13.8 Asset Inventory

This section is provided for informational purposes only. The ArcGIS inventory serves as the best resource for observing the Streetlight Network inventory.

13.8.1 Pole Types

A sampling of pole types include 16st Triple, 3A, 3A Ext, 5A, 716, Aerial, Catenary, Connecticut Twin, High Mast, Howard 5, Klingle Twin, L'Enfant 5, L'Enfant Twin, M19, nonconventional, PP and TW20, Wood,

13.8.2 Washington Upright Poles

This group includes Nos. 716, 16, 18, 13N, 14, 17M, 19M, Twin-20 and State Department Twin-20.

The Washington Upright poles (e.g., Nos. 716, 14, 16, 18, and Twin-20) are used in the historic districts/streets. No. 16 is the most commonly used upright pole; No. 716 is considered to be an inexpensive version of No.16 ($5000 vs. $2500). In the Downtown area near Foggy Bottom, No. 18 poles are used. The Twin-20 poles are used in Downtown, in historic districts and several entry points into Washington, DC.

The Nos. 16 and 18 poles use 24-inch bases and 15-inch bolt circles and can accommodate 70-400 Watt lamps. The No. 14 pole, on the other hand, uses a 17-inch base and 10.5-inch bolt circles and can accommodate 70-150 Watt lamps, since it is limited by the size of the casing. 716 poles are steel octaflute with a 9.5 inches bolt circle. AD11 poles, a variation of No. 716 poles, are used for traffic signals.

Figure 6 – Washington Upright Poles

13.8.3 Pendant Post Poles

The Pendant Post poles are installed citywide and can accommodate 70-400 Watt lamps with either single or twin arm(s). The District typically uses Cobrahead type arms and fixtures (although there are limited installations of Teardrop fixtures, another type of Pendant Post implementation). Pendant Post poles have an octaflute type of cross-section.

The most widely used Pendant Post poles are 28 feet –6 inches tall; 38 feet-6 inches tall poles are also used. There are a few high-mast (70 feet-100 feet tall) Pendant Post poles in the City that use 1000 Watt High Pressure Sodium (HPS) lamps.

The 5A Alley post is widely used in alleys.

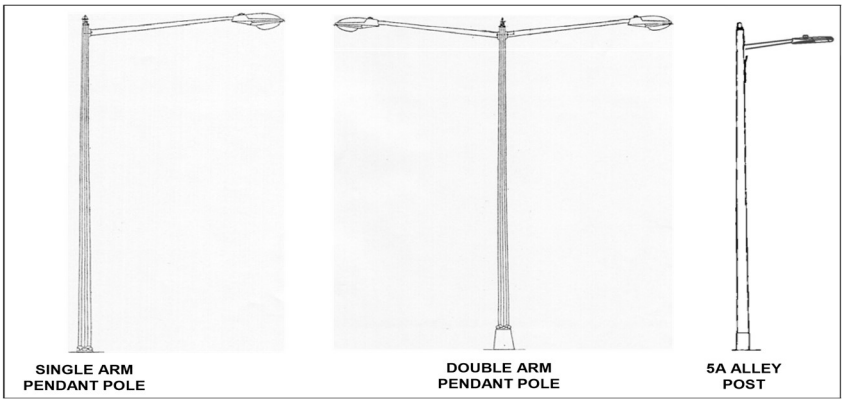


Figure 7 – Washington Family – Pendant Posts and 5A Alley Poles

13.8.4 Summary- All Pole Styles

Please find below a summary picture of all of the Poles used in the District.

40 Foot Pole

Dupont Circle Walk Path

Wood Pole

Metropolitan Branch Trail

Overpath Walk

13.8.5 Recommended Poles

The Washington Upright poles Nos. 14, 16, 18 and Twin-20 that are recommended in the standards are shown below.

The Pendant poles recommended for the District are Cobrahead, 5A Alley Post and Decorative Teardrop. The Cobrahead and 5A Alley Poles are installed citywide.

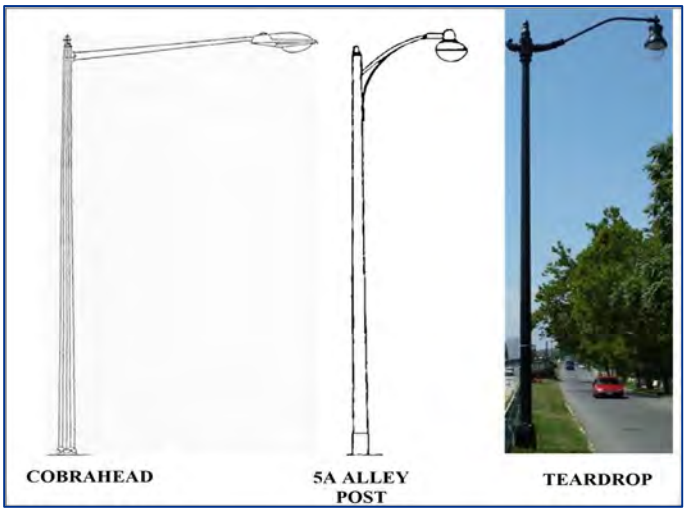


Figure 15 Types of Pendant Poles for Use in DC (Cobrahead, 5A Alley Post and Teardrop)

13.8.6 Pole Composition

The District currently identifies the poles as having the following possible composition: Aluminum, Cast Iron, Composite, Metal, Steel or Wood.

13.8.7 Arms

The District has data on the length of the arms. In addition, the District currently utilizes the following styles of arms:

- decorated (Straight, Wrap, Truss Wrap)
- j-Hook Arm
- regular Alley
- simple old teardrop
- simple pendant
- simple pendant with Guy
- simple teardrop
- simple teardrop with guy
- simple WP
- TR

- truss
- U-Shape
- wood Pole Truss
- WP Arm with Guy
- WP Decorated Scroll
- WP Decorated Scroll with Guy

13.8.8 Globes

The Lighting Network includes various types of globes including but not limited to Washington globes.

Washington globes are only for upright/posttop poles. The Washington globes are made of either glass or plastic. The District previously utilized glass for its Washington globes; however, due to safety concerns with the material, the District discontinued the use of glass. The District has since transitioned from the use of glass to plastic for the globes. Washington globes shall be stippled clear (90% transparent) shatter-proof ultraviolet stable polycarbonate.

Teardrop, cobrahead, and Spring City teardrop globes can be made of glass.

13.8.9 Fixture Styles

The District's asset inventory includes the following styles of fixtures for its Lighting Units:

- Cobrahead Cutoff
- Cobrahead Simi Cutoff
- Posttop
- Teardrop
- Incandescent
- Mushroom
- Spot Light
- Navigation
- Chinatown Luminaire
- Wallpack
- Overhead
- Standard LED
- Old Teardrop
- L'Enfant Globe
- L'Enfant Underdeck

The figures below displays photographs of the various lighting fixture styles within the District, for reference:

L’Enfant Globe

L’Enfant Underdeck

Figure 16. Lighting Fixture Styles for Use in the District

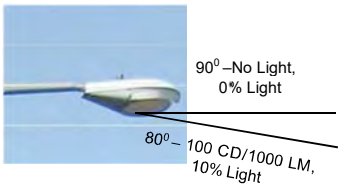
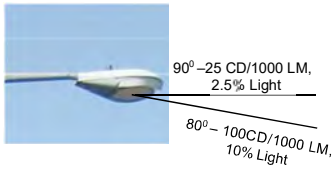
DDOT Streetlight: Fixture Style Reference	
Fixture Style	**Photographs**
1 - Cobrahead Cutoff	
2 - Cobrahead Simi Cutoff	
3 - Posttop	 
4 - Teardrop	
5 - Incandescent	
6 - Mushroom	
7 - Spot Light	 
8 - Navigation	
9 - Chinatown Luminaire	
10 - Wallpack	
11 - Overhead	
12 - Standard LED	   
13 - Old Teardrop	  

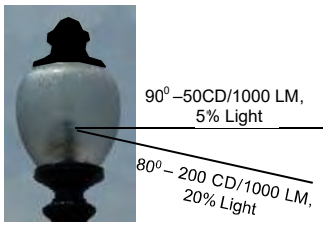
13.8.10 Cutoff Fixtures

It is important to control the distribution of light flux emission above the beam of maximum candlepower. At higher vertical angles, light flux emission generally contributes substantially to increased pavement brightness, but it also contributes greatly to increased disability and discomfort glare[6]. The light flux emission above the beam of maximum candlepower needs to be controlled to achieve balanced performance. The categories of control are presented in Table 9 with some facts, advantages and disadvantages of each option.

[6] Source: *Roadway Lighting Handbook,* Washington, DC, U.S. Department of Transportation, 1983.

Table 9: Comparison of Cutoff Levels

Options for Cutoff Levels	Facts	Advantages	Disadvantages
Full Cutoff  	▪ A luminaire light distribution with zero candela (intensity) at an angle of 90° or above. ▪ The candela per 1000 lamp lumens is ≤ 100 (10%) at 80° vertical angle ▪ No uplight allowed	▪ Perceived reduction in 'sky glow' ▪ Excellent light control at property line ▪ Limits spill light ▪ Reduces perceived glare	▪ Reduces pole spacing, increases pole and luminaire quantity ▪ Least cost effective of all cutoff categories ▪ Concentrated down light component results in maximum reflected uplight ▪ Decreased uniformity due to higher light levels under pole
Cutoff  	▪ A luminaire light distribution where the candela per 1000 lumens is ≤ 25 (2.5%) at an angle of 90° or more. ▪ The candela per 1000 lamp lumens does not exceed 100 (10%) at a vertical angle of 80°. ▪ 0% to 16% uplight	▪ Small increase in high-angle light compared to full cutoff ▪ Good light control at property line ▪ Potential for increased pole spacing and lowering overall power consumption when compared to full cutoff	▪ Can allow uplight, a problem where uplight is not desired ▪ Light control at property line less than full cutoff ▪ Higher amount of reflected light off pavement can contribute to sky glow

Semi-Cutoff 	▪ A luminaire light distribution where the candela per 1000 lumens is 50 (5%) at 90⁰ angle or above. ▪ The candela per 1000 lamp lumens is 200 (20%) at 80⁰ vertical angle ▪ 1% to 32% uplight	▪ Potential for increased pole spacing and lowering overall power consumption when compared to full cutoff ▪ High angle light accents taller surfaces ▪ Less reflected light off pavement than cutoff luminaires ▪ Vertical illumination increases pedestrian security and safety	▪ Greater potential for direct uplight component than cutoff ▪ Light trespass a concern near residential areas ▪ Increased high angle light compared to cutoff
Non-Cutoff 	▪ A luminaire light distribution there is no candela restriction at any angle. ▪ No restriction on uplight	▪ Potential for increased pole spacing and lowering overall power consumption when compared to full cutoff ▪ Accents taller surfaces ▪ Highest vertical illumination increases pedestrian safety & security ▪ Potential for excellent uniformity ▪ Least amount of reflected light off pavement ▪ 'Open visual environment' provides vertical surface visibility	▪ Greater potential for direct uplight component than cutoff ▪ Least control of uplight ▪ Increased high angle light compared to cutoff

13.8.11 Wattage

The District is currently considering a policy to design streetlights based on a lower wattage, so as to keep an extra cushion for higher level of illumination in future. If needed in future, the lower wattage lamps can be replaced by higher wattages. For example, No. 16 poles should be designed for a maximum

of 250 Watt (while allowed is up to 400att) and No. 14 poles should be designed for a maximum of 100 Watt (while allowed is up to 150 Watt). This will provide the flexibility of using higher wattages in future.

DDOT also discourages using 400 Watt conversion kits in residential areas.

