Asset Management Guide for Local Agency Bridges in Michigan

sponsored by  Michigan Transportation Asset Management Council

prepared by  TranSystems Corp
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1.0 Introduction

1.1 Format

This Asset Management Guide for Local Agency Bridges in Michigan is presented in two-column format. The left column contains the Guide’s text. Applicable references and other supporting material are contained in the right column with links to the source documents and information sources.

1.2 Purpose

Maintaining bridges in good condition has proven to extend service life and to be more cost effective than allowing deterioration to progress, resulting in the need for more extensive and costly rehabilitation or replacement projects. By developing and implementing a comprehensive bridge preservation plan, a local agency can better identify its needs, prioritize its actions, and allocate available funds appropriately.

This Asset Management Guide for Local Agency Bridges in Michigan is intended to provide:

- Assistance in understanding bridge management and bridge preservation;
- Guidance to decision makers and county bridge or highway engineers in the planning, developing, programming, and implementing of effective and efficient capital programs and maintenance actions to preserve the bridges under their jurisdiction;
- Information to assist local agencies (1) in understanding their bridge network, (2) in the preparation and implementation of a bridge preservation plan, and (3) to support applications for funding under Michigan’s Local Bridge Program.

1.3 Using this Guide

This Guide provides specific information related to the management of bridge assets, and is intended to be a complementary document to the Asset Management Guide for Local Agencies in Michigan, the primary resource for the management of transportation facilities in Michigan. In developing that document, Michigan’s Transportation Asset Management Council (TAMC) recast asset management guidance developed at the national level for state DOTs into a form intended to be useful for local agencies in Michigan.

Michigan also has substantial other resources to assist local agencies in guiding their asset management practices. This Guide provides useful links to that information and to resource material available from transportation agencies such as FHWA.

1.0 References


2011 Call for Applications Letter
http://www.michigan.gov/documents/mdot/mdot_Call_for_Applications_26705 _1_7.pdf

MDOT Asset Management Guide for Local Agencies in Michigan
AASHTO, and others. Users of this Guide are encouraged to consult these resources in the development of their bridge asset management plans.

### 1.4 Definitions / Acronyms

This Guide employs a number of terms commonly used in: the inspection, evaluation, and maintenance of bridges; asset management plans; capital programming and funding; resource management; and the administration of Michigan’s Local Bridge Program. Links to references containing definitions of these terms are provided in the right hand column, as are the common acronyms used in the Guide. The user is encouraged to review the cited references in order to better understand and implement the principles and procedures described in the Guide.

Bridge preservation starts with obtaining timely information on bridge conditions; then, developing and implementing a planned strategy to maintain and extend the useful life of the bridge network. A preservation strategy is composed of various preventive maintenance activities and treatments. Applied at the proper time, preventive maintenance activities extend the service life of the bridge in a cost-effective manner. The definition of critical terms used in the management of bridge assets are discussed in Section 2.2.

### 1.5 Asset Management in Michigan

In Michigan, asset management is defined as “an ongoing process of maintaining, upgrading, and operating physical assets cost effectively, based on a continuous physical inventory and condition assessment” per Act 499 of the Michigan Public Acts of 2002, Section 9(a)(1)(a).

Act 499 encourages all agencies that spend state transportation funds on roads and bridges to implement an asset management approach under the leadership and oversight of the TAMC.

### 1.6 Role of the Michigan Transportation Asset Management Council (TAMC)

Created by Act 499 of the Michigan Public Acts of 2002, the TAMC’s stated mission is to: advise the State Transportation Commission on a statewide asset management strategy & the necessary procedures & analytical tools to implement such a strategy on Michigan’s highway system in a cost-effective, efficient manner.

In order to apply the principles of asset management to the process of allocating transportation resources, TAMC developed the following high level strategic process which could be applied to a variety of infrastructure types:

- Assess current condition
- Create a “mix of fixes”, estimate costs and funding levels

### Definitions

- [FHWA Asset Management Overview](http://www.fhwa.dot.gov/asset/if08008/amo_09.cfm)
- [Bridge Preservation (TSP)](http://www.tsp2.org/files_tsp2/content/FHWA%20BPETG%20Draft%20TSP%202%20Definition%20Posting%2010-22-0%20Rev%202%20pm%20edits.pdf)

### Acronyms

- AASHTO – American Association of State Highway and Transportation Officials
- ADT – Average Daily Traffic
- ADTT - Average Daily Truck Traffic
- BCFS – Bridge Condition Forecasting System
- BIR – Bridge Inspection Report
- BMS – Bridge Management System
- BSIR – Bridge Safety Inspection Report
- CRAM – County Road Association of Michigan
- CFM – Capital Preventive Maintenance
- FHWA – U. S. Dept of Transportation, Federal Highway Administration
- LBAB – Local Bridge Advisory Board
- LBF – Local Bridge Fund
- LBP – Local Bridge Program
- LTAP – Michigan Local Technical Assistance Program
- LCCA – Life Cycle Cost Analysis
- MDOT – Michigan Department of Transportation
- MBIS – Michigan Bridge Inspection System
- MBRS – Michigan Bridge Reporting System
- MML – Michigan Municipal League
- MTF – Michigan Transportation Fund
- MPO – Metropolitan Planning Organization
- NBI – National Bridge Inventory
- NBIS – National Bridge Inspection Standards
- Predict future condition, develop performance measures and targets
- Conduct tradeoff analysis, indentify candidate projects
- Set Priorities, develop a multi-year program
- Report results

This Guide is intended to assist local agencies in applying this process to the development of a preservation plan for bridges under their jurisdiction and to provide background material on bridge preservation.

NCHRP - National Cooperative Highway Research Program
RBC – Regional Bridge Council
RSL – Remaining Service Life
SAFETEA-LU – Safe, Accountable, Flexible, and Efficient Transportation Equity Act Legacy for Users
SI – Structural Improvement
SIA – Structure Inventory and Appraisal
STIP – Statewide Transportation Improvement Program
TAMC – Michigan Transportation Asset Management Council
TEDF – Transportation Economic Development Fund
TIP – Transportation Improvement Program
TMS – Transportation Management System

TAMC Website Link
2.0 Bridge Asset Management in Michigan

2.1 Bridge Management System

A Bridge Management System (BMS) is defined as a collection of interacting processes designed to assist decision makers in the selection of cost-effective bridge preservation, rehabilitation, and improvement strategies and actions to improve the efficiency and safety of, and protect the investment in a network of bridges (23 CFR 500.107) Code of Federal Regulations.

Michigan has a system-wide process for transportation asset management of highway bridges. For local agencies this process is administered through the local bridge program by the Local Bridge Advisory Board and seven Regional Councils. The Transportation Asset Management Council supports the state’s BMS by providing technical assistance and guidance, and by publishing annual asset management reports, communicating infrastructure needs, and implementing asset management principles.

2.2 Bridge Preservation through Preventive Maintenance

The Federal-aid to Highways Program allows States to use Highway Bridge Program (HBP) funds to improve the condition of highway bridges through replacement, rehabilitation, and preservation activities identified using an approved systematic process. Bridge preservation and preventive maintenance are terms that are used interchangeably.

**Bridge preservation** is defined by FHWA as: *Actions or strategies that prevent, delay, or reduce deterioration of bridges or bridge elements; restore the function of existing bridges; keep bridges in good condition; and extend their useful life. Preservation actions may be preventive or condition-driven.*

**Preventive Maintenance** is recognized as a cost effective way to preserve the investment in and service life of bridges. AASHTO defines preventive maintenance as: *A planned strategy of cost-effective treatment to an existing roadway system and its appurtenances that preserves the system, retards future deterioration and maintains or improves the functional condition of the system without increasing structural capacity.*

An effective bridge preservation program: 1) employs long-term network strategies and practices that are aimed to preserve the condition of bridges and extends their useful life; 2) has sustained and adequate funding sources; 3) ensure that the appropriate treatments are applied at the appropriate time. Some agencies employ a program of scheduled maintenance performed by in-house forces.

2.0 References

2.3 Michigan’s Systematic Plan to Preserve Bridges

The FHWA defines a systematic process as “a documented methodology regularly applied to repeatedly achieve a desired outcome or goal.” The plan must define a specific outcome or goal for the preventive maintenance program, and describe a systematic process to achieve that goal.

2.3.1 Elements of Michigan’s Systematic Plan

The key elements of Michigan’s systematic plan for preserving its trunk line bridges are described below. Similar items should be addressed in a local bridge preservation plan.

- **Identify the needs:** This first step describes the engineering criteria used to determine the agency’s need for funding for bridge preventive maintenance. Michigan’s Local Bridge Program identifies statewide and Regional needs by monitoring bridge condition by functional classification annually. The Transportation Asset Management Council also identifies needs and provides reports to the Michigan Legislature annually. Bridge owners must also identify needs in order to schedule and perform routine maintenance, and to submit projects for capital preventive maintenance, rehabilitation, and replacement projects.

  Michigan uses extended bridge condition data collection in the NBI format as well as Pontis data collection to manage bridges. Pontis is one of the tools available in the Michigan BMS and Pontis data is collected based on the AASHTO element level inspection system.

- **Prioritize the needs:** Michigan has a prescriptive procedure that evaluates bridge condition using bridge inspection records and inventory data in MDOT’s bridge management system. This information is made available to the Local Bridge Advisory Board, Regional Councils, and local agency bridge owners to be used to prioritize bridge replacement, rehabilitation, and preventive maintenance projects. Bridge owners are encouraged to use the concepts of asset management and BMS tools to develop bridge preventive maintenance programs. Maintaining bridges to remain in good or fair condition consistently proves to be a cost effective way to manage a bridge population and minimize costly major rehabilitations. The Bridge Condition Forecasting System (BCFS) is an important tool in the BMS and is used by MDOT to develop preservation policies. Information on the BCFS is contained in MDOT’s Long Range Transportation Plan, 2005-2030.

- **Define the goal:** Bridge condition goals and objectives are an important part of a preservation plan as they provide
targets by which strategies can be set and performance monitored. The TAMC encourages local agencies to establish goals that will improve and preserve their bridge network: such as; opening closed bridges, reducing the number of structurally deficient and functionally obsolete bridges, maintaining a more of their bridges in good or fair condition, etc.

MDOT’s Strategic Investment Plan for Trunk Line Bridges contains specific goals for its bridges. The state of Michigan’s public Dashboard contains five metrics to measure the state’s economic progress. One of those key metrics is a progress monitor on the state’s success in reducing the number of structurally deficient bridges in the network.

- **Demonstrate cost-effectiveness:** Cost effectiveness of bridge preservation projects is best accomplished by monitoring bridge deterioration rates. MDOT has been doing preservation projects for many years and has accumulated data showing the effectiveness of many bridge preservation projects and activities for their highway bridges. MDOT’s Bridge Deck Preservation Matrix provides repair options for bridge decks in various condition states and it provides estimates of fix life for the repair options.

