Corrosion or section loss, frayed wires
			Worn or deteriorated dead ends

Details on the condition state rating schema are in Section 7.7, linked below:

Steel Strain Pole Condition State Tables

7.4.3.3 Span Wire Attachment Connections Element Condition States

Attachments connected to the span wire include signals and case signs. Typically, the signals and signs are connected using span wire hangers and suspension clamps. Consider the typical steel and fastener deterioration modes for these connections: loose connections, wear, corrosion, cracking, and deformation. The signals and signs themselves are not rated but if there is noticeable deterioration that could impact safety it should be reported.

Figure 7-17: Span wire supporting signals and sign (left), span wires supporting signs (right)

Figure 7-18: Span wire hanger

Table 7-13: Steel Strain Pole Span Wire Attachment Connections Element Distresses

Unit of Measure: Each connection quantity within the condition state

Element Number	Element	Description	Associated Distresses
17302	Span Wire Attachment Connections	Span wire hangers, lashing rods, armor rods, suspension clamps	Corrosion or section loss
			Loose, missing, or cracked hardware
			Deformed or worn parts

Details on the condition state rating schema are in Section 7.7, linked below:

Steel Strain Pole Condition State Tables

7.4.3.4 Luminaire and Luminaire Arm Element Condition States

Luminaires are usually mounted on a luminaire arm but may also be mounted directly on the pole, on a tenon, or using some other pole mounting device. The arms may be a single member type or truss type. Note that the bracket assembly or other method of attaching the luminaire arm to the pole is considered part of the vertical structure connections element. The arms should be inspected for steel condition and the condition of any welds. The condition of the luminaire connection to the arm or tenon should be inspected for material defects and connection type defects such as looseness and wear. The luminaire itself includes the light source, any fixtures or assemblies, and the housing. Note any visibly broken portions of the luminaire.

Figure 7-19: Luminaire and luminaire truss arm

Table 7-14: Luminaire and Luminaire Arm Element Distresses

Unit of Measure: Each luminaire and luminaire arm within the condition state

Element Number	Element	Description	Associated Distresses
17303	Luminaire and Luminaire Arm	Lighting sources, fixtures and assemblies, bracket arms, truss arms, tenon mounts, shepherds crooks, or other pole mounting devices	Broken lighting source or assembly
			Damaged or cracked housing, cover
			Corrosion or section loss
			Weld cracks/defects
			Deteriorated gasket/seal

Details on the condition state rating schema are in Section 7.7, linked below:

Steel Strain Pole Condition State Tables

7.4.3.5 Miscellaneous Arm, Bracket, and Attachment Element Condition States

Attachments or appurtenances may be mounted on a bracket or arm but may also be mounted directly on the pole, on a tenon, or using some other pole mounting device. The arms may be a single member type or truss type. Note that the bracket assembly or other method of attaching the miscellaneous bracket or arm to the pole is considered part of the vertical structure connections element. The miscellaneous arms, brackets, and attachments should be inspected for steel condition and the condition of any welds. The condition of the attachment connection to the bracket, arm, or tenon should be inspected for material defects and connection type defects such as looseness and wear. Cameras and other sensors may also be attached to the pole using the same types of arms and connections as luminaires.

Figure 7-20: Cameras mounted on luminaire truss arms

Table 7-15: Steel Strain Pole Miscellaneous Arm, Bracket, and Attachment Element Distresses

Unit of Measure: Each miscellaneous arm, bracket, and attachment within the condition state

Element Number	Element	Description	Associated Distresses
17304	Miscellaneous Arm, Bracket, and Attachment	Power sources, fixtures and assemblies, bracket arms, truss arms, tenon mounts, shepherds crooks, or other pole mounting devices	Broken power source or assembly
			Damaged or cracked housing, cover
			Corrosion or section loss
			Weld cracks/defects
			Deteriorated gasket/seal

Details on the condition state rating schema are in Section 7.7, linked below:

Steel Strain Pole Condition State Tables

7.4.4 REFERENCES

MDOT Steel Strain Pole Installation Inspection Procedure, describing UT and Sounding Testing

MDOT Traffic and Safety Standards and Special Details

SIG-010-series All Span Wire T.S. on Steel and Wood Poles

SIG-020-series 6 Anchor Bolt Strain Pole and Foundation

FUSP-820A Tolerances for alignment, sweep, camber, and twist

Pole Dent & Buckling Calculations

AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 2015 (AASHTO Signs)

7.5 Work Recommendation Guidance

The Work Recs are not meant to be all-inclusive and other Work Recs may be added to supplement those noted.

