

DEVELOPMENT OF BRIDGE ASSET MANAGEMENT FOR LOCAL GEORGIA
GOVERNMENTS

by

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(Under the Direction of Stephan Durham)

ABSTRACT

Bridge asset management is often an undervalued sector of a local government's infrastructure. Amid more urgent short-term priorities local governments generally do not have the funds or resources to effectively manage their bridges. This study evaluates available resources and practices supporting bridge management to develop feasible local bridge management methods. Evaluating existing practices entailed interviewing and surveying Georgia government representatives. This process demonstrated the lack of funding and processes for managing local bridges as well as the reactive responses towards bridge management across local governments. The preliminary and literature review contributed to the construction of a guide that supports local governments develop a bridge asset management plan. To assess its effectiveness, Spalding County was selected for implementation which included modifications specific to Spalding's goals and resources. The case study resulted in a comprehensive bridge management plan for Spalding County along with additional resources and discussion for different sized local governments.

INDEX WORDS: Bridge, Management, Local, Government

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1.0 | INTRODUCTION

Similar to roadways, bridges are crucial to a community's mobility and economy. Bridges provide the needed link for the transportation of goods and populations. These structures are considerable expenses to maintain and operate, especially for local governments, yet the management of bridges is an undervalued process for local governments. Resources and funds are often limited which pose a challenge when developing a process to better manage and preserve bridge structures.

This research assesses the existing bridge asset management practices of local Georgia governments through the culmination of surveys and several interviews. Furthermore, the research assesses the condition of locally owned bridges through data analysis methods. This process involved data from the National Bridge Inventory and budget reports from Georgia counties. This data was utilized to visualize bridge attributes in ArcGIS, and to implement a decision tree, which is a machine learning method, to identify factors that contribute to a bridge's condition rating. As a result, a local Georgia government bridge asset management guide was created by adopting information gathered through the interviews and surveys along with a literature review of existing guides and practices. The implementation of this guide was executed through a case study with Spalding County, Georgia, in order to create a comprehensive bridge asset management plan for their bridges and assess the feasibility of the implemented guide. The overall results, recommendations, and impact from this study is discussed within this study.

1.1 | Structure of Thesis Chapters

The structure of this thesis encompasses seven chapters that explain the development of bridge asset management for local Georgia governments and its implementation. Chapter 2 presents the

state of bridges in Georgia compared to the nation as a whole. This includes a preview of Georgia's bridge conditions, future plans, and funding sources for bridges. Chapter 3 presents existing bridge asset management practices nationally and for local levels. The problem statement and research objectives are discussed in Chapter 4. The research objectives and research significance in the problem statement guide the purpose of developing bridge asset management for local Georgia communities. Chapter 5, which explains the research methodology, and Chapter 6, which discusses the research findings, are structured in a manner as to present the research approach (Chapter 5) and results from that specific approach (Chapter 6). The conclusions and recommendations from the research approach and findings are resolved within Chapter 7.

2.0 | BACKGROUND

2.1 | State of Bridges in Georgia

According to the *2019 Report Card for Georgia's Infrastructure*, the Georgia Section of the American Society of Civil Engineers (ASCE) rated Georgia's bridges a C+; a grade that signifies a "mediocre" infrastructure that requires attention with, "some elements exhibiting significant deficiencies in conditions and functionality and with increasing vulnerability to risk," (*Figure 1*) [Report Card for Georgia's, 2019]. Fortunately, Georgia receives almost \$1 billion in transportation revenue every year from the Transportation Funding Act (TFA). This increased amount of funding was acquired for Georgia's infrastructure starting in 2015, which has helped raise its grade from the past report card in 2014 from a C- to a C+. However, this reported trend does not reflect the status of locally owned bridges, which are those not operated by the GDOT or off the National Highway System. Off-system bridges refer to those that are not on the National Highway System (NHS). Those that are owned by the NHS are considered on-system bridges and are crucial to the "nation's economy, defense, and mobility". This accounts for approximately 160,000 miles of highway (*What Constitutes a Federal*, n.d.).

The majority of the funding focuses on building new and expanding infrastructure to address growth and economic development in the state of Georgia, which are often GDOT projects. In addition, it is crucial to think ahead for when these funding acts do expire. Local and existing infrastructure needs will continue to dwindle in terms of priority.

GRADING SCALE



EXCEPTIONAL: FIT FOR THE FUTURE

The infrastructure in the system or network is generally in excellent condition, typically new or recently rehabilitated, and meets capacity needs for the future. A few elements show signs of general deterioration that require attention. Facilities meet modern standards for functionality and are resilient to withstand most disasters and severe weather events.



GOOD: ADEQUATE FOR NOW

The infrastructure in the system or network is in good to excellent condition; some elements show signs of general deterioration that require attention. A few elements exhibit significant deficiencies. Safe and reliable with minimal capacity issues and minimal risk.



MEDIOCRE: REQUIRES ATTENTION

The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies in conditions and functionality, with increasing vulnerability to risk.



POOR: AT RISK

The infrastructure is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of significant concern with strong risk of failure.



FAILING/CRITICAL: UNFIT FOR PURPOSE

The infrastructure in the system is in unacceptable condition with widespread advanced signs of deterioration. Many of the components of the system exhibit signs of imminent failure.

Figure 1: Grading Scale for ASCE's Infrastructure Report Card, Reprinted from Report Card for Georgia's, 2019

Within the state of Georgia there are a total of 14,750 bridges and 8,014 of those bridges are locally owned. In 2019, 441 Georgia bridges were classified as structurally deficient. This amounted to about 860,000 daily crossings on structurally deficient bridges (“ARTBA Bridge Report”, n.d.). Additionally, 13,626 Georgia bridges were in need of repair which is approximately 92% of all bridges in Georgia (Belt, 2019). The needed repairs for Georgia, according to The American Road and Transportation Builders Association (ARTBA), is estimated at a cost of \$15.1 billion (“ARTBA Bridge Report”, n.d.). The high volume of needed repairs demonstrates the need for better bridge maintenance. Unfortunately, the existing bridges in local level municipalities and counties are currently in poorer conditions and continue to decline. The lack of funding and tools

needed to prioritize maintenance of their bridges contribute to this decline. Current programs encourage local governments to wait until their bridges deteriorate in order to receive attention from the state. These areas lack proper local bridge management programs, which are crucial for economic development, environmental/sustainability efforts, and most importantly the safety and welfare of the public as well as their mobility and quality of life.

2.1.1 | Recommendations from the Report Card

The Report Card includes recommendations to raise the grade for Georgia's bridges. The main recommendations that are relevant to this research are those that suggest developing additional tools, programs, and funds in order to aid local governments in their bridge maintenance and repair. This section emphasizes that current programs allow local governments to wait until their bridges deteriorate and thus receive care from the state. GDOT currently programs all bridges in Poor Condition to be prioritized for repair, therefore encouraging a worst first approach to bridge maintenance. On the same note, the report card recommends expanding asset management implementation and continuing to, "remove all posted bridges and bridges in poor condition on both the state and local systems" (Report Card for Georgia's, 2019).

2.1.2 | Projected Plan for Georgia Bridges

An important theme in this research is to demonstrate the resources that local Georgia governments lack. For instance, the Georgia Department of Transportation has invested in a Major Mobility Investment Program (MMIP), which is funded by additional collected revenues by the state in a transportation funding program (Pendered, 2016). GDOT's 10-year plan to improve safety and mobility encompasses a formula for funding road and bridge projects. Budgets for fiscal years 2016 and 2017 were significantly increased for the plan, which mainly focuses on projects addressing large structures, such as I-285 as well as I-95 and I-16 (Pendered, 2016). However, the

plan does not focus on local bridges since congestion is mainly focused on populated highway bridges.

Additionally, GDOT recently published a *Transportation Asset Management Plan* (TAMP) for the next 10 fiscal years, 2019-2028 (2019). The plan aligns with the federal requirements: asset management objective and measures, inventory and condition, life cycle planning, risk management analysis, financial plan, and performance gap analysis. Within the plan, GDOT employs life-cycle management practices and effective preservation actions in order to extend the service life of their bridges. These bridges, however, constitute only those on the National Highway System and not local bridges. The expected funds for these bridges are two billion dollars. Aside from safety and bridge condition, there is an emphasis on mobility and freight movement as some of the several key factors that influence its life-cycle planning. The reason for this emphasis is due to Georgia's leading industry in agribusiness, which mobilizes 5.9 million tons (5.4 million metric tons) of freight across the state weekly. In addition, a table that summarizes GDOT's bridge treatments by work type and their associated unit cost is provided within the document which may be helpful for local agencies (*Transportation Asset Management Plan FY 2019-2028*, 2019). The plan overall, however, is not as feasible for local level agencies. GDOT's investment strategies and funding levels far exceed what local agencies are able to obtain.

2.2 | Bridge Value and Effects to Economic Development

Considering the assets that a local agency manages, bridges are typically the most expensive and most valuable assets. From the perspective of local governments, bridges are structures that last a relatively long time, compared to other assets such as roadways and therefore, little preventative maintenance is performed. However, based on a risk assessment and traffic effects perspective, these structures should receive more attention (Herbst, 2007). In 2017, Georgia's bridge

replacement unit cost was \$152 per square foot (\$14 per square meter). A local bridge in Georgia spans approximately 2,000 square feet (186 square meters), which costs \$300,000 to replace (FHWA, 2019). With a now recognized decline in bridge conditions, it is crucial to apply preventive maintenance to reduce the number of bridges needing rehabilitation. Typically, the first indicator will be signs posting weight restrictions on the bridge and rerouting trucks to alternative routes which will hike up costs in delivery, fuel, and hidden costs to consumers (Halsey, 2017). Trucks are crucial to transporting goods and a strong network of conflict-free paths/routes for trucks can improve a city's economic development. Bridges that cannot carry legal loads must be appropriately posted.

According to a report on bridge condition assessment, the process of posting a bridge in Georgia involves the use of the Operating rating as the posting limit for bridges on the state system and the Inventory rating for local bridges. Deciding whether a bridge requires posting involves structural analysis and load testing when appropriate. Georgia currently uses the load factor method, which is one of the three most common methods (Wang et al., 2009). The Inventory rating level generally provides a basis for the estimated capacity of an existing bridge with the capacity for a new bridge and therefore result in a live load that can safely be carried by the bridge for a long time. The Operating level is based on the maximum permissible live load that a bridge can be subjected to for a limited period of time. The Operating level is what generally determines traffic restriction and load posting (Wang et al., 2009).

Currently, 1,319 bridge postings in Georgia are below the legal loads. Most notably is the amount of posted bridges under the management of GDOT versus local agencies. According to the report card, 1.5% of all bridges on the state system, which are managed by GDOT, are posted bridges. Whereas, for local governments there are 31.1% posted bridges. The risk of posted bridges

can greatly impact communities. Critical vehicles, such as school buses and emergency vehicles, may need to use alternative routes that may be limited, especially in rural areas.

Furthermore, commercial vehicles and modern agriculture equipment carry important commodities to a community's economy. These vehicles often utilize public roads and require appropriate routes (Bridge Load Rating, 2018). Georgia, in fact, is a leading industry in agribusiness (i.e production of 1.3 billion chickens annually and timber as a leading state in the nation). The ports in Savannah and Brunswick, Georgia, open commerce to approximately 44 percent of the U.S (*Transportation Asset Management Plan FY 2019-2028*, 2019). In general, investing in transportation infrastructure can improve a local community's economy. An economic study found that every dollar spent on transportation infrastructure returns an expected \$4.00 to \$7.80 (*HB 170: Transportation Funding Act of 2015*, n.d.).

2.3 | Grants and Funding

One of the major disadvantages local governments face is the lack of funding priority for the development of effective bridge asset renewal programs. This section reviews applicable grants and funding programs that local communities could or already utilize in addition to strategic improvements. It is important to note that federal funding does not cover routine maintenance which entails short-term maintenance work due to events or season changes.

2.3.1 | Local Maintenance & Improvement Grant (LMIG)

The Local Maintenance & Improvement Grant is a GDOT program that funds local government's need for improvements on roadways. The program is funded by the state motor vehicle fuel tax. The annual LMIG allocation is based on the total centerline road miles for each local road system and the total population of each county or city as compared with the total statewide centerline road miles and total statewide population (Local Maintenance and Improvement, 2019). Centerline

Mileage is defined as the total length of a given road from its starting point to its end point. The LMIG program will allow local governments greater flexibility and quicker project delivery while allowing GDOT to effectively administer the program with a reduced workforce and new funding match requirements. The grant exclusively applies to local communities which is beneficial to local governments seeking out funding.

2.3.2 | Low Impact Bridge Program

The Georgia Department of Transportation (GDOT) provides a Low Impact Bridge Program that provides expedited project delivery for “least complicated” type bridge replacement projects. The projects that are not selected for the program include those that have impacts to sensitive environmental resources, Federal Emergency Management Agency (FEMA) regulated streams or complex constructability issues, and time-consuming components. The desired candidates meet low-impact requirements such as minimal permits, minor utility impacts, no FEMA coordination, and no on-site detours (Low Impact Bridge Program Manual, 2019). Additionally, they cannot exceed established environmental impact thresholds and thus qualify as a Categorical Exclusion (CE) determination in compliance with the National Environmental Policy Act (NEPA).

2.3.3 | Local Bridge Replacement Program (LOCBR)

Georgia's Department of Transportation Local Bridge Replacement Program (LOCBR), combined with the efforts of local governments, help replace Off-System Deficient Posted Bridges. The replacement of a deficient, posted bridge is a considerable expense for local counties and municipalities. Posted bridges restrict certain vehicle types from crossing. “These include emergency vehicles, school buses, agricultural vehicles and, in some cases, even “Suburban-like” SUVs or pickup trucks.” Within the state of Georgia there are approximately 1,400 posted bridges and the majority are locally-owned. Therefore, the Local Bridge Replacement Program aims to

reduce the number of locally-owned posted bridges. GDOT specifies the type of aid that will be included in the program.

“Within the Local Bridge program, GDOT provides preliminary engineering costs, any utility relocations, all construction costs and 50 percent of the preliminary right-of-way (ROW) estimate that includes all acquisition fees and other related costs” (GDOT Local Bridge Replacement Program, 2018).

The program, created in 2017, is federally funded and selects posted bridges that are locally owned. The first round of candidates was identified in the Spring 2017. A data-driven search was conducted on off-system bridges in Georgia and solicitation letters that detailed the program were sent to the selected bridge owners. *Figure 2* shows the result of either LIBR and LOCBR in Laurens County (Low Impact Bridge Program Manual, 2019).

2.3.4 | Special Purpose Local Option Sales Tax (SPLOST)

A SPLOST is a one percent county sales tax that is optional to county governments and participating qualified municipal governments. This tax is used to fund capital outlay projects (*Special Purpose Local Option Sales Tax*, 2016). Related eligible projects for funding include certain maintenance and repair activities. Examples of bridge projects include acquisition of rights of way, construction, renovation and improvement, relocation of utilities, improvement of surface water drainage, patching, leveling, milling, widening, shoulder preparation, culvert repair, other repairs necessary for preservation and major equipment. Additionally, stormwater and drainage capital outlay projects as a component of a bridge project may be funded. Several communities may depend on SPLOST, but there are some drawbacks in terms of funding for bridges. SPLOST does not restrict funds to be spent only on bridges let alone transportation itself. SPLOST can be utilized for parks, schools, and other public facilities. Additionally, a SPLOST, which only lasts

for five years, must be passed and voted for, usually in the next election. Therefore, if funding for a bridge project is not popular to the community the tax may not pass.



Figure 2: Results of LIBR & LOCBR in Laurens County Reprinted from Low Impact Bridge Program Manual, 2019

2.3.5 | Transportation Funding Act of 2015

In 2014 it was determined that Georgia's annual need was approximately \$1.25 billion for preservation of its existing transportation infrastructure and \$5 billion for all of Georgia's transportation needs (*HB 170: Transportation Funding Act of 2015*, n.d.). Additionally, Georgia's state gas taxes were among the lowest in the United States. This does not include the local sales taxes on motor fuel, which were not restricted to funding transportation needs. Georgia

dangerously depended on federal funds. For instance, more than 55 percent of GDOT's entire budget and more than 62 percent of GDOT's construction budget came from Federal funds. As Georgia continues to grow, The Transportation Funding Act of 2015 (TFA) or House Bill 170 aimed to address these issues. The act generates nearly one billion dollars annually to address infrastructure needs ("Summary of 2015 Transportation Legislation.", 2015). It focuses on opportunities for GDOT to increase maintenance and operations of roadways and bridge management. In terms of a local focus the plan highlights increased LMIG funds, which is oftentimes used for road resurfacing (*Garoads...*,n.d.).

2.3.5 | Transportation Investment Act

Starting in 2012 three Georgia regions voted to approve a 10-year one percent sales tax to fund regional and local transportation improvements. These regions are illustrated in **Figure 3**: River Valley, Central Savannah River Area, and Heart of Georgia Altamaha (Projects by region, n.d.). In 2018, the Southern Georgia Region passed the referendum. Local elected officials select projects for an Approved Investment List in each respective region. Collectively there are 1,023 TIA-funded projects. The tax collections will continue through 2022 for the first three regions and 2028 for Southern Georgia. The management of the budget, schedule, delivery of the projects is executed by GDOT. Currently 75 percent of the proceeds fund regional projects whereas 25 percent of the proceeds fund local projects. Additionally, regions that pass TIA receive a LMIG match reduction from 30% to 10%.

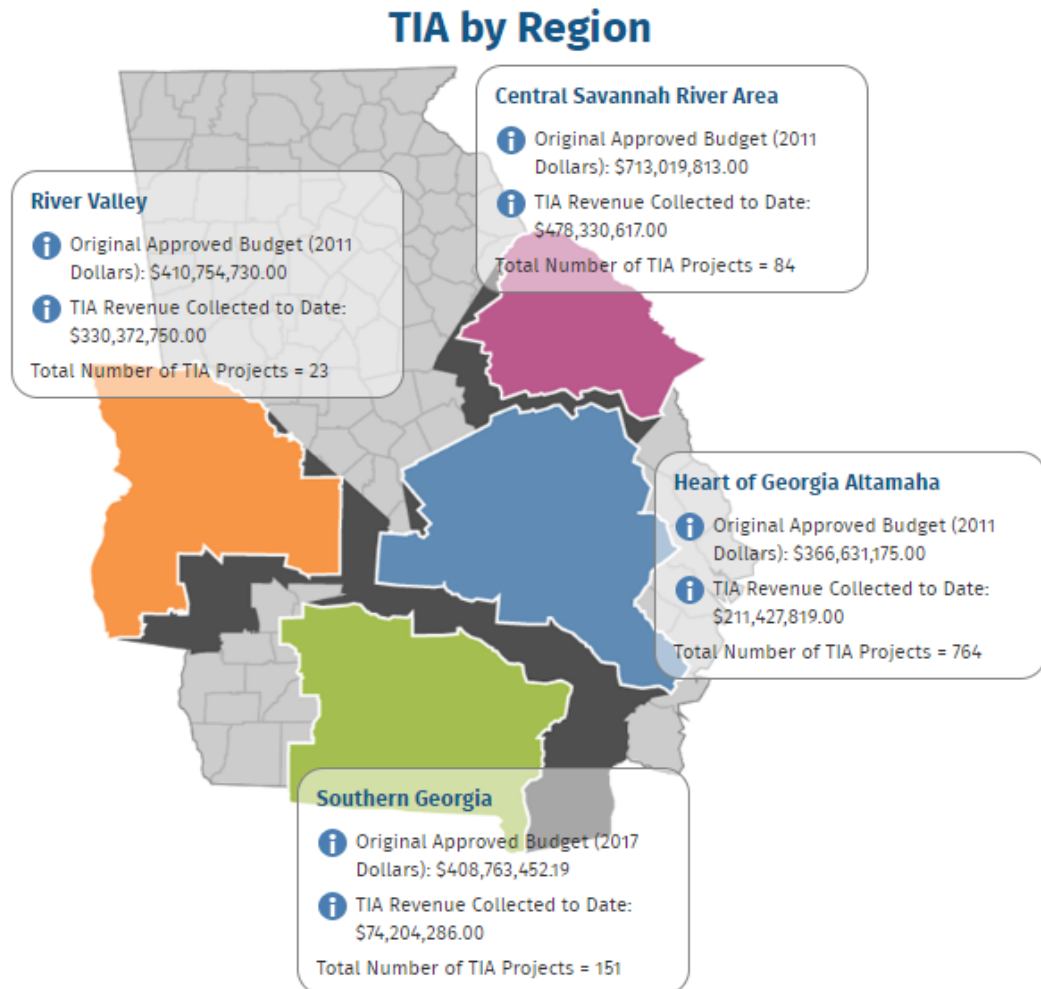


Figure 3: TIA Regions, Reprinted from <http://www.ga-tia.com/Project>

2.3.6 | Georgia Transportation Investment Bank (GTIB)

The Georgia Transportation Investment Bank (GTIB) was created by the State Road and Tollway Authority (SRTA) in order to fund needed transportation improvement projects that would add economic value to local communities and strengthen local transportation networks (Brantley, 2013). There is no funding match required and maintenance and new construction projects can be funded. Furthermore, low interest rates are provided based on the state's borrowing costs. The loan term typically ranges between 5-20 years. The process involves applying for a grant and loan application which gets reviewed in the selection process. Additionally, 2020 loans can be repaid

with LMIG funds, which may interest some local governments. The program has already aided local communities in Georgia providing \$151 million towards competitive transportation projects that “enhanced mobility and driven economic development”. GTIB aims to promote projects that are limited by traditional funding sources in local communities that want to boost its economy and transportation networks.

2.3.7 | Bridge Investment Act 2019

The projected Bridge Investment Act is a competitive grant program that aims to:

repair, improve, rehabilitate, or replace bridges to improve the safety, efficiency, and reliability of the movement of people and freight over bridge crossings, and for other purposes (Brown, 2019).

Eligible projects include projects to replace, rehabilitate, preserve, or protect one or more bridges on the NBI under section 144. Goals of the program are aimed at bridges in poor or fair condition and at risk of falling into poor condition within the next three years and to provide financial assistance that leverages and encourages non-Federal contributions from sponsors and stakeholders involved in planning design and construction of eligible projects. Although the bill is only in its introductory phase, it is important for a local community to establish a preservation plan in advance, which would allow for federal funding in the future.

3.0 | LITERATURE REVIEW

Bridge asset management is a relatively new and developing sector. As a result, there are limited resources and guides that can be utilized and replicated by local governments. The goal of the literature review is to understand the existing context of bridge asset management, study the existing practices at different levels, examine existing bridge asset management guides, and understand the rules that are already in place.

3.1 | State of Bridges in the United States

As reported by the American Road and Transportation Builders Association's (ARTBA) bridge report, over one-third of U.S. bridges are in need of repair work or replacement. **Figure 4** illustrates the percentages. The estimated cost to repair these bridges is nearly \$164 billion (*ARTBA Bridge Report*, 2020). Similarly, ASCE's 2017 Infrastructure Report Card for the nation emphasizes that although the number of bridges in poor condition are slowly decreasing, the average age of the nation's bridges is approaching the end of their design life. The United States' infrastructure grade on bridges is a C plus, which is the same grade for the state of Georgia. According to the report card, the average age of a bridge in America is 43 years old and most bridges were designed to have a lifespan of about 50 years ("Bridges: 2017 Infrastructure Report Card," 2017). The percentages of bridge age groups are shown in **Figure 5**. Almost 40 percent of the Nation's bridges are over 50 years old signifying a wave of needed rehabilitation and replacement in the coming years.

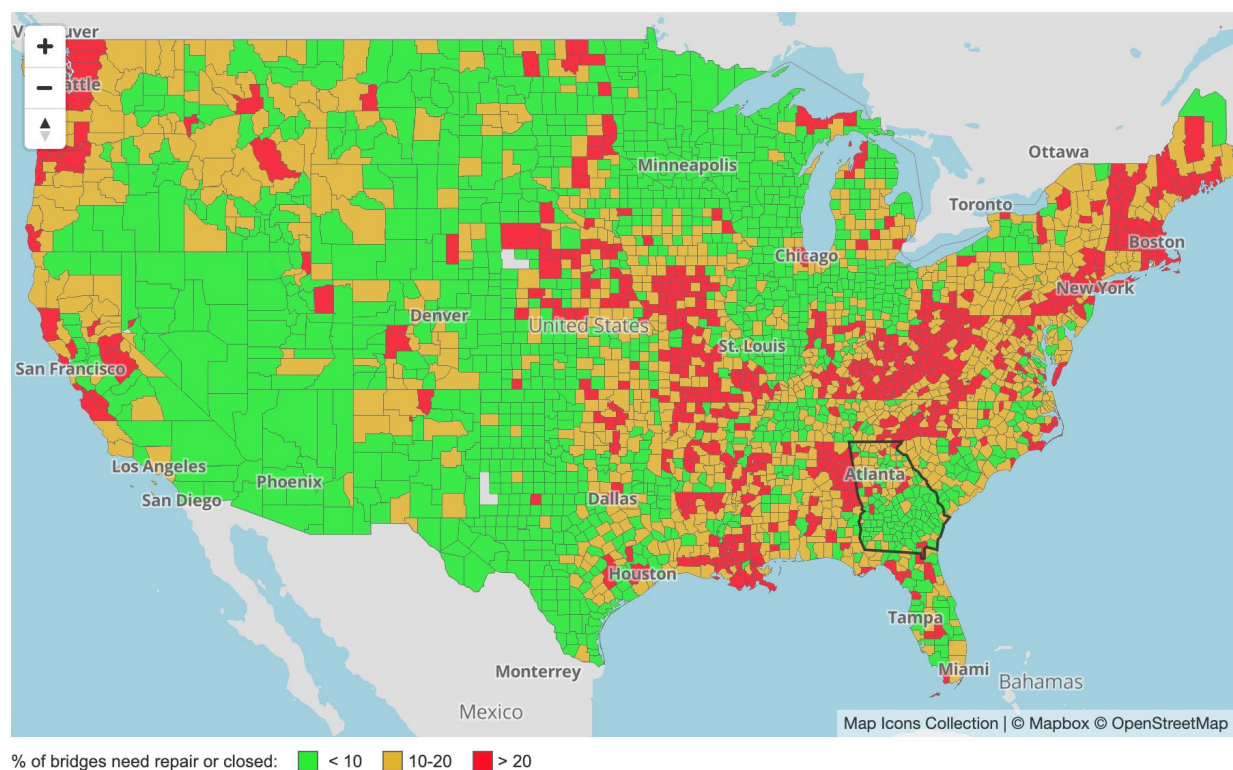


Figure 4: Map of Percentages of U.S. Bridges Needing Repairs (“Bridge Inspections: Georgia.”, n.d.)

The report card recommends all levels of government increase their funding to, “reduce the number of structurally deficient bridges, decrease the maintenance backlog, and address the large number of bridges that have passed or are approaching the end of their design life” (“Bridges: 2017 Infrastructure Report Card,” 2017). Bridge owners should further consider the costs associated with the lifecycle of a bridge in order to make more efficient design choices and prioritize maintenance and rehabilitation. In terms of funding, the report card suggests there is a need to fix the federal Highway Trust Fund by raising the federal motor fuels tax to tie to inflation.

America's Bridges by Age

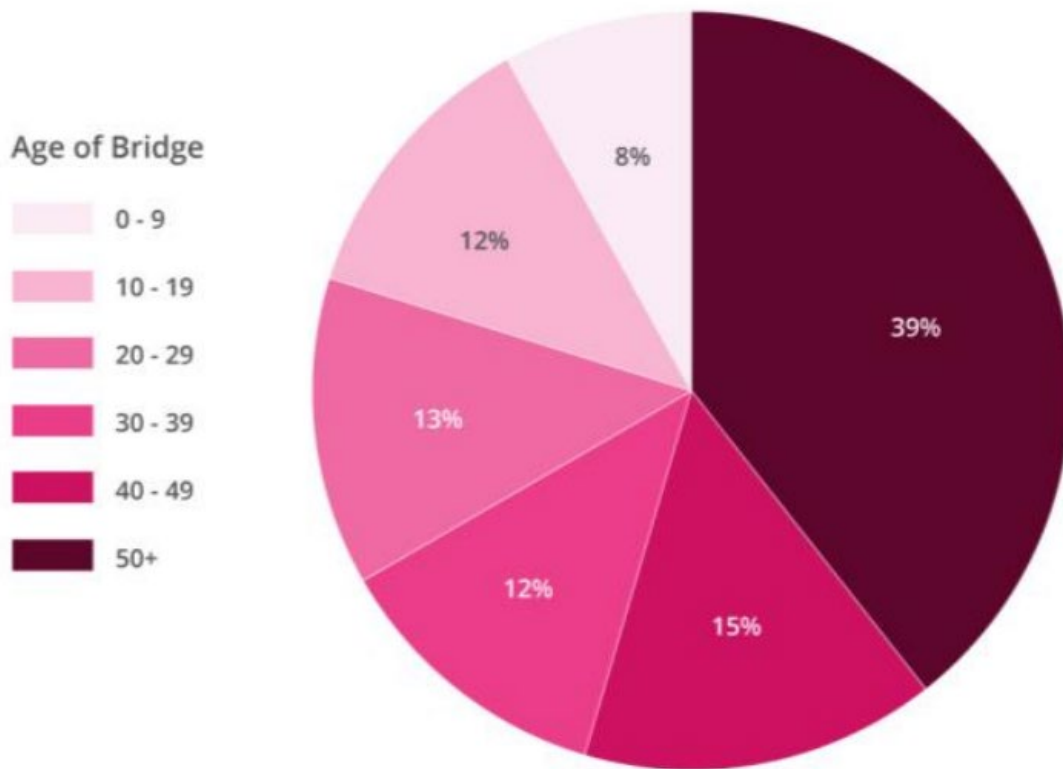


Figure 5: America's Bridges by Age, Reprinted from "Bridges: 2017 Infrastructure Report Card".

3.2 | Need for Bridge Preservation and Maintenance

Before the 1960s there was little consistency in measuring the nation's bridge infrastructure. A system was not in place for maintenance and preservation of bridges at the time. The turning point of the development of bridge programs was in part due to the collapse of the Silver Bridge in Point Pleasant, West Virginia, in December 1967. Following this time period, inspection programs, bridge data collection, formal bridge maintenance and improvement programs and modern management systems began to develop (*Transportation System Preservation*, 2008).

The *Transportation System Preservation Research, Development, and Implementation Roadmap* was developed with the Federal Highway Administration (FHWA), AASHTO, and

Transportation Research Board (TRB) to provide a systematic approach to pavement and bridge preservation. FHWA maintains the inventory for all bridge structures that have a total span larger than 20 linear feet (6.1 meters) and the data is updated annually. **Figure 6** displays the age distribution of all bridges in the U.S. until 2001, this includes bridges on the National Highway System (NHS) and those that are not (Non_NHS). By the 1960s, the amount of bridges dramatically increased. The need for bridge preservation also increased and therefore the benefit of FHWA's roadmap is to educate the importance of a preservation program and develop implementation towards preservation for bridges (*Transportation System Preservation*, 2008).

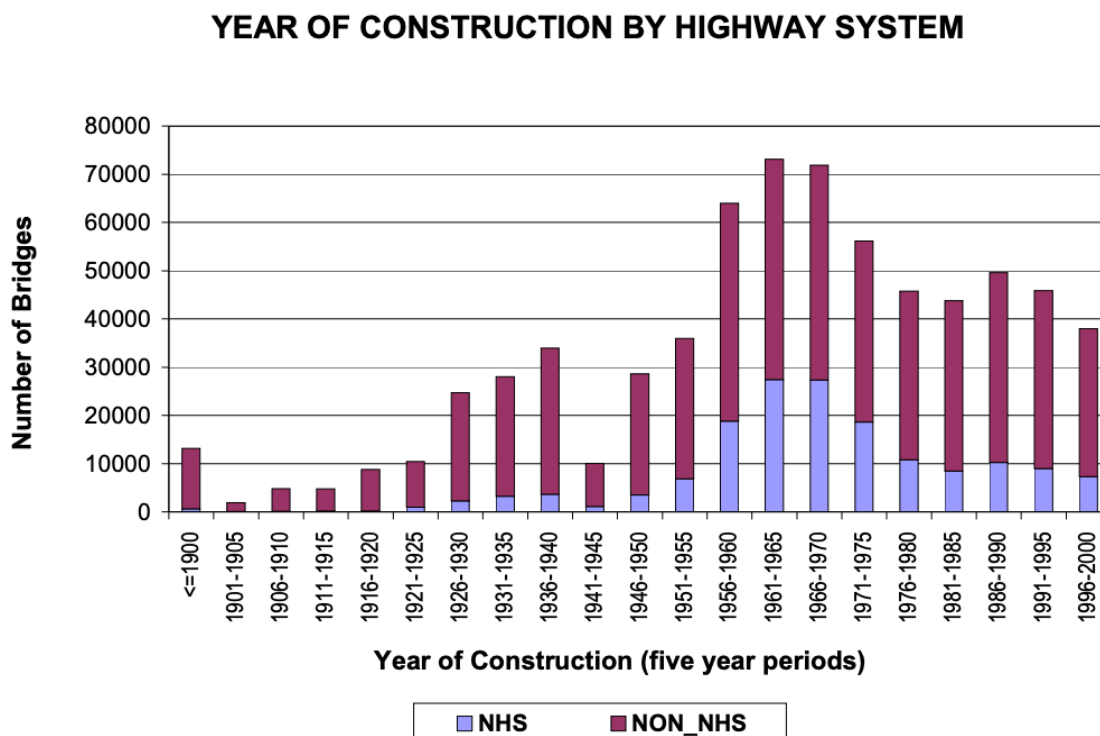


Figure 6: Age Distribution of All Bridges in the U.S., Reprinted from *Transportation System Preservation*, 2008.

Workshops for the bridge preservation roadmap were conducted to aid in the identification of areas of concern, clearly examine expert recommendations related to pavement and bridge preservation, and to organize those statements by priority in the respective research and

development roadmap. Within the bridge preservation sector, 46 experts carried out the activities of the workshop. These experts represented highway agencies, FHWA, TRB, industry, and academia. This workshop is advantageous in learning the obstacles that most agencies face when developing an asset management preservation plan for bridges. The complete list of statement needs is divided into sections: Asset Management, Decks and Joints, Superstructures, Substructures, Selection, and Performance of Preservation Actions. Following the activities of the workshop, the statements were then assembled into priority categories in **Figure 7**. The top priority titles for asset management are Evaluation Analysis and Documentation of Successful Bridge Preservation Practices; and Development of a Process for Estimating the Remaining Service Life (RSL) of Bridge Components and the Overall Bridge System Based on Observable Data.

There were additional issues that different experts identified in the workshop, which are relevant to this research. Statements that were agreed upon showed concern over the effect of preservation treatments being difficult to account for in decision-making processes, such as management systems. Additionally, preservation practitioners are unable to present the benefits of preservation programs in terms that are familiar and informative to upper management and legislatures. Lastly, securing funds for dedicated preservation programs is generally difficult in light of budgets, priority lists of necessary maintenance, rehabilitation work, and a general misunderstanding of the benefits of preservation programs. In terms of knowledge the roadmap emphasizes that,

“Well focused research studies, aimed at determining, calculating and documenting the safety, operational and financial benefits of preservation programs would provide the knowledge to support requests to agency leadership for dedicated funding” (*Transportation System Preservation*, 2008).

		<u>Bridge Preservation Needs Statements</u>	<u>Index of</u>
			<u>Importance +</u>
<u>Priority Ranking</u>	<u>Needs Statement #</u>	<u>Title</u>	<u>Priority</u>
1	Superstructures 04	Improved Inspection Techniques for Steel Prestressing Strand, Cables, and Ropes	2.54
2	Performance 01	Quantify the information necessary to guide bridge preservation decisions	2.11
3	Decks & Joints 01	Best practices for preserving bridge decks	2.06
4	Selection 01	Implementation of Preservation Practices on Highway Bridges by State DOTs	2.04
5	Substructures 01	Preservation of concrete highway bridge substructure units by preventing or delaying the initiation of active corrosion of the steel reinforcement	1.87
6	Asset 07	Evaluation, Analysis, and Documentation of Successful Bridge Preservation Practices	1.79
7	Substructures 02	Preservation of concrete highway bridge substructure units by controlling the corrosion rate of the steel reinforcement once corrosion has initiated	1.74
8	Superstructures 03	Performance Assessment of Existing Concrete Structure Corrosion Prevention/Mitigation Technologies	1.72
9	Selection 02	Develop bridge design guidelines to enhance Constructability and Maintainability	1.66
10	Performance 02	Develop deterioration models that account for the performance of preservation actions	1.65
11	Substructures 04	Substructure preservation decision matrix to address corrosion issues of the steel reinforcement of concrete bridge substructure elements	1.62
12	Asset 03	Development Of A Process For Estimating The Remaining Service Life (RSL) Of Bridge Components And The Overall Bridge System Based On Observable Data	1.57
13	Decks & Joints 03	Determine the recommended practice and the life-cycle cost savings for using sealers to preserve concrete bridge decks	1.39

Figure 7: Top Bridge Preservation Priorities, Reprinted from Transportation System Preservation, 2008.

Aging of the bridge infrastructure inventory has caused the Department of Transportation agencies to critically focus on bridge preservation and replacement needs, while often faced with constrained or reduced budgets every year. A strategic bridge preventive maintenance program has been shown to be an effective way to preserve and extend bridge service lives. A bridge preventive maintenance program is related to routine practices that are repeated with some particular frequency to obtain the best results. Moreover, it is well known that frequently performing less-costly preventive maintenance activities results in a more efficient alternative than performing fewer expensive repairs/rehabilitation or even replacements of bridge elements as

shown in **Figure 8** (Bowman, 2015). It illustrates the performance level over the age of the bridge with different types of bridge preservation treatments. The application of preventative maintenance is done more frequently but results in a consistent performance level over time.

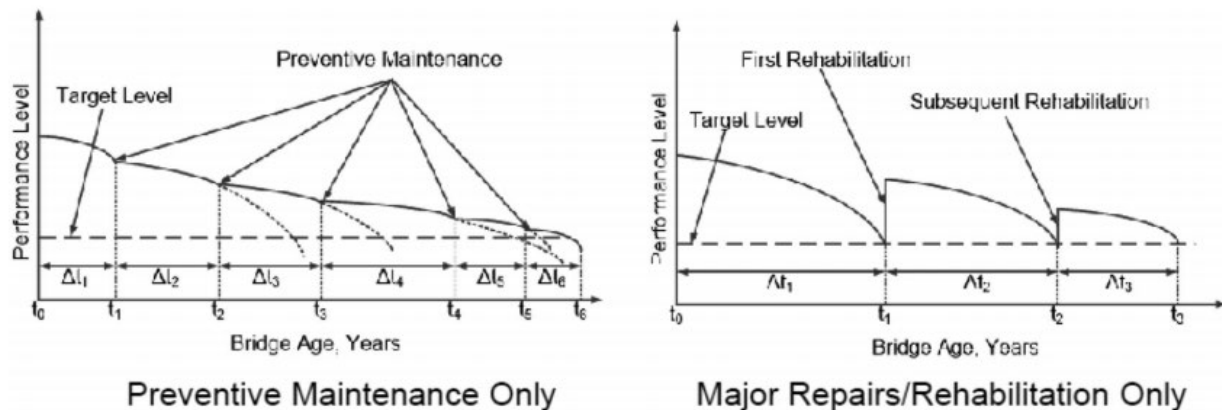


Figure 1.2 Application of two different preservation treatments. Left: only preventive maintenance activities; right: major rehabilitation works (Dunne, 2014b).

Figure 8: Application of Two Different Preservation Treatments, Reprinted from Bridge Preservation Treatments and Best Practices, 2015

3.3 | Existing Bridge Management Guides

There are several resources that can be examined to establish and benefit the development of a local government bridge asset management plan. One of those is *The Federal Administrative Highway Guide to Preservation*, which addresses management strategies within the preservation stage of the bridge's life cycle (2018). Bridge preservation is defined 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/fair condition; and extend their service life.” **Figure 9** outlines the three stages of bridge asset management: preservation, rehabilitation, and replacement. The guide focuses on two types of maintenance: cyclical and condition-based (*Bridge Preservation Guide*, 2018).

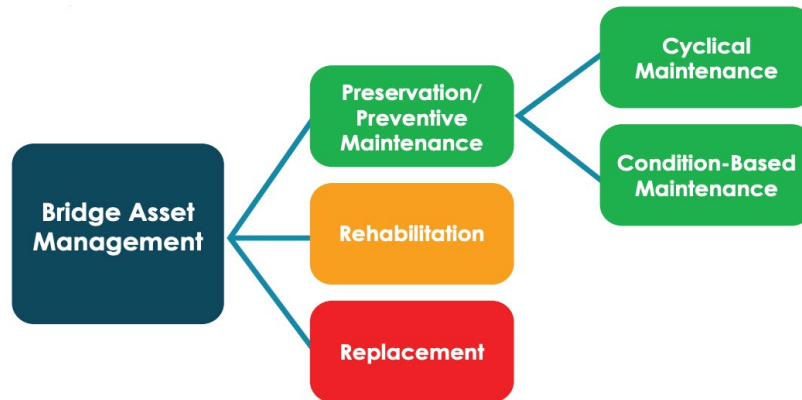


Figure 9: Bridge Action Categories, Reprinted from Bridge Preservation Guide, 2018.

As the guide emphasizes, bridge preservation is intended to slow down the need for rehabilitation and replacement. The Preservation stage ranges from “good” condition to “fair” and can overlap into the Rehabilitation stage. **Figure 10** graphically presents the three stages over time and the condition level at each stage. A general guideline to follow within the preservation phase includes a “needs identification method” that is consistent, definitive, and able to be performed cyclically. This method should use or be based on: National Bridge Inventory (NBI), major component condition ratings, detailed inspections and scopes, or element-level condition data. Fortunately, in the state of Georgia the inspections follow this rating system. Moreover, there should be a strong need for the agency to have commitment to asset preservation and for their network goals to guide the allocation of resources. These goals would additionally include a process for categorization and prioritization that will be consistently utilized. Finally, the guide suggests a need to include a verification and feedback system for the work that has been completed.

