City of Ann Arbor
2020 Bridge Asset Management Plan

A plan describing the City of Ann Arbor’s Bridge transportation assets and conditions

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**EXECUTIVE SUMMARY**

As conduits for commerce and connections to vital services, bridges are critical assets in our community, along with roads, culverts, traffic signs, traffic signals, and utilities that support and affect the road network. The cost of building and maintaining Ann Arbor’s 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 describe how Ann Arbor is meeting its obligations to maintain the city’s bridges.

This plan provides an overview of Ann Arbor’s bridge assets and conditions and explains how the City of Ann Arbor works to maintain and improve the overall condition of those assets. It includes:

- What kinds of bridge assets Ann Arbor has in its jurisdiction and the different options for maintaining them.
- What tools and processes Ann Arbor uses to track and manage bridge assets and funds.
- What condition Ann Arbor’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 conditions through proper planning and maintenance.
- How agency bridge assets are funded and the source of these funds.
- How funds are used, and the costs incurred during Ann Arbor’s bridge assets’ normal life cycle.
- The condition of Ann Arbor’s bridges if current funding levels continue.
- How changes in funding levels can affect the overall condition of Ann Arbor’s bridge assets.

Ann Arbor owns and/or manages 16 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 Ann Arbor’s obligations towards meeting these requirements. This asset management plan also helps demonstrate Ann Arbor’s responsible use of public funds by providing elected and appointed officials as well as the general public with inventory and condition information of Ann Arbor’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”. 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 City of Ann Arbor 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 Ann Arbor. Proper asset management should also provide for transparent decision-making, which allows the public to understand the technical and financial challenges of managing infrastructure with limited resources.

The City of Ann Arbor has adopted an “asset management” process for its 16 bridges to help overcome the challenges presented by limited funds, staffing, and other resources while meeting stringent safety standards and bridge users’ expectations.

This 2020 plan outlines how Ann Arbor determines its strategy to maintain and upgrade bridge conditions given agency goals, priorities of users, and resources provided. An updated plan is to be released every five (5) years to reflect changes in bridge conditions, finances, and priorities.

Questions regarding the use or content of this plan should be directed to Michael G. Nearing, P.E., Senior Project Manager, City of Ann Arbor – Engineering, via e-mail mnearing@a2gov.org or phone (734) 794-6410 extension 43635. A copy of this plan can be accessed on our website at www.a2gov.org/engineering.

Key terms used in this plan are defined in Ann Arbor’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**

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).

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.

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.
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>
<thead>
<tr>
<th>NBI Rating</th>
<th>General Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-7</td>
<td>Like new/good</td>
</tr>
<tr>
<td>6-5</td>
<td>Fair</td>
</tr>
<tr>
<td>4-3</td>
<td>Poor/serious</td>
</tr>
<tr>
<td>2-0</td>
<td>Critical/failed</td>
</tr>
</tbody>
</table>

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.
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.
Ann Arbor is working to implement an asset management program for its bridges. This program balances reconstruction, rehabilitation, preventive maintenance, scheduled maintenance, or new construction, with Ann Arbor’s bridge funding in order to maximize the useful service life and to ensure the safety of the city’s bridges.

Reality is, the City of Ann Arbor has limited funds for improving the bridge network. Since preservation strategies like preventive maintenance are generally a more effective use of funds than costly alternative management strategies like major rehabilitation or replacement, Ann Arbor is identifying 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 Ann Arbor’s asset management program is the preservation and safety of its bridge network, increase its bridge assets’ useful service life by extending the time that bridges remain in good and fair condition, and reduction of future maintenance costs. To quantify this goal, Ann Arbor specifically aims to have to have 100% of the city’s bridges in fair to good condition and to have none of them classified as structurally deficient over this 5-year plan.