Inspectors should create Work Recs to address span wires with less than 17 ft clearance. Half of the span of the wire is attributed to each pole. Inspectors should rate the Span Wire element as severe for both poles but generate a single Work Rec to correct the wire tension. Inspectors should assign it to one of the poles and note the Work Rec in the other pole's inspection.

Photographs should include sufficient information to determine the relationship of the defect to the element or component or entire structure. Close-up photos of each defect with deficiencies marked on the photo should be provided.

Table 7-16: Work Recommendations for Steel Strain Pole

Number	Description of Work Recommendation	Material Involved	Quantity/Unit of Measure
1	Repair guardrail (protecting pole)	Galvanized Steel	Linear feet
2	Correct erosion at foundation (prevent undermining)	Stone/Soil	Cubic feet
3	Repair/monitor foundation	Concrete	Cubic feet
4	Repair/replace handhole cover	Galvanized Steel	Each cover
5	Remove non-MDOT or unauthorized attachments to structures	Various	Each item
6	Remove graffiti	n/a	Square foot
7	Repair galvanizing	Galvanic Paint	Square inch
8	Repair protective coatings system	Metal Coatings System	Square foot
9	Tighten leveling nut	Galvanized Steel	Each nut
10	Address loose bolts	Galvanized Steel	Each bolt
11	Weld repair	Steel	Each weld
12	Replace pole band clamps	Galvanized Steel	Each clamp
13	Tension span wire	Steel Strand	Each
14	Replace span wire	Steel Strand	Linear feet
15	Replace span wire hanger	Galvanized Steel	Each
16	Replace pole cap	Galvanized Steel	Each cap
17	Replace pole cap bolt	Galvanized Steel	Each bolt
18	Replace preformed dead-end	Preformed Dead-end	Each preformed dead-end
19	Replace connectors	Galvanized Steel	Each connector
20	Replace service cap, PVC	PVC	Each cap

Number	Description of Work Recommendation	Material Involved	Quantity/Unit of Measure
21	Replace service cap, metal	Galvanized Steel	Each cap
22	Replace luminaire	Various	Each luminaire
23	Replace luminaire arm	Galvanized Steel	Each arm
24	Replace luminaire arm clamp	Galvanized Steel	Each clamp
25	Replace bracket assembly	Galvanized Steel	Each assembly
26	Replace signal head	Various	Each signal head
27	Replace case sign	Various	Each sign
28	Replace misc. attachment	Various	Each attachment
29	Replace miscellaneous arm or bracket	Various	Each arm or bracket

7.6 Request for Action Guidance

Examples of applicable priority level items include, but are not limited to:

Priority 1 Level Items

a. Major foundation deterioration including concrete cracking/spalling/delamination thread damage, steel reinforcement corrosion, and significant section loss of steel reinforcement

b. Ultrasonic test failure of an anchor bolt

c. Major soil erosion or undermining of the foundation element(s) evidenced by lateral displacement or pole out of plumb/rotated

d. Major base plate distortion or section loss around anchor bolts

e. Standoff distance more than twice the bolt diameter, where bending of anchor bolts is evident

f. Major cracks present in the base metal or weld(s)

g. Major section loss due to corrosion which impacts the capacity or short-term resiliency of the structure

h. Multiple loose or missing bolts in a high strength bolted connection or in attachment connection assemblies

i. Loose or missing nut at 1 anchor bolt on a 4-bolt foundation or 2 or more anchor bolts on a 6-bolt foundation

j. Major corrosion, section loss or failure of high strength bolts where load-path redundancy is minimal

k. Multiple loose or missing bolts where connections do not have load-path redundancy and bolt tensioning is not possible

l. Cracked or failing tenon/bracket assembly/luminaire or miscellaneous attachment mounting device

m. Band clamps with major cracks or bolts failures which impact the traffic lighting cable attachment

n. Major span wire corrosion and section loss, including fractured individual wires of the span wire strand

o. Major structural damage to foundation, anchor bolts, upright, or other elements, which impacts capacity or function, clearance, safety, or short-term resiliency of the structure

p. Pole is out of vertical alignment when the lean is greater than 4.75 over 4 feet (or about 10%)

