

CHECKLIST TO DESIGNATE AREAS OF EVALUATION FOR REQUESTS FOR PROPOSAL (RFP)

	REQUISITION NUMBER		DUE DATE XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX
MDOT PROJECT MANAGER	JOB NUMBER (JN)	CONTROL SECTION (CS)	
DESCRIPTION			
MDOT PROJECT MANAGER: Check all items to be included in RFP WHITE = REQUIRED GRAY SHADING = OPTIONAL Check the appropriate Tier in the box below		CONSULTANT: Provide only checked items below in proposal	
<input type="checkbox"/> TIER I (\$25,000-\$99,999)	<input type="checkbox"/> TIER II (\$100,000-\$250,000)	<input type="checkbox"/> TIER III (>\$250,000)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Understanding of Service
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<i>Innovations</i>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Organizational Chart
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Qualifications of Team
Not required as part of Official RFP	Not required as part of Official RFP	<input type="checkbox"/>	Quality Assurance/Quality Control
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Location: The percentage of work performed in Michigan will be used for all selections unless the project is for on-site p=inspection or survey activities, then location should be scored using the distance from the consultant office to the on-site inspection or survey activity.
N/A	N/A	<input type="checkbox"/>	Presentation
N/A	N/A	<input type="checkbox"/>	Technical Proposal (if Presentation is required)
3 pages (MDOT Forms not counted) (No Resumes)	7 pages (MDOT Forms not counted)	14 pages (MDOT forms not counted)	Total maximum pages for RFP not including key personnel resumes. Resumes limited to 2 pages per key staff personnel.

PROPOSAL AND BID SHEET EMAIL ADDRESS – mdot-rfp-response@michigan.gov

GENERAL INFORMATION

Any questions relative to the scope of services must be submitted by e-mail to the MDOT Project Manager. Questions must be received by the Project Manager at least five (5) working days prior to the due date and time specified above. All questions and answers will be placed on the MDOT website as soon as possible after receipt of the questions, and at least three (3) days prior to the RFP due date deadline. The names of vendors submitting questions will not be disclosed.

MDOT is an equal opportunity employer and MDOT DBE firms are encouraged to apply. The participating DBE firm, as currently certified by MDOT's Office of Equal Opportunity, shall be listed in the Proposal.

MDOT FORMS REQUIRED AS PART OF PROPOSAL SUBMISSION

5100D – Request for Proposal Cover Sheet

5100J – Consultant Data and Signature Sheet (Required only for firms not currently prequalified with MDOT)

(These forms are not included in the proposal maximum page count.)

REQUEST FOR PROPOSAL

The Michigan Department of Transportation (MDOT) is seeking professional services for the project contained in the attached scope of services.

If your firm is interested in providing services, please indicate your interest by submitting a Proposal, Proposal/Bid Sheet or Bid Sheet as indicated below. The documents must be submitted in accordance with the latest (Consultant/Vendor Selection Guidelines for Services Contracts" and "Guideline for Completing a Low Bid Sheet(S)*, if a low bid is involved as part of the selection process. **Reference Guidelines are available on MDOT's website under Doing Business > Vendor/Consultant Services > Vendor/Consultant Selections.**

RFP SPECIFIC INFORMATION

BUREAU OF HIGHWAYS BUREAU OF TRANSPORTATION PLANNING OTHER

THE SERVICE WAS POSTED ON THE ANTICIPATED QUARTERLY REQUESTS FOR PROPOSALS

NO YES DATED _____ THROUGH _____

Prequalified Services – See page ____ of the attached Scope of Services for required Prequalification Classifications.

Non-Prequalified Services – If selected, the vendor must make sure that current financial information, including labor rates, overhead computations, and financial statements, if overhead is not audited, is on file with MDOT's Office of Commission Audits. This information must be on file for the prime vendor and all sub vendors so that the contract will not be delayed. **Form 5100J is required with Proposal for firms not currently prequalified with MDOT**

Qualifications Based Selection – Use Consultant/Vendor Selection Guidelines

For all Qualifications Based Selections, the section team will review the information submitted and will select the firm considered most qualified to perform the services based on the proposals. The selected vendor will be contacted to confirm capacity. Upon confirmation, that firm will be asked to prepare a priced proposal. Negotiations will be conducted with the firm selected.

For a cost plus fixed fee contract, the selected vendor must have a cost accounting system to support a cost plus fixed fee contract. This type of system has a job-order cost accounting system for the recording and accumulation of costs incurred under its contracts. Each project is assigned a job number so that costs may be segregated and accumulated in the vendor's job-order accounting system.

Qualification Review / Low Bid – Use Consultant/Vendor Selection Guidelines. See Bid Sheet instructions for additional information.

For Qualification Review/Low Bid selections, the selection team will review the proposals submitted. The vendor that has met established qualification threshold and with the lowest bid will be selected. The selected vendor may be contacted to confirm capacity.

Best Value – Use Consultant/Vendor Selection Guidelines, See Bid Sheet Instructions below for additional information. The bid amount is a component of the total proposal score, not the determining factor of the selection.

Low Bid (no qualifications review required – no proposal required.) See Bid Sheet Instructions below for additional instructions.

BID SHEET INSTRUCTIONS

Bid Sheet(s) must be submitted in accordance with the "Guidelines for Completing a Low Bid Sheet(s)* (available on MDOT's website). Bid Sheet(s) are located at the end of the Scope of Services. Submit bid sheet(s) separate from the proposal, to the email address: mdot-rfp-response@michigan.gov. Failure to comply with this procedure may result in your bid being rejected from consideration.

**NOTIFICATION
MANDATORY ELECTRONIC SUBMITTAL**

Proposals submitted for this project must be submitted electronically.

The following are changes to the Proposal Submittal Requirements:

- Eliminated the Following Requirements:
 - Safety Program
 - Communication Plan
 - Past Performance as *a separate section*
 - Separate section for DBE Statement of goals. Include information in Qualification of Team section

- Implemented the Following Changes:
 - All proposals require an Organization Chart
 - Resumes must be a maximum of two pages
 - Only Key (lead) staff resumes may be submitted
 - Tier III proposal reduced from 19 to 14 pages
 - Forms 5100D, 5100I, and 5100G combined – 5100D
 - Forms 5100B and 5100H combined – 5100B
 - RFP's will be posted on a weekly basis -- on Mondays

The following are Requirements for Electronic Submittals:

- Proposals must be prepared using the most current guidelines
- The proposal must be bookmarked to clearly identify the proposal sections (See Below)
- For any section not required per the RFP, the bookmark must be edited to include “N/A” after the bookmark title.
Example: Understanding of Service – N/A
- Proposals must be assembled and saved as a single PDF file
- PDF file must be 5 megabytes or smaller
- PDF file must be submitted via e-mail to MDOT-RFP-Response@michigan.gov
- MDOT's requisition number and company name must be included in the subject line of the e-mail. The PDF shall be named using the following format:
 - Requisition#XXX_Company Name.PDF
- MDOT will not accept multiple submittals
- Proposals must be *received* by MDOT on or before the due date and time specified in each RFP

If the submittals do not comply with the requirements, they may be determined unresponsive.

The Consultant's will receive an e-mail reply/notification from MDOT when the proposal is received. Please retain a copy of this e-mail as proof that the proposal was received on time. **Consultants are responsible for ensuring the MDOT receives the proposal on time.**

Required Bookmarking Format:

- I. Request for Proposal Cover Sheet Form 5100D
 - A. Consultant Data and Signature Sheet, Form 5100J (if applicable)
- II. Understanding of Service
 - A. Innovations
- III. Qualifications of Team
 - A. Structure of Project Team
 - 1. Role of Firms
 - 2. Role of Key Personnel
 - B. Organization Chart
 - C. Location
- IV. Quality Assurance / Quality Control Plan
- V. Resumes of Key Staff
- VI. Pricing Documents/Bid Sheet (if applicable)

2/14/12

Michigan Department of Transportation

**SCOPE OF SERVICE
FOR
SPECIALTY SERVICES**
Structural Maintenance Field Inspection Services

CONTROL SECTION(S): Various

JOB NUMBER(S): Various

PROJECT LOCATION: Various locations statewide

DESCRIPTION OF WORK:

The Consultant must provide, to the satisfaction of the Michigan Department of Transportation (MDOT), Specialty Services as generally described herein: in-service structural maintenance field inspection of miscellaneous structural facilities, consulting, reporting, and traffic control.

The Specialty Services are as follows: **inspection of miscellaneous (in-service) roadway structures including light standards, tower lighting units, truss and cantilever sign structures, signal mast arms, Intelligent Transportation System (ITS) infrastructures, along with technical consulting and testing services.** These services will require traveling statewide to perform structural maintenance field inspections. See attached “Exhibit A: Structure Inspection Schedule” for estimated schedule.

Computer generated reports with electronic submittal is required. It is essential that the consultant perform all inspections and reporting on a timely basis.

Structures considered hazardous to the public (to be determined by MDOT), upon inspection, must be immediately reported to the MDOT Project Manager (PM) and designated MDOT Region contact person.

The Consultant is responsible for providing appropriate traffic control during all operations per the Michigan Manual of Uniform Traffic Control Devices and all other applicable rules and regulations. In most cases appropriate traffic control will be drawn from the “MDOT Maintenance Work Zone Traffic Control Guidelines” available on the MDOT website:

http://www.michigan.gov/documents/zonecontrol_112912_7.pdf.

However, the Department must approve all traffic control plans before work is to begin on each corridor.

A maximum of three (3) Consultants may be selected for these Specialty Services.

PRIMARY PREQUALIFICATION CLASSIFICATION:

N/A

SECONDARY PREQUALIFICATION CLASSIFICATION:

N/A

ANTICIPATED START DATE: January 1, 2013

ANTICIPATED COMPLETION DATE: December 31, 2015
(plus a possible two year extension)

DBE PARTICIPATION: N/A

MDOT PROJECT MANAGER:

Andrew Ilieff, P.E.
MDOT – Operations Field Services Division
Operation Field Services – Maintenance Services Section
6333 Old Lansing Rd
Lansing, Michigan 48917
Phone: (517) 322-3319
Fax: (517) 322-3385
Email: Ilieffa@michigan.gov

QUALIFICATION REQUIREMENTS:

Certifications of Inspectors - In-service, structural maintenance field inspections must be performed by personnel with the following certifications and qualifications as applicable:

- a. Certified Welding Inspector (CWI);
- b. Non-Destructive Test (NDT) Level II approved by the American Society for Nondestructive Testing;
- c. Michigan Concrete Association (MCA) Level I Field Testing Technician;
- d. Precast/Prestressed Concrete Institute (PCI) Level II Prestressed Concrete Technician.

GENERAL INFORMATION:

- A. The Consultant must furnish all services and labor necessary to conduct and complete the Specialty Services described herein. The Consultant must also furnish all materials, equipment, supplies, and incidentals necessary to perform the Services (other than those designated in writing to be furnished by the Department), and check and/or test the materials, equipment, supplies, and incidentals as necessary in carrying out this work. The Services must be performed to the satisfaction of the Department and consistent with applicable professional standards.
- B. The Consultant's principal contact with the Department must be through the designated Project Manager.

- C. The Services described herein are financed with public funds. The Consultant must comply with all applicable Federal and State laws, rules, and regulations.
- D. The Consultant agrees to demonstrate knowledge of and performance in compliance with the standard accounting practices of the Department, State of Michigan, Governmental Accounting Standards Board, and generally accepted accounting principles.
- E. The Consultant will notify the MDOT Project Manager, in writing, prior to any personnel changes from those specified in the Consultant's original approved proposal. Any personnel substitutions are subject to the review and approval of the MDOT Project Manager.
- F. The Consultant must contact the Project Manager prior to beginning any work on each authorization.
- G. The Consultant must submit invoices with weekly time sheets that are approved by the Consultants supervisor.

CONSULTANT RESPONSIBILITIES:

The Consultant must perform field operations in accordance with the Department's Personal Protective Equipment (PPE) Policy as stated in the MDOT Guidance Document #10118. A current copy of the MDOT's PPE Policy is available on the MDOT Vendor/Consultant Services webpage. Additionally, the Consultant must perform field operations in accordance with MIOSHA regulations and accepted safety practices.