Thus, Ann Arbor’s asset management plan objectives are:

- To continue to track the current condition of the city’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 maintain and/or restore functionality
  - Identify and program those eligible bridges in need of replacement
- To identify available funding sources, such as:
  - Dedicated city resources
  - Obtaining funding through Michigan’s Local Bridge Program
  - Opportunities to obtain other funding from outside sources such as the University of Michigan where there interests and the City’s bridge system intersect
- To prioritize the programmed actions within available funding limitations
- To raise the condition of all city-owned vehicular bridges within the City’s control to a condition of good by the end of City of Ann Arbor Fiscal Year 2024

Inventory

Ann Arbor is responsible for 16 local bridges. Table 2 summarizes Ann Arbor’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 Appendices 1, 2, and 3.
bridge inventory data was obtained from MDOT MiBRIDGE and other sources, and the 2020 condition data and maintenance actions are taken from the inspector’s summary report (see Appendix 2).

**Types**

Of Ann Arbor’s 16 structures for which it either owns or is responsible to report, 2 are concrete structures that meet the definition of a bridge, 5 are steel bridges, and 9 are pre-stressed concrete bridges. The City does not own any public, vehicular, timber bridges that have federally-mandated reporting requirements. Of the two concrete structures mentioned above, one is a pre-cast underground parking structure that meets the definition of a bridge; and, another is a cast-in-place concrete tunnel under a public roadway that meets the definition of a bridge. The tunnel is owned by the University of Michigan.

**Locations and Sizes**

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

**Condition**

Ann Arbor 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 Ann Arbor’s bridge network is 11 (69%) are good, 4 (25%) are fair, and 1 (6%) is poor or lower.
Another layer of classification of Ann Arbor’s bridge inventory classifies zero (0) bridges as either structurally deficient, posted with weight restrictions, or 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 safe for vehicular or traffic loads 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

<table>
<thead>
<tr>
<th>Bridge Type</th>
<th>Total Number of Bridges</th>
<th>Total Deck Area (sq ft)</th>
<th>Condition: Structurally Deficient, Posted, Closed</th>
<th>2020 Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Struct. Defic</td>
<td>Posted</td>
</tr>
<tr>
<td>Steel</td>
<td>5</td>
<td>126,144</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Concrete</td>
<td>2</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pre-stressed Concrete</td>
<td>9</td>
<td>77,476</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SD/Posted/Closed</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>16</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td></td>
<td></td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Statewide, MDOT’s statistics for local agency bridges show that 14% are poor and 86% are good/fair, indicating that the Ann Arbor has a lesser percentage of poor bridges compared to the statewide average for local agencies. Correspondingly, Ann Arbor has 93.75% 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 0.0% of Ann Arbor’s bridge deck area.

### Goals

The goal of Ann Arbor’s asset management program is the preservation and safety of its bridge network; it also aims to extend the 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 100% of its bridges rated fair/good condition by the end of City Fiscal Year 2024. These goals are juxtaposed with the historic and current condition and the projected trend in Figures 8 and 9.

Several metrics will be used to assess the effectiveness of this asset management program. Ann Arbor 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 Ann Arbor’s historic and current bridge conditions, projected trends, and goals.

Figure 9: Bridge construction timelines
Prioritization, Programmed/Funded Projects, and Planned Projects

Prioritization

Ann Arbor’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 by using a 'mix-of-fixes' strategy. Therefore, Ann Arbor prioritizes bridges for projects by evaluating five factors and weighting them as follows: condition – 30%, load capacity – 30%, traffic volume/roadway classification – 25%, safety – 15%, and length of Detour route/Impact to Major Stakeholders – 10%. 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.

Ann Arbor annually reviews the current condition of each of 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 Ann Arbor’s bridges in Appendix 3. Ann Arbor 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 Ann Arbor’s specific bridge network.