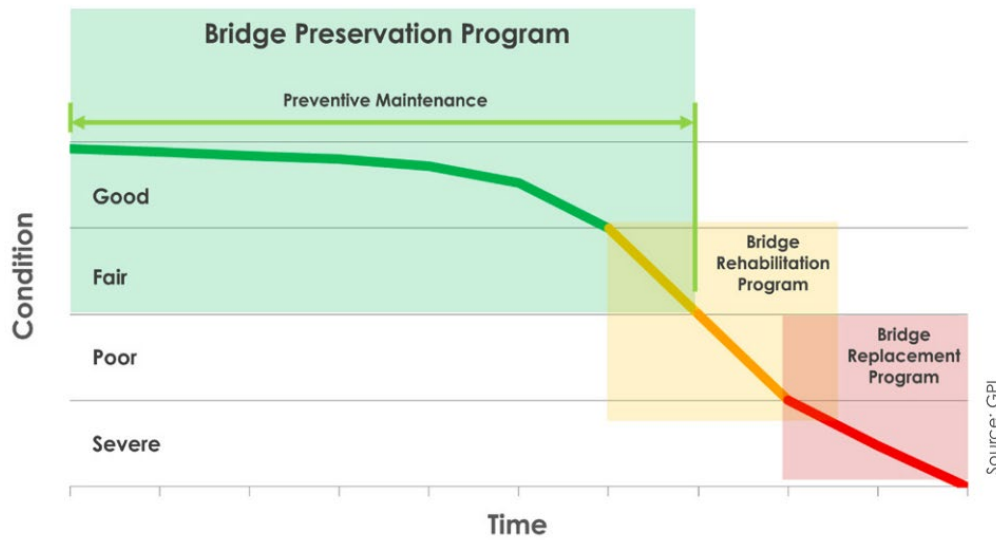


Figure 10: Bridge Condition Over Time, Reprinted from Bridge Preservation Guide, 2018.

Bridge preservation actions include the two types of preventative maintenance: Cyclical and Condition-Based. Cyclical maintenance activities are actions performed at set intervals in order to preserve and delay deterioration of bridge elements or component conditions. Condition based maintenance activities are those that are performed in response to a known defect. These actions can be determined through an inspection process. Rehabilitation and Replacement typically occurs when the bridge is in poorer condition and is required when preventative maintenance is no longer productive. Life cycle costs are typically used to compare costs between rehabilitation and replacement. If rehabilitation is selected, the work would restore the structural integrity of one or multiple components or elements of a bridge. It can further correct critical safety defects. Rehabilitation involves extensive work such as additional engineering design, completion schedule, and higher costs. On the same note, selecting replacement will also involve major work and resources as a result of meeting current geometric construction and structural standards for the projected traffic volume.

The design life and service life of a bridge or elements/components of a bridge are considered when performing any maintenance activity. The design life of a bridge or its

components is constrained by the design standards set by the designer. This will include the parameters that are specified in order for the structure to function within a given period of time. Therefore, codes and specifications are necessary to determine the parameters. On the other hand, the service life establishes the period of time that the item will perform overall. Service life of a bridge and its components can be extended with preventative maintenance activities. An owner agency can begin a bridge preservation program with basic cyclical activities and then develop additional preventative maintenance activities. Within **Figure 11**, there are steps that can be taken over a period of time.



Figure 11: Steps toward Establishing a Bridge Preservation Program, Reprinted from Bridge Preservation Guide, 2018.

The first few steps involve the agency identifying goals, objectives, and bridges to preserve that align with those goals. Preservation for selected bridges in this case must be feasible and cost effective. One of the obstacles for this step could include an agency having difficulty prioritizing and effectively identifying which bridges to preserve amidst limited funds. Subsequently, actions

for preservation and their rules need to be developed. These will consist of the cyclical and condition-based maintenance activities; however, considerations need to be made for how the preservation of a bridge maintenance element (BME) can protect national bridge elements (NBE). Once a rule is met, additional evaluation must be conducted to determine if the action is feasible. Other considerations include: net benefit of an action, duration of extension of service life, availability of specialty contractors, traffic operations, etc.

3.3.1 | Bridge Asset Management for Local Levels

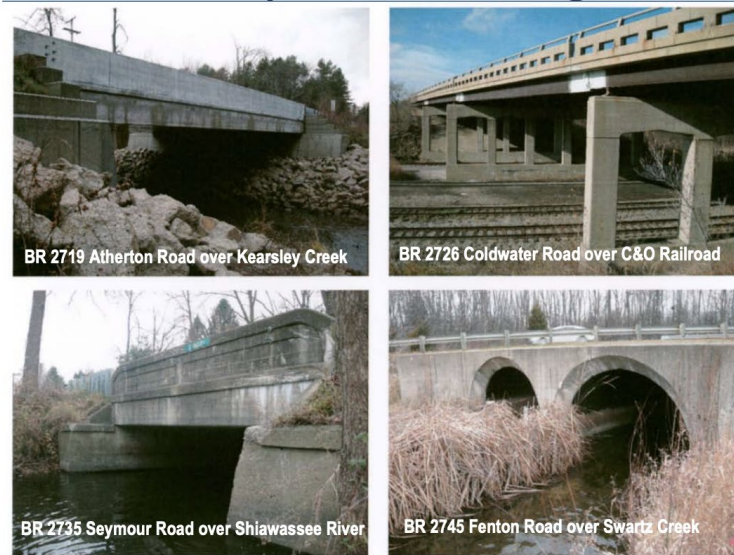
For local Georgia governments, GDOT does not define a specific asset management process. However, other states like Michigan provide a guide specific to local sized agencies. Michigan's Transportation Asset Management Council (TAMC) created a local bridge asset management guide; *Asset Management Guide for Local Agency Bridges in Michigan*. They suggest strategies on how to relate bridge condition and performance to maintenance by developing a local bridge preservation plan (*Asset Management Guide*, 2011). In terms of planning for the costs of a bridge preservation plan, the guide includes cost estimating as an important step. Some resources that the guide provides include MDOT's capital *Scheduled Maintenance Cost Estimate Workbook* and *Bridge Repair Cost Estimate Worksheet*, which provides unit prices for various preventive maintenance actions. Section five of the guide explains the two components of the cost to defer maintenance: increased costs due to greater deterioration and need to perform more extensive repairs in the future. This would be compared with the advantages of using available funding for another project in the same time period. Furthermore, the guide suggests that deterioration models can be utilized as a basis for determining those costs.

Another pertinent issue facing local governments is the decision between in house costs and contract costs. Local agencies typically use both means. Keeping a record of all the costs for

in house maintenance tasks is recommended to use as reference when leveraging in house costs over the contract costs. A method specific to TAMC is their concept of a “Mix of Fixes.” The idea compares maintenance, repair, preservation, rehabilitation needs, and deferring work to the cost of replacing the entire bridge. This would ensure the most cost-effective method in meeting a bridge’s structural and functional needs. Moreover, the guide provides a sample local bridge preservation plan, which is for Genesee County, Michigan.

The cover is shown in **Figure 12**. The implementation of the county’s strategies outlines a table that provides the preservation action, the bridge selection criteria and expected service life. A section of this table is provided in **Figure 13**. The project prioritization criteria used by Genesee County follows a formula that has varying weights for load capacity, traffic, safety, and detour. Finally, a five-year annual cost projection is outlined in the plan which highlights the subtotals for replacement, rehabilitation, and preventative maintenance respectively each year (*Asset Management Guide*, 2011).

Preservation Plan for Genesee County Local Bridges



May 2011



MICHIGAN TRANSPORTATION
ASSET MANAGEMENT COUNCIL



Figure 12: Preservation plan for Genesee County, Reprinted from Asset Management Guide, 2011

Preservation Action	Bridge Selection Criteria	Expected Service Life
Replacement		
Total Replacement	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	70 yrs
Superstructure Replacement	NBI Rating for Superstructure of 4 or less, or when cost of rehabilitating superstructure & deck exceeds replacement cost.	40 yrs
Deck Replacement Epoxy Coated Steel Black Steel	Use guidelines in MDOT's <i>Bridge Deck Preservation Matrix</i> . NBI Rating of 4 or less for deck surface and deck bottom, or when deck replacement cost is competitive with rehabilitation.	70 yrs 40 yrs
Substructure Replacement (Full or Partial)	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.	40 yrs
Rehabilitation		
Concrete Deck Overlays	Guidelines in MDOT's <i>Bridge Deck Preservation Matrix</i>	
Deep	NBI Deck Rating < 5 for surface and > 5 for bottom	25 yrs
Shallow	NBI Deck Rating < 5 for surface and > 4 for bottom	12 yrs
HMA / Membrane	NBI Deck Rating < 5 for surface and > 4 for bottom	8 yrs
HMA Cap	NBI Deck Rating < 5 for surface and < 4 for bottom	3 yrs

Figure 13: Implementation of County's Strategies, Reprinted from Asset Management Guide, 2011

3.4 | Existing Systems and Practices in Bridge Management

There are systems and practices that are effectively managing bridges which can be built upon. Large state agencies have the resources to acquire several methods and maintenance activities for their bridges. However, local agencies will not have the funds to invest in a large number of activities. In the best interest of local governments, a specialized group of bridge maintenance activities that are proven to be effective will make the most of local resources. Research performed by Bowman and Moran reviews bridge maintenance activities recommended by specialized literature. Additionally, the research examines maintenance activities currently conducted by the various Indiana Department of Transportation (INDOT) districts, and reviews maintenance activities performed by several other DOT agencies.

Based on the results of this review, a list of ten new and enhanced bridge preventive maintenance activities was identified to improve the effectiveness of bridge maintenance operations in Indiana shown below in **Figure 14** (Bowman, 2015). The required conditions and frequency to perform each activity was analyzed, and the cost and benefit of such operations was studied to ensure that the proposed activities are economically feasible and sustainable. The findings provide a beneficial methodology guide of preventative maintenance. The guide includes descriptions, supplies needed, materials, labor, pictures and procedures for each of the 10 tasks. The findings also propose a technical training program. Although a certain amount of local governments will be able to fund such a program, some will most likely be unable to provide a specialized preservation crew and program. However, those contracted out to carry out treatments may be evaluated and selected based on these tasks.

Recommended bridge preventive maintenance activities.

No.	Bridge preventive maintenance activities	Frequency (years)
1	Deck sweeping/cleaning	1
	- deck sweeping/cleaning	1
	- drainage system cleaning/washing	1
2	Concrete deck maintenance	
	- deck sealing	5
	- deck crack sealing	5
	- deck partial patching	5
3	Joints maintenance	
	- joints cleaning/flushing/resealing	1
4	Bearings maintenance	
	- bearings, seats and slope wall cleaning/flushing	2
	- lubricating	4
	- spot painting	10
5	Approach slab maintenance	
	- sweeping and cleaning	1
	- drainage system cleaning/flushing	1
	- seal approach deck/cracks	5
	- joints cleaning/flushing	1
6	Superstructure washing	
	- cleaning/washing	2
7	Spot painting	10
8	Vegetation control	1
9	Remove debris from piers/abutments	1
10	Pin/hanger (or hinge) connection maintenance	
	- clean/flush connection members	2
	- lubricate connection members	4
	- spot paint connection members	10

Figure 14: *Recommend Bridge Preventative Maintenance Activities, Reprinted from Bridge Preservation Treatments and Best Practices, 2015*

Similar to the review conducted by Bowman and Moran, a scan team from the National Cooperative Highway Research Program (NCHRP) performed a review on the *Best Practices in Bridge Management Decision-making*. This report, on the other hand, focuses on the “identification, prioritization, and execution of programs for management of highway bridges” (Weykamp et al., 2008). The in-depth report provides key findings and observations studied from 24 U.S. transportation departments. The findings include those from three categories: the bridge management process, preventative maintenance, and agency support. Furthermore, within the

bridge management process, four elements of that process include: identification of maintenance needs, performance measures, prioritization, and verification.

Some key recommendations propose utilizing owner-specific performance measures in order to allocate funding levels for all activity types i.e. maintenance, preservation, rehabilitation, and replacement. The performance measures utilize priority indicators such as the NBI bridge condition rating, health index, etc., to set values for the fitness of a bridge (Weykamp et al., 2008). Over time the values can inform the effectiveness of the management program. Another key recommendation emphasizes the establishment of standards for preventative maintenance. Effective state programs allocate a significant portion of their funding to preventative and minor maintenance as a way to move away from the “worst first” approach.

Of the 24 transportation departments studied, there are two county level DOTs. El Dorado County (California) uses a bridge crew for maintenance projects that are completed under 30 days. Otherwise, for larger projects contractors are utilized. The county additionally receives about \$200,000 annually for bridge maintenance, which is a justifiable amount for local agencies looking to increase funds. Placer County (California) inputs work recommendations from bridge inspection reports into a county spreadsheet along with work completion. There are county engineers that make field reviews of completed work and the spreadsheets are updated twice a year (Weykamp et al., 2008). These counties are, however, very large in terms of population size and bridge density. These counties receive greater funding and resources due to their size. Additionally, both counties have a bridge management program in place whereas several local Georgia governments may not.

3.5 | Bridge Rating Systems

The National Bridge Inventory follows the bridge condition ratings performed by FHWA. In the FHWA Computation Procedure for the Bridge Condition Measures, the logic in *Figure 15*

classifies a bridge as in Good, Fair, or Poor condition based on its lowest condition rating. The ratings are applied to four items: [DECK_058], [SUPERSTRUCTURE_059], [SUBSTRUCTURE_060] and [CULVERT_062]. The minimum of those items therefore classifies the entire bridge (Blades et al., 2018). The benefit of using this system as a basis is the tenure of its use. GDOT has utilized NBI condition ratings since 1992. Additionally, the Bridge Preservation Guide includes priority indicators based on NBI condition ratings, which can be observed in *Figure 16* and can be easy to integrate since all inspections require the same type of classification.

Table 2 – Good, Fair, and Poor Classification Criteria

Criteria	Classification	Description
IF MIN ([DECK_058], [SUPERSTRUCTURE_059], [SUBSTRUCTURE_060], [CULVERT_062]) IN (7, 8, 9)	THEN Good	If a bridge's lowest value of Items 58, 59, 60, and 62 is coded as 7, 8, or 9, then the bridge is classified as in Good condition.
IF MIN ([DECK_058], [SUPERSTRUCTURE_059], [SUBSTRUCTURE_060], [CULVERT_062]) IN (5, 6)	THEN Fair	If a bridge's lowest value of Items 58, 59, 60, and 62 is coded as 5 or 6, then the bridge is classified as in Fair condition.
IF MIN ([DECK_058], [SUPERSTRUCTURE_059], [SUBSTRUCTURE_060], [CULVERT_062]) IN (0, 1, 2, 3, 4)	THEN Poor	If a bridge's lowest value of Items 58, 59, 60, and 62 is coded as 0, 1, 2, 3 or 4, then the bridge is classified as in Poor condition.

Figure 15: Good, Fair, and Poor Classification Criteria Reprinted from FHWA Computation Procedure for the Bridge Condition Measures, 2018.

Code	Description	Common Actions
9	EXCELLENT CONDITION	Preservation/Cyclic Maintenance
8	VERY GOOD CONDITION—No problems noted.	
7	GOOD CONDITION—Some minor problems.	
6	SATISFACTORY CONDITION—Structural elements show some minor deterioration.	Preservation/Condition-Based Maintenance
5	FAIR CONDITION—All primary structural elements are sound but may have some minor section loss, cracking, spalling, or scour.	
4	POOR CONDITION—Advanced section loss, deterioration, spalling, or scour.	Rehabilitation or Replacement
3	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.	
2	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, the bridge may have to be closed until corrective action is taken.	
1	IMMINENT 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 it back in light service.	
0	FAILED CONDITION—Out of service. Bridge is beyond corrective action.	

Figure 16: Bridge Conditions and Activities, Reprinted from *Bridge Preservation Guide*, 2018.

The sufficiency rating is also a method of evaluating a bridge. The formula calculates four factors which provides a percentage that would describe the sufficiency of the bridge. The factors and the formula in **Figure 17** include factors: Structural adequacy and safety, serviceability and functional obsolescence, essentiality for public use, and special reductions (*Recording and Coding Guide*, 1995). Since the range of the rating is from 0 to 100 bridge owners can utilize this rating as a priority indicator.

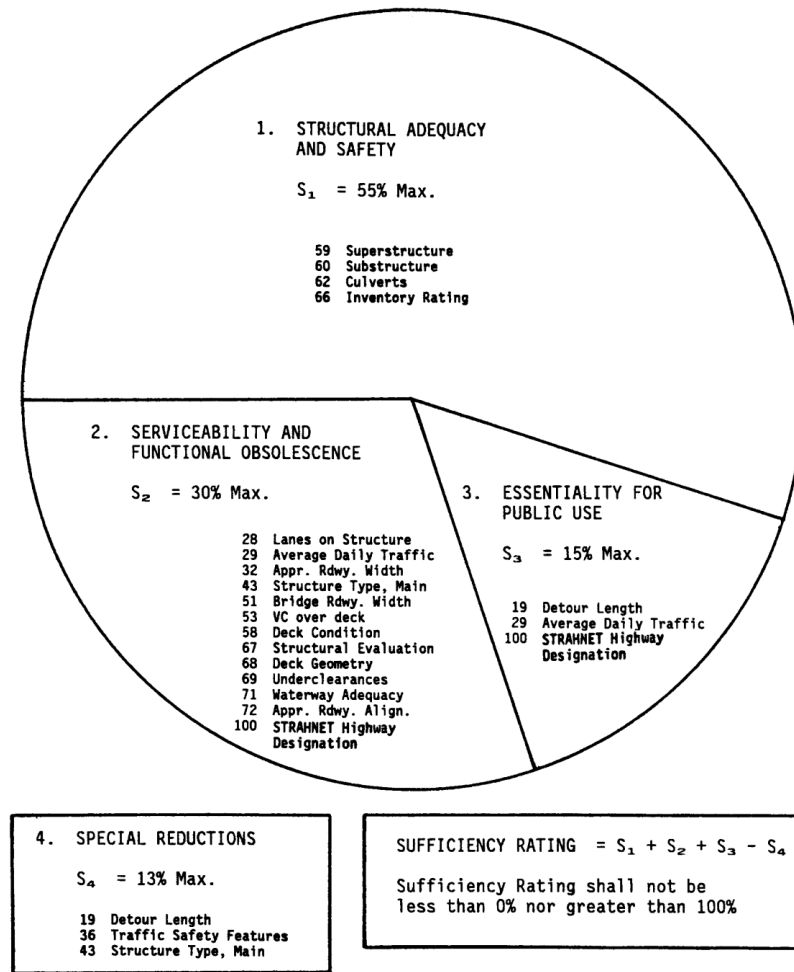


Figure 17: Summary of Sufficiency Rating. Reprinted from Recording and Coding Guide, 1995.

On the same note, AASHTO elements is another system that has been developed in order to assess the condition of a bridge and better perform bridge management. The element level bridge inspection techniques were introduced in the early 1990s and are currently adopted by the majority of U.S. transportation departments. The system is more detailed than NBI bridge condition ratings as it “describes each span of each bridge as a collection of elements selected from a catalog of more than 100 types of bridge members of varying functions and materials” (*Transportation Asset Management*, 2019). Each element has four condition states: 1-Good, 2-Fair, 3-Poor and 4-Severe (*SPECIFICATION FOR THE NATIONAL*, 2014). GDOT has been gathering this system’s bridge data only since 2014. Under those circumstances, as compared to the NBI’s 25 years of data, there

is only about 4 years of data using this format. However, at the same time, this system is recognized as more accurate and advantageous since it focuses on deficiencies in the elements of a bridge.

4.0 | PROBLEM STATEMENT

4.1 | Research Objectives

This research supports the efforts of the Georgia Chapter of American Public Works Association (APWA) to create and implement local bridge and large culvert management programs. Specifically, the objective of the research aims to develop bridge asset management programs, tools, and resources for local Georgia governments. In order to achieve this, an assessment on local governments and their understanding of their bridges is performed among different local government sizes. The tools created are developed from existing guides and practices but tailored and specialized to local Georgia governments and their systems. Furthermore, the delivery of the resources involves a collaboration with local governments and experts to measure its feasibility.

With those ideas in mind, the research further provides the principles and general fundamentals of a bridge and large culvert management program. This includes major components of an effective bridge management program; for example: inventory, rating systems and criteria, inspections, maintenance, life-cycle capital maintenance, repair, replacement, and funding strategies. Furthermore, the research suggests strategies to inform communities of the management methods and how to address the challenge of an aging infrastructure, as well as, developing methods to advocate community support for a sustainable and resilient bridge management program. Included within the planning are suggestions for innovative alternatives, tools for implementation of bridge management programs and funding opportunities at state & federal levels.

4.2 | Research Significance

Unfortunately, the existing bridges in local level municipalities and counties are currently in poorer conditions than those managed directly by the state. The existing local bridges are typically low priority for governments and have limited amounts of resources and “political will” to create and strengthen their asset renewal programs. The lack of funding and tools needed to prioritize maintenance of their bridges contribute to a decline in bridge condition. Current programs encourage local governments to wait until their bridges deteriorate in order to receive attention from the state. These areas lack proper local bridge management programs, which are crucial for economic development, environmental/sustainability efforts, and most importantly the safety and welfare of the public as well as their mobility and quality of life.

The ASCE report card recommends developing additional resources, programs, and funding that would help local bridges with maintenance and repairs. Additionally, the report card recommends expanding implementation for asset management in local governments. Therefore, these local public works agencies and governments would benefit from the development of a guide that would provide sustainable bridge management strategies. The main purpose of the bridge program would be to develop a plan to best utilize the citizen’s tax money, land, and resources in order to maximize economic, environmental, and social benefits. The impact of this work will better utilize investments and funding for local counties, along with aiding local counties in developing efficient bridge maintenance plans and extending the life cycle of existing bridges.

5.0 RESEARCH METHODOLOGY

The general scope of the research is suggested and outlined in *Figure 18*. In order to gain a more comprehensive understanding of the research goals, a preliminary review is executed to qualitatively and quantitatively analyze Georgia's local bridges. The preliminary review utilizes the National Bridge Inventory and ArcGIS. Secondly, a survey conducted with local Georgia government representatives investigates how local governments understand and manage their bridges. After a moderate response rate from the survey, further in-depth interviews were conducted with different population size governments to gain more qualitative insights into bridge management. Following the interviews, the development of local bridge asset management approaches is created, and the selection of potential stakeholders is considered for the implementation of local bridge asset management. *Figure 19* illustrates a summary of the methodology. Furthermore, the findings from the methodology are thoroughly described in Section 6.0.



Figure 18: Research Goals

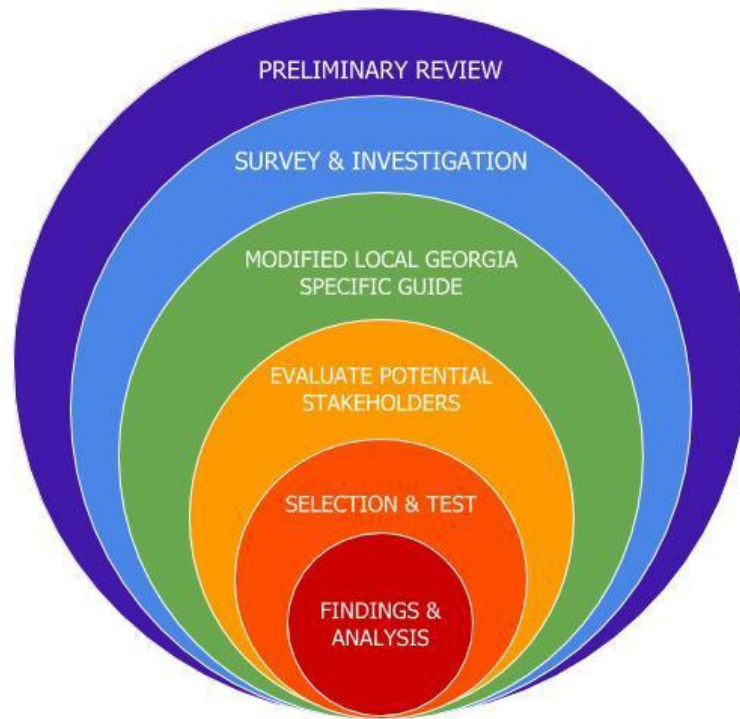


Figure 19: Summary of Research Methodology

5.1 | Preliminary Review

As previously stated, a preliminary review was executed using the National Bridge Inventory and ArcGIS as tools to analyze the current state of Georgia’s local bridges.

5.1.1 | Analysis of Georgia’s Bridge Inventory

The Department of Transportation’s Federal Highway Administration (FHWA) maintains an inventory of all the bridges in the U.S. in its National Bridge Inventory (NBI). The inventory can be filtered through several points of selected and excluded criteria. Of the 616,096 bridges in its inventory, which are Nationwide, the process of narrowing down to 7,907 Georgia bridges was based on selecting the “owner agency” of the bridges. **Figure 20** lists all the owners in its database. The selection of owners was based on communities that would be likely to invest in this study. Since the focus of this research is bridges in local cities and municipalities, the selected owners

for this research are County Highway Agency, City or Municipal Highway Agency, Town or Township Highway Agency, and Other Local Agencies. 608,189 bridges are filtered out for the scope of this focus and research.

State Highway Agency
County Highway Agency
Town or Township Highway Agency
City or Municipal Highway Agency
State Park, Forest, or Reservation Agency
Local Park, Forest, or Reservation Agency
Other State Agencies
Other Local Agencies
Private (other than railroad)
Railroad
State Toll Authority
Local Toll Authority
Other Federal Agencies (not listed below)
Indian Tribal Government
Bureau of Indian Affairs
Bureau of Fish and Wildlife
U.S. Forest Service
National Park Service
Tennessee Valley Authority
Bureau of Land Management
Bureau of Reclamation
Corps of Engineers (Civil)
Corps of Engineers (Military)
Air Force
Navy/Marines
Army
NASA
Metropolitan Washington Airports Service
Unknown

Figure 20: *Owners listed in NBI*

5.1.2 | Analysis by County

There are 159 counties in Georgia with each one ranging in population from 1,608 people (Taliaferro County) to 1,041,423 (Fulton County) [“Georgia Counties by Population.”, 2020]. The large range in population, density, resources, etc. between the counties can influence the distribution of Good Fair and Poor Conditioned bridges. Certain counties may own more poor condition bridges than others. GeorgiaDATA, which is powered by the Carl Vinson Institute of Government at the University of Georgia, is a tool that provides all budget reports for every local government in Georgia. The tool was utilized to evaluate budgets. The findings are described in Section 6.1.2.

5.1.3 | ArcGIS Analysis of Georgia's Bridge Inventory

ArcGIS is a geographic information system (GIS) that creates maps and geographic information. The system compiles geographic data, analyzes mapped information, shares and discovers geographic information. The system utilizes geographic information in a range of applications and manages geographic information all in a database. The system conveniently provides an infrastructure for making maps and geographic information, which is available throughout an organization, across a community, and openly on the Web. The advantage for local communities utilizing ArcGIS is the ability to visualize and communicate bridges and their attributes in each respective local government.

The data was collected through the National Bridge Inventory where data can be extracted with user selected attributes. Each selected bridge contained the longitude, latitude, and other selected features, such as Average Daily Traffic, span length, etc. The selected bridges from the inventory are exported into an excel file. The file is uploaded into ArcGIS allowing the user to display the locations of the bridges in Georgia. Attributes are displayed by selecting them and providing a color code to the respective range. Section **6.1.3** provides an ArcGIS illustration of Cobb, Marion, and Laurens counties' bridges.

5.1.4 | Decision Tree Analysis

Decision tree methods in machine learning have been utilized for its intuitive nature. Although it has the problem of overfitting, using decision trees have proven to be useful in terms of bridge conditions. The application of data tools is presented as a means of processing data on bridge inventory, conditions, and maintenance into useful information (Kass, 1980). Previous studies have shown that Optimal decision trees are beneficial in this case because they can, "identify the most influential factors in the performance of bridge structures and present complex multi factor

trends in a format readily digested by managers and decision makers, to inform standards and policy” (Bennetts et al. 2018).

Therefore, the tool can be useful when analyzing Georgia’s bridges, specifically from the NBI. An analysis was performed using a tree-based data mining method on Georgia’s local bridges. The analysis hopes to uncover factors that influence the performance of local bridges such as age, design type, traffic, etc. In other words, since the premise of the data is based on the condition of the bridges, a classification tree is created to uncover any relationships related to the bridge condition in the NBI. The selection of bridges is similar to the scope in section 5.1.2 with the addition of each county’s total annual budget. A government's total annual budget does not reflect the budget for bridge maintenance, however, there is not a consistent line item for that use across every county. Therefore, the total annual budget would be used to reflect their financial resources. The data for the total annual budget was retrieved from the Carl Vinson Institute of Government database, which provides each counties budget report link (Budget reports | local government financial documents, n.d.). The final scope of the NBI data included 7907 bridges with 23 columns. The structure of the data is listed in *Figure 21*.

```
'data.frame':  7806 obs. of  20 variables:
 $ OwnerAgency      : Factor w/  4 levels "City or Municipal Highway Agency",...: 2 2 2 2 2 2 2 2 2 ...
 $ CountyName        : Factor w/ 154 levels "Appling County",...: 1 1 1 1 1 1 1 1 1 ...
 $ ADT               : int  260 600 600 30 160 160 580 30 70 100 ...
 $ MainConstructionDesignValue : Factor w/ 13 levels "Arch - Deck",...: 12 5 5 5 5 5 12 10 4 10 ...
 $ NumberofSpansinMainUnit      : int   6 3 3 16 6 3 6 10 16 10 ...
 $ StructureLength              : num  180.1 32.2 28.9 140.1 60 ...
 $ BridgeCondition              : Factor w/  3 levels "Fair","Good",...: 2 2 2 2 2 2 2 2 2 ...
 $ BridgeAge                    : int   57 16 16 8 69 54 52 10 43 9 ...
 $ DeckArea                     : num  5437 738 663 2804 1142 ...
 $ TotalAnnualBudget            : int  48146608 48146608 48146608 48146608 48146608 48146608 48146608 48146608 48146608 48146608 ...
 $ NumberofFreezeThawCycles     : int   11 11 11 13 13 13 13 13 13 15 ...
 $ PrestressedConcrete          : int    0 0 0 0 0 0 0 0 0 ...
 $ Concrete                     : int    1 1 1 0 1 1 1 1 1 ...
 $ ConcreteContinuous           : int    0 0 0 0 0 0 0 0 0 ...
 $ Masonry                      : int    0 0 0 0 0 0 0 0 0 ...
 $ Other                        : int    0 0 0 0 0 0 0 0 0 ...
 $ Prestressed.Concrete.Continuous: int    0 0 0 0 0 0 0 0 0 ...
 $ Steel                        : int    0 0 0 1 0 0 0 0 0 ...
 $ Steel.Continuous             : int    0 0 0 0 0 0 0 0 0 ...
 $ Wood.or.Timber               : int    0 0 0 0 0 0 0 0 0 ...
```

Figure 21: Raw Structure of Local Bridges Dataset

Within the scope of 7,907 local bridges, 2000 was randomly sorted into a testing data set whereas the other 5,907 bridges were sorted in a training dataset. The process of creating the most effective decision tree required many iterations. The first few iterations required the removal of certain features from the NBI dataset. In a decision tree the nodes represent the most influential factors in predicting the condition of a bridge and the leaves are the bridge condition predictions based on what features were selected in the dataset. The result of the final decision tree is discussed in Section **6.1.4**.

5.2 | Survey

A survey was conducted and directed to local Georgia government representatives through the APWA contacts. They are also APWA Georgia chapter members. The primary goal of conducting the survey was to achieve an understanding of how local Georgia governments currently manage their bridge programs and how those activities are funded, whether allocated from a general fund budget or from other state funding programs. As discussed in the preliminary review, several of the local counties lacked a budget report and/or a comprehensive report that outlined exactly how the funds were utilized. Therefore, it was difficult to quantify their general fund budget and allocations to bridge asset management. Additionally, there was a further need to understand the decision-making process for managing bridges in general: for instance, how the responsibilities of maintaining, repairing, and replacing bridges were divided among the local government itself and GDOT. This section discusses the process of creating and distributing the survey and finally evaluating the results after the survey was complete.

5.2.1 | Development and Distribution of Survey

A copy of the survey is presented in **Appendix A**. The survey consisted of 20 questions both qualitative and quantitative and further separated into three generalized sections: General Agency

Information, Program Funding, and Bridge Asset Management/Planning. The General Agency Information section gathered basic information such as the local government type and name, general population, job position and contact of the respondent, and number of bridges and culverts maintained by that local government. The general population intervals were selected based on a previous research study performed on asset management in Georgia cities (Dickey, 2019). The sizes are categorized as rural, which is less than 2,500 people; Small City (2,500 to 20,000 people); Mid-sized (20,000 to 75,000 people); and Large City, which is greater than 75,000 people. The interval for the number of bridges and culverts were determined by inspecting the range in the national bridge inventory as shown in **Figure 22**. The number of bridges in each county ranged from 7 to 337, with Fulton County owning a significantly larger amount of bridges compared to the other counties. Therefore, a general range of “greater than 100 bridges” was set as the maximum option in the survey.

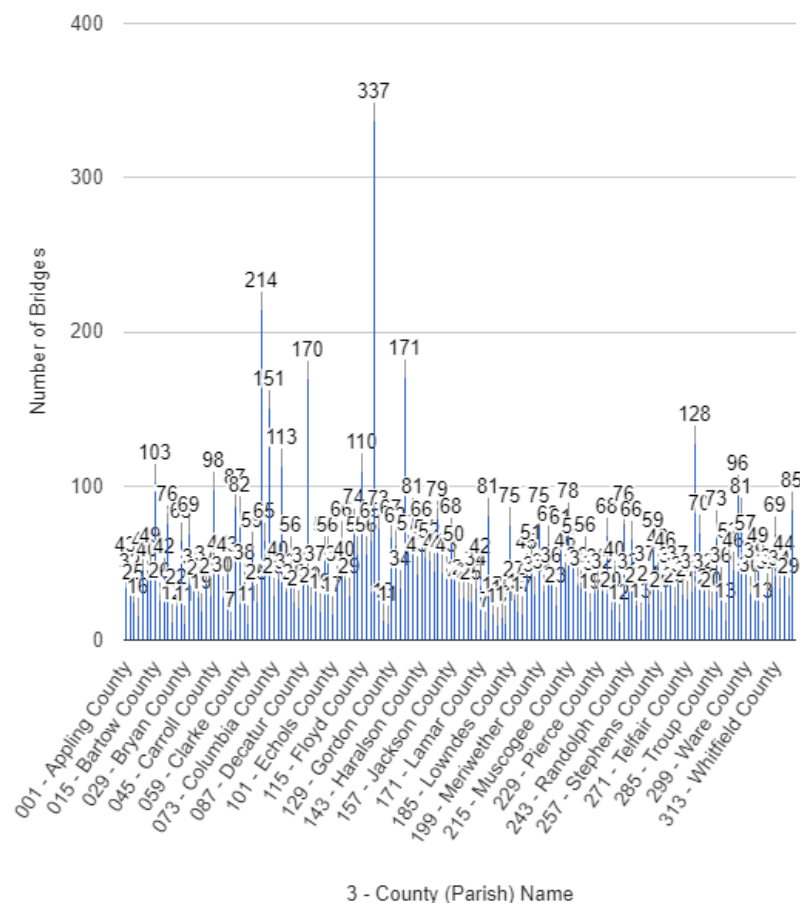


Figure 22: County Name and Number of Bridges

The next section of the survey requested information about the local government’s funding. The quantitative questions requested a general fund budget value and what percentage of that general fund budget was allocated to bridges. As this question can be rather vague, the following question allows the respondents to further subdivide the percentages of their bridge budget into percentages for maintenance, repairs, and replacement. Additional funding sources that may be used are inquired in the next question. The options include SPLOST, LMIG, LIBR, LOCBR, and Other. These funding sources are discussed in Section 2.3. Within those options the respondent can then quantify how much in dollars they receive from each respective funding source. The last section of the survey requests information about planning and asset management. Generally qualitative, the questions gain insights on personnel, comments on how bridge management is

prioritized, identifies which steps from the bridge preservation guide the local government performs, how inspections are performed, and their main challenges associated with managing or developing a bridge program.

5.2.2 | Analyzing the Survey

Survey responses from city representatives in Georgia on the APWA Georgia Chapter contact list were collected with Qualtrics. The initial conducted survey received a moderate number of respondents with 52 responses over a period of two weeks. The completion rate for the survey was 42%. Graphical representations and results were obtained using Qualtrics' Data and Analysis tools and excel sheets created from the data. The findings from the results are described in Section 6.2.

A Chi Squared Test is performed on the relationship between how many bridges and culverts maintained by a local government and the population within the local government. The P-Value within the test shows a measurement of statistical significance, which indicates whether the relationship between the two variables is consistent enough that it is unlikely to be a coincidence. A value less than 0.05 means that a relationship is "statistically significant." Additionally, Effect Size or Cramer's V is an indicator that measures whether a relationship is substantial enough in a practical sense, regardless of the amount of data and therefore is a beneficial indicator for this small sample size. The results for the Chi Squared Test were gathered using Stats IQ and can be observed in Section 6.2.1.1.

For the results from the survey assessing population size and allocations of bridge management, a Ranked ANOVA was applied. In order to gage a statistically significant relationship, a Ranked ANOVA was used rather than a Chi Squared Test for this assessment due to less responses at this stage in the survey. Additionally, the ranked ANOVA tests whether two variables are statistically related when outliers exist and when one of the variables is ordinal. In

this case those respondents who did not have bridge allocations from their General Fund Budget would produce outliers by either answering 0 for those categories and 100 for others. The results for the Ranked ANOVA test were gathered using Stats IQ and observed in Section 6.2.1.2.

5.3 | Interviews

Following the survey, there was still a need to gather additional information. The selection of candidates for the interviews was based on a combination of using both contact information from the survey and from contacts from APWA provided by Stan Brown and Walt McBride. Of the 52 responses on the survey, most respondents provided their contact information and identified their population size and the number of bridges that are managed. Therefore, a diverse range of 15 individuals were contacted to participate in an interview. Their position within the government extended from Public Works Director to City Engineer, etc. A full list of the selected contacts is in **Appendix B**.

Overall, seven individuals responded and were interviewed via web conferencing. These individuals represented two small and rural local governments: City of Dublin and City of Cairo; three mid-sized local governments: City of Valdosta, Dawson County, and City of Griffin; and two large-sized local governments: Chatham County and Dawson County. These interviews provided more insight into how each government manages their bridges and how they fund different bridge activities. Lastly, an interview with GDOT State Bridge Maintenance Engineer Clayton Bennett was conducted to gain insight from the perspective of an inspector. The interviews were recorded with the consent of the interviewee. A brief introduction on the purpose of the research was presented in each interview, then respondents discussed their experiences and insight on the government's methods of bridge asset management. A list of guiding questions was loosely

referred to in order to obtain consistent responses for the purpose of comparing the local governments. A list of the guiding questions is presented in **Appendix C**.

5.3.1 | Small and Rural Local Government Interviews

The small and rural sized categories were combined into a single group since several rural cities had none or very few bridges that were under their jurisdictions. Agencies in this size category include the City of Dublin and City of Cairo. The City of Dublin lies within Laurens County and has a population of 15,802. Interviewee Shawn Wood works as the Public Works Director for the City of Dublin (S. Wood, personal communication, April 2020). In the survey, the City of Dublin identified that it is responsible for 31-60 bridges. On the other hand, the City of Cairo is the smallest city interviewed with a population of 9,410 people (C. Addleton, personal communication, May 2020). Chris Addleton is the City Manager and the city only manages one bridge with several culverts. Section **6.3.1** presents the information gathered during the respective interviews.

5.3.2 | Mid-Sized Local Government Interviews

The Mid-Sized government category includes interviews conducted with Patrick Collins and Angela Bray at the City of Valdosta, Brant Keller at the City of Griffin, and David McKee at Dawson County. The City of Valdosta has a population of 56,426 people and manages 61-100 bridges and culverts (P. Collins, personal communication, April 2020). The City of Griffin and Dawson County are home to 22,878 and 26,108 people respectively (D. McKee, personal communication, April 2020) (B. Keller, personal communication, May 2020). Their populations are on the lower end of the mid-sized population group and both local governments manage less than 30 bridges. Both Brant Keller and David McKee work as the Public Works Director for their respective local government, whereas Patrick Collins and Angela Bray work as the Director/City

Engineer and Head of Stormwater Division for the City of Valdosta. Section **6.3.2** presents the information gathered during the respective interviews.

5.3.3 | Large-Sized Local Government Interviews

For the Large-Sized category, interviews were conducted with individuals with a more specialized job position. Nathaniel Panther is the Senior Engineer for the Department of Engineering at Chatham County (N. Panther, personal communication, April 2020). Chatham County has a population of 289,430 people, managing 31- 60 bridges. For Rockdale County, whose population is 90,000 people, John Moretto is the Director of Rockdale Department of Transportation (RDOT) and Blair Barnhardt is the Deputy Director of RDOT (J. Moretto, personal communication, May 2020). Rockdale County manages more than 100 bridges and culverts. Section **6.3.3** presents the information gathered during the respective interviews.

5.3.4 | GDOT Bridge Maintenance Engineer Interview

In addition to the local government interviews, Clayton Bennett who is the State Bridge Maintenance Engineer for GDOT was interviewed to provide deeper insights from a different, yet relevant perspective (C. Bennett, personal communication, May 2020). Bennett describes his two primary responsibilities. The first is to inspect all state bridge structures on a bi-annual cycle and make recommendations. The second responsibility is to develop plans to protect bridge assets and to improve the state's resources. Section **6.3.4** presents the information gathered during the interview with Clayton Bennett.