The Consultant must have the ability to provide electronic submittals of computer generated inspection reports and invoices through a web based portal using the Fabrication Inspection and Construction System (FICS) and perform all reporting on a timely basis.

Specialty Services work may include one or more of the following areas:

- A. **Structural Maintenance Field Inspection** - This category includes in-service maintenance inspection of the following steel and concrete structures:
 - a. Truss sign supports;
 - b. Cantilever sign supports;
 - c. Tower lighting units;
 - d. Light standards;
 - e. Traffic signal mast arm poles and mast arms;
 - f. Spun concrete poles;
 - g. Strain poles;
 - h. CCTV towers;
 - i. Bridge and secondary bridge elements and miscellaneous roadway structures.
 - j. Dynamic Message Sign Support Structures and other ITS structures.

Structural maintenance field inspection of the above listed structures (items a. thru j.) must be in accordance with the contract Special Provisions and the following sections of the 2012 MDOT Standard Specifications for Construction:

- a. Section 707 Structural Steel Construction;
- b. Section 716 Shop Cleaning and Coating Structural Steel;
- c. Section 810 Permanent Traffic Signs and Supports;
- d. Section 819 Electrical and Lighting;
- e. Section 820 Traffic Signals;

Additionally, structural maintenance field inspections must be in accordance with the following attached documents:

- a. Procedure for the Inspection of Traffic Signal Mast Arm Pole and Mast Arm;
 - b. Procedure for the Inspection of Sign Structures;
 - c. Procedure for the Inspection of Frangible Light Standards;
 - d. Procedure for the Inspection of Non-Frangible Light Standards;
 - e. Procedure for the Inspection of High Mast Luminaries and CCTV Towers;
 - f. Procedure for the Inspection of Tri-Chord Cantilever and Tri-Chord Truss Sign Structures;
- B. Technical Consulting and Testing Services** - Technical consulting and testing services needs will be determined by the MDOT Project Manager. In general, technical consulting may include assisting with specifications, procedure recommendations, or training efforts related to the work. Testing must be in accordance with the MDOT Standard Specifications for Construction and project Special Provisions and may consist of the following:
- a. Metal testing including tensile and Charpy V-Notch impact.
- C. Pre-Inspection Meeting** – The Consultant will be responsible for attending the annual pre-inspection meeting.
- D. Maintaining Traffic Requirements** – The Consultant shall design, furnish, install, maintain and remove all the necessary traffic control devices required to perform the tasks outlined in the Consultant Responsibilities. The Consultant must also obtain Department approval before implementing any maintaining traffic operation, and must follow all communication protocol established by the department regarding progression of work.
- E. Deliverables** – The Consultant must supply the following Computer generated deliverables as indicated below, or as requested by the project manager:
- a. An Immediate Attention Report, for each structure showing a deficiency(s), must be submitted to the PM via email by the end of each work week (or as requested), during the current inspection authorization period. Document pictures highlighting deficient structures according to attached “Exhibit B: Picture Formatting Requirements/ Example Immediate Attention Report”.

Structures considered hazardous to the public (to be determined by MDOT), upon inspection, must be immediately reported to the MDOT Project Manager and designated MDOT Region contact person.

- b. The appropriate MDOT standard form listed for each structure type must be submitted electronically through FICS on a weekly basis, during the current inspection authorization period. A unique identification code must be assigned to each form, which matches that from the appropriate Immediate Attention Report.
- c. The Consultant is also required to format report findings, for both frangible and non-frangible light standards, in order to allow direct importation of pertinent data into a master MDOT database (see “Exhibit C: Example Frangible and Non-Frangible Light Standard Databases”). These submittals are to be provided to the PM via email on a monthly basis during the current inspection authorization period (or as requested).
- d. At the end of each inspection authorization period, the Contractor shall supply all reports and supporting documentation on CD/DVD discs.

MDOT RESPONSIBILITIES

- A. **Authorizations** - The Project Manager will provide letters of authorization to the consultant, as needed, through FICS to initiate the work. Such authorizations will be in writing and will include the following:
 - a. Project Identification;
 - b. Work Location;
 - c. Duration of Services;
 - d. Scope of Services;
 - e. Consultant Inspector.
- B. **Pre-Inspection Meeting** – The Project Manager will be responsible for scheduling the annual pre-inspection meeting.

PAYMENT SCHEDULE

- A. **Pay Rates** - Payment for inspection and technical consulting must be based on a unit cost per hour basis. Payment for Traffic Control must be on Actual Cost Per day. The following pay categories are required:
 - a. Structural Maintenance Field Inspection Services Regular Time
Overtime
 - b. Technical Consulting Regular Time

Regular time is defined as time worked less than or equal to eight hours per day during the week (Monday through Friday) on non-holidays as defined below. Overtime is defined as time worked more than eight hours per day during the week (Monday through Friday). Rates cited for overtime, Saturdays, Sundays, and holidays (New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, and Christmas day) may be up to 1.5 times the regular time rate stated above.

B. Travel Expenses - Direct expenses (vehicle mileage, meals, and lodging) will not be paid in excess of that allowed by the Department for its own employees in accordance with the State of Michigan's Standardized Travel Regulations (unless actual hotel expenses are approved in advance of the travel by the Project Manager). Airplane fare must be approved in advance of purchase by the Project Manager. Supporting documentation must be submitted, with the invoice/bill, for all billable expenses on the Project.

Payment for meals will only be made with overnight lodging. Vehicle mileage must be based on travel from portal to portal. Receipts for tolls must be submitted with the invoice for payment (electronically scanned and sent with invoice).

Work authorized for consecutive inspection days will have roundtrip travel time and mileage reimbursed once per week. Exceptions to this would be as follows:

- a. If the work is placed on hold for an amount of time equal to the reimbursement for roundtrip travel time and mileage;
- b. If reimbursement for roundtrip travel time and vehicle mileage is less than reimbursement for lodging and meals.

If the Consultant elects to commute to the project location and back to their departing address on a daily basis when consecutive days of inspection is required, they will be reimbursed at the Per Diem rate or roundtrip travel time and vehicle mileage, whichever is less.

C. Reporting Expenses - When performing services as requested by MDOT, the Consultant must report the following information for expenses, mileage, regular time, and overtime in the weekly time sheets:

- a. The Consultant's office nearest the project location must be identified as the Official Work Station (OWS).
- b. When traveling by car or commercial airline, the Consultant must clearly show the following information for each day:
 - i. Departing address (OWS or Consultant's home, closest to the destination);
 - ii. Start and end time of work day;
 - iii. Consultant's total time on each project;
 - iv. Destination address;
 - v. Roundtrip mileage (departing address to destination address to departing address).

- c. When traveling by commercial airline for trips, the following must apply: Consultant must document travel time and mileage to and from the airport as outlined above. In addition to travel time and vehicle mileage to and from the airport, the Consultant must be paid a maximum of one and one half (1½) hours before flight departure to allow for check-in, and one (1) hour after flight arrival on the returning trip. Hours of flight departure and arrival will be verified through the travel itinerary, which must be submitted electronically to MDOT for expense reimbursement.
- d. Consultant must submit invoices with weekly time sheets that are approved by the Consultant's supervisor.

SCORING (160 points maximum)

Please submit four (4) copies of your proposal for our review.

MDOT will use the following criteria and point system to evaluate Consultant proposals:

- A. **Understanding of Services** (30 points) - State your understanding of project requirements and familiarity with federal, state, and local standards. Describe your technical approach to project scope in area of work to be performed by your firm.
- B. **Qualifications and Experience of Team** (45 points) - List qualifications and experience of the key staff inspectors and personnel who will be assigned to each component of work to be done by your firm for this contract. State your ability to meet time demands based on current workload with all clients.
- C. **Past Performance and Experience with Similar Transportation Projects** (30 points) - List and briefly describe all bridge and appurtenant structure maintenance inspections performed by your firm in the last five years. Also include bridge, sign structure, tower lighting unit, mast arm poles and mast arms, light standards, and field inspections performed and any technical consultant and testing related to the work. Include the name, title, address, and telephone number of a knowledgeable person we can contact regarding the work.
- D. **Price** (40 points) –Completed bid sheet is required. Bid will be determined by averaging the above stated hourly rate pay categories (all categories except Testing Services). Points will be determined using the following Central Selection Review Team (CSRT) approved formula:
(Low bid/bid) *Points assigned (40)
- E. **Quality Assurance/Quality Control Process** (10 points) - Outline a plan for this including background information of selected manager for this service, internal controls, reports, testing, dissemination of information to PM, etc.
- F. **Location** (5 points) - Location of office(s) from which work will be performed.

**MICHIGAN DEPARTMENT OF TRANSPORTATION
OPERATIONS FIELD SERVICES DIVISION
PROCEDURE FOR THE INSPECTION OF NON-FRANGIBLE LIGHT STANDARDS**

I. General Inspection Procedure

- A. Description: This procedure describes the requirements for inspecting the structural elements of non-frangible light standards.
- B. Establish Structure Location: Location information should include region name, county name, route number, control section, and description of the light standard location using global position system (GPS) coordinates, visible reference (intersections, buildings, etc.) to facilitate future inspections. Also, reference quadrant (when facing north at intersections) and stationing or mile markers if available.
- C. General Light Standard Inspection: If the structure information is not on the inspection form, the following should be noted: record upright material (aluminum or steel), coating material (galvanized or painted), and upright diameter at the base. Measure and record as much additional data as possible (arm diameter, arm length, upright diameter taper, etc.). A set of light standard detail sheets can be used to determine the dimensions that cannot be measured for the clamp type arm to upright connection. Use photographs as needed to supplement inspection data.

Visually inspect the condition of the structure's components. This may require the use of binoculars or other visual aids. The inspection must include the arm to upright connection as well as the base to foundation connection. Note any unusual gaps between the connection flanges, loose or missing bolts, washers, lock washers, missing hardware, cracked welds, cracks in the clamps and clamp ends, and misalignment or sagging of the arm. Luminaries should be inspected to ensure they are secure to the arm. Note unsecured or missing access panel covers. Also, note any signs mounted on the upright or arm. Estimate size and mounting locations of these signs.

Check the vertical support for plumbness using a 4 foot level. Record any tilt as inches per length of level (e.g., 1½ inches in 4 feet), either toward the roadway or away from the roadway. Additionally, measure and record any longitudinal tilt (e.g., upright tilts 2 inches in 4 feet north or south).

- D. Inspection of Base: With a plastic tie, attach a plastic tag to the number one anchor bolt. If the number one anchor bolt is already tagged, remove the old tag and replace it with a new one. The tag should include the date of inspection, inspector's name, organization, and structure number. This tag should be tied to the anchor bolt between the base plate and the concrete foundation. Use the following bolt number sequence: facing the roadway and the light standard, begin with right quadrant away from traffic numbering in a clockwise order. Using a permanent marker, mark the corresponding bolt numbers on the vertical support for future reference. Measure and record the anchor bolt diameter and the number of threads in one inch. Look for missing or

damaged anchor bolts, nuts, or washers (e.g. gouges, corrosion). Also, note any bolts that have been bent to align with holes in the base plate. Note any bolts that are lower than the top of the nut. If the bolt is lower, measure the depth and document it on the inspection form in the box corresponding to the bolt number. Visually inspect any welds in the base (gussets, vertical support to base connection) looking for cracks or unusual welds. Also, note any damage (corrosion, cracks, gouges, dents) to the base, gussets, and vertical support. Check levelness of base plate with the 4 foot level.

Inspect the condition of the concrete foundation noting any spalling, cracks, and general deterioration.

Using a 24 ounce ball-peen hammer hit the side of the top nuts and hit the top of the bolts. This is performed to check for loose nuts (leveling and top) and/or cracked or broken bolts. If the nuts are tight, there is a sharp ringing sound; if the nuts are loose, there is a dull sound. A loose leveling or top nut can also be the cause of the dull sound. Visually check for any gaps between the leveling and top nut and the base plate. Tap one side of each washer placing one hand on the washer opposite the side being tapped. If the washer moves, the nut is not properly tightened. Physically grasp the washer and try to move it to determine the leveling or top nut tightness. Note all loose nuts on the inspection report. Check for marks on the top nut to ensure snug tight plus one third of a turn past snug tight was achieved. Check for proper lubricant (bee's wax or toilet ring wax, grease, and oils are not allowed).