Currently, the District lamp wattage ranges from 24-1000. Specific wattage figures have included the following:

- 24,25, 30, 35,50, 54, 60, 70, 74,75, 92, 100, 110, 120, 135, 150, 15, 189, 200, 215, 250, 270, 295, 400, 405, 1000)

13.9 AMIS and RMCS Functional and Technical Requirements

13.9.1 AMIS/RMCS Functional Requirements

At a minimum the AMIS/RMCS shall:

AMIS/RMCS Minimum Functional Requirements	
ID	**Minimum Requirement**
General Features	
	Provide intuitive system navigation (e.g., configurable menus, screens, drop down lists, etc.)
	Provide data input supported by drop-down menus or lists with selected options
	Record full audit trail and history throughout all modules, including date, time, who made the change, etc.
	Allow for District-definable rules-based workflow
	Provide a multi-User platform with role-based user access with separate levels of access
	Allow for cloud-based hosting for system and associated data with remote access to all information
Technology	
	Integrate to enterprise applications, including work order management system, currently Cityworks 7, and asset inventory, which is currently held in an ArcGIS database, through Open Application Programming Interfaces (APIs)
	Allow for attaching electronic files (e.g., photos, PDFs, video) to various records and fields throughout the system, including assets, service requests and work orders
	Provide capability to link files to a District document management system and/or network file locations
	Email distribution of reports and approval requests from within the system
Graphical User Interface (GUI) / Dashboard	
	Provide multi-user access with differing tiers of privileges (user groups)
	Support map-view of data and queries with multiple basemapping options (e.g. street grid, topographic, and satellite)
	Provide a web-based front end, compatible with IE, Firefox , Chrome, and Safari.
	Provide an optimized-for-mobile interface for AMIS interaction (either an iOS App or a mobile version of the website)
	Provide a customizable dashboard that the user is directed to upon login, that is capable of: • Presenting saved, user-defined queries (e.g., open work orders, recently completed work orders, etc.) • Geographic presentation of user-defined queries (e.g., map of open work orders) • Presenting summary statics, graphical or otherwise, of user-defined queries (e.g., a bar chart for number of work orders generated in the past week, summarizing the number that are open/closed/in-progress/not-started).
	Provide an interactive search and reporting tool
	Provide ability to query data

AMIS/RMCS Minimum Functional Requirements	
ID	**Minimum Requirement**
	Display network infrastructure and status and allow configuration of monitoring and control devices, including scheduling.
	Provide ability to directly control fixture (On/Off/Dim) or group of fixtures from map view
	Provide ability to view real-time Automatic Vehicle Location (AVL) of work vehicles in a geographic presentation. Location shall be recorded at increments of 15 minutes or less. AVL should include name of employee(s) assigned to vehicle.
	Store historical work vehicle location data based on AVL records for minimum of 72 hours
	Allow for real-time reporting of performance metrics, including overdue Work Orders, Service Requests, light outages, etc. Auto-refresh of streetlight network status and related operational performance data shall be kept in accordance with industry standards.
	Provide ability to export searches and reports to open file formats (e.g., .csv, .xml, etc.)
	Allow for maps to be printed to aid in locating Service Requests and Work Orders
GIS System Capabilities	
	Ensure the GIS data structure is compatible with latest version of ESRI's ArcMap/ArcSDE/ArcGIS Server
	Integrate with 3rd party GIS systems via API for data push/pull capability (may require some matching and/or verification based on existing GIS data accuracy)
	Provide capability to geolocate Lighting Units and Elements within the Project Limits through both web and mobile interfaces
Asset Inventory Tracking	
	Track individual and grouped asset activities and history, including service requests, work orders, inspections, repairs, replacement, refurbishment, maintenance, upgrades, etc.
	Provide all Lighting Unit and associated Element(s) data fields currently included in the District-hosted Lighting Asset Inventory
	Track Element-specific product and equipment data, location, including manufacturer, model, serial, number, date of manufacture, and Pole Identification Tag
	Furnish, install, and maintain Pole Identification Tags for each pole
	Track as-built drawings, product literature, and any other documentation provided with s Lighting Unit and associated Element(s) materials and attach it to one or many Lighting Unit(s) in the Lighting Asset Inventory
	Provide ability to upload photos and relate them to specific Lighting Unit(s) and/or Element(s), including photos of deficiencies, inspections and before/after work order photos
Lighting Remote Monitoring and Control Data	
	Provide ability to remotely control a minimum of 100,000 RMCS nodes via mesh network, star network, and/or cellular network communication
	Relate individual RMCS nodes to the Lighting Asset Inventory in the AMIS.

AMIS/RMCS Minimum Functional Requirements	
ID	**Minimum Requirement**
	Provide the capability to store and retrieve Luminaire information from each individual node including (but not limited to): • Lamp Status and faults • Photocell feedback and faults (if applicable) • Voltage trips • Node status as it relates to communication, the real-time clock, temperature, and faults. • Power data including (but not limited to): voltage, current, kilowatts (KW), kilowatt-hours (KWH), burn hours, and power factor. • Dim status and dimming % (and/or % of full power).
	Retrieve and stores Luminaire status, energy usage, and node operating temperature at regular intervals (no less than once every 8 hours) from the RMCS field devices as well as their history
	Auto-refresh of streetlight network status and related operational performance data shall be kept in accordance with industry standards.
	Allow for manual on-off control of individual Lighting Unit(s) or groups of Lighting Units
	Allow for programmable dimming based on time and astronomical events (i.e. sunrise/sunset)
	Provide Daily/Weekly/Monthly schedule capability with Individual Events (Special Days)
	Support trimming or fine-tuning of the Luminaire for sunrise and sunset (E.g. starting light at 50% at sunset and ramping to 100% 30 minutes after sunset)
	Offer constant light output to automatically adjust power based on lumen depreciation curve from Luminaire manufacturer
	Provide ability to group Light Fixtures for (On/Off/Dim/Schedule) controls
	Provide ability to report burn hours report per node and per group
	Provide ability to report kWh usage per node and per group
	Ensure accuracy of both the individual control and the system groupings that must report with a degree of accuracy to provide revenue grade billing (0.5%) for the end customer
	Enable adaptive lighting optimization through an adaptive lighting engineering process, of lighting levels and energy consumption for different areas/land uses in the District based on a variety of measured inputs and predicted events
	Provide capability for error reporting and push notification of fallen poles, moved poles, day-burners, outages, or other user-definable queries
Work Order System	
	Interface with the District's work order management system (Cityworks 7 at the time of publication of these Technical Provisions) via the work order management system API to pull information from (e.g. service requests) as well as push information to (e.g. completed inspections, work orders, tasks, etc.) the work order management system
	Update the AMIS whenever a physical Element is constructed, installed, maintained, inspected, modified, renewed, replaced, or removed within two (2) Days of completion of such Work, with the

AMIS/RMCS Minimum Functional Requirements	
ID	**Minimum Requirement**
	exception of work completed on Fridays. Work completed on Friday must be reflected in the AMIS by 24:00 the next Tuesday.
	Provide ability to generate Service Requests and Work Orders on individual or multiple assets
	Provide ability to generate a Work Order that includes several actions/items, with no limits
	Provide ability to geocode service requests and work orders and see/edit them directly in the AMIS and through a GIS application
	Provide ability to group assets within a category and area in GIS format to help schedule and coordinate maintenance activities
	Track incidents
	Provide capability to search and view Service Requests, Work Orders, and inspections, with and without a map
	Work Order work flow and approval routing.
	Allow for a task library of common maintenance work and instructions
	Provide capability for automatic escalation if response time period is exceeded
	Provide ability to associate a new Service Request to an existing Work Order record
	Provide ability to modify Work Order type
	Allow for no limit on the number of Work Orders that can be open at any time.
	Provide ability to generate Work Orders tied to specific work type when generating Work Orders against an asset is not practical
	Ensure date and timestamp on all stages of the Work Order including: • Initiation of Service Request • Receipt of Service Request (if not generated by the Developer) • Initial inspection by the Developer • Generation of Work Order • Completion of Work Order • Closeout inspection documenting completion of work
	Track relationships between service requests and Work Orders
	Generate Work Order status messages
	Allow assignment of Service Requests and Work Orders to individuals or crews
	Assign Work Order priority status with ability to escalate
	Track operating status of the District's work order management system, currently Cityworks, in the event of an outage
	Track the use and location of lane closures needed for street light work
	Provide audit trail capability for work orders and service requests to track user data entry
Preventative Maintenance Capabilities	

AMIS/RMCS Minimum Functional Requirements	
ID	**Minimum Requirement**
	Provide capability for maintenance triggers and schedules based on parameters such as warranty expiration, usage hours, asset age, expected life, time milestones, etc.
	Generate Work Order with default information from predefined preventative maintenance tasks
	Provide warranty tracking capability and expiration alerts
	Generate condition assessment schedules based on asset types and condition assessment rules
	Store and assign preventive maintenance procedures tied to work type and asset
	Provide ability to view preventative maintenance schedule days, weeks or months in advance
	Track condition of individual Elements, including Luminaire, pole, arm, transformer base, foundation, RMCS node/gateway, etc.
	Provide standardized inspection templates (test results, photos, checklist of inspection activities, free-form notes, etc.)
	Provide inspection/condition assessment information, including but not limited to the following: • Inspection history • Inspection notes • Inspection condition rating • Asset performance comparisons with recent inspection data
	Provide asset maintenance history and schedules.
Handheld (Mobile) Devices	
	Provide ability to work on a handheld device in the field on an iOS platform
	Provide for the uploading and synchronization of selected data
	Provide ability to use handheld devices to take and attach photographs to individual records in the field
	Perform searches on records on handheld devices.
	Manage Service Requests and Work Orders on handheld devices in real-time
	Provide ability to enter a new Work Order on the spot
	Synchronize data using wireless networks or cell phone data plans
	Provide ability to conduct Field Evaluations in connected or disconnected mode
Non-Compliance Tracking	
	Calculate Noncompliance points based on the Performance Requirements through any required data inputs including but not limited to: current Light Fixture Remote Monitoring and Control Data, Work Order status, the Lighting Asset Inventory, and any other needed inputs
	Noncompliance events shall include the list of Lighting Units or Elements causing the Noncompliance and any Work Orders, Service Requests, inspections or other work tracking documentation related to those Lighting Units or Elements.
Reporting	

AMIS/RMCS Minimum Functional Requirements	
ID	**Minimum Requirement**
	Provide real-time, high-speed, remote unrestricted access to all functionalities of the AMIS and project records contained in the AMIS and the ability to download information contained in the AMIS
	Provide the District access to the same data, reports and analyses that the Developer has
	Provide ability to export reports in open file formats including (but not limited to): plain text, csv, xml, pdf and make reports available to the District on a file sharing site
	Search and report on all fields in the database, including user-defined fields, with the ability to organize, summarize, sort and sub-total in a variety of ways
	Provide intuitive ad hoc reports and queries with wild card search and drop-down lists
	Report by date range and multiple combinations of other parameters
	Modify report templates or standards reports and save new format for future use
	Provide access to reports through GUI dashboard display
	Save a query as a report.
	Provide standard reports to demonstrate compliance with obligations of the Agreement and Performance Requirements, including daily, monthly, and annual reports of performance metrics and Noncompliance events as per Sections 10.2 and 10.9 and Appendix 13.1 of these Technical Provisions
	Generate a daily report itemizing work completed today, patrolling completed today, work planned for tomorrow, and patrolling planned for tomorrow
	Provide a preset alerts report
Notifications and Alerts	
	Allow for user-configurable real-time alerts via email and SMS text messaging
	Allow for notifications configured for users or groups of users

13.9.2 AMIS Technical Requirements

At a minimum the AMIS shall:

AMIS Minimum Technical Requirements	
ID	**Minimum Requirement**
Hosting & Security	
	Fully hosted, including all data storage, within the continental U.S. Cloud enabled for mass data storage.
	The AMIS and RMCS shall be fully functional, with the exception of approved planned outages.
	Minimum 128 AES Encrypted Communications
	Use of persistent cookies or storage of tracking or configuration information is prohibited without prior written authorization from the District.
	Establish incident response procedures as they relate to security items, including a policy for breach notification.
	Provide protection from unauthorized users via security systems, fire walls and any other components or methods necessary to make the system secure.

