[Agency Name]

[Year] Bridge  
Asset Management Plan



A plan describing the [Agency Name]’s transportation assets and conditions

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## Executive Summary

As conduits for commerce and connections to vital services, bridges are among the most important assets in any community along with other assets like roads, culverts, traffic signs, traffic signals, and utilities that support and affect the road network. The [Agency Name]’s ([AgencyShort]) bridges, other road-related assets, and support systems are some of the most valuable and extensive public assets, all of which are paid for with taxes collected from ordinary citizens and businesses. The cost of building and maintaining bridges, their importance to society, and the investment made by taxpayers all place a high level of responsibility on local agencies to plan, build, and maintain the road and bridge network in an efficient and effective manner. This asset management plan is intended to report on how [AgencyShort] is meeting its obligations to maintain the bridges for which it is responsible.

This plan overviews [AgencyShort]’s bridge assets and conditions and explains how [Agency Name] works to maintain and improve the overall condition of those assets. These explanations can help answer:

* What kinds of bridge assets [AgencyShort] has in its jurisdiction and the different options for maintaining these assets.
* What tools and processes [AgencyShort] uses to track and manage bridge assets and funds.
* What condition [AgencyShort]’s bridge assets are in compared to statewide averages.
* Why some bridge assets are in better condition than others and the path to maintaining and improving bridge asset conditions through proper planning and maintenance.
* How agency bridge assets are funded and where those funds come from.
* How funds are used and the costs incurred during [AgencyShort]’s bridge assets’ normal life cycle.
* What condition [AgencyShort] can expect of its bridge assets if those assets continue to be funded at the current funding levels
* How changes in funding levels can affect the overall condition of all of [AgencyShort]’s bridge assets.

[AgencyShort] owns and/or manages [##] bridges. A summary of its historical and current bridge asset conditions, projected trends, and goals can be seen in the Figure, below.

An asset management plan is required by Michigan Public Act 325 of 2018, and this document represents fulfillment of some of [AgencyShort]’s obligations towards meeting these requirements. This asset management plan also helps demonstrate [AgencyShort]’s responsible use of public funds by providing elected and appointed officials as well as the general public with inventory and condition information of [AgencyShort]’s bridge assets, and gives taxpayers the information they need to make informed decisions about investing in essential transportation infrastructure.

# Introduction

Asset management is defined by Public Act 325 of 2018 as “an ongoing process of maintaining, preserving, upgrading, and operating physical assets cost effectively, based on a continuous physical inventory and condition assessment and investment to achieve established performance goals”. In other words, asset management is a process that uses data to manage and track assets, like roads and bridges, in a cost-effective manner using a combination of engineering and business principles. This process is endorsed by leaders in municipal planning and transportation infrastructure, including the Michigan Municipal League, County Road Association of Michigan, the Michigan Department of Transportation (MDOT), and the Federal Highway Administration (FHWA). The [Agency Name] is supported in its use of asset management principles and processes by the Michigan Transportation Asset Management Council (TAMC), formed by the State of Michigan.

Asset management, in the context of this plan, ensures that public funds are spent as effectively as possible to maximize the condition of the bridges in [Agency Name]’s road network. Asset management also provides a transparent decision-making process that allows the public to understand the technical and financial challenges of managing infrastructure with a limited budget.

The [Agency Name] ([AgencyShort]) has adopted an “asset management” business process to overcome the challenges presented by having limited financial, staffing, and other resources while needing to meet safety standards and bridge users’ expectations. [AgencyShort] is responsible for maintaining and operating [##] bridges.

This [Year] plan outlines how [AgencyShort] determines its strategy to maintain and upgrade bridge asset condition given agency goals, priorities of its bridge users, and resources provided. An updated plan is to be released approximately every [freq of updates] years to reflect changes in bridge conditions, finances, and priorities.

Questions regarding the use or content of this plan should be directed to [Contact Name][at contact address][or at phone/email]. [A copy of this plan can be accessed on our website at URL.]

Key terms used in this plan are defined in [AgencyShort]’s comprehensive transportation asset management plan (also known as the “compliance plan”) used for compliance with PA 325 or 2018.

Knowing the basic features of an asset class is a crucial starting point to understanding the rationale behind an asset management approach. The following primer provides an introduction to bridges.

### Bridge Primer

#### Bridge Types

Figure 1: Girder bridge



Bridges are structures that span 20 feet or more. These bridges can extend across one or multiple spans.

If culverts are placed side by side to form a span of 20 feet or more (for example, three 6-foot culverts with one-foot between each culvert), then this culvert system would be defined as a bridge. (Note: The Compliance Plan Appendix C contains a primer on culverts not defined as bridges.)

Bridge types are classified based on two features: design and material.

The most common bridge design is the girder system (Figure 1). With this design, the bridge deck transfers vehicle loads to girders (or beams) that, in turn, transfer the load to the piers or abutments (see Figure 6).



Figure 2: Slab bridge

A similar design that lacks girders (or beams) is a slab bridge (Figure 2, and see Figure 6). A slab bridge transfers the vehicle load directly to the abutments and, if necessary, piers.

Truss bridges were once quite common and consist of a support structure that is created when structural members are connected at joints to form interconnected triangles (Figure 4). Structural members may consist of steel tubes or angles connected at joints with gusset plates.



Figure 3: Truss bridge

Another common bridge design in Michigan is the three-sided pre-cast box or arch bridge (Figure 4).

Michigan is also home to several unique bridge designs.

Adding another layer of complexity to bridge typing is the primary construction materials used (Figure 5). Bridges are generally constructed from concrete, steel, pre-stressed concrete, or timber. Some historical bridges or bridge components in Michigan may be constructed from stone or masonry.



Figure 4: Three-sided box bridge



Figure 5: Examples of common bridge construction materials used in Michigan

#### Bridge Condition

Michigan inspectors rate bridge condition on a 0-9 scale known as the National Bridge Inventory (NBI) rating scale (see Table for a summary of the NBI Rating scale). Elements of the bridge’s superstructure, deck, and substructure receive a 9 if they are in excellent condition down to a 0 if they are in failed condition. A complete guide for Michigan bridge condition rating according to the NBI can be found in the MDOT Bridge Field Services’ Bridge Safety Inspection NBI Rating Guidelines (<https://www.michigan.gov/documents/mdot/BIR_Ratings_Guide_Combined_2017-10-30_606610_7.pdf>).

|  |  |
| --- | --- |
| Table 1: Summary of the NBI Rating Scale | |
| NBI Rating | General Condition |
| 9-7 | Like new/good |
| 6-5 | Fair |
| 4-3 | Poor/serious |
| 2-0 | Critical/failed |

#### Bridge Treatments

##### Replacement

Replacement work is typically performed when a bridge is in poor condition (NBI rating of 4 or less) and will improve the bridge to good condition (NBI rating of 7 or more). The Local Bridge Program, a part of MDOT’s Local Agency Program, defines bridge replacement as full replacement, which removes the entire bridge (superstructure, deck, and substructure) before re-building a bridge at the same location (Figure 6). The decision to perform a total replacement over rehabilitation (see below) should be made based on a life-cycle cost analysis. Generally, replacement is selected if rehabilitation costs more than two-thirds of the cost of replacement. Replacement is generally the most expensive of the treatment options.