<table>
<thead>
<tr>
<th>Table 3: Summary of Preservation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preservation Action</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td><strong>Replacement</strong></td>
</tr>
<tr>
<td>Total Replacement</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Superstructure</td>
</tr>
<tr>
<td>Replacement</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Deck Replacement</td>
</tr>
<tr>
<td>Epoxy Coated Steel</td>
</tr>
<tr>
<td>Black Steel</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Rehabilitation</strong></td>
</tr>
<tr>
<td>Substructure</td>
</tr>
<tr>
<td>Replacement</td>
</tr>
<tr>
<td>(Full or Partial)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Preservation Action</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
</tbody>
</table>
| **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 \(^{[1](a)}\) |
| **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 \(^{[1](a)}\) |
| **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 |
## Table 3: Summary of Preservation Criteria

<table>
<thead>
<tr>
<th>Preservation Action</th>
<th>Bridge Selection Criteria</th>
<th>Expected Service Life</th>
</tr>
</thead>
</table>
| 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:  
  o Abutment spalling under bearings [1]  
  o Beam end contact [1]  
  o Closed expansion joints and/or pin and hangers [1]  
  o Damaged railing and deck fascia at joints [1]  
  o 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] |                       |
<p>| Scheduled Maintenance                   |                                                                                         |                       |</p>
<table>
<thead>
<tr>
<th>Preservation Action</th>
<th>Bridge Selection Criteria</th>
<th>Expected Service Life</th>
</tr>
</thead>
</table>
| 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] |                      |
Table 3: Summary of Preservation Criteria

<table>
<thead>
<tr>
<th>Preservation Action</th>
<th>Bridge Selection Criteria</th>
<th>Expected Service Life</th>
</tr>
</thead>
</table>
| 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:  
* From source with interpretation added.

In terms of management and preservation actions, Ann Arbor’s asset management program uses a 'mix-of-fixes' strategy 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 Ann Arbor's in-house maintenance team and/or contracted out.

Ann Arbor’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.

One 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 may be generally eligible for funding under the local bridge program and any requests for funding may be submitted with Ann Arbor’s annual applications.

To achieve its goals, a primary objective of Ann Arbor’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 five (5) 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 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, Ann Arbor'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 plan is presented in the Appendix 2.

**Programmed/Funded Projects**

Ann Arbor receives about $10,900,000 per year in local funding allocated to its complete transportation network which includes roads, bridges, sidewalks, on-street bikelanes, and non-motorized paths. To achieve its goals, Ann Arbor plans to spend about $780,500 per year during the life of this asset management plan on preventive and scheduled maintenance of its bridges. Ann Arbor plans to replace 1 bridge (the Waste Water Treatment Plant Drive bridge) at an estimated cost of about $5,890,000. By performing the aforementioned preventive maintenance and replacement of bridge structures, Ann Arbor will meet its overall bridge network condition goals.

Ann Arbor computes the estimated cost of each typical management and/or preservation action using unit the suggested planning level costs contained 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 estimated on a bridge-by-bridge basis. The cost estimates are reviewed and updated periodically when better information
becomes available. A summary of the programmed/funded projects and investments can be found in Table 4, the Cost Projection table, below.

**Planned Projects**

Ann Arbor does not have any identified additional priority projects that remain unfunded.
The funding to be used for Structure 11078 (the Waste Water Treatment Plant Drive bridge over the Huron River, will come exclusively from the Sewage Disposal Fund as this bridge exclusively serves the Waste Water Treatment Plant.

The funding to be used for Structure 11065 (E. Medical Center Drive over the Wolverine Line) is expected to be funded primarily from University of Michigan Hospital funding sources as they are the primary user of this structure and the planned improvements are being coordinated with other improvements on and within the hospital campus.

Table 4: Planned Projects and Revenue Needs

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</table>

Notes:

The funding to be used for Structure 11078 (the Waste Water Treatment Plant Drive bridge over the Huron River, will come exclusively from the Sewage Disposal Fund as this bridge exclusively serves the Waste Water Treatment Plant.

