1 INTRODUCTION AND BACKGROUND

1.1 Program Overview

1.1.1 PURPOSE

The Michigan Department of Transportation (MDOT) has established the Ancillary Structures (AS) Program ("Program") to develop and maintain a statewide inventory of MDOT-owned AS assets. The Program's overarching goal is to minimize public safety risks due to deterioration of asset conditions. Other goals are as follows:

- To develop an asset management program for ancillary structures
- To develop and maintain an Ancillary Structures database framework
- To develop and maintain an ancillary structures program which results in consistency in managing the various ancillary structure types deployed by MDOT

1.1.1.1 Ancillary Structure Definition

Ancillary structures serve a secondary purpose to the roads and bridges within a transportation system but play a critical role in roadway network operations and safety. These structures are often significant in size and complexity and provide structural support for the roadway and/or appurtenances. Failure of an ancillary structure could have immediate, severe, and catastrophic impacts to public safety due to the non-redundant structural configuration and proximity to the roadway. Ancillary structures are not governed by the Federal Highway Administration's (FHWA) National Bridge Inspection System (NBIS) Oversight program and regulations.

The fifteen (15) AS types included in the Program are as follows:

1. Culvert Less than 10-Foot Span
2. Retaining Wall
3. Cantilever Structure
4. Truss Structure
5. Embedded Pole (includes Wood Pole)
6. Spun Concrete Pole
7. Steel Strain Pole
8. Noise Wall
9. Mast Arm
10. Dynamic Message Sign (DMS) Support Structure
11. Frangible Pole Structure
12. Non-Frangible Pole Structure
13. High Mast Lighting Tower (HMLT)
14. Communication Tower
15. Environmental Sensor Station (ESS) Tower

1.1.1.2 Inspection Program Definition

Condition inspection of AS assets is a vital part of the Program's implementation. Accurate, reliable, and current data is necessary to effectively manage infrastructure investments. This manual addresses the following considerations for each AS asset type:

- Inspection types and frequency
- Scope of inspection
- Element and component evaluation
- Inspection team roles and responsibilities
- Inspector qualifications
- Quality management
- Safety issues

In addition to inspection requirements, this manual provides direction on the management of inspection data.

1.1.1.3 Integration with the Asset Management Program

This Program is complementary to existing MDOT asset management programs for bridges and pavement. Bridges and pavement are considered primary structures within the state transportation system; Michigan's Transportation Asset Management Council (TAMC) directs asset management activities for bridge and pavement assets. The asset status and management of bridges and pavement for Michigan are outlined and described in the state's Transportation Asset Management Plan (TAMP), which is submitted on a bi-annual basis to the FHWA. The FHWA requires reporting of status and condition of these assets according to the NBIS and Highway Pavement Monitoring System (HPMS) requirements.

FHWA does not currently require or have a standard for ancillary structures. The FHWA publication FHWA-NHI-20-999 provides general guidance for the inspection of select ancillary structural types.

Inspection findings from this Program shall be communicated to and coordinated with other asset management programs. As ancillary structures are designed, constructed, and maintained in multiple MDOT departments and bureaus, coordination and decision making shall take place with these various stakeholders.

1.1.2 ORGANIZATION AND RESPONSIBILITIES

The AS Program is focused on the various structures that support a wide array of devices that are maintained by various departments. MDOT's Bureau of Bridges and Structures (BOBS) is the owning organization for the Program. The AS Program Manager reports directly to BOBS; MDOT's organization chart is located at the following link: MDOT Bureau of Bridges and Structures.

The Program implementation is supported by additional parties as described in this section, including a Program Management Consultant (PMC). Subsections 1.1.2.1 through 1.1.2.3 provide additional details on select party's responsibilities within the Program.

1.1.2.1 MDOT Ancillary Structures Program Manager

The MDOT Ancillary Structures Program Manager is responsible for the following major elements of the Program:

- Development of policies and procedures for AS asset management
- Enforcement of policies and procedures
- Develop AS information for statewide planning
- Report AS asset management status to parties of interest
- Coordinate with various MDOT departments and bureaus responsible for design, construction, and operations and maintenance of AS
- Engage MDOT Subject Matter Experts as technical advisors
- Conduct Request For Action (RFA) Committee Meetings
- Scoping and Preliminary Engineering

1.1.2.2 MDOT Ancillary Structures Region Champion

Each MDOT Region has a Region Champion and a Deputy Region Champion. The Region Champion serves as the Region main point of contact for the Bureau of Bridges and Structures (BOBS) and the PMC regarding AS. The Region Champion's responsibilities include the following:

- Disseminate necessary AS information throughout the Region
- Provide Region traffic and lane closure restriction guidance
- Provide direction on use of Region resources to address AS Requests for Action
- Participate in meetings for Program updates and discussions on AS issues

The Deputy Region Champion shall serve as a backup when the AS Region Champion is unavailable.

1.1.2.3 Program Manager Consultant

MDOT may engage a Program Manager Consultant (PMC) to support MDOT Program activities as directed by the MDOT Ancillary Structures Program Manager. The PMC's general responsibilities are generally as follows:

- Asset program development and data collection
- Develop and maintain an AS database framework
- Develop and update an AS inspection manual
- Maintain training and certification program for AS team leaders and inspectors
- Develop and maintain an asset management framework for AS
- Collect and manage AS inventory and inspection rating conditions data
- Collect and manage material testing data
- Collect and manage RFAs and Work Recommendations (Work Recs)
- Stakeholder communication and coordination

- Provide Subject Matter Experts on various topics
- Ensure compliance with MDOT policies and procedures
- Scoping and Preliminary Engineering for various assets
- Design standards review and validation
- On demand design and maintenance support

1.2 Quality Assurance and Quality Control

Quality Assurance (QA) and Quality Control (QC) procedures are required to maintain accurate and consistent asset information. Asset information is utilized in determining required preservation activities such as maintenance, repairs, prioritizing removal, rehabilitation or replacements, allocating resources, load ratings, and design improvements for new or existing assets.

1.2.1 COMPARISON OF QC AND QA

All parties involved in the Program shall understand the difference between QC and QA. QC is a check to verify that accurate data is collected by qualified individuals and to immediately address any identified safety deficiencies. QA is performed independently to assure QC measures are effective.

The QC system is designed to utilize general methods and standardized procedures to verify accurate and consistent inventory collection, inspection ratings, documentation, and reporting.

1.2.2 RESPONSIBILITIES

Inspection parties are required to develop and implement appropriate QC procedures to assure quality of inspection data. QC procedures include the following:

1. Define and document QC roles and responsibilities
2. Document required qualifications
3. Document special skills, training, and equipment needs for specific types of Program process
4. Document procedures for review and validation of Program reports and data
5. Document procedures for identification and resolution of data errors, omissions, and/or changes.

Regular meetings shall be conducted to review QC procedures, issues, and/or resolutions. Feedback will be provided to all parties on:

- Hardware and software issues for data collection tools
- Digital inspection and reporting platform issues
- Process improvements needed
- Inspection performance and accuracy
- Field inspection scheduling and completion performance

Inspection parties are responsible for ensuring QA activities are completed. Regular meetings shall be conducted to review QA procedures, issues, and/or resolutions. MDOT may hire one or more consultants to perform AS inspections. These consultants will have responsibility for QA and QC of their field inspection crews.

QA/QC requirements specific to field inspection team personnel and their field inspection include:

- Meeting the qualification requirements as specified in Section 1.4 prior to commencement of field inspections. This includes:
  - Document inspection and testing qualifications for each inspector. Consultants are required to provide evidence of individual inspector qualifications when requested by MDOT.
  - Meet current applicable standards for equipment
  - Develop consultant specific safety plan (if applicable)
  - Document and ensure conformance to the safety plan
- Ensure personnel attendance and successful completion of program-specific training on inspection recording process/system and equipment and individual AS modules
- Perform QC reviews of field inspections documentation
- Monitor conformance to the safety plan and safety standards governing AS field inspections

1.2.3 QUALITY CONTROL REQUIREMENTS

Field inspection teams shall complete the following QC activities at a minimum:

- Perform QC reviews of inspection team field inspections documentation
  - Review inspection results using an internally assigned senior level reviewer
  - Complete QC review by a reviewer that did not perform the original inspection being reviewed.
  - Maintain documentation of QC reviews
  - Correct documentation by inspection personnel if needed
  - Turn around for documentation of a maximum 1 week (5 workdays), including review process
  - Review field inspections documentation including:
    - Completed asset inventory of AS features and attributes
    - Asset condition inspection in accordance with the Michigan Ancillary Structures Inspection Manual (MiASIM)
    - Inspector comments to verify the comments support the inspection rating
    - GPS structure location
    - Photo documentation
    - RFA and Work recommendation reasonableness check based on inspection

    - Complete final review and re-submittal to database
- Monitor conformance to the safety plan and safety standards that govern AS field inspections

1.2.4 QUALITY ASSURANCE REQUIREMENTS

Programmatic QA activities are as follows:

- Distribute the QA findings regularly to inspection teams.
- Review findings identified in the QA processes
- Analyze declining performance trends that potentially jeopardize program quality and determine root cause
- Work with inspection teams to:
    - Prepare action plans that reduce or eliminate mistakes from occurring during the inventory and inspection process.
    - Determine and implement program or procedure changes that address findings
    - Develop and implement corrective measures and/or program modifications to reverse these trends
    - Implement actions that reduce or eliminate mistakes from occurring during the inventory and inspection process.

QA activities are required for ensuring quality in the field inspection processes. The key QA requirement is to perform post-inspection review of collected data to ensure completeness, accuracy, and compliance with data collection and storage requirements.