Priority 2 Level Items

a. Significant foundation deterioration including concrete cracking/spalling/delamination, steel reinforcement corrosion and section loss

b. Significant soil erosion or undermining of the foundation

c. Pole is significantly out of vertical alignment when the lean is between 3.375” to 4.75” over 4 feet (or about 7% to 10%)

d. Significant base plate distortion or section loss around anchor bolts

e. Anchor bolt standoff distance more than twice the anchor bolt diameter with no bending of the anchor bolts

f. Anchor nuts are engaged with some gaps and/or bolts are misaligned

g. Loose bolts in a high strength bolted connection, or in attachment connection assemblies where there is acceptable load-path redundancy, but significant impact to capacity or durability

h. Loose or missing nut at 1 anchor bolt on a 6-bolt foundation

i. Significantly loose or misaligned tenon/bracket assembly/luminaire or miscellaneous attachment mounting device

j. Band clamps with significant cracks or loose bolts which impact the traffic lighting cable attachment

k. Significant weld deficiencies that have not initiated cracking but do not meet current code or will lead to Priority Level 1, but acceptable redundancy and/or resiliency is present

l. Structural cracks in secondary members that could potentially propagate through welded connections into main members

m. Significant corrosion of primary elements or connections is present

n. Significant span wire corrosion and section loss

o. Significant structural damage to foundation, upright, or other elements, which moderately impacts capacity or function, clearance, safety, or durability of the structure

- For strain and frangible/non-frangible poles with dents above the actionable level according to Pole Dent & Buckling Calculations guidance document

Priority 3 Level Items

a. Localized moderate foundation deterioration including concrete cracking/spalling/delamination, or exposed steel reinforcement, but section loss is negligible

b. Moderate erosion around the foundation

c. Pole is moderately out of vertical alignment when the lean is between 2.375” to 3.375” over 4 feet (or about 5% to 7%)

d. Moderate base plate distortion or section loss around anchor bolts

e. Standoff distance more than one bolt diameter but less than two bolt diameters with no bending of anchor bolts

f. Moderate corrosion of primary elements or connections is present

g. Loose connections where there is adequate redundancy and moderate impact to structural capacity or durability

h. Moderate weld deficiencies, which do not meet code but do not impact function where significant redundancy is also present

i. Misaligned tenon/bracket assembly/luminaire mounting device

j. Surface corrosion on span wire

k. Moderate structural damage to foundation, anchor bolts, upright, or other elements, which moderately impacts capacity or function, clearance, safety, or durability of the structure

7.7 Element Condition States

Element Number	Element	Condition States Defects Note	Link to Discussion in Section 7
17101	Concrete Foundation	Use the appropriate condition state table.	Concrete Foundation Element Condition States
17102	Anchor Bolts and Leveling Nuts	Use the appropriate condition state table. Use UT testing result to assist in the condition assessment.	Anchor Bolts and Leveling Nuts Element Condition States
17201	Base Plate	Use the appropriate condition state table.	Base Plate Element Condition States
17202	Vertical Support Column	Use the appropriate condition state table.	Vertical Support Column (Upright) Element Condition States
17203	Vertical Structure Connections	Use the appropriate condition state table.	Vertical Structure Connections Element Condition States
17301	Span Wire	Use the appropriate condition state table.	Span Wire Element Condition States
17302	Span Wire Attachment Connections	Use the appropriate condition state table.	Span Wire Attachment Connections Element Condition States
17303	Luminaire and Luminaire Arm Connections	Use the appropriate condition state table.	Luminaire and Luminaire Arm Connections Element Condition States
17304	Miscellaneous Arm, Bracket, and Attachment	Use the appropriate condition state table.	Miscellaneous Arm, Bracket, and Attachment Element Condition States