- E. Ultrasonic Inspection: The individual doing the ultrasonic testing (UT) must be certified at ASNT Level II on recommended practice SNT-TC-1A.

Grind all anchor bolt ends flat (perpendicular to the shank of the bolt) being sure to remove all galvanizing, paint, dirt, and debris. Because deep (1/16 in. or greater) surface imperfections (gouges, cuts) can affect the UT results, make the ground surface as smooth as possible. Some bolts have been marked with an "X" for use as bench marks. It is not necessary to grind the bolt until the indentations are completely removed, since these are usually shallow and should not affect the UT inspection. Only grind the bolt a sufficient amount to remove any paint and smooth the surface. There are some bolt ends that have an extreme slant and cannot be ground to a flat, perpendicular surface. Note any bolts that have this problem on the inspection form. At some future date, these bolts should be corrected with a flat, perpendicular surface to allow for inspection.

Calibrate the ultrasonic unit for straight beam probe method using a 10 inch screen with a 1 inch diameter straight beam probe. The probe is placed on a 1 inch calibration block (DSC block or section of anchor bolt) and the indications on the screen are adjusted so that a reflection is positioned at each inch mark. Next, place the probe on a 9 inch long test bar that has a 1/8 inch deep saw cut at a set distance (3 inch from the end) in the threaded portion of the rod. Peak the back reflection from the 1/8 inch deep saw cut until the indication is at 60 or 80 percent of screen height. The dB reading is recorded to establish the "REFERENCE LEVEL". The "SCANNING LEVEL" is set by adding 14 to 30 dB over the reference level. Calibration should be checked at each location before inspecting any bolts.

Apply couplant (glycerin) to the ends of the bolts. Ultrasonically test the anchor bolts using a circular motion inspection pattern and record the results. When scanning the anchor bolts, there should be no indications on the CRT screen between the Main Bang (zero depth) and the end of the screen (10 inch depth). Any indication that is displayed after the Main Bang is a possible flaw. Record the depth of the discontinuity observed and the amount of dB required to bring the indication to the “REFERENCE LEVEL” on the screen. This is recorded as the “INDICATION LEVEL”.

After the inspection is complete, wipe off all the couplant (glycerin) with a wet rag, allow to dry completely, and spray the bolt ends with cold galvanizing or zinc-rich paint.

II. Procedure for the Inspection of Bolts at Arm to Upright Connection

- A. Description: This section of the inspection procedure describes the requirements for inspecting the bolts connecting the luminaire arm to the upright. This connection is a single or double arm connection with two to four (possibly more) bolts per connection depending on the type of arm to upright connection. The arm to upright connection is a clamp connection with the arm welded to one side of the clamp. Locate bolts on the other side of the clamp (the side opposite traffic) with the clamp bolted around the upright. Record connection method in the “arm to upright comments” box.
- B. Field Inspection: With the through bolt connections and clamp connections, as a minimum, each bolt end should be at least flush with the nut. If there is not at least a flush condition between the bolt end and the nut, record this in the inspection report. Each bolt should have a flat washer on the bolt head end and a flat washer and lock washer on the nut end. Record any parts that are missing or not in their proper location. All bolts, nuts, and washers should be galvanized. Record any signs of rust. Visually examine the contact area and record any gap.

All types of luminaire arm to upright connections require visual inspection of the welds. The vertical welds connecting plates to the sides to the upright are critical in nature and require extra attention. Pay close attention to welds wrapping around corners on gusset stiffener plates at the arm to upright connection. The arm may be two pieces with a slip joint connection near the midpoint of the arm span. If a slip joint exists, visually examine the longitudinal seam weld at that location. Record any visible cracks, noting size and location. Record the total arm length.

III. Report Writing, Safety and Equipment

- A. Reporting Procedure: All written reports (MDOT Form 1041, available at <http://mdotwas1.mdot.state.mi.us/public/webforms/>) must be legible, accurate, and detailed. These documents will be used as evidence of work performed (pay item). Payment for work will not be made if data gathered are illegible or undecipherable. Provide digital photographs of deficiencies. Dated and labeled digital photographs

must correspond to a specific structure or inspection report number and provided in jpg format on CD media.

Any unusual or potentially dangerous conditions must be reported immediately to the Michigan Department of Transportation, Operations Field Services Division at 517-322-1235 or 517-322-5709.

B. Safety: All inspections and related work must be in accordance with the Department's Personal Protective Equipment (PPE) Policy as stated in the MDOT Guidance Document #10118 and MIOSHA safety standards (use of safety apparel and equipment safety guards). Safety apparel and equipment (hard hats, leather gloves, harnesses, lanyards, safety glasses, safety shoes, and safety vests) must be worn by all workers.

C. Equipment/Tool List:

- 24 Ounce Ball-Peen Hammer
- Round Point Shovel
- 4 Foot Level
- Digital Camera
- Torpedo Level
- Wrenches (Spud, Spanner or Socket)
- Binoculars
- 3 Foot Pipe Extension
- Box of Rags for Cleaning
- Portable Generator
- 12 Foot Tape Measure
- L-Head Grinder With Grinding Disks
- 6 Inch Ruler
- Container of Couplant
- GPS Unit
- Voltage Protection Gloves
- Voltage Detector
- UT Device and Transducer
- Cell Phone
- MDOT Form 1041, *Non-Frangible Light Standard Inspection*

**MICHIGAN DEPARTMENT OF TRANSPORTATION
OPERATIONS FIELD SERVICES DIVISION
PROCEDURE FOR THE INSPECTION OF FRANGIBLE LIGHT STANDARDS**

I. General Inspection Procedure

- A. Description: This procedure describes the requirements for inspecting the structural elements of frangible light standards.
- B. Establish Structure Location: Location information should include region name, county name, route number, control section, and description of the light standard location using global position system (GPS) coordinates, visible reference (intersections, buildings, etc.) to facilitate future inspections. Also, reference quadrant (when facing north at intersections) and stationing or mile markers if available.
- C. General Light Standard Inspection: If the structure information is not on the inspection form, the following should be noted: record upright material (aluminum or steel), coating material (galvanized or painted), and upright diameter at the base. Measure and record as much additional data as possible (arm diameter, arm length, upright diameter taper, etc.). A 25 foot collapsible survey rod aids in obtaining many of the dimensions. A set of light standard detail sheets can be used to determine the dimensions that cannot be measured for the clamp type arm to upright connection. Use photographs as needed to supplement inspection data.

Visually inspect the condition of the structure's components. This may require the use of binoculars or other visual aids. The inspection must include the arm to upright connection, as well as the base to foundation connection. Note any unusual gaps between the connection flanges, loose or missing bolts, washers, lock washers, missing hardware, cracked welds, cracks in the clamps and clamp ends, misalignment or sagging of the arm. Luminaries should be inspected to ensure they are secure to the arm. Note unsecured or missing access panel covers. Also, note any signs mounted on the upright or arm. Estimate size and mounting locations of these signs.

Check the vertical support for plumbness using a 4 foot level. Record any tilt as inches per length of level (e.g., 1½ inches in 4 feet), either toward the roadway or away from the roadway. Also, measure and record any longitudinal tilt (e.g., upright tilts 2 inches in 4 feet north or south).

PRIOR TO INSPECTION OF INTERIOR OF BREAKAWAY BASE, REVIEW SAFETY REQUIREMENTS IN SECTION III.B.

- D. Inspection of Frangible Base: With a plastic tie, attach a plastic tag to the number one anchor bolt. If the number one anchor bolt is already tagged, remove the old tag and replace it with a new one. The tag should include the date of inspection, inspector's name, organization and structure number. Use the following bolt number sequence: facing the roadway and the light standard, begin with right back quadrant away from traffic numbering in a clockwise order. The top nuts and bolts must be labeled T1-T4

and the bottom anchor bolts must be labeled B1-B4. Using a permanent marker, mark the corresponding bolt numbers on the vertical support for T1-T4 and inside the frangible base for B1-B4 for future reference. Nut covers or base plate covers (if any) are to be removed. Note removal of the covers on the report. Do not replace nut covers or base plate covers on top of the frangible base. Nut covers can typically be removed with either a socket wrench or screwdriver. Remove any accumulated debris under the covers prior to inspection.

- E. Upright to Breakaway Base (Bolts T1-T4): Measure and record the bolt diameter and the number of threads in one inch, along with the bolt circle diameter. Record the number, size, and type of washers present. Look for missing or damaged bolts, nuts, washers or lock washers (gouges, corrosion). Also, document any bolts that have been bent to align with holes in the base plate. Note any bolts that are lower than the top of the nut. If the bolt is lower, measure the depth and document it on the inspection form in the box corresponding to the bolt number. Visually inspect any welds in the base (gussets, vertical support to base connection) looking for cracks or unusual welds. Also, document any damage (corrosion, cracks, gouges, dents) to the base, gussets, and vertical support.

Note all loose top nuts on the inspection report. The top nut is tight when no gaps are visible between the nut bearing face and the lock washer and flat washers. All lock washers should be completely compressed and flat to ensure proper nut tightening was performed.

- F. Frangible Base to Foundation (Bolts B1-B4): Determine the type of foundation (steel screw-in or concrete). Inspect the condition of the foundation, noting any spalling, cracks, and general deterioration. Measure and record the anchor bolt diameter and the number of threads in one inch, along with the bolt circle diameter. Record the number, size, and type of washers present. Look for missing or damaged anchor bolts, nuts, washers or lock washers (gouges, corrosion). Also, note any bolts that have been bent to align with holes in the frangible base plate. Note any bolts that are lower than the top of the nut. If the bolt is lower, measure the depth and document it on the inspection form in the box corresponding to the bolt number. Visually inspect any welds in the base (gussets, vertical support to base connection) looking for cracks or unusual welds. Document any leveling nuts on the report.

Note all loose anchor nuts on the inspection report. The anchor nut is tight when no gaps are visible between the nut bearing face and the lock washer and flat washers. All lock washers should be completely compressed and flat to ensure proper nut tightening was performed.

II. Procedure for the Inspection of Arm to Upright Connection

- A. Description: This section of the inspection procedure describes the requirements for inspecting the bolts connecting the luminaire arm to the upright. This connection is a single or double arm connection with two to four (possibly more) bolts per connection depending on the type of arm to upright connection. The arm to upright connection is a clamp connection with the arm welded to one side of the clamp. Locate bolts on the

other side of the clamp (the side opposite traffic) with the clamp bolted around the upright. Record connection method in “arm to upright comments” box.

- B. Field Inspection: With the through bolt connections and clamp connections, as a minimum, each bolt end should be at least flush with the nut. If there is not at least a flush condition between the bolt end and the nut, record this in the inspection report. Each bolt should have a flat washer on the bolt head end and a flat washer and lock washer on the nut end. Record any parts that are missing or not in their proper location. All bolts, nuts, and washers should be galvanized. Record any signs of rust. Visually examine the contact area and record any gap.

All types of luminaire arm to upright connections require visual inspection of the welds. The vertical welds connecting plates to the sides to the upright are critical in nature and require extra attention. Pay close attention to welds wrapping around corners on gusset stiffener plates at the arm to upright connection. The arm may be two pieces with a slip joint connection near the midpoint of the arm span. If a slip joint exists, visually examine the longitudinal seam weld at that location. Record any visible cracks, noting size and location. Record the total arm length.

III. Report Writing, Safety and Equipment

- A. Reporting Procedure: All written reports (MDOT Form 1040, available at <http://mdotwas1.mdot.state.mi.us/public/webforms/>) must be legible, accurate, and detailed. These documents will be used as evidence of work performed (pay item). Payment for work will not be made if data gathered are illegible or undecipherable. Provide digital photographs of deficiencies. Dated and labeled digital photographs must correspond to a specific structure or inspection report number and provided in jpg format on CD media.

Any unusual or potentially dangerous conditions must be reported immediately to the Michigan Department of Transportation, Operations Field Services Division at 517-322-1235 or 517-322-5709.