AMIS Minimum Technical Requirements	
ID	**Minimum Requirement**
	The servers where the data is stored shall be protected from unauthorized access and security measures shall be in place to protect them from unauthorized physical access.
Disaster Recovery	
	Provide system redundancy and backup server location(s) as part of a disaster recovery plan.
	The Developer shall have daily, off-site backups of all AMIS data. Backups shall be retained for a period of 1 year from their date of creation.
Work Order System	
	Automated information exchange between the AMIS and the District work order management system, currently Cityworks 7, in real-time or near real-time, i.e., no less than once every 5 minutes.
AMIS Architecture	
	Developer shall prepare an AMIS Architecture that includes the following: A. AMIS processes and rules; B. AMIS structure in a work breakdown structure; C. Proposed hardware and software technical data; D. Flow charts of the work-flows for notifications and work orders; and E. Other required processes. Concurrent with the Asset Management Plan (AMP) Submittal, Developer shall submit the AMIS Architecture to the District for approval. During the Term, Developer may propose changes to the AMIS Architecture and prepare an updated AMIS Architecture. No later than 20 days prior to implementing the update to the AMIS, Developer shall submit the updated AMIS Architecture to the District for approval.
Intellectual Property Rights	
	Ensure the ability for the District to, at any point, access, use, reproduce, modify, adapt, disclose to, and sublicense the Intellectual Property of the AMIS owned or licensable by the Developer or any Developer-Related Entity.
Data Ownership and Confidentiality	
	Maintain confidentiality of all Information within the AMIS and make all Project Data in the ownership or possession of the Developer or any other Developer-Related Entity available to the District promptly upon request.

13.9.3 RMCS Nodes Functional Requirements

At a minimum the RMCS Nodes shall:

RMCS Node Minimum Functional Requirements		
ID	**Specification**	**Minimum Requirement**
	General Control Interface	Digital Addressable Lighting Interface (DALI) control. DALI protocol shall be in compliance with the most recent standards and protocols available and published by the Digital Illumination Interface Alliance (DIIA).
	Dimming	DALI control dimming with range capabilities from 100% down to 10%. DALI protocol shall be in compliance with the most recent standards and protocols available and published by the Digital Illumination Interface Alliance (DIIA).
	Energy Measurement for controller	Controller reports its own energy use (luminaire + node).
	GPS	GPS included, 2.5 meter accuracy or better.
	Tilt Sensor	Tilt sensors must be affixed to Upright Pedestal, Twin 20's, and Washington Globe lighting units owned by District. Sensors must have minimum functionality of programming for detection and notification of a max tilt angle alarm. While not a minimum requirement, tilt sensors may also be affixed to highway lighting units. Note, as per section 2.3.1 of the ITP, it is to be determined if this functionality will be pursued by the District or not.
	Programmable Schedule	Minimum of 1 week schedule stored in node
	Loss of Communication	Light and node functionality shall be independent of wireless network
	Fallback Operations	In the event of communications loss – operational mode shall be user-configurable to 'On', photocell control, or astronomical clock schedule.
	Certification	UL Certification, FCC
	Physical Installation	Both NEMA twistlock (ANSI C136.10 and C136.41) and in-fixture (for pole top fixtures) form factors
	Communication	Wireless – cellular, mesh, and star network topology are all acceptable RMCS communication protocols. Please note that the District would like cellular network communication to be the primary RMCS communication protocol.
	Addressing	IPv-4 Addressable
	Firmware upgrades	Over-the-air (i.e. wireless)
	Auxiliary Functionality	RMCS shall have auxiliary inputs for future expansion (e.g. proximity sensors)
	Warranty	Equipment and all components of Nodes are guaranteed for a minimum of 10 years from the date of installation for repair or replacement of any

RMCS Node Minimum Functional Requirements		
ID	**Specification**	**Minimum Requirement**
		component determined to be defective under normal use at no cost to the municipality.

13.9.4 RMCS Nodes Technical Requirements

The RMCS Nodes shall comply with the following:

RMCS Nodes Technical Requirements		
ID	**Specification**	**Minimum Requirement**
3.5.1	Voltage input	120-277V AC
3.5.2	Frequency	60 Hz
3.5.3	Wattage	Maximum wattage is 3 W
3.5.4	Operating Temperature Range	Must operate in the range -30 to +55°C
3.5.6	On and Off Control	Integrated relay
3.5.8	Energy Measurement	ANSI C12.20 Class 0.5 metrology (i.e. utility-grade metering with minimum accuracy of 0.5% operating at Power Factor 0.9)
3.5.12	Data logging	Minimum of 1 week of energy use stored in node.
3.5.13	Data transmission and availability	Data pushed to AMIS at least every 8 hours with the ability to enable push alerts for critical events (e.g. fixture outage, sensor knockdown, etc.). Auto-refresh of streetlight network status and related operational performance data shall be kept in accordance with industry standards.
3.5.14	Ingress Protection	IP54 or better
3.5.15	Surge Protection	Minimum 6kV/3kA
3.5.24	Frequency	Comply with one of the following: 1. Unlicensed spectrum: a. 902-928 MHz, Max Tx Power 1W, BW 250k b. 902-928 MHz, Max Tx Power 0.25W, BW 500k c. 2.4-2.4835 GHz, Max Tx Power 0.125W, 1MHz (BWmin) d. 2.4/2.5 GHz WiFi 2. Any licensed spectrum (cellular allowed)
3.5.25	Security	Minimum 128 AES Encrypted Communication
3.5.28	Command Time	Under 6 Seconds (after any user-required confirmation or authentication)

13.9.5 RMCS Gateways Functional Requirements

At a minimum the RMCS Gateways shall:

RMCS Gateway Minimum Functional Requirements		
ID	**Specification**	**Minimum Requirement**
	Scale	Capable of controlling/communicating with at least 1,000 RMCS nodes
	Communication from Gateway to Node	Wireless

	Backhaul Communications	Capable of both ethernet, wifi and cellular connections to AMIS
	Warranty	Equipment and all components of Gateways are guaranteed for a minimum of 10 years from the date of installation for repair or replacement of any component determined to be defective under normal use at no cost to the municipality.

13.9.6 RMCS Gateways Technical Requirements

The RMCS Gateways shall comply with the following:

RMCS Gateway Minimum Technical Requirements		
ID	**Specification**	**Minimum Requirement**
3.6.1	System Voltage	120-277V AC
3.6.2	System Frequency	60 Hz
3.6.3	Power Consumption	Max 15W or 1.5 kW total network power.
3.6.4	Operating Temperature	Must operate in range -30 to +55°C
3.6.5	Surge Protection	Minimum 6kV/3kA
3.6.6	Ingress Protection	IP64 or better
3.6.8	Frequency to communicate from Gateway to node	Comply with one of the following: 1. Unlicensed spectrum: a. 902-928 MHz, Max Tx Power 1W, BW 250k b. 902-928 MHz, Max Tx Power 0.25W, BW 500k c. 2.4-2.4835 GHz, Max Tx Power 0.125W, 1MHz (BWmin) d. 2.4/2.5 GHz WiFi 2. Any licensed spectrum (cellular allowed)
3.6.9	Network Communication	If using unlicensed spectrum either: 1. IEEE 802.15.4 (6LoWPAN/FHSS/DSSS) Or 2. 802.1.11
3.6.10	Security	Minimum 128 AES Encrypted Communication

13.10 Condition Assessment Rating Scale & Procedures

Typical Lighting Units consist of a foundation, pole, arm and luminaire. The Elements of each Lighting Unit will vary in style and material. Typical street light configurations can be found in the District of Columbia Streetlight Policy and Design Guidelines. Material specifications and details can be found in the District of Columbia Department of Transportation Standard Specifications for Highways and Structures and District of Columbia Department of Transportation Standard Drawings.

13.10.1 Condition Ratings Scale

The table on the following page depicts the condition ratings scale used in the 2020 condition assessment and to be used throughout the Project Term to determine Element condition ratings.

Component	Description	Scoring					
		5 (Excellent)	4 (Good)	3 (Fair)	2 (Poor)	1 (Very Poor)	0 (Emergency)
Pole Shaft	Visual inspection for rust, corrosion, cracks, dents, and other signs of that the structural integrity is compromised	No damage/new condition	No rust, corrosion, or damage and slight wear	Moderate wear, some light rust, or corrosion, or damage	Heavy wear, moderate rust, or corrosion, or damage	Heavy rust or corrosion, significant dents, cracks or structural damage	Severely damaged and presents a threat to property and public safety
Brackets and Arms	Visual inspection for rust, corrosion, cracks, condition of any welds, and any signs of metal Fatigue	No damage/new condition	No rust, corrosion, or damage, welds are intact, and slight wear	Moderate wear, some light rust, or corrosion, or damage, welds are intact	Heavy wear, moderate rust, or corrosion, or damage, signs of weld deterioration	Heavy rust or corrosion, significant dent or structural damage, welds are cracked or have broken	Severely damaged and presents a threat to property and public safety
Luminaires	Visual inspection of luminaries and associated fixtures for damage, cracks, and deterioration	No damage/new condition	No damage and slight wear	Moderate wear, some discoloring, minor cosmetic damage, such as pitting	Heavy wear, moderate cosmetic damage, significant cracks, pits, or breakage	Heavy wear, significant cosmetic damage, significant cracks, pits, or breakage	Severely damaged and presents a threat to property and public safety
Glare Shield	Visual inspection of glare shield and for durable attachment, deterioration, and damage.	No damage/new condition	No rust, corrosion, or damage and slight wear/attachment intact	Some light rust, corrosion, or damage and moderate, and attachment intact	Heavy wear, moderate rust, corrosion, or damage, attachment intact	Heavy rust or corrosion, significant dent or structural damage, attachment not intact or missing	Severely damaged and presents a threat to property and public safety
Handhole	Inspection of condition of the handhole for deterioration, and that covers are intact	No damage/new condition	No rust, corrosion, or damage and slight wear/cover intact	Some light rust, corrosion, or damage and moderate wear/cover intact	Heavy wear, moderate rust, corrosion, or damage, cover intact but not sealed	Heavy rust or corrosion, significant dent or structural damage, cover not intact or missing	Severely damaged and presents a threat to property and public safety
T-Base/Base Cover	Visual inspection for rust, corrosion, cracks, dents, and other signs of that the structural integrity is compromised, and of any weld above the base plate	No damage/new condition	No rust, corrosion, or damage, welds are intact, and slight wear	Light rust, corrosion, or damage, welds are intact, and moderate wear	Heavy wear, moderate rust, corrosion, or damage, signs of weld deterioration	Heavy rust or corrosion, significant dent or structural damage, welds are cracked or have broken	Severely damaged and presents a threat to property and public safety
Anchor Bolts	Ensure all anchor bolts are in place, securely tightened, and visually inspected for rust, corrosion, cracks, other damage	All/No damage/new condition	All bolts on and tight, no rust, corrosion, or damage and slight wear	All bolts on and tight, light rust, corrosion, or damage and moderate wear	All bolts on and tight, moderate rust, corrosion, or damage and moderate wear	One or more bolts are missing or loose, heavy rust, corrosion, or damage and severe wear	Severely damaged and presents a threat to property and public safety
Foundation	Visual inspection to assess condition of foundation for cracks, erosion, deterioration, chipping, or other damage	No damage/new condition	No cracks, erosion, or damage and slight wear	Small cracks, chips or damage, start of erosion, moderate wear	Large cracks, chips or damage, or erosion, moderate wear	Missing in whole or in part, extreme wear, pole unaligned with foundation	Severely damaged and presents a threat to property and public safety

13.10.2 Foundations

13.10.2.1 Inspection Procedures and Common Defects

13.10.2.1.1Erosion/Undermining/Settlement/Drainage

The foundation should be visually assessed for erosion, undermining, settlement and/or drainage deficiencies. The inspection team should inspect and document the following conditions:

(a) Location of the foundation relative to the immediate area around the foundation.