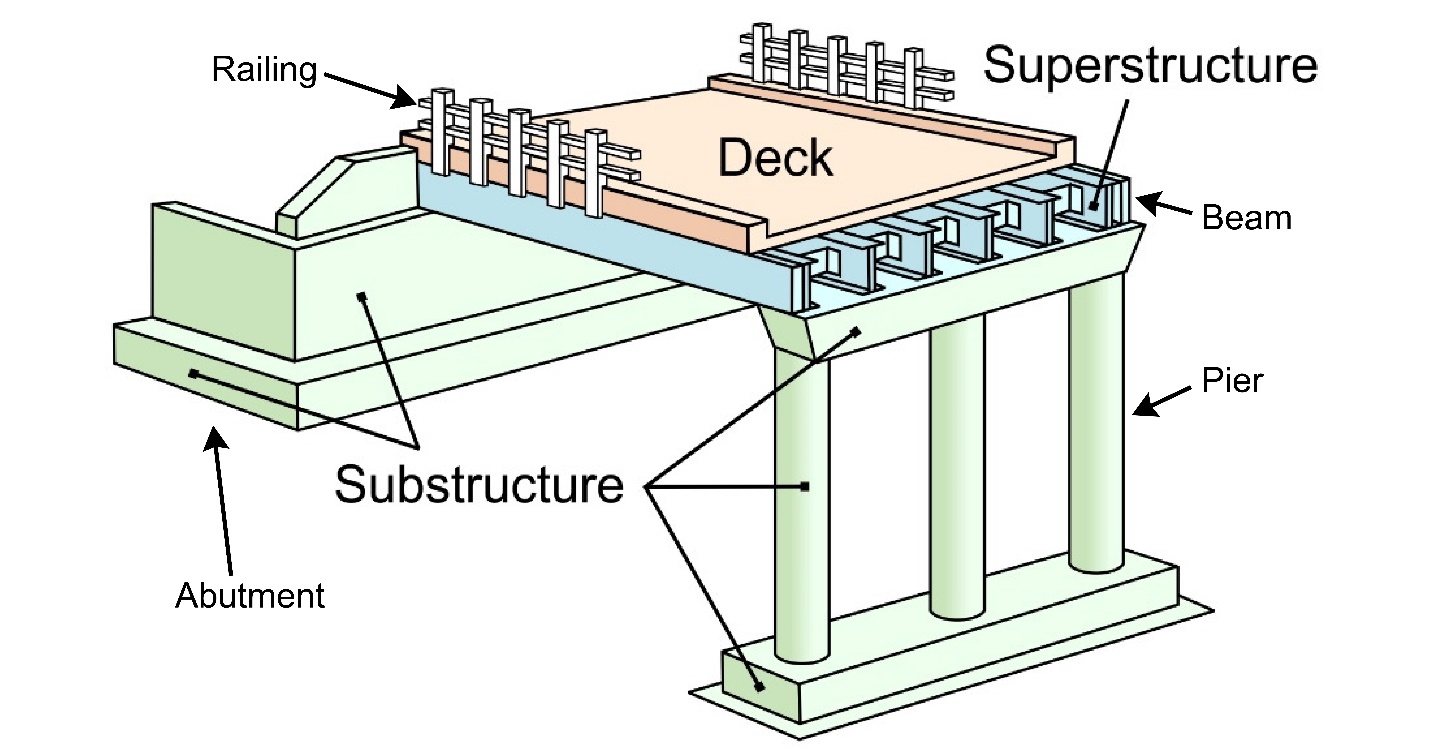


Figure 6: Diagram of basic elements of a bridge

##### Rehabilitation

Rehabilitation involves repairs that improve the existing condition and extend the service life of the structure and the riding surface. Most often, rehabilitation options are associated with bridges that have degraded beyond what can be fixed with preventive maintenance. Rehabilitation is typically performed on poor-rated elements (NBI rating of 4 or less) to improve them to fair or good condition (NBI rating of 5 or more). Rehabilitation can include superstructure replacement (removal and replacement of beams and deck) or deck replacement. While typically more expensive than general maintenance, rehabilitation treatments may be more cost-effective than replacing the entire structure.

* Railing retrofit/replacement: A railing retrofit or replacement either reinforces the existing railing or replaces it entirely (Figure 6). This rehabilitation is driven by a need for safety improvements on poor-rated railings or barriers (NBI rating less than 5).
* Beam repair: Beam repair corrects damage that has reduced beam strength (Figure 6). In the case of steel beams, it is performed if there is 25 percent or more of section loss in an area of the beam that affects load-carrying capacity. In the case of concrete beams, this is performed if there is 50 percent or more spalling (i.e., loss of material) at the ends of beams.
* Substructure concrete patching and repair: Patching and repairing the substructure is essential to keep a bridge in service. These rehabilitation efforts are performed when the abutments or piers are fair or poor (NBI rating of 5 or 4), or if spalling and delamination affect less than 30 percent of the bridge surface.

##### Preventive Maintenance

The Federal Highway Administration’s (FHWA) Bridge Preservation Guide (2018) defines preventive maintenance as “a strategy of extending service life by applying cost-effective treatments to bridge elements…[that] retard future deterioration and avoid large expenses in bridge rehabilitation or replacements.”

Preventive maintenance work is typically done on bridges rated fair (NBI rating of 5 or 6) in order to slow the rate of deterioration and keep them from falling into poor condition.

* Concrete deck overlay: A concrete deck overlay involves removing and replacing the driving surface. Typically, this is done when the deck surface is poor (NBI rating is less than 5) and the underneath portion of the deck is at least fair (NBI rating greater than 4). A shallow or deep concrete overlay may be performed depending on the condition of the bottom of the deck. The MDOT Bridge Deck Preservation matrices provide more detail on concrete deck overlays (see https://www.michigan.gov/mdot/0,4616,7-151-9625\_24768\_24773---,00.html).
* Deck repairs: Deck repairs include three common techniques: HMA overlay with or without waterproof membranes, concrete patching, deck sealing, crack sealing, and joint repair/replacement. An HMA overlay with an underlying waterproof membrane can be placed on bridge decks with a surface rating of fair or lower (NBI of 5 or less) and with deficiencies that cover between 15 and 30 percent of the deck surface and deck bottom. An HMA overlay without a waterproof membrane should be used on a bridge deck with a deck surface and deck bottom rating of serious condition or lower (NBI rating of 3 or less) and with deficiencies that cover greater than 30 percent of the deck surface and bottom; this is considered a temporary holdover to improve ride quality when a bridge deck is scheduled to undergo major rehabilitation within five years. All HMA overlays need to be accompanied by an updated load rating. Patching of the concrete on a bridge deck is done in response to an inspector’s work recommendation or when the deck surface is in good, satisfactory, or fair condition (NBI rating of 7, 6, or 5) with minor delamination and spalling. To preserve a good bridge deck in good condition, a deck sealer can be used.   
   Deck sealing should only be done when the bridge deck has surface rating of fair or better (NBI of 5 or more). Concrete sealers should only be used when the top and bottom surfaces of the deck are free from major deficiencies, cracks, and spalling. An epoxy overlay may be used when between 2 and 5 percent of the deck surface has delaminations and spalls, but these deficiencies must be repaired prior to the overlay. An epoxy overlay may also be used to repair an existing epoxy overlay. Concrete crack sealing is an option to maintain concrete in otherwise good condition that has visible cracks with the potential of reaching the steel reinforcement. Crack sealing may be performed on concrete with a surface rating of good, satisfactory, or fair (NBIS rating of 7, 6, or 5) with minor surface spalling and delamination; it may also be performed in response to a work recommendation by an inspector who has determined that the frequency and size of the cracks require sealing.
* Steel bearing repair/replacement: Rather than sitting directly on the piers, a bridge superstructure is separated from the piers by bearings. Bearings allow for a certain degree of movement due to temperature changes or other forces. Repairing or replacing the bearings is considered preventive maintenance. Girders and a deck in at least fair condition (NBI of 5 or higher) and bearings in poor condition (NBI rating of 4 or less) identifies candidates for this maintenance activity.
* Painting: Re-painting a bridge structure can either be done in totality or in part. Total re-painting is done in response to an inspector’s work recommendation or when the paint condition is in serious condition (NBI rating of 3 or less). Partial re-painting can either consist of zone re-painting, which is a preventive maintenance technique, or spot re-painting, which is scheduled maintenance (see below). Zone re-painting is done when less than 15 percent of the paint in a smaller area, or zone, has failed while the rest of the bridge is in good or fair condition. It is also done if the paint condition is fair or poor (NBI rating of 5 or 4).
* Channel improvements: Occasionally, it is necessary to make improvements to the waterway that flows underneath the bridge. Such channel improvements are driven by an inspector’s work recommendation based on a hydraulic analysis or to remove vegetation, debris, or sediment from the channel and banks (Figure 6).
* Scour countermeasures: An inspector’s work recommendations or a hydraulic analysis may require scour countermeasures (see the Risk Management section of this plan for more information on scour). This is done when a structure is categorized as scour critical and is not scheduled for replacement or when NBI comments in abutment and pier ratings indicate the presence of scour holes.
* Approach repaving: A bridge’s approach is the transition area between the roadway leading up to and away from the bridge and the bridge deck. Repaving the approach areas is performed in response to an inspector’s work recommendation, when the pavement surface is in poor condition (NBI rating of 4 or less), or when the bridge deck is replaced or rehabilitated (e.g., concrete overlay).
* Guardrail repair/replacement: A guardrail is a safety feature on many roads and bridges that prevents or minimizes the effects of lane departure incidents. Keeping bridge guardrails in good condition is important. Repair or replacement of bridge guardrail should be done when a guardrail is missing or damaged, or when it needs a safety improvement.