- B. Safety: **Prior to inspection of breakaway base interior, verify that electricity is OFF using a voltage detector.** All inspections and related work must be in accordance with the Department’s Personal Protective Equipment (PPE) Policy as stated in the MDOT Guidance Document #10118 and MIOSHA safety standards (use of safety apparel and equipment safety guards). Safety apparel and equipment (hard hats, leather gloves, harnesses, lanyards, safety glasses, safety shoes, and safety vests) must be worn by all workers.
- C. Equipment/Tool List:
- Voltage Protection Gloves
 - Screwdrivers (Flathead and Philips)
 - 24 Ounce Ball-Peen Hammer
 - Binoculars
 - 4 Foot Level

- 25 Foot Collapsible Survey Rod
- Box of Rags for Cleaning
- GPS Unit
- 12 Foot Tape Measure
- Digital Camera
- 6 Inch Ruler
- Wrenches (Spud, Spanner or Socket)
- Round Point Shovel
- Voltage Detector
- Cell Phone
- MDOT Form 1040, *Frangible Light Standard Inspection*

**MICHIGAN DEPARTMENT OF TRANSPORTATION
OPERATIONS FIELD SERVICES DIVISION
PROCEDURE FOR THE INSPECTION OF HIGH MAST
LUMINAIRES AND CCTV TOWERS**

I. General Inspection Procedure

- A. Description: This procedure describes the requirements for inspecting the structural elements of high mast luminaires and CCTV towers.
- B. Establish Structure Location: Location information should include region name, the Michigan Department of Transportation's (MDOT) structure inventory number, county name, route number, control section, and description of structure location using global position system (GPS) coordinates and visible reference (ramps, overpasses, intersections, buildings, etc.) to facilitate future inspections. Also, reference to stationing or mile markers should be used if available.
- C. General Structure Inspection: Record the condition of the galvanized coating on the structure. Many structures are A588 without coating. In all cases, note the general condition (heavy corrosive areas, bleed rust, etc.) of the structure. Inspect the condition of any visible welds (base plate to upright, hand hole, longitudinal seam welds, etc.). Count the number of sections that make up the high mast luminaire or CCTV tower and visually examine the longitudinal welded lap splice and/or transverse splice welds with binoculars. Most of the high mast luminaries and CCTV towers are 60 to 100 feet tall and have at least one lap splice. Record any tilt or lean the high mast luminaire or CCTV tower may have (north, south, east or west, and approximate horizontal distance of tilt from center of concrete foundation), as well as any cracks or damage to the structure. If cracks are found, use dye penetrant or other approved nondestructive testing method to determine the crack length and tip.

All of the above information must be recorded on the inspection form with any additional comments noted.

- D. Inspection of Base: With a plastic tie, attach a plastic tag to the number one anchor bolt (this can be any bolt if not already tagged). If the number one anchor bolt is already tagged, remove the old tag and replace it with a new one. The tag should include the date of inspection, inspector's name, organization and structure number. This tag should be tied to the anchor bolt between the base plate and the concrete foundation. Using a permanent marker, mark the corresponding bolt numbers on the vertical support in a clockwise pattern from the number one, or tagged, anchor bolt for future reference. Measure and record the anchor bolt diameter. Look for missing or damaged anchor bolts or nuts (gouges, corrosion, etc.). Note any bolt ends that have been bent to align with the holes in the base plate or anchor bolts that are not plumb. Note any bolts that are lower than the top of the top nut. If the bolt is lower than one or two threads, measure the depth and mark it on the inspection form in the box corresponding to the bolt number. Note any nuts that are tack welded to the base plate. Visually inspect any welds in the base (gussets, vertical support to base plate

connection) looking for cracks or unusual welds. Also, note any damage (corrosion, cracks, gouges, dents) to the base, gussets, and vertical support.

Inspect the condition of the concrete foundation, noting any spalling, cracks, and general deterioration.

Using a 24 ounce ball-peen hammer, hit the side of the top and leveling nuts, and hit the top of the bolts. This is done to check for loose nuts (leveling and top) and/or cracked or broken bolts. If the nuts are tight, there is a sharp ringing sound; if the nuts are loose, there is a dull sound. A loose leveling nut can also be the cause of the dull sound, so do not immediately tighten the top nut. Inspection of leveling nut and washer may require the removal of a rodent screen between the base plate and the foundation. Rodent screens are steel mesh wrapped around the base plate with the ends wire tied together. After removing the rodent screen, visually check for any gaps between the leveling nut and the base plate. Physically grasp the washer and try to move it to determine the leveling nut tightness. If the leveling nut is loose, tighten it after tightening the corresponding top nut. If the leveling nut appears to be tight, proceed to tighten the top nut. After all leveling nuts and washers have been inspected, tag the number one bolt, as stated above, and reinstall the rodent screen tying the ends together with new galvanized tie wire. Be sure the rodent screen is securely in place and tightly tied at the ends. Because some bases have a grout between the vertical support base and the concrete foundation, inspection of the leveling nut is not always possible. If this is the case, try to tighten the top nut. If the top nut cannot be tightened further, note this on the inspection form and proceed. Some grout may need to be removed at one bolt to attach the plastic tag to the bolt.

Tightening either of the anchor bolt nuts (leveling or top) can be done using an appropriately sized spud wrench, spanner wrench or socket wrench. A 3-foot to 4-foot (maximum of 4-foot length) pipe can be added to the wrench to increase leverage. The nut is tightened until no further movement takes place. Any broken anchor bolts should be easily identified as both the nut and the bolt will continue to twist with little applied torque. If only the nut rotates under the applied torque, complete the tightening and resound the side of the nut and the bolt with the hammer. Note all the nuts that require tightening on the inspection form.

- E. Ultrasonic Inspection: The individual performing the ultrasonic testing (UT) must be certified at ASNT Level II on recommended practice SNT-TC-1A.

Grind all anchor bolt ends flat (perpendicular to the shank of the bolt) being sure to remove all galvanizing, paint, dirt, and debris. Because deep (1/16 inch or greater) surface imperfections (gouges, cuts) can affect the UT results, make the ground surface as smooth as possible. Some bolts have been marked with an "X" for use as bench marks. It is not necessary to grind the bolt until the indentations are completely removed, as these are usually shallow and should not affect the UT inspection. Only grind the bolt a sufficient amount to remove any paint and smooth the surface. There are some bolt ends that have extreme slant and cannot be ground to a flat, perpendicular surface. Note any bolts that have this problem on the inspection form. At some future

date, these bolts should be corrected with a flat, perpendicular surface to allow for inspection.

Calibrate the ultrasonic unit for straight beam probe method using a 10 inch screen with a 1 inch diameter straight beam probe. The probe is placed on a 1 inch thick calibration block (DSC block or section of anchor bolt) and the indications on the screen are adjusted so that a reflection is positioned at each inch mark. Next, place the probe on a 9 inch long test bar that has a 1/8 inch deep saw cut at a set distance (3 inches to 4 inches from the end) in the threaded portion of the rod. Peak the back reflection from the 1/8 inch deep saw cut until the indication is at 60 or 80 percent of screen height. The dB reading is recorded to establish the REFERENCE LEVEL. The SCANNING LEVEL is set by adding 14 to 30 dB over the reference level. Calibration should be checked at each location before inspecting any bolts.

Apply couplant (glycerin) to the ends of the bolts. Ultrasonically test the anchor bolts using a circular motion inspection pattern and record the results. When scanning the anchor bolts, there should be no indications on the CRT screen between the Main Bang (zero depth) and the end of the screen (10 inch depth). Any indication that is displayed after the Main Bang is a possible flaw. Record the depth of the discontinuity observed and the amount of the dB required to bring the indication to the REFERENCE LEVEL on the screen. This is recorded as the INDICATION LEVEL.

After the inspection is complete, wipe off the couplant (glycerin) and spray the bolt ends with cold galvanizing or zinc-rich paint.

II. Report Writing, Safety and Equipment

- A. Reporting Procedure: All written reports (MDOT Form 1018, available at <http://mdotwas1.mdot.state.mi.us/public/webforms/>) must be legible, accurate, and detailed. These documents will be used as evidence of work performed (pay item). Payment for work will not be made if data gathered are illegible or undecipherable. Provide digital photographs of deficiencies. Dated and labeled digital photographs must correspond to a specific structure or inspection report number and provided in jpg format on CD media.

Any unusual or potentially dangerous conditions must be reported immediately to the Michigan Department of Transportation, Operations Field Services at 517-322-1235 or 517-322-5709.

- B. Safety: All inspections and related work must be in accordance with the Department's Personal Protective Equipment (PPE) Policy as stated in the MDOT Guidance Document #10118 and MIOSHA safety standards (use of safety apparel and equipment safety guards). Safety apparel and equipment (hard hats, leather gloves, harnesses, lanyards, safety glasses, safety shoes, and safety vests) must be worn by all workers.

C. Equipment/Tool List:

- Complete Ultrasonic Unit With Straight Beam Probe
- Portable Generator to Operate Ultrasonic Unit and Grinder
- 100 Foot Electrical Power Cord
- 24 Ounce Ball-Peen Hammer
- 4 Foot Level
- Container of Couplant (Glycerin)
- Box of Cleaning Rags
- Cans of Cold Galvanizing or Zinc-Rich Paint
- L-Head Grinder With Grinding Disks
- 5 Gallon Gas Can, Must be Safety Type
- 12 Foot Tape Measure
- Round Point Shovel
- Wrenches (Spud, Spanner or Socket) and 4-Foot Pipe Extension
- Binoculars
- Stencil Pad With Numbers and Letters
- Black and White Spray Paint
- Voltage Protection Gloves
- Voltage Detector
- GPS Unit
- Digital Camera
- Cell Phone
- MDOT Form 1018, *High Mast Luminaire and CCTV Tower Inspection*

**MICHIGAN DEPARTMENT OF TRANSPORTATION
OPERATIONS FIELD SERVICES DIVISION
PROCEDURE FOR THE INSPECTION OF SIGN STRUCTURES**

I. General Inspection Procedure

- A. Description: This procedure describes the requirements for inspecting cantilever, truss, bridge mounted and dynamic message sign support structures.
- B. Establish Structure Location: Location information should include region name, the Michigan Department of Transportation's (MDOT) structure inventory number, county name, route number, control section, and description of structure location using global position system (GPS) coordinates and visible reference (ramps, overpasses, intersections, buildings, etc.) to facilitate future inspections. Also, reference to stationing or mile markers should be used if available.
- C. General Sign Structure Inspection: If the structure information is not in the inspection form, the following should be noted. Record cantilever or truss type, material type (steel or aluminum for trusses), coating material (galvanized or painted), and upright diameter. Measure and record as much additional sign data as possible (upright height, base diameter, etc.). A 25 foot collapsible survey rod aids in obtaining many of the dimensions. A set of sign structure standard plans should be used to determine the dimensions that cannot be measured.

Visually inspect the condition of the support components. This may require the use of binoculars or other visual aids. The inspection must include the horizontal to vertical support connection for cantilevers and a walk-through inspection of the truss box for sign truss bridges. Note any unusual gaps between the bolt flanges, loose or missing bolts, missing hardware or caps, cracked welds, cracks at the end of gusset plates, sagging of the horizontal support, and any broken or missing cross braces. Inspect the condition of the sign or signs noting any missing hardware or damage. Record the sign legend in the appropriate box. Visually inspect the U-bolts (where located, what connection, noting stainless or galvanized steel), and record any that are missing or damaged. Inspect the bottom of the signs for direct bolting through the vertical "I" beams (which prevent signs from slipping down on the "I" beams). Also, note any non-highway signs mounted on the sign structure. Estimate size, material types, and mounting locations of these signs.

Inspect gusset plates at arm to upright connection of cantilever sign supports, visual inspection at arm's length. Note gusset and crack locations according to designation on UT form referenced in Section III.

Check the vertical support for plumbness using a 4 foot level. Record any tilt as inches per length of level (i.e. 1 ½ inches in 4 feet), either towards the roadway or away from the roadway. Also, measure and record any longitudinal tilt (i.e. upright tilts 2 inches in 4 feet north or south).