5.4 | Developing a Local Government Bridge Asset Management Guide

The next step in the study was to develop a guide that assists local Georgia governments to establish or better develop their bridge asset management plan or program. Similar to the FHWA's *Bridge Preservation Guide* and Michigan's *Asset Management Guide for Local Agency Bridges*

in Michigan, the developed guide for local Georgia emphasizes similar topics. However, a combination of literature review and results from the surveys and interviews influenced the contents of the guide. For instance, priority indicators are specialized for each local government's needs (i.e. average daily traffic, bridge age, emergency routes, etc.). This section discusses the process of developing each component in the guide.

5.4.1| Bridge Condition Assessment

The process for providing this section involved a brief overview of the general methods Georgia uses to assess a bridge's condition, which mainly cover the NBI scale, the sufficiency rating, definitions for Structurally Deficient and Functionally Obsolete Bridges. An important component of bridge condition assessment that a local government can leverage is their method of interpreting the bridge inspection reports. This information is gathered from the discussion with Clayton Bennett as the Bridge Maintenance Engineer at GDOT. The suggestions are briefly listed in this section. Additionally, based on the preliminary review findings, there was a need to inform local Georgia bridge owners on the additional factors that affect bridge condition. As a reminder, these findings include bridge age (typically after 26 years), bridge design material (specifically steel), and total annual budget (typically around \$260 million).

5.4.2| Components of the Bridge Preservation Strategy

The plan for the Bridge Asset Management Guide for Local Georgia Governments is to provide a straightforward 8 step approach to establishing or improving a bridge asset management plan for any local Georgia government. Therefore, the section "Components of the Bridge Preservation Strategy" acts as a more in-depth discussion on strategy and precursor to the 8-step approach. This section provides definitions for the types of preservation actions, such as replacement, rehabilitation, and preventative maintenance, and lists activities within those types. The general

activities for each type of bridge actions were compiled from a variety of sources. For example, within the list of Conditional Maintenance Activities there are concrete deck overlay, deck repairs, steel bearing repairs, painting, channel improvements, guardrail repair, scour countermeasures, and approach repaving. These general activities were compiled from FHWA's *Bridge Preservation Guide*, TAMC's Guide, and the *Bridge Preservation Treatments and Best Practices* previously discussed in the literature review.

In addition, a discussion of in-house costs vs contract costs is provided based on the discussion from the multiple interviews with local Georgia governments and the Bridge Maintenance Engineer. Moreover, this section would be able to provide optional steps/strategies that local governments with more resources could implement, such as exploring deterioration models for their bridges.

5.4.3| Steps in Developing a Bridge Management Plan

The different steps in this approach were decided based on a combination of the concerns from the interviews, and the steps outlined in FHWA's *Bridge Preservation Guide* and TAMC's *Asset Management Guide for Local Agency Bridges in Michigan*. FHWA suggested an 11-step process in **Figure 23** while TAMC's guide also listed a similar approach where the steps were more localized. Since FHWA's approach is more generalized and included state owned bridges that typically receive more resources, there were some steps that could be altered to fit the abilities of a local government. For instance, certain steps were combined such as step 10 and 11 "Monitor and Measure Performance" and "Reporting and Improving." In the resulting 8 Step procedure for local Georgia, this would be combined as "Measure and Report Performance."

TAMC suggested actions for a preservation strategy that were utilized in this guide. The preservation criteria, cost estimate worksheet, operation and maintenance plan, and five-year

annual cost projection strategies proved to be plans that were approachable for local governments and therefore considered in the development of the steps in a local bridge management plan. Steps that were needed across the board included developing goals and objectives, as a first step, and developing a preservation strategy. Most importantly, acknowledging the fact that local governments struggle to optimize and find funding for their bridges would create a step to identify those funding sources. The result of this section provides the 8-step approach towards Georgia's steps in a local bridge management plan, which is discussed in **Section 6**.



Figure 23: FHWA's 11 step approach

5.4.3.1| Developing a Cost Estimate Worksheet:

Although TAMC developed a Bridge Maintenance Cost Estimate Worksheet, the unit costs and actions were established in the state of Michigan. There is a need to tailor a similar worksheet in

the state of Georgia. FHWA published the average replacement unit cost for non-NHS bridges for the year 2017. In Georgia the typical bridge replacement cost is \$129 per square feet (Bridge Replacement Unit Costs 2017, 2017). Without contacting GDOT directly, their web sources did not provide unit costs for any bridge preservation activities. However, cost estimates were calculated within a value engineering report for a bridge project on Brampton Road Connector in Chatham County, GA. This project was carried out by GDOT offices and Michael Baker International. (Value Engineering Report, 2017).

Within this project, Stephen Sander, the cost estimator with GDOT, provided input for this analysis and reviewed the figures. Some included cost estimate items are the ROW costs, concrete pavement, deck drainage, straddle bents, environmental mitigation, MSE walls, bridge construction area reduction, and utilities. Since not all preservation activities could be estimated from sources within the state of GA some of the estimates remained sourced to TAMC's worksheet. These estimates are broken down into unit costs and presented in **Appendix 3 of Appendix F**. Ultimately, this loosely developed worksheet is meant to be utilized as a starting point when developing a cost estimate process. Local governments would ideally update their values and activities based on the history of their completed maintenance work costs. Attributes that the sheet need to contain would be sections for replacement, rehabilitation, conditional preventative maintenance, cyclical preventative maintenance, traffic control, miscellaneous, and mobilization and contingency. An alternative structure could follow the activities for each element of the bridge. For instance, the sections instead would be deck, superstructure, substructure, culvert, etc.

5.4.3.2| *Developing the Funding Matrix Checklist*

The idea for a funding matrix checklist tool originated from researching the additional funding sources from GDOT and from federal sources in the Background section of this study. As opposed to an informational paraphrased list of sources, a simple matrix checklist format would be able to quickly inform a bridge owner or stakeholder the variety of funding sources available, along with what each source is eligible for and its criteria. The Funding Matrix Checklist is presented in **Appendix E** and further discussed in the next chapter.

5.5 | Selection for Case Study

The process for identifying and selecting a local government involved searching for a community that would most benefit from a case study. Since rural and small sized data was not well obtained and represented from the survey or interviews, the deciding factor of a potential case study community would be the number of bridges the local government manages and most importantly the level of commitment and participation for its implementation.

The desired community for the implementation of the bridge asset management plan ideally manages between 20-60 bridges. Too few bridges would not be feasible, as funds will not be sustainable, and a larger number of bridges may interfere with an already established bridge management program. As previously completed in the Preliminary Review for Georgia Counties in **Section 5.1.2**, with results later discussed in **Section 6.1.2**, the counties with the highest ratio of Poor Bridges over total number of bridges and the counties with the highest ratio of bridges needing repair over total bridges were examined, along with considerations for previously interviewed and surveyed local governments. Ultimately Spalding County was selected. The county has 57 local bridges under its jurisdiction, not including those managed by GDOT or Griffin City. Within the state of Georgia, Spalding County had the highest percentage of bridges needing

repairs. In terms of percentage of poor condition bridges, Spalding County is in the top 10 counties in Georgia with 9.2% poor bridges (“Bridge Inspections: Spalding County, Georgia.”, n.d). This presents a great potential for improvement. Furthermore, Spalding County was selected based on their established archway partnership with the university. The Archway Partnership at the University of Georgia is able to connect to Georgia communities with resources that address critical locally-identified needs. This partnership with Spalding County is an advantageous relationship and with Angel Jackson serving as the Archway Professional, she is able to effectively facilitate correspondence between Spalding County and this study.

Once Spalding County was contacted as a considered case study community, Jackson organized a meeting that was held on August 4th, 2020. This virtual meeting and future meetings involved participation from William P. Wilson, Jr., County Manager; Michelle Irizarry, Assistant County Manager; TJ Imberger, the Public Works Director; Alicia Brown, Public Works Administrative Assistant; Scott Sullivan, Road Supervisor; and Kevin King, Bridge Crew Lead. The purpose of this meeting was to present a summary of the research, which included the background, research objectives, literature review, and some research findings, as well as the plan for the bridge asset management guide that was in progress at the time. Most importantly this meeting discussed the needs and expectations from the partnership and case study, which is to build Spalding County a tailored Bridge Asset Management Plan. Another goal for the meeting was to assess the current interest and level of commitment that Spalding County had after being presented the proposal of the case study. The proposal was well received by all members and prompted a discussion for the next steps.

5.6 | Case Study Implementation

Now that a draft of the *2020 Bridge Asset Management Guide for Local Georgia Governments* is completed and Spalding County is selected as the community for the case study, the next phase is to implement the steps within the created guide and discuss its desired modifications to best suit the local government's needs and objectives. This process involved a series of virtual meetings in pursuit of creating a comprehensive plan for Spalding County. The following were the dates of the 2020 Virtual Team Meetings:

- August 17th: Initial Assessment
- September 10th: First Three Steps
- September 23rd: Step Three - Six
- October 1st: Last Two Steps
- October 9th: Comprehensive Plan Review
- October 14th: Bridge Plan Handoff Meeting

Prior to the first team meeting a general introductory meeting was held on August 17th to review the current practices and needs for Spalding County's bridges. Generally, in terms of the process of bridge management, the GDOT bridge inspection report is used as a guideline for any bridge work needs. The bridge crew also conducts regular maintenance which includes visual inspections and debris cleanup. There is not a calculated process for following the bridge inspection report. Those that are more severe, signifying emergency or dangerous conditions, are prioritized first. The work is processed through a combination of utilizing a computerized work order system and more traditional systems such as written inventory binders in their bridge crew truck. The resources that Spalding County rely on are their GDOT bridge inspector and the consulting services from Paragon Consulting Group as needed for more specialized repairs. Imberger stated that the bridge recommendations are typically handled within that inspection cycle, which is usually two to three years. Their in-house maintenance crew consists of the Senior

Public Works Officer that uses four inmates for labor. The crew is set up with their own bridge truck, trailer and specialized equipment. This crew is supplemented with heavy equipment and additional crews as needed. One useful tool mentioned by King is the GDOT repair manual.

In terms of funding their bridge management, the county uses the state bridge fund and GDOT local bridge programs to fund their bridge replacements. The county pays for some utility relocation. SPLOST is utilized for few specific replacement projects. Current policies and plans only include an old existing plan. The county has a joint city-county plan established in 2016 with the city of Griffin in their Comprehensive Transportation Plan (CTP). When asked about the types of improvements that the county would like in their bridge management program, GDOT and other entities providing more learning opportunities to specifically train the individuals completing the repairs would be most beneficial. The latter part of the meeting discussed the goals for the next meeting, which consists of the first 3 steps within the bridge guide: identifying goals and objectives, completing a bridge condition analysis, and developing a preservation strategy.

5.6.1| First Team Meeting

The first team meeting was held on September 9th. The Public Works Director, Administrative Assistant, Road Supervisor, and Archway Professional were the main participants in this and the following meetings until the final hand off meeting. The first three steps in the guide were discussed. Step 1 was to identify goals and objectives of the bridge management plan for Spalding County. Since the previously mentioned Comprehensive Transportation Plan established some goals for their transportation plan, those goals were discussed as a primer to developing Spalding's bridge specific goals. The CTP goals can be seen in *Figure 24*.

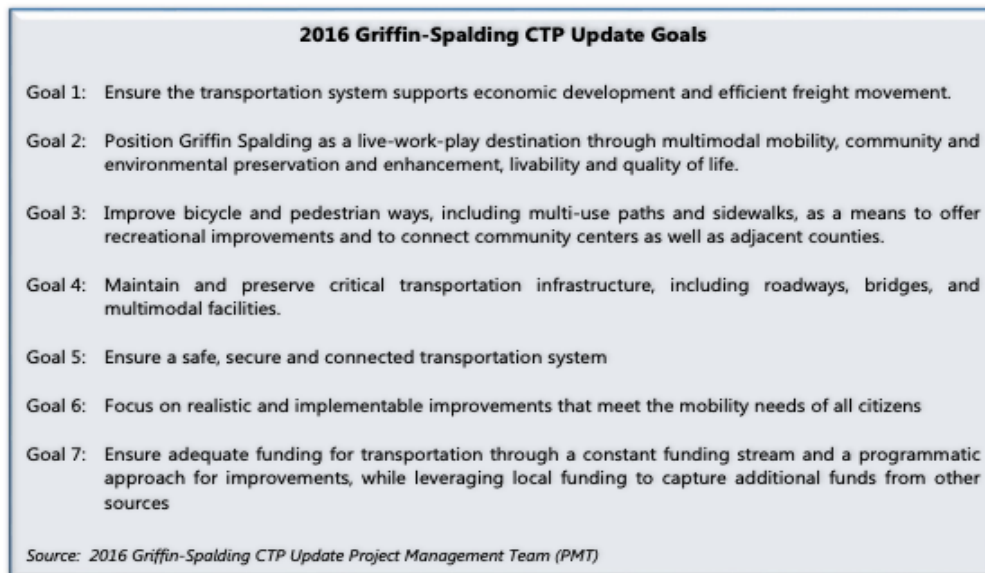


Figure 24: CTP Goals

It was suggested and established that the objectives of the bridge asset management plan would be to maintain and preserve the safety of Spalding’s bridge network, increase Spalding’s bridge assets’ useful service life by extending of the time that bridges remain in good and fair condition through preventative maintenance, reduce future maintenance costs and premature bridge replacements and create a programmatic approach for improvements, while leveraging local funding to identify additional funding sources. In order to quantify the overall goals for this plan Spalding county was asked to identify a performance measure and a measurable goal. Currently 88% of Spalding’s bridges are in Fair to Good Condition, 74% and 14% respectively, and 38% are structurally deficient. Since a quantifiable goal was not already established, a suggestion was made to propose the county have 95% or more of its bridges in fair to good condition and to have less than 25% of its bridges classified as structurally deficient at the end of its plan. The length of the plan and therefore timeline for this goal was determined to be 10 years.

Step 2 is to complete a bridge asset or bridge condition analysis. This was completed prior to the meeting since it was necessary when evaluating different local governments for this case

study. Spalding’s 57 bridges were assessed based on the results from the NBI database and Shreveport Times’ data central (“Bridge Inspections: Spalding County, Georgia.” n.d). Their bridges were separated by bridge type and assessed on their size and conditions. The results presented in this meeting is shown in a meeting slide, **Figure 25**, and the later tabulated result listed in the next chapter.

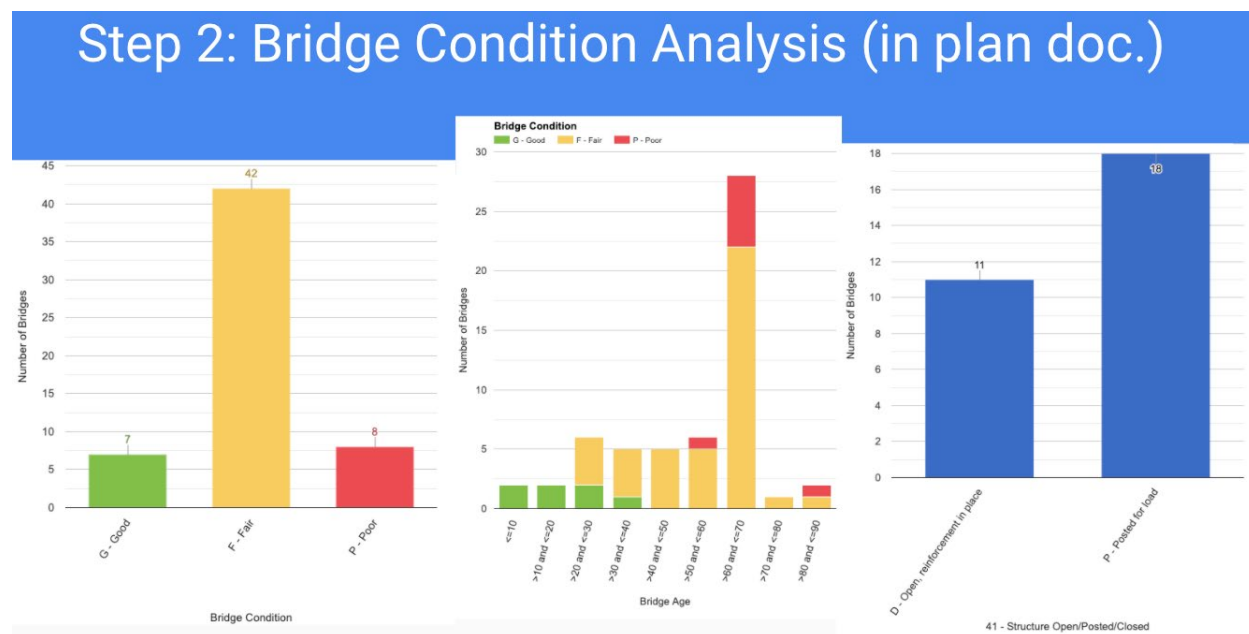


Figure 25: Spalding County Bridge condition analysis

Lastly, Step 3, the development of a preservation strategy was discussed. Although the CTP already established a bridge need priority methodology using tiers, it was important to point out that the plan included bridge needs for both Griffin City and Spalding County. Therefore, a separate priority formula was created instead using the typical five factors: condition, load capacity, safety, traffic, and detour with the respective weights: 30%, 25%, 20%, 20%, and 5%. The preservation criteria is another area of the strategy that was discussed. The county would categorize the bridge inspection recommendations and in-house maintenance actions and build criteria for each activity under replacement, rehabilitation, conditional preventative maintenance, and cyclical preventative maintenance. The example forms the guide was provided and the team

agreed to set up a separate meeting among themselves to create a similar table. The resulting tasks from the meeting was to work on the preservation strategy and review the next three steps in the guide.

5.6.2| Second Team Meeting

The second meeting was held on September 23rd. The process of structuring the meetings at this point became more refined. The agenda of this meeting was to address any questions and concerns from both sides since the last meeting, address the current progress on the preservation strategy, walk through the next three steps, and outline the expectations (or to-do list) for the next meeting. Prior to the meeting the team submitted completed components of the preservation strategy. The team had decided to switch the weights on the condition and load capacity of the priority formula. Load capacity would be weighted at 30% and bridge condition at 25%. This was calculated and justified by Spalding's goals to address their large number of posted bridges and concern for their community's school busses depending on critical bridges. On the same note, one of the concerns addressed to the team were the safety and detour factors. The team was asked if there was a method to specifically measure safety and detour. Since there was not a quantifiable way that was agreed upon, a new priority formula was established to weigh load capacity at 40%, condition at 35% and traffic at 25%. It was further clarified that safety and detour restrictions would still be considered with the best judgement and expertise when comparing projects with similar priority scores.

5.6.2.1 | Inventory Priority Scores

The process of scoring each bridge in the inventory evaluated data from the NBI database which would also be contained in the cyclic bridge inspection report that Spalding Provided. The most recent inspection report for Spalding's bridges was from 2018. The load capacity was determined on the status of the bridge, whether it was open for all traffic loads, coded as "A"; posted for load,

coded as “P”; or would be posted but open due to temporary shoring, coded as “D”. This is item 41 in the database. The posted code would have the most weight for this factor and open would have the least. Likewise, with bridge condition the bridges in Poor condition would have the most weight for the bridge condition factor and Good would have the least. For traffic, the ADT item was evaluated by weighing the traffic count out of the most populated bridge. For instance, the bridge on Hill Street had the highest ADT at 8570. The traffic factor score for that bridge would be converted to 1. A bridge with half the ADT would have a traffic factor score of 0.5. All three factors would be further weighed respective to the agreed upon weights and would result in a priority score for each bridge.

The next three steps, cost estimate worksheet, operations & maintenance plan, and five-year annual cost projection, were discussed. A few recent work orders for a bridge repair and minor maintenance were reviewed. The costs were calculated by hourly rates with equipment fees from FEMA’s 2019 schedule of equipment rates (*Fema’s Schedule of Equipment Rates 2019*, 2019). A cost estimate worksheet similar to the one developed in the guide was encouraged. The work orders would be an ideal foundation for developing a cost estimate worksheet for bridge work. For Step 5, since Spalding county had no actual established process of programming their bridge work, the operation & maintenance plan would be the next step in strategizing and optimizing their bridge program. A simple annual O&M plan organized by type of actions along with the priority score for each considered bridge project was recommended. Lastly, the five-year annual cost projection is the last step discussed in the meeting. The cost estimates and projects listed in the CTP plan would be added as well. The three steps discussed were expected to be completed before the next meeting.

5.6.3| Third Team Meeting

The third team meeting was held on October 1st. Following the same structure as before, concerns were raised at this point since the cost estimate worksheet and the operations & maintenance plan had yet to be completed. The concern was that the department was unable to budget with unit costs as they were utilizing hourly rates according to their work order system. As a result, an agreement was made to utilize and develop the created cost estimate worksheet in the guide in the future. Nevertheless, the five-year annual cost projection was completed and reviewed. It was clarified that within the five-year annual cost projection annually there is a capacity to provide conditional maintenance to seven bridges at a time estimated at \$10,000 per bridge. Additionally, the CTP bridges that remained in progress were highlighted and those that have been completed were removed.

Step 7 requires an evaluation on the county's funding sources. The task for the team was to identify current amounts of the funding sources that are being utilized and the funding sources that will be utilized in the future. The Funding Matrix Checklist was provided as a tool for the group to utilize when considering new funding sources for their bridge projects. Ideally the O&M Plan and the Five-Year Annual Cost Projection sheet will justify and identify needs for newer funding sources. The amount received from the general fund budget was reevaluated from the very first meeting. \$175,000 is the provided amount for the bridge crew salary and repairs and maintenance. SPLOST and TSPLOST did not program any future bridge projects from the group's knowledge. However, LOCBR and LBRP continue to fund their bridge replacements amounting to approximately two million dollars each bridge.

Finally, the last step is to measure and report performance of the plan. This process would require effective updating. The researcher in this study served as an advisor or consultant and

therefore prepared the comprehensive plan and all the supporting worksheets. Therefore, it was crucial to properly instruct the team how to update all the items in order to make the necessary changes. An Update Process flowchart was created for this purpose. The flowchart was explained and provided to the team for their convenience.

5.6.4| Fourth Team Meeting

The team unanimously agreed to an additional meeting before the official bridge plan handoff on October 9th. The purpose of this meeting was to review the completed draft of Spalding County's Bridge Asset Management Plan and address any needed final changes and concerns. On top of that, this meeting was a great opportunity to review the compiled ZIP file that was prepared for and sent to the team. This package consisted of the bridge plan document and four numbered excel files that contained all the completed worksheets. **Figure 26** displays the contents and file names within the package.

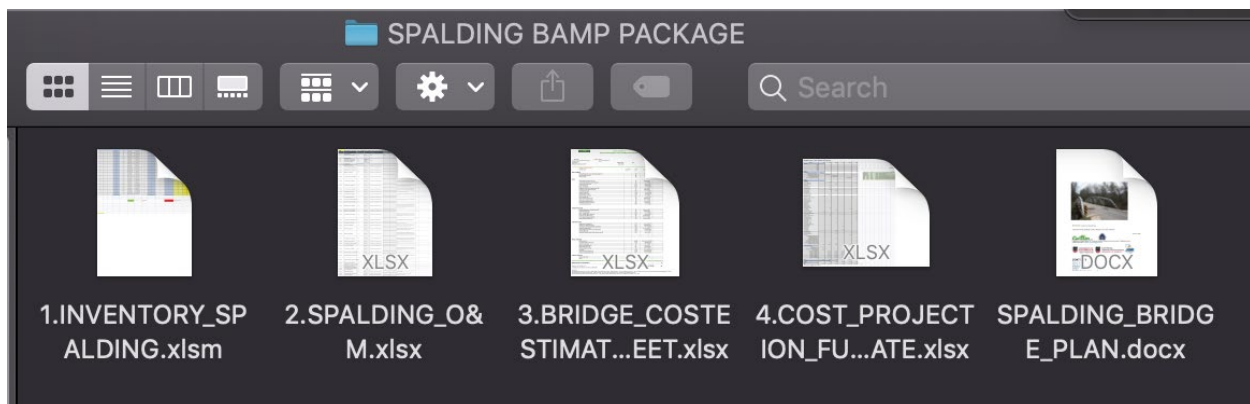


Figure 26: Contents of Spalding BAMP Package ZIP file

Within the bridge asset analysis section, Imberger pointed out that there were 9 wood bridges that Spalding County manages and owns but is not inspected by GDOT and therefore not included in the inspection reports or the overall plan. Other changes concerned the 5-year annual cost projection estimates. The annual \$170,000 for cyclical maintenance was further clarified to

acknowledge the value as the annual cost for Spalding's in-house crew. In terms of funding sources, it was recently brought to their attention that TSPLOST planning was pushed back to 2022 and SPLOST to 2021, which meant that future bridge projects could still be requested and planned.

5.6.5| Official Bridge Plan Handoff

After approximately three months, the official bridge plan handoff meeting was held on October 14th. Unfortunately, due to scheduling conflicts and time constraints, William Wilson, the County Manager, was unable to attend. However, Michelle Irizarry, the Assistant County Manager, was able to oversee the meeting. The agenda for the meeting was similar to the last where the completed draft of Spalding County's Bridge Asset Management Plan, which is presented in **Appendix G**, was reviewed and then once again the contents of the Spalding BAMP Package were examined to reinforce the process of collecting the data. Irizarry expressed positive feedback for Spalding's plan and especially the Five-Year Annual Cost Projection table, which she stated was similar to a five-year capital plan that justifies what needs to be done in order to keep the assets in check. It also includes personnel costs which is another bonus.

Following the end of the plan review, Imberger expressed that in the process of creating the plan they were able to dig into a large amount of background work and found that there were a few bridges that belonged to Spalding County that weren't maintained because they initially thought it was owned by another agency. Another point that he noted was that their GDOT bridge inspector found that the average county after eight to ten years still doesn't complete the work on the bridge reports and therefore the process of programming and funding will be a major step for the communities in the future. Irizarry emphasized that the process helps adapt a more proactive approach rather than a reactive approach which has been the norm for local governments.

6.0 | RESEARCH FINDINGS

Section **5.0** discussed the research methodology and processes related to this study. Accordingly, this section summarizes the findings and results from that approach.

6.1 | Preliminary Review Findings

The preliminary review encompasses the analysis of the National Bridge Inventory database, the findings using ArcGIS, and data mining results using decision trees.

6.1.1 | Analysis of Georgia's Bridge Inventory

Within the scope of 7,907 local bridges, **Figure 27** divides those by bridge conditions: Good, Fair, and Poor. Good condition suggests the bridge is sufficient and in need of preventative maintenance, Fair condition can range from needing preventative maintenance alone to requiring bridge rehabilitation. Poor condition requires rehabilitation and in some cases replacement [FHWA, 2019]. The majority of the local bridges are classified as Fair conditioned, which is about 55% of the total. Comparatively, **Figure 28** illustrates bridges that are owned by the state or managed by GDOT. It is important to note that state owned bridges are significantly in better condition. The amount of good conditioned bridges is greater relative to the total number of bridges and the amount of poor conditioned bridges account for only 48 as compared to 404 local bridges.

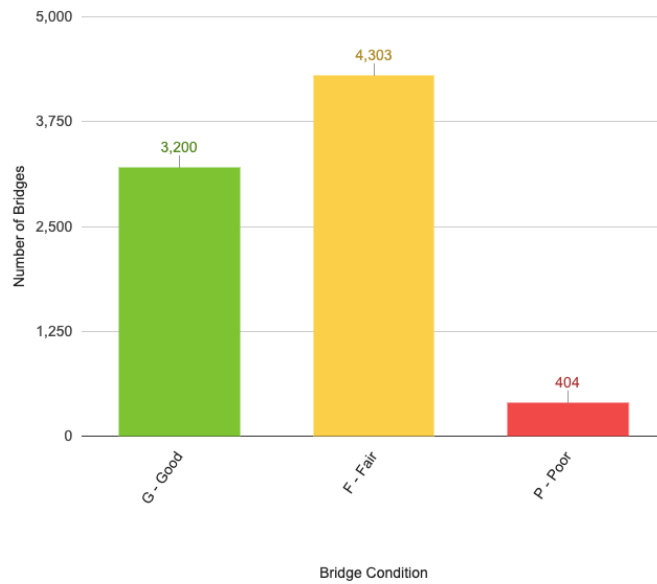


Figure 27: Local Bridge Conditions

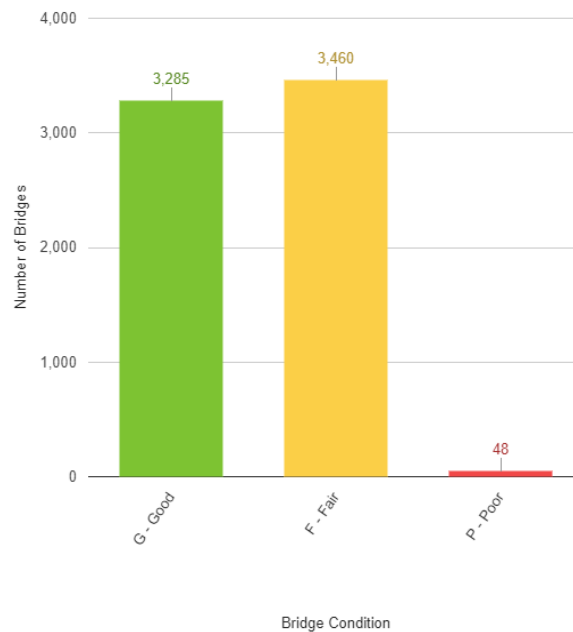


Figure 28: State Owned Bridge Conditions

Furthermore, when analyzing these bridges by age in **Figure 29** a trend emerges. As bridges age, especially after 30 years the relative amount of bridges in Fair and Poor condition increases relative to the amount in good condition. **Figure 30** illustrates the increase in the amount

of fair conditioned bridges relative to good conditioned bridges after 2011. This increase demonstrates a decline in the condition of local bridges. There could be several reasons for the trend. Most obviously bridges will deteriorate over time. The average lifespan of a bridge is about 70 years even though several of Georgia's bridges are over 100 years old (Halsey, 2017). However, lack of proper preventative maintenance can accelerate this decline and end up costing more for local governments to prematurely replace.

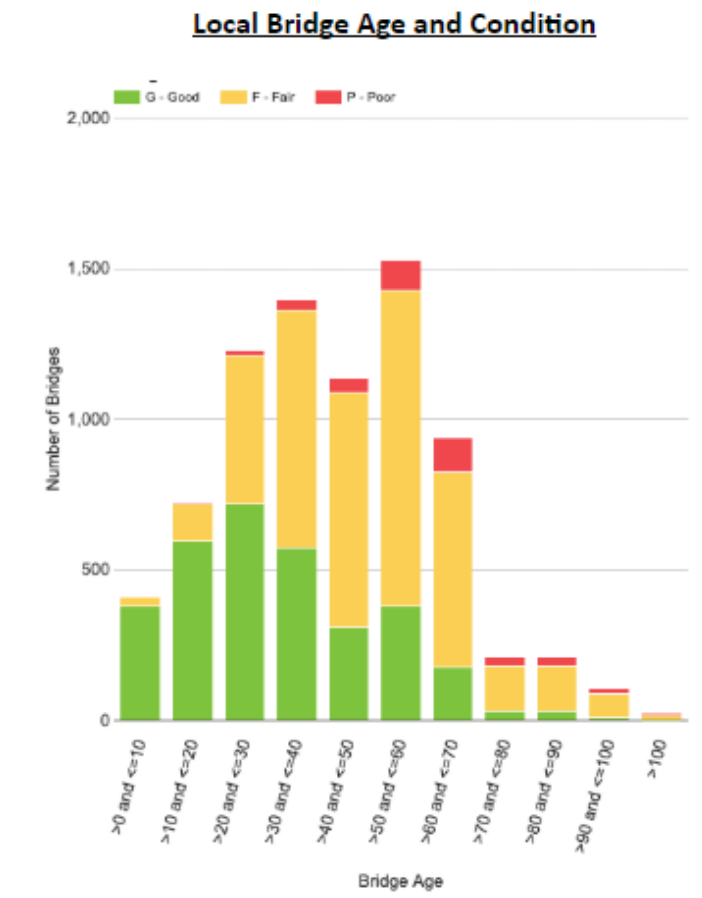


Figure 29: Local Bridge Age and Condition

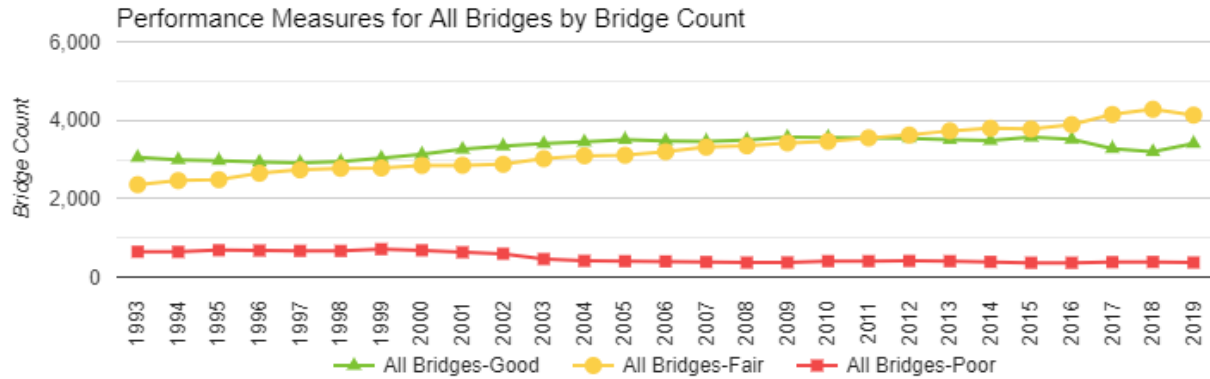


Figure 30: Local Bridge Conditions Over Time

6.1.2 | Analysis by County

Figure 31 displays the counties with the highest percentage of needed bridge repairs and **Figure 32** displays the counties with the highest percentage of Poor Condition bridges. Currently, Marion County has 37 percent of their bridges in poor condition, which is the highest of all counties in Georgia. When analyzing Marion County’s budget report for 2018, their total general fund revenue was about \$7 million. Laurens County which is in 10th place for highest percentage of poor bridges has a total general fund budget of \$22.5 million and approximately \$2 million was allocated to the Public Works Administration. Both counties exhibit low funds.

On the other hand, Cobb County has one of the lowest percentages of poor bridges, only 0.5% and Cobb County maintains the highest number of bridges in Good Condition. Furthermore, Cobb County, which has experienced economic growth and funding in the past decade provides a 75-page budget report consisting of numerous departments and sources of revenue. Their total general fund revenue amounted to approximately \$404 million and the Department of Transportation alone is allocated \$18 million.

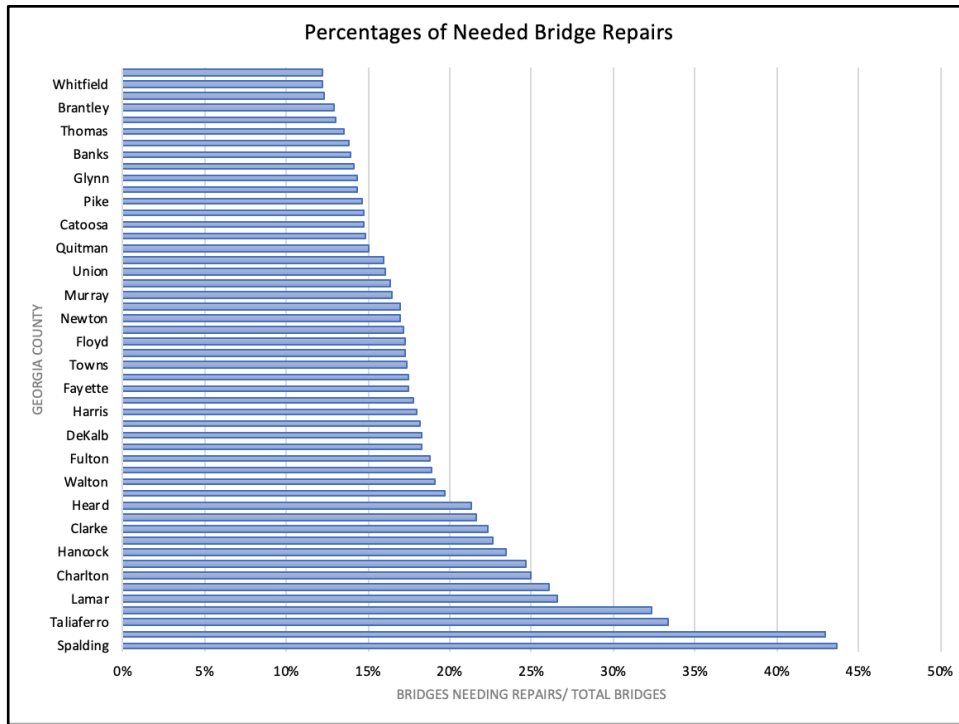


Figure 31: Highest Percentages of Needed Bridge Repairs

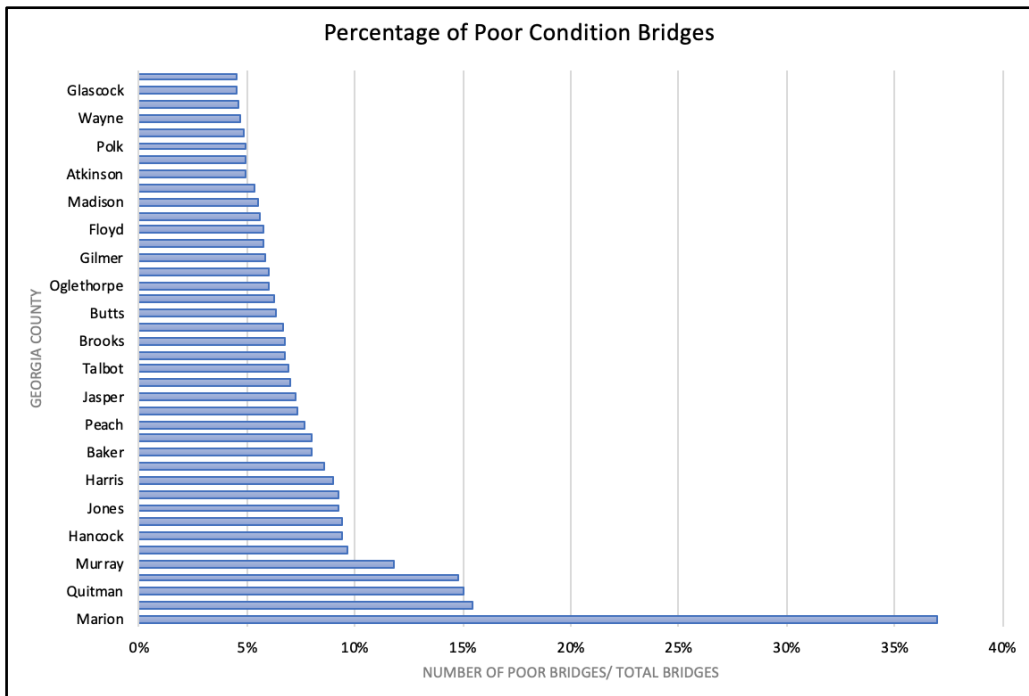


Figure 32: Highest Percentages of Poor Condition Bridges

However, it is important to realize that the complexity of each budget report is ambiguous and difficult to quantify in terms of how each local government is allocating for a bridge asset

management program. In addition, it is difficult to demonstrate a direct correlation between the amount of poor conditioned bridges and amount of government funding without considering additional factors.

6.1.3 | ArcGIS Analysis of Georgia's Bridge Inventory

The advantage for local communities who can utilize a GIS tool will be an ability to visualize and better communicate the attributes and location of their bridges. For instance, **Figure 33** shows the quantities for a Health Index legend within ArcGIS. The lowest Health Index for a bridge in Georgia is 17.22 which sets the lowest boundary. **Figure 34** maps and identifies the location and ranges of bridges by Health Index.

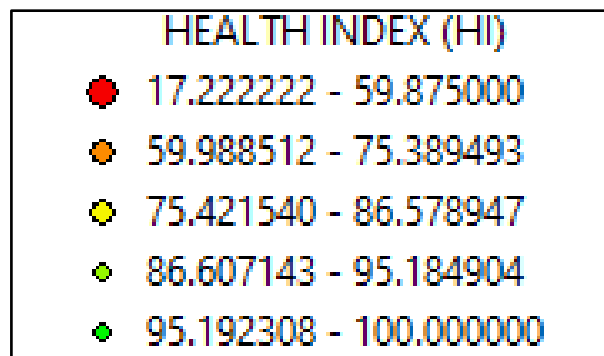


Figure 33: Health Index Legend

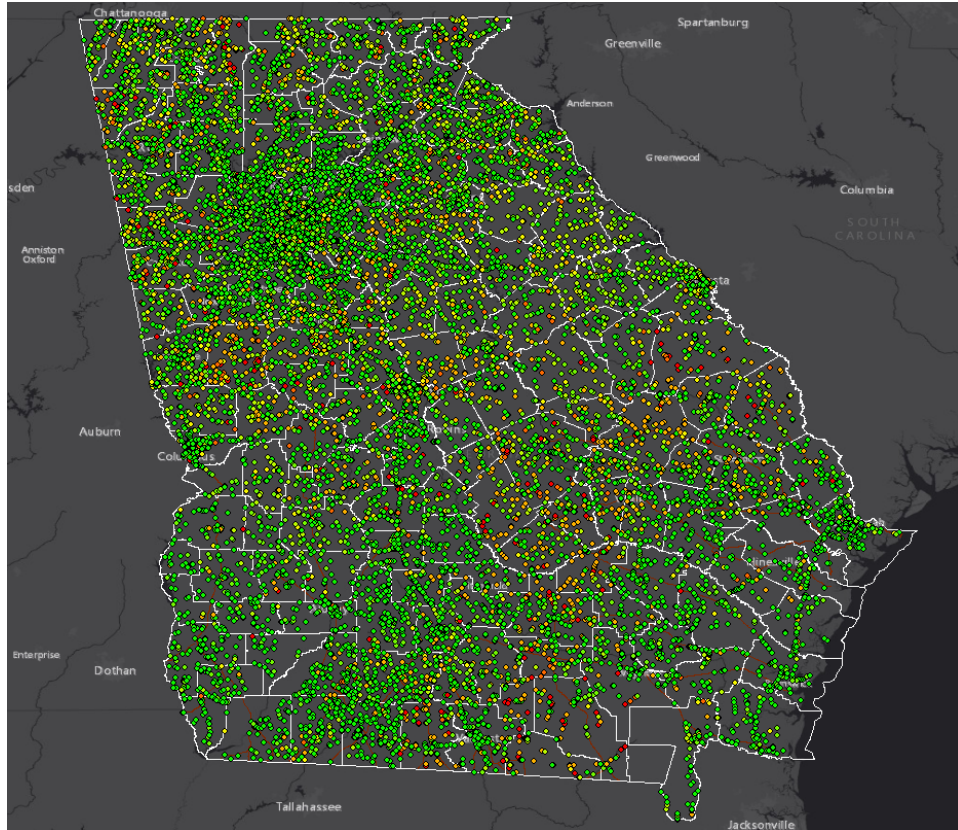


Figure 34: Georgia Bridges Labeled by Health Index

Furthermore **Figure 35** zooms into Cobb County's boundaries and **Figure 36** zooms into Lauren's County's. Immediately the user can identify that there are relatively more bridges in Cobb County and more bridges that are in better condition than in Laurens County. In terms of local bridges and their NBI bridge condition, Cobb County has 232 local bridges: 68 percent in good condition 32 percent in fair and less than one percent in poor condition. On the other hand, Laurens County has a total 81 local bridges with 33 percent classified as Good, 46 percent classified as fair and 21 percent classified as poor.