Element 17101 – Concrete Foundation

Description	This element defines a concrete foundation for a steel strain pole, regardless of foundation type such as drilled shaft or reinforced concrete pile			
Quantity Calculation	The quantity for this element is measured as “each.”			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Concrete Foundation	The concrete shows no deterioration. Superficial cracking, discoloration, or efflorescence or damage may be present. No exposed reinforcing.	Minor cracks and/or spalls may be present in the concrete. No exposed reinforcing or embedment erosion.	Moderate cracks and/or spalls may be present. Some reinforcing may be exposed. Incidental loss of section or surface pitting of reinforcing may be present. Element may show evidence of some impact damage or embedment erosion.	Major cracks and/or spalls are present. Major corrosion of exposed reinforcing. Extensive steel and/or concrete loss, impact damage or embedment erosion is present.

Element 17102 – Anchor Bolts and Leveling Nuts

Description	Anchor bolts and leveling nuts attaching the upright to the foundation.			
Quantity Calculation	The quantity for this element is each anchor bolt and nut unit.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Anchor Bolts and Leveling Nuts	There is no deterioration or damage The elements are fully engaged and the sounding test produces a sharp ringing sound, if applicable. Anchor bolt standoff distance is less than 1”.	Minor damage or corrosion of the elements may be present. The elements are fully engaged and functioning as intended. The sounding test produces a sharp ringing sound, if applicable. Anchor bolt standoff distance is less than 1”.	Moderate damage or corrosion/section loss of the elements may be present. Anchor nuts may not be fully tightened. The sounding test produces a dull sound, if applicable. Anchor bolt standoff distance is greater than 1” but less than two times the bolt diameter.	Major impact damage may be present. Major corrosion/section loss of the elements may be present. Nuts are loose/missing. The sounding test produces a dull sound, if applicable. Anchor bolt standoff distance is greater than two times the bolt diameter. UT testing

Description	Anchor bolts and leveling nuts attaching the upright to the foundation.			
Quantity Calculation	The quantity for this element is each anchor bolt and nut unit.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
				indicates cracks or breaks in bolts.

Element 17201 – Base Plate

Description	Base plate which connects the upright element to the anchor bolt and leveling nut element.			
Quantity Calculation	The quantity for this element is each base plate.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Base Plate Defects	No evidence of active corrosion or weld defect. Surface coating is sound.	Minor surface corrosion or superficial damage may be present. Protective coating failure with no section loss. Base element welds have no evidence of defects.	Moderate corrosion/ section loss may be present. Protective coatings are failing. Base element welds have no evidence of defects and/or cracking. Base plate may exhibit minor warping.	Major corrosion/section loss is present. Base element welds may have cracks/defects. Base plate has moderate to major warping.

Element 17202 – Vertical Support Column (Upright)

Description	This element is defined by all upright supporting a steel strain pole, regardless of material type or protective coating.			
Quantity Calculation	The quantity is collected in length in feet of vertical support.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Vertical Support Column (Upright) Defects	No evidence of active corrosion. Surface coating is sound.	Minor corrosion or superficial damage of the elements may be present. Protective coating failure with no section loss. No element weld defects or cracking are evident.	Moderate corrosion/ section loss may be present. Protective coatings are failing. Element welds have no evidence of defects and/or cracking. Support may be out moderately of plumb.	Major corrosion/section loss is present. Protective coatings are significantly failing. Element welds may have cracks/defects. Support may be majorly out of plumb.
Impact Damage	No damage caused by vehicular impact.	The element has minor damage caused by vehicular impact.	The element has moderate damage caused by vehicular impact.	Impact damage is major and affects the integrity of the structure.
Handhole Defects	Handhole cover and attachment to pole is securely fastened. The inside of the pole is free of excess moisture, and debris.	Handhole cover is in place but loosely fastened or minimally damaged. Handhole attachment to pole may have minor deficiencies. The inside of the pole may contain minor moisture and debris.	Handhole cover is moderately damaged or missing fasteners. Handhole attachment to pole may have moderate deficiencies. Moisture and debris may be present inside the pole creating moderate corrosion and/or section loss of material.	Handhole cover is missing or majorly damaged. Handhole attachment to pole is failing. Moisture or debris inside the pole is creating major corrosion and/or section loss of material.