##### Scheduled Maintenance

Scheduled maintenance activities are those activities or treatments that are regularly scheduled and intend to maintain serviceability while reducing the rate of deterioration.

* Superstructure washing: Washing the superstructure, or the main structure supporting the bridge, typically occurs in response to an inspector’s work recommendation or when salt-contaminated dirt and debris collected on the superstructure is causing corrosion or deterioration by trapping moisture.
* Drainage system cleanout/repair: Keeping a bridge’s drainage system clean and in good working order allows the bridge to shed water effectively. An inspector’s work recommendation may indicate drainage system cleanout/repair. Signs that a drainage system needs cleaning or repair include clogs and broken, deteriorated, or damaged drainage elements.
* Spot painting: Spot painting is a form of partial bridge painting. This scheduled maintenance technique involves painting a small portion of a bridge. Generally, this is done in response to an inspector’s work recommendation and is used for zinc-based paint systems only.
* Slope repair/reinforcement: The terrain on either side of the bridge that slopes down toward the channel is called the slope. At times, it is necessary to repair the slope. Situations that call for slope repair include when the slope is degraded, when the slope has significant areas of distress or failure, when the slope has settled, or if the slope is in fair or poor condition (NBI rating of 5 or less). Other times, it is necessary to reinforce the slope. Reinforcement can be added by installing Riprap, which is a side-slope covering made of stones. Riprap protects the stability of side slopes of channel banks when erosion threatens the surface.
* Vegetation control and debris removal: Keeping the area around a bridge structure free of vegetation and debris safeguards the bridge structure from these potentially damaging forces. Removing or restricting vegetation around bridges prevents damage to the structure. Vegetation control is done in response to an inspector’s work recommendation or when vegetation traps moisture on structural elements or is growing from joints or cracks. Debris in the water channel or in the bridge can also cause damage to the structure. Removing this debris is typically done in response to an inspector’s work recommendation or when vegetation, debris, or sediment accumulates on the structure or channel.
* Miscellaneous repairs: These are uncategorized repairs in response to an inspector’s work recommendation.

# 1. Bridge Assets

[AgencyShort] seeks to implement an asset management program for its bridge structures. This program balances the decision to perform reconstruction, rehabilitation, preventive maintenance, scheduled maintenance, or new construction, with [AgencyShort]’s bridge funding in order to maximize the useful service life and to ensure the safety of the local bridges under its jurisdiction. In other words, [AgencyShort]’s bridge asset management program aims to preserve and/or improve the condition of its local bridge network within the means of its financial resources.

Nonetheless, [AgencyShort] recognizes that limited funds are available for improving the bridge network. Since preservation strategies like preventive maintenance are generally a more effective use of these funds than costly alternative management strategies like major rehabilitation or replacement, [AgencyShort] seeks to identify those bridges that will benefit from a planned maintenance program while addressing those bridges that pose usability and/or safety concerns.

The three-fold goal of [AgencyShort]’s asset management program is the preservation and safety of its bridge network, increase of its bridge assets’ useful service life by extending of the time that bridges remain in good and fair condition, and reduction of future maintenance costs. To quantify this goal, [AgencyShort] specifically aims to have [to have ##% or more of the agency's local bridges in fair to good condition] and [to have less than ##% classify as structurally deficient] over its [##-year plan].

Thus, [AgencyShort]’s asset management plan objectives are:

* To establish the current condition of the county’s bridges
* To develop a “mix of fixes” that will:
  + Program scheduled maintenance actions to impede deterioration of bridges in good condition
  + Implement selective corrective repairs or rehabilitation for degraded bridge elements order to restore functionality
  + Identify and program those eligible bridges in need of replacement
* To identify available funding sources, such as:
  + Dedicated county resources
  + County funding through Michigan’s Local Bridge Program
  + Opportunities to obtain other funding
* To prioritize the programmed actions within available funding limitations
* To [improve the condition of bridges currently rated poor (4 or lower) and/or preserve bridges currently rated fair (5 or higher) in their current condition in order to extend their useful service life].

### Inventory

[AgencyShort] is responsible for [## of local bridges]. Table 2 summarizes [AgencyShort]’s bridge assets by type, sizes by bridge type, and condition by bridge type. Additional inventory data, condition ratings, and proposed preventive maintenance actions for each bridge are contained in the tables in Appendixes 3, 4, and 5. The bridge inventory data was obtained from MDOT MiBRIDGE and other sources, and the [YYYY] condition data and maintenance actions are taken from the inspector’s summary report (see Appendix 2).

#### Types

Of the [AgencyShort]’s [##] structures, [##] are concrete bridges, [##] are steel bridges, [##] are pre-stressed concrete bridges, and [##] are timber bridges.

#### Locations and Sizes

Figure 7 illustrates the locations of bridge assets owned by [AgencyShort]. Details about the locations and sizes of each individual asset can be found in [AgencyShort]’s MiBRIDGE database. For more information, please refer to the agency contact listed in the Introduction of this bridge asset management plan.