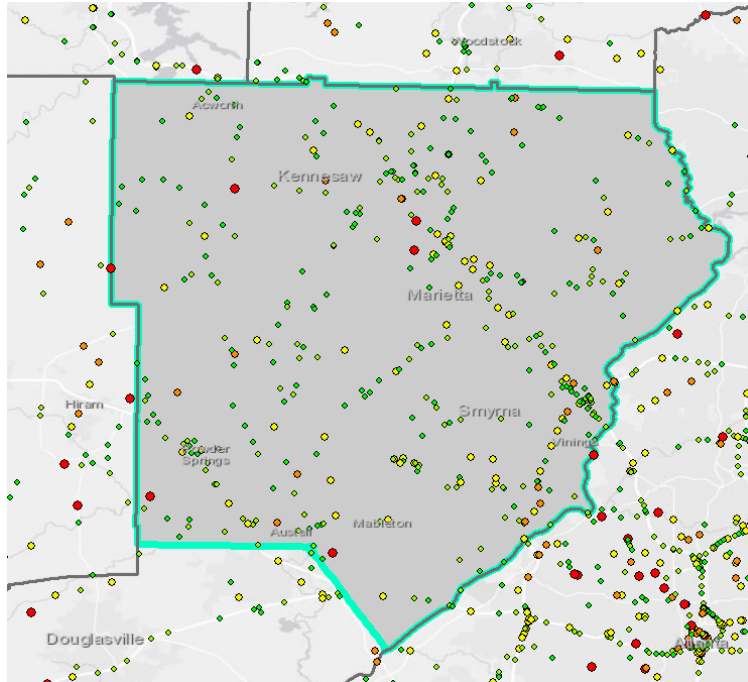


Figure 35: Cobb County Bridges vs. Health Index

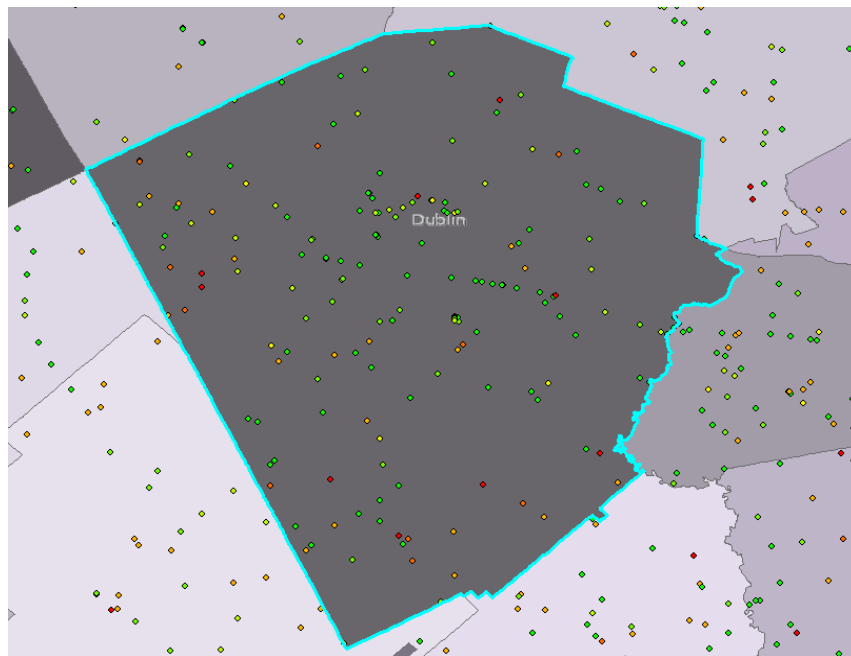


Figure 36: Lauren's County Bridges vs. Health Index

Another feature that can be displayed is the Annual Daily Traffic (ADT) of each bridge. This can be applied similar to the Health Index by setting the range for each label. The range for the ADT is from 0 to 350,000 as shown in **Figure 37**. Furthermore, **Figure 38** displays these

ranges in Cobb County and **Figure 39** displays those in Marion county. The majority of the bridges in Marion county have an average daily traffic between zero and 20,000 whereas in Cobb County there is a much wider range. Most notably, the bridges on and near Interstate 75 have the highest ADT entering the 300,000 range. A larger population and flow of traffic may explain why Cobb County has a larger number of bridges and bridges in better condition. The significance of mapping the ADT of bridges is to easily recognize and prioritize the locations of high traffic or low traffic areas and plan ahead for when load posting is needed.

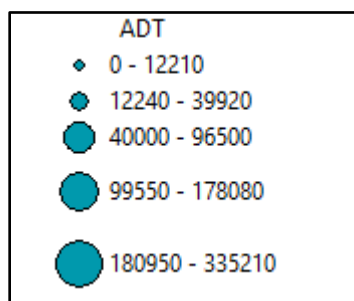


Figure 37: Annual Daily Traffic Legend

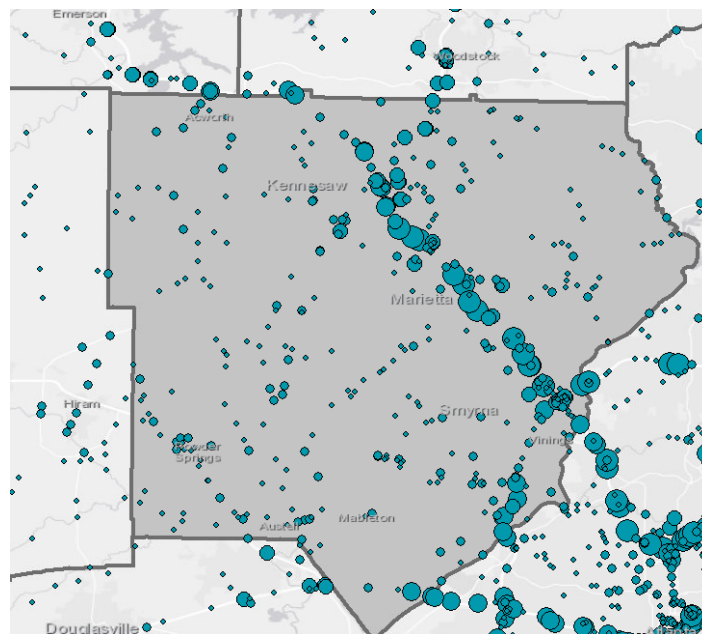


Figure 38: Cobb County's Bridges vs. ADT

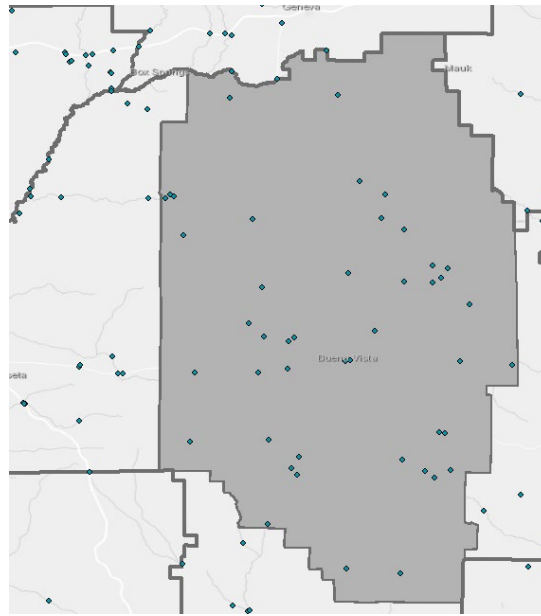


Figure 39: Marion County's Bridges vs. ADT

6.1.4 | Decision Tree Analysis of NBI

An analysis was performed using a tree-based data mining method on Georgia's local bridges. Since the premise of the data is based on the condition of the bridges, a classification tree is created to uncover any relationships related to the bridge condition in the NBI. The resulting decision tree in *Figure 40* now contains five nodes and six leaves. Each node box displays the classification, the probability of each class at that node, and the percentage of observations used at that node. The node "Steel = 1" signifies the main construction material, steel. If steel is the main material "yes" is to the left and "no" to the right. Most importantly, the total annual budget is the third node and the cut off is less than 260 million dollars for local Georgia governments. This decision tree is able to predict the bridge condition with an approximate 70 percent accuracy when performing a random forest test. The random forest consists of several decision trees to calculate its accuracy among a forest of uncorrelated trees. Finally, *Figure 41* summarizes all the factors that were considered in the construction of the decision tree and its order of importance. The "IncNodePurity" is a measure of variable importance, which is used to calculate the splits in trees.

The higher the value of the higher the importance of the variable to the prediction. The most significant factor was the bridge age followed by whether the main construction material is steel, the number of spans in the main unit, the total annual budget, etc.

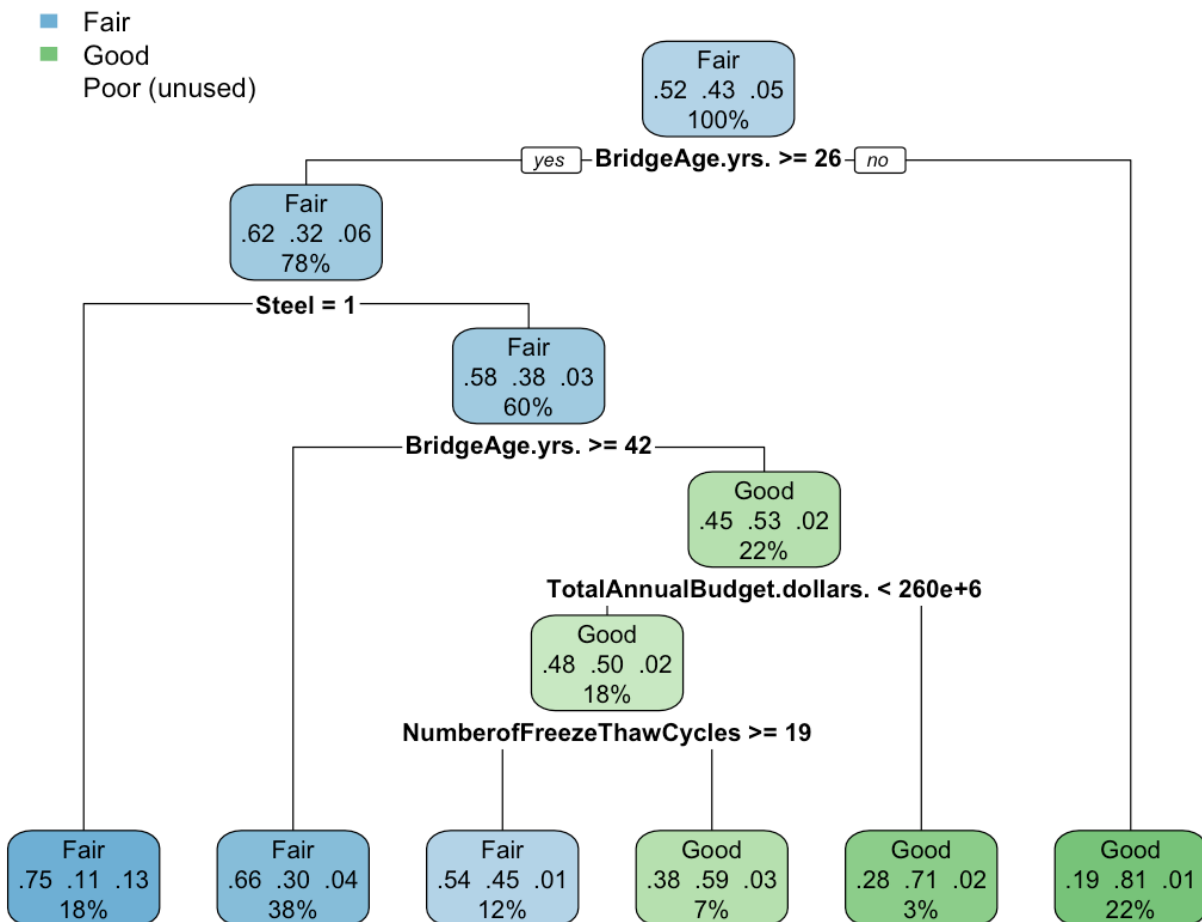


Figure 40: Final Decision Tree

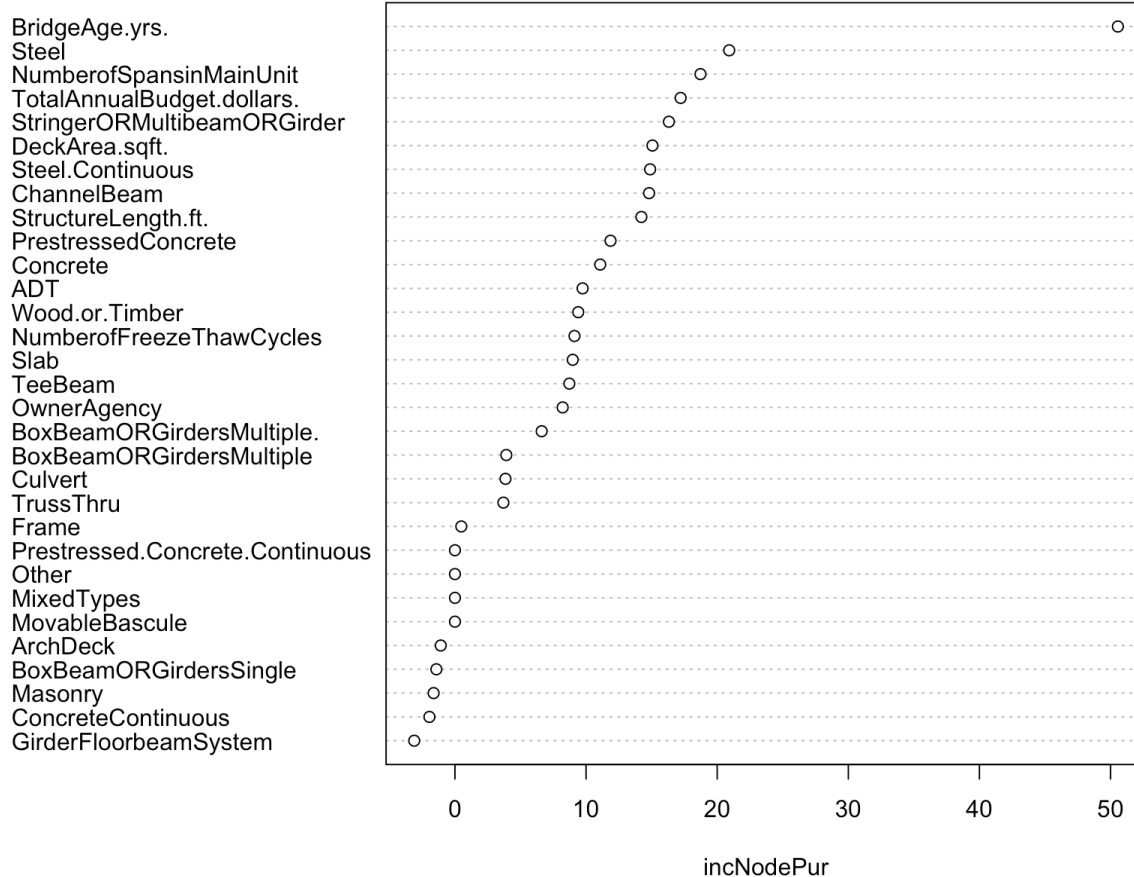


Figure 41: Factors that Influenced the Decision Tree Nodes

6.2 | Survey Analysis Results

Illustrated in the pie graph in **Figure 42**, more responses were collected from Mid-sized populations, about 45%. However, there were no rural populations that responded to the survey and about 25% of responses were from large cities and 30% from small cities. Therefore, there is not an equal representation of the population groups within the survey results.

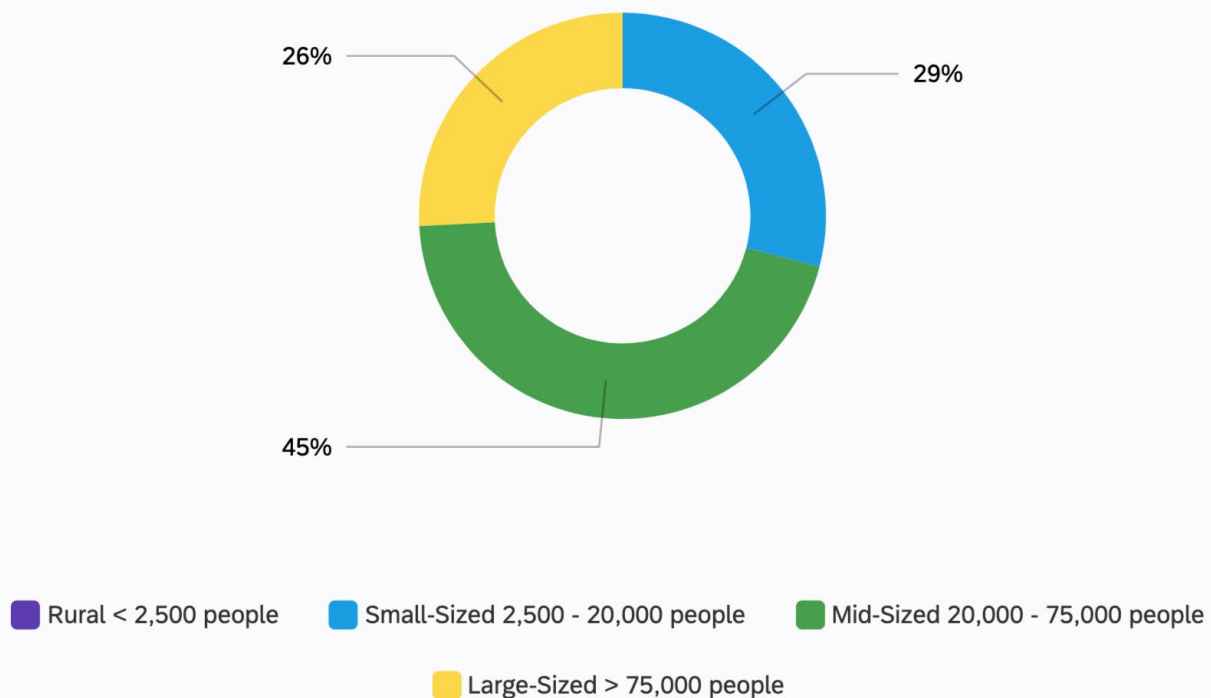


Figure 42: Local Government Population Size

The distribution of the number of bridges and culverts that each participating local government managed is listed in **Table 1**. The responses demonstrated that within this sample size the majority of the local governments maintain less than 30 bridges and culverts.

Table 1: Results from Number of Bridges and Culverts Managed by Respondents

Answer	%	Count
Less than 30	48.39%	15
31-60	16.13%	5
61-100	19.35%	6
More than 100	16.13%	5
Total	100%	31

Furthermore, when analyzing this data in relation to the population size of each local government in **Table 2**, it reveals a statistically significant relationship. This can be verified in a Chi Squared Test.

Table 2: Number of Bridges and Culverts Managed Crossed with Population Size

Q6: How many bri...	Large City > 75,000 p...	Mid-Sized 20,000 - 7...	Small City 2,500 - 20,...
Less than 30	12.5%	50.0%	77.8%
61-100	12.5%	28.6%	11.1%
31-60	25.0%	14.3%	11.1%
More than 100	50.0%	7.1%	0.0%
Total	100.0%	100.0%	100.0%

6.2.1 | Chi Squared Test on Population Size and Number of Bridges and Culverts

A Chi Squared Test is performed on the relationship between how many bridges and culverts maintained by a local government and the population within the local government. The P-Value determined in this relationship was 0.0389, which confirms a strong relationship. Additionally, for the Effect Size to be interpreted, the value for this sample size needs to be larger than 0.35. Thus, the Effect Size from the survey results was 0.463, signifying a statistically strong relationship despite the small sample size.

6.2.2 | Ranked ANOVA on Bridge Allocation Data and Population Size

When further analyzing the bridge allocation data in terms of population size, in **Figure 43**, there is no other conclusive pattern that emerges. In order to gage a statistically significant relationship, a Ranked ANOVA was used rather than a Chi Squared Test due to less responses at this stage in the survey.

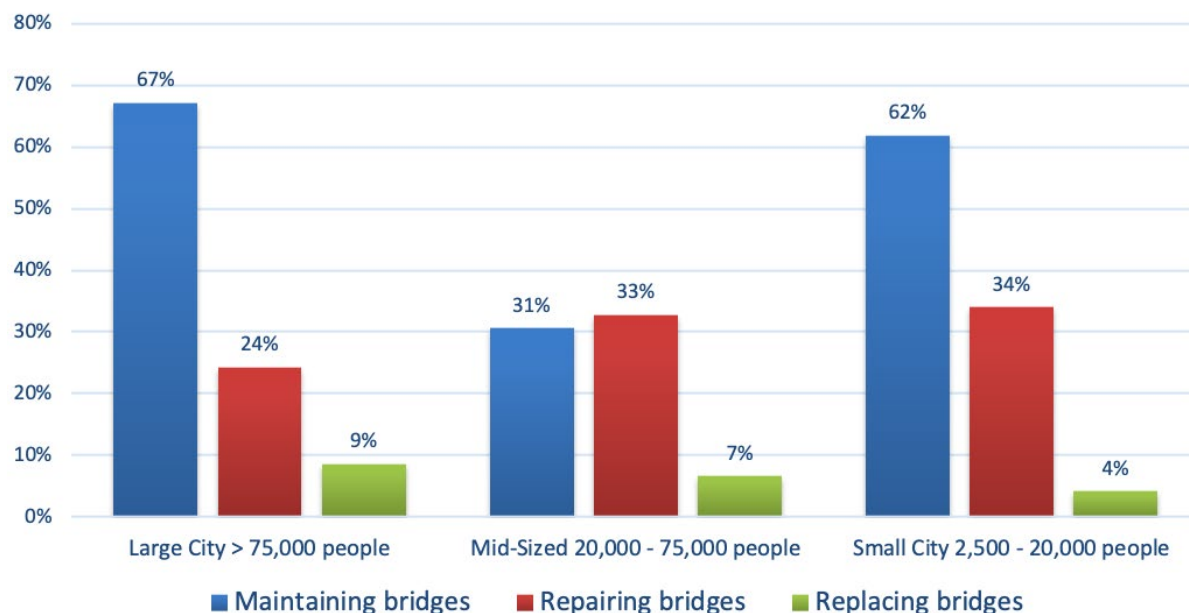


Figure 43: Average Percentage of Bridge Fund Allocated to Different Actions

A P-Value less than 0.05 signifies a “statistically significant” relationship. When performing a Ranked ANOVA on the relationship between the population size and average allocations towards bridge maintenance, repairs, and replacements, the respective P-Values are 0.0675, 0.817, 0.827, which all have no statistical significance. This could be due to the low number of responses or simply the nature of the information gathered for the funding percentage of maintenance, repairs, and replacement of bridges. Several local governments may not have a program in place which results in an inaccurate response on this question.

6.2.3 | Funding Information

Within the next section, the results from the General Fund budgets show that several local governments in the sample size do not allocate any or a large amount of funds towards bridge management. To begin with, the average General Fund Budget from the responses was \$27,919,243. The standard deviation was \$34,728,188 with a minimum of \$0 and a maximum of \$132,000,000. The \$0 was due to some incomplete responses in the survey. The average

percentage of the General Fund Budget allocated to managing bridges was a low 2.5%, with a standard deviation of 3.9%, minimum of 0%, and maximum of 15%. When further asked the percentage breakdown of that bridge allocation into percentages of Maintenance, Repairs, and Replacement the respective average percentages were about 40%, 28%, and 5%. The percentages are better listed in **Table 3**. Relatively, there is seemingly more attention towards a budget going towards maintaining and repairing bridges than there is towards replacing bridges.

Table 3: Statistics from Allocation of Bridge Funds

Allocation Type	Mean	Minimum	Maximum	Std Deviation
Maintaining Bridges	39.6%	0%	100%	35.1%
Repairing Bridges	27.7%	0%	100%	29.7%
Replacing Bridges	5.2%	0%	48%	10.9%

Since funding is a large part of a local government's need, respondents were asked about other funding sources used for the purpose of managing bridges. **Table 4** shows the choice counts per option. The most utilized funding source comes from SPLOST and LMIG, which gained 36% and 28% of the count respectively. **Figure 44** dissects the results into population sizes, however with few responses there is no conclusive analysis from the data.

Table 4: Funding Sources

Funding Source	Count	Percentage
Special Purpose Local Option Sales Tax (SPLOST)	18	36%
Local Maintenances & Improvement Grant (LMIG)	14	28%
Low Impact Bridge Program (LIBR)	6	12%
Local Bridge Replacement Program (LOCBR)	6	12%
Other	6	12%

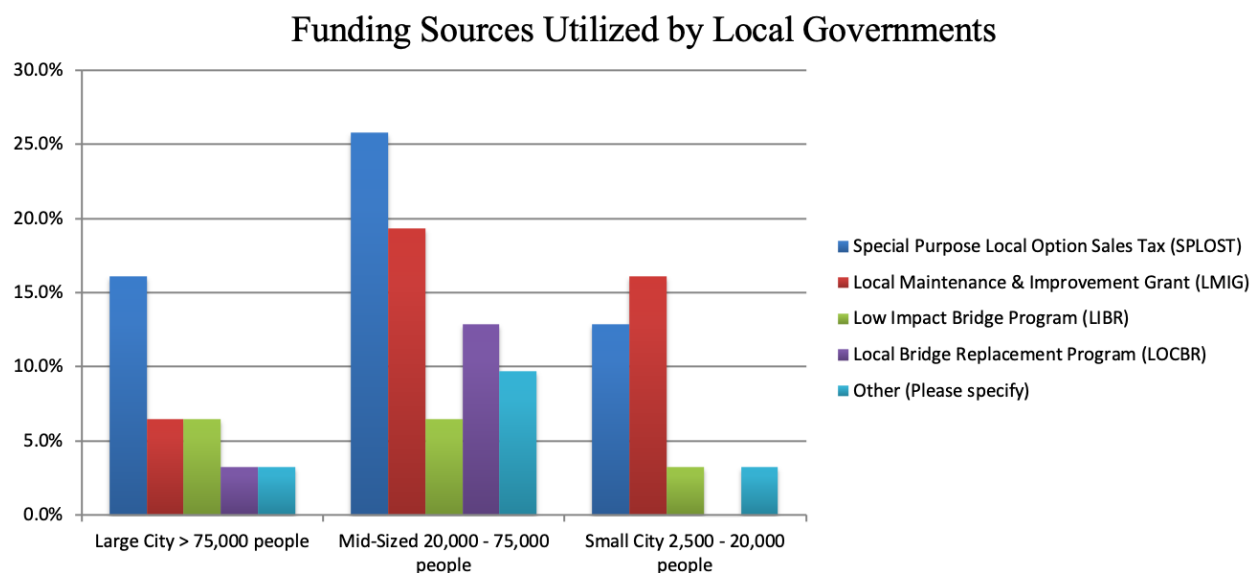
**Figure 44:** Funding Sources Utilized by Local Governments

Table 5 summarizes the results for the amounts in different funding sources. There is a relatively larger funding amount towards SPLOST than any other funding source in this sample size. On average there is \$2.3 million that SPLOST can provide to a local government in this

survey. SPLOST is followed by LMIG where the average funds received are about \$200,000. The two highest funding sources for these local governments are sources that are not used solely for bridges, whereas the sources such as LIBR and LOCBR, which are specifically funded towards bridges, are not as abundant. Even combined, there is barely an average of \$200,000 from the other funding sources.

Table 5: Results for Amounts in Funding Sources

Field	Mean	Maximum	Minimum	Std Deviation	Count
Special Purpose Local Option Sales Tax (SPLOST)	\$2,261,333	\$15,000,000	\$0	\$3,717,033	15
Local Maintenance & Improvement Grant (LMIG)	\$204,258	\$800,000	\$0	\$301,262	12
Low Impact Bridge Program (LIBR)	\$25	\$100	\$0	\$43	4
Local Bridge Replacement Program (LOCBR)	\$80,042	\$400,000	\$0	\$159,979	5
Other (Please specify)	\$116,667	\$600,000	\$0	\$219,216	6

6.2.4 | Planning and Bridge Asset Management Information

The next question deals with whether the local government has an asset management program for maintaining bridges. **Figure 45** illustrates that 50 percent of respondents have an informal form of a management program, 39 percent say they have none, and about 11 percent have a formalized program in place. If there were more respondents from the rural population category, there would most likely be a shift in the results. Overall, a large majority of the respondents show a lack of a formalized bridge asset management program. On average, in the presence of a program, only about two people manage the bridge asset management program in their respective governments. The maximum number of people managing the program was 13.

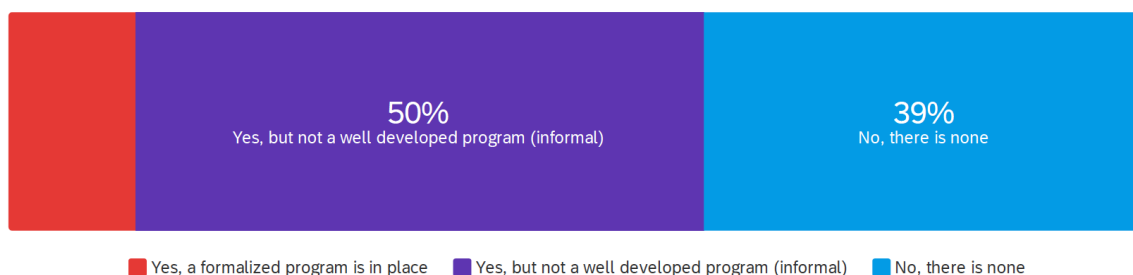


Figure 45: *Percent of having Bridge Asset Management Program in Place*

The next question concerned the prioritization of bridge maintenance, repair, and replacement. The summary of the responses can be seen in the **Appendix D**. This section of the survey served as open ended questions which lead to several vague responses. Several responses implied that GDOT's inspections or reports were their main source of prioritization. Overall, most responses relied on GDOT for all bridge prioritizations of replacements and some repairs. Some of the maintenance work and repairs were also prioritized by third parties. One response referred to their operational inspection program in order to prioritize maintenance and repairs. Another response indicated a monthly sweeping routine for maintenance and prioritizing underweight bridges first for repairs and replacement.

In order to generally assess how well local governments adapt to the Bridge Preservation Guide by FHWA the actions were listed in the next question in **Figure 46**. The actions that were most performed were developing actions for bridge maintenance, followed by monitoring and measuring performance of the bridge maintenance program. These two make up about 50% of the choice counts. Monitoring and measuring the performance of a bridge management program could be interpreted as simply reacting to a bridge inspection report, which every bridge receives every two years. The least performed actions were developing performance measures for effectiveness of the actions and developing methods of evaluation of benefits. These two are components to the basis of a bridge preservation program and they are the most proactive steps. These focus on

developing goals to meet and evaluating benefits that would justify more funding sources. These weaknesses could be addressed by local governments to better develop a bridge preservation program.

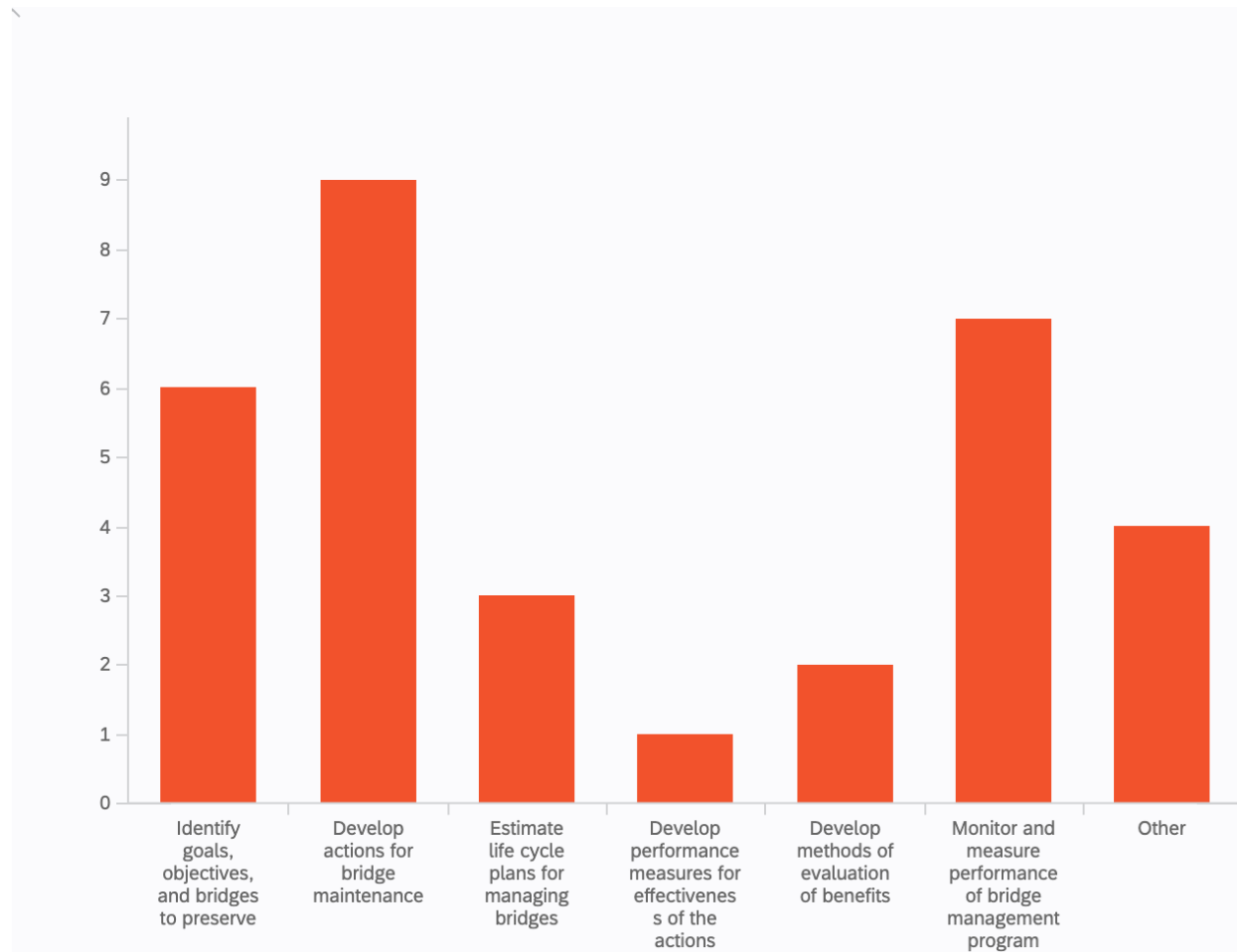


Figure 46: Bridge Preservation Steps performed by Local Governments

One of the last questions asked on the survey addressed the major challenges associated with managing or developing a bridge program. In **Figure 47** the main challenges selected were, in order, Funding, Personnel, Tools, and Guidelines. Furthermore, **Figure 48** shows the major challenges experienced in different population sizes. The results suggest that larger cities have less funding, guidelines, tools, and prioritization challenges than their counterparts. In **Appendix D** the

responses to the comments section are listed. This research hopes to fulfill these challenges that most local Georgia governments experience.

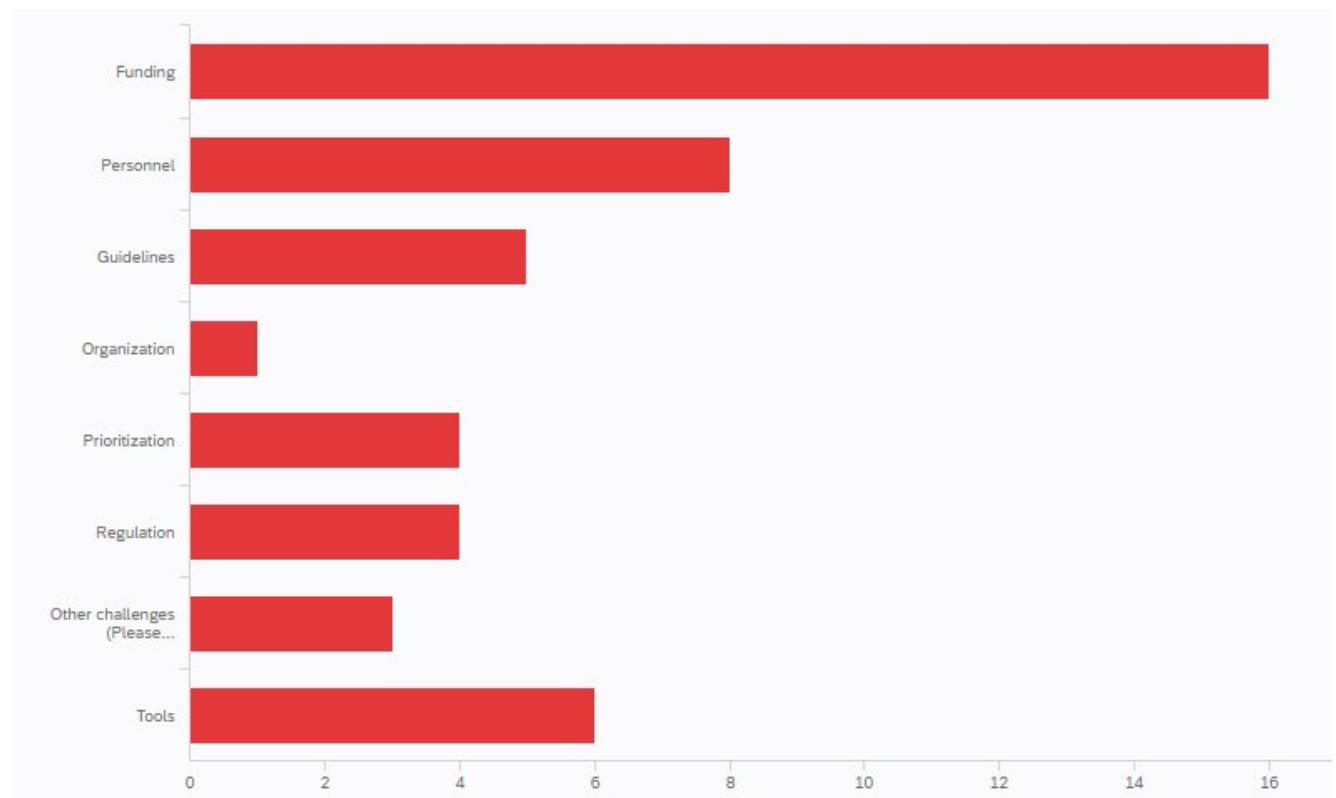


Figure 47: Results for Major Challenges

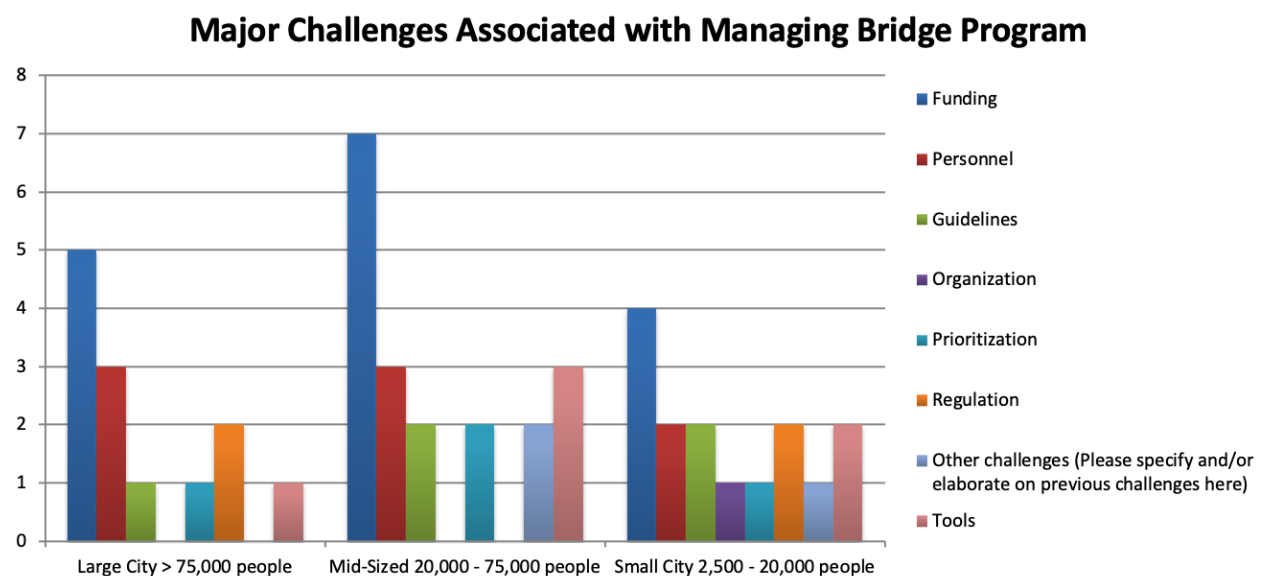


Figure 48: Results for Major Challenges and Population Size

6.3 | Interview Results

As outlined in the methodology, the interviews were conducted on three different population size categories. Additionally, an interview with GDOT State Bridge Maintenance Engineer Clayton Bennett was conducted to gain insight from a different perspective. **Table 6** outlines a summary of the interview findings (excluding Bennett’s interview) based on population size.