The funding to be used for Structure 11065 (E. Medical Center Drive over the Wolverine Line) is expected to be funded primarily from University of Michigan Hospital funding sources as they are the primary user of this structure and the planned improvements are being coordinated with other improvements on and within the hospital campus.
The funding required for the other bridges listed in the Table 4 will come from City of Ann Arbor funding sources (the Street Resurfacing Millage and the City’s Weight and Gas Tax Revenue that it receives from the State of Michigan.

**Gap Analysis**

When Ann Arbor compares its funding and its programmed/funded projects with all of its prioritized projects as shown in Table 4, Ann Arbor believes it should be able to achieve all of its asset management goals for the period of this plan. If circumstances develop that create a situation whereby the City of Ann Arbor is unable to complete a planned project, we will continue to monitor the 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

Ann Arbor has programmed projects and has identified expected funding streams for the purpose(s) of various performing the necessary work types for selected bridges. This funding is intended for use in the identified years.

Anticipated Expenses

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

Ann Arbor recognizes 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.

Ann Arbor addresses these risks by implementing regular bridge inspections and a preservation strategy consisting of preventive maintenance.

Ann Arbor administers the biennial inspection of its bridges in accordance with NBIS and MDOT requirements. The inspection reports document the condition of Ann Arbor’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 Ann Arbor’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.

Ann Arbor does not have any scour critical bridges.

Similarly, Ann Arbor does not have any bridges that require weight postings or are closed.
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: City of Ann Arbor 2018/2019 Bridge Inspection Report Summary of Additional Inspection Recommendations

Structure No. 11078  Waste Water Treatment Plant Drive over the Huron River

Perform underwater inspection of the bridge substructure consisting of the center pier and the east abutment at a recurrence interval of sixty (60) months. The last underwater inspection was performed on June 26, 2019. Perform the next underwater inspection of the subject substructure units on, or before June 2024 if this structure has not been replaced as currently planned.

Structure No. 11065  E. Medical Center Drive over the Wolverine Line

Given the current level of deterioration of the existing expansion joints and pier caps, it was decided that this bridge should be inspected every twelve (12) months to ensure that the piers can continue to carry the anticipated loads. If it is determined that they cannot, it will then be necessary to enact appropriate load restrictions or perform temporary repairs.
Appendix 2: City of Ann Arbor 2018/2019 Bridge Inspection Report Executive Summary

General Recommendations

- The City of Ann Arbor’s bridge network is generally in good to fair condition.
- The Waste Water Treatment Plant Drive Bridge is currently scheduled to be replaced in 2023 in order to improve accessibility and redundancy to the plant. It is expected that the existing bridge will remain in place to continue to carry the existing trunkline sanitary sewers that feed the plant. The existing bridge is not expected to continue to carry public vehicular traffic.
- E. Medical Center Drive bridge will be widened/rehabilitated in about three years. The City is currently working with the Michigan Medicine and the University to plan, schedule, and fund the proposed work.
- Two preventative/scheduled maintenance project will be undertaken in City FY20 and 21 to improve the conditions of four city bridges and return their condition level to “Good.”
- The above described work is expected to restore the condition of all City-owned roadway bridges to a condition of “Good” by City FY 24.
- Continue to perform the present inspection program in order to properly assess the condition of each bridge and its structural elements.

Bridge-by-bridge Preservation Plan

E. Medical Center Drive over the Wolverine Line

Year Constructed: 1982   Reconstructed: N/A   General Condition: Poor

Description: Three span bridge constructed in 1982 with twelve, rolled, steel, wide flange beams with welded coverplates and a composite, reinforced, concrete deck. The bridge length is 160’-0” from reference line to reference line with an out-to-out width of 70’-11¾” and an approximate skew of 36º to the left. The bridge carries a four-lane road and is located immediately south of the University of Michigan Medical Center. This bridge is located on the roadway that is the primary access into the Medical Center.