- D. Inspection of Base: With a plastic tie, attach a plastic tag to the number one anchor bolt. If the number one anchor bolt is already tagged, remove the old tag and replace it with a new one. The tag should include the date of inspection, inspector's name, organization and structure number. This tag should be tied to the anchor bolt between the base plate and the concrete foundation. Determine the bolt pattern for the anchor base using the examples on the back of the attached inspection Form 0591 or 0474 and, using a permanent marker, mark the corresponding bolt numbers on the vertical support for future reference. Measure and record the anchor bolt identification number, diameter and the number of threads in one inch. Look for missing or damaged anchor bolts or nuts (gouges, corrosion). Also, note any bolts that have been bent to align with holes in the base plate. Note any bolts that are lower than the top of the nut. If the bolt is lower, measure the depth and mark it on the inspection form in the box corresponding to the bolt number. Visually inspect any welds in the base (gussets, vertical support to base connection) looking for cracks or unusual welds. Also, note any damage (corrosion, cracks, gouges, dents) to the base, gussets, and vertical support.

Inspect the condition of the concrete foundation, noting any spalling, cracks, and general deterioration.

Using a 24 ounce ball-peen hammer, hit the side of the top nuts and hit the top of the bolts. This is done to check for loose nuts (leveling and top) and/or cracked or broken bolts. If the nuts are tight, there is a sharp ringing sound; if the nuts are loose, there is a dull sound. A loose leveling nut can also be the cause of the dull sound, so do not immediately tighten the top nut. Visually check for any gaps between the leveling nut and the base plate. Tap one side of each washer placing one hand on the washer opposite the side being tapped. If the washer moves, the nut is not properly tightened. Physically grasp the washer and try to move it to determine the leveling nut tightness. If the leveling nut appears to be tight, proceed to tighten the top nut. Because some bases have a grout between the vertical support base and the concrete foundation, inspection of the leveling nut is not always possible. If this is the case, try to tighten the top nut. If the top nut cannot be tightened further, note this on the inspection form and proceed.

Tightening either of the anchor bolt nuts (leveling or top) can be done using an appropriately sized spud wrench, spanner wrench or socket wrench. A 3-foot to 4-foot (maximum of 4-foot length) pipe can be added to the wrench to increase leverage. The nut is tightened until no further movement takes place. Any broken anchor bolts should be easily identified as both the nut and the bolt will continue to twist with little applied torque. If only the nut rotates under the applied torque, complete the tightening and resound the side of the nut and the bolt with the hammer. Note all the nuts that require tightening on the inspection report.

- E. Ultrasonic Inspection: The individual doing the ultrasonic testing (UT) must be certified at ASNT Level II, on recommended practice SNT-TC-1A.

Grind all anchor bolt ends flat (perpendicular to the shank of the bolt) being sure to remove all galvanizing, paint, dirt, and debris. Because deep (1/16 inch or greater) surface imperfections (gouges, cuts) can affect the UT results, make the ground surface

as smooth as possible. Some bolts have been marked with an “X” for use as bench marks. It is not necessary to grind the bolt until the indentations are completely removed, as these are usually shallow and should not affect the UT inspection. Only grind the bolt a sufficient amount to remove any paint and smooth the surface. There are some bolt ends that have extreme slant and cannot be ground to a flat and perpendicular surface. Note any bolts that have this problem on the inspection form. At some future date, these bolts should be corrected with a flat, perpendicular surface to allow for inspection.

Calibrate the ultrasonic unit for straight beam probe method using a 10 inch screen with a 1 inch diameter straight beam probe. The probe is placed on a 1 inch calibration block (DSC block or section of anchor bolt) and the indications on the screen are adjusted so that a reflection is positioned at each inch mark. Next, place the probe on a 9 inch long test bar that has a 1/8 inch deep saw cut at a set distance (3 inches from the end) in the threaded portion of the rod. Peak the back reflection from the 1/8 inch deep saw cut until the indication is at 60 or 80 percent of screen height. The dB reading is recorded to establish the “REFERENCE LEVEL.” The “SCANNING LEVEL” is set by adding 14 to 30 dB over the reference level. Calibration should be checked at each location before inspecting any bolts.

Apply couplant (glycerin) to the ends of the bolts. Ultrasonically test the anchor bolts using a circular motion inspection pattern and record the results. When scanning the anchor bolts, there should be no indications on the CRT screen between the Main Bang (zero depth) and the end of the screen (10 inch depth). Any indication that is displayed after the Main Bang is a possible flaw. Record the depth of the discontinuity observed and the amount of dB required to bring the indication to the “REFERENCE LEVEL” on the screen. This is recorded as the “INDICATION LEVEL.”

After the inspection is complete, wipe off all the couplant (glycerin) with a wet rag, allow surface to dry completely and spray the bolt ends with cold galvanizing or zinc-rich paint.

II. Procedure for the Inspection of High Strength Bolts at Arm to Upright Connection for Cantilever Sign Structures

- A. Description: This section of the inspection procedure describes the requirements for inspecting the 1 inch diameter bolts connecting the cantilever arm to the pipe upright. This connection is a double arm connection (top arm and bottom arm) with four to twelve bolts per arm connection depending on the type of cantilever. Each arm connection is a double flange connection with the pipe welded all around to each flange.
- B. Specification Tightening: During new support installations, each bolt is required to be tightened according to Subsection 707.03.D.7 of the 2012 Standard Specifications for Construction. This requires each bolt to be tightened using the turn-of-nut method. This tightening method requires the nut to be snug tight and then turned beyond snug tight an additional ½ turn. After this tightening is complete each flange plate should be drawn tight together with no visible gap between the plates.

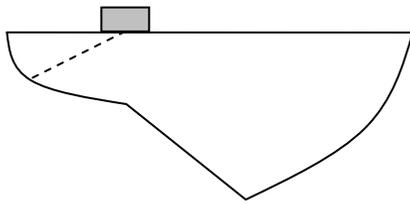
- C. Field Inspection: Visually examine the contact area between the flange plates and measure and record any gap. Visually examine each bolt that connects each arm to the pole upright. Verify that the bolt diameter is 1 inch, if not, record the bolt diameter. Check the bolt head to confirm that the bolt is ASTM A325. The bolt head should have three radial lines coming out from the center of the bolt head. If these lines are not present on the bolt head, record which bolt lacks these markings. As a minimum, each bolt end should be at least flush with the nut. If there is not at least a flush condition between the bolt end and the nut, record this in the inspection report. Each bolt should have a flat washer on the bolt head end and a flat washer and lock washer on the nut end. Record any parts that are missing or not in their proper location. All bolts, nuts and washers should have galvanizing on them. Record any signs of rust.

Placing a 14 to 19 inch long wrench on each nut, try to move each nut by using one hand on the wrench and pulling firmly using your body weight as leverage. With the wrench on the nut and pulling firmly, check for loose nuts or nuts you can turn either by loosening or tightening. If a nut can be removed, remove it and lubricate the bolt threads and nut bearing face with beeswax or equivalent (not oil or grease). Make sure the flat washer and lock washer are present. If not, place one of each on the bolt before installing the nut (the flat washer should be installed before the lock washer). Reinstall the nut and tighten it with both hands on the end of the wrench turning the nut with full effort until the nut stops turning (you may need more than one wrench to prevent the bolt from turning during initial tightening). Remove only one nut a one time. Repeat this operation, as necessary, until all the nuts have been tightened for a given flange connection. Taking the nut off is only necessary when it can be removed as described above. For documentation purposes, describe each bolt as located in the top or bottom arm and numbered clockwise on each flange connection while standing looking at the cantilever upright from the roadway with the number one bolt being on top just right of vertical. Note which nuts were removed and reinstalled and any other non-compliant items within the connection.

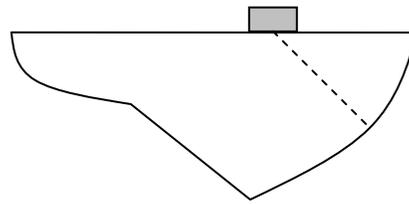
III. Procedure for Ultrasonic Testing of Gusset Plates on Cantilever Sign Supports

- A. Description: This section of the inspection procedure is used when performing ultrasonic testing at the end of horizontal gusset plates on cantilever sign supports only when cracks are found through visual examination. Ultrasonically examine each crack found visually and document the results on MDOT form 1042 ([Report of Ultrasonic Inspection Cantilever Sign Arms](#)).
- B. Ultrasonic Inspection: Inspection must be done by ASNT Level II or higher Technician.
- C. Calibration Procedure: Set the CRT screen for a 5 inch scale. Using the DSC block, couple the 70° transducer to the block and calibrate for a 1 inch distance (Figure 1). Reverse the transducer and verify calibration for a 3 inch distance (Figure 2).

Peak the signal from the (1/16 inch) hole to get a horizontal reference line height of 60% level on the screen.



Calibration for 1" Distance
Figure 1



Calibration for 3" Distance
Figure 2

D. Testing Procedure:

1. The test is intended to verify cracks that have been found visually. A defect rating must be done for all cracks using MDOT Form 1042. If ultrasonic inspection verifies a crack, the Operations Field Services Lab must be contacted and a second team will confirm the ultrasonic inspection.
2. Remove the galvanizing from the area around the crack location using a grinder with 50 - 80 grit sandpaper disks. Grind area until bare metal is indicated by sparks from the surface of the mast. The area ground must extend horizontally 2 inches, above and below the gusset, beyond the end of the gusset plate where the crack is seen.
3. The wall thickness must be determined before angle beam inspection is done. This can be done using either a straight beam probe with the test unit or an ultrasonic thickness gage. The wall thickness will be either 3/8 inch or 1/2 inch.
4. Angle beam testing will be done using a scanning level of 6-12 dBs above the reference level and the AWS scanning patterns A and B. For a wall thickness of 3/8 inch, the first leg is 1.1 inches, the second leg (V-path) is 2.2 inches and the skip distance is 2.06 inches. For a wall thickness of 1/2 inch, the first leg is 1.46 inches, the second leg (V-path) is 2.92 inches, and the skip distance is 2.75 inches.
5. The area ultrasonically tested must extend beyond the ends of the cracks to verify the crack termination points.
6. Record all information shown on MDOT Form 1042. The sound path must be the distance at which the maximum indication level occurs.
7. If no defects are found ultrasonically, remove the couplant and spray the area that was ground using the zinc rich paint. If defects are found, leave the ground areas unpainted.
8. If the crack is confirmed ultrasonically, send a copy of the inspection report to the Structural Fabrication Unit, Operations Field Services Division, 8885 Ricks Road, P.O. Box 30049, Lansing, MI, 48909. Any unusual or potentially dangerous

conditions must be reported immediately to the Michigan Department of Transportation, Operations Field Services Division at 517-322-1235 or 517-322-5709.

IV. Report Writing, Safety and Equipment

- A. Reporting Procedure: All written reports (MDOT Forms 0474, 0519, 0585, and 1042 available at <http://mdotwas1.mdot.state.mi.us/public/webforms/>) must be legible, accurate, and detailed. These documents will be used as evidence of work performed (pay item). Payment for work will not be made if data gathered are illegible or undecipherable. Provide digital photographs of deficiencies. Dated and labeled digital photographs must correspond to a specific structure or inspection report number and provided in jpg format on CD media.

Any unusual or potentially dangerous conditions must be reported immediately to the Michigan Department of Transportation, Operations Field Services Division at 517-322-1235 or 517-322-5709.

- B. Safety: All inspections and related work must be in accordance with the Department's Personal Protective Equipment (PPE) Policy as stated in the MDOT Guidance Document #10118 and MIOSHA safety standards (use of safety apparel and equipment safety guards). Safety apparel and equipment (hard hats, leather gloves, harnesses, lanyards, safety glasses, safety shoes, and safety vests) must be worn by all workers.