Table 6: Summary of Interview Findings Based on Population Size

Summary Items	Small-Sized	Mid-Sized	Large-Sized
<i>Current operations</i>	No main unit, mainly under roadway divisions	Mainly with stormwater division	Department of Engineering or Transportation
<i>Constraints and Challenges</i>	Mostly funding	Funding, no proactive measures and lack of assistance from GDOT	Funding, right personnel, and better coordination between departments
<i>Opportunities</i>	Bridge inspection platform and list of trusted engineers and contractors for various activities	Better management structure, guidelines and software	Dedicated “bridge person”, Better budgeting: Local guidebook for PWD with step-by-step development of maintenance activity costs
<i>Crews and Contractors</i>	Contractors used for most maintenance and repairs, internal actions include visual inspections	Routine maintenance: storm debris cleanup and scour inspections done by road crew, more specialized work contracted out	Chatham County- DOE handles replacement and repairs of load posted bridges and PWD handles bridge maintenance Rockdale County- Mostly contractors
<i>Funding Sources</i>	SPLOST LMIG TIA	Stormwater division line item, SPLOST, LOCBR LMIG EEE, TIA, Discretionary funds	SPLOST Chatham County- Small amount from general fund budget Rockdale County - Could tap into RDOT’s general operating budget

6.3.1 | Small and Rural Local Government Interview

6.3.1.1 | *City of Dublin*

Shawn Wood is the Public Works Director of the City of Dublin. Wood is responsible for several departments: natural gas, highways and streets, wastewater, and the maintenance of bridges. Currently, the City of Dublin does not have a program in place for the purpose of managing their bridges. However, Wood states that they are in the process of drafting a bridge and culvert maintenance policy, which they consulted with the City of Columbus to obtain, adopt, and revise their policy and procedures. Wood is hoping to implement the policy by 2021. The policy will provide operating procedures, tasks, and repair procedures for a range of bridge activities.

Currently however, bridges are categorized within the highways and streets department, as well as stormwater since the stormwater department is responsible for waterway obstructions. In order to prioritize bridge management, Wood revealed that they utilize an online GIS work order management system called Hyperweb. There are different levels of priority within the system, with bridges being at the top of the priority list. The City of Dublin heavily relies on GDOT to perform inspections and provide recommendations for their bridges. The only time they perform internal actions is for problematic bridges. For instance, if a bridge is not on schedule with its repairs, they will perform periodic inspections, sometimes bi-weekly, and follow up once those repairs are made. Bridge work is carried out in-house by the road and stormwater crew, however for more specialized work they find contractors to carry it out. According to Wood, GDOT's bridge inspection reports include a comments section that notes the severity of the problems and suggests a method of action. This is typically what is followed as corrective maintenance. There is not currently any preventative maintenance that is performed on their local bridges.

When asked about the bridge funding, Wood estimated that about three percent of the general fund budget is used for bridge management. Other bridge funding sources that the city takes advantage of is the Transportation Investment Act (TIA), SPLOST, and LMIG. The majority of structural work is funded by either SPLOST, TIA, or their discretionary funds whereas LMIG is mostly used for resurfacing, which is categorized as maintenance work. Wood could not recount the exact amounts for each respective funding source but estimates that the city receives about \$250,000 from LMIG. Overall, when asked about the limitations that exist in the face of developing a bridge management program Wood believes that there have not been many issues that the city faces, in terms of bridges. GDOT is always there to assist. He suggests that a bridge inspection platform would be useful, but not cost effective due to the size of their city. Additionally, if they did not have the assistance of GDOT they would most likely adopt their procedures.

6.3.1.2 | City of Cairo

Within the city of Cairo, City Manager Chris Addleton manages all aspects of public safety, utilities, streets, sewer, water, bridges, etc. Currently, there is no bridge management program. Bridges are managed under the street and sidewalk division. The City of Cairo only manages one bridge and several culverts. In 2008, a tropical storm hit the city which revealed their stormwater issues. The storm prompted the city to enlist an engineering firm to create a stormwater plan. Addleton relies on GDOT inspections for the bridge, but the culverts are visually inspected in house. Engineers would be enlisted for any suspicious cracks or defects.

The majority of maintenance and repairs are contracted out by engineering firms. The street and sidewalks division are funded through the general fund. Other funding sources are usually taken from SPLOST and LMIG. Approximately \$1 million is received from SPLOST

and ten percent of that is used for managing the bridge and culverts. Addleton states that the main limitations that the City of Cairo faces when managing their bridges is the funding. There would not be any infrastructure maintenance without SPLOST available. Since the city is so small, they depend on outside engineers. A trusted list of contractors and engineers for various types of work would be helpful along with funding for that work.

6.3.2 | Mid-Sized Local Government Interview

6.3.2.1 | *City of Valdosta*

Collins is the Director and City Engineer for the City of Valdosta. Angela Bray, who is the head of the stormwater and arbor division, also joined the interview with Collins. She plays a role in bridge management because the city has a large number of culverts, which falls under her jurisdiction. Collins is responsible for all public and private development projects, stormwater hydraulic reports, GIS group, right of ways, capital improvement program, and the traffic and streets division.

Currently, there is no bridge management program in place. In terms of prioritizing any bridge work, Collins stated that they rely heavily on the GDOT reports that they receive bi-annually. Any issues that are identified by GDOT would be addressed by monitoring and budgeting the repairs for the bridge. Collins emphasizes that the management of bridges is a reactive approach, which is one of the limitations of developing a formal program. In terms of bridge maintenance, Bray's team will perform in-house bridge and culvert inspections every two and a half years. Bray mentions that there is a separate employee that specifically performs the inspections for culverts and drainage canals. They typically search for erosion and inspect underneath bridges to determine whether the bridge needs washing or any other visual maintenance work.

Collins mentions that the GDOT reports will flag and identify certain issues for a bridge but does not identify the needed repairs. Therefore, Collins often hires local structural engineers to further inspect the flagged bridges and then inform him of what actions are needed on the bridge. An instance where inhouse work was performed was when Bray received a call on a bridge that was supported by piles rather than abutments. The soil near the piles had washed away, which prompted Bray's crew to install concrete reinforced slabs in the area. They also do not perform bridge preservation projects as they mostly perform reactive measures.

In terms of funding, there is no money allocated to a "bridge management category" from the general fund budget. However, their culverts are funded by a line item through the stormwater division as box culvert management. Bray does receive about \$1.6 million annually for the stormwater division. For the past two years they have repaired two box culverts, which cost around \$145,000 to \$150,000 each. Those repairs would be paid for by SPLOST. Additionally, a line item regarding piping repairs amounted to \$143,000 for the year. Collins recounted that several replacements are performed on corrugated metal pipe culverts due to the fact that they have a shorter life span than reinforced concrete pipe. The City of Valdosta does fortunately utilize both SPLOST and TSPLOST. A future project that the city anticipates consists of a \$20 million four lane bridge structure that will be constructed over railroad tracks, which will be funded by TSPLOST. LMIG is another funding source that can be used for the city but is mostly utilized for resurfacing. The city has also utilized a local bridge program that would cover the costs for a replacement project if the roadway is able to completely shut down without any traffic mitigation.

Overall, Collins concludes that a bridge management program does not currently exist mainly due to lack of funding. They are however fortunate to have other funding sources like

SPLOST and TSPLOST to carry out some bridge projects. In the case of maintenance and repairs their approach is reactive.

6.3.2.2 | Dawson County

David McKee of Dawson County was interviewed as another representative of the mid-sized category. McKee as the Public Works Director on the other hand, is responsible for roughly 300 centerline miles of roads, 21 bridge structures which includes box culverts, 11 of those are bridge superstructures, a commercial transfer station and closed landfill. Dawson County similarly does not have a program in place for the purpose of managing their local bridges. When asked about how the county prioritizes bridge management McKee states that he also depends on the GDOT reports to *figure* out what work each bridge needs. The road crew would typically carry out some routine maintenance such as debris cleanup and scour inspections, but he does not have the ability inhouse to perform bridge repairs. The repairs would be contracted out. In the last two years, two to three structures have been deemed structurally obsolete. In which case, the county will ask GDOT to partner with them and budget for the replacement. Typically, budgets are approved in June and July each year.

The funding mechanisms are the main problems that the county faces with their bridge management. McKee remarks that the decision makers are more concerned for potholes on the bridge than the bridge itself. He observed that when the county is successful in getting funds for a bridge it typically occurs when GDOT deems the bridge structurally obsolete. Since there is no funding from the general fund budget, bridge work is usually extracted from his discretionary funds of roughly \$30,000, which covers “property and maintenance repair or general supplies.” Those funds will generally cover the routine maintenance however they do not receive funding for sandblasting and repainting structures unless GDOT instructs them to. McKee receives about

\$550,000 annually from LMIG and an LMIG (Education, Economic and Emergency) EEE is utilized as well. For any serious bridge closures McKee would have to go to the board of commissioners and utilize the emergency fund. Fortunately, in June 2020, TSPLOST will be on the ballot and they will be able to have additional funds to prioritize the list of items on GDOT's inspection reports. The issues that are identified in the report usually prompt repairs done by other contractors. Overall McKee would prefer a straight-lined funding source and structure for bridges and assistance from the DOT in prioritizing the work. Furthermore, McKee believes Dawson County would benefit from other tools and resources like guidelines and software.

6.3.2.3 | *City of Griffin*

Brant Keller works as the Public Works Director at the City of Griffin. A bridge management program is not employed however a condition analysis was completed for the city in 2012 by Florence and Hutchison Inc., an engineering management firm. This yielded a cost analysis and review of the city's culverts. The work performed by the firm is the basis of how the city manages its bridges and culverts. The firm surveyed storm drains and culverts and then gave recommendations to validate where to spend money. An interesting point that Keller made was the absence of a GDOT inspection since 2014. He explains that the inspections are usually sent to the county and not the city. Therefore, they relied on outside inspections. In terms of prioritizing the bridge work, the ratings that the bridges and culverts are given are usually considered. The city depends on consulting engineers to review and determine how to move forward. There are about five bridges in the city and several culverts. Most activities include the replacements of culverts. Keller states that the city tends to be proactive in replacement, but reactive in maintenance. Most maintenance work includes visual inspections once every 10 years (with recommendations) and work done by contractors since the city does not employ an in-house engineer.

The loose program is funded through SPLOST funds and the Stormwater Utility funds. The City of Griffin also utilizes bridge safety funds from FHWA where the city matches 10% of the costs. Recently due to the age of the city's bridges most have been replaced. When asked about types of improvements that would be beneficial to the city Keller explains that better technical data on bridge inspections along with development of guidelines and manuals for in house training are desired. Additionally, the program can be developed to make inspections and submit to engineering firms for quality assurance and quality control. Keller notes that there needs to be another inspection manual or check off sheet for municipalities, since the state bridge manual does not apply well to the city's needs and is oftentimes too lengthy. Over the last six years the city has received \$10-14 million from SPLOST and TSPLOST which is not enough for additional plans.

6.3.3 | Large-Sized Local Government Interview

6.3.3.1 | *Chatham County*

Nathaniel Panther with Chatham County was interviewed as the Senior Engineer of the Department of Engineering (DOE). He is responsible for projects relating to transportation, drainage, right of ways, and on call contracts with a variety of contractors. Chatham County does have a bridge management program, but Panther suggests it is rather informal. Panther explains that the Public Works (PWD) is in charge of the maintenance of bridges, whereas the DOE is in charge of the repairs and replacements of the bridges. They do not however have a dedicated department like roads and stormwater as it is too expensive.

Currently, there are about 30 individuals in the Department of Engineering. They manage approximately 50 bridges within the county. Panther believes that the program in place is well followed, however there is a need to have better coordination between the Public Works Department and the Department of Engineering. The two different departments can have

overlapping issues and work which may not be as efficient. When asked about prioritization of bridge management work, Panther explains that the DOE's main priority is to address load rated bridges, oftentimes replacing them as repairing them is not as cost effective.

In terms of funding, they do receive a small amount from the general fund budget. Other funding sources include LMIG, which is utilized for road resurfacing and SPLOST for the past 30 years. SPLOST has been utilized for replacement projects. When asked about the types of improvements that were needed within the bridge program Panther expressed that a need for one or two staff members who carry out bridge routine actions would be beneficial. For instance, they could perform regular inspection and trim vegetation on the bridges. Panther recounts that they had high water tides the week prior, which is something that a dedicated staff member could monitor for a bridge.

Panther was not aware that the department did not have a dedicated staff member for bridges until he reached out to the Bridge Superintendent, who was also supposed to participate in the interview. That individual actually oversees one specific drawbridge rather than a number of bridges. Overall, from the perspective of the DOE, Public Works would benefit from a local government guidebook that would determine a step by step process in developing the different costs of certain maintenance activities. This would allow the PWD to better budget those types of actions and defend their request for needing more funds.

6.3.3.2 | *Rockdale County*

The other large-sized government that was interviewed is Rockdale County Department of Transportation (RDOT). John Moretto who is the Director of RDOT and Blair Barnhardt who is the Deputy Director of RDOT were both interviewed. Both the Director and Deputy Director oversee all the roadways of Rockdale County, maintenance of roadway traffic signals, stormwater,

access management, and management of 22 bridges. Morreto has oversight over projects and retrieves federal funding. He has a consulting team for the department as well. His main focus is a 25-year plan on the infrastructure whereas Barnhardt focus is more short-term, about six months ahead.

RDOT currently does not have a program in place for bridge management. Their main priority at the moment are roadways. Barnhardt explains that RDOT does not have proper inventory of their bridges. They do, however, have a “GDOT Binder” which contains the GDOT inspection reports. The bridges are low priority until there is an event because although they are aware that bridges are important, bridge structures tend to last longer. Therefore, they focus on other infrastructure projects.

In terms of prioritizing bridge maintenance work, they simply rely on GDOT’s inspections. They prioritize the ratings from the reports in conjunction with the dependable traffic routes. They are mainly worried about causing delay by blocking those critical routes. In short, their priority starts with the sufficiency ratings, then functionality of bridges, then the traffic count and access points. Although the department is much more proactive with their road work Moretto and Barnhardt are aware that they take the worst-first approach for their bridges. They strongly recognize that there is a need to transition from a reactive approach to a more proactive one. They typically utilize contractors for most of the bridge work since there are no internal bridge inspectors.

When discussing the funding mechanisms, they have dedicated funds for pavement within their department but not for bridges. Funds could be tapped from RDOT’s General operating budget. Emergencies could be funded by the Federal Emergency Management Agency (FEMA) and Georgia Emergency Management and Homeland Security Agency (GEMA). In order to

implement a program for the bridges, the work needs to be identified and planned out six to eight months in advance. Then the bids have to be approved to get funding. Additionally, RDOT has a SPLOST transportation subcommittee. Currently, they have five years of planned pavement rehabilitation work but no mention of bridge work within that five-year plan. When asked about other funding sources, such as LMIG and LOBR, they expressed that they have wanted to take advantage of those programs in the past but are not sure if they have currently utilized them.

When discussing improvements for their bridge management system, Barnhardt suggested a need for the right personnel, “to have a set of eyes to be proactive. Adding up all the costs of 23 bridges would justify a salary.” He further mentioned that there are some bridges that are not safe and misaligned from older construction practices. Moretto expressed the struggles he faces when justifying a bridge staff concerns funding, manpower, environmental challenges that prevent replacements, the specialized field of bridge work, and the small number of bridges in the county. He adds that it is difficult to get a politician on board with bridge funding since the projects would not be “flashy enough.” They also agreed that other tools such as software would aid in the development of a bridge program. Overall according to both Moretto and Barnhardt the interview allowed them to self-reflect on their department and allowed them to recognize a need to be more proactive with Rockdale County’s bridges.

6.3.4 | GDOT Bridge Maintenance Engineer Interview

In addition to the local government interviews, Clayton Bennett who is the State Bridge Maintenance Engineer for GDOT was interviewed to provide deeper insights from the perspective of an inspector. When asked about the contents of the inspection reports, Bennett stated that typically a summary of findings is provided for the deficiencies in each bridge. An NBI number is generated by element ratings in order to correctly quantify the inspection results. Photographs

along with recommendations are provided as well. Bennett cautioned that the inspectors are not engineers, which is a common assumption that counties make when asking for help. Oftentimes, Bennett asks local governments to send repair plans to GDOT's bridge maintenance to further assess the efficiency of their bridge plans.

A flaw that Bennett acknowledges is that once the plans for a bridge are carried out, a life plan for the bridge is not considered. For instance, there should be a bridge preservation plan along with the construction of the bridge. 10 years from its construction a construction joint, for example, should be replaced whether it is necessary or not in order to continuously expand the life of the bridge. Bennett recounts that the House Bill 170 (2015) does not only apply for state bridges, but could also apply to local bridges. The bill would cover the costs for the bridge work if there is a strategic life plan of the bridge present, at least 10 years in advance. Although he is not exactly sure where to find the program there are additional federal reimbursements that the federal government would provide if there are preservation activities performed on the bridge.

On the subject of prioritization of bridge management work, Bennett suggests local governments prioritize the bridges that are most critical to its citizens. This could stem from indicators, such as the average daily traffic that the bridge receives or from GDOT's state route group, which identifies the critical routes throughout the state. When discussing local governments' decision on whether to use an in-house crew or contractors, Bennett suggests that it would take about seven to eight crew members for maintenance or the added cost of consultants producing the design/repair plans. He states that local governments can utilize GDOT's repair plan that has been developed to help agencies step by step. LMIG is typically only used for resurfacing and not bridge work.

Bennett does not specifically recommend any software tools for local governments, although GDOT is working on a transportation asset management tool that could be utilized. This tool would be an excel type spreadsheet that would help counties with their bridge assets. Although it is difficult to locate on the GDOT website, Bennett further states that agencies have access to a repair manual that was created in 2012. GDOT's Office of Bridge and Structural Design Bridge Maintenance Unit created the *Bridge Structure Maintenance and Rehabilitation Repair Manual*, which can be utilized as a reference for bridge activities, such as preventative maintenance and repairs applicable to state and local bridges (2012). The activities are listed and followed by general notes, material specifications, construction detail drawings and safety procedures to follow. This manual, however, does not specify when these activities are needed; solely how to perform them. A local agency would need to identify the needed activities from the inspection reports or from an established plan.

Overall, Bennett encourages all local governments to contact GDOT's bridge maintenance office and mainly the state bridge maintenance engineer, instead of the inspectors. The contacts could help them prioritize the bridge work that needs to be done.

6.4 | 2020 Bridge Asset Management Guide for Local Georgia Governments

This section focuses on the main points outlined in each segment of the *2020 Bridge Asset Management Guide for Local Georgia Governments*, which is presented in **Appendix F** and previewed in *Figure 49*.

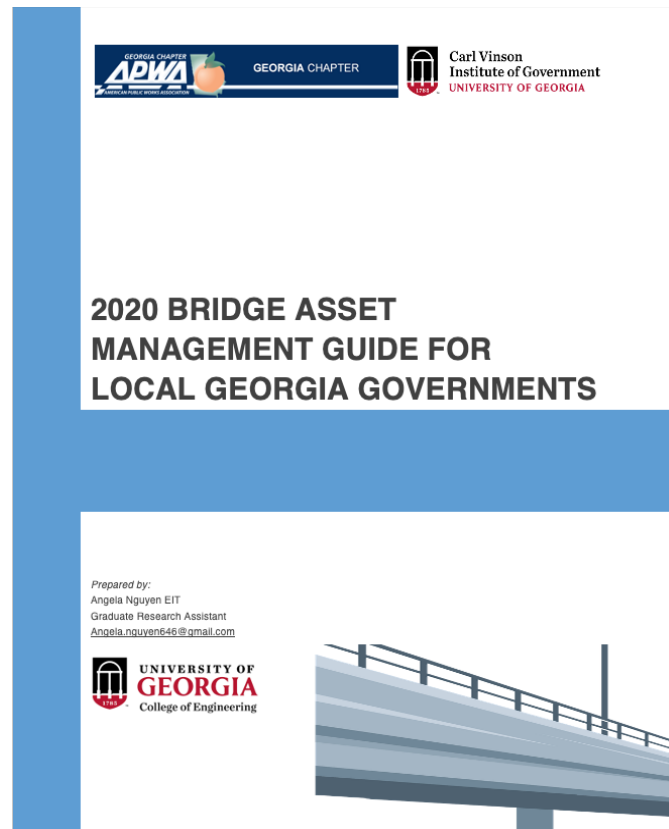


Figure 49: 2020 Bridge Asset Management Guide for Local Georgia Governments

6.4.1| Bridge Condition Assessment

In order for a local government to begin developing a management plan for their bridges, the appropriate assessment of the government's bridge conditions need to be considered and evaluated. This section in the guide discusses the general methods used to assess a bridge's condition, which mainly cover the NBI scale, the sufficiency rating, definitions for Structurally Deficient and Functionally Obsolete Bridges. Additionally, the inspector recommendations are discussed in order to introduce the process that local governments should consider when interpreting and taking action on those recommendations.

Some of the recommendations for this section include: establishing a set of metrics as a basis for prioritizing its bridge actions with structural and safety issues taking precedence, bridge owners leveraging their bridge inspections for both the identification of needed work as well as

the verification of completed work (ie. checking to see how the last repairs affect the bridge's life cycle). Additionally, as recommended by GDOT's State Bridge Maintenance Engineer, sending in any repair plans to the bridge maintenance office would allow the office to assess the feasibility of the plans.

Lastly, included in the bridge condition assessment are the additional factors affecting bridge condition which stem from the findings of the preliminary review in **Section 5.1 and 6.1**. The three main factors to monitor include bridge age, bridge design material, specifically steel, and total annual budget. When solely analyzing local Georgia bridges through machine learning, bridges of 26 years or older begin to decline from good condition to fair and poor condition. Local governments should pay more attention to bridges approaching this age as well as proactively preserving all bridges. Again, it was observed that steel bridges are in relatively lower conditions. Most steel bridges in Georgia are typically older than concrete bridges, which may explain why the majority of steel bridges are classified at a lower condition.

Unsurprisingly, a local government's financial resources greatly influence the condition of their bridges. The analysis of local Georgia bridges indicates that bridges older than 26 years but younger than 42 years will typically be in Good condition only if the county had a total annual budget greater than \$260 million for the 2019 fiscal year. Although the total annual budget does not assess the sources solely for transportation and bridges it still demonstrates an apparent conclusion that local governments with more financial resources will have better condition bridges. Local governments with low financial resources should invest in a long-term bridge preservation plan, especially since it can extend the bridges' service life and lower annualized costs.

6.4.2| Components of the Bridge Preservation Strategy

This section provides a discussion on several components of the bridge preservation strategy, which will provide guidance when drafting a local bridge management plan. The main points covered in this section include the types of actions, and the cost estimating considerations. **Figure 50** shows the four types of bridge actions.



Figure 50: Four Types of Bridge Actions

Preventative maintenance such as cyclical and conditional maintenance activities, rehabilitation, and replacement are defined with examples, as well as the process for preventative maintenance activities and repairs through the *GDOT Bridge Repair Manual* in Chapter 3 and Chapter 2 respectively. Within the cost estimating section, the cost benefits of utilizing a deterioration model and considerations for in-house vs. contract costs are discussed. The advantage of utilizing deterioration models would be beneficial for local governments managing over 50 bridges. The models can be a tool to prioritize funding, since they can determine the cost of deferred maintenance and repairs by predicting future conditions based on what actions are chosen. Costs for both in-house work and contract work should be recorded to develop standardized

itemized cost estimate worksheets. Consideration for collaborating with adjacent local governments to share resources, such as a combined specialized crew, is suggested.

6.4.3| Steps in Developing a Bridge Management Plan

The structure of this section within the guide presents eight suggested steps for an effective bridge management plan and the included concepts to consider. The steps are displayed in **Figure 51** and are in a suggestive order, which can be adjusted according to the local government's needs. The concepts within each step should inform the bridge owner on how to execute each phase.



Figure 51: Steps in a Local Bridge Management Plan

6.4.3.1| Step 1 Develop Goals and Objectives

The first step identifies the goals and objectives for the local government's bridge plan. It is suggested that the bridge asset management plan improves Poor bridges, provides a capital preventive maintenance program to maintain Fair and Good bridges in the same condition or better.

The goals and objectives are tracked through performance measures, which each local government decides. Performance measures are the metrics by which the local government will evaluate the effectiveness of the plan. For example, the measure could be the NBI condition rating and the respective goal would be to reduce the percentage of poor condition bridges below 10% over the course of 10 years.

Within this step, it would be advantageous to establish a methodology for prioritizing projects for funding. A method to measure priority can be high to low categories or it can be evaluated by factors and weighing them as a percentage, such as condition (25%), load capacity (20%), traffic (20%), safety (20%), and detour (15%).

6.4.3.2| Step 2 Perform Bridge Asset Analysis

An effective plan begins with the assessment of the local government's bridges. Step 2 presents the need for a bridge asset or condition analysis, which is an overall assessment of the current state of the bridge population. This would comprise of the types, number, and percentages of bridges in good, fair and poor condition, etc. Moreover, a discussion of the bridge assets and their conditions can be tied to the established goals and performance measures. Likewise, a discussion of the bridge asset analysis can alternatively influence and inspire the goals and performance measures for the local government's plan. Along with the analysis, there should be a more developed inventory than what is provided by the bridge inspections. Although bridge inspectors provide the report for all the bridges in the local government, there should be a separate inventory in order to track condition changes and work needs. For local governments that do not already have a separate inventory of their bridges, the inspection reports can be used as a foundation for the separate inventory.

6.4.3.3| Step 3 Implement a Preservation Strategy

The third step is to implement a preservation strategy, which is the main process in a bridge asset management plan. The preservation strategy is the overall actions to be taken by the local government to address preservation. A general approach would entail developing a list of actions and rules for maintenance and repairs. The types of fixes and list of actions for preservation as previously mentioned in the components of the preservation strategy section are suggested. **Figure 52** shows a preview of an example of bridge selection criteria and the expected outcomes for each action. The full table can be observed in **Appendix 2** within **Appendix F**. A local government can utilize this decision table by modifying it to its specific bridges and inspection reports. The section in the same appendix also provides an example of an expanded Preservation Criteria Table. A local government starting their preservation criteria table can follow the general recommendation in **Figure 53** which lists the most recommended bridge preventative maintenance activities that can be implemented (Bowman and Moran, 2015).

Appendix 2: Examples of Preservation Criteria

Table 9: Bridge Preservation Criteria Established for Genesee County

Preservation Action	Bridge Selection Criteria	Expected Service Life
Replacement		
Total Replacement	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	70 yrs
Superstructure Replacement	NBI Rating for Superstructure of 4 or less, or when cost of rehabilitating superstructure & deck exceeds replacement cost.	40 yrs
Deck Replacement Epoxy Coated Steel Black Steel	Use guidelines in MDOT's <i>Bridge Deck Preservation Matrix</i> . NBI Rating of 4 or less for deck surface and deck bottom, or when deck replacement cost is competitive with rehabilitation.	70 yrs 40 yrs
Substructure Replacement (Full or Partial)	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.	40 yrs
Rehabilitation		
Concrete Deck Overlays Deep Shallow HMA / Membrane HMA Cap	Guidelines in MDOT's <i>Bridge Deck Preservation Matrix</i> NBI Deck Rating < 5 for surface and > 5 for bottom NBI Deck Rating < 5 for surface and > 4 for bottom NBI Deck Rating < 5 for surface and > 4 for bottom NBI Deck Rating < 5 for surface and < 4 for bottom	25 yrs 12 yrs 8 yrs 3 yrs
Railing Retrofit / Replacement	NBI Deck Rating greater than 5, Railing / Barrier rated less than 5, or Safety Improvement is needed	
Steel Beam Repairs	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	

Figure 52: Preview of Bridge Preservation Criteria Example

No.	Bridge preventive maintenance activities	Frequency (years)
1	Deck sweeping/cleaning	
	- deck sweeping/cleaning	1
	- drainage system cleaning/washing	1
2	Concrete deck maintenance	
	- deck sealing	5
	- deck crack sealing	5
	- deck partial patching	5
3	Joints maintenance	
	- joints cleaning/flushing/resealing	1
4	Bearings maintenance	
	- bearings, seats and slope wall cleaning/flushing	2
	- lubricating	4
	- spot painting	10
5	Approach slab maintenance	
	- sweeping and cleaning	1
	- drainage system cleaning/flushing	1
	- seal approach deck/cracks	5
	- joints cleaning/flushing	1
6	Superstructure washing	
	- cleaning/washing	2
7	Spot painting	10
8	Vegetation control	1
9	Remove debris from piers/abutments	1
10	Pin/hanger (or hinge) connection maintenance	
	- clean/flush connection members	2
	- lubricate connection members	4
	- spot paint connection members	10

Figure 53: Recommended Bridge Maintenance Activities

6.4.3.4| Step 4 Establish Cost Estimates

The process of creating a preservation strategy further suggests the creation and establishment of a cost estimate worksheet, which is Step 4. Local governments can develop standardized item-based in-house and contracting cost estimates for on-call activities. The process was previously discussed in **Section 5.4.3.1**. The result of the cost estimate worksheet can be previewed in **Figure 54**. This sheet can be further tailored to each local government through their recorded work orders and cost data from each bridge repair, maintenance activity, and previous contract work.

2020		- LOCAL GEORGIA -		REV. 9/18/2020	
BRIDGE MAINTENANCE COST ESTIMATE WORKSHEET					
REGION: _____		FISCAL YEAR: _____		STRUCTURE NUMBER: (3-5 digit) _____	
SUPERVISOR: _____		DATE: _____			
LOCATION: _____		DECK AREA: _____		BRIDGE ID: XXX-XXXX	
PRIMARY WORK ACTIVITY: _____		DECK DIM: _____		STR. TYPE: _____	
*Delete any item not used					
WORK ITEM					
		QUANTITY	UNIT	UNIT COST	TOTAL
REPLACEMENT					
Bridge Replacement Cost (Georgia Bridge) [1]			SF	\$129.00 /SF	
New Superstructure [2]			SF	\$185.00 /SF	
New Deck [2]			SF	\$75.00 /SF	
DECK					
Bridge Railing Replacement [2]			FT	\$400.00 /FT	
Concrete Brush Block / Curb Patch [2]			FT	\$24.00 /FT	
Concrete Deck Patch [2]			SFT	\$30.00 /SFT	
Deep Overlay [2]			SFT	\$33.00 /SFT	
Epoxy Overlay [2]			SYD	\$30.00 /SYD	
Expansion Joint Gland Replacement [2]			FT	\$85.00 /FT	
Expansion Joint Replacement [2]			FT	\$600.00 /FT	
Full Depth Patch [2]			SFT	\$76.00 /SFT	
Healer / Sealer [2]			SYD	\$15.00 /SYD	
Overlay Removal [2]			SYD	\$16.00 /SYD	
Reseal Bridge Joints [2]			FT	\$16.00 /FT	
Deck Drainage [3]			SFT	\$5.00 /SFT	
Drain Casting Assembly [2]			EA	\$950.00 /EA	
Deck Drain , Extension [2]			EA	\$400.00 /EA	
Downspout Replacement [2]			EA	\$400.00 /EA	
Embedded Galvanic Anode [2]			EA	\$15.00 /EA	
Concrete Pavement [3]			SFT	\$14.82 /SFT	
SUPERSTRUCTURE					
Bearing Realignment / Replacement [2]			EA	\$5,000.00 /EA	
Pack Rust Repair [2]			FT	\$500.00 /FT	
Paint - Complete [2]			SFT	\$12.00 /SFT	
Paint - Partial / Spot / Zone [2]			SFT	\$24.00 /SFT	
PCI Beam End Blockout [2]			EA	\$7,200.00 /EA	
Pin & Hanger Replacement [2]			EA	\$8,000.00 /EA	
Structural Steel Repair [2]			EA	\$3,000.00 /EA	
SUBSTRUCTURE					
Substructure Patching [2]			CFT	\$300.00 /CFT	
Substructure Replacement [2]			CFT	\$180.00 /CFT	
Substructure Horizontal Surface Sealer [2]			SYD	\$40.00 /SYD	
Temporary Supports [2]			EA	\$2,500.00 /EA	
Water Repellent Treatment, Penetrating [2]			SYD	\$16.00 /SYD	
Straddle Bents [3]			SFT	\$15.00 /SFT	
Basic MSE (Mechanically Stable Earth) walls [3]			SFT	\$50.00 /SFT	
MISCELLANEOUS					
ROW costs [3]			ACRE	\$140,000.00 /ACRE	
Concrete Surface Coating [2]			SYD	\$28.00 /SYD	
Culvert Cleanout [2]			FT	\$30.00 /FT	
Epoxy Crack Injection [2]			FT	\$50.00 /FT	
Metal Mesh Panels [2]			SFT	\$20.00 /SFT	
Pressure Relief Joint [2]			FT	\$100.00 /FT	
Riprap [2]			SYD	\$175.00 /SYD	
Slope Protection Repairs [2]			SYD	\$100.00 /SYD	
Environmental Mitigation [3]			SFT	\$10.00 /SFT	
TRAFFIC CONTROL					
Maintaining Traffic			LS		LS
Other					
MOBILIZATION & CONTINGENCY					
			20 %	\$0	\$0
(DOES NOT INCLUDE PE & CE)				CONSTRUCTION TOTAL	
* Estimated as unit shown, Paid for as LUMP SUM				\$0	
SOURCES:					
[1] Bridge Replacement Unit Costs 2017 - Bridge Tables - National Bridge Inventory - Bridge Inspection - Safety - Bridges & Structures - Federal Highway Administration. https://www.fhwa.dot.gov					
[2] BRIDGE COST ESTIMATE WORKSHEET . MDOT University, Feb. 2020, https://mdotjboss.state.mi.us/stdplan/englishbridgemanual.htm .					
[3] Value Engineering Report: Brampton Road Connector . PI No. 0006328, GDOT, Michael Baker International, Georgia Ports Authority, 17 Oct. 2017.					

Figure 54: Preview of Cost Estimate Worksheet

6.4.3.5| Step 5 Create Operations and Maintenance Plan

Step 5 involves creating an Operations and Maintenance Plan (O&M). This plan outlines the annual activities that are scheduled in a suggested five-year program. The activities in this step should be strategically programmed and prioritized considering each bridge's needs. The process includes tabulating proposed maintenance actions from bridge inspections and preservation criteria table and identifying the maintenance actions whether it be performed by in house crews or contracted out. **Figure 55** displays a preview of a basic outline of an annual O&M plan that was later used in the case study. The activities can be organized by type: Replacement, Rehabilitation, Conditional Maintenance, and Cyclical Maintenance. There are columns for the bridge number, task name, priority score, status, assigned to, anticipated start and end date, and comments.

2021 ANNUAL BRIDGE OPERATION AND MAINTENANCE PLAN								STATUS
BRIDGE NO.	TASK NAME	BRIDGE PRIORITY SCORE	STATUS	ASSIGNED TO	ANTICIPATED START DATE	ANTICIPATED END DATE	COMMENTS	
REPLACEMENT								
BRIDGE ##	-		Not Started		01/02	01/11		Not Started
BRIDGE ##	-		Not Started		01/07	01/11		In Progress
BRIDGE ##	-		Not Started		01/10	02/23		Complete
BRIDGE ##	-		Not Started		01/10	01/20		On Hold
BRIDGE ##	-		Complete		01/16	01/29		
BRIDGE ##	-		In Progress		01/19	02/01		
BRIDGE ##	-		In Progress		01/22	02/09		
REHABILITATION								
BRIDGE ##	-		On Hold		01/28	02/06		
BRIDGE ##	-		In Progress		01/31	02/02		
BRIDGE ##	-		In Progress		02/04	02/12		
BRIDGE ##	-		Complete		02/06	02/14		
CONDITIONAL MAINTENANCE								
BRIDGE ##	-		Not Started		02/18	02/20		
BRIDGE ##	-		Not Started		02/18	02/23		
BRIDGE ##	-		Not Started		02/18	02/26		
BRIDGE ##	-		Not Started		02/21	02/23		
BRIDGE ##	-		Not Started		02/22	02/23		
BRIDGE ##	-		In Progress		02/25	03/26		
CYCLICAL MAINTENANCE								
BRIDGE ##	-		In Progress		02/25	02/23		
BRIDGE ##	-		On Hold		02/26	03/03		
BRIDGE ##	-		Not Started		02/25	03/06		
BRIDGE ##	-		Not Started		03/03	03/26		
BRIDGE ##	-		Not Started		01/10	01/20		
BRIDGE ##	-		Complete		01/16	01/29		
2020 O&M PLAN 2021 O&M PLAN 2022 O&M PLAN 2023 O&M PLAN 2024 O&M PLAN 2025 O&M PLAN +								

Figure 55: Basic Outline of an Annual O&M Plan

6.4.3.6| Step 6 Outline Five-Year Annual Cost Projection

In order to maximize planning and project funding strategies, Step 6 recommends outlining a Five-Year Annual Cost Projection, which is a year-by-year, project-by-project schedule of bridge maintenance projects and estimated costs for those projects. An example is outlined in **Table 7**. The activities are grouped by types of actions: replacement, rehabilitation, conditional

maintenance, cyclical maintenance, etc. The bridge structure number is identified and the corresponding cost estimate for that project is included and totaled for each fiscal year.

Table 7: Example of Five-Year Annual Cost Projection

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

6.4.3.7 | Step 7 Identify Funding Sources

Step seven Identifies the appropriate funding sources. This process should provide a discussion of the existing sources, potential sources, and allocation of funds for the bridge asset management plan. Based on research, programming a specified amount for bridge preservation is recommended. Once a plan is mapped out and the importance of bridge preservation is realized, it becomes easier to identify funding needs and therefore justify larger budgeting amounts. A tool that local

governments can utilize to check for the eligibility and criteria requirements of different funding sources is the Local Georgia Funding Matrix and Checklist that is created and presented in **Appendix E** and previewed in *Figure 56*. The main funding sources included in this tool are LMIG, LOCBR, LIBP, GTIB, SPLOST, TSPLOST, and Design Build Program. The type of fund that each source can provide is outlined in the left column. The boxes under each funding source are checked if the type of fund applies. The second page of the Funding Matrix Checklist is similarly structured, but instead the criteria requirements are on the left column. The right-side ribbon provides a brief discussion on each funding source and the link to its website for additional information. For instance, a local government interested in additional funding for bridge maintenance work would be able to identify LMIG and GTIB as options. Moreover, the criteria section for those sources would inform the local government that both sources require the project to be defined and outlined. Additionally, LMIG would require a 10% to 30% match, whereas GTIB would require a low-interest loan application.

FUNDING MATRIX

Use this funding checklist/matrix to determine which funding sources your local government is applicable for. The section on the right provides helpful links for more information.

ADDITIONAL FUNDING SOURCES FOR LOCAL GOVERNMENTS

Eligibility/Criteria	LMIG	LOCBR	LIBP	GTIB	SPLOST	TSPLOST	Design Build Program
ELIGIBLE FOR:							
Amount based on formula	☒	☐	☐	☐	☐	☐	☐
Full Replacement	☐	☒	☒	☒	☒	☒	☒
Maintenance	☒	☐	☐	☒	☐	☐	☐
Replacement of Posted Bridges	☐	☒	☒	☒	☒	☒	☒
Grant	☒	☐	☒	☒	☐	☐	☐
Low-interest Loan 5-20 yrs.	☐	☐	☐	☒	☐	☐	☐
\$0.01 sales tax up to 5-6 years	☐	☐	☐	☐	☒	☐	☐
\$0.01 sales tax up to 10 years	☐	☐	☐	☐	☐	☒	☐

Funding Source Info.

LMIG
Local Maintenance Improvement Grant. Provides coverage from GDOT for maintenance purposes.
Formula used for award amount = $[(\text{Pop.}/\text{State Pop.}) \times (33\%)] + [(\text{Mileage}/\text{Total State Mileage}) \times (66\%)]$
<http://www.dot.ga.gov/PS/Local/LMIG>

LOCBR
Local Bridge Replacement Program aims to help Local Governments reduce the number of posted and closed bridges throughout the state
<http://www.dot.ga.gov/InvestSmart/BridgePrograms/Pages/LocalBridges.aspx>

LIBP
Low Impact Bridge Program LIBP projects must meet low impact criteria such as no geometry or grade changes, low environmental impacts and off-site detours are accepted by local entities. LIBPs are completed with expedited delivery by means of prefabricated bridge components.
<http://www.dot.ga.gov/InvestSmart/BridgePrograms/Pages/LocalBridges.aspx>

GTIB
Georgia Transportation Infrastructure Bank is a grant and low-interest loan program administered by the State Road and Tollway Authority (SRTA). Since inception, GTIB has provided over \$151 million in grants and loans to projects that have enhanced mobility and driven economic development in local communities throughout Georgia
<https://www.srta.ga.gov/gtib/>

ADDITIONAL FUNDING SOURCES FOR LOCAL GOVERNMENTS

CRITERIA FOR:	LMIG	LOCBR	LIBP	GTIB	SPLOST	TSPLOST	Design Build Program
Low-interest Loan Application	☐	☐	☐	☒	☐	☐	☐
Local Contribution of \$50,000 - \$100,000 for Right of Way phase	☐	☒	☐	☐	☐	☐	☐
Low impact criteria compliance	☐	☐	☒	☐	☐	☐	☐
Local match ranging from 10% - 30 %	☒	☐	☐	☐	☐	☐	☐
Off-site detour up to 12 months	☐	☒	☐	☐	☐	☐	☐
Low-interest Loan Application	☐	☐	☐	☒	☐	☐	☐
Define Projects	☒	☐	☒	☒	☒	☒	☒
Financially provide about 50% of ROW estimates	☐	☒	☐	☐	☐	☐	☐
Return solicited Memorandums of Agreement (MOA) for participation	☐	☒	☐	☐	☐	☐	☐
Defined on ballot	☐	☐	☐	☐	☒	☒	☐
Application fee \$250	☐	☐	☐	☒	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐

Funding Source Info.