Recommendation: This structure requires rehabilitation in order to keep it in a high functioning condition and increase its rating to good. The major items of the proposed rehabilitation include; remove and replace the deck joints; perform beam end repairs; repair/replace rusted end diaphragms; replace the pier cap at the north pier (Pier 2); perform substructure repairs to the south pier (Pier 1); re-paint the structural steel; remove vegetation overgrowth from all quadrants of the bridge; perform a deep deck overlay; chip and patch delaminated concrete on the existing sidewalks; perform guardrail upgrades to meet current safety standards; remove and hot-dip galvanize and paint the existing steel tube railings.

This structure is also under consideration to be widened to five lanes to better accommodate vehicular traffic entering and existing the University of Michigan Medical Center.
11066 E. Stadium Boulevard over the Ann Arbor Railroad  
**Year Constructed:** 2012  
**Reconstructed:** N/A  
**General Condition:** Good  

**Description:** Single span bridge constructed in 2012 with eighteen adjacent pre-stressed concrete box beams and a composite reinforced concrete deck. The bridge length is 118’-4” from reference line to reference line with an out-to-out width of 77’-1” and an approximate skew of almost 20º to the right. The bridge carries a four-lane road along a major thoroughfare within the City.  

E. Stadium Boulevard is a National Highway System Route.  

**Recommendation:** The bridge is in good condition. However, due to the geometry and vertical clearance requirements with which the bridge was required to be constructed, the deck developed temperature and shrinkage cracks. In order to keep the bridge in a high functioning condition it is recommended that a thin epoxy overlay be placed on the bridge deck and approach slabs. Also, route and seal the crack in the west approach slab.

11067 E. Stadium Boulevard over S. State Street  
**Year Constructed:** 2012  
**Reconstructed:** N/A  
**General Condition:** Good  

**Description:** Single span bridge constructed in 2012 with eighteen adjacent pre-stressed concrete box beams and a composite reinforced concrete deck. The bridge length is 74’-5” from reference line to reference line with an out-to-out width of 77’-1” and an approximate skew of 42º to the right. The bridge carries a four-lane road along a major thoroughfare within the City.  

E. Stadium Boulevard is a National Highway System Route.  

**Recommendation:** The bridge is in good condition. However, due to the geometry with which the bridge was required to be constructed, the deck developed temperature and shrinkage cracks. In order to keep the bridge in a high functioning condition it is recommended that a thin epoxy overlay be placed on the bridge deck and approach slabs. Also, seal the cracks in the south sidewalk.

11069 Fuller Road over the Wolverine Line  
**Year Constructed:** 1982  
**Reconstructed:** N/A  
**General Condition:** Good  

**Description:** Three span bridge constructed in 1982 with ten, rolled, steel, wide flange beams with welded coverplates and a composite, reinforced, concrete deck. The bridge length is 261’-0” from reference line to reference line with an out-to-out width of 81’-5” and an approximate skew of 60º to the right. The bridge was rehabilitated in 2015 with a shallow concrete deck overlay; deck joint replacement; pin and hangar and end diaphragm replacement; zone painting; clearing existing vegetation from all four quadrants of the bridge; railing end wall and backwall repairs; and, guardrail upgrades at the SW quadrant.  

**Recommendation:** Due to the recently completed rehabilitation of this structure, no repairs are recommended at this time other than standard O&M tasks.
Fuller Road (WB) over the Huron River

**Year Constructed:** 1994  **Reconstructed:** N/A  **General Condition:** Good

**Description:** Three span bridge constructed in 1994 with 13 adjacent 27” pre-stressed, concrete, box beams with a 6” composite concrete deck. The box beams are transversely post-tensioned. The bridge length is 168’-0” from reference line to reference line with an out-to-out width of 40’-10½”. The bridge substructure is pile supported.