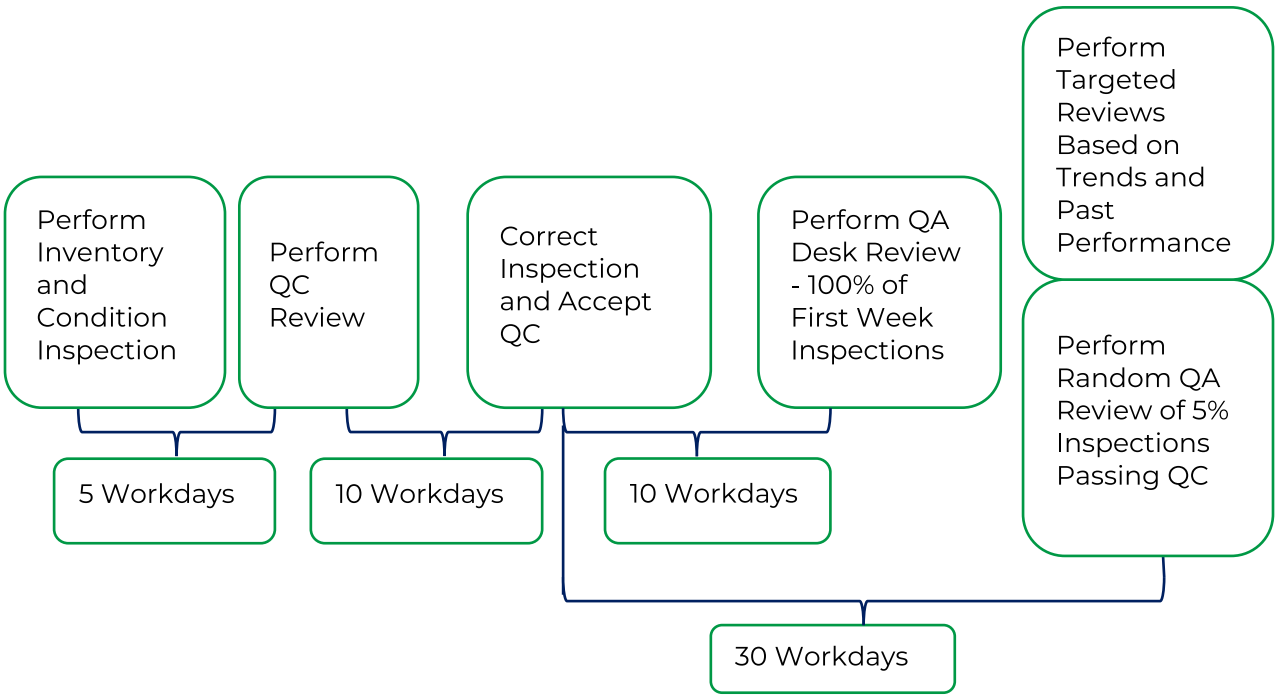
This post-inspection review will consist of:

- During field inspection resumption after winter season shut down, verify 100 percent of field inspection start-up reporting of each inspection team for the first five days of inspection to ensure accurate and complete reporting
- Randomly sample and perform desk review of five percent of structures from the field collection system that have passed the QC review. This percentage may increase/decrease as needed based on performance of each inspection team.
- Field verify one percent of the random sample desk reviews with at least one field verification per each inspection team
- Perform targeted desk reviews as needed based on trends identified during performance monitoring and review of inspection teams. The number of target reviews may increase/decrease as needed based on the performance of each inspection team
- Field verify one percent of the targeted desk reviews
- Field inspections data found to be incomplete or substandard shall be rejected and returned to the inspector of record for clarification and updating. The field review will include verifying applicable items are accurately coded. The field review shall confirm any comments provided
- Within two weeks from date of rejection, clarify/update field inspection data, perform internal QC reviews, and resubmit the inspection documentation

- Maintain records of QA review activities
- Initiate QA within 30 days after all final inspections have been performed and data quality checked

The QA process for field inspection is indicated in Figure 1-1.

Figure 1-1: Field inspection QC and QA process



1.3 Ancillary Structure Documentation and Records

1.3.1 INVENTORY DATABASE

AS documentation and records data is maintained in a single database; this database is capable of sorting and prioritizing the data sets to maximize its usefulness for all potential users of the data. The Program currently uses a data management platform configured using ArcGIS Online and ArcGIS Enterprise technologies.

The database contains both geospatial location data as well as attribute data. Most of the AS asset types are stored as point locations (e.g., steel strain poles, truss and cantilever structures) and a few of the AS asset types are stored as line locations (e.g., culverts, retaining walls, noise walls). The data dictionary describing the specific attributes associated with each AS asset is provided in their respective sections.

Asset information included in the database is not expected to vary, such as physical location, asset type, design standard, asset material, and installation date. Asset information is stored as one GIS layer for each asset type. Assets are added to the AS database as new assets are designed and constructed.

1.3.2 NAMING CONVENTION

Each asset is assigned a structure number. The structure number of each ancillary asset type is independent of other types and is identified with a prefix.

Structure Name

A structure name is built from the selected structure prefix, structure name, and structure number. Prefixes are individually determined based on the structure type. The structure number is a combination of prefix and number. The structure name is a concatenation of structure number, type, and location along with a key identifying feature. The structure name formula is provided for each AS type.

Table 1-1: Structure Name

Asset Type	Prefix	Structure Number Example	Structure Name Formula
Culvert Less than 10-Foot Span	CULV	CULV-004801	strc_num + CulverShape + location
Retaining Walls	RW	RW-000025	strc_num + ret_wall_type_cd + location
Cantilever Structure	SS	SS-000001	strc_num + sign_strc_type_cd + location
Truss Structure	SS	SS-000910	strc_num + sign_strc_type_cd + location
Embedded Pole (including wood poles)	EP	EP-004801	strc_num + sppt_matl_type_cd + location
Spun Concrete Pole	SCP	SCP-000001	strc_num + location
Steel Strain Pole	SPP	SSP-000025	strc_num + location
Mast Arm	MA	MA-000001	strc_num + arm_type_cd + location
Noise Wall	NW	NW-000001	strc_num + panel_mat_cd + location
Dynamic Message Sign Support Structure	DSS	DSS-000001	strc_num + location
Frangible Pole Structure	FPS	FPS-004801	strc_num + sppt_matl_type_cd + location
Non-Frangible Pole Structure	NFPS	NFPS -00025	strc_num + sppt_matl_type_cd + location
High Mast Lighting Towers	HMLT	HMLT-000001	strc_num + location
Communication Tower	CT	CT-000021	strc_num + sppt_type_cd + location
Environmental Sensor Station Tower	ESST	ESST-000001	strc_num + location

Structure Name Examples

The Structure Name is a concatenation of structure number, type, and location as noted in the structure name formula. Examples are provided for select AS types:

- CULV–000001 – Concrete – I94W @ Partello Rd
- RW–000025 – Concrete Cantilever Retaining Wall – I496W @ Martin Luther King Jr Blvd
- SS–000910 – Cantilever, Type D – I275N @ US12

1.3.3 DATA MODEL

The data collected for each of the AS asset types is spread across several database tables, each with a specific purpose. A data model diagram shows the type of relationships between the separate tables and the key values that link records from one table to another. MDOT maintains a data model for the Program, including inventory, inspections, RFA, Work Recs, and QA/QC with the ability to maintain multiple inspections with each inventory record.

1.3.4 INSPECTION RECORDS

The inventory attributes collected during inspection include various data fields which involve the physical location of the structure, the personnel involved with the inventory or inspection, specifics about the structure itself, relevant dimensions, and specific attachments. The full list of inventory fields for each AS asset type is provided in the Ancillary Structures Data Dictionary. The list below is a sample of inventory data fields which apply to all AS assets.

- Structure Number
- GPS Coordinates
- County
- Route
- Milepost
- Location Description
- Installation Year
- Last Inspection Date
- Last Inspector Name
- Last Component Rating
- Next Inspection Frequency
- Physical Access Methods
- Traffic Control Requirements

The inspection attributes shall include the broad categories of inspection information, measurements/checks, element ratings, component ratings, and inspection frequency. The inspection frequency is provided for all AS types in the Ancillary Structures Data Dictionary.

All asset location descriptions should be consistently described. If the asset exists in between roadways, for example in a green space between a ramp and the mainline, the mainline should be the reference point to the location of the asset. If another reference point is used other than the mainline, a comment is required to be noted detailing the route chosen in reference to the asset. Additionally, identify left or right in relation to the direction of travel to the nearest lane of the selected route. The asset should be labeled as "protected" if the asset is behind guardrail, barrier wall, bollard, berm, etc. Assets should be labeled as "unprotected" in instances where there are no protected measures adjacent to the asset.

A sample of the inspection fields include:

- Inspector Name
- Inspection Date
- Measurements
- Checks/Tests
- Element Rating
- Component Rating

Work Rec and RFA information will be included, if applicable. Section 1.7, Section 1.8, and each structure-specific section provide additional detail on Work Recs and RFAs.

The following QA/QC attributes are also captured in the inspection record:

- Quality Control Status
- Quality Assurance Status
- Name of QC Reviewers
- Name of QA Reviewers

The following standard cracking widths for reinforced concrete shall apply to all assets except for wood poles and spun concrete poles. Prestressed concrete cracking widths apply only to spun concrete poles.

Table 1-2: Standard Cracking Widths

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

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

1.3.5 CONSTRUCTION AND MAINTENANCE DOCUMENTATION

Design and construction plans and maintenance records are maintained outside of the Program database by various MDOT departments and regions and may not be directly accessible through the Program's asset management system, its databases and inventory. The MDOT AS Program Manager will initiate coordination to obtain relevant construction and maintenance information.