- **Identify and dedicate resources:** The Local Bridge Advisory Board dedicates funds to each of the seven Regional councils for replacement, rehabilitation, and preventive maintenance projects. Local agency bridge owners should estimate the resource requirements over time to preserve their bridges.

Using the NBI condition ratings, bridge deterioration rate, project cost, expected inflation, and fix strategies, BCFS estimates the future condition of a bridge network. BCFS can compare a mix of fixes by modeling different percentages of preventive maintenance, rehabilitation, and replacement projects.

- **Annual reporting:** The TAMC annually tracks bridge condition and provides reports to the State Transportation Commission and Michigan Legislature.

Bridge owners are encouraged to use the Michigan Bridge Reporting System to monitor bridge condition and needs over time. Annual reports showing bridge condition trends and needs are an important part of a local bridge preservation plan and are helpful in justifying funds to local agencies.

### 2.4 Funding Bridge Preservation

Under SAFETEA-LU, Michigan is eligible to use federal funds to support bridge preventive maintenance. MDOT has an MDOT Strategic Investment Plan for Trunk Line Bridges


Michigan Dashboard


TAMC Annual Report 2009


Michigan Bridge Reporting System


Act 51 Primer

www.house.mi.gov/hfa/PDFs/act51.pdf
FHWA approved systematic plan for the preventive maintenance program that ensures the activities are cost effective in extending the service life of bridges.

Through legislation enacted on October 1, 2004, Michigan created a Local Bridge Fund to be administered by the newly formed Local Bridge Advisory Board and seven regional Bridge Councils, giving control of the funding allocations to the local agencies. An application process was instituted for local agency funding at that time.

Michigan uses a combination of Federal HBP funds, MTF funds, and critical bridge funds to implement the approved preservation plan. A typical Act 51 Flow Chart showing the sources and distribution of funds is presented in Appendix C.

Act 51 Public Acts 1951

Federal Highway Bridge Program Funds
http://www.fhwa.dot.gov/bridge/hbrrp.htm
http://www.fhwa.dot.gov/preservation/100804.cfm

Federal Surface Transportation Program Funds

State Bridge Funds - MDOT 5 Year Plan
http://www.michigan.gov/mdot/0,1607,7-151-9621_14807_14810---,00.html

Transportation Fund
http://www.michigan.gov/mdot/0,1607,7-151-9622_11045_34388---,00.html

Maintenance Funds

State Economic Development Funds
http://connect.michigan.gov/portal/site/mdot/mnuitem.be8896d05609f5da4640f0c778783859/

Local funds
http://www.micountyroads.org/PDF/Twp_funding.pdf

Muskegon County Road Commission Funding Brochure

Michigan TF2 Report on Funding
3.0 MDOT Local Agency Program

3.1 Overview

By legislation in October, 2004, Michigan established a Local Bridge Program that includes a Local Bridge Fund to be administered by a Local Bridge Advisory Board (LBAB) and seven Regional Bridge Councils (RBC), giving control of the funding allocations to the local agencies. Funding from the Local Bridge Fund is allocated to each region based on available funds and weighted ratios provided in the legislation.

MDOT provides administrative support, technical assistance, and bridge inventory data. MDOT reviews submitted applications, determines the computer generated rating points, checks the plans and specifications for conformance to AASHTO guidelines, schedules and participates in all required meetings, and advertises and awards contracts for the bridge projects. MDOT representatives are non-voting members of both the LBAB and the RBCs.

3.2 Local Bridge Advisory Board

The LBAB is the state level committee that oversees the Local Bridge Program operations. The LBAB is responsible for, at a minimum, the "Large" bridge program, emergency situations involving local bridges, allocating percentages of funding to each region, and ensuring the RBCs are following established guidelines.

The LBAB allocates funding to each region by formula. The three elements in formula are: number of bridges, bridge deck area, and deficient bridge deck area.

3.3 Regional Bridge Council

An RBC is a regional committee that is charged with the responsibility of determining a 3-year bridge program that replaces, rehabilitates, and maintains the bridge inventory of their respective region. Each region's RBC evaluates and rates applications submitted by local agencies using the RBC Discretionary Rating Guide, and determines which bridge projects are to be funded each year based on the dollars allocated by the LBAB.

Projects are selected and programmed on a rolling three year basis; for example, projects that are selected based on the 2011 applications will be funded in 2014 as the 2011 thru 2013 programs have already been established. Each RBC's 3-year program is reviewed annually by the LBAB for concurrence.

3.4 Michigan’s Local Bridge Program Strategy

The local bridge preservation strategy is established by the LBAB using MDOT's Bridge Condition Forecast System

3.0 References

Local Bridge Program Link
http://www.michigan.gov/mdot/0,1607,7-151-9625_25885_40558---,00.html

Guidelines of Local Bridge Program

Overview of Local Bridge Program:

Local Bridge Advisory Board
www.michigan.gov/documents/mdot_Local_Bridge_Advisory_Board_Procedures_116599_7.pdf

Local Bridge Advisory Board Procedures:

Local Bridge Selection Process
http://www.michigan.gov/mdot/0,1607,7-151-9625_25885_40558_40560-113373--,00.html

Regional Bridge Councils
http://www.michigan.gov/mdot/0,1607,7-151-9625_25885_40558-113368--.00.html

Regional Bridge Council Procedures:

RBC Discretionary Rating Guidance

RBC Three Year Programs
http://www.michigan.gov/mdot/0,1607,7-151-9625_25885_40558_40560-
(BCFS). Certain funding is reserved for “large bridges” and local bridge emergencies. The LBAB then allocates funds to the regions in the major categories of work - replacement, rehabilitation, and preventive maintenance. The RBC’s distribute the funds to the local agencies based on a review and rating of the applications for funding submitted by the local agencies. The LBAB evaluates the program results annually.

3.5 Call for Applications

A copy of the Application Documents for 2011 is contained in Appendix A.

3.6 Application Process

A copy of a Flow Chart describing the application process is contained in Appendix B.
4.0 Bridge Condition Assessment

The NBIS sets the national standards for the proper safety inspection and evaluation of all highway bridges. The NBIS regulations apply to all publicly owned highway bridges longer than twenty feet located on public roads. These same standards are applied to Michigan’s local bridges.

As the inspection results are the foundation of bridge preservation planning, it is critical the each agency obtain complete and accurate data on the current condition of each bridge in its network. Inspection reporting includes the inspector’s “work recommendations” which should initiate preventive maintenance actions.

4.1 The National Bridge Inventory

The National Bridge Inventory (NBI) is a database covering about 600,000 of the nation’s bridges located on public roads, including Interstate Highways, U.S. highways, State and county roads, and publicly-accessible bridges on Federal lands. It presents a State by State summary of the number, location, and general condition of the highway bridges within each State.

The collection of NBI data is authorized by federal statute and implemented by regulation. The FHWA established National Bridge Inspection Standards (NBIS) for the safety inspection and evaluation of highway bridges; and each State is required to conduct periodic inspections of all bridges subject to the NBIS, prepare and maintain a current inventory of these structures, and report the data to the FHWA using the procedures and format outlined in the Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges.

After evaluation of the inspection data, the FHWA provides States with a list of bridges that are eligible for replacement or rehabilitation based on their sufficiency rating (Section 4.3.7). The FHWA uses the data to submit a required biannual report to Congress on the status of the Nation's bridges, to publish an Annual Materials Report on New Bridge Construction and Bridge Rehabilitation in the Federal Register, and to apportion funds for the Highway Bridge Program.

Use of the NBI data also enables FHWA to satisfy its requirements under law, which mandates the inventory, classification, cost estimates for replacement or rehabilitation, and assignment of replacement or rehabilitation priorities for all highway bridges on all public roads.

4.2 Bridge Safety Inspections

4.0 References

National Bridge Inspection Standards
http://www.fhwa.dot.gov/bridge/nbis.htm

NBIS Bridge Inspection Definitions
http://www.dot.state.mn.us/i35wbridge/pdfs/bridgenspectiondefs.pdf

MDOT Resources and Guides
http://www.michigan.gov/mdot/0,1607,7-151-9625_24768_24773---00.html

FHWA, Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges

AASHTO, Manual for Bridge
The FHWA bridge inspection program regulations were developed as a result of the Federal-Aid Highway Act of 1968 that required the Secretary of Transportation to establish the national bridge inspection standards. The primary purpose of the NBIS is to locate and evaluate existing bridge deficiencies to ensure the safety of the traveling public.

The 1968 Federal-Aid Highway Act directed the States to maintain an inventory of Federal-aid highway system bridges. The Federal-Aid Highway Act of 1970 limited the NBIS to bridges on the Federal-aid highway system. After the Surface Transportation Assistance Act of 1978 (STAA) was passed, NBIS requirements were extended to bridges greater than 20 feet on all public roads. The Surface Transportation and Uniform Relocation Assistance Act of 1987 (STURRA) expanded bridge inspection programs to include special inspection procedures for fracture critical members and underwater inspection.

There are some 10,900 highway bridges in Michigan. MDOT is directly responsible for about 4,500 of them, and administers a biennial inspection program in compliance with NBIS requirements, collecting both NBI data and Pontis element level inspection data. The remaining 6,400 bridges are the responsibility of local agencies, which are required to perform biennial inspections of their bridges in accordance with NBIS. While it is not required that local agencies collect Pontis element level inspection data, MDOT encourages that local agencies do so, as this data is extremely useful when determining a preservation plan for their bridges.

4.3 Bridge Condition and Appraisal

Bridge inspectors carefully inspect and evaluate the entire structure, and assign a numerical rating to each component of the bridge. There are two categories of ratings – condition ratings and appraisals.

Together these ratings define the current condition of the bridge, the extent and severity of deterioration, and its compliance with current standards. Deteriorated and/or substandard bridges can be further classified as “structurally deficient” or “functionally obsolete”. In addition, an all-encompassing “sufficiency rating” is compiled to assess the overall utility of the bridge. The sufficiency rating is used as a method of determining the eligibility of bridge projects for federal funding.