**Recommendation:** The bridge is in good condition. However, in order to keep it in a high functioning condition and maintain its good rating the following scheduled maintenance repairs are scheduled to be performed in calendar year 2021. Chip and patch spalled area of the barrier wall; place concrete surface coating on the barrier walls; chip and patch delaminated areas of the bridge deck; place a thin epoxy overlay on the bridge deck; replace damaged segments of guardrail; patch minor spalls near the ends of the fascia beams; re-seal the cracks along the centerline of the approach slabs; remove vegetation that is growing within the rip-rap areas between the bridges; and, place additional rip-rap on the slope in front of the abutments.

Fuller Road (EB) over the Huron River

**Year Constructed:** 1993  **Reconstructed:** N/A  **General Condition:** Good

**Description:** Three span bridge constructed in 1993 with 13 adjacent 27” pre-stressed, concrete, box beams with a 6” composite concrete deck. The box beams are transversely post-tensioned. The bridge length is 168’-0” from reference line to reference line with an out-to-out width of 40’-10½”. The bridge sub-structure is pile supported.

**Recommendation:** See the Fuller Road (WB) Bridge for the recommended minor repairs to be performed on this bridge as well.

Maiden Lane over the Huron River

**Year Constructed:** 1982  **Reconstructed:** N/A  **General Condition:** Fair

**Description:** Three span bridge constructed in 1982 with nine, rolled, steel, wide flange beams with a composite, reinforced, concrete deck. The bridge length is 209’-0” from reference line to reference line with an out-to-out width of 70’-11¼” and an approximate skew of 15º to the right. The bridge was rehabilitated in 2015 with a shallow concrete deck overlay; deck joint replacement; zone painting; clearing existing vegetation from all four quadrants of the bridge; railing end wall repairs; and, guardrail upgrades at the NW and SE quadrants.

**Recommendation:** Due to the recently completed repairs to this bridge, no repairs are recommended at this time other than standard O & M tasks.
Huron Parkway over the Huron River, Geddes Avenue, and the Wolverine Line

**Year Constructed:** 1968  **Reconstructed:** 2000  **General Condition:** Fair

**Description:** Seven span bridge constructed in 1968 with eight, continuous, variable depth, steel plate girders with a composite, reinforced, concrete deck. The bridge length is 1,018’-6.75” from reference line to reference line with an out-to-out width of 75’-1½”. The bridge was rehabilitated in 2000 and 2007.

The 2000 rehabilitation included replacement of the east deck, sidewalk, and railing; the west deck was overlaid with a cantilevered sidewalk added and railing replacements, beam end repairs, diaphragm replacement under expansion joints, partial painting, expansion joint replacement, slope paving repairs, tree removal, and rip-rap placement.

The 2007 rehabilitation included cleaning and coating of the structural steel, bolted beam repairs to areas with section loss, and placing a strip seal at the center longitudinal open joint between the east and west decks.

**Recommendation:** The bridge is in fair condition. However, in order to keep it in a high functioning condition and restore its good condition rating the following minor repairs should be made; chip and patch delaminated deck concrete, spalled curb sections, and sidewalk area; repair spalled and delaminated concrete on the substructure; repair one section of damaged steel railing; repair damaged expansion joint cover plate; repair slope protection; remove vegetation growth in the rip-rap areas at the three northern piers; repair spalled and delaminated concrete on the deck, curbs, and sidewalks; and

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Broadway Bridge over the Huron River

**Year Constructed:** 2004  **Reconstructed:** N/A  **General Condition:** Good

**Description:** Three span bridge constructed in 2004 with nine, 39”, pre-stressed concrete box beams in a spread configuration with a composite, reinforced, concrete deck. The bridge length is 166’-8” from reference line to reference line with an out-to-out width of approximately 73’-0”. The bridge substructure is pile supported.