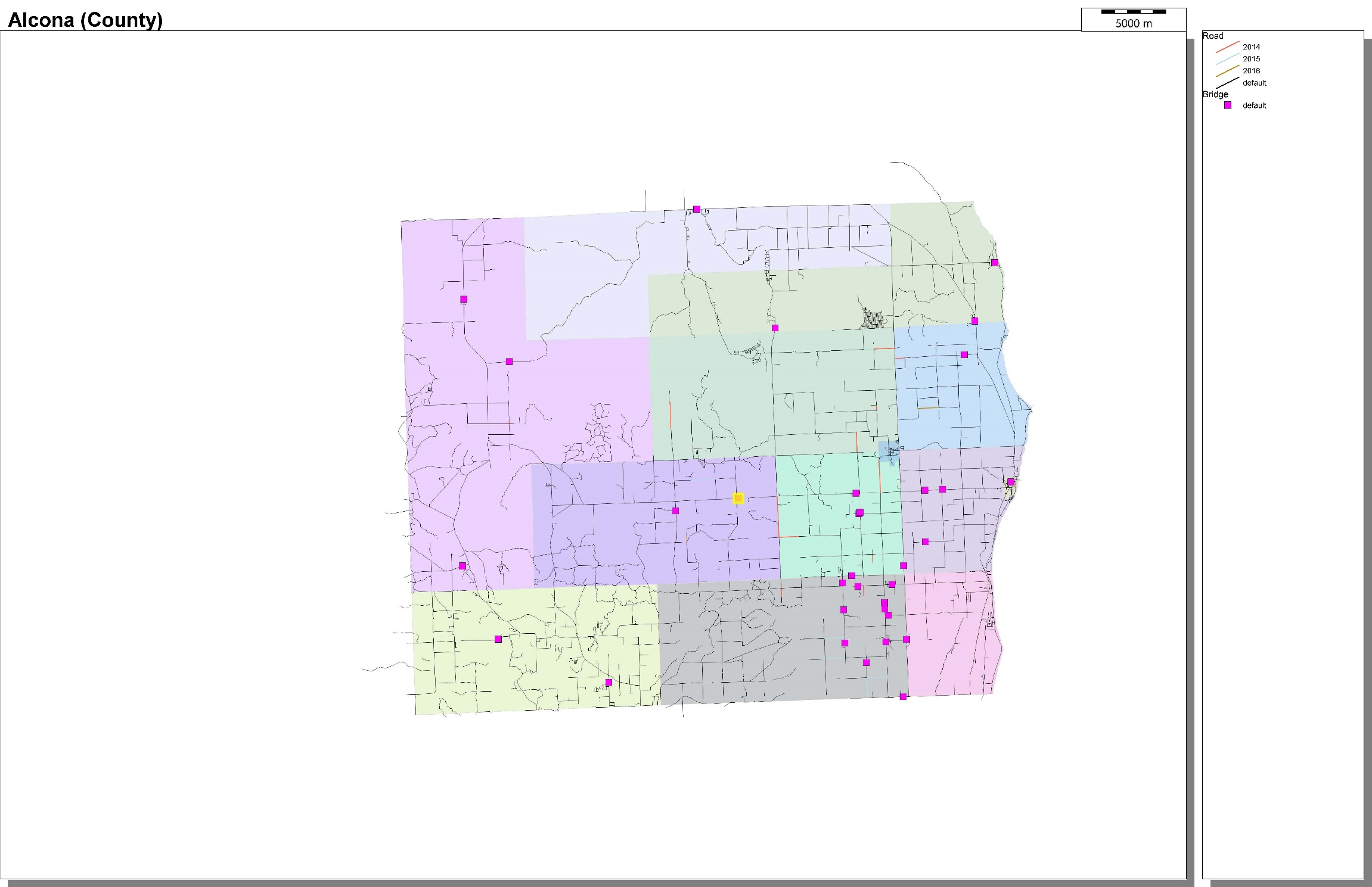


Figure 7: Map illustrating locations [AgencyShort]’s of bridge assets

#### Condition

[AgencyShort] evaluates its bridges according to the National Bridge Inspection Standards rating scale, with a rating of 9 to 7 being like new to good condition, a rating of 6 and 5 being fair condition, and a rating of 4 or lower being poor or serious/critical condition. The current condition of [AgencyShort]’s bridge network is [##] ([##]%) are good, [##] ([##]%) are fair, and [##] ([##]%) are poor or lower.

Another layer of classification of [AgencyShort]’s bridge inventory classifies [##] ([##%]) bridges as structurally deficient, [##] ([##]) bridges as posted, and [##] ([##]) bridges as closed. Structurally deficient bridges are those with a deck, superstructure, substructure, and/or culvert rated as “poor” according to the NBI rating scale, with a load-carrying capacity significantly below design standards, or with a waterway that regularly overtops the bridge during floods. Posted bridges are those that have declined in condition to a point where a restriction is necessary for what would be considered a safe vehicular or traffic load passing over the bridge; designating a bridge as “posted” has no influence on its condition rating. Closed bridges are those that are closed to all traffic; closing a bridge is contingent upon its ability to carry a set minimum live load.

| Table 2: Bridge Assets by Type: Inventory, Size, and Condition | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bridge Type | Total Number of Bridges | Total Deck Area (sq ft) | Condition: Structurally Deficient, Posted, Closed | | | [YYYY] Condition | | |
| Struct. Defic | Posted | Closed | Poor | Fair | Good |
| [Bridge Type] | [##] | [##] | [##] | [##] | [##] | [##] | [##] | [##] |
| [Bridge Type] | [##] | [##] | [##] | [##] | [##] | [##] | [##] | [##] |
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| [Bridge Type] | [##] | [##] | [##] | [##] | [##] | [##] | [##] | [##] |
|  |  |  |  |  |  |  |  |  |
| Total SD/Posted/Closed |  |  | [##] | [##] | [##] |  |  |  |
| Total | [##] | [##] |  |  |  | [##] | [##] | [##] |
| Percentage (%) |  |  | [##%] | [##] | [##] | [##] | [##] | [##] |

Statewide, MDOT’s statistics for local agency bridges show that 14% are poor and 86% are good/fair, indicating that the [AgencyShort] has [a greater/lesser percentage of poor bridges] compared to the statewide average for local agencies. Correspondingly, [AgencyShort] has [##%] of its bridges in fair/good condition versus the statewide average of 86% for local agency bridges. Statewide, 8% of local agency bridge deck area classifies as structurally deficient compared to [##%] of [AgencyShort]’s bridge deck area.

### Goals

The goal of [AgencyShort]’s asset management program is the preservation and safety of its bridge network; it also aims to extend the period of time that bridges remain in good and fair condition, thereby increasing their useful service life and reducing future maintenance costs.

Specifically, this goal translates into long-range goals of [having ##% of its bridges rated fair/good] and [having less than ##% classify as structurally deficient] within [a yet-to-be-determine time frame]. These goals are juxtaposed with the historic and current condition and the projected trend in Figure 8.

Several metrics will be used to assess the effectiveness of this asset management program. [AgencyShort] will monitor and report the annual change in the number of its bridges rated fair/good (5 or higher) and the annual change in the number of its bridges classified as structurally deficient.

Figure 8: Progress tracking graph indicating [AgencyShort]’s historic and current bridge conditions, projected trends, and goals.

Based on past inspection records and condition ratings, [AgencyShort] will establish a baseline of past performance by determining the average period of time that a bridge remains in good or fair condition. The performance measure will be the increased average amount of time a bridge is in the good or fair condition status after implementation of the asset management strategy when compared to the baseline time before implementation.