SPLOST Types:

County SPLOST.
Imposed up to 5 years (6 years if certain conditions are satisfied), to be shared with its cities (for the proposed governmentally owned or operated capital outlays).

Regional TSPLOST
Counties within specified regions amounts up to 1¢ for proposed periods to fund proposed regional transportation projects and purposes.
<http://www.ga-tia.com/Home/>

County TSPLOST
Sales tax for specific periods up to 5 years to fund any transportation projects and activities for counties outside of MARTA jurisdiction

MARTA County TSPLOST.
Counties within MARTA jurisdiction can impose a different up to 1¢ TSPLOST to fund proposed transportation projects

Design-Build Bridge Replacement Program
The program allows GDOT to replace and update local bridges deemed structurally deficient. The program utilizes bridge bundles to maximize efficiency and speed in the replacement of locally owned bridges.
<http://www.dot.ga.gov/PartnerSmart/Innovative/Pages/DBBridgeReplacementProgram.aspx>

Figure 56: Preview of Funding Matrix Checklist

6.4.3.8| Step 8 Measure and Report Performance

The local government will find it advantageous to adjust their program over time. Therefore, the eighth step is where reporting and updating is crucial to informing local government stakeholders and executives of the accomplishments of the bridge management plan. Reporting will additionally allow justification for continued support. The created plan should be feasible and easily updated. Furthermore, it is important to develop methods to evaluate benefits. This process requires a method of measuring the performance of the bridge management program. The Performance Measures are monitored and updated to show progress. Results of a project will typically take multiple inspection cycles to effectively measure the performance. **Figure 57** is included as an example of progress tracking. The 7-year goal for this government is to reduce their Structurally Deficient bridges to 25% while increasing their Good/Fair bridges to 80%. The bolded lines represent the current progress (2018) and the dotted lines represent the future projections leading to the local government's goal, which is represented by a thin straight line.

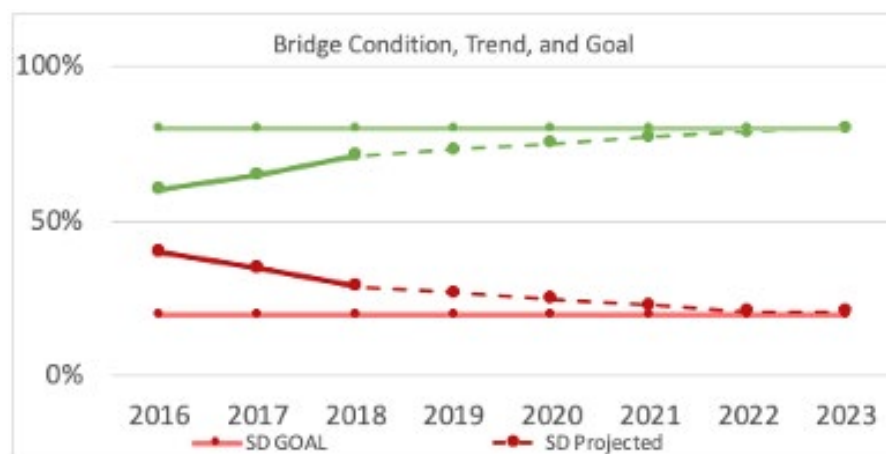


Figure 57: Example of progress tracking, Reprinted from Asset Management Guide, 2011

6.5 | Case Study: Spalding County Bridge Asset Management Plan

Spalding's Bridge Asset Management Plan is intended to implement the created guide in this study and report on how the county is meeting its obligations to proactively maintain its bridges. On the

same note, this plan provides a transparent decision-making process that allows the public to understand the technical and financial challenges of managing Spalding’s bridge network within a limited budget. This unprecedented 2020 bridge plan outlines how Spalding determines its strategy to maintain and upgrade bridge asset conditions given goals, priorities of its bridge users, and resources provided. An updated plan is to be released approximately every five years to reflect changes in bridge conditions, finances, and priorities. The process of creating Spalding County’s Bridge Asset Management Plan, followed the steps outlined in the *Bridge Asset Management Guide for Local Georgia Governments*, which is presented in **Appendix F** and previewed in **Figure 58**. This section discusses the focal points of each segment within the plan. Please note that any number references to the Appendix in this section are nested within **Appendix G**.

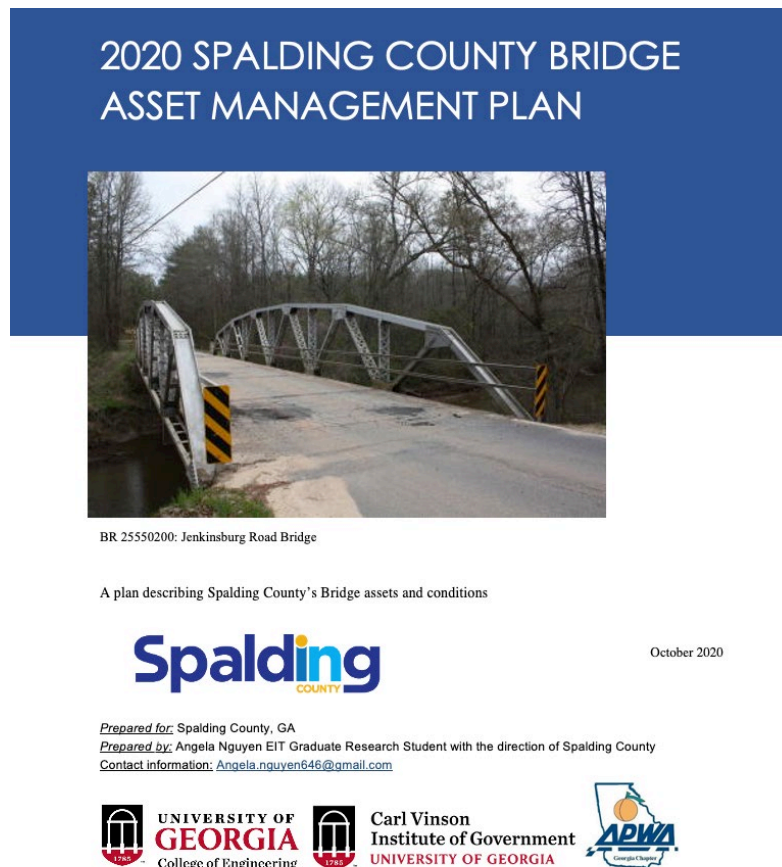


Figure 58: 2020 Spalding County Bridge Asset Management Plan

6.5.1 | Goals

The main goal of implementing Spalding County’s bridge asset management plan is to preserve and improve the condition of its local bridge network within the means of its financial resources. To quantify this goal, over its 10-year plan Spalding County aims to have 95% of more of its bridges in Fair to Good condition and less than 25% of its bridges classified as structurally deficient. To measure the progress of the Bridge Asset Management Plan the projected goals in **Figure 59** will be updated after every inspection cycle. Currently 88% of Spalding’s bridges are in Fair to Good Condition 74% and 14% respectively and 38% are structurally deficient. The dotted lines represent a projected trend line towards Spalding’s 10-year goal.

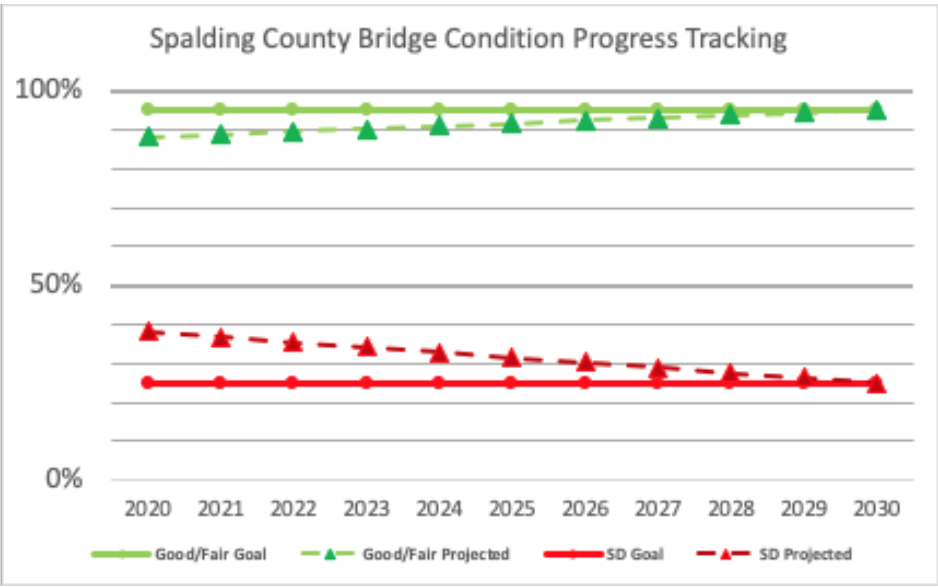


Figure 59: Spalding County Bridge Condition Progress Tracking

6.5.2 | Inventory

Within its inventory, Spalding is responsible for 57 local bridges according to the NBI. **Table 8** summarizes Spalding’s bridge assets by type, size, and condition. Of the Spalding’s 57 structures, 35 are concrete bridges, 15 are steel bridges, 6 are prestressed concrete bridges, and 1 is a timber bridge. However, there are an additional 9 local wood bridges that are owned and maintained by

Spalding County and not included or inspected by GDOT. To contrast, the bridge conditions for local bridges in Georgia show that 5% are poor and 95% are good/fair, indicating that Spalding County has a greater percentage of poor bridges (14%) and lower percentage of Good/Fair bridges (88%) compared to the statewide average for local Georgia governments.

Table 8: Spalding’s bridge assets by type, size, and condition

Bridge Type	Total Number of Bridges	Total Deck Area (sq ft)	Condition: Structurally Deficient, Posted, Closed			2018 Condition		
			Struct. Defic	Posted	Closed	Poor	Fair	Good
Concrete	35	58896.5	17	10	--	5	25	4
Prestressed Concrete	6	26493	--	--	--	0	4	2
Steel	13	22080.3	6	5	--	2	10	1
Steel Continuous	2	2855.9	--	1	--	--	2	--
Wood or Timber*	1	683	1	1	--	--	1	--
Total SD/Posted/Closed			22	18	0			
Total	57	111008.6				8	42	7
Percentage (%)			38%	32%	0%	14%	74%	12%

6.5.3 | Strategy

6.5.3.1 Prioritization

Spalding prioritizes bridges for projects by evaluating three main factors and weighting them as follows: load capacity 40%, condition 35%, and traffic 25%. The priority score calculated for each bridge is tabulated alongside the inventory in **Appendix 1** and previewed in **Figure 60**. There are several components within each factor that are used to arrive at its score. Bridge load capacity and condition are the main focuses for Spalding’s bridges since several bridges are depended on by

school bus traffic. Further posting bridges and delaying the repairs of existing posted bridges in the county pose a risk to the general public. To clarify, each project under consideration is scored out of 1, 1 being the highest priority and 0 being the lowest priority, and its total score is then compared with other proposed projects to establish a priority order. Furthermore, it is established that when selecting bridges for funding or action, those with similar priority scores would be further assessed by the bridge's safety and detour restrictions.

= (0.4*[@42 - LOAD CONDITION converted])+0.35*[@CAT10 - CONDITION converted]+0.25*[@30 - ADT Converted])												
A	B	C	D	E	F	G	H	I	J	K	L	M
Structure Number	27 - Year Built	28 - Average Daily Traffic	30 - ADT Converted	43A - Main Design Mat Type Val.	6A - Feature Intersect	7 - Facility Carried By Structure	CAT10 - Bridge Condition	CAT10 - CONDITION converted	41 - Structure Operational Status Code	42 - LOAD CONDITION converted		PRIORITY SCORE (highest = 1)
25500300	1953	1780	0.208	Concrete	LINE CREEK TRIB	HOLLOMAN ROAD	Poor	1	P	1		0.802
25500380	1956	1780	0.208	Concrete	SHOAL CREEK	VAUGHN ROAD	Poor	1	P	1		0.802
25500390	1954	1780	0.208	Concrete	HEADS CREEK	VAUGHN ROAD	Poor	1	P	1		0.802
25500410	1958	1580	0.184	Concrete	TROUBESOME CREEK TRIB	JORDAN HILL ROAD	Poor	1	P	1		0.796
25500200	1937	490	0.057	Steel	TOWAUGA RIVER	JENKINSBURG ROAD	Poor	1	P	1		0.764
25500440	1938	1940	0.226	Steel	CABIN CREEK	N SECOND ST EXT.	Fair	0.5	P	1		0.632
25500110	1953	1760	0.205	Steel	BUCK CREEK TRIB	MCDONOUGH ROAD	Fair	0.5	P	1		0.616
25500400	1958	1560	0.182	Concrete	TROUBESOME CREEK	JORDAN HILL ROAD	Fair	0.5	P	1		0.621
25500420	1954	1200	0.140	Concrete	GRIFFIN RESERVOIR TRIB	BURDIE ROAD	Fair	0.5	P	1		0.610
25500140	1958	850	0.099	Steel Continuous	CABIN CREEK	WALKERS MILL RD	Fair	0.5	P	1		0.600
25500430	1968	560	0.065	Concrete	BUCK CREEK	BAINESVILLE ROAD	Fair	0.5	P	1		0.591
25500340	1966	490	0.057	Steel	GRIFFIN RESERVOIR	CREATHAM ROAD	Fair	0.5	P	1		0.589
25500060	1955	490	0.057	Concrete	HEADS CREEK	ELLIS ROAD	Fair	0.5	P	1		0.589
25500110	1957	400	0.047	Concrete	BUCK CREEK	MANGHAM ROAD	Fair	0.5	P	1		0.587
25500210	1959	360	0.042	Concrete	CABIN CREEK	TOMOCHECH ROAD	Fair	0.5	P	1		0.586
25500100	1970	120	0.014	Steel	CABIN CREEK	DUTCHMAN ROAD	Fair	0.5	P	1		0.579
25500180	1970	110	0.013	Wood or Timber	TOWAUGA RIVER TRIB	CHUI ROAD	Fair	0.5	P	1		0.578
25500260	1956	110	0.013	Concrete	TOWAUGA RIVER TRIB	NORTH POMONA RD	Fair	0.5	P	1		0.578
25500450	1954	490	0.057	Steel	BEAR CREEK	WILDWOOD ROAD	Poor	1	D	0.5		0.564
25500350	1959	230	0.027	Concrete	WILDCAT CREEK	MOON ROAD	Poor	1	D	0.5		0.557
25500190	1957	120	0.014	Concrete	TOWAUGA RIVER	PULLAN ROAD	Poor	1	D	0.5		0.554
25500360	1956	3820	0.446	Concrete	POTATO CREEK	COUNTY LINE ROAD	Fair	0.5	D	0.5		0.486
25500420	1959	1740	0.203	Concrete	TOWAUGA RIVER TRIB	JORDAN HILL ROAD	Fair	0.5	D	0.5		0.426
25500010	1957	690	0.081	Concrete	HEADS CREEK TRIB	MANLEY ROAD	Fair	0.5	D	0.5		0.395
25500330	1956	690	0.081	Concrete	MANLEY CREEK	WEST MORELAND RD	Fair	0.5	D	0.5		0.395
25500270	1956	520	0.061	Concrete	BEAR CREEK TRIB	STELLE ROAD	Fair	0.5	D	0.5		0.390
25500020	1956	220	0.026	Concrete	HEADS CREEK TRIB	MANLEY ROAD	Fair	0.5	D	0.5		0.381
25500050	1959	190	0.022	Concrete	WILDCAT CREEK	ELLIS ROAD	Fair	0.5	D	0.5		0.381
25500250	1953	80	0.009	Steel	TOWAUGA RIVER	TRESTLE ROAD	Fair	0.5	D	0.5		0.377
25500250	1977	5430	0.634	Prestressed Concrete	NS RAILROAD	POPULAR STREET	Fair	0.5	A	0		0.333
25500330	1982	3150	0.368	Concrete	CABIN CREEK	MCDONOUGH ROAD	Fair	0.5	A	0		0.267
25500410	1956	2860	0.334	Concrete	SHOAL CREEK TRIB	PINE HILL ROAD	Fair	0.5	A	0		0.258
25500660	2018	8570	1.000	Concrete	CABIN CREEK	HILL STREET	Good	0	A	0		0.256
25500540	1989	1670	0.195	Steel	HEADS CREEK TRIBUTARY	MINTOSH ROAD	Fair	0.5	A	0		0.224
25500350	1989	1670	0.195	Prestressed Concrete	HEADS CREEK TRIB	MINTOSH ROAD	Fair	0.5	A	0		0.224
25500340	1940	1660	0.194	Concrete	TOWAUGA RIVER	LOCUST GROVE RD	Fair	0.5	A	0		0.223
25500070	1956	1290	0.151	Steel	BUCK CREEK TRIB	RHINOTHY ROAD	Fair	0.5	A	0		0.213
25500280	1970	440	0.025	Concrete	HEADS CREEK	PATTISON ROAD	Fair	0.5	A	0		0.184
25500500	1998	600	0.070	Steel	CABIN CREEK	BAILEY JESTER RD	Fair	0.5	A	0		0.193
25500290	1956	600	0.070	Concrete	FUNT RIVER TRIB	MOORE ROAD	Fair	0.5	A	0		0.193
25500300	1979	600	0.070	Concrete	HEADS CREEK	STEEL ROAD	Fair	0.5	A	0		0.193

Figure 60: Preview of Inventory with Priority Scores

6.5.3.2 Preservation Criteria

Spalding's asset management plan and created criteria table intends to implement a strategy that aims to move away from the "worst-first" approach and is made up of replacement, rehabilitation, conditional preventive maintenance and/or cyclical preventative maintenance activities along with their selection criteria and frequency. The table is meant to be further developed with additional bridge crew training in the future. This table is shown in **Table 3** of the plan in **Appendix G**.

6.5.3.3 Cost Estimate

Spalding County computes the estimated cost of each typical action using a combination of hourly rates from the FEMA Document and unit costs from the developed cost estimate worksheet in **Appendix 4** and previewed in **Figure 61 & 62**, (*Fema's schedule of equipment rates 2019, 2019*). Currently, Spalding County uses an hour by hour unit cost for in-house work based on their work orders. The county is moving towards utilizing and adjusting the cost-estimate worksheet in their further development. This development is expected to be accomplished alongside with the update of their existing CTP and new county manager.

FEMA Code ID		Equipment Description					2019 Updated Rate
Cost Code	Equipment	Specifications	Capacity or Size	HP	Notes	Unit	
8010	Air Compressor	Air Delivery	41 CFM	to 10	Hoses included.	hour	\$ 1.62
8011	Air Compressor	Air Delivery	103 CFM	to 30	Hoses included.	hour	\$ 9.86
8012	Air Compressor	Air Delivery	130 CFM	to 50	Hoses included.	hour	\$ 12.49
8013	Air Compressor	Air Delivery	175 CFM	to 90	Hoses included.	hour	\$ 20.98
8014	Air Compressor	Air Delivery	400 CFM	to 145	Hoses included.	hour	\$ 32.13
8015	Air Compressor	Air Delivery	575 CFM	to 230	Hoses included.	hour	\$ 57.05
8016	Air Compressor	Air Delivery	1100 CFM	to 355	Hoses included.	hour	\$ 95.60
8017	Air Compressor	Air Delivery	1600 CFM	to 500	Hoses included.	hour	\$ 98.55
8040	Ambulance			to 150		hour	\$ 28.09
8041	Ambulance			to 210		hour	\$ 41.18
8050	Board, Arrow			to 8	Trailer Mounted.	hour	\$ 4.53
8051	Board, Message			to 5	Trailer Mounted.	hour	\$ 11.60
8060	Auger, Portable	Hole Diameter	16 In	to 6		hour	\$ 2.34
8061	Auger, Portable	Hole Diameter	18 In	to 13		hour	\$ 4.65
8062	Auger, Tractor Mntd	Max. Auger Diameter	36 In	to 13	Includes digger, boom and mounting hardware.	hour	\$ 3.25
8063	Auger, Truck Mntd	Max. Auger Size	24 In	to 100	Includes digger, boom and mounting hardware. Add this rate to tractor rate for total auger and tractor rate.	hour	\$ 34.93
8064	Hydraulic Post Driver					hour	\$ 35.27
8065	Auger	Horizontal Directional Boring Machine	250 X 100	300	DD-140B YR-2003	hour	\$ 172.29
8066	Auger	Horizontal Directional Boring Machine	50 X 100	24	Average to 7,000 lbs	hour	\$ 33.83
8067	Auger, Directional Boring Machine	Auger, Directional Boring Machine	7,000 - 10,000 lbs	45	JT920L (2013)	hour	\$ 41.04
8068	Bush Hog	Bush Hog - Model 326	Single Spindle Rotary Cutters			hour	\$ 20.61
8068-1	Bush Hog	Bush Hog - Model 3210	Lift, Pull, Semi-Mount & Offset Model			hour	\$ 28.74

Figure 61: Preview of FEMA costs

2020		- LOCAL GEORGIA -		REV. 9/18/2020	
BRIDGE MAINTENANCE COST ESTIMATE WORKSHEET					
REGION: _____		FISCAL YEAR: _____		STRUCTURE NUMBER: (3-5 digit) _____	
SUPERVISOR: _____		DATE: _____			
LOCATION: _____		DECK AREA: _____		BRIDGE ID: XXX-XXXX	
PRIMARY WORK ACTIVITY: _____		DECK DIM: _____		STR. TYPE: _____	
*Delete any item not used					
WORK ITEM					
	QUANTITY	UNIT	UNIT COST	TOTAL	
REPLACEMENT					
Bridge Replacement Cost (Georgia Bridge) [1]		SF	\$129.00 /SF		
New Superstructure [2]		SF	\$185.00 /SF		
New Deck [2]		SF	\$75.00 /SF		
DECK					
Bridge Railing Replacement [2]		FT	\$400.00 /FT		
Concrete Brush Block / Curb Patch [2]		FT	\$24.00 /FT		
Concrete Deck Patch [2]		SFT	\$30.00 /SFT		
Deep Overlay [2]		SFT	\$33.00 /SFT		
Epoxy Overlay [2]		SYD	\$30.00 /SYD		
Expansion Joint Gland Replacement [2]		FT	\$85.00 /FT		
Expansion Joint Replacement [2]		FT	\$600.00 /FT		
Full Depth Patch [2]		SFT	\$76.00 /SFT		
Healer / Sealer [2]		SYD	\$15.00 /SYD		
Overlay Removal [2]		SYD	\$16.00 /SYD		
Reseal Bridge Joints [2]		FT	\$16.00 /FT		
Deck Drainage [3]		SFT	\$5.00 /SFT		
Drain Casting Assembly [2]		EA	\$950.00 /EA		
Deck Drain, Extension [2]		EA	\$400.00 /EA		
Downspout Replacement [2]		EA	\$400.00 /EA		
Embedded Galvanic Anode [2]		EA	\$15.00 /EA		
Concrete Pavement [3]		SFT	\$14.82 /SFT		
SUPERSTRUCTURE					
Bearing Realignment / Replacement [2]		EA	\$5,000.00 /EA		
Pack Rust Repair [2]		FT	\$500.00 /FT		
Paint - Complete [2]		SFT	\$12.00 /SFT		
Paint - Partial / Spot / Zone [2]		SFT	\$24.00 /SFT		
PCI Beam End Blockout [2]		EA	\$7,200.00 /EA		
Pin & Hanger Replacement [2]		EA	\$8,000.00 /EA		
Structural Steel Repair [2]		EA	\$3,000.00 /EA		
SUBSTRUCTURE					
Substructure Patching [2]		CFT	\$300.00 /CFT		
Substructure Replacement [2]		CFT	\$180.00 /CFT		
Substructure Horizontal Surface Sealer [2]		SYD	\$40.00 /SYD		
Temporary Supports [2]		EA	\$2,500.00 /EA		
Water Repellent Treatment, Penetrating [2]		SYD	\$16.00 /SYD		
Straddle Bents [3]		SFT	\$15.00 /SFT		
Basic MSE (Mechanically Stable Earth) walls [3]		SFT	\$50.00 /SFT		
MISCELLANEOUS					
ROW costs [3]		ACRE	\$140,000.00 /ACRE		
Concrete Surface Coating [2]		SYD	\$28.00 /SYD		
Culvert Cleanout [2]		FT	\$30.00 /FT		
Epoxy Crack Injection [2]		FT	\$50.00 /FT		
Metal Mesh Panels [2]		SFT	\$20.00 /SFT		
Pressure Relief Joint [2]		FT	\$100.00 /FT		
Riprap [2]		SYD	\$175.00 /SYD		
Slope Protection Repairs [2]		SYD	\$100.00 /SYD		
Environmental Mitigation [3]		SFT	\$10.00 /SFT		
TRAFFIC CONTROL					
Maintaining Traffic		LS		LS	
Other					
MOBILIZATION & CONTINGENCY		20 %	\$0	\$0	
(DOES NOT INCLUDE PE & CE)				CONSTRUCTION TOTAL	
* Estimated as unit shown, Paid for as LUMP SUM				\$0	
SOURCES:					
[1] Bridge Replacement Unit Costs 2017 - Bridge Tables - National Bridge Inventory - Bridge Inspection - Safety - Bridges & Structures - Federal Highway Administration. https://www.fhwa.dot.gov					
[2] BRIDGE COST ESTIMATE WORKSHEET . MDOT University, Feb. 2020, https://mdotjboss.state.mi.us/stdplan/englishbridgemanual.htm .					
[3] Value Engineering Report: Brampton Road Connector . PI No. 0006328, GDOT, Michael Baker International, Georgia Ports Authority, 17 Oct. 2017.					

Figure 62: Preview of Spalding's Cost Estimate Worksheet

6.5.3.4 Operations and Maintenance Plan

Spalding County established an annual operations and maintenance plan that follows the Bridge Preservation Criteria and programs bridges in need of replacement, rehabilitation, and preventative maintenance every year. Recommendations from the Bridge Inspection Report are reviewed and programmed into the plan. The plan utilizes the priority score calculated in **Appendix 1** to prioritize which bridges need action and funding within the year. The full 2020 Operations and Maintenance Plan can be observed in **Appendix 3** and briefly previewed in **Figure 63**.

APPENDIX 3: 2020 Operations & Maintenance Plan for Spalding County

STATUS							
Not Started							
In Progress							
Complete							
On Hold							

BRIDGE NO.	TASK NAME	BRIDGE PRIORITY SCORE	STATUS	ASSIGNED TO	ANTICIPATED START DATE	ANTICIPATED END DATE	COMMENTS
REPLACEMENT							
25500410	JORDAN HILL ROAD BRIDGE	0.796	In Progress	GDOT	09/20	09/21	
-							
REHABILITATION							
25550380	LINE CREEK ROAD BRIDGE	0.177	In Progress				
25550200	JEKINSBURG ROAD BRIDGE	0.764	In Progress	Paragon			
25550290	MOORE ROAD BRIDGE	0.193	complete				
-							
MAINTENANCE							
	AMELIA ROAD BRIDGE		Not Started	SPALDING COUNTY BRIDGE CREW			
25550500	BAILEY JESTER ROAD BRIDGE	0.193	Not Started	SPALDING COUNTY BRIDGE CREW			Both abutment joints need to be cleaned and ~~sealed~~ Steel beams and piles need to be cleaned and painted.
25550430	BARNESVILLE ROAD BRIDGE	0.591	Not Started	SPALDING COUNTY BRIDGE CREW			Forward approach slab has settlement causing traffic to bounce and needs to be leveled.
25500420	BIRDIE ROAD BRIDGE	0.61	Not Started	SPALDING COUNTY BRIDGE CREW			Span 2 forward bottom of deck over bent 3 piles 4 and 6. Bent 2, piles 2 and 3 have extensive rot and need to be scheduled for replacement.
25550370	BLANTON MILL ROAD BRIDGE	0.181	Not Started	SPALDING COUNTY BRIDGE CREW			Repair spall in bent 2 cap, bottom left face; some spalls have been sealed with epoxy. Erosion under abutment 1 cap is now up to 3.0' back with loss of fill and needs to be repaired.

Figure 63: Preview of Spalding County's 2020 O&M Plan

6.5.3.5 Five-Year Annual Cost Projection

The Five-Year Annual Cost Projection created can be observed in **Appendix 5** and previewed in **Figure 64**. There is an average annual cost of \$275,100 for the maintenance of Spalding's local bridges. Note that the bridge replacements funded by GDOT are not included in the estimated cost.

Additionally, there is an estimate of \$10,000 for maintenance on a capacity of 7 different bridges per year.

APPENDIX 5: Spalding County Annual 5-year Cost Projection

Strategy	2020	2021	2022	2023	2024	2025
New Bridge						
N/A	\$ -					
Subtotal	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Replacement						
JORDAN HILL ROAD 255-0041-0	2 Million GDOT					
VAUGHN ROAD 255-0038-0		2 Million GDOT				
DUTCHMAN ROAD 255-5010-0			2 Million GDOT	\$ -		
WILDWOOD 255-5045-0			2 Million GDOT		\$ -	
COUNTY LINE ROAD 255-0036-0					2 Million GDOT	\$ -
			\$ -			
Subtotal	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Rehabilitation						
AMELIA ROAD	\$ -	\$2,500				
BAILEY JESTER ROAD		\$ -				\$2,500
BARNESVILLE ROAD			\$2,500			
BIRDIE ROAD		\$ 2,500.00				
BLANTON MILL ROAD					\$ 2,500.00	
CALDWELL ROAD		\$ 2,500.00		\$ -		
CHEATHAM ROAD						\$ 2,500.00
COUNTY LINE ROAD		\$ 2,500.00				
CROWDER ROAD			\$ 2,500.00			
DUTCHMAN ROAD						\$ 2,500.00

Figure 64: Preview of Spalding Five-Year Annual Cost Projection

6.5.3.6 Identifying Funding Sources

Spalding County utilizes a combination of both GDOT's Local Bridge Replacement Program (LOCBR) and Low Impact Bridge Program (LIBP) to cover bridge replacements. This amounts to roughly \$2 million per programmed bridge. Upcoming projects funded by LOCBR and LIBP are shown in the Five-Year Annual Cost Projection. State funded and SPLOST passed bridge projects

that are in the process of being completed are listed in **Figure 65**. These have been outlined by the 2016 Comprehensive Transportation Plan (CTP) for the City of Griffin and Spalding County.

255-0019-0	CR 390/MCINTOSH RD @ FUMT RIVER @ FAYETTE/SPALDING CO LINE	\$ 2,103,280	State Bridge Fund, SPLOST, Local General Revenue
255-0040-0	JORDAN HILL ROAD AT TROUBLESOME CREEK, 4 MI N OF GRIFFIN	\$ 1,250,000	State Bridge Fund, SPLOST, Local General Revenue
255-0044-0	N SECOND ST EXT. AT CABIN CREEK, 3 MI NE OF GRIFFIN	\$ 1,267,300	State Bridge Fund, HB 170
255-0031-0	McDonough ROAD AT BLACK CREEK TRIB, 4 MI SE OF GRIFFIN	\$ 808,750	State Bridge Fund, HB 170
255-0042-0	BIRDIE ROAD AT GRIFFIN RESERVOIR TRIB, 5 MI NW OF GRIFFIN	\$ 1,129,400	State Bridge Fund, HB 170
255-0036-0	COUNTY LINE ROAD AT POTATO CREEK, 3 MI SE OF GRIFFIN	\$ 1,129,400	State Bridge Fund, HB 170
255-0042-0	JORDAN HILL ROAD AT TOWNINGA RIVER TRIB, AT HENRY CO. LINE	\$ 1,415,700	State Bridge Fund, HB 170
255-0030-0	HOLLOWVILLE ROAD AT LIME CREEK TRIB, 12 MI W OF GRIFFIN	\$ 1,423,500	State Bridge Fund, HB 170
255-0038-0	VAUGHN ROAD AT SHOAL CREEK, 6 MI W OF GRIFFIN	\$ 2,843,100	State Bridge Fund, HB 170
255-0041-0	JORDAN HILL ROAD AT TROUBLESOME CREEK TRIB, 5 MI N OF GRIFFIN	\$ 1,415,700	State Bridge Fund, HB 170
255-0039-0	NUSSROVE ROAD AT CABIN CREEK TRIB, 2 MI E OF GRIFFIN	\$ 1,179,750	State Bridge Fund, HB 170

Figure 65: In Progress Funded Bridge Projects, Source: CTP Action Plan

Currently, SPLOST and TSPLOST have not programmed/funded/passed any requested future bridge projects. However, Spalding county has plans to request for bridge projects in 2021 for SPLOST and 2022 for TSPLOST. The amounts and project types are to be determined. Scheduled maintenance activities and minor repairs that are not affiliated with any applications, grants, or other funded projects will be performed by the Spalding's in-house maintenance forces and funded through the Spalding's annual general fund budget. Within the general fund budget, Spalding County receives approximately \$175,000 annually for the bridge work and maintenance. Furthermore, Spalding County's Operation and Maintenance Plan will be utilized as a means for identifying needs for future funding sources. The plan underlines the priority score of each bridge needing repairs. The priority score can help prioritize bridge work with a limited budget and program and request additional funding sources for those bridges. The Funding Matrix Checklist is a tool utilized to check for the eligibility and criteria requirements for different funding sources applicable to local Georgia bridges.

6.5.3.7 Measure, Report, and Update Process

An important part of an asset management plan is to make sure its progress is tracked and measured over time. This information can inform government executives and the public of the plan's

progress in order to continue their support. In order to produce the results, the plan needs to be executed and properly updated. **Figure 66** illustrates the update process for Spalding’s Bridge Asset Management Plan. The flowchart provides a visual aid that outlines the update process and the respective frequency level for each update. The annual adjustments cover the most frequent O&M plan for needed maintenance activities, funding sources to apply for new projects, and the cost estimate worksheet, which needs to be adjusted as work orders are completed. Medium frequency accounts for the Bridge inventory sheet with the calculated priority scores and the five-year annual cost projection to maintain its accuracy. The least frequent updates consist of the bridge assets analysis and the projected goals graph which track the condition changes that are available once every inspection cycle. According to Spalding county the inspection report is received every three years.

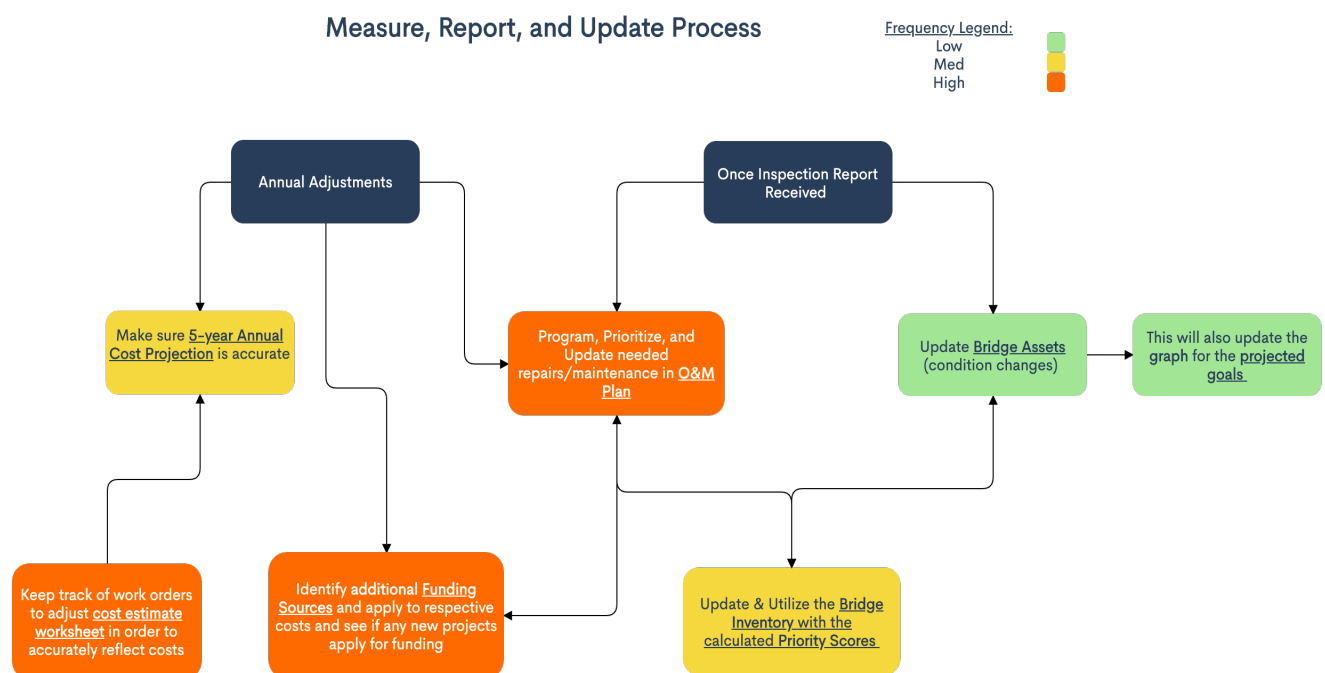


Figure 66: Update Process Flowchart

6.5.4 | Spalding BAMP Package

As previously discussed, at the end of the case study the team was given a comprehensive ZIP file with the overall 2020 Spalding County Bridge Asset Management Plan and four Excel files that contained the various required worksheets that were created. The contents of each Excel file and additional sheets within them are as followed:

1. Inventory

- Sheet 1: Inventory with calculated priority scores for each bridge
- Sheet 2: Inventory retrieved from Shreveport Times database with identification of Structurally Deficient bridges
- Sheet 3: 2018 Inspection Report
- Sheet 4: Progress Tracking Graph
- Sheet 5: Inventory retrieved from NBI database

2. Operation & Maintenance Plan

- Sheet 1: Completed 2020 O&M Plan
- Sheet 2-6: Template for 2021-2025 O&M Plan

3. Bridge Cost Estimate Worksheet

4. Five-Year Annual Cost Projection

- Sheet 1: Spalding County Five-Year Annual Cost Projection
- Sheet 2: Funding Matrix Checklist
- Sheet 3: Update Process Flowchart

6.5.5 | Evaluation Follow Up

Due to time constraints and the bounds of this study, an official follow up was not feasible. However, a simplified evaluation questionnaire was utilized to gage the practicability of the case

study process. **Figure 67** displays the questions and responses following the end of the official bridge handoff meeting. Although there were delays, the amount of work that was achieved in the short time span of three months was commendable for a government of their size. The main advantages of the plan included discovering bridges that were not previously inventoried and maintained and a more efficient process to identify and justify more budget requests.



Name: TJ Imberger

Evaluation for the Implementation of Bridge Asset Management for Local Georgia Governments

Throughout this process of implementing a local bridge plan for Spalding County:

- 1. What were some things that could be improved on?**
Honestly, the improvement portion would be on our part. We did our best to keep up with returning data as requested. However due to work load we got delayed at times.
- 2. What were the most helpful outcomes of this process?**
We now have a specific plan that can be followed. This was the first bridge specific plan that we have had. Also during the process, we discovered some errors in our system that we were unaware of.
- 3. Which parts of this plan are the most sustainable/feasible?**
The annual maintenance costs will be added to our budget.
- 4. Which parts of this plan are the least sustainable/feasible?**
The larger replacement costs. This is strictly a budgetary issue though.
- 5. What reasons would you have for not being able to continue updating the plan?**
Budget only, however I believe as good as this plan is. It will make a difference in budget requests.
- 6. Other helpful criticism/comments/requests?**
We enjoyed the process. Angela was excellent to work with and was extremely professional. The plan is extremely detailed and executable.

Figure 67: Results from evaluation follow up

6.5.6 | Discussion of Case Study Impact

The implementation of the guide for local Georgia governments was carried out through a case study with Spalding County, which took approximately three months to establish. Spalding County was an ideal and representative candidate due to its mid-sized population, and number of bridges managed (57 bridges). More importantly, Spalding County was ranked relatively high in terms of poor percentage bridges and highest in bridges needing repairs within Georgia. Ideally for other local governments there is no set timeline to complete a plan. In this case, since the research was time sensitive the case study was restricted to three months and six virtual meetings.

The feasibility of the guide was well received from the team, which consisted of the public works director, the administrative assistant, and road supervisor. One of the drawbacks to applying the steps was the cost estimate worksheet. Many local governments may not have a process where they provide unit costs for each activity, rather they are given a budget and salary from the general fund budget to maintain their bridges and the hours for each repair are reflected in workorders. Therefore, shifting to a cost estimate worksheet would require a new system. Larger local governments with a larger number of bridges may already have a similar established cost estimate worksheet system or have the means to better establish one, whereas smaller governments may not. The developed worksheet in the guide would be beneficial as a starting point for both size extremes.

Furthermore, when considering an approach for smaller local governments with fewer bridges, the full eight-step process may not need to be as in-depth. For instance, the preservation criteria table that was discussed in the preservation strategy had a range of complexity based on the presence of an in-house bridge maintenance team. If there is not a knowledgeable maintenance team then several of the preservation activities would be contracted out based on the inspection

recommendations. Therefore, budgeting would be based on the history of those contracted costs. Instead of a detailed unit-cost method for the cost estimate worksheet, the local government would record the average contracted costs of the respective activities for future estimations. Additionally, a smaller government may not have a very populated five-year annual cost projection plan, however establishing a simple one can be advantageous for justifying budget increases and finding additional funding sources. Overall, the steps in the guide should be flexible enough to cater to a smaller government.

On the other side of the spectrum, when considering larger governments with a higher number of bridges, the eight-step approach would significantly benefit the management of those bridges. The establishment of a priority score for a large number of bridges would be valuable, especially with limited funds and several bridges that need attention. The complexity of each step can be expanded based on the needs of the government. For instance, an area that can be expanded is the eighth step, which consists of developing a process to measure and report performance. Instead of only tracking the general bridge condition, the individual conditions for each bridge element can be tracked and monitored as well. This results in additional progress tracking graphs and even different methods. This step is dependent on the complexity of the goals and objectives of the local government. Larger governments may already have elements of a bridge asset management plan in place. As a result, there needs to be a process of assembling a comprehensive plan along with any missing gaps that the larger local government may have. To summarize, the steps in the guide should be flexible enough to cater to a larger government.