**Broadway is a National Highway System route.**

**Recommendation:** The bridge is in good condition. However, in order to keep it in a high functioning condition and maintain its good rating the following minor repairs should be made; chip and patch spalled area of the barrier wall; place concrete surface coating on the barrier walls; chip and patch delaminated areas of the bridge deck; place a healer/sealer on the bridge deck; repair loose railing anchor bolts; remove vegetation near the structure; and, replace missing rip-rap from around the bridge abutments.
Broadway Bridge over Depot Street and the Wolverine Line

**Year Constructed:** 2004  **Reconstructed:** N/A  **General Condition:** Good

**Description:** Four span bridge constructed in 2004 with nine, 39”, pre-stressed concrete box beams in a spread configuration with a composite, reinforced, concrete deck. The bridge length is 316’-6” from reference line to reference line with an out-to-out width of approximately 73’-0”. The Abutment “B” and Pier Nos. 2 and 3 are pile supported. **Broadway is a National Highway System route.**

**Recommendation:** The bridge is in good condition. However, in order to keep it in a high functioning condition and maintain its good rating, the following minor repairs should be made; chip and patch spalled area of the barrier wall; place concrete surface coating on the barrier walls; chip and patch delaminated areas of the bridge deck; place a healer/sealer on the bridge deck; repair loose railing anchor bolts; and, remove vegetation near the structure.

Eisenhower Parkway over the Ann Arbor Railroad

**Year Constructed:** 1974  **Reconstructed:** N/A  **General Condition:** Good

**Description:** Three span bridge constructed in 1974. The original structure consisted of a dual structure on shared substructure units separated by an open joint along the bridge centerline. The superstructure is comprised of twelve, 36”, pre-stressed, concrete, I-beams with a composite, reinforced concrete deck. The bridge length is 132’-5¼” from reference line to reference line with an out-to-out width of 78’-5”.

**Eisenhower Parkway is a National Highway System route.**

The bridge was rehabilitated in 2005. The raised median and open joint was removed and a continuous bridge deck was constructed. The deck joints were removed and replaced and a shallow overlay was performed. Substructure repairs were performed as well as guard rail upgrades and other miscellaneous improvements.

**Recommendation:** The bridge is in good condition. In order to keep it in a high functioning condition and maintain its good rating, the bridge only requires routine O & M tasks. We will also continue to remove vegetation that grows near the structure.
**Waste Water Treatment Plant Drive bridge over the Huron River**

**Year Constructed:** 1934  
**Reconstructed:** N/A  
**General Condition:** Fair

**Description:** Two span bridge constructed in 1934 with three, rolled steel, wide flange, beams and composite reinforced concrete deck. The bridge length is 117’-1” from reference line to reference line with an out-to-out width of 18’-6”. The substructure is pile supported based on the information contained in the original design drawings.

The bridge was rehabilitated in 1985 and 2000. In 1985 the expansion joint device and guard rails were replaced and the beams were painted. In 2000, the bridge deck was overlaid, the bridge railings and guardrails were replaced, the expansion joint was replaced, and the substructure was patched.

In Summer 2016 the following repairs were performed on the structure; clearing and tree removal in all quadrants of the structure; two diaphragms were replaced over the piers; substructure repairs above and below the water line were made using a Porta-dam system to control the river flows; placement of scour counter-measures at the east abutment and upstream end of the pier; cleaning the expansion joint; removal of timber debris at upstream end of the pier; spot painting of the steel beams; and crack injection at the abutments and pier.

**Recommendation:** Each bay and fascia conveys utilities across the river to the city’s Waste Water Treatment Plant. The beams are difficult to access for painting due to the utilities. The bearings are currently rate a 5 due to pack rust, exposed shims, and deterioration. There is no method for repairing the bearings. Bearing replacement can only be performed by raising the beams and should be performed as part of a more extensive and future deck and/or superstructure replacement project. Further, this structure is a single lane bridge that will require extensive deck repairs in the near future.

Consequently, given all these constraints, the city is working to construct a new vehicular structure directly adjacent to this bridge for traffic that will enter and exit the plant. This will allow the deck of the current bridge to be removed so that the existing structural steel can be repaired to the extent that it can continue to function as a viaduct for the existing utilities that enter the plant.