1.3.6 SIGNIFICANT CORRESPONDENCE

Significant correspondence pertaining to AS management shall be maintained by MDOT. A document control system such as ProjectWise shall be the repository for significant correspondence. The document control system shall be accessible by Program personnel as appropriate. Required correspondence to be retained is discussed in pertinent sections within this manual.

1.3.7 PHOTO DOCUMENTATION

The Program maintains a repository of photos for AS assets in the database. Each asset type has a standard required list of photos for the inventory listed in their respective section. Inspection photos shall be saved to illustrate poor condition assets or anomalous situations.

During an AS inspection for any AS asset type, inspectors shall capture and save photos for the following conditions:

- Any issues found or unique conditions
- Photo documentation for RFAs and Work Recs
- Photo documentation for components and elements rated poor or severe with accompanying comments

Photographs will follow a standard naming convention, which is provided in each asset type's specific section.

1.3.8 ASSET MANAGEMENT SYSTEM REQUIREMENTS

An Asset Management System (AMS) is a software application or suite of applications used to manage an asset through its lifecycle from design to retirement/replacement. The AMS provides the following functions:

- Support for a geospatial database
- Single point of access for all AS asset types
- Mobile device support for inventory and inspection data editing and viewing
- Real-time inventory and inspection editing and viewing
- Data reporting and dashboarding

The following sections describe more detailed AMS requirements and how the AMS is configured.

1.3.8.1 *Geospatial Database*

The geospatial database maintains the following:

- Location for each of the assets, stored as either a point or a line
- Attribute (i.e., tabular data) information for inventory, inspection, Work Recs, and RFAs
- Geotagged photographs

The current geospatial database has a single point of access for Program users, ArcGIS Online, which provides the following functions:

- Varying levels of access and permissions for asset information security
- Data dictionary alignment
- Device agnostic access, providing for web browser and mobile device access
- Single point to access all relevant Program data sources

1.3.8.2 *Inspection Software*

The data for the Program is stored within ArcGIS Online and/or ArcGIS Enterprise software. Inspectors interact with the data through either a browser-based web map or a mobile application. Access to the data is provided through role-based user accounts and ArcGIS Online groups.

1.3.8.3 *Inspection Documentation*

Inspection data is entered in the database using a mobile application. Inspection results are viewable in a browser-based web map or dashboard application.

1.3.9 MONITORING AND REPORTING

The Program requires periodic reports and real-time dashboards to monitor the program status. Data monitoring is developed as required by the AS Program Manager. Minimum reporting requirements include:

- Inspection progress
- QA/QC status reports
- RFAs
- Duplicate photo status reports
- Work Recommendations

1.4 Inspector Qualifications

Inspectors shall be qualified to perform inspections of the AS and perform inspections safely. Inspection findings are communicated and coordinated with multiple stakeholders. Various roles and responsibilities are described in this section. In-service inspections and initial inspections as defined in Section 1.7 may have different inspector qualifications requirements. Where requirements differ, they are noted within this section.

1.4.1 INSPECTION CREW ORGANIZATION

The inspection team, or crew, performs both the inventory and inspection of ancillary structures.

An in-service inspection team is to be comprised of at least two people: an inspection team leader and at least one other inspector (helper). The team leader is to be a fully qualified lead inspector and the helper may possess less technical qualifications. All inspectors must meet the minimum safety requirements. Varying conditions could warrant the need for additional inspectors.

Initial inspections may be composed of a single person, whom should have the qualification of an inspection team leader and is referred to as a team leader.

1.4.1.1 Team Leader

The team leader is responsible for the performance of accurate and complete field inspections of assigned AS assets. The team leader shall meet the technical inspection qualifications required for each AS asset type inspected and shall be qualified to be able to identify critical safety issues. Core responsibilities of the team leader are as follows:

- Perform/confirm asset inventory and geospatial location of assigned AS
- Perform field inspections in compliance with this document
- Identify Work Recs
- Identify RFAs and complete the RFA report form
- Report Priority 1 RFA issues in accordance with Section 1.8
- Monitor and coordinate approved action, when required

The Team Leader shall exercise reasonable judgement based on their knowledge and experience in applying the inspection criteria and rating components and elements of AS inspected. This judgement will require determining whether a Work Rec or RFA is appropriate to address the conditions observed and the priority level of RFA based on safety considerations. The Team Leader is encouraged to seek Subject Matter Expert guidance in making these determinations.

1.4.1.2 Inspector

The member(s) of an inspection crew who shall assist the team leader with inspections as directed. May also be referred to as the helper.

1.4.1.3 Remote Pilot in Command

If an Unmanned Aerial System (UAS) or Unmanned Aerial Vehicle (UAV) is used during the course of an inspection, a person acting as a Remote Pilot in Command (RPIC) of a UAS in the United States National Airspace System (NAS) under part 107 shall hold a current remote pilot certificate with a UAS rating issued by the Federal Aviation Administration (FAA) prior to UAS operation. Though the FAA does provide for a non-FAA certified person to operate the controls under direct, in-person, supervision of a certified pilot, a non-certified person may not operate a UAS for any reason on this Program. Furthermore, the RPIC shall operate under all FAA rules and regulations as well as any additional federal, state, or local laws. Though responsible for the operation of the UAS, the RPIC is a member of the inspection crew and reports to the Team Leader. The RPIC is required to hold all minimum safety training requirements.

1.4.2 INSPECTION CREW RESPONSIBILITIES

Inspection crew responsibilities are to perform AS asset inventory and inspections consistently, accurately, and safely by adhering to the inspection procedures described in this manual. Inspection crews will identify safety concerns based on the structure's condition states and recommend appropriate actions to remove or mitigate unsafe conditions.

Based on the processes established for bridge inspections and management as described in the Michigan Structure Inspection Manual (MiSIM), an RFA process will be initiated to address observed safety concerns. RFA guidance is provided in Section 1.8. Work Recs will be initiated to alert MDOT of maintenance and repair needs which are not safety related. Work Rec guidance is provided for each AS in Section 2 through Section 14.

Prior to starting inspections, inspection crews shall be required to attend and satisfactorily pass training. Inspector training includes minimum safety training requirements. Inspection crews shall not provide engineering judgement on structure design.

1.4.2.1 Minimum Safety Training Requirements

These safety procedures will address, but not necessarily be limited to working near traffic and proper use of personal protective equipment (PPE).

All members of the inspection crew shall possess the following training:

- Review Guidance Document 10118 - Personal Protective Equipment (PPE) Policy
- Viewing mandatory MDOT Videos for working near traffic:
    - One Step from Death – Charlie's Story – YouTube (7 minutes)
    - One Step From Death - Mark's Story – YouTube (6.5 minutes)
    - One Step from Death – Scott's Story – YouTube (4.5 minutes)
- Roadway safety training including working near traffic, entering/exiting work zones, and specific training for the applicable responsibilities on the project and tasks being performed
- Proper wearing and maintaining the following minimum PPE items
    - Hard Hat (ANSI Z89.1, Type 1 Class C or E)
    - Safety Glasses (ANSI Z87.1)
    - Safety Vest (ANSI 107 Class 2 or 3)
    - Steel or Composite Toe Boots (ASTM F2413, previously ANSI Z41 Impact Rating I-75)

OSHA 10-hour training certification is desirable but not required. Other specialized safety training may be required for unique site conditions. Examples include, but are not limited to, the following:

- Railroad safety training, various
- ERail safe (if working near rail)

- Confined space training (Culverts Less Than 10-Foot Span)
- Confined space entry training (manhole, inlet, and catch-basin structures)

When applicable, the members of the inspection crew shall possess the following training:

- Aerial lift training and certification if performing reviews from aerial lift
- Fall protection when working at heights greater than six feet

The AS Program Manager is responsible for coordinating additional identified safety training requirements. Additional safety requirements and protocols are discussed in Section 1.5.

1.4.2.2 Physical Ability

All members of the inspection crew shall meet the following minimal physical job requirements:

- Capable of performing physically strenuous outdoor activities, including lifting 50 pounds
- Comfortable working from an aerial lift at heights of 20-30 feet (when performing inspections with this equipment)
- Working while carrying tools in demanding outdoor conditions such as:
    - Cramped spaces
    - Rugged terrain
    - Steep embankments
    - Elevated surfaces
    - Live traffic in adjacent lanes
    - All seasons and associated weather or environmental conditions
    - In and around water

All team leaders and inspectors shall be capable of using a digital reporting platform to perform field inspections. Team leaders and inspectors shall attend and have successfully completed required training on inspection recording process, system, and equipment. Team leaders shall have appropriate database access for inspection personnel and QC review technicians. Team leaders and inspectors shall attend and successfully complete photo-documentation training for all AS asset inspection elements and components.

Inspection crew technical inspection qualifications for specific structure types are provided in subsections following each AS asset type. A listing of typical tools to be used for structure types is provided in Section 1.6.

1.4.3 CONSULTANT INSPECTION TEAM RESPONSIBILITIES

Consultants hired by MDOT to perform AS field inspection work shall manage their field inspection crew(s). These responsibilities include, but are not limited to:

- Identify team leader and inspection team personnel and provide names to MDOT AS Program Manager
- Ensure team leader and inspector personnel meet inspection qualifications

- Confirm MDOT permits and advanced notifications are in place and approved prior to performing field inspections
- Assist in obtaining permits or notifications when necessary
- Coordinate traffic control when applicable
- Provide inspection personnel with appropriate (i.e., compliance with MDOT Guidance Document 10118) equipment to safely accomplish each task
- Require inspectors to attend and successfully pass training covering inspection processes and reporting requirements.