C. Equipment/Tool List:

- Bucket Truck
- Complete Ultrasonic Unit with Straight and Angle Beam Probe 70° - 5 MHZ miniature transducer, (1/4 inch x 1/4 inch element)
- DSC (distance and sensitivity calibration) Block
- Portable Generator to Operate Ultrasonic Unit and Grinder
- 100 Foot Electrical Power Cord
- 24 Ounce Ball-Peen Hammer
- 3 Foot Level
- Container of Couplant (Glycerin)
- Box of Rags for Cleaning
- Spray cans of Cold Galvanizing or Zinc-Rich Paint
- L-head Grinder with Grinding Disks
- 50 - 80 Grit Sanding Disks (used to grind off zinc on cantilever pipe wall)
- 5 Gallon Gas Can, Must be Safety Type
- 12 Foot Tape Measure
- 6 Inch Ruler
- Round Point Shovel
- Wrenches (Spud, Spanner or Socket) and 10 foot Pipe Extension
- Screwdrivers (Flathead and Philips)
- Two 14 Inch Long Wrenches
- Binoculars
- 25 Foot Collapsible Survey Rod

- Beeswax, Toilet Ring wax or equivalent (not oil or grease)
- Hot Dip Galvanized Flat and Lock Washers (provided by MDOT Maintenance)
- Traffic Signs
- Voltage Protection Gloves
- Voltage Detector
- GPS Unit
- Digital Camera
- Cell Phone
- MDOT Form 0474, [Truss Inspection](#)
- MDOT Form 0519, [Cantilever and Bridge Connection Inspection](#)
- MDOT Form 0585, [Dynamic Message Sign Inspection](#)
- MDOT Form 1042, [Report of Ultrasonic Inspection Cantilever Sign Arms](#)

**MICHIGAN DEPARTMENT OF TRANSPORTATION
OPERATIONS FIELD SERVICES DIVISION
PROCEDURE FOR THE INSPECTION OF
TRAFFIC SIGNAL MAST ARM POLE AND MAST ARM**

I. General Inspection Procedure

- A. Description: This procedure describes the requirements for inspecting the structural elements of traffic signal mast arm poles and mast arms.
- B. Establish Structure Location: Location information should include region name, county name, route number, control section, and description of the traffic signal structure location using global position system (GPS) coordinates and visible reference (intersections, buildings, etc.) to facilitate future inspections. Also, reference quadrant (when facing north at intersections) and stationing or mile markers if available.
- C. General Traffic Signal Structure Inspection: If the structure information is not on the inspection form, the following should be noted: record coating material (galvanized or painted), and upright diameter. Measure and record as much additional data as possible (arm diameter, arm length, etc.). A 25 foot collapsible survey rod aids in obtaining many of the dimensions. A set of mast arm pole and mast arm standard plans can be used to determine the dimensions that cannot be measured for the clamp type arm to upright connection.

Visually inspect the condition of the structure's components. This may require the use of binoculars or other visual aids. The inspection must include the arm to upright connection as well as the base to foundation connection. Note any unusual gaps between the connection flanges (see Section II), loose or missing bolts, missing hardware or caps, cracked welds, cracks in the clamps and clamp ends (see Section II), or sagging of the arm. The number and condition of traffic signal(s) should be noted. Traffic signals should be inspected to ensure they are secure to the arm. Note unsecured or missing access panel covers. Also, note any non-highway signs mounted on the mast signal pole or arm. Estimate size and mounting locations of these signs.

Check the vertical support for plumbness using a 4 foot level. Record any tilt as inches per length of level (i.e. 1 ½ inches in 4 feet), either towards the roadway or away from the roadway. Also, measure and record any longitudinal tilt (i.e. upright tilts 2 inches in 4 feet north or south).

- D. Inspection of Base: With a plastic tie, attach a plastic tag to the number one anchor bolt (this can be any bolt if not already tagged). If the number one anchor bolt is already tagged, remove the old tag and replace it with a new one. The tag should include the date of inspection, inspector's name, organization and structure number. This tag should be tied to the anchor bolt between the base plate and the concrete foundation. Using a permanent marker, mark the corresponding bolt numbers on the vertical support for future reference. Nut covers or base plate covers (if any) are to be removed as necessary to gain access to the anchor bolts and nuts. After inspection, the covers

are to be reinstalled to its original condition. Note removal and reinstallation of the covers on the report along with the cover's condition. Nut covers can typically be removed with either a socket wrench or screwdriver. Remove any accumulated debris under the covers prior to reinstallation. If nut or base plate covers are present, record this on the inspection report.

Measure and record the anchor bolt diameter and the number of threads in one inch. Look for missing or damaged anchor bolts or nuts (gouges, corrosion). Also, note any bolts that have been bent to align with holes in the base plate. Note any bolts that are lower than the top of the nut. If the bolt is lower, measure the depth and mark it on the inspection form in the box corresponding to the bolt number. Visually inspect any welds in the base (gussets, vertical support to base connection) looking for cracks or unusual welds. Also, note any damage (corrosion, cracks, gouges, dents) to the base, gussets, and vertical support.

Inspect the condition of the concrete foundation, noting any spalling, cracks, and general deterioration.

Using a 24 ounce ball-peen hammer, hit the side of the top nuts and hit the top of the bolts. This is done to check for loose nuts (leveling and top) and/or cracked or broken bolts. If the nuts are tight, there is a sharp ringing sound; if the nuts are loose, there is a dull sound. A loose leveling nut can also be the cause of the dull sound, so do not immediately tighten the top nut. Visually check for any gaps between the leveling nut and the base plate. Tap one side of each washer placing one hand on the washer opposite the side being tapped. If the washer moves, the nut is not properly tightened. Physically grasp the washer and try to move it to determine the leveling nut tightness. If the leveling nut appears to be tight, proceed to tighten the top nut. Because some bases have a grout between the vertical support base and the concrete foundation, inspection of the leveling nut is not always possible. If this is the case, try to tighten the top nut. If the top nut cannot be tightened further, note this on the inspection form and proceed. These structures may have stainless steel beveled washers used to provide the upright tilt. Ensure these washers are properly configured to provide the correct tilt direction. Check for gaps between the leveling nut and the base as stated above. Note any incorrect configurations or gaps on the inspection report.

Tightening either of the anchor bolt nuts (leveling or top) can be done using an appropriately sized spud wrench, spanner wrench or socket wrench. A 10 foot long pipe can be added to the wrench to increase leverage. The nut is tightened until no further movement takes place. Any broken anchor bolts should be easily identified as both the nut and the bolt will continue to twist with little applied torque. If only the nut rotates under the applied torque, complete the tightening and resound the side of the nut and the bolt with the hammer. Note all the nuts that require tightening on the inspection report.

- E. Ultrasonic Inspection: The individual doing the ultrasonic testing (UT) must be certified at ASNT Level II on recommended practice SNT-TC-1A.

Grind all anchor bolt ends flat (perpendicular to the shank of the bolt) being sure to

remove all galvanizing, paint, dirt, and debris. Because deep (1/16 inch or greater) surface imperfections (gouges, cuts) can affect the UT results, make the ground surface as smooth as possible. Some bolts have been marked with an "X" for use as bench marks. It is not necessary to grind the bolt until the indentations are completely removed, as these are usually shallow and should not affect the UT inspection. Only grind the bolt a sufficient amount to remove any paint and smooth the surface. There are some bolt ends that have extreme slant and cannot be ground to a flat, perpendicular surface. Note any bolts that have this problem on the inspection form. At some future date, these bolts should be corrected with a flat, perpendicular surface to allow for inspection.

Calibrate the ultrasonic unit for straight beam probe method using a 10 inch screen with a 1 inch diameter straight beam probe. The probe is placed on a 1 inch calibration block (DSC block or section of anchor bolt) and the indications on the screen are adjusted so that a reflection is positioned at each inch mark. Next, place the probe on a 9 inch long test bar that has a 1/8 inch deep saw cut at a set distance (3 inches from the end) in the threaded portion of the rod. Peak the back reflection from the 1/8 inch deep saw cut until the indication is at 60 or 80 percent of screen height. The dB reading is recorded to establish the "REFERENCE LEVEL." The "SCANNING LEVEL" is set by adding 14 to 30 dB over the reference level. Calibration should be checked at each location before inspecting any bolts.

Apply couplant (glycerin) to the ends of the bolts. Ultrasonically test the anchor bolts using a circular motion inspection pattern and record the results. When scanning the anchor bolts, there should be no indications on the CRT screen between the Main Bang (zero depth) and the end of the screen (10 inch depth). Any indication that is displayed after the Main Bang is a possible flaw. Record the depth of the discontinuity observed and the amount of dB required to bring the indication to the "REFERENCE LEVEL" on the screen. This is recorded as the "INDICATION LEVEL."

After the inspection is complete, wipe off all the couplant (glycerin) with a wet rag, allow to dry completely and spray the bolt ends with cold galvanizing or zinc-rich paint. If the nut or base plate covers were removed, reinstall and fasten securely in place.

II. Procedure for the Inspection of High Strength Bolts at Arm to Upright Connection.

- A. Description: This section of the inspection procedure describes the requirements for inspecting the bolts connecting the traffic signal arm to the pole upright. This connection is a single arm connection with four (possibly more) bolts per connection depending on the type of arm to pole upright connection. The arm to pole upright connection may be one of three types: (1) a box connection with the bolts tightened into the box (box is tapped to receive the bolts), (2) a box connection with a wide outer face flange plate allowing a through bolt connection (flange to flange connection) or (3) a clamp connection with the arm welded to one side of the clamp, locator bolts on the other side of the clamp (the side opposite traffic) with the clamp bolted around the upright.

- B. Specification Tightening: With the box wide flange plate connection, each bolt is required to be tightened according to Subsection 707.03.D.7 of the 2012 Standard Specifications for Construction. This requires each bolt to be tightened using the turn-of-nut method. This tightening method requires the nut to be snugged up and then turned beyond snug tight an additional 1/3 or turn. After tightening, each flange plate should be drawn tight together with no visible gap between the plates.

With a clamped connection, the bolts are required to be snug tight. Locator bolts should be present on the back side clamp (opposite side from traffic) and placed into a bushing fixed with a cotter pin (see MDOT Standard Details). Check for cracks at the bushing connection. Note any missing locator bolts, bushings and/or cotter pins.

- C. Field Inspection: Visually examine each bolt, verify and record the bolt diameter (if applicable). Check the bolt head to confirm that the bolt is ASTM A325. The bolt head should have three radial lines coming out from the center of the bolt head. If these lines are not present on the bolt head, record which bolt lacks these markings. With the through bolt connections and clamp connections, as a minimum, each bolt end should be at least flush with the nut. If there is not at least a flush condition between the bolt end and the nut, record this in the inspection report. Each bolt should have a flat washer on the bolt head end and a flat washer and lock washer on the nut end. Record any parts that are missing or not in their proper location. All bolts, nuts and washers should be galvanized. Record any signs of rust. Visually examine the contact area between the flange plates, measure and record any gap.

When checking the nuts place a 14 to 19 inch long wrench on each nut, try to move each nut by using one hand on the wrench and pull firmly using your body weight as leverage. With the wrench on the nut and pulling firmly, check for loose nuts or nuts you can turn either by loosening or tightening. If a nut can be removed, remove it and lubricate the bolt threads and nut bearing face with beeswax or equivalent (not oil or grease). Make sure the flat washer and lock washer are present, if not, place one of each on the bolt before installing the nut (the flat washer should be installed before the lock washer). Reinstall the nut and tighten it with both hands on the end of the wrench turning the nut with full effort until the nut stops turning (you may need more than one wrench to prevent the bolt from turning during initial tightening). Remove only one nut at one time. Repeat this operation, as necessary, until all the nuts have been tightened for a given flange connection. Taking the nut off is only necessary when it can be removed as described above. For documentation purposes, describe each bolt as numbered clockwise on the flange connection while standing looking at the cantilever upright from the roadway with the number one bolt being on top just right of vertical. Note which nuts were removed and reinstalled along with any other non-compliant items within the connection.

All three types of traffic signal structure arm to pole upright connections require visual inspection of the welds. The vertical welds connecting plates to the sides to the pole upright are critical in nature and require extra attention. Pay close attention to welds wrapping around corners on gusset stiffener plates at the arm to pole upright connection. The arm may be two pieces with a slip joint connection near the midpoint of the arm span. If a slip joint exists, visually examine the longitudinal seam weld at

that location. Record any visible cracks, noting size and location. Record the total arm length of the mast arm. If cracks are found, send a copy of the inspection report to Structural Fabrication Engineer, Operations Field Services, 8885 Rick Road, P.O. Box 30049, Lansing, MI, 48909.