(i) If the top of the foundation is buried less than 12" below grade, remove the dirt/fill until the top of the foundation is exposed. Inspect and document that the pedestal was buried and uncovered for inspection.

(ii) If the top of the pedestal is located under a walkway or sidewalk, or buried below grade 12" or more, document the condition and report it to District of Columbia Department of Transportation for further instruction on whether further excavation to uncover the foundation is required.

(b) Erosion or undermining around the foundation faces. Any areas of undermining should be probed and documented to determine depth and extent.

(c) Any indications of movement or rotation of the foundation should be measured and documented. Movement or rotation of a foundation could be indicative of an underlying foundation or soil issue.

(d) Standing water or indications of poor drainage. If standing water is present, note the depth of water measured.

(e) The foundation is located in a swale or drainage ditch. A foundation located in a swale or drainage ditch could periodically be submerged resulting in corrosion, debris accumulation, or damage of the submerged areas.

13.10.2.2 Concrete Foundations

Concrete is commonly used for foundations. All loose debris and vegetation should be removed. The foundation should be visually and tactilely inspected. The inspection team should inspect and document the following conditions:

(a) 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.

(b) 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.

(c) Spalling, Honeycombing, Scaling. All spalling, honeycombing, and scaling should be documented. Any exposed reinforcing should be documented along with any associated section loss.

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

13.10.2.3 Grout Pads

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

(a) 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, and then remove the grout pad and note that it was removed by the inspector.

(b) 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. The grout pad should provide means of providing drainage for water inside the pole.

(c) 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 foundation.

FOUNDATIONS

(5)Excellent

(4) Good

(4) Good

(3) Fair

FOUNDATIONS

(2) Poor

(1/0) Very Poor/Emergency

No Photo Available – Refer to Ratings Scale

PENDANT POLE - FOUNDATIONS

(5) Excellent

(4) Good

(3) Fair

(2) Poor

PENDANT POLE - FOUNDATIONS

(2) Poor

(1) Very Poor

13.10.3 Anchor Bolts

13.10.3.1 Inspection Procedures and Common Defects

All loose debris and vegetation should be removed. If the anchor bolts are covered by bolt covers ("elephant ears") or with another type of cover, the cover shall be removed for inspection. Any covers that are missing, loose, or have missing or loose hardware shall be noted. Once the inspection of the anchor bolts is completed, the covers shall be re-installed. Anchor bolts, washers, and nuts should be visually and tactilely inspected if accessible (i.e., not obscured by a grout pad). The inspection team should inspect and document the following conditions:

(a) Document any deviation, excess or missing components from a typical configuration shown in Figure 17. Examples include presence of lock washers, beveled washers, lock or jam nuts, extra washers, or missing nuts and washers.

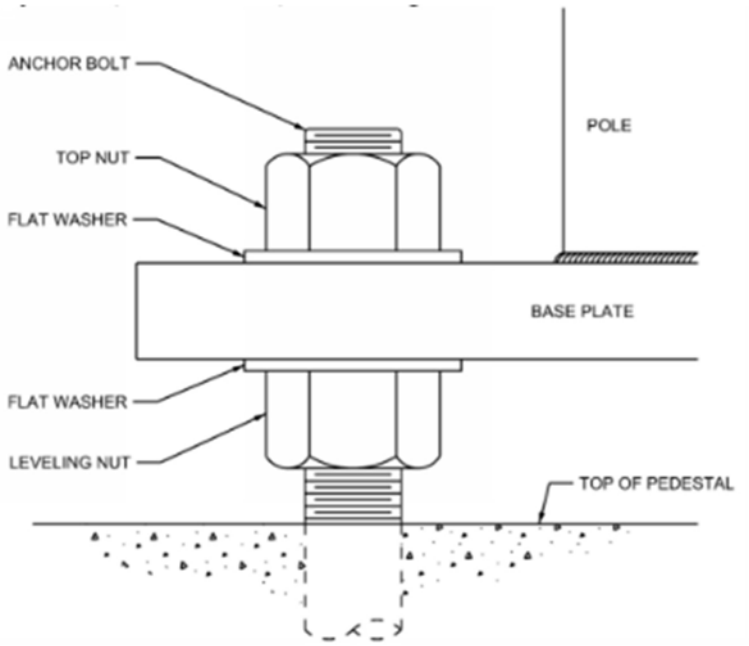


Figure 17 - Typical Anchor Bolt Configuration

(b) Check the presence of any tack welds or other additional welds on the anchor bolt assemblies. Welding can change the material characteristics and result in loss in bolt strength.

(c) 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.

(d) Inadequately sized flat washers or missing flat washers should be checked and enlarged or oversized holes should be noted be noted because enlarged holes reduce the bearing area of the top nut and/or leveling nut on the base plate.

(e) Adequate engagement of the top nut should be checked. Less than 100% engagement of the top nut reduces the ability of the anchor bolt to develop its full load carrying capacity.

(f) Plumbness of 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 as shown in Figure 18.

(i) Measure the plumb vertical distance or height, V, of the bolt above the top of concrete.

(ii) 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.

(iii) Calculate H/V.

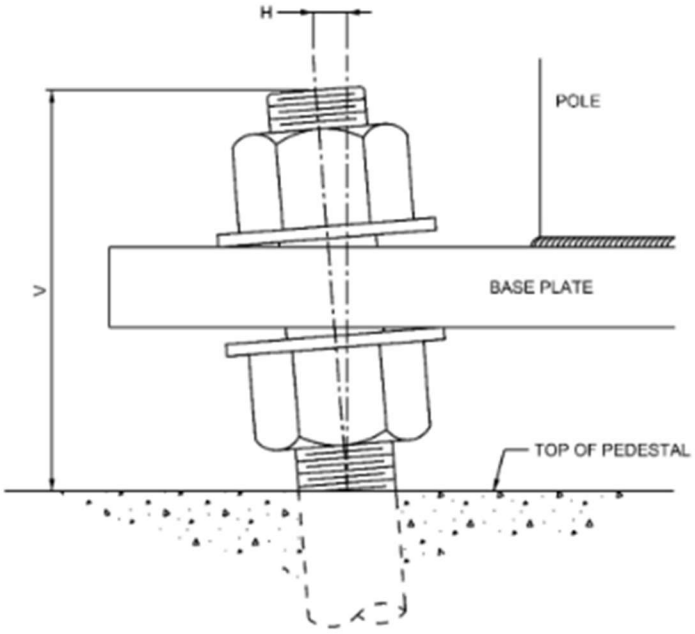


Figure 18 - Measurement Methodology for Out of Plumb Anchor Bolts

(g) Improperly seated anchor bolt top nuts on the base plate can reduce the bearing area of the nut on the bearing area and 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 is taken from the top of the washer to the bottom of the nut as shown in Figure 19. If a washer does not exist, the measurement, D, shall be taken from the top of the base plate to the bottom of the nut. Measure the bolt diameter “d” and calculate D/d.

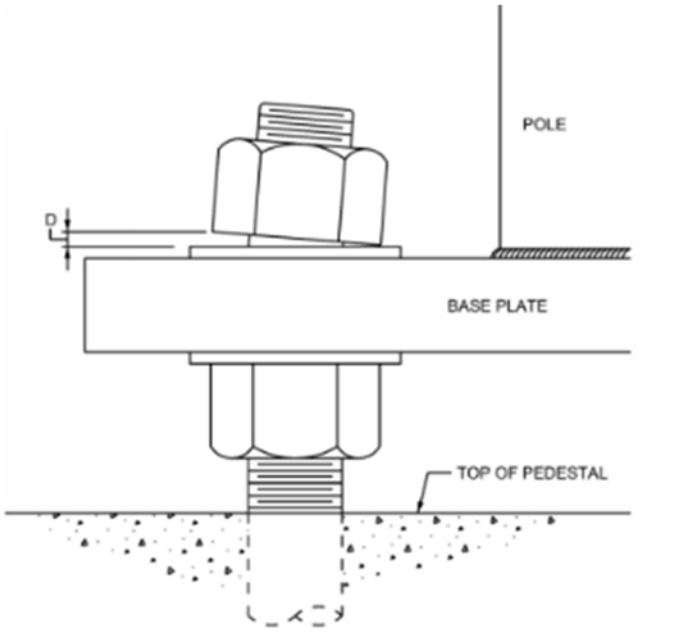


Figure 19 - Measurement Methodology for Improperly Seated Nuts

(h) 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.

(i) Distance between the bottom of the base plate and the top of the pedestal, H (refer to Figure 20). 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.

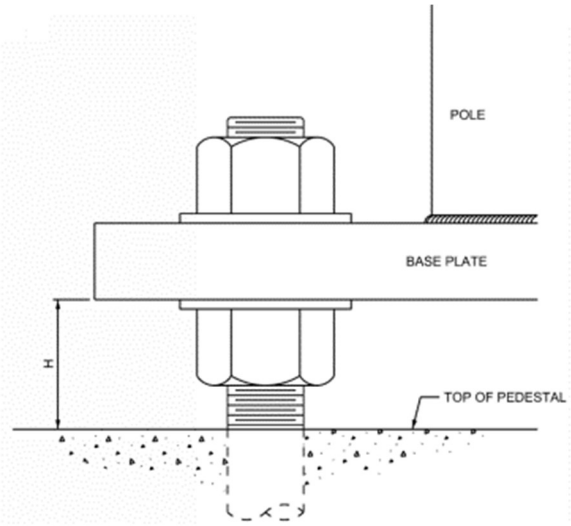


Figure 20 - Measurement Methodology for Improperly Seated Nuts

(j) 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. A structure with a deteriorated grout pad and no leveling nut is a serious condition. The presence of, or lack of, a leveling nut shall be noted in the inspection report.

(k) 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 a ball-peen hammer for any hollow sounds that could indicate the presence of a crack.

13.10.3.2 Anchor Bolt Numbering Methodology

Anchor bolt numbering is necessary to accurately define the various defects and deficiencies encountered during the inspection. 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 as shown in Figure 21.