1.4.4 INSPECTION SYSTEM TRAINING

All team leaders and inspectors shall be capable of using a digital reporting platform. Team leaders and inspectors shall attend and have successful completion of training on inspection recording process/system and equipment.

1.4.5 MINIMUM TECHNICAL QUALIFICATIONS

The minimum technical inspection qualifications for each AS asset are described in each asset's respective section.

1.5 Safety Requirements

MDOT is committed to ensuring the safety of its employees, partners, and the public through comprehensive measures that foster the prevention of incidents. MDOT occupational safety guidelines are instituted because of the regulations promulgated under Public Act 154 of 1974; the provisions of which are enforced by the Michigan Occupational Safety and Health Administration (MiOSHA). This section describes the minimum safety requirements that shall be adhered to for AS safety inspection. Although consultants performing AS inspections are required to have their own safety plan, they are encouraged to follow MDOT practices to supplement their plans when applicable. An employee concerned for their safety and health on site should contact their supervisor or designated safety person.

Link to MiOSHA:

Michigan Occupational Safety and Health Administration (MIOSHA)

The Team Leader shall be familiar with the conditions to be encountered at the inspection site(s) to identify any potential hazards or conditions that need to be accommodated to safely complete the inspections. These should be discussed with the inspection team before inventory and inspection activities begin.

Inspection personnel shall be provided the necessary safety equipment suitable for each type of inspection and properly trained in the use of safety equipment and understand the safety procedures associated with AS inventory and condition inspection activities. Each employee is required to inspect PPE before each use and notify the employer of any defects or damage that may affect the performance of the equipment. Team leaders are responsible for seeing that all on-site inspectors adhere to the PPE requirements.

Inspectors are required to review *Guidance Document 10118 - Personal Protective Equipment Policy* prior to performing any inspections. The guidance document provides up-to-date information regarding the minimum requirements for eye, head, and foot protection. The requirement for additional safety equipment shall be assessed according to the specific type of activities to be performed.

Link to MDOT Guidance Document 10118:

MDOT Personal Protective Equipment (PPE) Policy

1.5.1 WORKING NEAR TRAFFIC

Working near traffic is an inherent hazard for all types of AS inspections. While high visibility safety apparel provides attention to motor vehicle operators of a worker's presence near the structure, additional precautions are necessary to limit the risk of an accident. All vehicles used to transport personnel and inspection equipment to the site shall be outfitted with high-visibility lighting and conspicuity tape per MDOT Vehicle Visibility Standard 10196 to provide an additional means for cautioning motorists that work is actively being completed in proximity to the structure. Vehicles shall also be parked in the safest manner possible, where the potential to limit site distance for adjacent intersections is minimized and worker protection is maximized.

Inspectors shall also be cautious of motorist's actions and aware that distracted driving is commonplace. It is never safe to assume that motorists are attentive to the activities being performed even when advanced signing or traffic control devices are in place. It is always preferred to efficiently utilize time for inspections that limit the duration that work occurs nears traffic. When it is possible, inspect ancillary structures from behind the protection of guardrail or have an escape path identified when a barrier does not exist.

1.5.2 CREW SIZE MINIMUM

When feasible, a two-person team performs inspections of an AS. The team is to be comprised of a team leader and an inspector (helper). Two people on-site enable the members to monitor each other's safety and call for assistance if something were to happen to the other crew member. Varying conditions could potentially warrant the need for additional inspectors.

1.5.3 WORKING NEAR POWER LINES

To minimize the risk of injury or death, every inspection shall include a review of the surroundings prior to performing work near power lines. Before using a ladder or entering the platform of a bucket truck or aerial lift, the team leader should review the site for the presence of power lines. Although some overhead wires may be insulated for protection, most are not and rely on adequate clearance to provide shielding. MIOSHA provides minimum recommended distances for working near electrical lines that are dependent on the amount of voltage being transmitted. When work is conducted near the lines, the team leader should contact the utility owner to determine the rating and consult MIOSHA standards for the minimum clearance to determine whether a temporary shutoff during the inspection will be required. Some utility owners may require their own personnel to be on site during inspections; this is not a substitute for complying with required safety procedures.

1.5.4 CONFINED SPACES

A permit-required confined space is defined by MIOSHA as a space having one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere.
- Contains a material that has a potential for engulfing an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
- Contains any other recognized serious safety or health hazard.

Examples of confined spaces that may be encountered by the team leader while performing AS inspections include, but are not limited to, culverts and enclosed drainage structures such as manholes, inlets and catch basins. Specialized equipment is necessary to test the atmospheric conditions inside the space, provide suitable air for inspectors to perform the work, and provide a means for retrieving individuals that cannot exit under their own effort.

AS inspectors shall not enter culverts if it is unsafe to do so, and inspectors shall not enter enclosed drainage structures. Visual inspection of culverts that cannot be entered shall be performed from the end section and enclosed drainage structures shall be performed from the grate or manhole cover at the top of the structure. If the inspector notices a deficient condition that requires further up-close inspection, this should be recommended as a follow-up inspection, such as televising the culvert or enclosed drainage structure inspection by a confined space trained and equipped inspection crew.

1.5.5 ENVIRONMENTAL AND HEALTH HAZARDS

The environmental and health hazards that could be encountered by inspectors inspecting AS can be varied and unpredictable. Often characterized by heavy vegetation growth and wet conditions, culverts and ditches are an attractive habitat for ticks, mosquitos, spiders, snakes, rodents, small wild animals, and noxious plant growth, such as poison ivy and others vegetation. Heavy vegetation could also obscure a slope failure or depression that could trip an inspector and cause a fall resulting in personal injury. These conditions should not be taken lightly and inspectors shall wear appropriate work attire to ensure their safety during culvert inspections and take precautions when approaching a culvert end section and drainage way. AS may have been constructed with materials, such as lead, asbestos, or silica, which may pose long-term exposure hazards. The safety equipment discussed in this section can help mitigate the hazards that may be experienced while performing inspections.

1.5.6 WORKING NEAR TOWERS

Tools and equipment for communication tower inspections shall follow the MiOSHA Communication Towers Standard.

Link to MiOSHA Communication Towers Standard:

[MIOSHA-STD-1329 (03/09) - Construction Safety And Health Standard Part 29. Communication Towers]

If a communications tower or other tower structure was originally constructed or also functions as an AM Tower, follow safety requirements for radiation and other special considerations prior to inspection. AM towers have high wattage which can cause serious damage or death.

1.5.7 SAFETY EQUIPMENT

Most AS are in close proximity to adjacent roadway driving lanes, and in many cases the inspection vehicle will be located on the shoulder or off the paved surface. Safety of the inspection crew and passing motorists are the highest priority. Inspectors are to use appropriate safety equipment for the specific site characteristics of the AS inspection location. Immediately when exiting the confines of their vehicle, PPE is to be used in accordance with MiOSHA and the employing agency's safety plan. Minimum PPE for all inspectors is as follows:

- Hard Hat (ANSI Standard Z89.1, Type 1 Class C or E)
- Safety Glasses (ANSI Z87.1)
- Safety Vest (ANSI 107 Class 2 or 3)
- Steel or Composite Toe Boots (ASTM F2413, previously ANSI Z41 Impact Rating I-75)

The following list describes typical safety equipment used for the inspection of ancillary structures. Other tools may be used by the inspector at their discretion or as required for a specific job or task:

- **PPE** specific to inspection activities:
    - **Gloves**: Used as hand protection when performing inspections or specific inspection activities such as grinding, clearing brush, digging out foundations, etc.
    - **Waders**: Used as leg protection when performing inspections around culverts.
    - **Long Sleeves**: Used as arm protection when performing inspections around brush or for sun protection
    - **Sunscreen and Bug Spray**: Used as protection from environmental hazards, such as sun exposure and animals, such as ticks or mosquitos
    - **Hearing Protection**: Used when exposed to high decibel noises
    - **Fall Arrest System (body harness and lanyard):** Used for protection against fall from dangerous heights.
- **First Aid Kit**: Used for addressing minor on-site injuries. A kit should always be available in each inspection vehicle.
- **Cellular Phone**: Used for contacting and communicating with various entities for the purpose of coordination or reporting personnel or inspection emergencies or critical conditions.
- **Two Way Radios**: Used for communication between the inspectors during the inspection process, specifically when one inspector is performing inspections from an aerial lift or bucket.
- **Fire Extinguisher:** Required additions to Standard PPE if a UAS is being utilized.
- **Respiratory Protection:** May be needed if confined space entry is undertaken.

1.6 Inspection Tools and Equipment

Different types of ancillary structures require different tools to perform inspection procedures. Access to hand tools and testing equipment during field inspection is vital for proper inspection. The tool lists presented in each subsection are grouped by purpose and are not all inclusive; some situations may require more specialized tools. Tools are listed by name and general purpose for each tool. This list is not exclusive and other tools may be used by the inspector at their discretion.

It is the responsibility of the team leader to determine the necessary tools for each inspection. It is the responsibility of each inspector and their inspection firm to keep the tools the inspector uses in good working condition and properly calibrated when required.

1.6.1 PREPARATION

The lead inspector shall be responsible for determining the appropriate tools necessary to complete the inspection procedures for the ancillary structure(s) being inspected and to confirm the tools are calibrated and are in adequate condition to perform the required inspection. Inspectors should also ensure proper use of any equipment for inspection. When working from an aerial lift to inspect cantilever or truss structures above and adjacent to live traffic lanes, tools used for inspection should be tethered to the inspector or the aerial bucket or platform, to prevent a tool from dropping and potentially striking a ground worker or passing vehicle.

