High-Mast Tower-Base Inspection

Ohio Department of Transportation
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Office of Structural Engineering
December 9 & 10, 2014
High-Mast Tower-Base Inspection

1. BACKGROUND
2. RESPONSE
3. METHODS
   a) SCOPE
   b) SCHEDULE
   c) INSPECTION
      i. VISUAL
      ii. PHYSICAL
      iii. NON-DESTRUCTIVE
Corroded Edge VS. ‘Shiny’ Edge
Fatigue Life

Number of load cycles required to initiate a crack. Its life is made up of three stages:

1. Crack Initiation
2. Crack Propagation
3. Fracture
Value Structures, Inc.

- Minimum 18 sides “fluted”
- 6 bolts (1-3/8-in. DIA. Holes
- Overall Height = $98\text{-ft} - 112\text{-ft}$
- Dia. Base Plate = 30-in
- Thickness of base plate = 1-3/8-in.
- Dia. Pole at base = varies 18-24-in
- Thickness of pole at base = 1/8-in.
NOTE:
FRAME TO POLE WELD
152mm (6") DEEP x
13mm (1/2"")
THICK HANDHOLE
FRAME (SEE DETAIL)

NOTE:
SILICONE OR NEOPRENE RUBBER GASKET
REQUIRED FOR WEATHERPROOF SEAL
BETWEEN DOOR AND FRAME

WELD IN 13mm (1/2"") NUT @ 0°, PROVIDE
13mm x 19mm (1/2" x 3/4") HEX S.S. BOLT LOCATED
610mm (24") ABOVE BOTTOM OF BASE PLATE
ON 1/2 OF HANDHOLE AT 0° AND 180°

WALL + 3mm (1/8"") WALL
108mm
3/4"
8mm
5/16"
WINCH SUPPORT PLATE
WINCH AND WINCH PLATE
HANDHOLE AND WINCH PLATE
RESPONSE

- IMMEDIATE INSPECTION AT INTERCHANGE
- DEVELOP APP
- TRAINING
- INSPECT *ALL* HIGH MAST TOWERS FOR CRACKING AT THE BASE
<table>
<thead>
<tr>
<th>Training</th>
<th>Time</th>
<th>Location</th>
<th>District</th>
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<tbody>
<tr>
<td>Tuesday 12/9</td>
<td>9:30 – 11:30 AM</td>
<td>GA</td>
<td>D5, D6, D9</td>
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<tr>
<td>Tuesday 12/9</td>
<td>12:30 – 2:30 PM</td>
<td>GA</td>
<td>D2, D7, D12</td>
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<tr>
<td>Tuesday 12/9</td>
<td>9:30 – 11:30 AM</td>
<td>GB</td>
<td>D3, D1, D8</td>
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<tr>
<td>Tuesday 12/9</td>
<td>12:30 – 2:30 PM</td>
<td>GB</td>
<td>D4, D10, D11</td>
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<td>Wednesday 12/10</td>
<td>9:30 – 11:30 AM</td>
<td>GA</td>
<td>Backup Day As Needed For Changes</td>
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<tr>
<td>Wednesday 12/10</td>
<td>12:30 – 2:30 PM</td>
<td>GA</td>
<td>Backup Day As Needed For Changes</td>
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METHODS (SCOPE)

District personal should visit each light tower location and perform a visual inspection of the structure, with particular attention to the area around the base weld.
<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
<th>Can District Provide 4G Cell Phone &amp; Charger (y/n)</th>
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METHODS (Inspection App)

Name of District Personnel to be Automatically Emailed if an Inspection Report Finds an Issue (These are the people who would be involved in a followup examination of the tower in question)

<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
<th>Email (<a href="mailto:xxx.xxx@dot.state.oh.us">xxx.xxx@dot.state.oh.us</a>)</th>
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<tr>
<td>District</td>
<td># of Towers</td>
<td># of Locations</td>
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</tr>
<tr>
<td>1</td>
<td>298</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>350</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>320</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>664</td>
<td>53</td>
</tr>
<tr>
<td>5</td>
<td>400</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>has # of lamps</td>
<td>72</td>
</tr>
<tr>
<td>7</td>
<td>306</td>
<td>31</td>
</tr>
<tr>
<td>8</td>
<td>510</td>
<td>37</td>
</tr>
<tr>
<td>9</td>
<td>12</td>
<td>1</td>
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<td>10</td>
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<td>5</td>
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<td>11</td>
<td>not stated</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>1023</td>
<td>not stated</td>
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Locations = interchanges, circuits, rest areas
Wild Card = weather, snow & ice ops, snow buried foundations
Biggest time factor to inventory is getting from pole to pole (ex. drive up and turn around)
Above does not include time saved by adjacent districts "helping neighbors"
* = Estimate based on doubling D8's number of days (they have half as many poles)