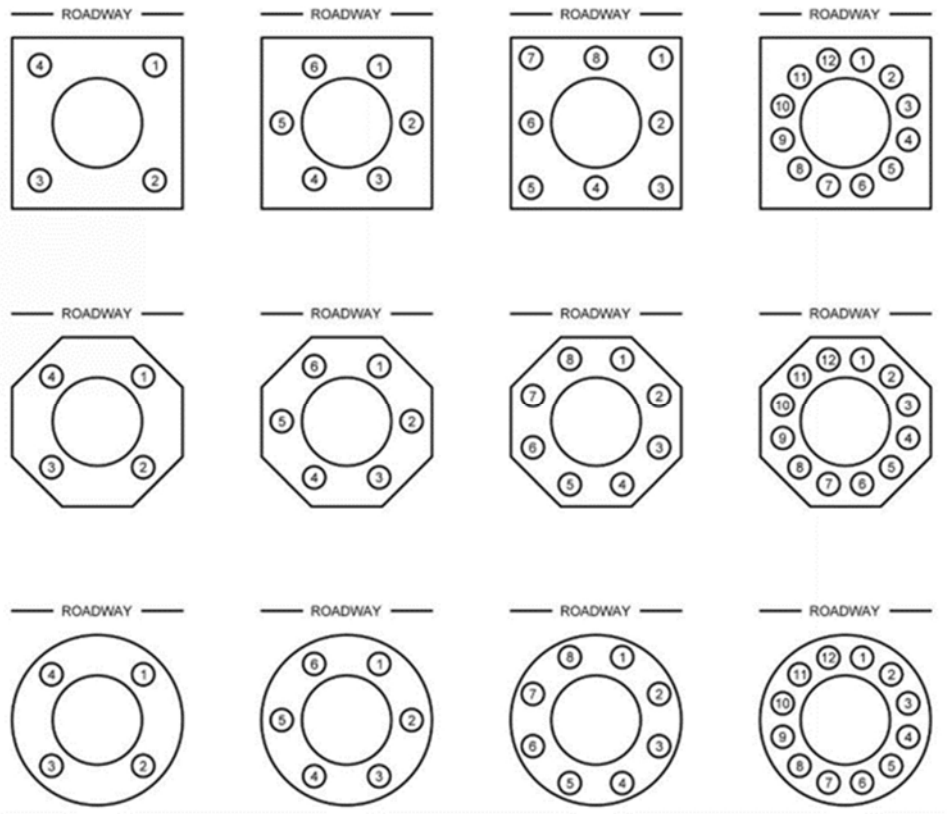


Figure 21 - Anchor Bolt Numbering Methodology

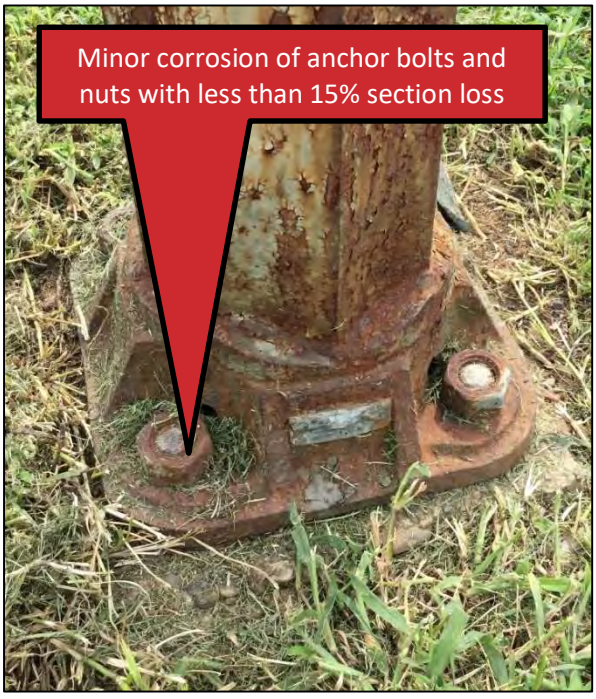
ANCHOR BOLTS - FOUNDATIONS

(5) Excellent

(4) Good

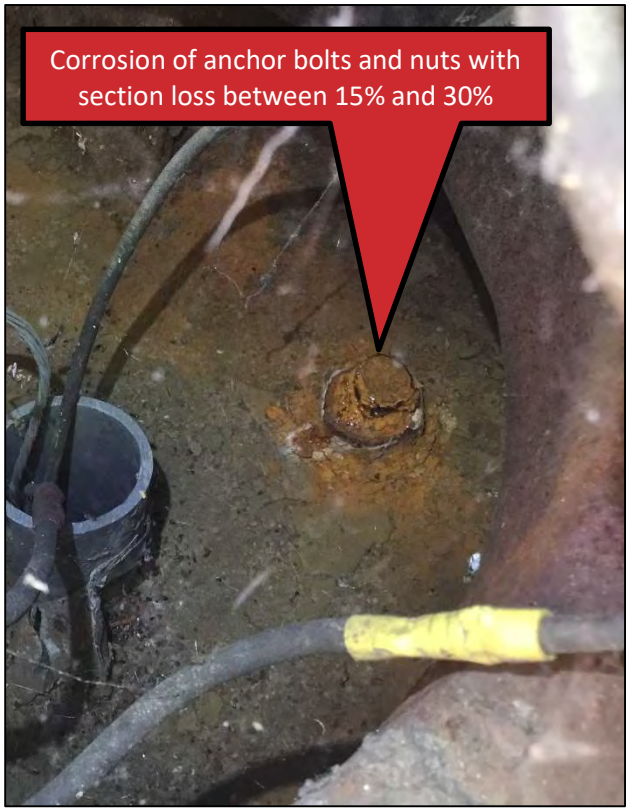
(4) Good

(3) Fair



ANCHOR BOLTS - FOUNDATIONS

(2) Poor



(2) Poor

(1) Very Poor

13.10.4 Transformer Bases

Transformer bases (T-Bases) are typically located between the pole and the foundation and are typically aluminum or steel. There is a fiberglass type which is typically ornamental only and do not provide any structural support.

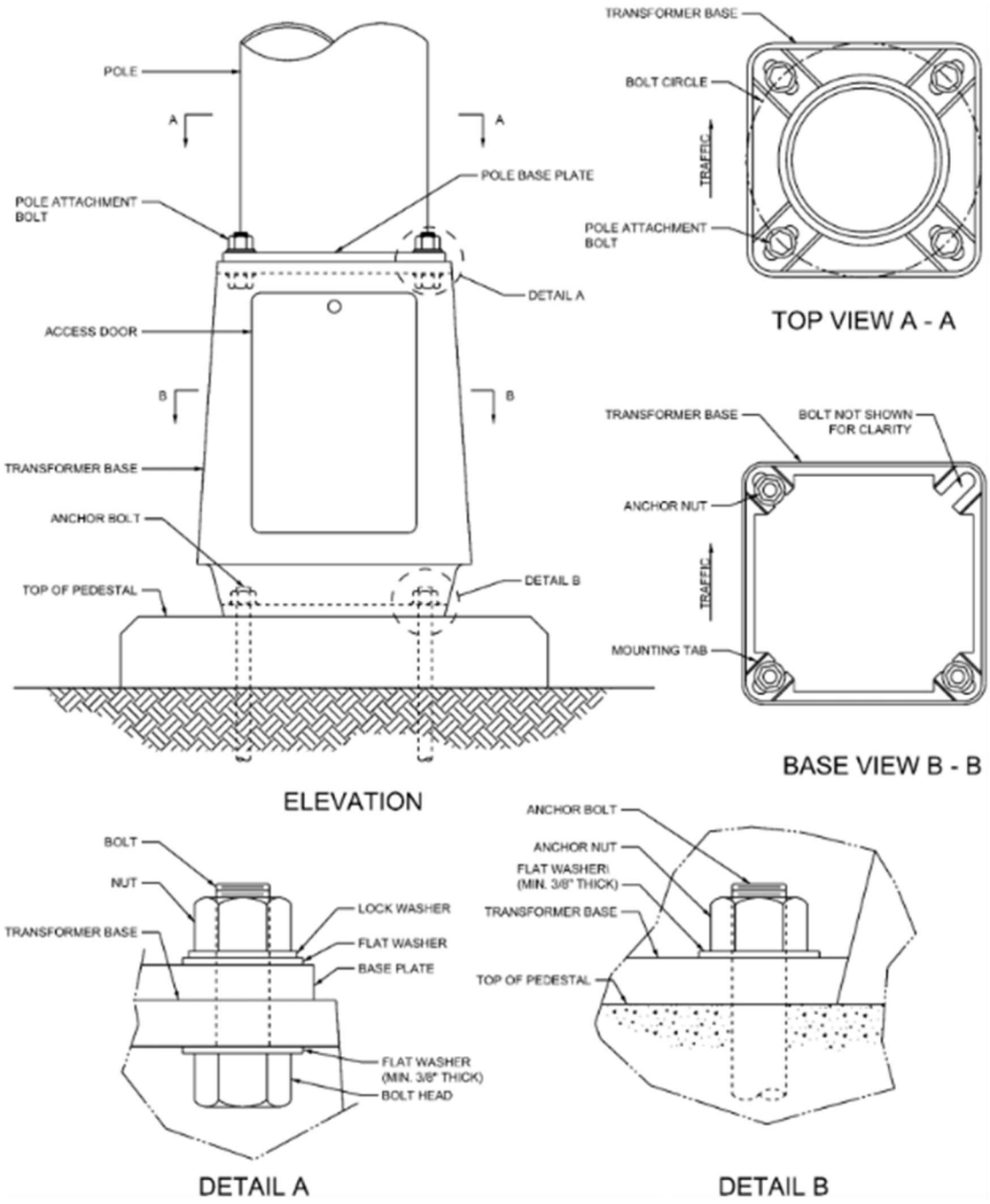


Figure 22 - Typical T-Base Configuration

13.10.4.1 Inspection Procedures and Common Defects:

Transformer bases (T-Bases) are typically located between the pole and the foundation. All loose debris and vegetation should be removed from under and around the transformer base. Transformer bases should be visually and tactilely inspected. The inspection team should inspect and document the following conditions:

(a) Document any deviation, excess or missing components from a typical configuration (as shown in the DDOT Standard Drawings). Some examples of deviations from the typical configuration may include extra washers or missing nuts and washers.

(b) Condition of the welded connections. T-bases typically have several welded connections and they shall be inspected thoroughly. 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.

(c) 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.

(d) Condition of the transformer base to base plate bolted connections. There are typically 4 anchor bolts attaching the pole to the top of the T-Base which are coded with “T-Bases”. The area around the anchor bolts shall be examined for any signs of distress as this is the location of high stress. The area, specifically the mounting tabs/flanges of T-bases commonly exhibit cracking of the brittle aluminum due to over tightening of the anchor bolts. Bolted connections should be inspected for loose or missing components, under engaged nuts, improperly sized 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.

(e) Transformer base access door and condition of inside of transformer base. There is typically a door to access the inside of the T-bases which will need to be opened to look for any defects on the inside of the T-Bases. Any access doors that cannot be opened, closed or are missing shall be noted and appropriate recommendations for remediation noted. The doors shall be inspected for tightness and for missing hardware or missing or loose fasteners. Missing or loose doors allow for water and debris infiltration and animal infestation. After the access door is opened, a visual inspection of the interior portions is required. The inspector shall treat all wiring as energized and recognize the potential for an electrical hazard. If tactile or other inspection methods are necessary inside the T-base, electrically insulated tools/equipment along with personal protective equipment shall be utilized in accordance with OSHA Standards. Look for observable corrosion, damage and/or section loss inside the T-base. Verify that the access door is closed and secured after inspection.

(f) Debris in and around the transformer base access door. Any debris present within the transformer base shall be removed by the inspection team

(g) Distortion of the transformer base. Distortion could be indicative of overloading, damage during erection, or improper welding procedures during fabrication.

(h) Impact damage. Document any observable impact damage, including dents and cracks, that exist and any deficiencies associated with it.

TRANSFORMER BASES - FOUNDATIONS

(5) Excellent

(4) Good

(3) Fair

(2) Poor

TRANSFORMER BASES - FOUNDATIONS

(2) Poor

(1) Very Poor

13.10.5 Poles

13.10.5.1 Inspection Procedures and Common Defects

Poles should be visually and tactilely inspected. The upper portions of the poles are to be inspected from an aerial lift (bucket or platform) or visually thought use of a scope or binoculars. For all pole types, the inspection team should inspect and document the following conditions:

(a) Out of plumb or leaning vertical supports/poles. Any observable leaning of the poles should be measured and the direction of the lean documented. The measurement can be obtained by lowering a plumb bob from anywhere along the height of the pole within a few inches of the base plate and taking a horizontal measurement, D, from the base of the support to the plumb line as shown in Figure 6. Alternatively, a level may be used for non-tapered poles as shown in Figure 24.