7.0 | CONCLUSIONS

One of the major themes that surfaced from the background and preliminary review of this study was the lack of resources that local Georgia governments are dealt with in terms of managing their bridges. Despite the general need, states focus on funding their more crucial state-owned bridges rather than funding local bridge needs. As the average bridge in America is approaching the end of a typical bridge service life, it is evident that bridge asset management is a field that needs to be further developed for not only the state's most crucial bridges, but also the locally owned bridges.

Some of the most crucial factors that were observed to predict lower bridge conditions within local Georgia bridges concerned those that were older than 26 years, the design material (Steel in particular), and the amount of financial resources the local government received as a whole. The majority of the surveyed and interviewed local Georgia governments had populations ranging from small to large, and yet an overwhelming amount had no formal bridge management plan in place. A vast amount of local Georgia governments continues to follow a reactive approach in their bridge management rather than a proactive approach. Consequently, this aligned with the apparent trend of local Georgia bridges functioning at much lower conditions compared to state-owned bridges in the preliminary review.

The Literature review covering components of bridge asset management focused on state DOTs and governments with an abundance of resources. Although valuable, it is important to note that there were few resources specifically for small governments. The literature and preliminary review established the path to create the components of the *2020 Bridge Asset Management Guide*

for Local Georgia Governments. This guide provides local Georgia governments crucial steps in developing a localized bridge asset management plan. The guide was implemented through a three-month case study with Spalding County, Georgia, which resulted in the construction of the *2020 Spalding County Bridge Asset Management Plan*. Several additional resources were created in this process, such as the Local Georgia Bridge Funding Matrix Checklist, and Cost Estimate Worksheet for bridge management activities, as well as a thoroughly outlined process for the construction of a local bridge management plan.

7.1 | Recommendations and Feedback

The overall feedback and recommendations from this study are compiled through the following statements:

- The researcher in this study served as the consultant and prepared the various worksheets for the county serving as the case study. It is possible that these worksheets could be adjusted to be expanded or simplified to meet the needs of the county or city utilizing them.
- The feasibility of the guide for different sizes of governments was measured based on the results from the case study. Creating a local government specific cost estimate worksheet was challenging due to the Spalding County having no established unit costs.
- Despite the success of creating the plan, there should be additional studies to follow up on the long-term implementation of the plan and its feasibility. Furthermore, additional case studies with different government size extremes may be insightful to analyze how flexible the guide is.
- Although there is only 4 years of data, elemental data from the inspection process would be more useful and detailed compared to the general bridge condition rating. The results would be incorporated and utilized to better develop a more detailed preservation criteria

and strategy. However, since the data is relatively new a knowledge transfer would be necessary.

- Some recommendations reiterated from the guide include the following advice to local governments:
 - Promote as a policy the scheduled replacement of wearing surfaces, coatings, surface sealers, and joint seals instead of reactively waiting for defects in order to plan for repairs.
 - Use the data from bridge inspections to monitor and update the conditions of the previously mentioned scheduled replacements.
 - Create a method to quantify and report on the performance of the bridge plan, specifically annualized costs benefits achieved through preservation to gain support of bridge preservation practices.
 - Prioritize the bridges that are most critical to its citizens. The process could stem from indicators such as the Average Daily Traffic that a bridge receives or from GDOT's state route group, which identifies the critical routes throughout the state.
 - When weighing options between in-house crews and contractors consider about 7-8 crew members for maintenance or the added cost of consultants producing the design and repair plans
 - Consider the potential to partner with neighboring local governments to jointly hire consultants/contractors and pool together other resources.

- Local governments should recognize that inspectors are not engineers. Contact GDOT's Bridge Maintenance Office to prioritize bridge work or send repair plans in order to assess feasibility.

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APPENDICES

APPENDIX A: Qualtrics Survey Questions



**UNIVERSITY OF
GEORGIA**

The American Public Works Association (APWA) in partnership with the University of Georgia College of Engineering and Carl Vinson Institute of Government is conducting research for the development of Bridge Asset Management for Local Georgia Agencies. The primary goal of this study is to create a specific guide tailored to local governments in order to better maintain their bridges and prevent premature deterioration of their bridges. The research intends to address the lack of funding and resources for local governments.

This survey is being conducted in order to gain a better understanding of how local Georgia governments currently manage bridge programs and how those activities are funded, whether allocated from a general fund budget or from other state funding programs.

We appreciate your time in completing the survey and your input that may help us further in this research. The survey should take no longer than 5 - 10 minutes to complete. If you have any questions, you may contact the graduate research assistant on this project, Angela Nguyen at adn56938@uga.edu, (470)-269-9331.



General Agency Information

Respondent Information

Name	
Position Title	
Contact email	

County/City/Town/Municipal Name

What is the population within your local government?

Rural < 2,500 people

Small City 2,500 - 20,000 people

Mid-Sized 20,000 - 75,000 people

Large City > 75,000 people

How many bridges and culverts are maintained by your local government?

Less than 30

31-60

61-100

More than 100

Program Funding

What is the general fund budget for your local government? (Approximate in dollars \$)

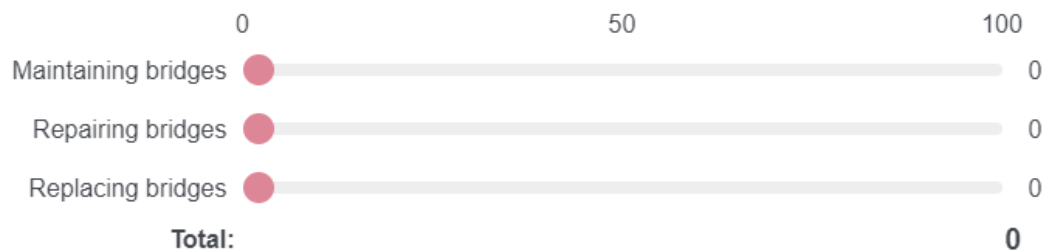
What percentage of the general fund budget is allocated to bridges?

0 10 20 30 40 50 60 70 80 90 100

% of general fund budget



About what percent of the bridge budget is allocated to...



What other funding sources are available for the purpose of managing your bridges?
(Please select all that apply)

Special Purpose Local Option Sales Tax (SPLOST)

Local Maintenance & Improvement Grant (LMIG)

Low Impact Bridge Program (LIBR)

Local Bridge Replacement Program (LOCBR)

Other (Please specify)

If you selected any of the funding sources from the last question, how much supplemental funding from these other sources has been provided to your local government?

(Approximate in dollars)

Special Purpose Local Option Sales Tax (SPLOST) \$

Local Maintenance & Improvement Grant (LMIG) \$

Low Impact Bridge Program (LIBR) \$

Local Bridge Replacement Program (LOCBR) \$

Other (Please specify) \$

Total \$

Planning

Does your local government have an asset management program for maintaining bridges?

Yes, a formalized program is in place

Yes, but not a well developed program (informal)

No, there is none

How many individuals are involved with managing your government's bridge program?

How does your local government prioritize bridges that are in need of...

...maintenance?

...repair?

...replacement?

Which of these steps are performed by the local government for bridge management?
(Select all that apply)

Identify goals, objectives, and bridges to preserve

Develop actions for bridge maintenance

Estimate life cycle plans for managing bridges

Develop performance measures for effectiveness of the actions

Develop methods of evaluation of benefits

Monitor and measure performance of bridge management program

Other

How are bridge inspections performed?

In house
With GDOT
Outside contractors
Other

What are the major challenges associated with managing/developing your bridge program?

Funding

Personnel

Guidelines

Organization

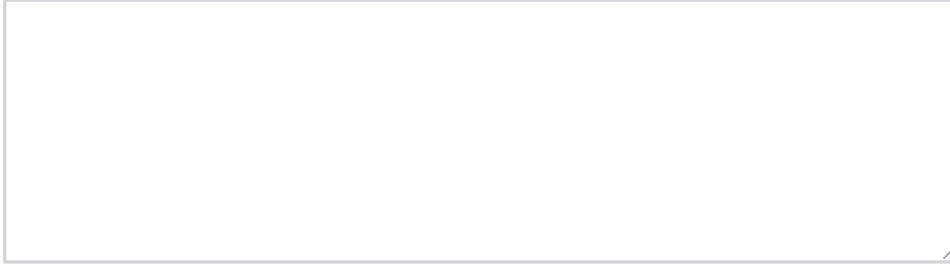
Prioritization

Regulation

Tools

Other challenges (Please specify and/or elaborate on previous challenges here)

Comments - Questions - Concerns



Bridge Asset Management for Local Georgia Agencies

APPENDIX B: List of Local Government Contacts for Interviews

Large City > 75,000 people

- Chatham County, 31-60 bridges
 - Nathaniel Panther
 - Senior Engineer npanther@chathamcounty.org
- Rockdale County
 - Blair Barnett +100 bridges
- Barrow County , manages 61-100 bridges
 - Autron Hayes- Public Works Director
 - ahayes@barrowga.org
- Hall County, manages more than 100 bridges
 - Kevin McInturff, P.E.
 - kmcinturff@hallcounty.org
- Jackson County, 61-100 bridges
 - Jeff Bridges, PWD
 - jbridges@jacksoncountygov.com

Mid Sized 20,000-75,000 people

- City of Valdosta, manages 61-100 bridges
 - Patrick Collins - Director/City Engineer
 - pcollins@valdostacity.com
- Dawson County, manages less than 30 bridges
 - David McKee - Public Works Director
 - SCHEDULED APR 20 10 AM
 - dmckee@dawsoncounty.org
- City of Brookhaven, manages 31-60 bridges
 - Hari Kariakran - Public Works Director
 - Hari.Karikaran@Brookhavenga.gov
- City of Griffin
 - Kenny Williams, City Manager
 - 678-300-4315; ksmith@cityofgriffin.com

Small City 2,500 - 20,000 people

- City of Brunswick, manages less than 30 bridges
 - Rick Charnock - Assistant PWD
 - Said They only had bridges maintained by GDOT. Will check on that.
 - rcharnock@cityofbrunswick-ga.gov
- City of Dublin , manages 31-60 bridges

- Shawn Wood - PWD
- woods@dublinga.org

Rural City < 2,500 people

- City of Lavonia
 - Charles Cawthon
 - charlesc@lavoniaga.gov
 - SCHEDULED APRIL 20 1:00 PM
 - Couldn't because they have no bridges under their jurisdiction
- City of Royston
 - Edward Andrews
 - Still no response
- City of Moultrie
 - Pete Dillard, City Manager;
 - Office number is 229-668-0022
- City of Cairo
 - Chris Addleton, City Manager;
 - (229) 377-1722 ext. 105; caddleton@cairocity.net

APPENDIX C: Guiding Questions for Interviews

General Questions

1. Could you describe the main responsibilities of your position?
2. Is there currently a program in place for the purpose of managing the local government's bridges?
 - a. If one doesn't exist, what limitations are present?
3. If there is one, how formal would you say the local government's bridge asset management program is?
 - a. How is it generally organized/structured?
 - b. How many individuals are involved?
4. How well is the program in place followed?

Management Specific Questions:

1. How do you prioritize bridge management work?
 - a. I.e. maintenance, repairs, replacement
 - b. Are there any internal actions done, such as inspections ?
 - c. What resources do you use? guidelines/manuals?
2. What is usually provided in GDOT's bridge inspection reports/recommendations?
 - a. How do you currently handle those recommendations?
 - b. Are bridge preservation projects included?
 - c. Do you believe there is enough available expertise to correctly follow/interpret those recommendations?
3. Is there a government maintenance crew or are other contractors used?
4. How is the work that's done monitored for effectiveness? Yes sometimes we use
5. In terms of preparing for bridge repairs and rehabilitation, what does planning for the future look like?

Budget/Funding Questions

1. How is bridge management funded?
 - a. How much funding from the general fund budget do you receive for bridge management? (percentage)

- b. How do you take advantage of other bridge funding sources? I.e. SPLOST LMIG
- c. If there is not much funding available from the state, are there any other places money is pulled from?

The Main Question

- 6. What types of improvements would you like to see within the government's bridge management program?
 - a. If one doesn't exist, what do you think are the limitations that need to be overcome in order to develop one?
 - i. Other than money/funding, what other tools and resources would benefit the program? I.e. guidelines, software, personnel..

APPENDIX D: Qualtrics Survey Results

How does your local government prioritize bridges that are in need of...

...maintenance?	...repair?	...replacement?
GA DOT Bridge reports	GA DOT Bridge reports	GA DOT Bridge reports
Contract third party	Contract third party	GDOT Program or TSPLOST
Maintenance funding and activities are prioritized each budget year	Repairs are prioritized on an as needed basis depending on the critical nature of the repair	Replacement is evaluated from the bridge inspections and anticipated lifespan
We only have one bridge and it is maintained by GDOT	N/A	N/A
GDOT	GDOT	GDOT
N/A	Repair Deficiencies.	Replace as last needed.
All maintenance, repair, and replacement priority are determined from the Georgia DOT reports.	All maintenance, repair, and replacement priority are determined from the Georgia DOT reports.	All maintenance, repair, and replacement priority are determined from the Georgia DOT reports.
We have no bridges	We have no bridges	We have no bridges
2	1	3
monthly routines for sweeping. Annual routines for erosion inspection. Biannual routines for GDOT inspection	We prioritize the under weight bridges first, followed by the bridges that receive the lowest rating score provided by GDOT	The under weight bridges first.
2	1	3
GDOT	GDOT	GDOT
Prioritization based upon visual inspection of condition with higher priority for heavily traveled bridges.	Prioritization based upon visual inspection of condition with higher priority for heavily traveled bridges.	Prioritization based upon visual inspection of condition with higher priority for heavily traveled bridges.
GDOT inspections	GDOT Inspection reports	GDOT inspection reports
N/A	N/A	We have several locations that are in need of replacing.
Operational Inspections program	Structural Engineer and Operational inspection program. 15 year resurfacing program	Structural Engineer inspection. Estimated at 30 years for replacement. Assets life is extended if possible

Comments - Questions - Concerns

Recorded from phone call due to issues with survey. There is a reactive response to bridge management from DOT inspection and recommendation. Several communities don't have engineers on staff and so they outsource to consultants. They need staff and personnel which is expensive when there is not continuous work to do, therefore they default to DOT. 3/11/2020 call 2:49 PM Patrick Collins

Please note that our bridge replacement and repair is funded entirely through our Special Local Option Sales Tax program (SPLOST). Hall County does not fund bridges currently out of general fund which is the reason for the 0% funding answer for the general fund percentage question.

We have no City maintained bridges within the City of Brunswick. The GDOT maintains the two bridges we have because they are state highways.

We have a good repair program here in Glynn County. Over the last four years we have allocated funds for bridge repairs recommended by GDOT. SPLOST will be the primary funding source for replacement of bridges. We also have good tools to address repair needs that are found.

APPENDIX E : Local Georgia Bridge Funding Matrix Checklist

FUNDING MATRIX

Use this funding checklist/matrix to determine which funding sources your local government is applicable for. The section on the right provides helpful links for more information.

ADDITIONAL FUNDING SOURCES FOR LOCAL GOVERNMENTS

Eligibility/Criteria	LMIG	LOCBR	LIBP	GTIB	SPLOST	TSPLOST	Design Build Program
<u>ELIGIBLE FOR:</u>							
Amount based on formula	☒	☐	☐	☐	☐	☐	☐
Full Replacement	☐	☒	☒	☒	☒	☒	☒
Maintenance	☒	☐	☐	☒	☐	☐	☐
Replacement of Posted Bridges	☐	☒	☒	☒	☒	☒	☒
Grant	☒	☐	☒	☒	☐	☐	☐
Low-interest Loan 5-20 yrs.	☐	☐	☐	☒	☐	☐	☐
\$0.01 sales tax up to 5- 6 years	☐	☐	☐	☐	☒	☐	☐
\$0.01 sales tax up to 10 years	☐	☐	☐	☐	☐	☒	☐

Funding Source Info.

LMIG

Local Maintenance Improvement Grant. Provides coverage from GDOT for maintenance purposes.
Formula used for award amount = (Pop./State Pop.) x (33%) + (Mileage./Total State Mileage) x (66%)
<http://www.dot.ga.gov/PS/Local/LMIG>

LOCBR

Local Bridge Replacement Program aims to help Local Governments reduce the number of posted and closed bridges throughout the state
<http://www.dot.ga.gov/InvestSmart/BridgePrograms/Pages/LocalBridges.aspx>

LIBP

Low Impact Bridge Program LIBP projects must meet low impact criteria such as no geometry or grade changes, low environmental impacts and off-site detours are accepted by local entities. LIBPs are completed with expedited delivery by means of prefabricated bridge components.
<http://www.dot.ga.gov/InvestSmart/BridgePrograms/Pages/LocalBridges.aspx>

GTIB

Georgia Transportation Infrastructure Bank is a grant and low-interest loan program administered by the State Road and Tollway Authority (SRTA). Since inception, GTIB has provided over \$151 million in grants and loans to projects that have enhanced mobility and driven economic development in local communities throughout Georgia

<https://www.srta.ga.gov/gtib/>

ADDITIONAL FUNDING SOURCES FOR LOCAL GOVERNMENTS

CRITERIA FOR:	LMIG	LOCBR	LIBP	GTIB	SPLOST	TSPLOST	Design Build Program
Low-interest Loan Application	☐	☐	☐	☒	☐	☐	☐
Local Contribution of \$50,000 - \$100,000 for Right of Way phase	☐	☒	☐	☐	☐	☐	☐
Low impact criteria compliance	☐	☐	☒	☐	☐	☐	☐
Local match ranging from 10% - 30 %	☒	☐	☐	☐	☐	☐	☐
Off-site detour up to 12 months	☐	☒	☐	☐	☐	☐	☐
Low-interest Loan Application	☐	☐	☐	☒	☐	☐	☐
Define Projects	☒	☐	☒	☒	☒	☒	☒
Financially provide about 50% of ROW estimates	☐	☒	☐	☐	☐	☐	☐
Return solicited Memorandums of Agreement (MOA) for participation	☐	☒	☐	☐	☐	☐	☐
Defined on ballot	☐	☐	☐	☐	☒	☒	☐
Application fee \$250	☐	☐	☐	☒	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐

Funding Source Info.

SPLOST Types:

County SPLOST.

Imposed up to 5 years (6 years if certain conditions are satisfied), to be shared with its cities (for the proposed governmentally owned or operated capital outlays.

Regional TSPLOST

Counties within specified regions amounts up to 1¢ for proposed periods to fund proposed regional transportation projects and purposes.

<http://www.ga-tia.com/Home/>

County TSPLOST

Sales tax for specific periods up to 5 years to fund any transportation projects and activities for counties outside of MARTA jurisdiction

MARTA County TSPLOST.

Counties within MARTA jurisdiction can impose a different up to 1¢ TSPLOST to fund proposed transportation projects

Design-Build Bridge Replacement Program

The program allows GDOT to replace and update local bridges deemed structurally deficient. The program utilizes bridge bundles to maximize efficiency and speed in the replacement of locally owned bridges.

<http://www.dot.ga.gov/PartnerSmart/Innovative/Pages/DBBridgeReplacementProgram.aspx>

APPENDIX F : 2020 Bridge Asset Management Guide for Local Georgia Governments

2020 BRIDGE ASSET MANAGEMENT GUIDE FOR LOCAL GEORGIA GOVERNMENTS

Prepared by:

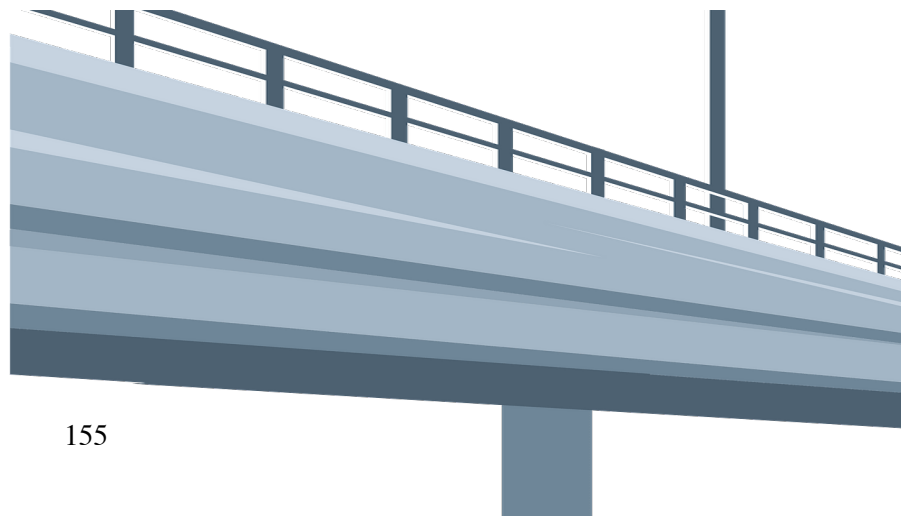
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Graduate Research Assistant

Angela.nguyen646@gmail.com



UNIVERSITY OF
GEORGIA
College of Engineering



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1.0 INTRODUCTION

1.1 Purpose:

The goal of this guide is to support local Georgia governments in their pursuit of developing a bridge asset management plan in order to improve and preserve the condition of their bridge structures. This guide utilizes principals and text from the FHWA *Bridge Preservation Guide*¹, *Asset Management Guide for Local Agency Bridges in Michigan*², and GDOT *Bridge Structures Maintenance Plan*³ as a foundation to tailoring a comprehensive guide for local Georgia governments. The recommendations and steps developed in this guide was influenced by research performed through The University of Georgia College of Engineering Master's program and sponsored by the Georgia Chapter of the American Public Works Association.

This guide will outline the steps in a management plan, which will explain how to maintain and improve the overall condition of those assets. The main purpose of the Bridge Asset Management Guide for Local Georgia Governments is to:

- Create a better understanding of bridge management and bridge preservation
- Provide some guidance to decision makers and local bridge owners in the development of a more effective bridge management plan.
- Aid local governments in their understanding of their bridge network, their available funding resources, and preparation and implementation of a bridge management plan.

¹ Bridge Preservation Guide. (2018). U.S. Department of Transportation Federal Highway Administration.
<https://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf>

² *Asset Management Guide for Local Agency Bridges in Michigan*. (2011). Michigan Transportation Asset Management Council.
https://www.michigan.gov/documents/mdot/Local_Bridge_Asset_Management_Guide_480551_7.pdf

³ Doyle, A. (2013). Bridge Structures Maintenance Plan.
<http://www.dot.ga.gov/InvestSmart/BridgePrograms/BridgePrograms/GDOT%20PM%20PLAN%20August%202013.pdf>

1.2 Asset Management:

According to FHWA's Bridge Preservation Guide, the components of Asset management includes "a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both engineering and economic analysis based on quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the life cycle of the assets at a minimum practicable cost." In summary, bridge asset management within this guide encompasses the means to effectively utilize limited public funds in order to maximize the condition of local bridges in Georgia. Figure 1 illustrates the branches within bridge asset management.

Bridge Preservation:

An important aspect of bridge asset management is the bridge preservation. 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 preventative, or condition driven."

A local government must consider bridge preservation in order to prolong the life of its bridge structures which in turn will optimize funds overtime.

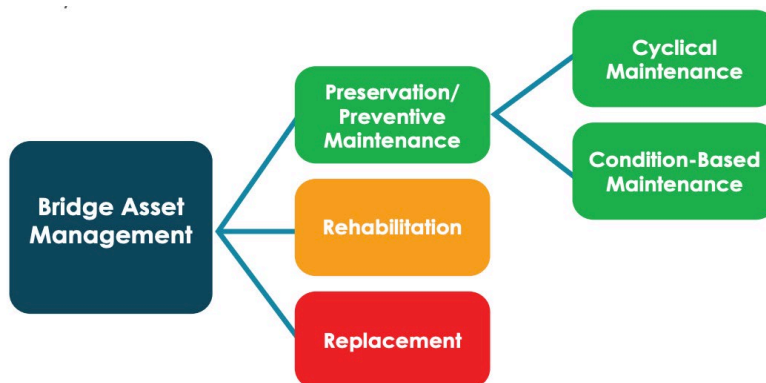


Figure 1: Bridge Action Categories, source: Bridge Preservation Guide⁴

⁴ Bridge Preservation Guide. (2018).

2.0 BRIDGE CONDITION ASSESSMENT

In order for a local government to begin developing a management plan for their bridges, the appropriate assessment of the government's bridge conditions need to be considered and outlined. This section discusses the general methods used to assess a bridge's condition.

2.1 Bridge Condition Rating

GDOT's bridge maintenance activities include conducting an inspection of all bridges and bridge culverts in Georgia within a two-year-year cycle and underwater bridge inspection every five years. Inspectors rate bridge condition on a 0-9 scale known as the National Bridge Inventory (NBI) rating scale (see Table 1 for a summary of the NBI Rating scale). Elements of the bridge's superstructure, deck, and substructure, shown in Figure 2, receive a 9 if they are in excellent condition down to a 0 if they are in failed condition.

Table 1: FHWA NBI Coding Guide

Code	Description	Common Actions
9	EXCELLENT CONDITION	Preservation/Cyclic Maintenance
8	VERY GOOD CONDITION —No problems noted.	
7	GOOD CONDITION —Some minor problems.	
6	SATISFACTORY CONDITION —Structural elements show some minor deterioration.	Preservation/ Condition-Based Maintenance
5	FAIR CONDITION —All primary structural elements are sound but may have some minor section loss, cracking, spalling, or scour.	
4	POOR CONDITION —Advanced section loss, deterioration, spalling, or scour.	Rehabilitation or Replacement
3	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.	
2	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, the bridge may have to be closed until corrective action is taken.	
1	IMMINENT 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 it back in light service.	
0	FAILED CONDITION —Out of service. Bridge is beyond corrective action.	

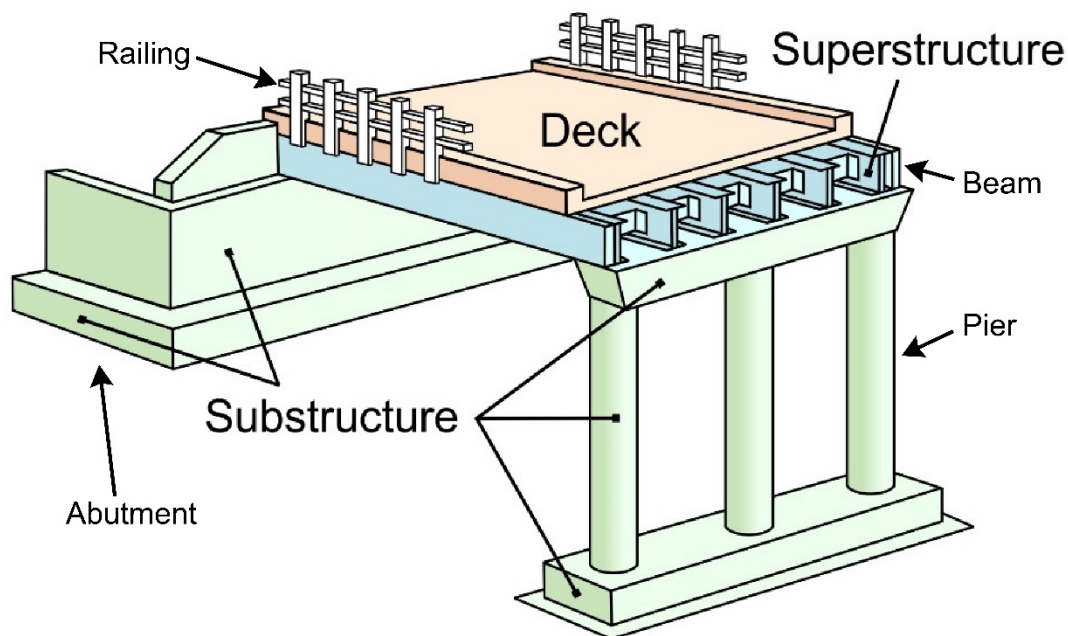


Figure 2: Bridge Structure Elements, Source: Michigan's BAMP Template

2.2 Sufficiency Rating⁵

In Georgia, the sufficiency rating is assumed as an indicator of the health of bridge along with other metrics such as structurally deficient bridges, meaning they require maintenance or replacement, and functionally obsolete bridges, which means they were not built to today's standards or needs. This information is determined based on the bi-annual inspection of the state's bridges undertaken by GDOT and is utilized to establish the priority for repairs and replacement of bridges throughout the state. Figure 3 illustrates the formula for the bridge's sufficiency rating. The formula encompasses the structural adequacy and safety (55 percent), Serviceability and Functional Obsolescence (30 percent), Essentiality for Public Use (15 percent), and Special Reductions (13 percent).

⁵ 2014 GEORGIA INFRASTRUCTURE REPORT CARD Bridges. (2014). ASCE. http://www.ascega.org/wp-content/uploads/2014/01/ASCE-GA2014-Report-Card_Bridges.pdf

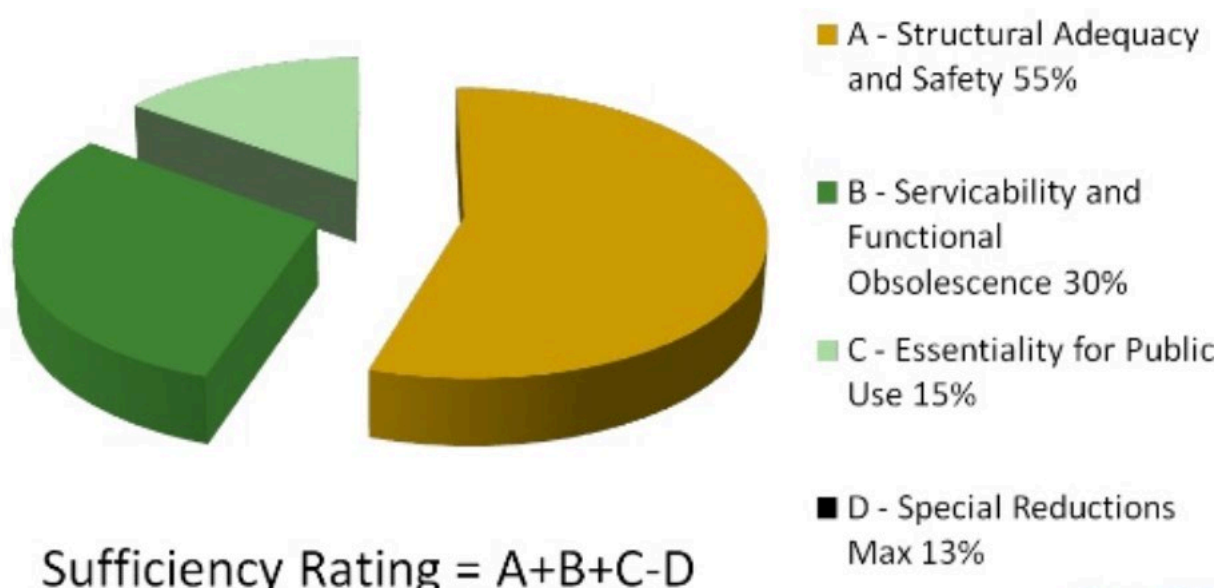


Figure 3: Sufficiency Rating Formula⁶

The primary use of the sufficiency rating is to determine eligibility for federal bridge funds. The sufficiency rating is not the best indicator of the relative safety of a bridge. MAP-21 changed the way that bridges will be evaluated in the future which include a departure from the sufficiency-based model since the sufficiency model is a “worst first” replacement methodology. MAP-21 now requires state DOTs to develop asset management-based plans with the change requiring the prioritization of bridge replacement based on risk rather than condition alone.⁶

Structurally Deficient

A bridge is considered structurally deficient if the bridge requires significant maintenance, rehabilitation or replacement. These bridges must be inspected at least every year since critical load-carrying elements were found to be in poor condition due to deterioration or damage. However, bridges classified as “structurally deficient” does not imply that it is unsafe. Structurally deficient bridges actually require significant maintenance and repair to remain in service to all traffic and will eventually require rehabilitation or replacement to address their deficiencies. In order to remain in service, these bridges are typically posted, which restricts the gross weight allowed on the bridge.

⁶ *Recording and coding guide for the structure inventory and appraisal of the nation's bridges* (FHWA-PD-96-001). (1995). Federal Highway Administration.

Functionally Obsolete

A bridge classified as functionally obsolete is one that was built to outdated standards. However, functionally obsolete bridges are not necessarily rated as structurally deficient, nor are they considered unsafe. These bridges may not have adequate lane widths, shoulder widths, or vertical clearances to serve current traffic demand, or those that may be occasionally flooded⁷. Similarly, functionally obsolete bridges require major repair work to function at the current code standards and requirements.

2.3 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. The bridge owner takes action based on the inspector's recommendations. It is crucial to properly interpret the inspection data, which can better help make informed maintenance, repair, and 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.
- ❖ Additionally, bridge owners need to leverage their bridge inspections for both the identification of needed work and the verification of completed work. For example, checking to see how the last repairs affect the bridge's life cycle.
- ❖ As recommended by GDOT' State Bridge Maintenance Engineer, local governments should send their repair plans to the bridge maintenance office in order to assess the feasibility of the plans.

⁷ 2014 GEORGIA INFRASTRUCTURE REPORT CARD Bridges. (2014). ASCE. http://www.ascega.org/wp-content/uploads/2014/01/ASCE-GA2014-Report-Card_Bridges.pdf

2.4 Additional Factors Affecting Bridge Condition⁸

Assessment of a local government's bridges is crucial to a bridge management plan. Figure 4 demonstrates the discrepancy between the condition of bridges owned by the state (GDOT) and by local Georgia governments. Since local bridges are not a priority to the state they are generally in poorer conditions.

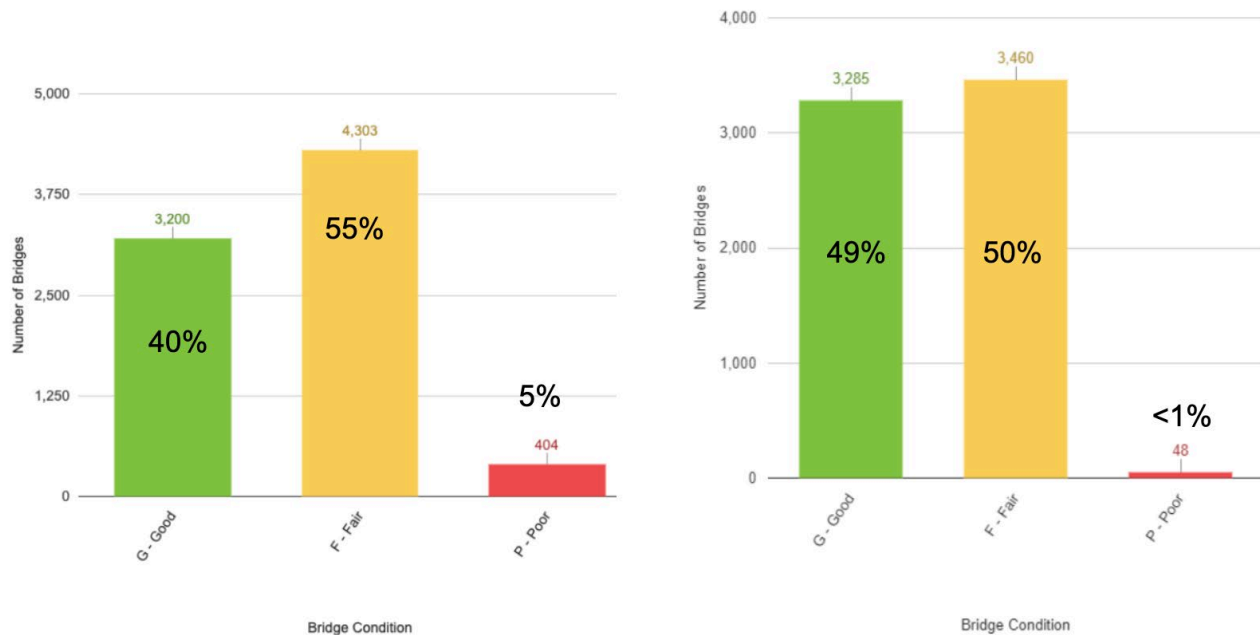


Figure 4: Comparison of Bridge Conditions for Georgia (left) and Local Georgia (right)

This section discusses some of the known factors that affect local Georgia bridge condition. Being aware of other factors that may negatively affect a bridge's condition is advantageous when making decisions and can aid in preventative measures. Some factors that bridges in poorer conditions share include:

Bridge Age

- Most obviously a bridge's age is indicative of its condition, however when solely analyzing local Georgia bridges, bridges **26 years or older** begin to decline from good condition to fair and poor condition. Figure 5 illustrates this trend.
- Local governments should pay more attention to bridges approaching this age as well as proactively preserving all bridges.

⁸ Nguyen, A. (2020). Development of Bridge Asset Management for Local Georgia Governments (Master's thesis, University of Georgia, Athens, United States).

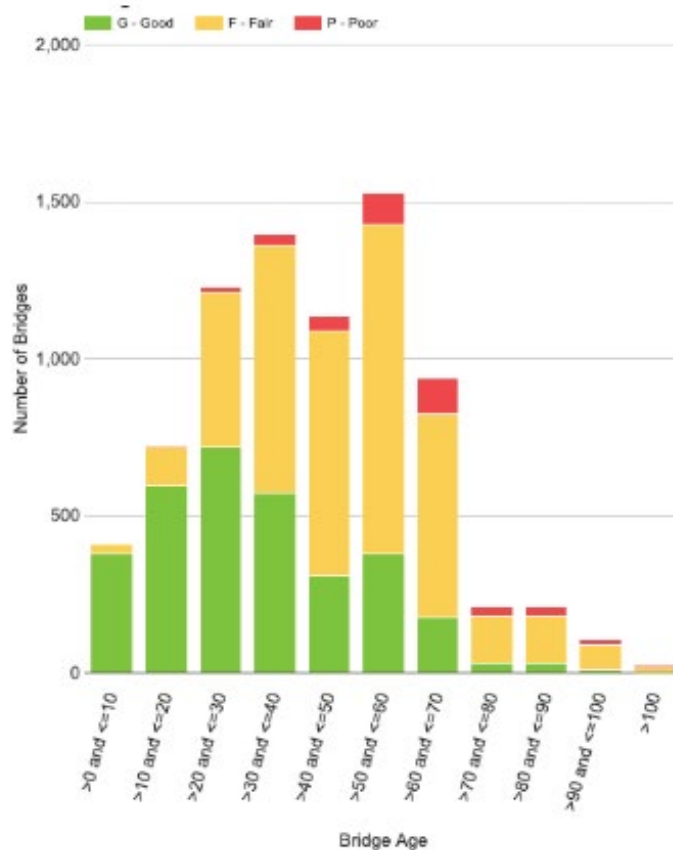


Figure 5: Local Bridge Age and Condition

Bridge Design Material

- Additionally, another factor affecting the bridge condition is the design material of the bridge. It was observed that **steel bridges** are in relatively lower conditions.
- Most steel bridges in Georgia are typically older than concrete bridges which may explain why the majority of steel bridges are classified at a lower condition.

Total Annual Budget

- Unsurprisingly, a local government's financial resources greatly influence the condition of their bridges.
- The analysis of local Georgia bridges indicates that bridges older than 26 years but younger than 42 years will typically be in Good condition IF the county had a total annual budget **greater than \$260 million** for the 2019 fiscal year.
- Table 2 shows the total annual budget for the counties with the some of the highest percentages of Poor condition bridges and those with the lowest percentage of Poor Condition Bridges.
- Although the total annual budget does not assess the sources solely for transportation and bridges it still demonstrates an apparent conclusion that local governments with more financial resources will have better condition bridges.
- Local governments with low financial resources should invest in a long-term bridge preservation plan especially since it can extend the bridges' service life and lower annualized costs.

Table 2: Total Annual Budget for Counties with Highest Percentage of Poor Bridges

County	Highest Percentage of Poor Bridges	Total Annual Budget
Marion	36.9%	\$7,200,000
Meriwether	15.4%	\$14,101,000
Quitman	15.0%	\$2,387,284
Chattooga	14.8%	\$10,834,000

Table 3: Total Annual Budget for Counties with Lowest Percentage of Poor Bridges

County	Lowest Percentage of Poor Bridges	Total Annual Budget
Gwinnett	1.0%	\$1,844,126,481
Fulton	1.0%	\$1,200,000,000
Dekalb	0.7%	\$610,364,533
Cobb	0.5%	\$998,932,289

3.0 COMPONENTS OF THE BRIDGE PRESERVATION STRATEGY

The appropriate response in addressing recorded condition deficiencies is to take the needed actions and preventative measures to retard potential future degradation. An effective way to achieve this goal is to develop a local bridge management plan that includes preservation. This section provides information on several components of the bridge preservation strategy which will provide guidance when drafting a local bridge management plan.

3.1 Types of Actions

Once the bridges' conditions are assessed, the next phase in strategizing is to determine the types of actions that need to be taken. Figure 6 illustrates the four types of actions that are performed on a bridge: cyclical maintenance, condition-based maintenance, replacement, and rehabilitation.