The best guess on inspection rate is 2 interchanges per person per day
METHODS (INSPECTION)

1. Visual
   - Bifocals
     - Use them if you require them to drive
   - Within Arms Length Visual inspection; preferably within 18-inches
2. **Audible**

- Sound each bolt with hammer
- Heavy 1-3 lb. blacksmith or ball-peen hammer for “sounding test” of base/anchor bolts
METHODS (INSPECTION)

3. Record Keeping - Use the ‘App’

- Separate 1-hour Training Today
- Take Photos – Minimum of 3
  - 0-180 degrees
  - 180-360 degrees
  - Pole ID-Marker

Good Practices when taking photos:
- Take overall and close up
- Focus
- Try to have the sun behind you
- Look at the image on the screen
- Document the location of the photographs and even direction
The Minimum Three Photos

- Use the ‘App’

Pole ID Marker:
CONTROL CENTER 4, CIRCUIT G, TOWER # 2
Recordkeeping - Use the ‘App’

SITE CONDITIONS:

ACCESS TO TOWER (GOOD, POOR, NONE):

____________________________________________________

____________________________________________________

IS THERE A MOVING TRAFFIC HAZARD DURING ACCESS? (Y/N)
Recordkeeping - Use the ‘App’

TOWER CONDITION


Is the main tube multi-sided? (Y/N) ____________________

# of sides? (8-30) ____________________________

What is the shape of the base plate? (square, octagon, rectangle, round) _______________________

# of anchor bolts (4-16) ________ ARE ANY ANCHOR BOLTS VISIBLE CRACKED (Y/N) _______________

Do anchor/leveling nuts appear tight? (Y/N) ________ ALL LOCK WASHERS IN PLACE? (Y/N) ________

Do all lock washers (if present) appear to be fully compressed? (Y/N/not applicable) ________
Recordkeeping - Use the ‘App’

TOWER CONDITION [HAMMER TEST]

- STRIKE A STRONG BLOW TO THE TOP OF THE ANCHOR BOLTS WITH THE HAMMER TO CHECK FOR LOOSE NUTS AND/OR BROKEN ANCHOR BOLTS:

- 1. DO ANY ANCHOR NUTS LOOSEN WHEN THE TOP OF THE BOLT IS STRUCK WITH THE HAMMER? (Y/N) ___________ (HINT: WATCH FOR NUT TO ROTATE A SMALL AMOUNT)

- 2. DO THE ANCHOR BOLTS HAVE A SOLID-SOUNDING “RING” WHEN STRUCK? (Y/N) ________________ (HINT: BROKEN ANCHOR BOLTS WILL OFTEN HAVE A DULL, “THUD” SOUND)
Recordkeeping - Use the ‘App’

FOUNDATION

- IS THERE AT LEAST ONE THREAD STICKING OUT ABOVE ALL THE ANCHOR NUTS? (Y/N)
  ________________

- IS THERE A LARGE AMOUNT OF RUST STAINING OF THE CONCRETE AROUND THE ANCHOR BOLTS? (Y/N)
  ________________ (A SMALL AMOUNT IS NORMAL). IF YES, PROVIDE PHOTOS.

- IS THERE A LARGE AMOUNT OF RUST STAINING OF THE CONCRETE UNDERNEATH THE TUBE? (Y/N)
  ________________ (A SMALL AMOUNT IS NORMAL). IF YES, PROVIDE PHOTOS.
GOOD

No CRACKING
No Follow Up Warranted

POOR

CRACKING
1 or 2 cracks
Use judgment! For example only 1 crack exists but it is 10-inches long.

SEVERE

CRACKING
3 or more cracks
Follow Up Warranted, automatic emails, District and OSE.
Response includes removing luminaire rings immediately and the pole should be removed as soon as possible.

Note: The App will Prioritize and Send Emails
POOR
SEVERE

CRACKS

BASE WELD

11/24/2014  14:55
SEVERE
GOOD
GOOD
NOT CLOSE ENOUGH
Questions