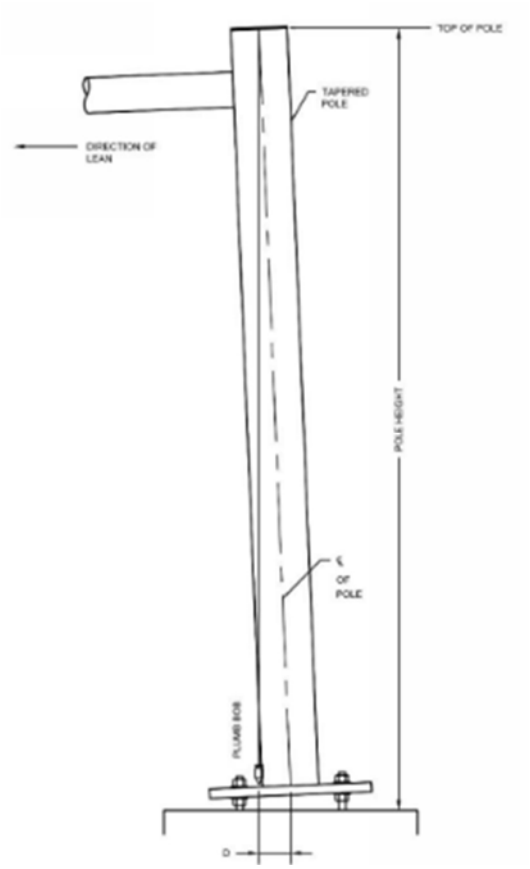


Figure 23 - Measurement Methodology for Leaning or Out of Plumb Tapered Poles

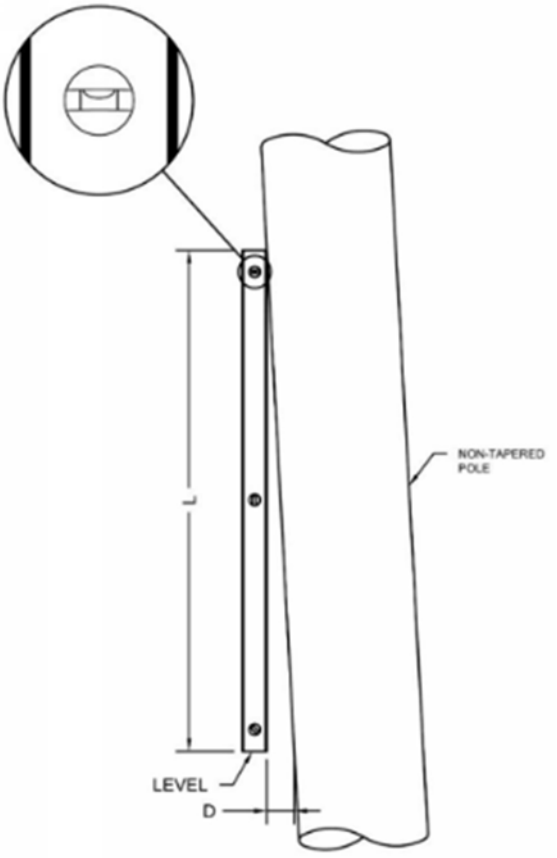


Figure 24 - Measurement Methodology for Leaning or Out of Plumb Non-Tapered Poles

(b) Bowing of the pole. 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.

(c) Impact Damage. Document any observable impact damage that exists and any deficiencies associated with it.

13.10.5.2 Metal Poles

For metal poles, the inspection team should inspect and document the following conditions:

(d) Conditions of, in, and around the hand holes and covers. Handhole access covers should be removed/opened and the interior of the pole examined for moisture, buildup of debris, corrosion on the inside of the pole, and cracks around the hand hole. Verify that the access cover is closed and secured after inspection. Look for any missing screws or bolts used to secure the cover. The inspector shall take extreme caution when inspecting the inside of the pole as the electrical wiring should be considered live.

(e) Coating loss (paint or galvanizing), corrosion, or section loss.

(i) If an area of corrosion is observed outside the pole, the area should be thoroughly cleaned of any rust scale and the amount and extend of section loss should be determined and documented.

(ii) 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 sued to visually inspect the inside of the pole. The use of a borescope is to be documented.

(iii) All metal poles that are either attached to a concrete foundation through anchor bolts or are embedded in the ground shall have D-meter readings taken just above the base weld and 4 ft above the base. The purpose of taking the D-meter readings 4 ft above the base is to use as a baseline to compare against those taken at the base. For section loss exceeding 10% of the total pole thickness, record additional readings in the immediate vicinity to determine extent of section loss. Each of the readings shall be taken at the 12:00, 3:00, 6:00, and 9:00 o’clock positions around the circumference of the pole as shown in Figure 8. D-meter 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, pack rust, the testing personnel should be familiar with, or directly supervised by someone who is familiar with D-meter operation. This ensures personnel have the knowledge to handle these situations in the field to prevent erroneous data.

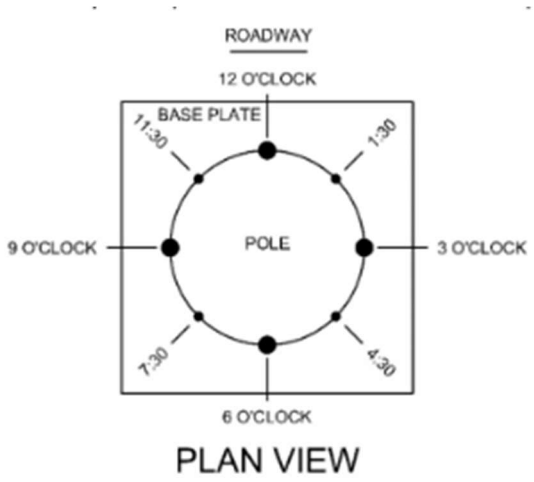


Figure 25 - Measurement Methodology for Pole D-Meter Readings

(f) 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 inspection team 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.

(g) Dents and ruptures. Dents and ruptures in round vertical poles can reduce the load carrying capacity of the pole as they could significantly reduce the cross section of the pole. The depth of the dent or rupture does not affect the rating, as it is a function of the wall thickness that, like 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. The dimensions of any dent or rupture, as measured with a ruler, along with descriptions of any tears or punctures within the dent or rupture, should be recorded during the inspection. The following measurements as indicated in Figure 9 should be taken and documented.

(i) H: Horizontal measurement of the dent or rupture.

(ii) V: Vertical measurement of the dent or rupture.

(iii) d: Depth of the dent or rupture at the deepest point of the dent.

(iv) C: Circumference of the support, immediately above or below the affected area.

(v) D: Distance form top of the base plate to the center/middle of the dent.

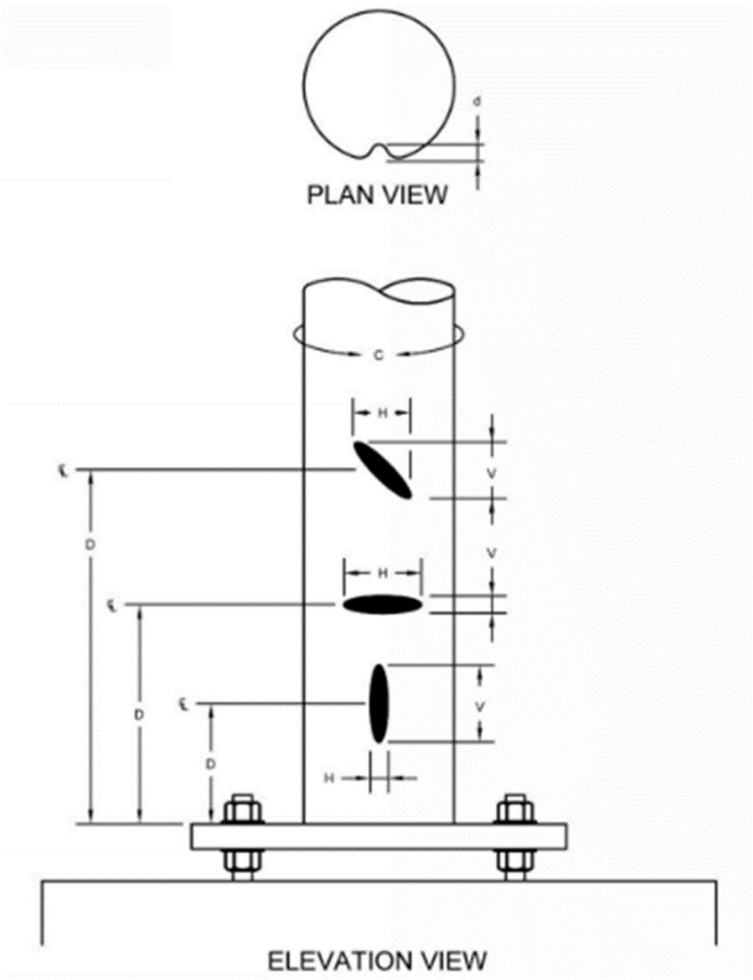


Figure 26 - Measurement Methodology for Dents and Ruptures in Round Poles

(h) Condition of 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.

(i) Condition of pole caps. Loose of missing caps allow water intrusion and animal infestation and should be documented.

(j) ***High Mast Poles:*** For high mast poles, the winch system steel support members should be inspected for loose connections and weld cracks. Slip joints should be examined for pack rust forming between the pole segments due to the tendency for water to be drawn into them by capillary action; vertical cracks emanating from the bottom of the upper pole segment; deformation along the base of the connection; and rust stains. Retainer rings added as a retrofit to the slip joints should be examined for cracks, particularly at the welded joint on the ring. A spotting scope with 50x minimum magnification capabilities shall be used to visually inspect each slip joint. Conditions may dictate that additional spotting scope locations be provided. The spotting scope shall have a camera

attachment so that pictures or video may be taken. The use of drones to inspect the high mast poles and luminaires is strictly prohibited.

13.10.5.3 Wood Poles

For wood poles, the inspection team should inspect and document the following conditions:

(a) Wood pole decay, checking, splitting, shakes, knots, fire damage or insect damage. All wood poles shall be checked for splits, shakes, or checks, insect infestation, fire damage, and decay. Wood poles should be checked for decay caused by insects, fungus or other means. Some wood poles are treated with creosote and any sawdust at the base of the pole may be a sign of insect infestation. Decay often occurs below the ground line, so the timber pole should be excavated at least 6 inches to allow adequate inspection.