4.3.1 Condition Ratings

Condition ratings are used to describe the existing condition of in-place bridge components compared to their original as-built condition. Evaluation is done for the components of the deck, superstructure, and substructure components of a bridge. The

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Evaluation


FHWA, Guidelines for Installation, Maintenance, and Repair of Structural Supports for Highway Signs, Luminaires, and Traffic Signals

http://www.fhwa.dot.gov/BRIDGE/signinspections.cfm

FHWA, HEC 20 Stream Stability at Highway Structures

http://www.fhwa.dot.gov/engineering/hydraulics/library_arc.cfm?pub_number=19&id=43

FHWA, Scour Publications

http://www.fhwa.dot.gov/engineering/hydraulics/library_sub.cfm?keyword=006

AASHTO, Guide for Commonly Recognized (CoRe) Elements,

https://bookstore.transportation.org/Item_details.aspx?id=1574

Michigan Structure Inventory and Appraisal Coding Guide

condition evaluation of channels and channel protection and culverts are also included. The ratings range from 0 to 9 as follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>NOT APPLICABLE</td>
</tr>
<tr>
<td>9</td>
<td>EXCELLENT CONDITION</td>
</tr>
<tr>
<td>8</td>
<td>VERY GOOD CONDITION - no problems noted.</td>
</tr>
<tr>
<td>7</td>
<td>GOOD CONDITION - some minor problems.</td>
</tr>
<tr>
<td>6</td>
<td>SATISFACTORY CONDITION – structural elements show some minor deterioration.</td>
</tr>
<tr>
<td>5</td>
<td>FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling or scour.</td>
</tr>
<tr>
<td>4</td>
<td>POOR CONDITION - advanced section loss, deterioration, spalling or scour.</td>
</tr>
<tr>
<td>3</td>
<td>SERIOUS CONDITION - loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.</td>
</tr>
<tr>
<td>2</td>
<td>CRITICAL CONDITION - advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored, closing the bridge may be necessary until corrective action is taken.</td>
</tr>
<tr>
<td>1</td>
<td>&quot;IMMINENT&quot; FAILURE CONDITION - major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.</td>
</tr>
<tr>
<td>0</td>
<td>FAILED CONDITION - out of service - beyond corrective action.</td>
</tr>
</tbody>
</table>

As culverts do not have distinct decks, superstructures, and substructures, separate component ratings are not given. Instead, a single “culvert rating” of 0 to 9 is assigned which takes into account the overall condition of the culvert.

4.3.2 Appraisals

Appraisal Ratings rate components in comparison to current standards. The items are used to evaluate a bridge in relation to the level of service which it provides on the highway system of which it is a part. The structure is compared to a new one which is built to current standards for that particular type of road. The appraisals also range from 0 to 9 as follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Not applicable</td>
</tr>
<tr>
<td>9</td>
<td>Superior to present desirable criteria</td>
</tr>
</tbody>
</table>
4.3.3. MDOT Inspection Data Collection

The proper assessment of the condition of bridge elements is the cornerstone of sound bridge management. Element level inspection methods have been adopted by MDOT, and these detailed condition assessments provide the raw inspection information used in the bridge management system’s expanded performance measures, deterioration forecasting, and bridge evaluation.

MDOT collects extended bridge condition data in the NBI format to manage bridges as well Pontis data which is based upon the AASHTO element based inspection system. In addition to the standard NBI ratings, MDOT inspectors record data for 21 elements. MDOT stresses that the inspectors provide detailed comments describing the bridge condition.

Pontis inspection data describes the extent and severity of deterioration observed in the inspection of each element, using condition states numbered from 1 to 5, with condition state 1 representing the least deteriorated (almost new) condition and condition state 5 representing the most severely deteriorated conditions. The MDOT Pontis Bridge Inspection Manual defines the level of deterioration for each condition state for every element comprising the total bridge. As materials and function are different for each element, the description of the defects for each condition state varies from element to element.

Bridge element level inspection consists of performing a field inspection and recording quantities of the element that have observed defects that correlate to the severity of the defects defined in the particular condition state definition of the Pontis Bridge Inspection Manual. The inspector records the appropriate percentage of the total quantity in each condition state. Pontis element level inspection data can be used in advanced bridge management applications.

4.3.4 Structurally Deficient Bridges

Bridges are considered to be “structurally deficient” if the physical condition of any of the major structural components –

MDOT definitions of ‘Structurally deficient’ and ‘Functionally Obsolete’
deck, superstructure, substructure – are rated as “poor” or below (a numerical rating of 4 or less) or if the appraisal ratings for the structure or waterway adequacy are rated as requiring a high priority for replacement (a numerical rating of 2 or less). A culvert is considered structurally deficient if the overall culvert rating is poor or below (4 or less).

4.3.5. Functionally Obsolete Bridges

A bridge is considered “functionally obsolete” if the structural evaluation, deck geometry, under-clearances, approach roadway alignment, or waterway adequacy is rated as “intolerable requiring high priority of corrective action” (a numerical rating of 3 or less. A functionally obsolete bridge may or may not be able to carry all legal loads, but its configuration impairs its ability to carry traffic safely or pass high water.

Information on functionally obsolete bridges can be obtained through MDOT’s Michigan Bridge Reporting System (MBRS), See Sect 4.5.

4.3.6. Closed Bridges

At any given time, a number of local agency bridges around the state of Michigan are closed pending funding for major rehabilitation or replacement. These closed crossings can cause considerable inconvenience to the travelling public by extending travel times, creating troublesome detours, and increasing traffic volumes on available routes.

Some local bridges remain closed for years. While closed the bridge remains on the NBI and remains eligible for federal funding. Bridges which have been closed for over five years will be removed from inventory unless the agency provides documentation of progress being made for the replacement or rehabilitation of the bridge.

One of the goals of a local agency bridge asset management plan is to program preventive maintenance and repairs to avoid the progressive deterioration of bridges to the point where an expensive rehabilitation or replacement project is necessary. In this way potential problems can be addressed before a critical condition develops that may require closing a bridge.

Information on functionally obsolete bridges can be obtained through MDOT’s Michigan Bridge Reporting System (MBRS), See Sect 4.5.

4.3.7. Sufficiency Rating

The sufficiency rating is an important component of determining federal eligibility. The sufficiency rating formula combines structural adequacy (55%), serviceability and functional obsolescence (30%), and essentiality for public use (15%) to obtain a numerical percentage between 0 and 100. The

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For more information:
- [MDOT List of Structurally Deficient Local Agency Bridges](http://www.michigan.gov/documents/mdot/0,1607,7-151-9618_47418-173622--00.html)
- [Federal Sufficiency Rating for Local Bridges](http://www.michigan.gov/documents/mdot_Local_Bridge_Data_for_FSR_and)_
rating is indicative of the bridge’s sufficiency to remain in service, where a score of 100 represents a completely sufficient structure and 0 represents a completely insufficient structure.

The primary use of the sufficiency rating is to determine eligibility for federal bridge funds. A sufficiency rating below 80 qualifies a bridge for funding for rehabilitation, while a sufficiency rating below 50 qualifies a bridge for replacement funds.

The sufficiency rating is not the best indicator of the relative safety of a bridge. The sufficiency rating formula and its components can be found in Appendix B of the MDOT Michigan Structure Inventory and Appraisal Coding Guide.

4.4 Michigan Bridge Inspection System

The MDOT Michigan Bridge Inspection System (MBIS) is an Internet-based application for the collection and retrieval of National Bridge Inspection System (NBIS) and inventory data. This website allows bridge owners or inspectors to complete the required forms online or download them to their computer and complete them remote from an Internet connection.

4.5 Michigan Bridge Reporting System

The MDOT Michigan Bridge Reporting System (MBRS) is a tool allowing bridge owners and inspectors to retrieve bridge inspection information and standardized bridge reports, including network summaries, bridge condition reports, Federal Highway Bridge Program (HBP) eligibility, Inspection Schedules, Scour Critical Structures, Load Rating Needs, Work Recommendations, and Ad-Hoc Reports.

4.6 Michigan’s Bridge Management System

As one of the components of Michigan’s Transportation Management System (TMS), the Bridge Management System (BMS) is the decision-support tool responsible for managing the inspection, analysis, and maintenance of the numerous components that make up a bridge.

The BMS includes data on the more than 10,900 bridges in Michigan. As such, the BMS provides complete coverage of all bridges in Michigan, not just those for which MDOT has responsibility, and supports the efforts of regional and local agencies bridge asset management efforts.

Within the BMS, bridge information is organized into three packages: Inventory – structure and route data; Inspection – record of field examinations and findings; and Work – Maintenance recommendations. Users are able to access each of these packages to monitor or manage data on bridges and their components.
MDOT’s BMS includes a bridge management software tool called Pontis which was developed under an FHWA contract during the early 1990’s, and became an AASHTO product in 1994. Pontis is a data application relying on the collected condition and cost data of individual bridge elements. This data can be useful to provide asset management at the element level.

The system is designed to support the bridge inspection process, recommend a bridge preservation policy, predict future bridge conditions, and recommend actions to perform on one or more bridges to derive the most agency and user benefit from a specified budget. The key features of Pontis include:

- Recording bridge inventory and inspection data
- Scenario modeling, including deterioration prediction models
- Various bridge improvement options, including maintenance, repair, and rehabilitation.
- Economic models to identify and prioritize capital improvements
- Development of an optimal preservation strategy

4.7 Reporting Condition Data

MDOT’s BMS produces three reports to assure a proper level of decision support to the user:

- National Bridge Inventory Bridge Inspection: Information on bridge conditions
- Pontis Bridge Inspection: Information on extent and severity of bridge element deterioration
- Structure Inventory & Appraisal: Information on location, dimensions, material, design, capacity, condition, etc.

The first two reports describe the condition of the bridge at the time of the inspection. The NBI report uses the condition and appraisal evaluations described above, and the findings are presented in the MDOT Bridge Safety Inspection Report (BSIR). The Pontis report describes the extent and severity of the deterioration using the condition state levels described above, and the findings are presented on the Core Elements Inspection Form.

This condition data is the basis for determining a preservation program for each bridge and for prioritizing actions within a bridge asset management plan. The importance of starting with complete and accurate inspection data and “work recommendations” cannot be overemphasized.

4.8 Inspector Recommendations

The bridge inspector is expected to assess and evaluate the
condition of the bridge elements and recommend appropriate corrective action based on his judgment of the condition. These “Work Recommendations” are presented on the Bridge Inspection Report (BIR) Form.

In Michigan bridge inspectors using NBI terminology provide work recommendations at three levels of priority. The work is categorized as High, Medium, or Low priority. The bridge owner takes action based on the inspector’s recommendations. MDOT’s Project Scoping Manual for state trunk line bridges is a valuable resource for local agencies in understanding and implementing work recommendations.

The proper interpretation of the inspection condition data by the owning agency is the foundation for making informed maintenance – repair - replacement decisions in order to develop an optimum strategy for bridge preservation. The local agency should establish a set of metrics as a basis for prioritizing its actions with structural and safety issues taking precedence.

4.9 Structure Evaluation

The Michigan Structure Inventory & Appraisal (S.I.&A.) Sheet calculates a structure evaluation, Item 67, which is an overall assessment of the bridge. The appraisal takes into account the major structural deficiencies, and evaluates a bridge in relation to the level of service it provides, as compared with a new bridge built to current standards. Important factors considered in this appraisal are the bridge load rating and the condition ratings of the superstructure and substructure.

Condition ratings and appraisals are described in sections 4.3.1. and 4.3.2. The bridge load rating, in tons, denotes the safe sustained load capacity of a structure, determined in accordance with the MDOT Bridge Analysis Guide, the AASHTO Manual for Bridge Evaluation, and federal regulations.

Bridge elements having an NBI condition rating of 4 or less exhibit advanced deterioration. These structures are considered to be in poor condition and in need of repair or rehabilitation. If action is deferred and the deterioration is left to progress, the bridge elements will degrade to serious or critical condition.