If there is an attached luminaire mounted on top of the mast signal pole, note this on the inspection report. Visually inspect all components. This includes the mounting bracket clamp and the bolts that attach it to the mast signal pole. The bolts should have a flat washer and lock washer under each nut. The nut should be tightened to a snug tight condition so that the lock washer is completely flat. Also, visually inspect the fillet weld connecting the luminaire pole to the mounting bracket clamp. Note any non-conformities in the comment section of the inspection report.

III. Report Writing, Safety and Equipment

- A. Reporting Procedure: All written reports (MDOT Form 0542 available at <http://mdotwas1.mdot.state.mi.us/public/webforms/>) must be legible, accurate, and detailed. These documents will be used as evidence of work performed (pay item). Payment for work will not be made if data gathered are illegible or undecipherable. Provide digital photographs of deficiencies. Dated and labeled digital photographs must correspond to a specific structure or inspection report number and provided in jpg format on CD media.

Any unusual or potentially dangerous conditions must be reported immediately to the Michigan Department of Transportation, Operations Field Services Division at 517-322-1235 or 517-322-5709.

- B. Safety: All inspections and related work must be in accordance with the Department's Personal Protective Equipment (PPE) Policy as stated in the MDOT Guidance Document #10118 and MIOSHA safety standards (use of safety apparel and equipment safety guards). Safety apparel and equipment (hard hats, leather gloves, harnesses, lanyards, safety glasses, safety shoes, and safety vests) must be worn by all workers.

- C. Equipment/Tool List:

- Bucket Truck
- Complete Ultrasonic Unit and Transducer
- DSC (distance and sensitivity calibration) Block
- Portable Generator to Operate Ultrasonic Unit and Grinder
- 100 Foot Electrical Power Cord
- 24 Ounce Ball-Peen Hammer
- 4 Foot Level
- Container of Couplant (Glycerin)
- Box of Rags for Cleaning
- Spray Cans of Cold Galvanizing or Zinc-Rich Paint
- L-head Grinder with Grinding Disks
- 5 gallon Gas Can, Must be Safety Type

- 12 Foot Tape Measure
- 6 Inch Ruler
- Round Point Shovel
- Wrenches (Spud, Spanner or Socket) and 10 foot Pipe Extension
- Screwdrivers (Flathead and Philips)
- Two 14 Inch Long Wrenches
- Binoculars
- 25 Foot Collapsible Survey Rod
- Beeswax, Toilet Ring wax or equivalent (not oil or grease)
- Hot Dip Galvanized flat and lock washers (provided by MDOT Operations Field Services Division)
- Traffic Signs
- Voltage Protection Gloves
- Voltage Detector
- GPS Unit
- Digital Camera
- Cell Phone
- MDOT Form 0542, *Traffic Signal Mast Arm Pole and Mast Arm Inspection*

**MICHIGAN DEPARTMENT OF TRANSPORTATION
OPERATIONS FIELD SERVICES DIVISION
PROCEDURE FOR THE INSPECTION OF TRI-CHORD
CANTILEVER AND TRI-CHORD TRUSS SIGN STRUCTURES**

I. General Inspection Procedure

- A. Description: This procedure describes the requirements for inspecting tri-chord cantilever and tri-chord truss sign support structures.
- B. Establish Structure Location: Location information should include region name, the Michigan Department of Transportation's (MDOT) structure inventory number, county name, route number, control section, and description of structure location using global position system (GPS) coordinates and visible reference (ramps, overpasses, intersections, buildings, etc.) to facilitate future inspections. Also, reference to stationing or mile markers should be used if available.
- C. General Sign Structure Inspection: If the structure information is not in the inspection form, the following should be noted. Record cantilever or truss type, coating material (galvanized or painted), and upright diameter. Measure and record as much additional sign data as possible (upright height, base diameter, etc.). A 25 foot collapsible survey rod aids in obtaining many of the dimensions. A set of sign structure standard plans should be used to determine the dimensions that cannot be measured.

Visually inspect the condition of the support components. This may require the use of binoculars or other visual aids. The inspection must include the horizontal to vertical support connection and a walk-through inspection of the tri-chord truss span or arm. Note any unusual gaps between the bolt flanges, loose or missing bolts, missing hardware or caps, cracked welds, cracks at the end of gusset plates, sagging of the horizontal support, and any broken or missing cross braces. Inspect the condition of the sign or signs noting any missing hardware or damage. Record the sign legend in the appropriate box. Visually inspect the U-bolts (where located, what connection, noting stainless or galvanized steel), and record any that are missing or damaged. Inspect the bottom of the signs for direct bolting through the vertical "I" beams (which prevent signs from slipping down on the "I" beams). Also, note any non-highway signs mounted on the sign structure. Estimate size, material types, and mounting locations of these signs.

Check the vertical support for plumbness using a 4 foot level. Record any tilt as inches per length of level (i.e. 1 ½ inches in 4 feet), either towards the roadway or away from the roadway. Also, measure and record any longitudinal tilt (i.e. upright tilts 2 inches in 4 feet north or south).

- D. Inspection of Base Plate and Anchor Bolts: With a plastic tie, attach a plastic tag to the number one anchor bolt. The number one anchor bolt is defined as the anchor bolt furthest away from traffic. If the number one anchor bolt is already tagged, remove the old tag and replace it with a new one. The tag should include the date of inspection,

inspector's name, organization and structure number. This tag should be tied to the anchor bolt between the base plate and the concrete foundation. Determine the number of anchor bolts in each anchor bolt pattern and, using a permanent marker, mark the corresponding bolt numbers on the vertical support for future reference. The numbering sequence should be in a clockwise pattern starting from the number one anchor bolt. Measure and record the anchor bolt identification number, diameter and the number of threads in one inch. Look for missing or damaged anchor bolts or nuts (gouges, corrosion). Also, note any bolts that have been bent to align with holes in the base plate. Note any bolts that are lower than the top of the nut. If the bolt is lower, measure the depth and mark it on the inspection form in the box corresponding to the bolt number. Visually inspect any welds in the base (gussets, vertical support to base connection) looking for cracks or unusual welds. Also, note any damage (corrosion, cracks, gouges, dents) to the base, gussets, and vertical support.

Inspect the condition of the concrete foundation, noting any spalling, cracks, and general deterioration.

Using a 24 ounce ball-peen hammer, hit the side of the top nuts and hit the top of the bolts. This is done to check for loose nuts (leveling and top) and/or cracked or broken bolts. If the nuts are tight, there is a sharp ringing sound; if the nuts are loose, there is a dull sound. A loose leveling nut can also be the cause of the dull sound, so do not immediately tighten the top nut. Visually check for any gaps between the leveling nut and the base plate. Tap one side of each washer placing one hand on the washer opposite the side being tapped. If the washer moves, the nut is not properly tightened. Physically grasp the washer and try to move it to determine the leveling nut tightness. If the leveling nut appears to be tight, proceed to tighten the top nut. Because some bases have a grout between the vertical support base and the concrete foundation, inspection of the leveling nut is not always possible. If this is the case, try to tighten the top nut. If the top nut cannot be tightened further, note this on the inspection form and proceed.

Tightening either of the anchor bolt nuts (leveling or top) can be done using an appropriately sized spud wrench, spanner wrench or socket wrench. A 3 foot to 4 foot (maximum of 4 foot length) pipe can be added to the wrench to increase leverage. The nut is tightened until no further movement takes place. Any broken anchor bolts should be easily identified as both the nut and the bolt will continue to twist with little applied rotation. If only the nut rotates under the applied rotation, complete the tightening and resound the side of the nut and the bolt with the hammer. Note all the nuts that require tightening on the inspection report.

- E. Ultrasonic Inspection: The individual doing the ultrasonic testing (UT) must be certified at ASNT Level II on recommended practice SNT-TC-1A.

Grind all anchor bolt ends flat (perpendicular to the shank of the bolt) being sure to remove all galvanizing, paint, dirt, and debris. Because deep (1/16 inch or greater) surface imperfections (gouges, cuts) can affect the UT results, make the ground surface as smooth as possible. Some bolts have been marked with an "X" for use as bench marks. It is not necessary to grind the bolt until the indentations are completely

removed, as these are usually shallow and should not affect the UT inspection. Only grind the bolt a sufficient amount to remove any paint and smooth the surface. There are some bolt ends that have extreme slant and cannot be ground to a flat and perpendicular surface. Note any bolts that have this problem on the inspection form. At some future date, these bolts should be corrected with a flat, perpendicular surface to allow for inspection.

Calibrate the ultrasonic unit for straight beam probe method using a 10 inch screen with a 1 inch diameter straight beam probe. The probe is placed on a 1 inch calibration block (DSC block or section of anchor bolt) and the indications on the screen are adjusted so that a reflection is positioned at each inch mark. Next, place the probe on a 9 inch long test bar that has a 1/8 inch deep saw cut at a set distance (3 inches from the end) in the threaded portion of the rod. Peak the back reflection from the 1/8 inch deep saw cut until the indication is at 60 or 80 percent of screen height. The dB reading is recorded to establish the "REFERENCE LEVEL." The "SCANNING LEVEL" is set by adding 14 to 30 dB over the reference level. Calibration should be checked at each location before inspecting any bolts.

Apply couplant (glycerin) to the ends of the bolts. Ultrasonically test the anchor bolts using a circular motion inspection pattern and record the results. When scanning the anchor bolts, there should be no indications on the CRT screen between the Main Bang (zero depth) and the end of the screen (10 inch depth). Any indication that is displayed after the Main Bang is a possible flaw. Record the depth of the discontinuity observed and the amount of dB required to bring the indication to the "REFERENCE LEVEL" on the screen. This is recorded as the "INDICATION LEVEL."

After the inspection is complete, wipe off all the couplant (glycerin) with a wet rag, allow surface to dry completely and spray the bolt ends with cold galvanizing or zinc-rich paint.

II. Procedure for the Inspection of High Strength Bolts at Tri-Chord Truss Span or Arm to Upright Connection

- A. Description: This section of the inspection procedure describes the requirements for inspecting the 7/8 inch diameter bolts connecting the tri-chord truss span or arm to the pipe upright gusset saddles. There are two different types of connections between the tri-chord truss span or arm and the pipe upright gusset saddles. The tri-chord cantilever truss arm has a three chord connection (two on the front of the upright and one on the back of the upright) with fourteen bolts per chord connection. The tri-chord truss span is a two chord connection (two connections on the front of each upright) with fourteen bolts per chord connection. Each tri-chord connection consists of a horizontal flange plate welded to a tri-chord pipe end section.
- B. Specification Tightening: During new support installations, each bolt is required to be tightened according to Subsection 707.03.D.7 of the 2012 Standard Specifications for Construction. This requires each bolt to be tightened using the turn-of-nut method. This tightening method requires the nut to be snug tight and

then turned beyond snug tight an additional 1/3 turn. After this tightening is complete each flange plate should be drawn tight together with no visible gap between the plates.

- C. Field Inspection: Visually examine the contact area between the pipe upright gusset saddles and the horizontal flange plates. Measure and record any gap. Visually examine each bolt that connects each chord to the pole upright. Verify that the bolt diameter is 7/8 inch, if not, record the bolt diameter. Check the bolt head to confirm that the bolt is ASTM A325. The bolt head should have three radial lines coming out from the center of the bolt head. If these lines are not present on the bolt head, record which bolt lacks these markings. As a minimum, each bolt end should be at least flush with the nut. If there is not at least a flush condition between the bolt end and the nut, record this in the inspection report. Each bolt should have a flat washer on the bolt head end and a flat washer on the nut end. Record any parts that are missing or not in their proper location. All bolts, nuts and washers should be galvanized. Record any signs of rust.

Placing a 14 to 19 inch long wrench on each nut, try to move each nut by using one hand on the wrench and pulling firmly using your body weight as leverage. With the wrench on the nut and pulling firmly, check for loose nuts or nuts you can turn either by loosening or tightening. If a nut can be removed, remove it and lubricate the bolt threads and nut bearing face with beeswax, toilet ring wax or equivalent (not oil or grease). Make sure the flat washer is present. If not, place one on the bolt before installing the nut. Reinstall the nut and tighten it with both hands on the end of the wrench turning the nut with full effort until the nut stops turning (you may need more than one wrench to prevent the bolt from turning during initial tightening). Remove only one nut at a time. Repeat this operation, as necessary, until all the nuts have been tightened for a given flange connection. Taking the nut off is only necessary when it can be removed as described above. For documentation purposes, describe each bolt as located in the top, center (for tri-chord cantilever only) or bottom chord connection and numbered clockwise on each flange connection as if looking down at the pipe upright from a bucket truck with the number one bolt being furthest away from traffic closest to the pipe upright. Note which nuts were removed and reinstalled and any other non-compliant items within the connection.