UPRIGHT POLE - POLES

(5) Excellent

(4) Good

(4) Good

(3)Fair

UPRIGHT POLE - POLES

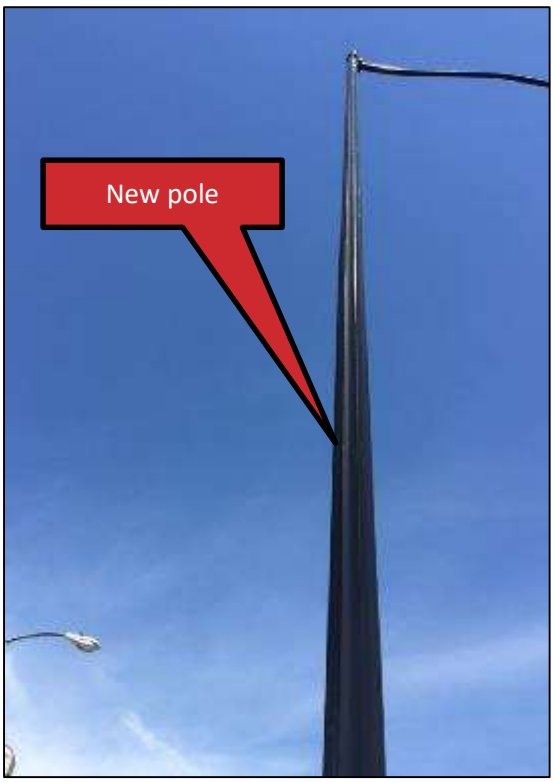
(2) Poor

(1) Very Poor

No Photo Available – Refer to Ratings Scale

PENDANT POLE - POLES

(5) Excellent



(4) Good

(3) Fair

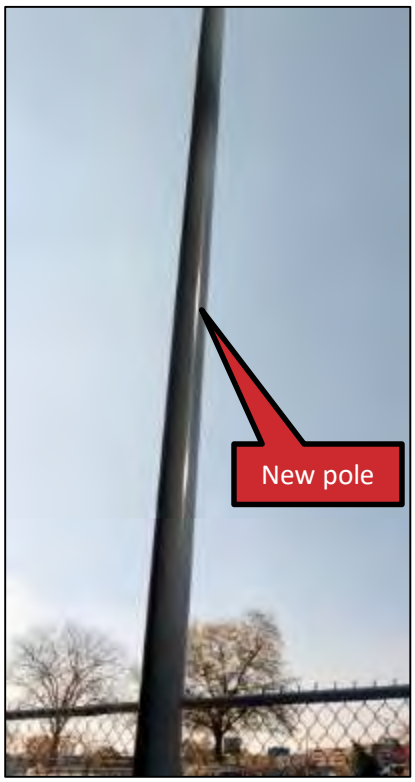
(2) Poor

PENDANT POLE - POLES

(1) Very Poor

ALLEY POLE - POLES

(5) Excellent



(4) Good

(3) Fair

(2) Poor

No Photo Available – Refer to Ratings Scale

ALLEY POLE - POLES

(1) Very Poor

(1) Very Poor

WOOD POLE - POLES

(5) Excellent

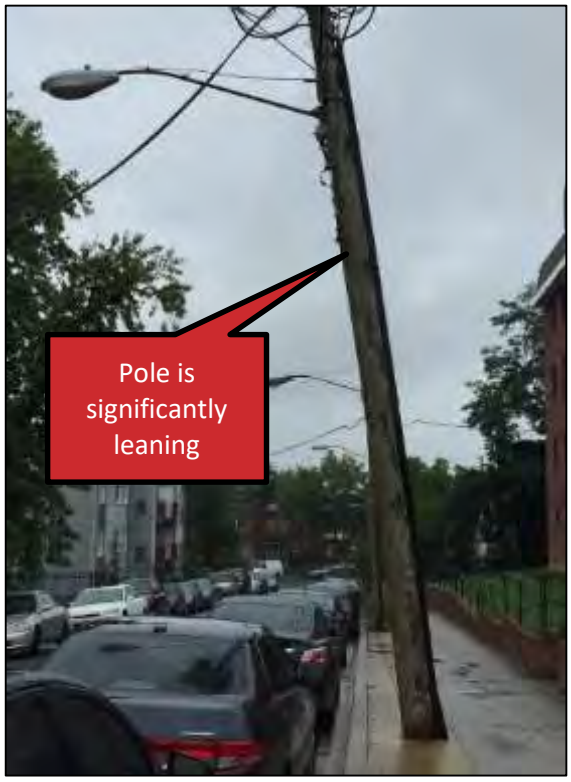
(4) Good

(3) Fair

(3) Fair

WOOD POLE - POLES

(2) Poor



(1) Very Poor

13.10.6 Arms

13.10.6.1 Inspection Procedures and Common Defects

Arms and brackets should be visually and tactilely inspected from an aerial lift (bucket or truck) or using a scope or binoculars from ground level. The connection between the arm and pole is included in this Element. The inspection team should inspect and document the following conditions:

(a) Coating loss (paint or galvanizing), corrosion, or section loss.

(i) 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.

(ii) 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. D-meter thickness testing shall be performed to determine the amount and extent of section loss.

(b) 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 inspection team 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.

(c) Condition of welded connections. If an aerial lift (bucket or truck) is used to inspect arms, 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.

(d) Condition of bolted connections. Bolted connections should be inspected for loose or missing components, under engaged nuts, presence of extra washers. Document engagement if less than 100%.

(e) Condition of set screws. Set screws should be inspected for loose or missing components,

(f) 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.

(g) 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.

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

(i) Condition of end caps. Loose or missing caps allow water intrusion and debris accumulation and should be documented.

(j) High Mast Luminaire Ring: The high mast luminaire ring shall be visually inspected by lowering the ring to the ground using the winch inside the pole. If the ring cannot be lowered at the time of inspection, it should be visually inspected with a high-powered scope. The inspection team should inspect and document the following conditions:

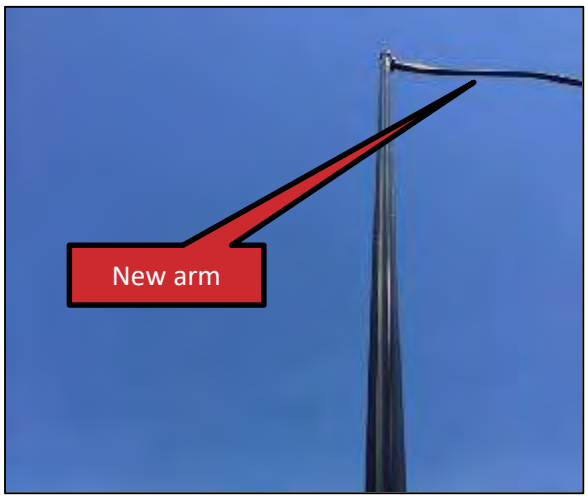
(i) Coating loss (paint or galvanizing), corrosion, section loss, etc.

(ii) Imbalance or misalignment of the luminaire ring.

(iii) Missing damaged or loose components.

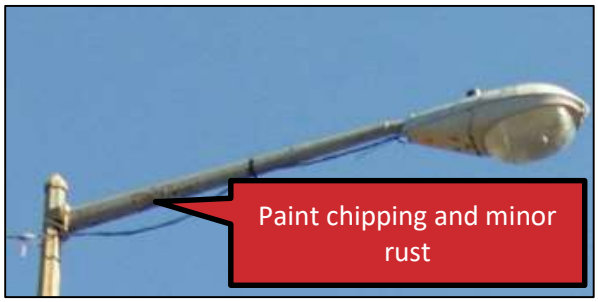
PENDANT POLE - ARMS

(5) Excellent

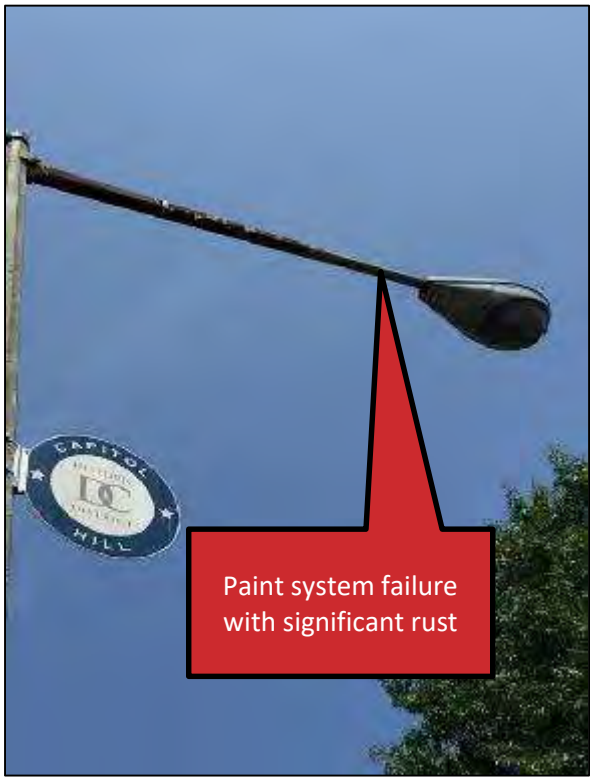


(4) Good

(3) Fair

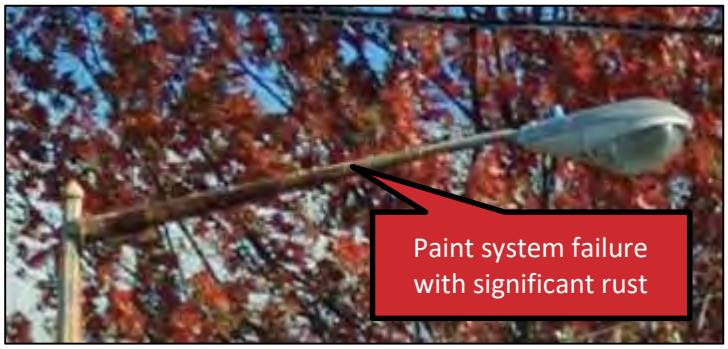


(2) Poor

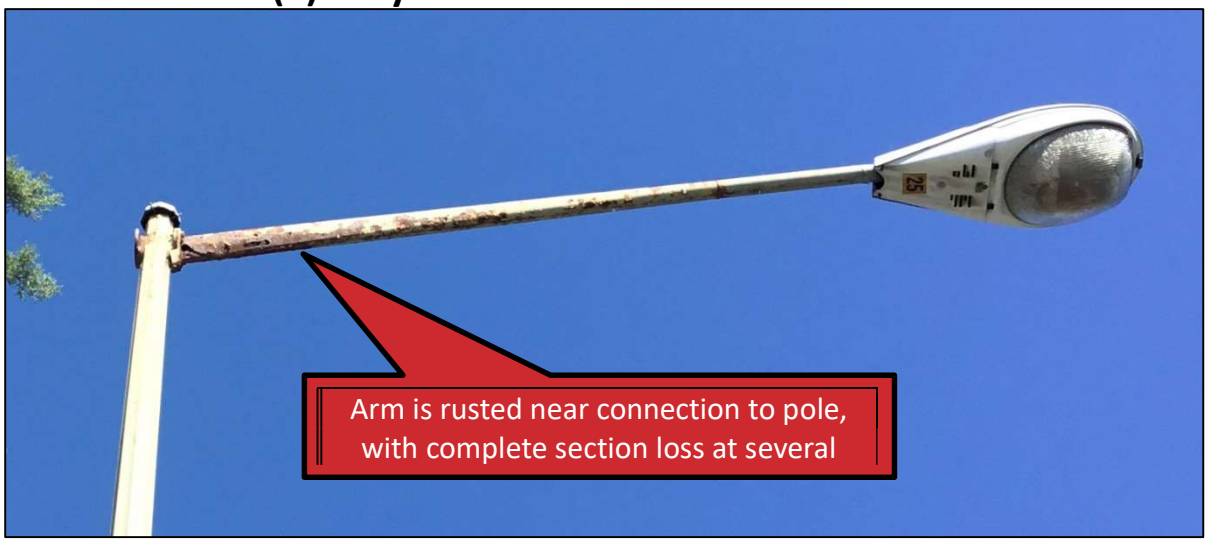


PENDANT POLE - ARMS

(2) Poor

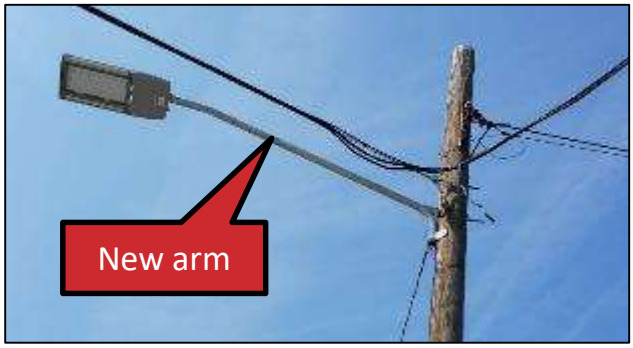


(1) Very Poor



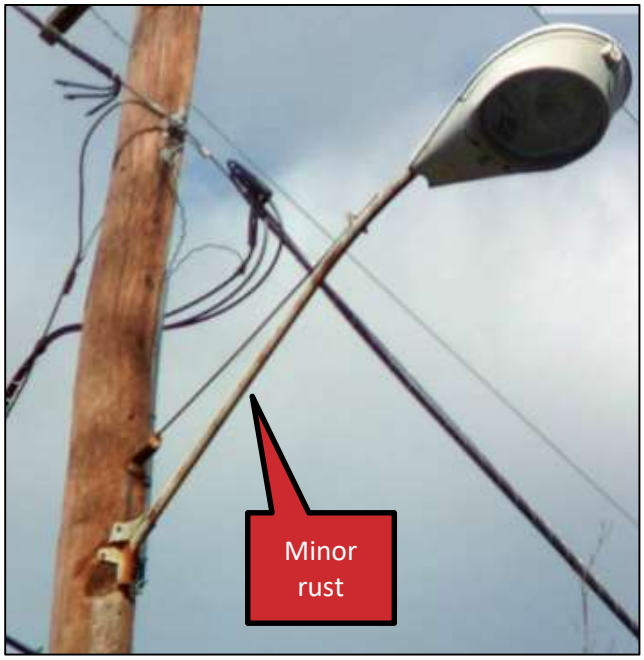
WOOD POLE - ARMS

(5) Excellent

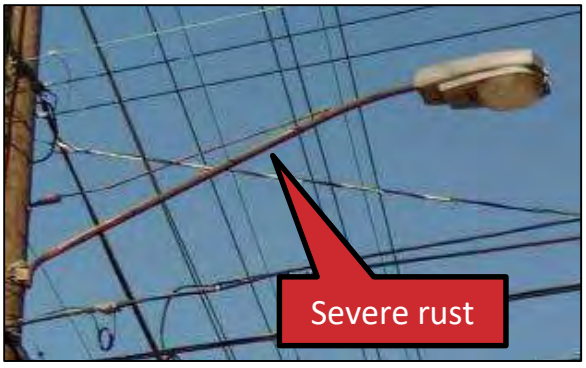


(4) Good

(3) Fair



(2) Poor



WOOD POLE - ARMS

(1) Very Poor

13.10.7 Luminaires

13.10.7.1 Inspection Procedures and Common Defects

(a) The luminaire shall be visually and tactilely inspected. The inspector should inspect and document the following conditions:

(i) Costing loss (paint or galvanizing), corrosion, section loss, etc.