Bridge elements having an NBI condition rating of 5 or 6 exhibit minor to moderate deterioration. These structures are considered to be sound and in fair condition, but need maintenance or minor repair, and are often good candidates for preventive maintenance.

Bridge elements having an NBI condition rating of 7 or higher exhibit only minor deterioration. These structures are considered to be in good condition, needing scheduled maintenance.

4.10 Relating Bridge Condition and Performance to Maintenance.
Proper condition evaluation is an essential component of an asset management plan for bridge preservation. The appropriate response in addressing recorded condition deficiencies in bridge elements and the preventive measures taken to retard potential future degradation is important for the overall health of the local bridge network. A goal of preservation is to employ preventive and responsive maintenance to sustain the network in good condition longer and to extend the service life of the bridges.

An effective way to achieve this goal is to develop a local bridge preservation plan. A local agency should attempt to maintain its bridges at an appraisal rating of 5 or better and a load capacity that meets the demands of the traffic using the route. It is suggested that the preservation plan improves poor bridges, provides a capital preventive maintenance program to maintain fair bridges in the same condition or better, and addresses its good bridges through a capital scheduled maintenance program.

The combination of potential actions into an appropriate “mix of fixes” enables the local agency to develop an optimum bridge preservation strategy.
5.0 Developing an Optimum Bridge Preservation Strategy

A local agency is encouraged to prepare a bridge preservation plan that includes a capital program designed to maximize the service life of bridges and to achieve optimal use of funding. The capital program may include structural improvements as well as preventive maintenance.

MDOT, through the RBC’s and LBAB’s, annually reviews applications for bridge replacements, rehabilitation and preventive maintenance projects and evaluates the needs based on the applications submitted by local agencies.

Once a local agency has assessed the condition of the bridges in its network, it must then determine the available fixes that will best preserve the system - The Right fix in the Right Place at the Right Time. A properly developed “mix of fixes” usually includes a combination of activities - structural improvements in the form of replacement and/or rehabilitation projects and both scheduled and preventive maintenance programs.

It is advisable to have both short and long-term objectives. Long-term objectives address the need for sustained investment in the bridge network thru capital preventive maintenance while near term objectives address facilities that currently are in poor condition.

MDOT has developed a Project Scoping Manual for state trunk line bridges for the purpose of more accurately and uniformly scoping projects. It serves as a valuable resource for local agencies in determining required fixes and in preparing their preservation plans.

5.1 Types of Potential Fixes

Many types of fixes are available to the local agency. The fixes described in the following sections are generally based on those actions delineated on the lists in MDOT’s Local Bridge Program.

5.1.1 Structural Improvement

Structural Improvement includes any activity that preserves or improves the structural integrity of a bridge. These activities may be replacement or rehabilitation.

Replacement - Projects involving replacement of the entire bridge – substructure, superstructure, and deck, and associated approach work. This work is intended to improve the condition from "poor" to "good", such as:

- Deck Replacement
- Superstructure Replacement

5.0 References

Project Scoping Manual
http://www.michigan.gov/mdot/0,1607,7-151-9622_11044_11367-243045--00.html

Project Scoping Checklist

TR News (pp 26-30) - Michigan’s Bridge Preservation Program
http://onlinepubs.trb.org/onlinepubs/trnnews/trnews228.pdf

LTAP – The Bridge - Bridge Replacement by Agency Work Force
- Substructure Replacement
- Total Structure Replacement

**Rehabilitation** - Major work required to restore the structural integrity of a bridge as well as work necessary to correct major safety defects. This work is intended to improve ratings from “poor” or “fair” to “good.” Some typical rehabilitation projects include:

- Deep or shallow concrete deck overlays
- Superstructure repairs
- Bridge barrier replacement
- Substructure replacement
- Extensive substructure repairs
- Steel repairs
- Concrete beam end repairs
- Geometric upgrades

### 5.1.2 Preventive Maintenance

Preventive Maintenance encompasses both routine scheduled maintenance and capital preventive maintenance.

Routine Scheduled Maintenance is a regularly scheduled activity that maintains serviceability and reduces the rate of deterioration of structural elements. In many instances, local agency forces are able to perform some or all of this work. Examples of routine scheduled maintenance include:

- Superstructure washing*
- Vegetation control*
- Drainage system clean-out and repair*
- Spot painting*
- Joint repair or replacement*
- Concrete sealing*
- Minor concrete patching and repair*
- Concrete crack sealing*
- Approach pavement relief joints*
- Slope paving repair*

*Federal Aid eligible preventive maintenance activity.

Capital Preventive Maintenance is a scheduled work activity that restores element integrity and supports serviceability. This work is intended to address the needs of elements rated “fair.” Examples of capital preventive maintenance include:

- Joint replacement *
- Painting Steel *
  - Complete repainting
  - Zone Painting
- Deck patching *
- Deck Overlays *
  - Epoxy overlays

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**MDOT Capital Scheduled Maintenance Manual**

**MDOT Deck Evaluation Matrix**

**AASHTO Center for Environmental Excellence – Bridge Maintenance - Best Practices**
http://environment.transportation.org/environmental_issues/construct_maint_prac/compendium/manual/7_1.aspx
HMA overlays with waterproofing
HMA cap (no membrane)
- Scour countermeasures
- Pin and hanger replacement

*Federal Aid eligible preventive maintenance activity.

5.1.3 Bridge Maintenance Technical Guidance

Capital scheduled maintenance activities maintain the existing serviceability, and reduce deterioration rates on bridges. CSM work activities sustain the current bridge condition longer, whether the current condition is good, fair, or poor. MDOT’s Capital Scheduled Maintenance Manual provides a thorough description of various preventive maintenance actions.

5.2 Cost Estimating

MDOT’s Capital Scheduled Maintenance Cost Estimate Workbook contains unit prices for various preventive maintenance actions. These values can be used to estimate the cost of alternative maintenance or rehabilitation actions and to evaluate relative costs in determining the optimum program in the preparation of a bridge asset management plan.

The MDOT Bridge Repair Cost Estimate Worksheet also provides useful guidance for estimating cost in scoping projects.

5.2.1 Deterioration Models

The objective of a bridge asset management plan is to determine the optimal preservation decisions in the current year and in future years based on the consequences of alternative actions on the future condition of the system using the data in MDOT’s BMS.

Bridge deterioration models are an essential component of the bridge management system, and express a relationship between condition and time by predicting the future condition of the bridge components based on selected actions or inactions.

Bridge deterioration models use condition rating as the measure of bridge performance. Deterioration models predict the deterioration process as a decay of condition ratings over time, and are built based on expert opinion and inspection history.

5.2.2 Costing Deferred Maintenance

There are two components to consider when evaluating the cost of deferred maintenance. The first is the increased costs due to greater deterioration of the bridge or component and the need to perform more extensive repairs in the future. This must be compared to the benefit of using the available funding for another
project within that time period.

Deterioration models can serve as a basis for determining the cost of deferring specific maintenance or repair actions. As the models establish a relationship between condition and time, the user can predict the future condition of a bridge element based on its current condition, and in this way determine the future increased repair work and associated cost resulting from deferral.

The benefits of a project can include safety, reduced agency or user costs, elimination of traffic congestion, reduction of travel time, better geometrics, improved surface rideability, and operational improvements by addition of traffic control devices.

Deferring work is not a recommended strategy if the cost of deferral exceeds the benefits of the alternate project. As the difference becomes greater, the work becomes more urgent. This type of comparison and its results are factored into the prioritization decision process through the life cycle cost analysis module of a BMS.

5.2.3 In-House Costs vs. Contract Costs

Scheduled maintenance work and preventive maintenance work can be performed by either in-house maintenance crews or by contract. Most local agencies use a combination of the two.

An estimate of the cost of work to be performed by in-house crews should consider: both supervisory and crew labor expenses, including wages, benefits, and other payroll burdens; materials and supplies; equipment operating costs for owned equipment; equipment rental costs, as needed; and administrative costs. The local agency should keep a record of all maintenance work performed by in-house crews in the bridge file for future reference.

Work done by contract with private sector firms generally involves projects too large or too specialized to be done by in-house crews. Estimates of work to be performed by contract may be based on the unit price guide contained in MDOT’s Capital Scheduled Maintenance Cost Estimate Workbook. The local agency’s cost of contract administration and project support should be added to the estimated contract cost.

In its analysis the local agency should consider the potential cost benefits of collaborating with other agencies to combine resources and share the costs of work to be performed in-house or by contract.

The final estimated costs are used in the development of the prioritization plan within the bridge asset management plan.

5.2.4 Life Cycle Cost Analysis

The cost of a bridge is not a one-time expense. A bridge represents a long term, multi-year investment. After its initial
planning, design, and construction, over its lifetime a bridge requires maintenance, repair, rehabilitation, and, ultimately, replacement.

The time period between construction and replacement is the service life of a bridge. The actions and events that influence the condition of the bridge during its service life comprise the life cycle. Bridge owners develop a bridge management strategy by making decisions about bridge materials, design, construction, maintenance, and repairs based on their expectations of costs and results.

Life Cycle Cost Analysis (LCCA) is a computational process for comparing initial and future costs to arrive at the most economical strategy for ensuring that the bridge will provide its intended service for its expected service life. LCCA is essentially a method for considering the economic efficiency of various alternate expenditures.

5.3 Concept of a Mix of Fixes

In its asset management plan, TAMC has adopted the philosophy of “The Right Fix in the Right Place at the Right Time”. This philosophy espouses a program of developing a mix of fixes that results in the optimum use of preservation funds.

By comparing maintenance, repair, and rehabilitation needs for each bridge, the cost of implementing various preservation actions or deferring work can be compared with the cost of completely replacing a bridge. Replacement of a bridge may be warranted if replacement is the most cost-effective means to satisfy the existing structural or functional needs. Alternatively, if the physical condition of the bridge has deteriorated to a point where the bridge is considered unsafe, bridge replacement may be determined to be the only feasible alternative.

A Bridge Preventive Maintenance Strategy developed by the Greater Buffalo-Niagara Regional Transportation Council for its bridges is accessible thru the referenced link.

5.4 Developing a Local Bridge Preservation Plan

Developing and implementing a local bridge preservation plan is a means of extending the useful service life of the agency’s bridges and for using available funds more effectively.

The benefits of a preservation plan to a local agency include:

- an identification and understanding of the condition of the bridges in the network;
- a defined program of rehabilitation, replacement, and preventive maintenance designed to restore the functionality of degraded bridge elements;
a program of regular maintenance to impede deterioration of sound bridges;
dedicated local resources and an increased opportunity to obtain additional funding;
optimal use of all available resources.