1.6.2 MEASURING DEVICES AND TEST EQUIPMENT

- **4-foot Level**: Used for checking plumbness of non-tapered vertical supports/poles and checking levelness of other components.
- **Plumb Bob**: Used for checking tapered and non-tapered vertical support/pole plumbness and bowing.
- **Nylon string**: Used for determining and measuring sag or any other distortion to a chord or other member.
- **Laser Distance Measuring Tool**: Used to measure clearances and span lengths.
- **25-foot Steel Tape Measure**: Used for measuring sign dimensions, anchor bolt diameters, base plate standoff distances, and deficiency sizes, etc.
- **Folding Ruler**: Used for measuring some sign dimensions, anchor bolt diameters, base plate standoff distances, deficiency sizes, and used as a scale in photographs.
- **Calipers**: Used for measuring diameter or thickness of smaller structure components, such as anchor bolts, and component section losses.
- **Crack Gauge:** Used for measuring width of cracks. For concrete cracks, provide a crack gauge measurement in a photo. For concrete cracks, mark the crack width measurement value on the concrete structure and include the date of the inspection.
- **Feeler or Taper Gauge**: Used for measuring gaps between parts or pieces such as gaps between top nuts and base plates.
- **D-meter**: Used for measuring thickness of components where access to one side is restricted (e.g., pole wall thickness).

- **8-foot Aluminum Range Pole:** Used in prodding for scour around culvert and for putting in photos to help show depth of scour or embankment erosion.

1.6.3 INSPECTION EQUIPMENT AND TOOLS

- **Angle Grinder**: Used for grinding the tops of anchor bolts to level the surfaces and remove any coating.
- **Cold Galvanizing Compound**: Used for painting the tops of anchor bolts following the grinding and ultrasonic testing to minimize or prevent corrosion.
- **Drill**: Used for drilling grout pads in determining the presence of leveling nuts and assessment of timber vertical supports/poles.
- **Dye Penetrant Testing Kit**: Used for performing non-destructive testing (NDT) on suspected cracks in welds and metal members.
- **Magnet**: Used for determining the material of a structure, securing the end of a string line when measuring sag or distortion of a vertical support/pole or horizontal support/truss, etc.
- **Magnetic Particle Testing Kit**: Used for performing NDT on suspected cracks in welds or steel members.
- **Mason Hammer**: Used for checking tightness of top and leveling nuts, sounding anchor bolts for possible cracks or debonding from the concrete, sounding the concrete pedestals for delamination, removal of rust scale, sounding of wood poles for delamination, and sounding of other structure elements for possible internal corrosion and section loss.
- **Marking Utensils:** Paint sticks (preferred) or lumber crayons used to mark conditions in the structure such as loose bolts, turn of nut measure, etc**.**
- **Number and Letter Stencils**: Used for establishing and applying structure numbers to vertical supports/poles of structures and parapets for bridge parapet-mounted structures.
- **Paint Remover**: Used for removing excess spray paint or overspray created by painting structure numbers on structures.
- **Spray Paint**: Used for painting structure numbers to vertical supports/poles of structures and parapets for bridge parapet-mounted structures.
- **Stencil Template**: Used for aligning, securing, and framing structure numbers and letters (described above) in a vertical or horizontal orientation, and to prevent overspray on the structure during the painting process.
- **Wrenches and Screw Drivers**: Used for removal of anchor bolt covers, hand hole covers, and transformer base access covers.
- **Soil probe:** Used to determine if there is a concrete encasement below grade soil at the base of an embedded pole.

1.6.4 CLEANING TOOLS AND MATERIALS

- **Hand whisk broom:** Used to remove light dirt and debris from foundation anchorage to enable visual inspection of leveling nut and anchor bolts

- **Shovel**: Used for uncovering pedestals, base plate, etc.
- **Machete/Bush Axe**: Used for removing undergrowth.
- **Rags, Painters Tape, Duct Tape**: Rags are used for various activities, including wiping or cleaning paint, dirt, or grime from areas or elements; painters' tape is used for taping stencils to the stencil template; and duct tape is used for a variety of conditions.
- **Wire Brush:** Used to remove rust and scale from metal to determine the extent of corrosion and metal material loss. Can also be used to remove foreign debris from foundations to provide a clear view or anchor bolt and nut assemblies.

1.6.5 VISUAL AIDS

- **High Powered Binoculars (10x-15x Magnification)**: Used for performing visual inspections of upper portions of offset luminaires when the luminaire distance from the roadway prevents hands-on inspection access using an aerial lift.
- **High Powered Spotting Scope (20x-50x Magnification)**: Used for performing visual inspections of high mast lights, communication towers and for inspecting offset luminaires should access prevent a hands-on inspection.
- **Mechanics Mirror**: Used for inspecting areas that are difficult to access through normal hands-on inspection methods. The mirror affords a visual inspection of the areas. If the mirror is to be used inside hand holes or other potentially electrically active locations, the mirror shall have an electrically insulated handle.
- **Unmanned Aerial System (UAS):** Used for reviewing and documenting vertical structures (High-Mast Lighting, Communication Towers, Environmental Sensor Station Towers) and other ancillary structures as required.

1.6.6 MISCELLANEOUS EQUIPMENT

- **Awl or Ice Pick**: Used for detecting and quantifying the depth of softwood and decay present in timber vertical supports/poles**.**
- **Digital Camera**: Used to take photographs of required items or deficiencies. The inspection tablets used to perform routine inspections should be capable of photos of sufficient quality. However, there may be cases for special inspections where a tablet is not available, and a digital camera is necessary. The camera shall be capable of time and date stamping the photographs with a minimum of 12MP. A camera that can capture voice captions may be beneficial.
- **Electrically Insulated Borescope**: Used for inspecting the interior areas of vertical supports/poles, chords, etc. that cannot be inspected through conventional means due to limited accessibility or live electrical components within the areas.
- **Extension Cord**: Used for powering tools or equipment when accessibility is limited due to structure location or obstructions. Ensure the cord is in good condition and the ground prong is intact.
- **Extension Ladder:** Used for reaching moderate heights when use of a bucket truck is not available.

- **Generator**: Used for powering various corded power tools or equipment including lights for night inspections, drills for drilling of grout pads, and grinders for ultrasonic testing of anchor bolts.
- **Headlamps and Flashlights**: Used by the inspector when performing an inspection of dark areas or when performing night inspections. Headlamps are particularly useful when mounted to a hardhat as it aids in keeping the inspector's hands free for handling the structure or other tools and equipment. MiOSHA General Rules for Illumination may be referenced for best practices.
- **Manhole Pick:** Used to loosen and remove a manhole cover or drainage casting installed on top of a manhole structure to enable the inspector to visually assess the inside condition of the structure and the connection between the culvert and drainage structure
- **Portable Lighting**: Used to light/illuminate the work zone and structure during nighttime inspection work and able to provide accuracy to within 6 to 10 feet.
- **Resistograph**: Instrument that uses drilling resistance for determining the presence and depth of any softwood, decay, and cavities within timber vertical supports/poles.
- **Timber Coring Kit**: Used for sampling and determining the presence of interior decay and cavities within timber vertical supports/poles.
- **Voltmeter:** Used to determine if a structure that contains internal wiring has become energized due to arcing.

1.7 Inspection Types And Actions

1.7.1 ROUTINE INSPECTION

Ancillary structures typically require acceptance inspection and testing during fabrication and construction for conformance to specifications. After the structures are put into service, they are routinely inspected to evaluate their condition. This section describes the general procedure for inspecting any ancillary structure in the Program as it moves past design and construction and then into its in-service phase. Types of inspection in the Program include initial or acceptance inspection, routine inspection, damage inspection, and in-depth inspection.

The general procedure for completing a routine inspection and guidance for performing Element and Component ratings and evaluating condition states is provided in the following sections.

1.7.1.1 Definitions

Element

Elements are individual pieces of an asset that can be condition assessed on their engineering or maintenance behavior against a consistent set of standards. Element ratings can be used to make decisions on maintenance and funding. The element level inspection is quantity-based, and each quantity is assigned a Condition State to reflect the differing categories of deterioration that often exist on any element. The element rating scale for the Program is in *Table 1-3*.

Component

A component is a set of related elements that, together, make up a unit that is interrelated for its behavior. Component ratings provide a means to determine the safety of the structure. The component rating scale for the Program is in *Table 1-4*.

Condition State

The combination of defects or distresses results in the element exhibiting behavior at different standards, or condition states. Elements within the AS program have four defined condition states: Good, Fair, Poor, and Severe. During the inspection process, each element shall note the quantity of the element performing at each condition state.

1.7.1.2 Initial Inspection (New Structure or Existing Structure Replacement)

The initial inspection consists of a routine inspection with the addition of confirming or updating the inventory database by entering missing inventory data or comparing the description in the database against the asset in the field so the asset is accurately described. The initial inspection differs from a routine inspection in that previous records are not available to compare inventory items or inspection records.

Initial inspection is considered an acceptance activity that occurs following initial placement of the structure type into the Program, following installation, or initial placement into or back into service. Throughout the life of the structure, it may become necessary to take it out of service temporarily for rehabilitation. Prior to returning it to service, a construction inspection will be necessary to verify the work done was according to MDOT specification.

The initial inspection shall be completed after construction or return to service following notification by the MDOT AS Program Manager. Timelines to complete initial inspection will be determined by the MDOT AS Program Manager as appropriate.