(ii) Luminaire operation (on/off, if nighttime inspection).

(iii) Moisture accumulation or water presence.

(iv) Lens, hinge, latch, weathering seal, and RMCS node/light sensor components loose, missing, cracked, clouded or damaged.

(v) Loose, missing, deformed, or misaligned connection hardware or set screws.

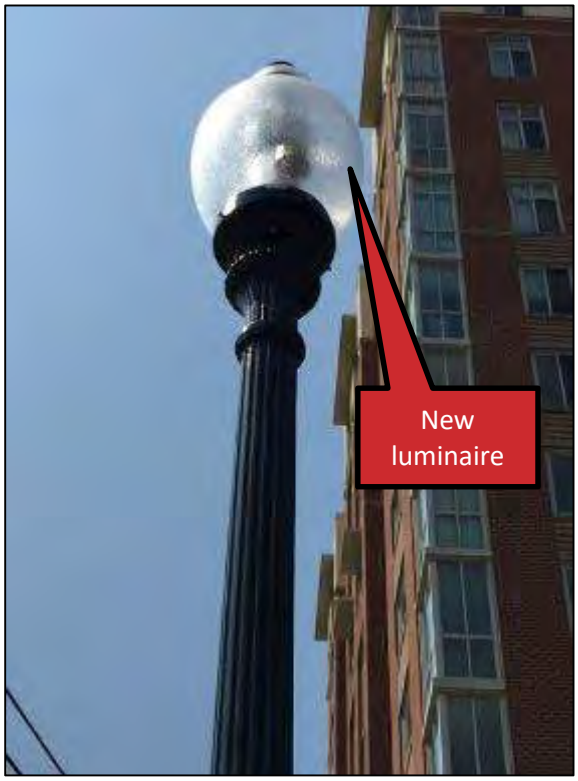
(vi) Impact damage. Location and dimensions or impact damage should be documented.

(vii) Presence of birds' nests or other debris that impacts luminaire operation.

(b) For High Mast Poles, Examine the luminaire ring for coating loss/corrosion and section loss. The luminaire ring may be imbalanced or misaligned and the reflector rings may be missing.

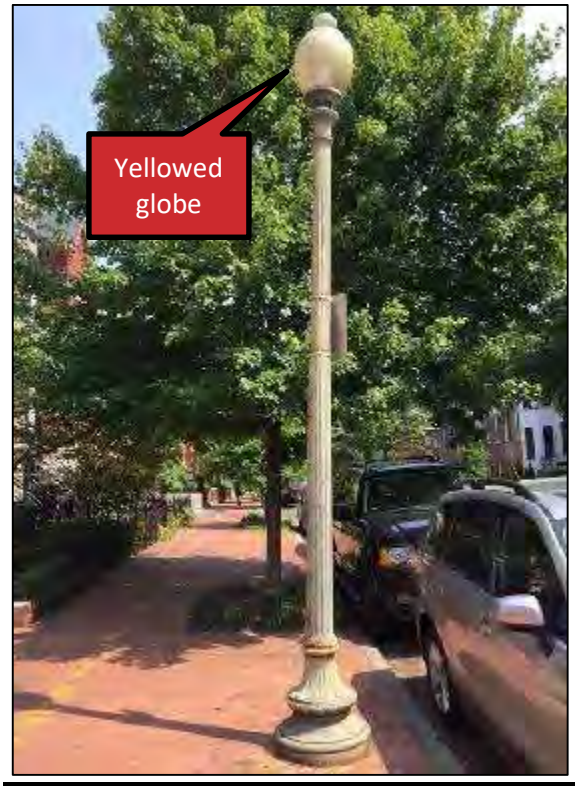
UPRIGHT POLE - LUMINAIRES

(5) Excellent



(4) Good

(3) Fair

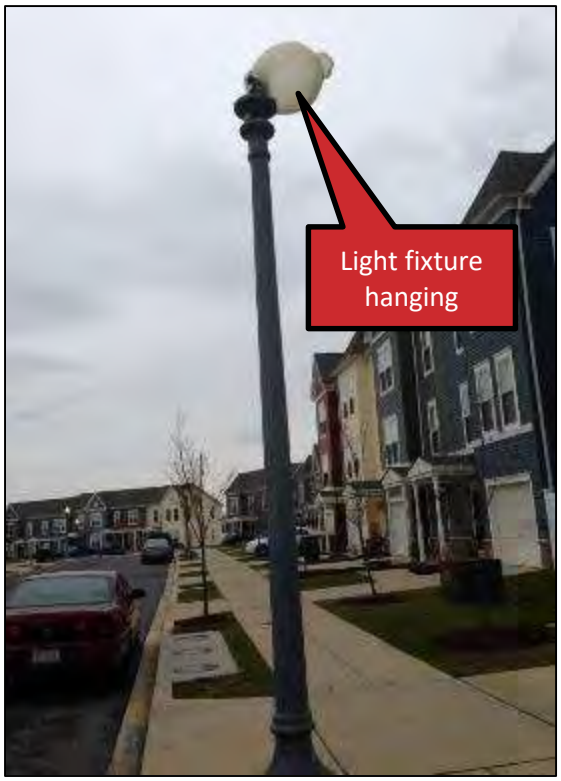


(2) Poor

UPRIGHT POLE - LUMINAIRES

(2) Poor

(1) Very Poor

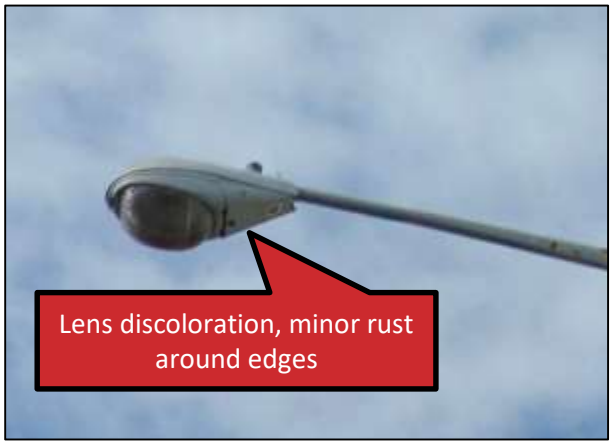


PENDENT POLE - LUMINAIRES

(5) Excellent

(4) Good

(3) Fair



(2) Poor

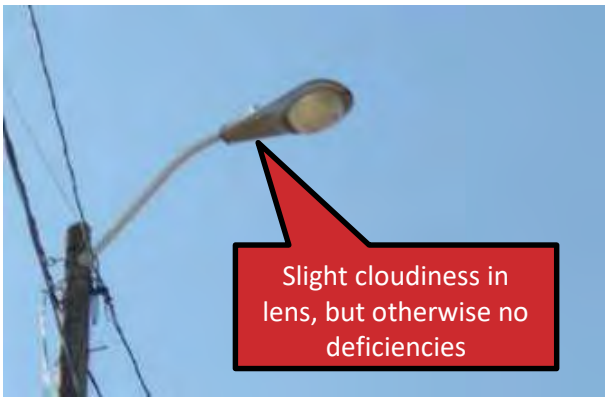
PENDENT POLE - LUMINAIRES

(1) Very Poor

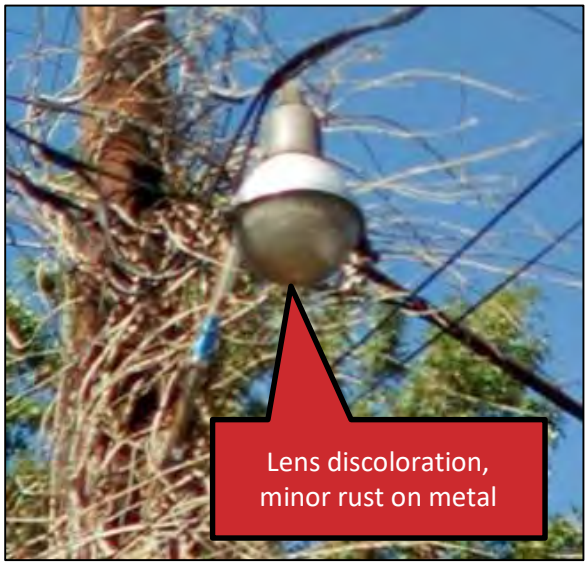
WOOD POLE - LUMINAIRES

(5) Excellent

(4) Good



(3) Fair



(2) Poor

WOOD POLE - LUMINAIRES

(1) Very Poor

13.10.8 Electrical Wires

The inspector should note the condition of electrical wiring where visible inside the pole or t-base. The wiring should be inspected for missing components, breaks, exposed wiring and corrosion and section loss of connectors and attachments.

13.11 Incident Responses for Pole Knockdowns

At times, the Developer may be required to assess and/or conduct damage repair Work related to Incident Responses, such as in the event that a pole is knocked down from a traffic crash. The following presents the process for how the District responds to an Incident, using a pole knock-down as an example:

(a) If a pole is knocked down from a traffic crash, the Metropolitan Police Department (MPD) dispatches an officer(s) to the incident scene to respond to the incident. MPD then files a Public Traffic Packet – Involved Persons report to record the event. The packet includes a traffic crash report, identification of motor vehicles and/or non-motorists involved, crash details, sequence of events, harmful events, witnesses, narrative of the occurrence, diagram of the crash, and details of the vehicle involved, actions and damage, and passengers and occupants.

(b) If District property is damaged as a result of the incident (e.g., a streetlight pole), MPD reports the damaged property and location to the District DOT Emergency Management. The District will then generate a work order in its Work Management System and contact the Developer to dispatch a technician to assess the damaged property. The dispatched crew assesses the damages and photographs the incident scene and any public or private damaged property. An engineer assesses the damage to any District property and prepares a cost estimate to conduct the repairs.

(c) The District DOT then notifies the Office of Risk Management's Tort Liability Division of a potential District Department of Transportation subrogation claim. The claim is assigned a Torts Examiner for investigation and processing. Within 30 business days after review of the submission, the Torts Division will determine whether to pursue the subrogation claim. The District is responsible for submitting all documents that may bear on the validity or amount of the claim to the Tort Liability Division. Such documents include, but are not limited to, the following:

    (i) Photographs of the incident scene, any public or private damaged property; and/or injuries;

    (ii) All related medical records and bills if claiming injury;

    (iii) Repair estimates;

    (iv) Police reports;

    (v) Receipts;

    (vi) proof of expenses;

    (vii) estimate of repairs;

    (viii) invoices;

    (ix) appraisals;

    (x) District's work order to conduct repairs, etc.

(d) In the event that an involved person is charged for the incident, the accused person will receive a summons from MPD. If fault is determined, then the person is responsible for paying a fine to the District for the damaged property.

    (i) Any resulting fines paid to the District will remain with the District and will not be disbursed to the Developer.