Element 17203 – Vertical Structure Connections

Description	This element consists of the connections along the steel strain pole for various attachments. Connections may include bracket assemblies, pole band clamps, stainless steel straps, through bolts, or other connections to poles.			
Quantity Calculation	The quantity to be collected includes each connection location.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Vertical Structure Connection Defects	Pole band clamps, bracket assemblies, and other connection hardware are functioning as intended with no evidence of wear or corrosion.	Minor surface corrosion, wear, or superficial damage may be present. Pole band clamps, bracket assemblies, and other connection hardware are functioning as intended.	Moderate corrosion/ section loss or wear is present. U-bolts, band clamps, or lag bolts may be loose, but the conditions do not significantly affect serviceability and/or function.	Major corrosion/section loss is present. Protective coatings are significantly failing. Members may have cracks/defects or major wear. U-bolts, band clamps, or lag bolts are loose or missing. Element is not functioning as intended.

Element 17301 – Span Wire

Description	This element defines the span wires, thimbles, preformed dead ends which extend to terminate at another vertical structure.			
Quantity Calculation	The quantity is measured in length in each span wire.”			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Span Wire Defects	Span wire, preformed dead end, and thimble have no evidence of corrosion or wear and minimum clearance is 17 ft from roadway to bottom of any signal/sign.	Minor surface corrosion or wear may be present. Minimum clearance is 17 ft from roadway to bottom of any signal/sign.	Moderate corrosion/section loss or wear is present. Minimum clearance is 17 ft from roadway to bottom of any signal/sign.	Minimum clearance is less than 17 ft from roadway to bottom of any signal/sign. Major corrosion/pitting/ section loss is present. Protective coatings are significantly failing. Members may have cracks/defects or major wear.

Element 17302 – Span Wire Attachment Connections

Description	This element is defined by the span wire hangers, lashing rods, armor rods, suspension clamps.			
Quantity Calculation	The quantity to be collected is the number of connections for span wires.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Span Wire Attachment Connections	Span wire hangers, preformed lashing rods and armor rods, and other connection hardware have no evidence of wear or corrosion.	Minor surface corrosion or wear may be present.	Moderate corrosion/section loss or wear is present.	Major corrosion/pitting/section loss is present. Protective coatings are significantly failing. Members may have cracks/defects or major wear.

Element 17303 – Luminaire and Luminaire Arm

Description	This element consists of lighting sources, fixtures and assemblies, bracket arms, truss arms, tenon mounts, shepherds crooks, or other pole mounting devices			
Quantity Calculation	The quantity is collected as each luminaire and luminaire arm unit.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Luminaire and Luminaire Arm	Lighting source, housing/cover, waterproofing-gasket/seal, and arm or mounting device do not have evident wear or corrosion and are functioning as intended.	Gasket/seal may have minor deterioration. Lighting source, housing/cover, arm, and connections may have minor wear or corrosion.	Gasket/seal may be moderately deteriorated. Lighting source, housing/cover, arm, and connections may have moderate wear or corrosion, but the conditions do not significantly affect serviceability and/or function.	Major deterioration of gasket/seal is present. Lighting assembly or hardware is broken or missing. Major failure of protective coatings with corrosion/pitting/section loss is present. Welds have cracks/defects. Element is not functioning as intended.

Element 17304 – Miscellaneous Arm, Bracket, and Attachment

Description	This element consists of power sources, fixtures and assemblies, bracket arms, truss arms, tenon mounts, shepherds' crooks, or other pole mounting devices.			
Quantity Calculation	The quantity is collected as each miscellaneous arm, bracket, and attachment unit.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Miscellaneous Arm, Bracket, and Attachment	Power source, housing/cover, waterproofing-gasket/seal, and arm do not have evident wear or corrosion.	Gasket/seal may have minor deterioration. Power source, housing/cover, or arm may have minor wear or corrosion.	Gasket/seal may be moderately deteriorated. Power source, housing/cover, or arm have moderate wear or corrosion, but the conditions do not significantly affect serviceability and/or function.	Major deterioration of gasket/seal is present. Assembly or hardware is broken or missing. Major failure of protective coatings with corrosion/ pitting/section loss is present. Welds have cracks/defects.