### Prioritization, Programmed/Funded Projects, and Planned Projects

#### Prioritization

[AgencyShort]’s asset management program aims to address the structures of critical concern by targeting elements rated as being in poor condition and to improve and maintain the overall condition of the bridge network to good or fair condition through a [strategy, similar to either the 'worst-first' or the 'mix-of-fixes' strategies,]. Therefore, [AgencyShort] prioritizes bridges for projects by evaluating five factors and weighting them as follows: condition –[##]%, load capacity –[##]%, traffic –[##]%, safety –[##]%, and detour –[##]%. There are several components within each factor that are used to arrive at its score. Each project under consideration is scored, and its total score is then compared with other proposed project to establish a priority order.

[AgencyShort] annually reviews the current condition of each of the its bridges using the NBIS inspection data contained in the MDOT Bridge Safety Inspection Report and the inspector’s work recommendations contained in MDOT’s Bridge Inspection Report. The inspection inventory and condition data are consolidated in spreadsheet format for [AgencyShort]’s bridges in Appendix 3. [AgencyShort] then determines management and preservation needs and corresponding actions for each bridge (Appendix 4) As well as inspection follow-up actions (Appendix 5). The management and preservation actions are selected in accordance with criteria contained in the Summary of Preservation Criteria table (below) and adapted to [AgencyShort]’s specific bridge network.

| Table 3: Summary of Preservation Criteria | | |
| --- | --- | --- |
| Preservation Action | Bridge Selection Criteria | Expected Service Life |
| Replacement | | |
| Total Replacement | * NBI rating of 3 or less [1] [2] * OR Cost of rehabilitation exceeds cost of replacement [1] * OR Bridge is scour critical with no counter-measures available [1] | 70 years |
| Superstructure Replacement | * NBI rating of 4 or less for the superstructure [1] [2] * OR Cost of superstructure and deck rehabilitation exceeds cost of replacement [1] | 40 years [1] |
| Deck Replacement  Epoxy Coated Steel  Black Steel | * Use guidelines in MDOT’s Bridge Deck Preservation Matrix [3] [4] * NBI rating of 4 or less for the deck surface and deck bottom [1] [2] * Deck bottom has more than 25% total area with deficiencies [1] * OR Replacement cost of deck is competitive with rehabilitation [1] | 60+ years [3] [4] |
| Rehabilitation | | |
| Substructure Replacement  (Full or Partial) | * NBI rating of 4 or less for abutments, piers, or pier cap [1] [2] * Has open vertical cracks, signs of differential settlement, or active movement [1] * Pontis rating of 3 or 5 for more than 30 percent of the substructure [1] [5] * OR Bridge is scour critical with no counter-measures available | 40 years [1\*] |
| Steel Beam Repair | * More than 25% section loss in an area of the beam that affects load carrying capacity [1] * OR To correct impact damage that impairs beam strength [1] | 40 years [1\*] |
| Prestressed Concrete Beam Repair | * More than 5% spalling at ends of prestressed I-beams [1] * OR Impact damage that impairs beam strength or exposes prestressing strands [1] | 40 years [1\*] |
| Substructure Concrete Patching and Repair | * NBI rating of 5 or 4 for abutments or piers, and surface has less than 30% area spalled and delaminated [1] [2] * OR Pontis rating of 3 or 4 for the column or pile extension, pier wall, and/or abutment wall and surface has between 2% and 30% area with deficiencies [1] [5] * OR In response to inspector’s work recommendation for substructure patching [1] |  |
| Abutment Repair/Replacement | * NBI rating of 4 or less for the abutment [1] [2] * OR Has open vertical cracks, signs of differential settlement, or active movement |  |
| Railing/Barrier Replacement | * NBI rating greater than 5 for the deck [1] [2] * NBI rating less than 5 for the railing with more than 30% total area having deficiencies [1] [2] * OR Pontis rating is 4 for railing [1] [5] * OR Safety improvement is needed [1] |  |
| Culvert Repair/Replacement | * NBI rating of 4 or less for culvert or drainage outlet structure * OR Has open vertical cracks, signs of deformation, movement, or differential settlement |  |
| Preventive Maintenance | | |
| Shallow Concrete Deck Overlay | * NBI rating is 5 or less for deck surface, and deck surface has more than 15% area with deficiencies [1] [2] * NBI rating of 4 or 5 for deck bottom, and deck bottom has between 5% and 30% area with deficiencies [1] [2] * OR In response to inspector’s work recommendation [1] | 12 years |
| Deep Concrete Deck Overlay | * NBI rating of 5 or less for deck surface, and deck surface has more than 15% area with deficiencies [1] [2] * NBI deck bottom rating is 5 or 6, and deck bottom has less than 10% area with deficiencies [1] [2] * OR In response to inspector’s work recommendation [1] | 25 years |
| HMA Overlay with Waterproofing Membrane | * NBI rating of 5 or less for deck surface, and both deck surface and bottom have between 15% and 30% area with deficiencies [1] [2] * OR Bridge is in poor condition and will be replaced in the near future and the most cost-effective fix is HMA overlay [1] |  |
| HMA Overlay Cap without Membrane | * Note: All HMA caps should have membranes unless scheduled for replacement within five years. * NBI rating of 3 or less for deck surface and deck bottom, and deck surface and deck bottom have more than 30% area with deficiencies. Temporary holdover to improve ride quality for a bridge in the five-year plan for rehab/replacement. [1] [2] | 3 years |
| Concrete Deck Patching | * NBI rating of 5, 6, or 7 for deck surface, and deck surface has between 2% and 5% area with delamination and spalling [1] [2] * OR In response to inspector’s work recommendation [1] | 5 years |
| Steel Bearing Repair/Replacement | * NBI rating of 5 or more for superstructure and deck, and NBI rating 4 or less for bearing [2] |  |
| Deck Joint Replacement | * Always include when doing deep or shallow concrete overlays [1] * NBI rating of 4 or less for joints [1] [2] * OR Joint leaking heavily [1] * OR In response to inspector’s work recommendation for replacement [1] |  |
| Pin and Hanger Replacement | * NBI rating of 4 or less for superstructure for pins and hangers [1] [2] * Pontis rating of 1, 2, or 3 for a frozen or deformed pin and hanger [1] [5] * OR Presence of excessive section loss, severe pack rust, or out-of-plane distortion [1] | 15 years |
| Zone Repainting | * NBI rating of 5 or 4 for paint condition, and paint has 3% to 15% total area failing [1] [2] * OR During routine maintenance on beam ends or pins and hangers [1] * OR less than 15% of existing paint area has failed and remainder of paint system is in good or fair condition [1] | 10 years |
| Complete Repainting | * NBI rating of 3 or less for paint condition [1] [2] * OR Painted steel beams that have greater than 15% of the existing paint area failing [1] |  |
| Partial Repainting | * See Zone or Spot Painting |  |
| Channel Improvements | * Removal of vegetation, debris, or sediment from channel and banks to improve channel flow * OR in response to inspector’s work recommendation |  |
| Scour Countermeasures | * Pontis scour rating of 2 or 3 and is not scheduled for replacement [1] [5] * OR NBI comments in abutment and pier ratings indicate presence of scour holes [1] [2] |  |
| Approach Repaving | * Approach pavement relief joints should be included in all projects that contain a significant amount of concrete roadway (in excess of 1000’ adjacent to the structure). The purpose is to alleviate the effects of pavement growth that may cause distress to the structure. Signs of pavement growth include:   + Abutment spalling under bearings [1]   + Beam end contact [1]   + Closed expansion joints and/or pin and hangers [1]   + Damaged railing and deck fascia at joints [1]   + Cracking in deck at reference line (45 degree angle) [1] |  |
| Guard Rail Repair/Replacement | * Guard rail missing or damaged [2\*] * OR Safety improvement is needed [2\*] |  |
| Scheduled Maintenance | | |
| Superstructure Washing | * When salt contaminated dirt and debris collected on superstructure is causing corrosion or deterioration by trapping moisture [1] * OR Expansion or construction joints are to be replaced and the steel is not to be repainted [1] * OR Prior to a detailed replacement [1] * OR In response to inspector’s work recommendation [1] | 2 years |
| Drainage System Clean-Out/Repair | * When drainage system is clogged with debris [1] * OR Drainage elements are broken, deteriorated, or damaged [1] * OR NBI rating comments for drainage system indicate need for cleaning or repair [1] [2] | 2 years |
| Spot Repainting | * For zinc-based paint systems only. Do not spot paint with lead-based paints. * Less than 5% of paint area has failed in isolated areas [1] * OR In response to inspector’s work recommendation [1] | 5 years |
| Slope Paving Repair | * NBI rating is 5 or less for slope protection [1] [2] * OR Slope is degraded or sloughed * OR Slope paving has significant areas of distress, failure, or has settled [1] |  |
| Riprap Installation | * To protect surface when erosion threatens the stability of side slopes of channel banks |  |
| Vegetation Control | * When vegetation traps moisture on structural elements [1] * OR Vegetation is growing from joints or cracks [1] * OR In response to inspector’s work recommendation for brush cut [1] | 1 year |
| Debris Removal | * When vegetation, debris, or sediment accumulates on the structure or in the channel * OR In response to inspectors work recommendation | 1 year |
| Deck Joint Repair | * Do not repair compression joint seals, assembly joint seals, steel armor expansions joints, and block out expansion joints; these should always be replaced. [1] * NBI rating is 5 for joint [1] [2] * OR In response to inspector’s work recommendation for repair [1] |  |
| Concrete Sealing | * Top surface of pier or abutments are below deck joints and, when contaminated with salt, salt can collect on the surface [1] * OR Surface of the concrete has heavy salt exposure. Horizontal surfaces of substructure elements are directly below expansion joints [1] |  |
| Concrete Crack Sealing | * Concrete is in good or fair condition, and cracks extend to the depth of the steel reinforcement [1] * OR NBI rating of 5, 6, or 7 for deck surface, and deck surface has between 2% and 5% area with deficiencies [1] [2] * OR Unsealed cracks exist that are narrow and/or less than 1/8” wide and spaced more than 8’ apart [1] * OR In response to inspector’s work recommendation [1] | 5 years |
| Minor Concrete Patching | * Repair minor delaminations and spalling that cover less than 30% of the concrete substructure [1] * OR NBI rating of 5 or 4 for abutments or piers, and comments indicate that their surface has less than 30% spalling or delamination [1] [2] * OR Pontis rating of 3 or 4 for the column or pile extension, pier wall and/or abutment wall, and surface has between 2% and 30% area with deficiencies [1] [5] * OR In response to inspector’s work recommendation [1] |  |
| HMA Surface Repair/Replacement | * HMA surface is in poor condition * OR In response to inspector’s work recommendation |  |
| Seal HMA Cracks/Joints | * HMA surface is in good or fair condition, and cracks extend to the surface of the underlying slab or sub course * OR In response to inspector’s work recommendation |  |
| Timber Repair | * NBI rating of 4 or less for substructure for timber members * OR To repair extensive rot, checking, or insect infestation |  |
| Miscellaneous Repair | * Uncategorized repairs in response to inspector’s work recommendation |  |
|  | This table was produced by TransSystems and includes information from the following sources:  [1] MDOT, Project Scoping Manual, MDOT, 2019.    [2] MDOT, MDOT NBI Rating Guidelines, MDOT, 2017.    [3] MDOT, Bridge Deck Preservation Matrix - Decks with Uncoated "Black" Rebar, MDOT, 2017.  [4] MDOT, Bridge Deck Preservation Matrix - Decks with Epoxy Coated Rebar, 2017.  [5] MDOT, Pontis Bridge Inspection Manual, MDOT, 2009.  \* From source with interpretation added. |  |