The preservation plan should address similar items as described for a systematic plan in Section 2.3.1. Some of the items suggested for inclusion in a local agency preservation plan include:

- Goal – a definition of the agency’s purpose
- Objectives – a description of what the agency seeks to achieve by implementing the plan
- Performance Measures – the metrics by which the agency will evaluate the effectiveness of the plan
- Bridge Assets – a summary of the number, type, and condition state of the bridges in the network;
- Condition Analysis – an overall assessment of the current state of the bridge population;
- Risk Management – a recognition of the risks inherent in degraded bridges and a program to address them;
- Preservation Strategy - the overall actions to be taken by the agency to address preservation;
- Prioritization – agency’s methodology used to rank projects for funding
- Implementation – how the agency will execute the plan;
- Cost Estimate – an annual review and updating of the actions programmed in the plan;
- Operations and Maintenance Plan – the annual activities scheduled in a five year program;
- Five Year Annual Cost Projection – a year-by-year, project-by-project schedule of costs;
- Funding Sources - a year-by-year source and allocation of funds for the five year program.

A sample plan for a local bridge owner following this format is discussed in Section 5.4.3. below.

5.4.1. Risk Assessment

As Local Bridge Program funds are being used for bridge preservation activities, a level of assurance is needed to confirm that the funds are being applied cost effectively to improve and preserve Michigan’s bridges. Local agencies should attempt to prioritize their funding needs according to a risk-based methodology.

The potential risks associated with bridges can include personal injury, property damage, limited commercial access to a region, delays, congestion, and inconvenience arising from bridge collapse or element failure, closures, temporary outages, restricted load postings, or a reduced level of serviceability.
The local agency owner should recognize the potential risks related to each degraded bridge and assess the need for improvement based on impacts of action versus deferral when prioritizing repairs. Structural and safety issues should be given priority. For example, a beam end needing repair that reduces the load rating for a beam may need higher consideration than other repairs that have little or no impact on the bridge load carrying capacity.

5.4.2. Prioritization of Repairs

The local bridge owner seeks to optimize the use of available funding in the implementation of a preservation plan, and, therefore, must establish a priority order for the replacement, rehabilitation, and preventive maintenance actions proposed in the plan. Many factors may be used to rank the importance of projects, and the owner should establish a guideline to accomplish this end. Some of the factors which should be considered in developing a prioritization rating include:

- **Condition** – consider the NBI condition ratings for the deck, superstructure, and substructure for bridges and the culvert rating for culverts;
- **Structural Adequacy** – is the bridge classified as “structurally deficient”;  
- **Load Capacity** – is the load rating sufficient for the traffic routinely crossing the bridge;
- **Operational Characteristics** – is the bridge classified as “functionally obsolete”? Do any of its inadequacies create a safety hazard?
- **Importance** – is the bridge on a primary or secondary route? Is it a designated route for essential services, school buses, or emergency evacuation;
- **Detour** – evaluate the distance, traffic volume, and delay time of the detour route;
- **Cost** – compare the cost of the preservation action using current pricing with the projected cost of deferred action using deterioration modeling (Sect 5.2.2 and 5.3.3).

Each factor in the prioritization formula should be weighted at the discretion of the owner. For example, in the Genesee County Sample Preservation Plan discussed in 5.4.3, the County uses a prioritization formula that evaluates five factors and weights them as follows: condition – 30%; load capacity – 25%; traffic – 20%; safety – 15%; and detour – 10%. The total score is then compared to other proposed actions to establish a priority order.

5.4.3. Sample Local Bridge Preservation Plan

A bridge preservation plan has been developed for the Genesee County Road Commission for the bridges under its jurisdiction. The TMAC has included a copy of the document in Appendix D as a sample for other local agencies.

PONTIS Based Health Indicies for Bridge Priority Evaluation (Define fix life for various repairs)  
Appendix A

Local Bridge Program Application Documents

MDOT Call for Applications 2011
Mr. John D. Niemela, Director  
County Road Association of Michigan  
P.O. Box 12067  
Lansing, Michigan 48901-2067

Mr. Chris Hackbarth  
Assistant Director, State Affairs  
Michigan Municipal League  
320 N. Washington Sq., Ste. 100  
Lansing, Michigan 48933-1288

Dear Mr. Niemela and Mr. Hackbarth:

LOCAL BRIDGE PROGRAM  
DEADLINE FOR APPLICATIONS – MAY 1, 2011  
(Limit of Five (5) Applications per Agency)

We are soliciting applications for candidate projects for the Local Bridge Program. Selected projects will be funded during the 2014 fiscal year. Enclosed are the application requirements. Do not submit projects which cannot be committed to construction within the 2014 fiscal year. The applications can be submitted by the local agency owner or their consultant. The total number of applications from any local agency is limited to five (5). Submitting more than five applications from one agency will be cause to reject all applications submitted.

To be eligible for bridge funds, the structure must meet the definition of a bridge. A bridge is defined as a structure with a total clear span of more than 20 feet, measured along the centerline of the roadway over a stream, watercourse, or opening. For a span bridge, this means that the clear opening span, measured face to face of the inside of the abutments, is greater than 20 feet. Multi-unit culverts are considered bridges if the total length as measured along the centerline of the roadway is greater than 20 feet and if the distance between the culvert units is less than half the diameter of the smallest unit. This description is referenced in item number 112 of the “Michigan Structure Inventory and Appraisal Coding Guide.” There are many multi-unit culverts under local agency jurisdiction that qualify as bridges, and thus, are required to be on the structure inventory and regularly inspected. Please check the multi-unit culverts in your area to see if they qualify under the “definition of a bridge.”

A list of all locally owned bridges in Michigan has been posted on the Michigan Department of Transportation’s (MDOT) website: http://www.michigan.gov/documents/mdot_Local_Bridge_Data_for_FSR_and_Call_for_Applications_148254_7.pdf This list includes the Federal Sufficiency Rating (FSR) value for each bridge. Replacement projects must have an FSR value between 0 and 50 to be eligible for the Local Bridge Program. Rehabilitation projects are eligible provided their FSR values are between 0 and 80. Preventive Maintenance work is eligible for all bridges. The specific work being applied for in preventive maintenance and rehabilitation categories must be listed in the application.
Enclosed is the current scoping document (dated 01/20/2010) which indicates per unit cost estimates of various rehabilitation and preventive maintenance options. This will be helpful in determining the estimated construction costs for different types of repairs. All estimates for projects to be constructed in 2014 should incorporate an annual inflationary factor of four percent. If the structure is over a railroad, include the railroad’s flagging and construction fees.

To assist in the bridge scoping and fix selection process, MDOT’s Scoping Manual (Bridge Distress and Fix Selection Guidelines, Chapter 5, pages 30-48) is posted on the Michigan Department of Transportation’s (MDOT) web site: http://www.michigan.gov/mdot/0,1607,7-151-9622_11044_11367-243045--,00.html

Replacement:
Replacement projects involve replacing the entire substructure, superstructure, deck and necessary approach work.

For replacement projects, at a minimum, the average cost per square foot of proposed deck area should be estimated at $200 for rural roadways and $220 for urban roadways. If a multi-use path or sidewalks are planned but do not currently exist, the estimate needs to clearly indicate the costs of these items. If the project is selected for funding, a master plan showing the path or sidewalk must be provided in order for them to be considered participating within the Local Bridge Program.

The approach costs should be estimated using, at a minimum, $25,000 per station with a minimum approach cost of $100,000. The estimate needs to account for public utilities, such as water mains and sewers, which will need to be altered during construction. Also, if the structure is within a substandard horizontal or vertical alignment, be sure the estimate accounts for the increased approach distance.

Replacement projects need to meet the current American Association of State Highway and Transportation Officials (AASHTO) guidelines and the Load Factor Resistance Design (LRFD) criteria. The minimum overall estimated cost for a replacement project including approach work should be $300,000.

Rehabilitation:
Based on the federal Highway Bridge Program (HBP), rehabilitation is defined as “The major work required to restore the structural integrity of a bridge as well as work necessary to correct major safety defects.” These projects are required to meet the AASHTO guidelines. If a rehabilitation project is over water, a scour analysis will be required during the design phase and the existing foundations will need to be shown to be stable under a scour event. A structure that is found not to be stable during a scour event may not be allowed to proceed to contract. If making the structure stable results in a change in scope, it may be necessary to re-apply during a future call for applications.

For bridge rehabilitation projects, the estimated repair costs will vary by the type of work. Include publicly owned utility relocation costs. Examples of rehabilitation work eligible for funding under the program are:

- Full deck replacement (with or without painting of steel beams)
- Superstructure replacement
Structure widening
Demolition of existing bridge

Preventive Maintenance:
Preventative Maintenance applications can be a single bridge or multiple bridges submitted for similar preventive maintenance work into one application. This can include multiple agencies working together to submit one application. A multiple bridge application will count as one of the five applications any one agency is allowed to submit per year. The Region Bridge Councils will review a multiple structure application as one package and will not rate each structure independently. Preventive Maintenance activities are eligible under the Local Bridge Program. When applying for a multiple bridge 
preventative maintenance project, submit each structure individually. For electronic submission, select “PM-Multiple Structure” as the type of work on each form. For paper submission, identify on the cover sheet that each bridge is part of a “PM-Multiple Structure” application.

Examples of Preventive Maintenance are:

- Painting only (full, zone, or spot painting)
- Pin and Hanger replacement
- Slope paving repair
- Joint replacement and repair
- Drainage system repair (bridge deck drains and bridge approach downspouts)
- Scour Countermeasures
- Concrete crack sealing
- Concrete patching and repair
- Approach pavement relief joint installation
- HMA overlay
  - Shallow deck overlay (removing and replacing concrete surface above the top mat of steel reinforcement)
  - Deep deck overlay (removing and replacing the concrete surface below the top mat of steel reinforcement)
- Temporary Supports
- Expansion or Construction joint repair
- Guard Rail Beam retrofit or installation

The data found on the Structure Inventory and Appraisal (SIA&I) form is used in many of the formula rating point calculations and is one item looked at by your Region Bridge Council when considering discretionary rating points. It is very important that this data be current and correct before submitting the application; incorrect data may significantly affect the rating points. When completing an application, the data stated in the supporting documents must match the data found in the SIA&I form. Conflicting information may be cause to reject an application.

MDOT bridge personnel will review submitted applications for completeness, check the eligibility based on the FSR requirement, and determine the preliminary (computer generated) rating points. Local Agency Program’s bridge staff will perform site visits, verify appropriate scopes of work, and create written site reports. The applications, preliminary rating points, and the site visit reports will then be forwarded to the respective Region Bridge Council for their review and the addition of the discretionary rating points.
The preventive maintenance, structure rehabilitation and replacement, and approach construction costs may be eligible for a maximum of 95 percent participation from federal and/or state funds. The right of way, design engineering, and construction engineering costs are not eligible for Local Bridge Program funds.

The Local Bridge Advisory Board (LBAB) has set a policy for projects coming in over application estimate. If, at the grade inspection stage, the project estimate exceeds the application estimate, the Region Bridge Council may review the project. The council can decide to accept the project at the increased estimate, cap the project at a percentage above the application estimate, or delay the project until the following year. Please take due diligence in getting the most reasonable application estimates.