Prior to Mobilization to Site

1. Confirm AS Type
2. Confirm inspectors meet appropriate Inspector Qualification (Section 1.4)
3. Confirm safety requirements are met and appropriate safety equipment is available (Section 1.5)
4. Verify Inspection Tools and Equipment are available and appropriate (Section 1.6)
5. Review Routine Inspection Procedure for Inspection Type (Sections 1.7)
6. Review the structure-specific section in Section 2 through Section 14

Following Site Mobilization

1. Arrive on Site
2. Confirm maintenance of traffic (MOT)
3. Confirm safe work zone
4. Verify device and application access
5. Identify/verify GIS Location
6. Verify/edit prepopulated data
7. Enter field collected inventory data input attribute fields

8. Create inspection record
9. Follow inspection process on tablet for applicable AS type
10. Note if structure is accepted or rejected from construction
11. Follow QC procedures after inspection is submitted

UAS Mobilization Procedure

Prior to Site Mobilization:

- RPIC shall review airspace along with any additional federal, state, or local laws related to UAS missions.
- If in proximity to an airport, an FAA waiver may be required. This waiver could be submitted via the Low Altitude Authorization and Notification Capability (LAANC) or may require a direct submittal to the FAA. Typically, LAANC is an automated system for operations below the denoted elevation deck for the area. Direct submittals to the FAA are generally for flights above the denoted elevation deck and/or complicated airspace.
- Perform equipment check and inventory to support mission
- Review weather forecast for mission location and time to ensure acceptable conditions
- Complete UAS Pre-Mob Documentation

Following Site Mobilization:

- Check for last minute filing of Notice to Airmen (NOTAMs) and Temporary Flight Restrictions (TFRs)
- If a FAA waiver has been acquired, follow all guidance listed
- Secure a Launch and Recovery Zone (LRZ) with cones, flagging, and other required demarcations
- Review weather forecast
- Complete UAS pre-flight and mission documentation
- After ensuring secure LRZ, launch UAS
- Hover at approximately 3 feet, once stability has been confirmed, fly mission
- Provide inspector with visibility to components; capture imagery as requested by inspector
- Land and recover UAS
- Complete post-flight documentation

1.7.1.3 Routine Component and Element Inspection

A routine inspection consists of confirming structure inventory attributes, rating the structural condition states, and rating the structure's overall integrity and safety. The entire structure then receives an overall rating based on the worst component rating identified during the on-site inspection. The overall culvert less than 10-foot span rating is calculated using an alternative method based on a subset of the components (see Section 2.1.3 for more details).

Inventory items are structure specific attributes. The inventory data are used in conjunction with the inspection data and other documentation in support of the overall AS asset management system. Inventory items are grouped into subheadings for general, location, asset, and QC. For new structures or initial inspections this data needs to be populated; for existing structures, the data may be verified and updated. Inventory tables can be found in the Ancillary Structures Data Dictionary.

Each structure consists of select components. Each component is characterized and rated on its structural condition, ability to perform its function, and possible safety concerns or negative impact to the structure or its foundation. Components may be divided further into elements. The component rating requires an overall assessment and is not directly calculated from the element ratings. However, the condition of the individual elements within the components is likely to affect the component rating.

Report public safety concerns to the appropriate subject matter expert(s) for a more complete evaluation and determination. This may include notifying the appropriate authority, suspending the inspection, directing an RFA, and/or calling for an additional/in-depth inspection. Inspectors do not make engineering judgements or evaluations of public safety independently from trained experienced professionals.

Prior to Mobilization to Site:

1. Confirm AS Type
2. Confirm team meets appropriate Inspector Qualification (Section 1.4)
3. Confirm safety requirements are met and appropriate safety equipment is available (Section 1.5)
4. Verify Inspection Tools and Equipment are available and appropriate (Section 1.6)
5. Review Routine Inspection Procedure for Inspection Type (Section 1.7)
6. Review the structure-specific section in Section 2 through Section 14
7. Review previous inspection records (if available)

Following Site Mobilization:

1. Arrive on Site
2. Confirm maintenance of traffic (MOT) MDOT Work Zone Safety And Mobility Manual
3. Confirm safe work zone
4. Verify device and application access
5. Identify/Verify GIS Location
6. Verify/edit prepopulated data
7. Enter/verify field collected inventory data input attribute fields
8. Create inspection record
9. Follow inspection process on tablet for applicable AS type (refer to Section 2 through Section 14 for details)
10. Perform element(s) rating (see description below)
11. Perform component(s) rating (see description below)
12. Photo-document the conditions (see description below)
13. Record rating comments to support each rating, as required
14. Review for accuracy/completeness before closing the inspection to trigger the QC/QA process (refer to Section 1.2 for details)

15. Create Work Recs if necessary (see Section 2 through Section 14 for structure specific guidance)
16. Initiate the RFA Process if necessary (See Section 1.8); follow QC procedures after inspection is submitted

UAS Mobilization Procedure

Prior to Mobilization:

- RPIC shall review airspace along with any additional federal, state, or local laws related to UAS missions.
- If in proximity to an airport, an FAA waiver may be required. This waiver could be submitted via LAANC or may require a direct submittal to the FAA. Typically, LAANC is an automated system for operations below the denoted elevation deck for the area. Direct submittals to the FAA are generally for flights above the denoted elevation deck and/or complicated airspace.
- Perform equipment check and inventory to support mission
- Review weather forecast for mission location and time to ensure acceptable conditions
- Complete UAS Pre-Mob Documentation

Following Mobilization:

- Check for last minute filing of NOTAMs and TFRs
- If an FAA waiver has been acquired, follow all guidance listed
- Secure an LRZ with cones, flagging, etc.
- Review weather forecast
- Complete UAS pre-flight and mission documentation
- After ensuring secure LRZ, launch UAS
- Hover at approximately 3 feet, once stability has been confirmed, fly mission
- Provide inspector with visibility to components; capture imagery as requested by inspector
- Land and recover UAS
- Complete post-flight documentation

Element Ratings

Inspectors shall perform element ratings for each element. The condition states for each element are tabulated per the sample shown in *Table 1-3*. Tables specific for each element's condition states are presented in Section 1.10. It is important to note component ratings and element ratings have different scales. These differing scales were developed by the NBIS to require inspectors to evaluate components and elements separately.

Table 1-3: Element Condition State Ratings with Descriptions

Condition State Description					
Condition Rating	**Good**	**Fair**	**Poor**	**Severe**	**Not Rated**
Action Indicated	No action is recommended. Note in inspection report only.	No immediate action is recommended but more frequent inspection may be warranted. Maintenance personnel should be informed.	Inspector evaluates need for corrective action and makes recommendations in inspection report.	Corrective action is required and urgent. Engineering evaluation is required to specify appropriate repair.	No action is required (except when review could not be performed due to conditions.)
Condition Description	Like new with little or no deterioration. Structurally sound and functionally adequate.	Minor to moderate deterioration. Structurally sound with adequate function.	Significant deterioration. May not have adequate function. Maintenance or repair required.	Major deterioration. Failure may have occurred. Requires maintenance, repair, or replacement.	The element was not part of the system design and is not required for functional adequacy. This includes items missing due to vandalism. Also includes inaccessible items that need to be reviewed.

Component Ratings

Perform component ratings per *Table 1-4* for each component in the structure as itemized. Note that component ratings and element ratings have different scales. These differing scales were developed by the NBIS to require inspectors to evaluate components and elements separately. Component rating guidance is provided for each structure in the applicable subsections of Section 2 through Section 14.

Table 1-4: Component Rating System

Component Rating	Condition	Condition State
9	NEW	Like new, within normal range for a newly installed structure.
8	VERY GOOD	Only minor distress or deterioration
7	GOOD	Some problems noted
6	SATISFACTORY	Some moderate or multiple indications of distress/deterioration
5	FAIR	Moderate or multiple indications of distress/deterioration affecting performance
4	POOR	Significant distress
3	SERIOUS	Significant distress/deterioration with potential for local failure
2	CRITICAL	Advanced deterioration with potential for failure of primary structural elements
1	IMMINENT FAILURE	Imminent failure which could threaten public safety
0	FAILED	Failure has occurred

1.7.1.4 Routine Inspections During and After Existing Structure Rehabilitation

Throughout the life of the structure, it may become necessary to take it out of service temporarily for rehabilitation or replacement. Prior to returning it to service, an installation inspection will be necessary to verify the work done was according to MDOT specifications.

A routine inspection scheduled at the time of a structure rehabilitation may be documented as incomplete with the items which are undergoing rehabilitation left as uninspected.

A routine inspection scheduled after an existing structure is rehabilitated shall complete a full routine inspection, including elements and components which were not rehabilitated. A new inspection cycle is then initiated following the rehabilitation.

Timelines to complete the routine inspection following rehabilitation will be determined by the MDOT AS Program Manager as appropriate at the time of notification of the rehabilitation action completion.

1.7.2 SPECIAL INSPECTIONS

Special inspections are determined on a case-by-case basis and can be triggered by observations from a routine inspection and requested by MDOT or other stakeholders. Special inspections may be necessary due to damage noted by MDOT personnel or the traveling public from a traffic incident, weather event, or other precipitating event not caused by typical deterioration. Special Inspection procedures may be sourced from external references or may be designed for each unique situation. Special Inspections may or may not require a routine inspection as part of the Special Inspection. Identified subject matter experts shall lead the special inspections as approved by MDOT. UAS may be deployed for rapid review, photographic documentation, and additional situational awareness.

1.7.3 WORK RECOMMENDATIONS

The role of the inspector includes recommending work that can be performed by maintenance crews. Work Recs include items such as clearing vegetation and debris or performing other maintenance allowing the asset to function properly and prevent premature deterioration. Inspectors should create separate Work Recs for each type of repair.

1.7.4 RFA PROCESS

The role of the inspector includes initiating the RFA process if a safety issue is observed. The RFA Process is described in greater detail in Section 1.8.