In terms of management and preservation actions, [AgencyShort]’s asset management program uses a [strategy, similar to either the 'worst-first' or the 'mix-of-fixes' strategies,] that is [made up of replacement, rehabilitation, preventive maintenance and/or scheduled maintenance].

Replacement involves substantial changes to the existing structure, such as bridge deck replacement, superstructure replacement, or complete structure replacement, and is intended to improve critical or closed bridges to a good condition rating.

Rehabilitation is undertaken to extend the service life of existing bridges. The work will restore deficient bridges to a condition of structural or functional adequacy, and may include upgrading geometric features. Rehabilitation actions are intended to improve the poor or fair condition bridges to fair or good condition.

Preventive maintenance work will improve and extend the service life of fair bridges, and will be performed with the understanding that future rehabilitation or replacement projects will contain appropriate safety and geometric enhancements. Preventive maintenance projects are directed at limited bridge elements that are rated in fair condition with the intent of improving these elements to a good rating. Most preventive maintenance projects will be one-time actions in response to a condition state need.[Routine maintenance will be performed by the agency's in-house maintenance team and/or contracted out.]

[AgencyShort]’s scheduled maintenance program is an integral part of the preservation plan, and is intended to extend the service life of fair and good structures by preserving the bridges in their current condition for a longer period of time. Scheduled maintenance is proactive and not necessarily condition driven. In-house maintenance crews will perform much of this work.

Certain of the severely degraded and structurally deficient bridges require replacement or major rehabilitation. Several of the remaining bridges require one-time preventive maintenance actions to repair defects and restore the structure to a higher condition rating. Most bridges are included in a scheduled maintenance plan with appropriate maintenance actions programmed for groups of bridges of similar material and type, bundled by location.

The replacement, rehabilitation, and preventive maintenance projects [will/may or may not be/will not] generally eligible for funding under the local bridge program[, and any requests for funding may or may not be submitted with TCRC's annual applications].

To achieve its goals, [a primary objective of TCRC's asset management program is improvement of bridges rated poor (4 or lower) to a rating of fair (5) or higher and/or preservation of bridges currently rated fair (5) or higher in their current condition within a -year time period through management and/or preservation activities.][The primary work activities that will be used to meet this improvement objective include a combination of reconstruction, replacement, rehabilitation, preventive maintenance, and scheduled maintenance.][The work has been prioritized by considering each individual bridge’s needs, its importance, the present costs of improvements, and the impact of deferral (i.e., cost increase due to increased degradation).] [Additionally, ][AgencyShort's asset management program incorporates preservation of bridges currently rated fair (5) or higher in their current condition in order to extend their useful service life. ][The primary work activities used to meet this preservation objective include some combination of scheduled and preventive maintenance.] A bridge-by-bridge preservation—or maintenance—plan is presented in the Appendix 4.

#### Programmed/Funded Projects

[AgencyShort] received [$###,###] in total funding per year for the years [##]. To achieve its goals, [AgencyShort] plans to spend [$###,###] per year on preventive maintenance of bridges. [AgencyShort] plans to replace [##] bridges at a cost of [$###,###]. By performing the aforementioned preventive maintenance and replacement of bridge structures, [AgencyShort] [will/may or may not/will not] meet its overall bridge network condition goals.