All applications must include the requirements listed on the enclosed pages. All bridge applications submitted in previous years that have not been selected for funding have been discarded. The Region Bridge Councils and the Local Bridge Advisory Board will only consider applications submitted during the current year’s call. Incomplete applications will be rejected and will be returned to the local agency.

Applications can be submitted using the MDOT Website. Navigate to www.Michigan.gov/MDOT. On the left hand side of the page choose “doing business”, “Local Agency Program” then “Bridge Program”. From here you can access the electronic form to submit your application electronically. Please be sure your Structure Number is correct and have your signed resolution, SI&A, Bridge Inspection Report, cost estimate, location and detour maps, project narrative, letters of support and photos ready to include as attachments. If you only have Adobe Reader on your computer system, please submit physical copies of your applications via mail or delivery service.

Applications submitted via mail or delivery service must be postmarked no later than May 1, 2011. Applications postmarked or submitted on the MDOT Website after May 1, 2011, will be rejected and returned to the local agency. We encourage you to submit your applications early if they are complete.

If you have any questions, or need further information, please contact Mr. Keith Cooper, Bridge Program Manager, at (517) 373-2346.

Sincerely,

Bradley C. Wieferich, P.E.
Engineer of Design

Enclosure
APPLICATION REQUIREMENTS
(Standard and Emergency Applications)

1. Include the most recent Structure, Inventory and Appraisal (SI&A) form and Bridge Inspection form (BIR). These forms must have been updated within the 24-month period, prior to May 1, 2011. The data found on the SI&A form is used in many of the formula rating point calculations and is one item looked at by your Region Bridge Council when considering discretionary rating points. It is very important that this data be current and correct before submitting the application; incorrect data may significantly affect the rating points. The SI&A and BIR forms must be updated electronically on MBIS prior to the May 1, 2011, deadline. Do not send in any marked up forms as we can not update the data for you.

2. Submit a legible map (8 ½" X 11") showing:
   a. Emergency facilities such as fire stations, hospitals or police stations.
   b. Schools and other significant traffic generating facilities.
   c. The alternate routes or detours which must be used as a result of load limits or closures.
   d. Do not color code this map, it will be reproduced on a black and white scanner/copier.

3. For all applications, include a minimum of two photographs of the following:
   a. One showing the structure's alignment.
   b. One showing the structure's profile view.
   c. If the bridge is posted, include one photograph of the bridge clearly showing the current posting sign. These photos need to be of good quality in order to reproduce copies on a black and white scanner/copier.

4. For rehabilitation and preventive maintenance applications, also include photographs of the following:
   a. The deck showing the areas of delamination and patches.
   b. The substructure units showing areas of delaminations/spalls.
   c. The beams showing areas of cracks and delamination for concrete and local areas of corrosion and/or local failure for steel.
   d. The photos need to be of good quality in order to reproduce copies on a black and white scanner/copier.

5. Submit a narrative which includes the following:
   a. The responsible local agency contact person's name, title and telephone number.
   b. Clearly indicate whether the application is for rehabilitation, replacement, and preventive maintenance. For rehabilitation and preventive maintenance, clearly specify work requested for funding.
   c. A statement explaining the economic importance of the structure.
   d. In a short paragraph, if there is currently a detour for the structure, explain "Existing detour currently affects ....".
   e. In a short paragraph, if the structure is or would be closed, explain "If the structure is closed, the detour would affect...."
   f. If the structure is closed, what year the structure was closed.
   g. A statement of any maintenance done on the structure either past or present.

6. Submit a breakdown of the estimated replacement, rehabilitation, and preventive maintenance as follows:
   1. Right of Way (if any) (1) $
   2. Design Engineering (2) $
   3. Construction Engineering (3)$
Total (1, 2 & 3)  

A. Approach Construction  
   (A) $__________

B. Structure Construction  
   (B) $__________

Total (A & B)  
   Total $__________

7. Submit a "Priority List" listing all the structures that you want rated. Any application not containing a total priority list of all applications will be considered incomplete, and will be rejected and returned to the owner.

8. For each application, submit a current resolution, signed and dated, from the governing board supporting the project. Resolutions from previous applications will not be accepted. Letters of local support are recommended but are not mandatory.

9. Do not staple the application together or put in a booklet or binder, as it needs to be reproduced on a black and white scanner/copier.

10. Any application that is not complete will be rejected and returned to the local agency. Common examples of incomplete applications are those that are missing updated SI&A forms, photos of postings, load ratings, missing resolutions, and priority lists. A complete application must be postmarked by the May 1, 2011, deadline.

11. All applications must have a Federal Sufficiency Rating, FSR, value between 0 and 100. A list of all locally owned bridges in Michigan with their respective FSR values has been placed on MDOT’s website. For replacement projects, the FSR value must be less than 50. For rehabilitation projects, the FSR value must be between 0 and 80. All bridges are eligible for preventive maintenance.

12. Previous years’ applications have been discarded. The Region Bridge Councils and the Local Bridge Advisory Board will only review applications submitted during the current call for applications. After the applications have been reviewed and projects have been selected for funding, all non-funded bridge applications will be discarded.

13. Clearly indicate whether the application is for rehabilitation, replacement, or preventive maintenance. For rehabilitation and preventive maintenance, clearly specify the work requested for funding.

Submit all applications to:

Rita Levine  
Local Agency Programs-Design Division, MDOT  
425 West Ottawa Street  
P.O. Box 30050  
Lansing, Michigan 48909  
Phone: (517) 373-0041
<table>
<thead>
<tr>
<th>WORK ITEM</th>
<th>QUANTITY</th>
<th>DIMENSION</th>
<th>UNIT COST</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NEW BRIDGE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple spans, Concrete (add demo &amp; road approach &amp; traffic control)</td>
<td>SFT</td>
<td>$160.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple spans, Steel (as above)</td>
<td>SFT</td>
<td>$175.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single span (or multi span over water), Concrete (as above)</td>
<td>SFT</td>
<td>$180.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single span (or multi span over water), Steel (as above)</td>
<td>SFT</td>
<td>$220.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedestrian Bridge (includes removal, add traffic control)</td>
<td>SFT</td>
<td>$265.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NEW SUPERSTRUCTURE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete (includes removal of old super &amp; new railing, add traffic control &amp; approach)</td>
<td>SFT</td>
<td>$120.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel (as above)</td>
<td>SFT</td>
<td>$150.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over Water (add to new superstructure cost)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>WIDENING</strong></td>
<td>ft. width</td>
<td></td>
<td>$185.00/SFT</td>
<td></td>
</tr>
<tr>
<td>Added portion only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NEW DECK</strong></td>
<td></td>
<td></td>
<td>$70.00/SFT</td>
<td></td>
</tr>
<tr>
<td>Includes removal of old deck &amp; new railing, add traffic control &amp; approach</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DEMOLITION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entire bridge, grade separation</td>
<td>SFT</td>
<td>$27.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entire bridge, over water</td>
<td>SFT</td>
<td>$30.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SUPERSTRUCTURE REPAIR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete Deck Patch (includes hand chipping)</td>
<td>SFT</td>
<td>$32.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HMA Cipp Pipe segment - add bridge rail if req’d</td>
<td>SFT</td>
<td>$1.25/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HMA Overlay with VIP membrane, add bridge rail if req’d (SFT)</td>
<td>SFT</td>
<td>$5.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal of Concrete Weaving Concrete kerb or Scarify Overlay</td>
<td>SFT</td>
<td>$1.50/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epoxy Overlay</td>
<td>SFT</td>
<td>$1.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shotcrete Overlay (includes nitrate and hydro, add bridge rail if req’d)</td>
<td>SFT</td>
<td>$24.00/SFyd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep Overlay (includes nitrate and hydro, add bridge rail if req’d)</td>
<td>SFT</td>
<td>$26.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCI Beam End Repair ($2000-5000 per beam end)</td>
<td>EA</td>
<td>$3,000.00 EA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repairs Structural Steel ($2000 bolted, $5000 welded)</td>
<td>EA</td>
<td>$5,000.00 EA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helical End Replacement (PCI Beams)</td>
<td>SFT</td>
<td>$200.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paint Structural Steel</td>
<td>SFT</td>
<td>$6.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partial Painting</td>
<td>SFT</td>
<td>$10.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pin &amp; Hanger replacement (includes temporary supports)</td>
<td>EA</td>
<td>$6,000.00 EA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SUBSTRUCTURE REPAIR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pier repair (measured x 2), Replace unit if spalled area &gt; 30%</td>
<td>CFT</td>
<td>$200.00/CFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pier repair over water (measured x 2)</td>
<td>CFT</td>
<td>$200.00/CFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abutment repair (measured x 2)</td>
<td>CFT</td>
<td>$200.00/CFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporary Supports for Substructure Repair</td>
<td>EA</td>
<td>$1,800.00 EA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slab Protection repairs</td>
<td>SFT</td>
<td>$50.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MISCELLANEOUS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expansion or Construction Details (includes removal)</td>
<td>FT</td>
<td>$420.00/FT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge Railing, remove and replace</td>
<td>FT</td>
<td>$216.00/FT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thru Beam Railing, weight</td>
<td>FT</td>
<td>$90.00/FT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deck Drain Extensions</td>
<td>EA</td>
<td>$500.00 EA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scour Countermeasures</td>
<td>LSUM</td>
<td>LSUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ROAD WORK</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach Pavement, 6&quot; HDG (add C &amp; G, Sip, Bldg) 4&quot; ea. end</td>
<td>SFT</td>
<td>$8.00/SFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach Curb &amp; gutter (18&quot; ea. end)</td>
<td>FT</td>
<td>$32.00/FT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guardrail Anchorage to Bridge (40&quot;)</td>
<td>EA</td>
<td>$1,400.00 EA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guardrail, Type 3 or 4 (beyond GR anchorage to bridge, &lt;200&quot;)</td>
<td>EA</td>
<td>$20.00/EA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guardrail Endings (end section)</td>
<td>EA</td>
<td>$1,000.00 EA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roadway Approach work (beyond approach pavement)</td>
<td>LSUM</td>
<td>LSUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilities</td>
<td>LSUM</td>
<td>LSUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>LSUM</td>
<td>LSUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TRAFFIC CONTROL - Unit Cost to be determined by Region or TSC T&amp;L</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part Width Construction</td>
<td>LSUM</td>
<td>LSUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crosswinds</td>
<td>EA</td>
<td>$260,000.00 EA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporary Traffic Signals</td>
<td>set</td>
<td>$18,000.00 set</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RR Pylons</td>
<td>LSUM</td>
<td>LSUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detour</td>
<td>LSUM</td>
<td>LSUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>LSUM</td>
<td>LSUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CONSIDERATION (10% - 20%) (see higher contingency for small projects)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MODIFICATION (estimates at 5% but put &quot;5% max&quot; in pay item description)</td>
<td>5%</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>INFLATION (assume 5% per year, beginning in 2011)</td>
<td>5%</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>DOES NOT INCLUDE PE &amp; CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CONSTRUCTION TOTAL</strong></td>
<td></td>
<td></td>
<td>$8.00</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Application Process Flow Chart
Local Agency Programs
Evaluates Condition State of Bridge Assets and Program Effectiveness. LAP
Writes Legislatively Required report.