1.8 Request for Action Process

Generate an RFA when a structural- or safety-related deficiency requires immediate follow-up inspection or action. This includes any instance where an entire bridge, roadway, lane, or shoulder is closed to protect public safety due to the condition of an AS component or element.

There may be safety issues identified that result in immediate action but do not affect the structural integrity of the ancillary structure. These situations are addressed using typical emergency or high priority procedures and may require follow-up safety related deficiency documentation. For example, lane or shoulder closures to repair or remove deficient appurtenances shall not be considered a safety issue. Specific examples of safety issues are provided in Section 1.8.4.

1.8.1 PURPOSE OF REQUEST FOR ACTION AND REQUEST FOR ACTION COMMITTEE

The AS RFA Committee is responsible for reviewing, prioritizing, initiating action, monitoring, ensuring resolution and/or following up on all AS RFAs statewide for MDOT-owned AS. The AS RFA Committee will also set goals and timeframes and identify resources for addressing RFAs based on the Priority Levels listed in Section 1.8.4. Committee actions may involve lane or road closure, asset removal, emergency repairs, or contracting of work depending on current maintenance crew backlog and situational urgency.

The inspection teams submit RFAs based on findings from the various field inspection. RFAs are defined by varying degrees of urgency requiring ongoing prioritization and monitoring of implementation. The inspection teams where the RFA originates from will recommend the initial Priority Level to the local Transportation Service Center (TSC) or Region. The TSC and/or Region personnel will confirm the initial Priority Level and actions necessary to ensure public safety.

1.8.2 DOCUMENTING FINDINGS

The procedures herein set forth the minimum requirements for AS Program personnel during critical finding observations and follow-up activities.

The RFA report shall be used for addressing issues with structures that need to be scheduled for repair more urgently than the normal capital work programming process. When the inspector's judgment dictates immediate action is necessary to mitigate a hazard, such action shall be undertaken and reported in the "Immediate Action" section on the RFA report. Immediate action typically requires mitigation of the critical item such as repair or removal of the structure, placement of a barricade, and/or closing a lane or shoulder of adjacent or below a structure because of a safety issue. Documentation of safety issues for MDOT are required to be reported using the RFA report or within the AMS for the RFA process.

1.8.3 RFA PROCEDURES

1.8.3.1 Team Leader Responsibilities

Team leaders are responsible to initiate RFAs as necessary from findings encountered during a special or routine inspection. Team leader and subject matter experts may perform a special inspection during or after action taken by the RFA committee. The team leader shall immediately notify the AS Program Manager or acting responsible authority verbally of any safety issue that is discovered during an inspection. The safety issue shall be documented by entering all known information in the Problems/Comments Explanation on the RFA report. The team leader shall also enter data into the Immediate Action Section and Intermediate Action fields, when applicable. Immediate Action Section is only used for Priority Level 1 RFAs. The Intermediate Action Section can be used for all RFAs and is utilized to request non-critical actions that are submitted to resolve the RFA. Team leaders must submit the form within 24 hours to the AS owner.

The team leader is also responsible for documenting the safety issue on the inspection report. They may also be engaged during or after action taken by the RFA committee to complete a special inspection.

1.8.3.2 MDOT Responsibilities

Upon receiving notification of an RFA, the Program Manager engages subject matter experts as necessary to assist in the evaluation of RFAs. The Program Manager shall ensure that all the processes and procedures to mitigate the deficiency are fulfilled and the safety issue is reported to MDOT.

After the immediate and final actions have been completed to address a safety issue, MDOT will assign a RFA Reinspection be completed of the structure to adjust its rating. If the inspection frequency requires adjustment, the MDOT Program Manager will identify the new inspection frequency.

MDOT shall assemble the RFA Committee and determine methods, such as maintenance or other contracts, necessary to execute actions determined as necessary by the committee. For non-MDOT-owned assets located in MDOT Right-of-Way, the AS Program Manager shall engage the owner for further action after resolving any immediate safety concerns.

1.8.4 RFA PRIORITIES

RFAs are initiated typically through a routine inspection but may be initiated following a special inspection or notification from MDOT.

Damage inspections are not scheduled and typically initiated by a report from MDOT or the public. MDOT may be the first to be informed and often responds directly. The most common damage inspections performed in Michigan are a result of a vehicle damaging the ancillary structure asset.

The following Priority Levels describe the deficiencies common to each level and the timeframe upon which the deficiency should be addressed, along with any necessary increased inspection frequencies or structural condition monitoring. Deficiencies not addressed within defined timeframes are to be further discussed at AS RFA Committee meetings. Example inspection findings are provided for each Priority Level; however, these lists are not all-inclusive. When assigning Priority Levels, consideration is given to public safety, structural redundancy, resiliency, risk, and consequences of failure including:

- Severe injury or fatality
- Damage to personal or State property
- Partial or total loss of structure
- Long-term impact to the environment
- Intrusion within the clearance of the traveling lanes and shoulders
- Partial or complete closure of traveled roadways

Priority Level 1, Emergency

Repairs, mitigation, or monitoring is typically required as soon as reasonably possible or as determined by engineering judgement and may require on-site presence until the deficiency is addressed. Emergency repairs, closures, or removals are to be completed either by MDOT crews or emergency contract (or combination thereof) to address impacts to public safety. Structural issues resulting in immediate impacts to public safety should be considered for emergency contracting to address and the policy included in the Authority for Bridge Closures memorandum should be followed located at the following link:

MDOT Memo On Authority for Bridge Closures

Priority Level 2, Critical

Repairs, mitigation, or monitoring to be completed within 1 year or as determined by engineering judgement. The deficiency examples below are deemed to pose critical threats to public safety if left unaddressed within the specified timeframe. Emergency contracts shall not be used for this Priority Level.

This Priority Level requires review and assessment of the active RFA list to ensure Priority Level 2 items are addressed within the appropriate timeframe or do not escalate to a Priority Level 1.

Priority Level 3, Primary

Repairs, mitigation, or monitoring to be completed as determined per engineering judgement. The deficiency examples below are not deemed to be critical threats to public safety but could be if left unaddressed within the specified timeframe. Necessary repairs or mitigations for structures in this Priority Level could be programmed through the MDOT Call for Projects process or addressed through maintenance, if possible.

1.8.5 CLOSING REQUEST FOR ACTIONS

The AS RFA Committee meetings are scheduled monthly. The monthly meetings will consist of reviewing and prioritizing the current RFA requests, confirmation of resource availability, and implementation monitoring. The AS RFA Committee Chair will attend AS Steering Committee meetings as necessary to discuss any issues requiring further guidance.

Timeframes for the completion of work for each RFA will be based on the assigned Priority Levels and progress toward reducing the overall number of active RFAs will be tracked. RFAs considered to be Priority Level 1 (Emergency) will be reviewed by the RFA Committee when submitted and are not dependent upon the Committee monthly meeting schedule. The RFA Committee will develop a review system to facilitate tracking and closure of actions. The process actions by responsible parties are shown in *Table 1-5*: Summary of RFA Responsibilities and Actions.

Table 1-5: Summary of RFA Responsibilities and Actions

Responsibility	Action	Action Description
Team Leader/ Region AS Champion	1.	Initiates RFAs through the submission of a RFA form or a telephone call to the local TSC or Region personnel depending on the situational urgency. The local TSC or Region personnel are notified of recommended Priority Level 1 RFAs to be reviewed and addressed immediately. Appropriate MDOT Business Areas are notified per RFA Form guidance. Inspectors must contact respective asset owners and notify them to take actions for Priority Level 1 RFAs on assets not owned by MDOT. Emergency contact information for utility providers can be found here.
RFA Committee	2.	Review and accept final Priority Levels 2 & 3 RFAs and escalate priority level to 1 if RFA committee assesses the defect as more critical than originally thought. Decide on intermediate and/or final actions to be taken to address identified issues and restore the structure to a state of good repair such that the RFA can be closed out. Initiate final actions in Action 3.
Subject Matter Experts	3.	Perform intermediate action inspections. Recommend Priority Levels, timeframes, and final actions including any increased inspections for review and acceptance by the RFA Committee.

Responsibility	Action	Action Description
Maintenance/ Other Contract	4.	Execution of final actions necessary.
PMC Inspection Team	5.	Monitor maintenance or construction progress. Recommend closing out RFAs following completion or execution of final actions.
Region AS Champion	6.	Review final action recommendations for acceptance and close out RFAs.
RFA Committee Chair	7.	Record progress on addressing RFAs within predefined timeframes and any delays (e.g., funding, local agency coordination, etc.) for reporting. Identify issues that need to be discussed with the Steering Committee for further guidance.

1.9 Special Inspection Procedures

A special inspection may be required to verify findings from the initial or routine inspection, perform additional non-destructive testing, monitor/address conditions, or schedule follow-up site visits. Special inspections may involve enhanced accessibility, special qualifications, and engineered studies or analyses.

Special inspections consist of two major categories: In-depth or Damage Inspections. These Special Inspection types and requirements are discussed.

1.9.1 DAMAGE INSPECTION

Damage inspections are defined as an unscheduled inspection to assess structural damage resulting from environmental factors or human actions. Most damage inspections in Michigan are the result of vehicle or vessel impact to components of an AS. Occasionally the damage causes instability of the AS and reduces the safe function of the AS until repairs are performed. When the damage is substantial it may be a safety issue and the RFA Process shall be initiated. Timely response is required to protect public safety and accurate documentation of the resulting effects shall be accomplished to execute repair or replacement activities. Reporting of the damage is also required for recuperation of costs associated with the inspection, repair, or replacement activities.