[AgencyShort] computes the estimated cost of each typical management and/or preservation action using unit prices in the latest Bridge Repair Cost Estimate spreadsheet contained in MDOT’s Local Bridge Program Call for Projects. The cost of items of varying complexity, such as maintenance of traffic, staged construction, scour counter-measures, and so forth, are computed on a bridge-by-bridge basis. The cost estimates are reviewed and updated annually. A summary of the programmed/funded projects and investments can be found in Table 4, the Cost Projection table, below.

#### Planned Projects

[AgencyShort] identifies additional priority projects that remain unfunded. These are identified according to high, medium, and low priority in Table 4.

**Table 4: Planned Projects and Gap Analysis**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Strategy** | **2019** | **2020** | **2021** | **2022** | **2023** | **GAP** |
| **New** |  |  |  |  |  |  |
| 1003 | $5,000,000 |  |  |  |  |  |
| 1010 |  | $7,000,000 |  |  |  |  |
| 1005 |  |  |  | $124,000 |  |  |
| 1005 |  |  |  | $4,000,000 |  |  |
| 1011 |  |  |  |  | $6,699,000 |  |
| 1011 |  |  |  |  | $8,000,000 |  |
| Subtotal | $5,000,000 | $7,000,000 | $0 | $4,124,000 | $14,699,000 | $0 |
| **Replacement** | |  |  |  |  |  |
| 1023 |  | $935,000 |  |  |  |  |
| 1022 |  |  |  | $692,000 |  |  |
| 1004 |  |  |  |  |  | $680,000 |
| Subtotal | $0 | $935,000 | $0 | $692,000 | $0 | $680,000 |
| **Rehabilitation** | |  |  |  |  |  |
| 1016 |  |  | $181,000 |  |  |  |
| Subtotal | $0 | $0 | $181,000 | $0 | $0 | $0 |
| **Scheduled Maintenance** | |  |  |  |  |  |
| 1022 | $157,000 |  |  |  |  |  |
| 1014 |  |  | $686,000 |  |  |  |
| 1017 |  |  |  | $300,000 |  |  |
| Subtotal | $157,000 | $0 | $686,000 | $300,000 | $0 | $0 |
| **Preventive Maintenance** | |  |  |  |  |  |
| 1002 |  | $435,000 |  |  |  |  |
| 1015 |  |  | $500,000 |  |  |  |
| 1004 |  |  |  |  |  | $260,000 |
| 1009 |  |  |  |  |  | $20,000 |
| Subtotal | $0 | $435,000 | $500,000 | $0 | $0 | $280,000 |
| **Other** |  |  |  |  |  |  |
| Subtotal | $0 | $0 | $0 | $0 | $0 | $0 |

### Gap Analysis

When [AgencyShort] compares its funding and its programmed/funded projects with all of its prioritized projects as shown in Table 4, [AgencyShort] believes it should be able to achieve [a yet-undetermined portion] of its asset management goals for the period of this plan. For projects that it is unable to complete, [AgencyShort] will continue to monitor those bridge assets and take any necessary steps within its budget to prevent or mitigate a condition decline or a need to post or close the structure.

# 2. Financial Resources

### Anticipated Revenues

[AgencyShort has programmed projects and/or has been granted funding types for the purpose(s) of various primary work types for selected bridges. This funding is intended for use in the identified years.]

[AgencyShort applied for funding type in the specific funding years for the purpose(s) of various primary work types for selected bridges. This funding would be intended for use in the identified year(s).][AgencyShort also applied for funding type in the specific funding years for the purpose(s) of various primary work types for selected bridges. This funding would be intended for use in the identified year(s).]

[AgencyShort plans to prepare and submit applications for an idenfied funding type for the purpose(s) of various primary work types for identified bridges. This funding would be intended for use in the identified year(s).]

Any projects submitted to the local aid program that are not selected for funding will be added to the agency’s program.

### Anticipated Expenses

Scheduled maintenance activities and minor repairs that are not affiliated with any applications, grants, or other funded projects will be performed by the agency’s in-house maintenance forces and funded through the agency’s annual operating budget.

# 3. Risk Management

[AgencyShort] recognizes that the potential risks associated with bridges generally fall into several categories:

* Personal injury and property damage resulting from a bridge collapse or partial failure;
* Loss of access to a region or individual properties resulting from bridge closures, restricted load postings, or extended outages for rehabilitation and repair activities; and
* Delays, congestion, and inconvenience due to serviceability issues, such as poor quality riding surface, loose expansion joints, or missing expansion joints.

[AgencyShort] addresses these risks by implementing regular bridge inspections and a preservation strategy consisting of preventive maintenance.

[AgencyShort] administers the biennial inspection of its bridges in accordance with NBIS and MDOT requirements. The inspection reports document the condition of [AgencyShort]’s bridges and evaluates them in order to identify new defects and monitor advancing deterioration. The summary inspection report in Appendix 1 identifies items needing follow-up, special inspection actions, and recommended bridge-by-bridge maintenance activities.

Bridges that are considered “scour critical” pose a risk to [AgencyShort]’s road and bridge network. Scour is the depletion of sediment from around the foundation elements of a bridge commonly caused by fast-moving water. According to MDOT’s Michigan Structure Inventory and Appraisal Coding Guide, a scour critical bridge is one that has unstable abutment(s) and/or pier(s) due to observed or potential (based on an evaluation study) scour. Bridges receiving a scour rating of 3 or less are considered scour critical. [AgencyShort] has scour critical bridges, which are listed in Table 6.

|  |  |
| --- | --- |
| **Table 5: Scour Critical Bridges** | |
| **Bridge Structure Number** | **Scour Critical Rating** |
|  |  |
|  |  |

[AgencyShort] has posted or closed bridges that are critical to accessing entire areas or individual properties within its jurisdiction. These bridges are listed in Table 7.

|  |  |  |
| --- | --- | --- |
| **Table 6: Posted/Closed Bridges that are Critical Links** | | |
| **Bridge Structure Number** | **P/K** | **Comments** |
|  |  |  |
|  |  |  |

The preservation strategy identifies actions in the operations and maintenance plan that are preventive or are responsive to specific bridge conditions. The actions are prioritized to correct critical structural safety and traffic issues first, and then to address other needs based on the operational importance of each bridge and the long-term preservation of the network. The inspection results serve as a basis for modifying and updating the operations and maintenance plan annually.

### Appendix 1: [Agency Name] [YYYY] Bridge Inspection Report Summary of Additional Inspection Recommendations

[#####] [Name of road or drive] over [Name the feature intersected]: [Write a summary of additional inspection recommendations].

### Appendix 2: [Agency Name] [YYYY] Bridge Inspection Report Executive Summary

#### General Recommendations

* [List general recommendations that arise out of the inspection report here.]