MDOT's Bridge Management
Determines Percentages and Estimated Regional Funding.
LBAB Sends Info to RBCs & LAP.

Deadline for Bridge Applications to be Submitted to Local Agency Programs

Local Agency Programs
Checks Local Agency Programs
Staff Performs Field Reviews of Each Application and Creates Site Report.
LAP Sends E-mail of Applications to MDOT's Bridge Management Unit. LAP Sends List of Apps to Regional Bridge Councils.

LAP Sends List of Apps to Regional Bridge Councils.

MDOT's Bridge Management
Unit Determines Formula Rating Points and Forwards to Local Agency Programs

Regional Bridge Council Members Review Completed Applications and Meet to Assign Discretionary Rating 3-Year Plan

Regional Bridge Councils Submit Finished Rating Sheets and 3-Year Plans to Local Agency Programs

Local Agency Programs
Copies Final Rating Sheets and Distributes to LBAB

LBAB Meets to Discuss Final Ratings and 3 Year Plans of Each Region. LBAB Sends Acceptable 3-Year Plan to Local Agency Programs

LBAB Notifies Regional Bridge Councils, MDOT, and Local Agencies of Approved Projects and the Updated 3-Year Bridge Program for Each Region

Approved Projects Move to the Bridge Design Phase.

LBAB: Local Bridge Advisory Board
LAP: MDOT's Local Agency Programs
LA: Local Agencies
Appendix C

Act 51 Flow Chart
Appendix D

Sample Local Bridge Asset Management Plan

Genesee County Bridge Preservation Plan

Work in Progress

Draft Attached
DRAFT
Preservation Plan for Genesee County Local Bridges

March 2011

MICHIGAN TRANSPORTATION ASSET MANAGEMENT COUNCIL

TRAN Systems

GENESSEE COUNTY ROAD COMMISSION
Preservation Plan for Genesee County Local Bridges

Purpose:

The Genesee County Road Commission (GCRC) seeks to implement a cost-effective program of preventive maintenance to maximize the useful service life of the local bridges under its jurisdiction.

The GCRC recognizes that limited funds are available for improving the bridge network. Preventive maintenance is a more effective use of these funds than the costly alternative of major rehabilitation or replacement, and we seek to identify those bridges that will benefit from a planned maintenance program.

Goal:

The goal of the program is the preservation of the County’s bridge network.

Objectives:

The GCRC’s objectives in implementing the preservation plan include:

- Establishing the current condition of the bridges;
- Developing a “mix of fixes” that will:
  - Program regular scheduled maintenance actions to impede deterioration of bridges in good condition;
  - Implement selective corrective repairs or rehabilitation to degraded bridge elements to restore functionality;
  - Identify and program those eligible bridges in need of replacement;
- Identifying available funding sources;
  - Dedicated County resources;
  - Maximize opportunity to obtain other funding;
  - Support the County’s application for funding under Michigan’s Local Bridge Program;
- Prioritizing the programmed actions within available funding limitations;
- Having 85% of its bridges rated fair / good and less than 20% classified as structurally deficient or functionally obsolete within 5 years.
**Performance Measure:**

Several metrics will be used to assess the effectiveness of the preservation plan. GCRC 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 structurally deficient and functionally obsolete bridges. A tracking graph will be used to monitor progress toward an objective of having 85% of the County’s bridges rated fair / good and less than 20% classified as structurally deficient or functionally obsolete.

![Graph showing performance tracking](image)

**Progress Tracking**

Also, the preservation plan is intended to extend the period of time that bridges remain in condition states good and fair, thereby increasing their useful service life and reducing future maintenance costs. Based on past inspection records and condition ratings, the GCRC 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 at the good or fair condition state after implementation of the preservation strategy when compared to the base line time before the implementation.
Bridge Assets:

Genesee County is responsible for 121 local bridges – 120 highway bridges and 1 railroad bridge. Detailed inventory data, condition ratings, and proposed preventive maintenance actions for each bridge are contained in the tables in the Appendix. The condition rating is established by GCRC based on the latest NBI inspection data. A summary and distribution of the bridge population is presented in the following table:

<table>
<thead>
<tr>
<th>Bridge Type</th>
<th>Number of Bridges</th>
<th>2010 Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Struc Defic.</td>
</tr>
<tr>
<td>Concrete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slabs</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Tee Beams</td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td>Box Beams</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Arches</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Culverts</td>
<td>5</td>
<td>--</td>
</tr>
<tr>
<td>Steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-Girder</td>
<td>35</td>
<td>19</td>
</tr>
<tr>
<td>Multi-Girder / Composite</td>
<td>5</td>
<td>--</td>
</tr>
<tr>
<td>Culverts</td>
<td>12</td>
<td>--</td>
</tr>
<tr>
<td>Prestressed Concrete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi Girder</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>Box Beam</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Multi Girder / Composite</td>
<td>3</td>
<td>--</td>
</tr>
<tr>
<td>Timber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stringers</td>
<td>4</td>
<td>--</td>
</tr>
<tr>
<td>Total SD/FO/PSTD</td>
<td>35</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td></td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>29.0</td>
<td>11.6</td>
</tr>
</tbody>
</table>

Condition Analysis:

Of the GCRC’s 121 structures, 40 are concrete bridges, 52 are steel bridges, 25 are prestressed concrete bridges, and 4 are timber bridges. The distribution of overall condition is: 30 (24.8%) are poor or lower; 62 (51.2%) are fair; and 29 (24.0%) are good. The GCRC bridge inventory includes 35 (29.0%) structurally deficient bridges and 14 (11.6%) functionally obsolete crossings.

Statewide, MDOT’s statistics for local agency bridges show that 17% are poor, 34% are fair, and 49% are good, indicating that GCRC has a greater percentage of poor bridges compared to the statewide average for local agencies. Correspondingly, GCRC has 75.2% of its bridges in fair/good condition versus the statewide average of 83% for local agency bridges. Statewide, 17.4% of local agency bridges are classified as structurally deficient and 11.3% are functionally obsolete, compared to 29.0% and 11.6% of GCRC’s bridges.
Certain of the severely degraded, structurally deficient, and functionally obsolete bridges require replacement or major rehabilitation. Many 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.

GCRC’s objective in formulating this preservation plan is to have greater than 85% of the County’s local bridges in fair to good condition and less than 20% classified as structurally deficient within 5 years.

Risk Management:
The GCRC 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 or missing expansion joints, etc.

The GCRC addresses these risks by implementing a regular bridge inspection program and a preservation program of preventive maintenance.

GCRC administers the biennial inspection of its bridges in accordance with NBIS and MDOT requirements. The inspection reports document the condition of GCRC’s bridges and are evaluated to identify new defects and monitor advancing deterioration. The summary inspection report identifies items needing follow-up special inspection actions and recommends bridge-by-bridge maintenance activities.

The preservation program 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, then to address other needs based on the operational importance of each bridge and the long term preservation of the network. The inspection results are used to modify and update the operations and maintenance plan annually.

Preservation Strategy:
GCRC’s preservation plan employs a balanced “Mix of Fixes” strategy made up of Replacement, Rehabilitation (R&R), Preventive Maintenance, and Scheduled Maintenance. The aim of this plan is to address the structures of critical concern by targeting poor rated elements, and to improve the overall condition of the bridge network to good or fair condition.

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 preventive work will be performed by the County’s in-house maintenance crews, while the larger more complex work will be contracted.

The replacement, rehabilitation, and preventive maintenance projects are generally eligible for funding under the local bridge program and will be submitted with GCRC’s annual applications.

GCRC’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.

The “Mix of Fixes” strategy combines long-term reconstruction or replacement fixes, medium-term rehabilitation fixes, and short-term preventive maintenance fixes with a regular program of scheduled maintenance. Implementing this balanced mixture, as described in the Operations and Maintenance Plan below, will increase the number of bridges improved each year and preserve the overall health of GCRC’s bridge network.

**Implementation of the Strategy:**

GCRC’s implementation of the preservation plan strategy begins with an annual review of the current condition of each of the County’s bridges using the NBI inspection data contained on the MDOT Bridge Safety Inspection Report and the inspector’s work recommendations contained on MDOT’s Bridge Inspection Report. The inspection inventory and condition data are consolidated in spreadsheet format for GCRC’s bridges in Appendix A-1. Preventive maintenance needs are determined for each bridge and the corresponding actions are identified and assembled on a spreadsheet, sorted by bridge material and type in Appendix A-2.