**Island Drive over Traver Creek**

**Year Constructed:** 1962  
**Reconstructed:** N/A  
**General Condition:** Fair

**Description:** Single span bridge constructed in 1962 with fourteen, 12”, side-by-side box beams with a bituminous wearing surface. The bridge length is 24’-0” from reference line to reference line with an out-to-out width of 42’-3½”. The existing substructure consists of full-height reinforced concrete abutments supported on spread footings. The channel between the abutments is lined with a cast-in-place concrete slab.

**Recommendation:** This structure requires rehabilitation in order to increase its rating to good. The major items of the proposed rehabilitation include; remove the existing HMA wearing surface and waterproofing membrane and replace it with a 6” thick cast-in-place concrete deck; construct concrete sidewalk on top of the beams adjacent to the to the deck to waterproof those beam as well; perform approach work to match the grade of the new bridge deck; place rip-rap along the upstream and downstream ends of the bridge; remove vegetation at all four quadrants of the bridge; remove and replace bridge railings and install guardrail to meet current MDOT Standards.
**E. Huron River Drive over Mallett’s Creek**

**Year Constructed:** 1979  
**Reconstructed:** N/A  
**General Condition:** Good

**Description:** Single span bridge constructed in 1979 with 6, pre-stressed, concrete, I-beams with a 9” thick cast-in-place concrete deck. The bridge length is 50.0’ with an out-to-out width of 41’-7”. The existing substructure consists of full height curtain wall abutments on spread footings.

The bridge was rehabilitated in 2017. As part of the bridge work the existing concrete deck was patched, the existing railings were removed and replaced solid parapet wall type barrier with MDOT Standard 2-tube railings attached to the parapet wall. An epoxy overlay was placed on the bridge deck. Scour counter-measures were placed along the east abutment.

**Recommendation:** The bridge is in good condition. In order to keep it in a high functioning condition and maintain its good rating, the bridge only requires routine O & M tasks. We will also continue to remove vegetation that grows near the structure.

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**U of M Tunnel under Huron Parkway**

**Year Constructed:** 2001  
**Reconstructed:** N/A  
**General Condition:** Good

**Description:** The tunnel is a reinforced concrete, double-barrel. Tunnel. The tunnel is approximately 29’-0” wide by approximately 17’-0” tall and is 362’-0” long. The tunnel has two sections, the first is a 21’-6” wide by 17’-0” tall section that conveys pedestrians between two University of Michigan buildings. The second is a 7’-6” wide by 17’-0” section that enclose utilities that run between the buildings.

The University of Michigan owns and operates the tunnel.

**Recommendation:** The tunnel is in good condition. In order to keep it in a high functioning condition and maintain its good rating, the tunnel only requires routine O & M tasks. We will continue to inspect the tunnel and make recommendations, as needed, in order to keep the tunnel in good condition.
South Fifth Avenue over below grade parking structure

Year Constructed: 2011    Reconstructed: N/A    General Condition: Good

Description: A portion of the parking structure is located under the roadways and sidewalks of S. Fifth Avenue and Library Lane. The “bridge” portion of the structure is three spans totaling approximately 188’-6” long by approximately 63’-6” wide along S. Fifth Avenue. The “bridge” portion under Library Lane is approximately 17 spans totaling approximately 530’ long by 63’-6” and is located along Library Lane between S. Fifth Avenue and S. Division Street. The “bridge deck” consists of a post-tensioned concrete slab. The “bridge” substructure primarily consists of four columns per span supporting post-tensioned beams. The parking structure is four levels high.

Recommendation: The parking structure (bridge) is in good condition. In order to keep it in a high functioning condition and maintain its good rating, the parking structure only requires routine O & M tasks. We will continue to inspect the parking structure and make recommendations, as needed, in order to keep it in good condition.