#### [Township or Other Division]

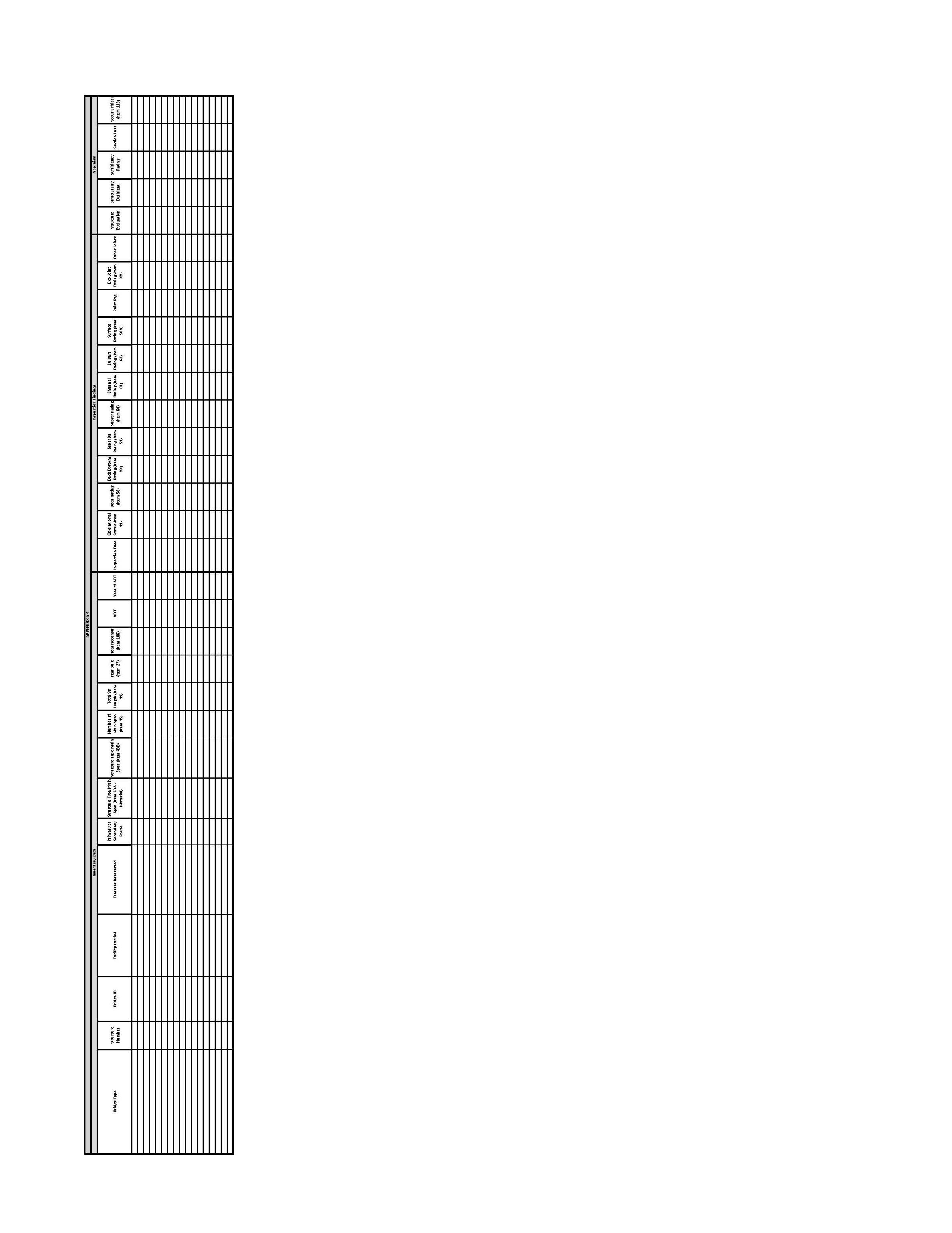
[#####] [Name of road or drive] over [Name the feature intersected]

**Constructed:** [YYYY] **Reconstructed:** [YYYY] **General Condition:** [Condition]

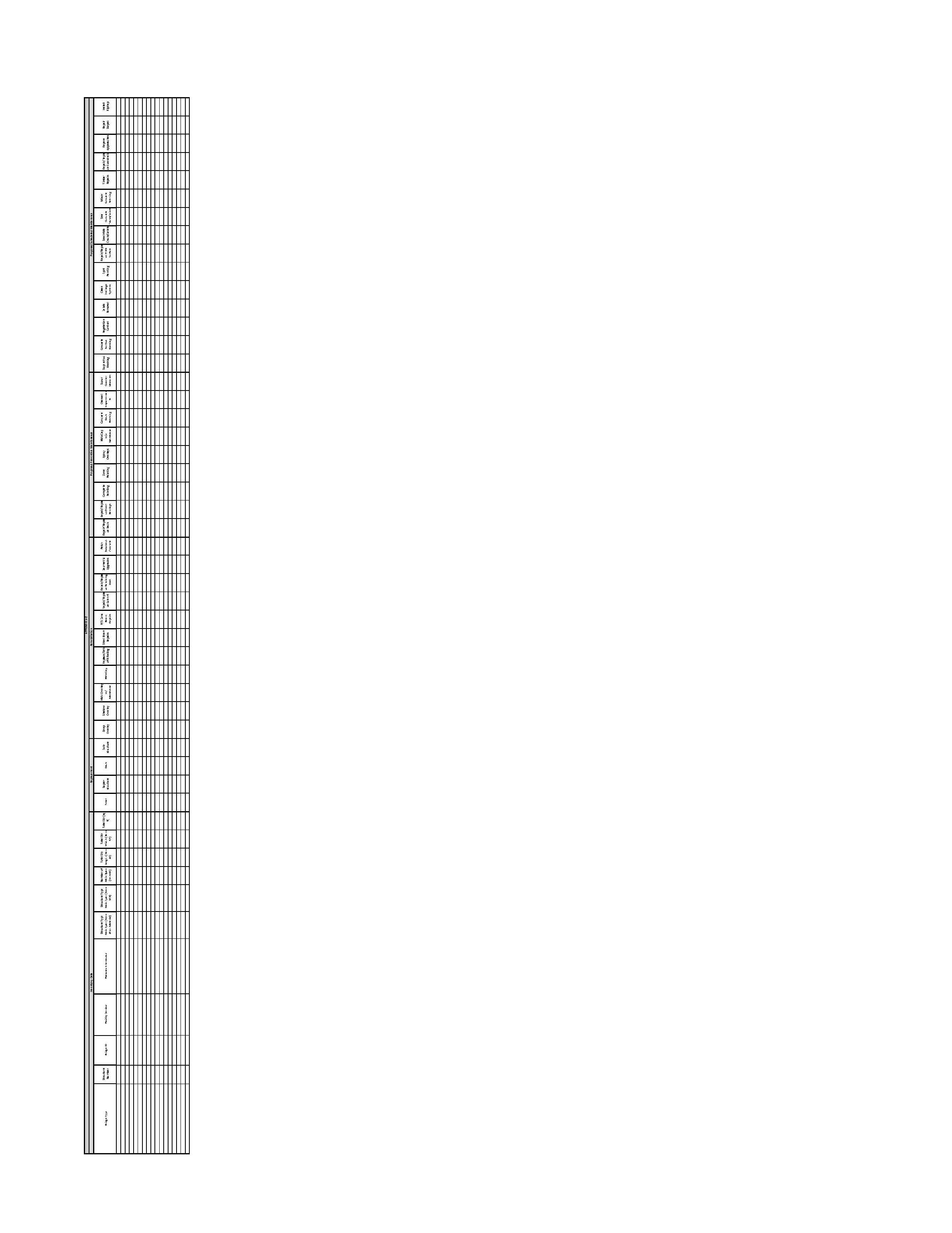
**Description:** [Write a description of the structure].

**Recommendations:** [Write a description of the recommendations for this structure].

### Appendix 3



### Appendix 4



### Appendix 5