III. Procedure for the Inspection of High Strength Bolts at Tri-Chord Splices/Connections

- A. Description: This section of the inspection procedure describes the requirements for the inspection of the 7/8 inch diameter bolts connecting separate sections of the tri-chord truss span. All tri-chord cantilevers and tri-chord trusses may not have

chord splices. This splice connection consists of two angles bolted around each chord pipe with sixteen bolts per chord.

- B. Specification Tightening: High strength bolts at chord splice connections require lock washers and do not require turn-of-nut tightening. Each bolt must be tightened until the lock washer is fully flattened.
- C. Field Inspection: Visually examine the contact area between the angles and chord pipe and measure and record any gap. Visually examine each bolt that connects each angle to the chord pipe. Verify that the bolt diameter is 7/8 inch, if not, record the bolt diameter. Check the bolt head to confirm that the bolt is ASTM A325. The bolt head should have three radial lines coming out from the center of the bolt head. If these lines are not present on the bolt head, record which bolt lacks these markings. As a minimum, each bolt end should be at least flush with the nut. If there is not at least a flush condition between the bolt end and the nut, record this in the inspection report. Each bolt should have a flat washer on the bolt head end and a flat washer and lock washer on the nut end. Record any parts that are missing or not in their proper location. All bolts, nuts and washers should be galvanized on them. Record any signs of rust.

Placing a 14 to 19 inch long wrench on each nut, try to move each nut by using one hand on the wrench and pulling firmly using your body weight as leverage. With the wrench on the nut and pulling firmly, check for loose nuts or nuts you can turn either by loosening or tightening. If a nut can be removed, remove it and lubricate the bolt threads and nut bearing face with beeswax, toilet ring wax or equivalent (not oil or grease). Make sure the flat washer and lock washer are present. If not, place one of each on the bolt before installing the nut. Reinstall the nut and tighten it with both hands on the end of the wrench turning the nut with full effort until the nut stops turning (you may need more than one wrench to prevent the bolt from turning during initial tightening). Remove only one nut a one time. Repeat this operation, as necessary, until all the nuts have been tightened for a given chord splice connection. Taking the nut off is only necessary when it can be removed as described above. For documentation purposes, describe each bolt as located in the top or side of the chord pipe and numbered with the number one bolt being closest to the upright. Note which nuts were removed and reinstalled and any other non-compliant items within the connection.

IV. Report Writing, Safety and Equipment

- A. Reporting Procedure: All written reports (MDOT Forms 0588 and 0589, available at <http://mdotwas1.mdot.state.mi.us/public/webforms/>) must be legible, accurate, and detailed. These documents will be used as evidence of work performed (pay item). Payment for work will not be made if data gathered are illegible or

undecipherable. Provide digital photographs of deficiencies. Dated and labeled digital photographs must correspond to a specific structure or inspection report number and provided in jpg format on CD media.

Any unusual or potentially dangerous conditions must be reported immediately to the Michigan Department of Transportation, Operations Field Services Division at 517-322-1235 or 517-322-5709.

B. Safety: All inspections and related work must be in accordance with the Department's Personal Protective Equipment (PPE) Policy as stated in the MDOT Guidance Document #10118 and MIOSHA safety standards (use of safety apparel and equipment safety guards). Safety apparel and equipment (hard hats, leather gloves, harnesses, lanyards, safety glasses, safety shoes, and safety vests) must be worn by all workers.

C. Equipment/Tool List:

- Bucket Truck
- Complete Ultrasonic Unit
- DSC (distance and sensitivity calibration) Block
- Portable Generator to Operate Ultrasonic Unit and Grinder
- 100 Foot Electrical Power Cord
- 24 Ounce Ball-Peen Hammer
- 3 Foot Level
- Container of Couplant (Glycerin)
- Box of Rags for Cleaning
- Spray cans of Cold Galvanizing or Zinc-Rich Paint
- L-Head Grinder with Grinding Disks
- 50 - 80 Grit Sanding Disks (used to grind off zinc on cantilever pipe wall)
- 5 Gallon Gas Can, Must be Safety Type
- 12 Foot Tape Measure
- 6 Inch Ruler
- Round Point Shovel
- Wrenches (Spud, Spanner or Socket) and 10 foot Pipe Extension
- Screwdrivers (Flathead and Philips)
- Two 14 Inch Long Wrenches
- Binoculars
- 25 Foot Collapsible Survey Rod
- Beeswax, Toilet Ring wax or equivalent (not oil or grease)
- Hot Dip Galvanized Flat and Lock Washers (provided by MDOT Maintenance)
- Traffic Signs
- GPS Unit

- Digital Camera
- Cell Phone
- MDOT Form 0588, [Tri-Chord Cantilever Inspection](#)
- MDOT Form 0589, [Tri-Chord Truss Inspection](#)

Exhibit A: Structure Inspection Schedule

Structure Inspection Schedule 2013 thru 2015 (plus a two year extension)

Year & Area	Structure	Quantity
2013 Metro	Cantilevers	379
	Trusses	5
	Light Towers	377
	Freeway lighting	1428
	Mast Arms	140
2014 Statewide	Cantilevers	436
	Trusses	5
	Light Towers	151
	Freeway lighting	1428
	Mast Arms	8
2015 Metro	Cantilevers	379
	Trusses	5
	Light Towers	377
	Freeway lighting	1428
	Mast Arms	140
2016 Statewide	Cantilevers	436
	Trusses	5
	Light Towers	151
	Freeway lighting	1428
	Mast Arms	8
2017 Metro	Cantilevers	379
	Trusses	5
	Light Towers	377
	Freeway lighting	1428
	Mast Arms	140

Note: This is an estimated inspection schedule and may be subject to change in quantity, location, and date.

Exhibit B: Picture Formatting Requirements/ Example Immediate Attention Report

When submitting pictures to include in structure inspection reports:

- Include one image showing the entire structure, including a digital location description, unique structure I.D., and inspection date located on the image.

- Include images showing an adequate close up perspective of the deficiency(s) with descriptive accounts for each deficiency matching those in the report. Include digital identification markings on the image relating it to both the site and inspection date.

- Compress report file sizes down as much as reasonably possible, before emailing to the Project Manager. The larger resolution picture files are to be provided on a CD/DVD disc at the end of each inspection authorization period, or as requested by the Project Manager.

Inspection Date: 06/04/2012
Inspector: MDOT- J. Doe
Report ID: 2012-1001

Lat: ?? deg. ??' ??."?
Long: ?? deg. ??' ??."?
Structure ID Marking: NA

Region: University
County: Ingham
Control Section 33044

Example Immediate Attention Report
(For Information Purposes Only)

Inspection Date: 6/4/2012
Inspector: MDOT - J. Doe
Region: University
County: Ingham
Control Section: 33044
Location: WB I-696, 1st Pole in Entrance Ramp from
Campbell Rd
Structure # : *List the structure number, if there is one.*
Latitude: ?? deg. ??' ??."?
Longitude: ?? deg. ??' ??."?
Unique Report ID # : 2012-1001 (*Format to be determined*)

Inspection notes: (*highlight critical items in bold*)

- **There are multiple cracks in the barrier wall varying in width and length, the largest being 3/16" coming from anchor bolt #4. The barrier wall near anchor bolt #4, underneath the crack, sounds hollow when tapped with a hammer. (See Picture #1 and #2)**
- **Anchor bolt #2, #4 and the nut and washer for anchor bolt #1 and #3 are corroded. (See Picture #1 and #2)**
- There is a slight gap at the bottom section on both flanges of the arm to upright bolted connection. There does not appear to be any separation of the nuts and bolts from the flanges. (See Picture #3)

Inspection Date: 06/04/2012
Inspector: MDOT- J. Doe
Report ID: 2012-1001

Lat: ?? deg. ??' ??.""
Long: ?? deg. ??' ??.""
Structure ID Marking: NA

Region: University
County: Ingham
Control Section 33044



Picture 1: Looking South at Structure 2012-1001 (CS 33044, MP 2.244)



Picture 2: Structure 2012-1001, looking East. Electrical cover is missing, base connections are corroded, and $\frac{3}{4}$ in gap is present between base and the concrete wall on the west side.

Exhibit C: Frangible and Non-Frangible Databases

Frangible Light Standard Database Headings

(For information only, actual database format will be provided to the Consultant by the PM)

(line up boxes by heading rows, left to right)

Report Number	Structure Number	Inspection Date	Inspected By
1		4/9/2012	MDOT- J.Doe

Control Section	Region	County	Route	Location Discription	Latitude			Longitude		
					Deg	Min	Sec	Deg	Min	Sec
	Metro	Oakland	I-696	1st poll in exit ramp to Amer	42	29	25.9	83	18	48.2

Upright						Arm to Upright Connection				Arm to Upright Connection Bolts		
Height	Diameter	Taper	Tilt	Coating	Upright Condition	Type	# of Arms	Arm Type	arm length	# of bolts	Bolt Dia.	Bolt Condition
21"	8"	n/a	plumb	galv.	good	flange bolted	1	single	0"	4	0"	good

Base Profile	Base Thickness	Foundation Type	Nut of Base Cover	Hand hole Cover	Access Panel
5/8 U w/ gusset	.25"	concrete	no	no	yes

Upright to Frangible Base Connention				Anchor Bolt Connentions		
Bolt Condition	Nut Condition	Flat washer	Lock Washers	Bolt Condition	Leveling Nut	Flat washer type and #
good	good	yes	yes		no	round-1

Non-Frangible Light Standard Database Headings

(For information only, actual database format will be provided to the Consultant by the PM)

(line up boxes by heading rows, left to right)

Report Number	Structure Number	Inspection Date	Inspected By
1		4/3/12	MDOT - J.Doe

Control Section	Region	County	Route	Location Discription	Latitude			Longitude		
					Deg	Min	Sec	Deg	Min	Sec
	Metro	Oakland	I-75	NB I-75, 1st pole in exit ramp	42	31	42.3	83	6	55.8

Upright						Arm to Upright Connection				Base			
Height	Diameter	Taper	Tilt	Coating	type	# of Arms	arm type	arm length	Bolt Circle Dia.	Base Dia.	Base Shape	Base Plate thickness	
25'	10"	n/a	plumb	galv.	flange bolted	1	single	0	15"	16.5"	Round	1.5"	

Anchor Bolts	
UT results	Sounding
acceptable	acceptable

CONSULTANT BID SHEET - UNIT PRICE

REVISED 9/4/2012

This bid sheet is required with the response to the Request for Proposal (RFP). All entries on this page must be handwritten in ink or computer generated. Payment for inspection and technical consulting must be based on a unit cost per hour basis.

Priced proposal costs will be required after selection, in accordance with MDOT's Priced Proposal Guidelines which can be found on the MDOT web page under [Vendor/Consultant Services](#). Payment to the Consultant for services rendered shall not exceed the total bid price.

Note: MDOT reserves the right to reject any or all bids.

PROJECT DESCRIPTION:

UNIT DESCRIPTION (Pay Items)	QUANTITY (Units)	UNIT PRICE
Senior Inspector - hourly rate	\$ _____	per hour
Assistant - hourly rate	\$ _____	per hour
Senior Inspector - overtime rate	\$ _____	per hour
Assistant - overtime rate	\$ _____	per hour
Technical Consulting	\$ _____	per hour
Light standard data entry - exhibit C only (Frangible and Non-frangible data bases)	\$ _____	per structure
Standard Equipment Charges (includes all inspection equipment and minor traffic control devises)	\$ _____	per day
Bucket Truck Rental*	\$ _____	per day
Traffic Control* (all required full lane or shoulder closures)	\$ _____	per day

*Reimbursement will be based on actual cost.

TOTAL BID PRICE: _____ \$ _____

Legal Business Name:	
Consultants Authorized Legal Signer:	
Consultant Address:	
Date:	