Damage Inspection Types I, II, and III follow damage inspection types detailed for bridge inspections in the MiSIM.

Type I Damage Inspection

A Type I inspection shall be completed when minor damage has occurred that was not previously documented or reported. This type of inspection is conducted at distances normally associated with a routine safety inspection where immediate repair work and testing is determined to be unnecessary. Generally, a Type I inspection is satisfactory for unreported vehicle impact damage with the observed defects that include surface damage, such as scrapes to the protective coating, distortion of 2” or less with no bending connections, or shallow spalling that does not exceed 6” in width without cracking.

Documentation shall occur as part of the Work Rec process during a routine inspection or damage inspection report for unscheduled inspections. Photographs with comments describing the damage and associated elements shall be provided. If any concern exists following the conclusion of the inspection, an RFA will be submitted. The AS RFA Committee is responsible for reviewing the RFA to determine whether a Type II inspection or other additional action shall be coordinated.

Type II Damage Inspection

A Type II inspection shall be completed whenever damage has occurred that is reported by law enforcement, the degree of damage exceeds the limits specified for the Type I inspection, or when engineering judgment dictates a need for hands-on inspection. Documented damage is provided by law officials through the issuance of a State of Michigan Traffic Crash Report (UD-10) to the agency. MDOT would then request the PMC perform a Type II Damage inspection. This type of inspection is conducted at arms-length to verify the requirements of repair work that may be scheduled or to provide a detailed historical record of any deformations that exist. This inspection shall be performed within 180 days from receipt of the UD-10, but it is recommended to be completed in cases where MDOT personnel arrive at the scene immediately following the incident.

All vessel impact and fire damage inspections should also begin with a Type II damage inspection to accurately assess whether affects to structural capacity occurred. Detailed measurements and photographs of all the affected components and elements shall be documented on the damage inspection report. It is also recommended provide reference for the inspection work or repairs that are installed. If any concern exists following the conclusion of the inspection an RFA shall be submitted. The AS RFA Committee is responsible for reviewing the RFA to determine whether a Type III inspection or other additional action shall be coordinated.

Type III Damage Inspection

A Type III inspection shall be completed when critical damage to the structure causes concern for stability or loss of safe structural capacity. Most of these inspections are initiated from verbal contact from law enforcement, although they may also result following observations during the Type I or II damage inspection. This inspection shall be performed as soon as the scene is safe for individuals and equipment to access the affected ancillary structure. Detailed measurements and photographs of the damaged components and elements shall be documented on the damage inspection report. When immediate repairs are necessary a narrative of the activities completed shall also be provided. Additional actions may be necessary following the inspection which shall be documented on the RFA form. The AS RFA Committee is responsible for reviewing the RFA. The AS Program Manager in coordination with the PMC is responsible for facilitating the necessary actions to resolve the matter and inventory and inspection coding. All damage that results in a safety issue shall be documented on the RFA form or AMS.

Damage Inspection Procedures

Since damage inspections are unscheduled events, extensive resources may not be available to immediately respond. The AS owner is usually the first to be informed of reported damage and often responds directly to the incident. The AS owner may delegate the responsibility of completing the damage inspection to a qualified individual or to the AS Program Manager. Although processes may vary according to agency specific guidelines, the AS owner is ultimately responsible for initiating any required reactions stemming from the reported damage and coordinating the immediate or intermediate actions that shall be undertaken. The course of action taken to ensure public safety will be unique for many incidents and depend upon the extent of damage or the resources available to mitigate public mobility impacts. The procedures that have been developed are guidelines for the AS owner and responding individuals to follow. The assessment of damage should follow established practices, when available, according to the conditions encountered and the degree of damage present. The AS owner or delegated authority responsible for assessing the damage may decide to deviate from established practices according to the damage encountered. However, the AS owner shall ensure that the level of response is appropriate for each reported incident, the damage is well documented, and confirm that follow-up activities to maintain public safety are accomplished. Resulting findings and recommendations shall be documented and submitted to the AS Program Manager and retained as Significant Correspondence as detailed in Section 1.3.

1.9.2 IN-DEPTH INSPECTION

Special inspections may be required to verify findings from the initial or routine inspection, to perform non-destructive testing, or to monitor/address conditions that may impact safety or serviceability. Special inspections not initiated from Damage are termed In-depth inspections. In-depth inspections may be required depending on RFA or Work Rec processes. These in-depth inspection items, which may be conducted as part of a special inspection, are detailed in the following subsections.

RFA-Initiated Special Inspection

Through the RFA process, the RFA committee in collaboration with the PMC may initiate an In-depth inspection. Subject Matter Experts in consultation with the PMC will define the extent of the In-depth inspections.

Work Recommendation-Initiated Special Inspection

Some structures will be encountered during the routine inspection in a state that requires a more detailed inspection than what is feasible during routine inspection but does not warrant an RFA. In this case, an inspector may recommend a Work Rec. The MDOT Program Manager will engage Subject Matter Experts to define the extent of the In-depth inspections.

In-depth Inspection Procedures

Means and methods for the In-depth inspection procedures are anticipated to vary depending upon the type of condition state defects or other structural inadequacies noted in the RFA or Work Rec. Subject Matter Experts should engage to determine the appropriate extent of investigation. The extent of investigations may include, but are not limited to, additional field investigation, testing, and analysis. If available, Subject Matter Experts may request or be provided the plans, specifications, construction documentation, and previous routine inspection results for the Ancillary Structure. Resulting findings and recommendations shall be documented and submitted to the AS Program Manager and retained as Significant Correspondence as detailed in Section 1.3.

1.10 Element Condition States

1.10.1 PURPOSE

The purpose of this section is to provide condition state information for structures inspected within the state of Michigan. This section is to be used by inspectors when collecting element level data.

The element level inspection method breaks the ancillary structures down into several elements. The element level inspection is a quantity-based inspection, and each quantity is assigned a Condition State to reflect the differing categories of deterioration that often exist on any element.

One of the results of performing element level inspections is the generation of a database for an AMS. By developing a database over time, deterioration rates based upon material, geographic location, age, usage, type of crossing, prior rehabilitation, or preventive actions, etc., can be estimated. The software modeling capabilities allow comparisons between the effectiveness of preventive and corrective actions, predictions of estimated future deterioration, and life cycle costs. Decisions can be made regarding prioritizing funds, when (or when not) to take action, and what type of action to take for the maximum benefit of capital spent.

1.10.2 DETAILED ELEMENT CONDITION STATE DESCRIPTIONS

The condition state tables for each asset are located in their respective section. They contain defect descriptions and severity with guidelines for the inspector on defect severity categorization.

The condition state descriptions are adapted from the standard set of National Bridge Elements (NBE), Bridge Management Elements (BME), or MDOT Agency Developed Elements (ADE). Some elements are unique to ancillary structures and their condition state descriptions were created for the Program.

Structure-specific Section 2 through Section 14 attempt to cover most conditions observed in the field, but the inspector may find conditions that are not described. In these cases, use the general description of the condition states to determine the appropriate condition. Overarching descriptors for the four condition states are as follows:

Condition State 1 (Good) – that portion of the element that has either no deterioration or the deterioration is insignificant to the management of the element, meaning that portion of the element has no condition based preventive maintenance needs or repairs. Areas of an element that have received long lasting structural repairs that restore the full capacity of the element with an expected life expectancy equal to the original element can be recorded as good condition.

Condition State 2 (Fair) – that portion of the element that has minor deficiencies that signifies a progression of the deterioration process. This portion of the element may need condition based preventive maintenance. Areas of the element that have received structural repairs that improve the element, but the repair is not considered equal to the original member recorded as fair.

Condition State 3 (Poor) – that portion of the element that has advanced deterioration requiring repair. The summation of the quantity of the element in poor or worse condition determines the need for repairs, rehabilitation, or replacement activities.

Condition State 4 (Severe) – that portion of the element that warrants a review to determine the effect on strength or serviceability of the element or structure; OR a structural review has been completed and the defects impact strength or serviceability of the element or structure. Elements with a portion or all of the quantity in state 4 may often have load capacity implications warranting a structural review. Within this manual, the term structural review is defined as a review by a person qualified to evaluate the field observed conditions (Subject Matter Expert) and decide the impacts of the conditions on the performance of the element. Structural reviews may include a review of the field inspection notes and photographs, review of as-built plans or analysis as deemed appropriate to evaluate the performance of the element.

Each subsection contains a detailed description for each element and is broken down into the following subsections:

- Structure Type
- Element Number and Name
- Condition State Table to Reference
- Description—Detailed identification and classification of the element.

Unlike the Michigan Bridge Element Inspection Manual (MiBEIM), the MiASIM applies to 15 different Ancillary Structure types instead of a single structure type. Although elements and associated condition states may be similar between ancillary structures, differences in the severity of condition state defects may occur due to different element design considerations. For some ancillary structures, condition state defects are grouped together for each element (e.g., concrete foundation element defects include distresses such as concrete cracking, exposed reinforcement, and erosion). Therefore, rather than referencing Condition States for each element for all ancillary structure types, each structure contains an element subsection arranged as follows:

- Ancillary Structure Type
- Associated Elements – With definition of the element
- Condition States for Each Element – Guidelines for the inspector on defect severity categorization

2 CULVERTS LESS THAN 10-FOOT SPAN

2.1 Definitions

A linear drainage conduit(s) that has a combined span of less than 10 feet as measured along the centerline of the roadway, and the conduit is 12 inches in diameter or greater. Culverts are differentiated from storm sewers in that they are straight-line conduits that are open at each end and typically do not include intermediate drainage structures (manholes, catch basins etc.). When a culvert system includes intermediate drainage structures, the culverts shall be inventoried as two culverts.