The preservation actions are selected in accordance with criteria contained in the table below. These criteria are based on MDOT’s Project Scoping Manual, which is intended to address MDOT’s trunkline bridges. GCRC has modified the selection criteria slightly to better address its local bridge network.
<table>
<thead>
<tr>
<th>Preservation Action</th>
<th>Bridge Selection Criteria</th>
<th>Expected Service Life</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Replacement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Replacement</td>
<td>NBI Rating of 3 or less, or when cost of rehabilitation exceeds cost of replacement, or when bridge is scour critical with no countermeasures available</td>
<td>70 yrs</td>
</tr>
<tr>
<td>Superstructure Replacement</td>
<td>NBI Rating for Superstructure of 4 or less, or when cost of rehabilitating superstructure &amp; deck exceeds replacement cost.</td>
<td>40 yrs</td>
</tr>
<tr>
<td>Deck Replacement Epoxy Coated Steel Black Steel</td>
<td>Use guidelines in MDOT’s <em>Bridge Deck Preservation Matrix</em>. NBI Rating of 4 or less for deck surface and deck bottom, or when deck replacement cost is competitive with rehabilitation.</td>
<td>70 yrs 40 yrs</td>
</tr>
<tr>
<td>Substructure Replacement (Full or Partial)</td>
<td>NBI Rating of 4 or less for abutments, piers, or pier cap, or there is existence of open vertical cracks, signs of differential settlement, or presence of active movement, or bridge is scour critical with no countermeasures available.</td>
<td>40 yrs</td>
</tr>
<tr>
<td><strong>Rehabilitation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete Deck Overlays</td>
<td>Guidelines in MDOT’s <em>Bridge Deck Preservation Matrix</em></td>
<td></td>
</tr>
<tr>
<td>Deep HMA / Membrane</td>
<td>NBI Deck Rating &lt; 5 for surface and &gt; 5 for bottom</td>
<td>25 yrs</td>
</tr>
<tr>
<td>Shallow HMA Cap</td>
<td>NBI Deck Rating &lt; 5 for surface and &gt; 4 for bottom</td>
<td>12 yrs</td>
</tr>
<tr>
<td>HMA Cap</td>
<td>NBI Deck Rating &lt; 5 for surface and &gt; 4 for bottom</td>
<td>8 yrs</td>
</tr>
<tr>
<td></td>
<td>NBI Deck Rating &lt; 5 for surface and &lt; 4 for bottom</td>
<td>3 yrs</td>
</tr>
<tr>
<td>Railing Retrofit / Replacement</td>
<td>Deck Rating greater than 5, Railing / Barrier rated less than 5, or Safety Improvement is needed</td>
<td></td>
</tr>
<tr>
<td>Steel Beam Repairs</td>
<td>When more than 25% section loss is present in an area of the beam that affects load carrying capacity, or to correct impact damage that impairs beam strength.</td>
<td></td>
</tr>
<tr>
<td>Prestressed Concrete Beam Repairs</td>
<td>Repair ends of prestressed I-beams when more that 5% spalling is present, or repair areas to correct impact damage that impairs beam strength or exposes prestressing strands.</td>
<td></td>
</tr>
<tr>
<td>Pin and Hanger Replacement</td>
<td>NBI Rating for elements is 4 or lower. Presence of excessive section loss, severe pack rust, or out-of-plane distortion.</td>
<td></td>
</tr>
<tr>
<td>Substructure Concrete Patching and Repair</td>
<td>NBI Rating for abutments or piers is 5 or 4 and less than 30% of the surface is spalled and delaminated, or in response to Inspector’s work recommendation for substructure patching.</td>
<td></td>
</tr>
<tr>
<td>Preventive Maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Deck Joint Replacement</td>
<td>Include when doing deep or shallow overlays, or when NBI Rating for joint is 4 or lower, or when joint is leaking heavily.</td>
<td></td>
</tr>
<tr>
<td>Steel Bearing Replacement</td>
<td>NBI Rating for girders and deck is 5 or higher and rating for bearings is 4 or lower.</td>
<td></td>
</tr>
<tr>
<td>Complete Painting</td>
<td>NBI Rating for paint condition is 3 or lower, or in response to Inspector’s work recommendation for complete painting</td>
<td>15 yrs</td>
</tr>
<tr>
<td>Zone Painting</td>
<td>NBI Rating for paint condition is 5 or 4, or less than 15% of existing paint area has failed and remainder of paint system is in good or fair condition.</td>
<td>10 yrs</td>
</tr>
<tr>
<td>Thin Epoxy Overlays</td>
<td>Deck Surface Rating of 5, 6, or 7 with minor delamination and spalling and/or moderate cracking.</td>
<td>10 yrs</td>
</tr>
<tr>
<td>HMA Overlay Cap without Membrane</td>
<td>NBI Rating of 3 or less for deck surface and deck bottom. Temporary holdover to improve rideability for a bridge in the 5 year plan for rehab / replacement.</td>
<td>3 yrs</td>
</tr>
<tr>
<td>Concrete Deck Patching</td>
<td>Deck Surface Rating of 5, 6, or 7 with minor delamination and spalling, or in response to Inspector’s work recommendation</td>
<td>5 yrs</td>
</tr>
<tr>
<td>Scour Countermeasures</td>
<td>Structure is categorized as scour critical and is not scheduled for replacement. NBI comments in abutment and pier ratings indicate presence of scour holes.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheduled Maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superstructure Washing</td>
<td>When salt contaminated dirt and debris collected on superstructure is causing corrosion or deterioration by trapping moisture, or in response to Inspector’s work recommendation.</td>
<td>2 yrs</td>
</tr>
<tr>
<td>Concrete Surface Washing</td>
<td>When concrete is exposed to salt contamination widespread map cracking is present, or in response to Inspector’s work recommendation.</td>
<td>2 yrs</td>
</tr>
<tr>
<td>Vegetation Control</td>
<td>When vegetation traps moisture on structural elements or is growing from joints or cracks, or in response to Inspector’s work recommendation for brush cut.</td>
<td>1 yr</td>
</tr>
<tr>
<td>Debris Removal</td>
<td>When vegetation, debris, or sediment accumulates on the structure or in the channel or in response to inspector’s work recommendation.</td>
<td>1 yr</td>
</tr>
<tr>
<td>Drainage System Clean-Out/Repair</td>
<td>When drainage system is clogged with debris, or drainage elements are broken, deteriorated, or damaged.</td>
<td>2 yrs</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Spot Painting</td>
<td>For zinc based paint systems only, in response to Inspector’s work recommendation.</td>
<td>5 yrs</td>
</tr>
<tr>
<td>Concrete Crack Sealing</td>
<td>Concrete is in good or fair condition, and cracks extend to the depth of the reinforcement, or in response to Inspector’s work recommendation</td>
<td>5 yrs</td>
</tr>
<tr>
<td>Slope Paving Repair</td>
<td>NBI Rating is 5 or lower, or when slope paving has significant areas of distress or failure, or has settled.</td>
<td></td>
</tr>
<tr>
<td>Install Riprap</td>
<td>To protect surfaces when erosion threatens the stability of side slopes or channel banks.</td>
<td></td>
</tr>
</tbody>
</table>

**Cost Estimate:**

GCRC computes the estimated cost of each typical 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 countermeasures, etc., are computed on a bridge-by-bridge basis. The cost estimates are reviewed and updated annually.

**Operations and Maintenance Plan – Annual Activities / 5 Year Program:**

A primary objective of GCRC’s preservation plan is improvement of the 36 bridges rated poor (4) or lower to a rating of fair (5) or higher within 5 years thru a program of replacement, rehabilitation, and preventive maintenance actions. The work has been prioritized considering each individual bridge’s needs, its importance, present cost of improvements, and impact (cost increase due to increased degradation) of deferral. The 5 year program incorporates comprehensive annual scheduled maintenance activities designed to preserve bridges currently rated fair (5) or higher with the objective of extending their useful service life. The bridge-by-bridge Maintenance Plan is presented in Appendix A-2.

**Project Prioritization Criteria**

Genesee County uses a prioritization formula that evaluates five factors and weights them as follows: condition – 30%; load capacity – 25%; traffic – 20%; safety – 15%; and detour – 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 projects to establish a priority order.
Five Year Annual Cost Projection:

<table>
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<tr>
<th>Preservation Activity</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td><strong>Replacement</strong></td>
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<td></td>
</tr>
<tr>
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<tr>
<td>Bridge 2798</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>1,000,000</td>
<td>387,500</td>
<td></td>
<td></td>
<td>2,137,500</td>
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<tr>
<td>Bridge 2716</td>
<td>600,000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge 2717</td>
<td></td>
<td>1,315,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge 2765</td>
<td>450,000</td>
<td></td>
<td></td>
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<tr>
<td>Bridge 2772</td>
<td></td>
<td>400,000</td>
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<tr>
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<td>1,315,000</td>
<td>880,000</td>
<td>1,162,300</td>
<td>1,200,000</td>
<td>5,607,300</td>
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<td>Bridge 2761</td>
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<td><strong>Preventive Maintenance</strong></td>
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</tr>
<tr>
<td>Project 1</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Scheduled Maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Annual Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Projects for the replacement of bridges 2710, 2723, and 2798 have been programmed and funded. The GCRC plans to replace the remaining bridges on the list beginning in 2012, using a County appropriation of $5,000,000, supplemented by available state and federal funding. If excess funding is available, other replacement / rehabilitation projects will be added to the program.
### Identify Funding Sources:

<table>
<thead>
<tr>
<th>Source</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridges 2710, 2723, 2798</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>GCRC</td>
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<td>240,000</td>
<td>93,000</td>
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<tr>
<td>MDOT / Federal</td>
<td>--</td>
<td>760,000</td>
<td>294,500</td>
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<td>1,054,500</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td>750,000</td>
<td>1,000,000</td>
<td>387,500</td>
<td></td>
<td></td>
<td><strong>2,137,500</strong></td>
</tr>
<tr>
<td>Bridges 2716, 2717, 2765, 2772, 2774, 2780, 2801, 2804, 2813, 2817</td>
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</tr>
<tr>
<td>GCRC</td>
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<td>1,315,000</td>
<td>880,000</td>
<td>855,000</td>
<td>900,000</td>
<td>5,000,000</td>
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<td>Other Sources</td>
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<td>307,300</td>
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<td>880,000</td>
<td>1,162,300</td>
<td>1,200,000</td>
<td><strong>5,607,300</strong></td>
</tr>
</tbody>
</table>
### Appendix A-1

#### Genesee County Bridges - Inventory and Inspection Summary

<table>
<thead>
<tr>
<th>Bridge</th>
<th>Structure Number</th>
<th>Bridge ID</th>
<th>Facility Carried</th>
<th>Paved/Rural Rd</th>
<th>Features Intersected</th>
<th>Main Span Type</th>
<th>Main Span Span (ft)</th>
<th>Main Span Span (ft)</th>
<th>Total No. Length (ft)</th>
<th>Year Built (yr)</th>
<th>Year Accepted (yr)</th>
<th>Inspection Date</th>
<th>Type</th>
<th>Site Bldg.</th>
<th>SuperStr</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>2521</td>
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<td>BRENT RUN</td>
<td>JALD 0015001</td>
<td>1</td>
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<td>04</td>
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<td>58.7</td>
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<td>2794</td>
<td>2794</td>
<td>2794</td>
<td>11/17/2010</td>
<td>6</td>
<td>3</td>
<td>58.7</td>
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<td>BRENT RUN</td>
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<td>Steel Multi-Girder Bridges</td>
<td>6527</td>
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<td>04</td>
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<td>2794</td>
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<td>2794</td>
<td>11/17/2010</td>
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<td>58.7</td>
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<td>2794</td>
<td>2794</td>
<td>2794</td>
<td>2794</td>
<td>11/17/2010</td>
<td>6</td>
<td>3</td>
<td>58.7</td>
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### Genesee County Bridges - Maintenance Plan

#### Appendix A-2

<p>| Facility Code | Facility Name | Facility Location | Length (ft) | Number of Main Spans (Item 45) | Total Str Total | Superstr | Concrete Patching | Concrete Sealing | Concrete Washing | Minor Paving | RipRap Install | Paint Zone Overlays | Concrete Paint Repairs | Steel Beam Repairs | Replacement / Railing Repairs | Repairs | Retaining Wall Repairs | Bridge Deck Repairs | HMA Overlay | HMA w/ Membrane | Concrete Pin and Retrofit | Concrete Deck Wash | Counter Washing | Spot Concrete Sealing | Storm Drainage Clean Out | Support Structures | Bridge Work | Roadway Paving | Railroad Paving | Retaining Wall Paving | Bridge Repair | Roadway Repair | Area Painted |
|---------------|---------------|------------------|-------------|--------------------------------|----------------|----------|------------------|-----------------|-----------------|-------------|----------------|-------------------|-------------------|-------------------|-----------------------------|----------------|-------------------|-------------------|----------------|----------------|--------------------------------|-----------------|----------------|-------------------|----------------|----------------|-------------------|----------------|----------------|-----------------|</p>
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Steel Culverts

Prestressed Concrete Box Beam Bridges

Timber Bridges

Prestressed Concrete/Composite Deck Bridges

Prestressed Concrete Box Beam Bridges - Single or Spread

Steel Girder / Composite Deck Bridges

Steel /Plate Girder Composite