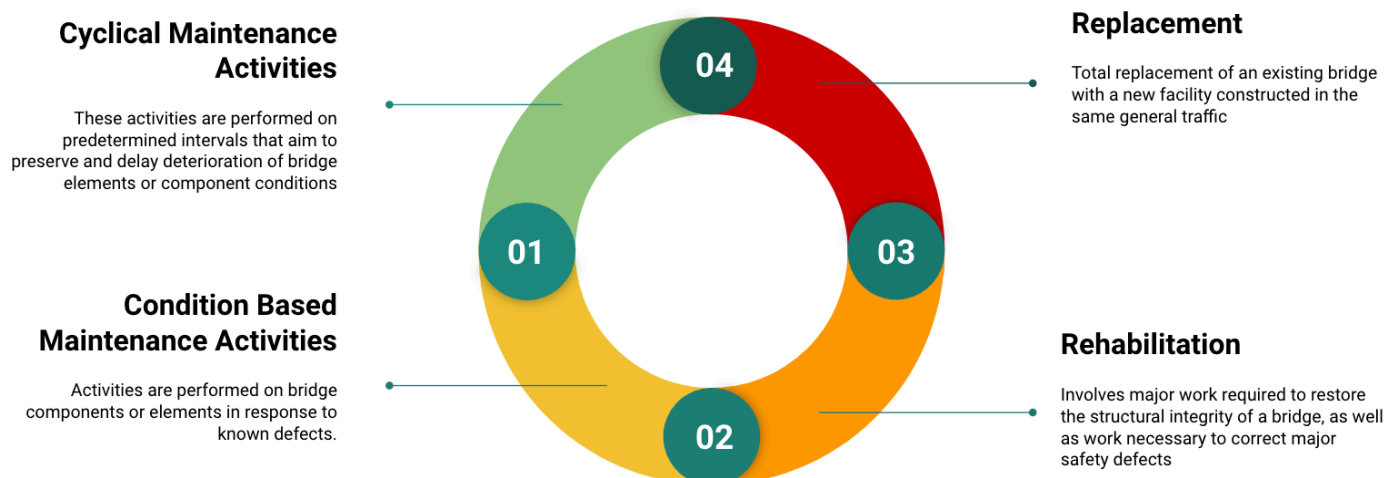


Figure 6: Four Types of Bridge Actions

3.1.1 Preventative Maintenance⁹

In order to preserve and extend the useful life of a bridge preventative maintenance actions need to be considered. The Federal Highway Administration's (FHWA) *Bridge Preservation Guide* (2018) defines preventive maintenance as "a strategy of extending service life by applying cost-effective treatments to bridge elements...[that] retard future deterioration and avoid large expenses in bridge rehabilitation or replacements." Preventive maintenance work is typically performed on bridges rated fair, which is an NBI rating of 5 or 6, in order to slow the rate of deterioration and keep them from falling into poor condition. Preventative Maintenance consists of Cyclical Maintenance and Conditional Maintenance, which is defined by FHWA below, with examples in Table 4 and 5:

Cyclical Maintenance Activities

"Cyclical maintenance activities are performed on pre-determined intervals that aim to preserve and delay deterioration of bridge elements or component conditions."

- ❖ Example: If there are any environmental or conditions changes, the frequency of cyclical preventative maintenance activities can also change. For example, a 3-year cycle superstructure cleaning that was based on pervious accumulation of debris buildup changes if pigeons start routinely nesting on those elements.
 - **Cleaning** activities include annual water flush of all decks, drains, bearings, joints, pier caps, abutment seats, concrete rails, parapets.
 - **Drainage system cleanout & repair** is crucial for the bridge to effectively shed water.
 - **Vegetation control & debris removal** prevents potential damage to the structure.

⁹ Bridge Preservation Guide. (2018)

Condition Maintenance Activities

“Condition-based maintenance activities are performed on bridge components or elements in response to known defects. Condition-based maintenance improves the condition of that portion of the element but may or may not result in an increase in the component condition rating.”

- ❖ Example: These activities are usually identified through an inspection process. “A substructure element that was once rated fair due to spalled concrete and exposed reinforcement improved to a “Good” substructure rating after maintenance removed loose concrete, cleaned the exposed reinforcement, and formed and placed new concrete.” Some additional examples include:
 - **Concrete deck overlay**, which involves replacing the driving surface of the bridge.
 - **Deck repairs**, which can include concrete patching, deck sealing, crack sealing, and joint repair/replacement.
 - **Steel Bearing repair & replacement**, the bearings allow some movement due to temperature changes and forces and also separate the bridge superstructure from the piers.
 - **Painting**, coating, and sealant applications, and for routine, minor deck patching and railing repairs
 - **Channel Improvements**, stream channel maintenance including debris removal, stabilizing banks and correcting erosion problems
 - **Guardrail repair**, which improves the condition of the safety feature that prevents lane departure incidents.
 - **Scour countermeasures** are typically performed on the piers when a bridge is scour critical
 - **Approach repaving** where the bridge meets the roadway leading up to the bridge deck.
- ❖ Chapter 3 of the GDOT Bridge Repair Manual presents the process for the preventative maintenance activities ¹⁰

¹⁰ Bridge Structure Maintenance and Rehabilitation Repair Manual. (2012). Georgia Department of Transportation. <http://www.dot.ga.gov/InvestSmart/BridgePrograms/Documents/Bridge%20Programs/BridgeRepairManual.pdf>
Page 207

Table 4: Examples of Cyclical Maintenance Activities¹¹

Cyclical Maintenance Activity	Bridge Component
Clean/Wash Bridge	Deck and/or Super/Substructure
Clean and Flush Drains	Deck
Clean Joints	Deck
Deck/Parapet/Rail Sealing and Crack Sealing	Deck
Seal Concrete	Super/Substructure

Table 5: Examples of Condition-based Maintenance Activities¹²

Examples of Condition-Based Maintenance Activity	Bridge Component
Drains, Repair/Replace	Deck
Joint Seal Replacement	Deck
Joint Repair/Replace/Elimination	Deck
Electrochemical Extraction (ECE)/Cathodic Protection (CP)	Deck
Concrete Deck Repair (see halo effect below) in Conjunction with Overlays, CP Systems or ECE Treatment	Deck
Deck Overlays (thin polymer epoxy, asphalt with waterproof membrane, rigid overlays)	Deck
Repair/Replace Approach Slabs	Approach
Seal/Patch/Repair Superstructure Concrete	Superstructure
Protective Coat Concrete/Steel Elements	Superstructure
Spot/Zone/Full Painting Steel Elements	Superstructure
Steel Member Repair	Superstructure
Fatigue Crack Mitigation (pin-and-hanger replacement, retrofit fracture critical members)	Superstructure
Bearing Restoration (cleaning, lubrication, resetting, replacement)	Superstructure
Movable Bridge Machinery Cleaning/Lubrication/Repair	Superstructure
Patch/Repair Substructure Concrete	Substructure/Culvert
Protective Coat/Concrete/Steel Substructure	Substructure/Culvert
ECE/CP	Substructure/Culvert
Spot/Zone/Full Painting Steel Substructure	Substructure
Pile Preservation (jackets/wraps/CP)	Substructure
Channel Cleaning / Debris Removal	Channel
Scour Countermeasure (installation/repair)	Channel

¹¹ Bridge Preservation Guide. (2018)¹² Bridge Preservation Guide. (2018)

Overall some of the recommended bridge maintenance activities that provide the greatest advantage for the least amount of investment generally include¹³:

- Eliminating deck joints in old bridges
- Repairing or installing new expansion dams on bridge decks
- Repairing bridge decks
- Maintaining proper deck drainage
- Restoring or replacing bridge bearings
- Repairing or replacing bridge approach slabs
- Repairing bridge beam ends and beam bearing areas
- Bridge painting

3.1.3 Rehabilitation

Rehabilitation involves repairs to improve the existing condition and extend the service life of the structure. Most often, bridges that have declined past what can be addressed with preventative maintenance need rehabilitation options. Rehabilitation is typically performed on poor-rated elements, which is an NBI rating of 4 or less, to improve them to a better condition. Rehabilitation can include a superstructure or deck replacement. Rehabilitation is usually more expensive than maintenance and sometimes on par with replacement costs depending on the situation. Therefore bridge owners should complete a feasibility analysis.

- ❖ Some examples include Railing retrofit/replacement, beam repair, and substructure concrete patching and repair.
- ❖ Chapter 2¹⁴ of the GDOT Bridge Repair Manual provides the process for some rehabilitation activities

3.1.4 Replacement

Replacement work is typically performed when a bridge is in poor condition, which is an NBI rating of 4 or less, and will improve to a good condition. Bridge replacement removes the entire bridge along with its bridge components and constructs a new bridge at the same location. The decision to perform a total replacement over rehabilitation should be made based on a life-cycle cost analysis. Replacement is generally the most expensive of the treatment options.

¹³ “Chapter 7: Bridge Maintenance.” Center for Environmental Excellence by AASHTO - Environmental Issue Construction and Maintenance Practices Compendium, https://environment.transportation.org/environmental_issues/construct_maint_prac/compendium/manual/7_1.aspx.

¹⁴ Bridge Structure Maintenance and Rehabilitation Repair Manual. (2012)

3.2 Cost Estimating ¹⁵

In preparation for creating a bridge asset management plan cost estimates and unit prices should be evaluated in order to determine an optimum program.

3.2.1 Deterioration Models

- ❖ A useful tool that local governments could benefit from is the use of deterioration models. Within a bridge management system, the deterioration model of a bridge predicts the condition of a bridge over time which can additionally show the decay over time with applied actions or inactions. An example of a deterioration curve is shown in Figure 7.
- ❖ This is a great option for a local government that manages over 50 bridges as it can be a tool to prioritize funding and map out future condition.
- ❖ When work is deferred, there are increased costs due to greater deterioration of the bridge and more expensive repairs that will be needed in the future. This will need to be compared to the advantages of using the available funding for another project at the given time period. The deterioration model can serve as a basis for determining the cost of deferred maintenance /repairs since it can predict the future conditions based on what actions are chosen. This analysis can be connected to the life cycle costs of the bridges.

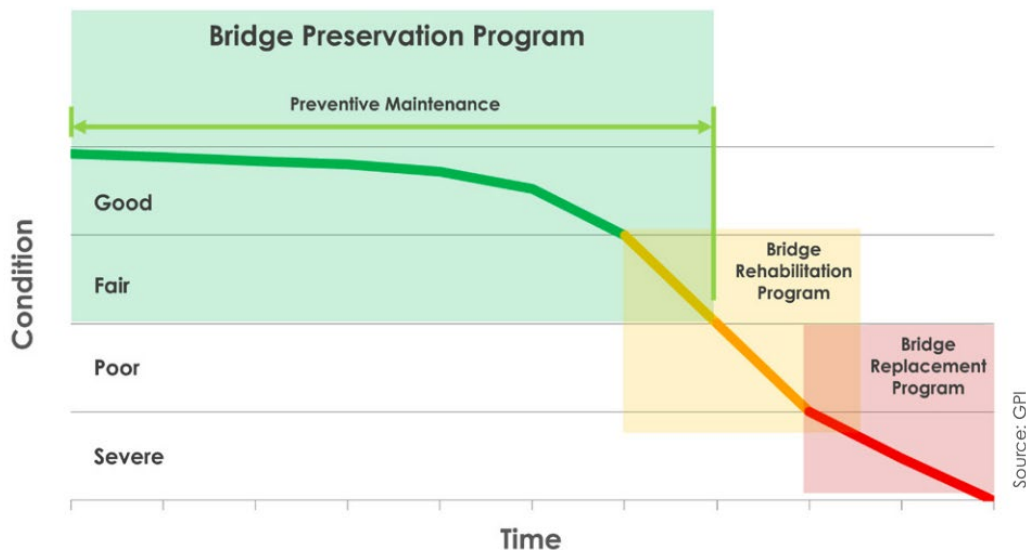


Figure 7: Bridge Condition over time ¹⁶

¹⁵ *Asset Management Guide for Local Agency Bridges in Michigan*. (2011). Michigan Transportation Asset Management Council. https://www.michigan.gov/documents/mdot/Local_Bridge_Asset_Management_Guide_480551_7.pdf

¹⁶ Bridge Preservation Guide. (2018)

3.2.2 In-house Costs vs. Contract Costs

Local governments typically do not have the means to have a full maintenance bridge crew to carry out all tasks. Typically, a combination of in-house road crews and contractors are utilized. When estimating the cost of work, a typical list of considerations includes:

- 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
- Administrative costs
- Traffic control

Additional recommendations:

- ❖ It is important for the local government to keep a record of all work/work orders performed by the in-house crew for reference in the future. Therefore, local governments should be able to develop standardized item-based cost estimate worksheets for both in-house and contracting for on-call projects.
- ❖ It may be beneficial to consider the cost advantages of collaborating with other adjacent municipalities or counties to share resources, such as a combined specialized crew, or costs of work by contract.

4.0 STEPS IN DEVELOPING A BRIDGE MANAGEMENT PLAN

The structure of this section presents eight suggested steps for an effective bridge management plan, shown in Figure 8, and the included recommendations to consider. The steps are in a suggestive order and can be adjusted according to the local government's needs. The concepts within each step should inform the bridge owner on what to consider.

1. Develop Goals and Objectives
2. Perform Bridge Asset Analysis
3. Implement a Preservation Strategy
4. Establish Cost Estimates
5. Create Operations and Maintenance Plan
6. Outline Five-Year Annual Cost Projection
7. Identify Funding Sources
8. Measure and Report Performance



Figure 8: Steps in a Local Bridge Management Plan

Step 1: Develop Goals and Objectives

The local government should identify its goals and objectives with this plan. It is suggested that the preservation plan improves poor bridges, provides a capital preventive maintenance program to maintain fair/good bridges in the same condition or better. The goals and objectives can be tracked through performance measures which each local government decides.

- ❖ **Goal:** a statement of the local government's purpose, describing future expected outcomes. Goals provide programmatic direction and focus on ends rather than means.
- ❖ **Objectives:** clear, specific, measurable, and time-limited statements of action which, when completed, will move towards achieving the goal

- ❖ **Performance Measures:** the metrics by which the local government will evaluate the effectiveness of the plan. Measures of accomplishment of preservation actions are comparative.
- ❖ Local governments have different performance measures specific to their objectives and goals. A few examples include:
 - Goal percentage of Good/Fair Condition Bridges
 - Goal percentage of Poor Condition or Structurally Deficient bridges
- ❖ **Prioritization:** local government's methodology used to rank projects for funding
 - The local government can prioritize bridges for projects. There are several methods to measure priority.
 - There can be Low, Medium, High categories or it can be evaluated by five typical factors and weighting them as follows: condition –[##]%, load capacity –[##]%, traffic –[##]%, safety –[##]%, and detour –[##]%.
 - There are several components within each factor that can be used to arrive at a score. Each project under consideration can be scored, and its total score is then compared with other proposed projects to establish a priority order.

Step 2: Perform Bridge Asset Analysis

As mentioned above in Section 2.0 an effective plan begins with the assessment of the government's bridges, which can be tied to the Performance Measures and Objectives over time.

- ❖ **Condition Analysis:** an overall assessment of the current state of the bridge population. This would include the number and percentages of bridges in good, fair and poor state, etc.
- ❖ **Develop Inventory and discussion of bridge assets:**
 - Although bridge inspectors provide the report for all the bridges in the local government, there should be a separate inventory in order to keep track of condition changes and work needs. The inspection reports can be used as a foundation for the inventory.
 - **Bridge Assets:** a summary of the number, type, and condition state of the bridges in the network.
 - An example of a Bridge Asset spreadsheet can be seen in **Appendix 1** .

Step 3: Implement Preservation Strategy

Preservation Strategy: The overall actions to be taken by the agency to address preservation. Develop a list of actions for maintenance and repairs.

- ❖ Consider the types of fixes and list of actions for preservation as mentioned in Section 3.1
- ❖ Develop standardized item-based in-house and contracting costs for on-call projects
- ❖ **Appendix 2** ➤ Table 5 outlines an example of bridge selection criteria and expected outcomes for each action. A local government can utilize this decision table by modifying it to its specific bridges and inspection reports. Table 6 is an example of an expanded Preservation Criteria Table.
- ❖ **Table 6** lists the most recommended bridge preventative maintenance activities that can be implemented.
 - Resource: GDOT's Preventative Maintenance selection criteria¹⁷
 - Resource: GDOT's Bridge Maintenance and Repair Manual for technical guidance ¹⁸
 - Provides the technical guidance for some of the actions mentioned in this guide.
 - Resource: GDOT's Qualified Product List (QPL) based on Category ¹⁹

¹⁷ Doyle, A. (2013). Bridge Structures Maintenance Plan.
<http://www.dot.ga.gov/InvestSmart/BridgePrograms/BridgePrograms/GDOT%20PM%20PLAN%20August%202013.pdf>

¹⁸ Bridge Structure Maintenance and Rehabilitation Repair Manual. (2012). Georgia Department of Transportation.
<http://www.dot.ga.gov/InvestSmart/BridgePrograms/Documents/Bridge%20Programs/BridgeRepairManual.pdf>

¹⁹ Qpl category. (n.d.), from <http://www.dot.ga.gov/PS/Materials/QPLCategories>

Table 6: Recommended Bridge Preservation Activities²⁰

No.	Bridge preventive maintenance activities	Frequency (years)
1	Deck sweeping/cleaning	
	- deck sweeping/cleaning	1
	- drainage system cleaning/washing	1
2	Concrete deck maintenance	
	- deck sealing	5
	- deck crack sealing	5
	- deck partial patching	5
3	Joints maintenance	
	- joints cleaning/flushing/resealing	1
4	Bearings maintenance	
	- bearings, seats and slope wall cleaning/flushing	2
	- lubricating	4
	- spot painting	10
5	Approach slab maintenance	
	- sweeping and cleaning	1
	- drainage system cleaning/flushing	1
	- seal approach deck/cracks	5
	- joints cleaning/flushing	1
6	Superstructure washing	
	- cleaning/washing	2
7	Spot painting	10
8	Vegetation control	1
9	Remove debris from piers/abutments	1
10	Pin/hanger (or hinge) connection maintenance	
	- clean/flush connection members	2
	- lubricate connection members	4
	- spot paint connection members	10

Step 4: Cost Estimate

- ❖ **Cost Estimate Worksheet:** A worksheet created to compile the predicted unit costs involved for any bridge management action.
- ❖ A general worksheet that local Georgia governments can utilize and build off of is created in **Appendix 3** . This comprehensive worksheet identifies the bridge work activity and the cost per unit.
 - This sheet can be further tailored to each local government through their recorded work orders/cost data from each bridge repair/maintenance activity and previous contract work.

²⁰ Bowman, M. D., & Moran, L. M. (2015). Bridge preservation treatments and best practices (Joint Transportation Research Program Publication No. FHWA/IN/JTRP-2015/22). West Lafayette, IN: Purdue University. <https://doi.org/10.5703/128828431600>

Step 5: Operations and Maintenance Plan

Operations and Maintenance Plan (O&M): the annual activities scheduled in a five-year program

- ❖ The activities in this step should be strategically programed and prioritized considering each bridge's needs.
- ❖ The process includes tabulating proposed maintenance actions from bridge inspections and identifying the maintenance actions whether it be performed by in house crews or contracted out.
- ❖ Figure 9 shows an outline of a basic annual O&M plan.

2021 ANNUAL BRIDGE OPERATION AND MAINTENANCE PLAN								STATUS
BRIDGE NO.	TASK NAME	BRIDGE PRIORITY SCORE	STATUS	ASSIGNED TO	ANTICIPATED START DATE	ANTICIPATED END DATE	COMMENTS	
REPLACEMENT								Not Started
BRIDGE ##	-		Not Started		01/02	01/11		In Progress
BRIDGE ##	-		Not Started		01/07	01/11		Complete
BRIDGE ##	-		Not Started		01/10	02/23		On Hold
BRIDGE ##	-		Not Started		01/10	01/20		
BRIDGE ##	-		Complete		01/16	01/29		
BRIDGE ##	-		In Progress		01/19	02/01		
BRIDGE ##	-		In Progress		01/22	02/09		
REHABILITATION								
BRIDGE ##	-		On Hold		01/28	02/06		
BRIDGE ##	-		In Progress		01/31	02/02		
BRIDGE ##	-		In Progress		02/04	02/12		
BRIDGE ##	-		Complete		02/06	02/14		
CONDITIONAL MAINTENANCE								
BRIDGE ##	-		Not Started		02/18	02/20		
BRIDGE ##	-		Not Started		02/18	02/23		
BRIDGE ##	-		Not Started		02/18	02/26		
BRIDGE ##	-		Not Started		02/21	02/23		
BRIDGE ##	-		Not Started		02/22	02/23		
BRIDGE ##	-		In Progress		02/25	03/26		
CYCUCAL MAINTENANCE								
BRIDGE ##	-		In Progress		02/25	02/23		
BRIDGE ##	-		On Hold		02/26	03/03		
BRIDGE ##	-		Not Started		02/25	03/06		
BRIDGE ##	-		Not Started		03/03	03/26		
BRIDGE ##	-		Not Started		01/10	01/20		
BRIDGE ##	-		Complete		01/16	01/29		
BRIDGE ##	-		In Progress		01/19	02/01		
BRIDGE ##	-		In Progress		01/22	02/09		

Figure 9: Outline of an Annual O&M Plan

Step 6: Five-Year Annual Cost Projection

❖ **Five Year Annual Cost Projection:** a year-by-year, project-by-project schedule of bridge maintenance projects and costs.

- Table 7 displays an example of cost projection table. The costs are separated by the types of actions: New, replacement, rehabilitation and preventative maintenance. The leftmost column numbers identify the corresponding short bridge identification number.

Table 7: Example of a Five-Year Annual Cost Projection

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

Step 7: Identify Funding Sources

- ❖ **Identifying Funding Sources:** Discussion of the existing and potential source and allocation of funds for the program. Based on research, programing a specified amount for bridge preservation is recommended. Overtime with demonstrated improvements funds can be increased.
- ❖ Once a plan is mapped out and the importance of bridge preservation is realized it becomes easier to Identify funding needs and justify larger budgeting amounts.
- ❖ **A Local Georgia Funding Matrix and Checklist** has been created in **Appendix 4: Funding Matrix** ➤ to be able to check for the eligibility and criteria requirements of different funding sources for local Georgia bridges.
- ❖ **Appendix 5: Brief Overview of Available Local Funding Sources** ➤ Tabulates a brief overview of some of the current funding sources available to local Georgia governments.
- ❖ **Funding sources** that local governments in Georgia can utilize for their bridges include but are not limited to:
 - Local Maintenance and Improvement Grant (LMIG)
 - Low Impact Bridge Program (LIBR)
 - Local Bridge Replacement Program (LOCBR)
 - Special Purpose Local Option Sales Tax (SPLOST)
 - Transportation Investment Act (TIA/TSPLOST)
 - Georgia Transportation Infrastructure Bank
 - Transportation Funding Act of 2015

Step 8: Measure and Report Performance²¹

The local government will find it advantageous to adjust their program based on the net benefits over time. Therefore, reporting is crucial to informing local government stakeholders and executives of the accomplishments of the bridge management plan. Reporting additionally allows justification for continued support.

- ❖ The created plan should be feasible and **easily updated**.
- ❖ It is important to develop methods to **evaluate benefits**. This process requires a method of measuring the performance of the bridge management program. The Performance Measures can be monitored and updated to show progress. Results of a project will typically take multiple inspection cycles to effectively measure the performance.
- ❖ **Figure 10** is an example of progress tracking. The 7-year goal for this government is to reduce their Structurally Deficient bridges to 25% while increasing their Good/Fair bridges to 80%. The bolded lines are the current projected progress (2018) and the dotted line represents the future projections leading to the local government's goal which is represented in with a thin straight line.

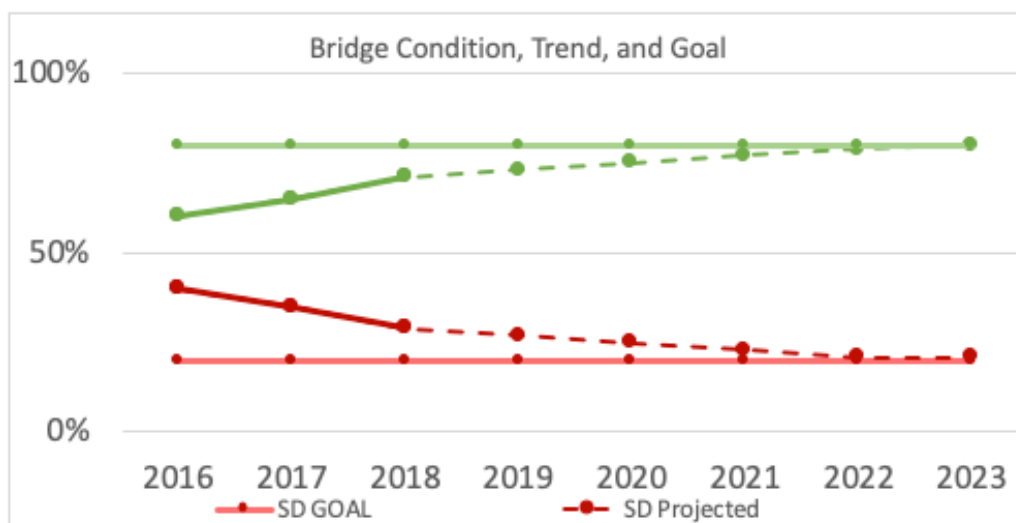


Figure 10: Example of Reporting Performance Measures²²

²¹ Bridge Preservation Guide. (2018), Page 16

²² *Asset Management Guide for Local Agency Bridges in Michigan*. (2011). Michigan Transportation Asset Management Council. https://www.michigan.gov/documents/mdot/Local_Bridge_Asset_Management_Guide_480551_7.pdf

5.0 OVERALL RECOMMENDATIONS:

Local governments can initially take smaller steps and start developing parts of a management plan. Over time there should be shifts in policies that lead to promotion of bridge preservation through performance measures and dedicated funds.

FHWA outlined a few recommendations to consider²³:

- ❖ Start a bridge cleaning program using basic tools such as brooms and shovels, to remove accumulated debris and road grit. Afterward, hoses and pressure washers can dilute deicing chemical from concrete and remove any remaining debris and road grit not removed from sweeping.
- ❖ Encourage maintenance crews to check deck joints for leakage and to replace seals where needed. Encourage maintenance supervisors to note conditions of both joints and beam ends, and then prioritize new joint seals at bridges with beam ends in good condition.
- ❖ Use inventory data from bridge inspections to monitor and update the conditions of wearing surfaces, coatings, and sealers and regularly schedule replacement accordingly.
- ❖ Quantify and report on the performance of the bridge plan, specifically reductions in annualized costs achieved through preservation to gain support of bridge preservation.
- ❖ Quantify and publicize the reductions in annualized costs of bridges achieved through preservation to gain and hold the support of owner agency or DOT executives for bridge preservation.

GDOT Bridge Maintenance Engineer Recommendations²⁴

- ❖ Prioritize the bridges that are most critical to its citizens. The process could stem from indicators such as the Average Daily Traffic that a bridge receives or from GDOT's state route group, which identifies the critical routes throughout the state.
- ❖ When weighing options between in-house crews and contractors consider about 7-8 crew members for maintenance or the added cost of consultants producing the design and repair plans
- ❖ Local governments should recognize that inspectors are not engineers. Contact GDOT's Bridge Maintenance Office to prioritize bridge work or send repair plans in order to assess feasibility.
- ❖ Contact Information:
 - Georgia Department of Transportation

²³ Bridge Preservation Guide. (2018), Page 16

²⁴ Nguyen, A. (2020). Development of Bridge Asset Management for Local Georgia Governments (Master's thesis, University of Georgia, Athens, United States).

- Office of Bridge Maintenance
- 935 United Ave, SE
- Building 24, Room 415
- Atlanta, GA 30316-2531
- 404-635-288

6.0 IMPLEMENTATION OF GUIDE: SAMPLE LOCAL BRIDGE ASSET MANAGEMENT PLAN

This guide was implemented through a case study with Spalding County, GA in 2020. “Spalding County’s Bridge Asset Management Plan” can be observed in **Appendix 6: Sample Local Bridge Asset Management Plan**.

APPENDIX

Appendix 1: Example of Bridge Assets by Type

Table 8: Spalding County Bridge Assets by Type: Inventory, Size, and Condition

Bridge Type	Total Number of Bridges	Total Deck Area (sq ft)	Condition: Structurally Deficient, Posted, Closed			2018 Condition		
			Struct. Defic	Posted	Closed	Poor	Fair	Good
Concrete	35	58896.5	17	10	--	5	25	4
Prestressed Concrete	6	26493	--	--	--	0	4	2
Steel	13	22080.3	6	5	--	2	10	1
Steel Continuous	2	2855.9	--	1	--	--	2	--
Wood or Timber*	1	683	1	1	--	--	1	--
Total SD/Posted/Closed			22	18	0			
Total	57	111008.6				8	42	7
Percentage (%)			38%	32%	0%	14%	74%	12%

Appendix 2: Examples of Preservation Criteria

Table 9: Bridge Preservation Criteria Established for Genesee County

Preservation Action	Bridge Selection Criteria	Expected Service Life
Replacement		
Total Replacement	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	70 yrs
Superstructure Replacement	NBI Rating for Superstructure of 4 or less, or when cost of rehabilitating superstructure & deck exceeds replacement cost.	40 yrs
Deck Replacement	Use guidelines in MDOT's <i>Bridge Deck Preservation Matrix</i> .	
Epoxy Coated Steel	NBI Rating of 4 or less for deck surface and deck bottom, or when deck replacement cost is competitive with rehabilitation.	70 yrs
Black Steel		40 yrs
Substructure Replacement (Full or Partial)	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.	40 yrs
Rehabilitation		
Concrete Deck Overlays	Guidelines in MDOT's <i>Bridge Deck Preservation Matrix</i>	
Deep	NBI Deck Rating < 5 for surface and > 5 for bottom	25 yrs
Shallow	NBI Deck Rating < 5 for surface and > 4 for bottom	12 yrs
HMA / Membrane	NBI Deck Rating < 5 for surface and > 4 for bottom	8 yrs
HMA Cap	NBI Deck Rating < 5 for surface and < 4 for bottom	3 yrs
Railing Retrofit / Replacement	NBI Deck Rating greater than 5, Railing / Barrier rated less than 5, or Safety Improvement is needed	
Steel Beam Repairs	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.	
Prestressed Concrete Beam Repairs	Repair ends of prestressed I-beams when more than 5% spalling is present, or repair areas to correct impact damage that impairs beam strength or exposes prestressing strands.	
Repair / Replace Culvert	NBI Rating of 4 or less for culvert or drainage outlet structure, or there is existence of open vertical cracks, signs of deformation, movement, or differential settlement.	
Repair / Replace Retaining Wall	NBI Rating of 4 or less for retaining wall, or there is existence of open vertical cracks, signs of differential settlement, or presence of active movement.	

Pin and Hanger Replacement	NBI Rating for elements is 4 or lower. Presence of excessive section loss, severe pack rust, or out-of-plane distortion.	
Substructure Concrete Patching and Repair	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.	
Preventive Maintenance		
Repair / Replace Deck Joint	Include when doing deep or shallow overlays, or when NBI Rating for joint is 4 or lower, or when joint is leaking heavily.	
Repair / Replace Steel Bearing	NBI Rating for girders and deck is 5 or higher and rating for bearings is 4 or lower.	
Complete Painting	NBI Rating for paint condition is 3 or lower, or in response to Inspector's work recommendation for complete painting	15 yrs
Zone Painting	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.	10 yrs
HMA Overlay Cap without Membrane	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.	3 yrs
Concrete Deck Patching	Deck Surface Rating of 5, 6, or 7 with minor delamination and spalling, or in response to Inspector's work recommendation	5 yrs
Channel Improvements	Removal of vegetation, debris, or sediment from channel and banks to improve channel flow, or in response to Inspector's work recommendation.	
Scour Countermeasures	Structure is categorized as scour critical and is not scheduled for replacement. NBI comments in abutment and pier ratings indicate presence of scour holes.	
Scheduled Maintenance		
Superstructure Washing	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.	2 yrs
Vegetation Control	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.	1 yr

Debris Removal	When vegetation, debris, or sediment accumulates on the structure or in the channel or in response to inspector's work recommendation.	1 yr
Drainage System Clean-Out/ Repair	When drainage system is clogged with debris, or drainage elements are broken, deteriorated, or damaged.	2 yrs
Spot Painting	For zinc based paint systems only, in response to Inspector's work recommendation.	5 yrs
Seal Concrete Cracks / Joints	Concrete is in good or fair condition, and cracks extend to the depth of the reinforcement, or in response to Inspector's work recommendation	5 yrs
Repair / Replace HMA Surface	HMA surface is in poor condition or in response to Inspector's work recommendation.	
Seal HMA Cracks / Joints	HMA surface is in good or fair condition, and cracks extend to the surface of the underlying slab or sub course, or in response to Inspector's work recommendation	
Minor Concrete Patching	Repair minor delaminations and spalling, or in response to Inspector's work recommendation.	
Timber Repairs	NBI Rating of 4 or less for timber members, or to repair extensive rot, checking, or insect infestation.	
Repair / Replace Guard Rail	Guard rail missing or damaged, or Safety Improvement is needed.	
Repave Approaches	HMA is in poor condition or in response to Inspector's work recommendation.	
Repair Slopes	NBI Rating is 5 or lower, or when slope is degraded or sloughed, or slope paving has significant areas of distress, failure, or has settled.	
Install Riprap	To protect surfaces when erosion threatens the stability of side slopes or channel banks.	
Miscellaneous Repairs	Uncategorized Repairs in response to Inspector's work recommendations.	

Table 10: Example of an Expanded Preservation Criteria Table by TAMC

Preservation Action	Bridge Selection Criteria	Expected Service Life
Replacement		
Total Replacement	- NBI rating of 3 or less (MDOT, 2019) (MDOT, 2017) - OR Cost of rehabilitation exceeds cost of replacement (MDOT, 2019) - OR Bridge is scour critical with no counter-measures available (MDOT, 2019)	70 years
Superstructure Replacement	- NBI rating of 4 or less for the superstructure (MDOT, 2019) (MDOT, 2017) - OR Cost of superstructure and deck rehabilitation exceeds cost of replacement (MDOT, 2019)	40 years (MDOT, 2019)
Deck Replacement Epoxy Coated Steel Black Steel	- Use guidelines in MDOT's Bridge Deck Preservation Matrix (MDOT, 2017) (MDOT, 2017) - NBI rating of 4 or less for the deck surface and deck bottom (MDOT, 2019) (MDOT, 2017) - Deck bottom has more than 25% total area with deficiencies (MDOT, 2019) - OR Replacement cost of deck is competitive with rehabilitation (MDOT, 2019)	60+ years (MDOT, 2017) (MDOT, 2017)
Rehabilitation		
Substructure Replacement (Full or Partial)	- NBI rating of 4 or less for abutments, piers, or pier cap (MDOT, 2019) (MDOT, 2017) - Has open vertical cracks, signs of differential settlement, or active movement (MDOT, 2019) - Pontis rating of 3 or 5 for more than 30 percent of the substructure (MDOT, 2019) (MDOT, 2009) - OR Bridge is scour critical with no counter-measures available	40 years ^[1*]
Steel Beam Repair	- More than 25% section loss in an area of the beam that affects load carrying capacity (MDOT, 2019) - OR To correct impact damage that impairs beam strength (MDOT, 2019)	40 years ^[1*]
Prestressed Concrete Beam Repair	- More than 5% spalling at ends of prestressed I-beams (MDOT, 2019) - OR Impact damage that impairs beam strength or exposes prestressing strands (MDOT, 2019)	40 years ^[1*]
Substructure Concrete Patching and Repair	- NBI rating of 5 or 4 for abutments or piers, and surface has less than 30% area spalled and delaminated (MDOT, 2019) (MDOT, 2017) - OR Pontis rating of 3 or 4 for the column or pile extension, pier wall, and/or abutment wall and surface has between 2% and 30% area with deficiencies (MDOT, 2019) (MDOT, 2009) - OR In response to inspector's work recommendation for substructure patching (MDOT, 2019)	
Abutment Repair/Replacement	- NBI rating of 4 or less for the abutment (MDOT, 2019) (MDOT, 2017) - OR Has open vertical cracks, signs of differential settlement, or active movement	

Preservation Action	Bridge Selection Criteria	Expected Service Life
Railing/Barrier Replacement	- NBI rating greater than 5 for the deck (MDOT, 2019) (MDOT, 2017) - NBI rating less than 5 for the railing with more than 30% total area having deficiencies (MDOT, 2019) (MDOT, 2017) - OR Pontis rating is 4 for railing (MDOT, 2019) (MDOT, 2009) - OR Safety improvement is needed (MDOT, 2019)	
Culvert Repair/Replacement	- NBI rating of 4 or less for culvert or drainage outlet structure - OR Has open vertical cracks, signs of deformation, movement, or differential settlement	
Preventive Maintenance		
Shallow Concrete Deck Overlay	- NBI rating is 5 or less for deck surface, and deck surface has more than 15% area with deficiencies (MDOT, 2019) (MDOT, 2017) - NBI rating of 4 or 5 for deck bottom, and deck bottom has between 5% and 30% area with deficiencies (MDOT, 2019) (MDOT, 2017) - OR In response to inspector's work recommendation (MDOT, 2019)	12 years
Deep Concrete Deck Overlay	- NBI rating of 5 or less for deck surface, and deck surface has more than 15% area with deficiencies (MDOT, 2019) (MDOT, 2017) - NBI deck bottom rating is 5 or 6, and deck bottom has less than 10% area with deficiencies (MDOT, 2019) (MDOT, 2017) - OR In response to inspector's work recommendation (MDOT, 2019)	25 years
HMA Overlay with Waterproofing Membrane	- NBI rating of 5 or less for deck surface, and both deck surface and bottom have between 15% and 30% area with deficiencies (MDOT, 2019) (MDOT, 2017) - OR Bridge is in poor condition and will be replaced in the near future and the most cost-effective fix is HMA overlay (MDOT, 2019)	
HMA Overlay Cap without Membrane	- Note: All HMA caps should have membranes unless scheduled for replacement within five years. - NBI rating of 3 or less for deck surface and deck bottom, and deck surface and deck bottom have more than 30% area with deficiencies. Temporary holdover to improve ride quality for a bridge in the five-year plan for rehab/replacement. (MDOT, 2019) (MDOT, 2017)	3 years
Concrete Deck Patching	- NBI rating of 5, 6, or 7 for deck surface, and deck surface has between 2% and 5% area with delamination and spalling (MDOT, 2019) (MDOT, 2017) - OR In response to inspector's work recommendation (MDOT, 2019)	5 years
Steel Bearing Repair/Replacement	NBI rating of 5 or more for superstructure and deck, and NBI rating 4 or less for bearing (MDOT, 2017)	
Deck Joint Replacement	- Always include when doing deep or shallow concrete overlays (MDOT, 2019) - NBI rating of 4 or less for joints (MDOT, 2019) (MDOT, 2017) - OR Joint leaking heavily (MDOT, 2019) - OR In response to inspector's work recommendation for replacement (MDOT, 2019)	
Pin and Hanger Replacement	- NBI rating of 4 or less for superstructure for pins and hangers (MDOT, 2019) (MDOT, 2017) - Pontis rating of 1, 2, or 3 for a frozen or deformed pin and hanger (MDOT, 2019) (MDOT, 2009)	15 years

Preservation Action	Bridge Selection Criteria	Expected Service Life
	OR Presence of excessive section loss, severe pack rust, or out-of-plane distortion (MDOT, 2019)	
Zone Repainting	- NBI rating of 5 or 4 for paint condition, and paint has 3% to 15% total area failing (MDOT, 2019) (MDOT, 2017) - OR During routine maintenance on beam ends or pins and hangers (MDOT, 2019) - OR less than 15% of existing paint area has failed and remainder of paint system is in good or fair condition (MDOT, 2019)	10 years
Complete Repainting	- NBI rating of 3 or less for paint condition (MDOT, 2019) (MDOT, 2017) - OR Painted steel beams that have greater than 15% of the existing paint area failing (MDOT, 2019)	
Partial Repainting	See Zone or Spot Painting	
Channel Improvements	- Removal of vegetation, debris, or sediment from channel and banks to improve channel flow - OR in response to inspector's work recommendation	
Scour Countermeasures	- Pontis scour rating of 2 or 3 and is not scheduled for replacement (MDOT, 2019) (MDOT, 2009) - OR NBI comments in abutment and pier ratings indicate presence of scour holes (MDOT, 2019) (MDOT, 2017)	
Approach Repaving	- Approach pavement relief joints should be included in all projects that contain a significant amount of concrete roadway (in excess of 1000' adjacent to the structure). The purpose is to alleviate the effects of pavement growth that may cause distress to the structure. Signs of pavement growth include: - Abutment spalling under bearings (MDOT, 2019) - Beam end contact (MDOT, 2019) - Closed expansion joints and/or pin and hangers (MDOT, 2019) - Damaged railing and deck fascia at joints (MDOT, 2019) - Cracking in deck at reference line (45 degree angle) (MDOT, 2019)	
Guard Rail Repair/Replacement	- Guard rail missing or damaged ^[2*] - OR Safety improvement is needed ^[2*]	
Scheduled Maintenance		
Superstructure Washing	- When salt contaminated dirt and debris collected on superstructure is causing corrosion or deterioration by trapping moisture (MDOT, 2019) - OR Expansion or construction joints are to be replaced and the steel is not to be repainted (MDOT, 2019) - OR Prior to a detailed replacement (MDOT, 2019) - OR In response to inspector's work recommendation (MDOT, 2019)	2 years
Drainage System Clean-Out/Repair	- When drainage system is clogged with debris (MDOT, 2019) - OR Drainage elements are broken, deteriorated, or damaged (MDOT, 2019) - OR NBI rating comments for drainage system indicate need for cleaning or repair (MDOT, 2019) (MDOT, 2017)	2 years

Preservation Action	Bridge Selection Criteria	Expected Service Life
Spot Repainting	- For zinc-based paint systems only. Do not spot paint with lead-based paints. - Less than 5% of paint area has failed in isolated areas (MDOT, 2019) - OR In response to inspector's work recommendation (MDOT, 2019)	5 years
Slope Paving Repair	- NBI rating is 5 or less for slope protection (MDOT, 2019) (MDOT, 2017) - OR Slope is degraded or sloughed - OR Slope paving has significant areas of distress, failure, or has settled (MDOT, 2019)	
Riprap Installation	To protect surface when erosion threatens the stability of side slopes of channel banks	
Vegetation Control	- When vegetation traps moisture on structural elements (MDOT, 2019) - OR Vegetation is growing from joints or cracks (MDOT, 2019) - OR In response to inspector's work recommendation for brush cut (MDOT, 2019)	1 year
Debris Removal	- When vegetation, debris, or sediment accumulates on the structure or in the channel - OR In response to inspectors work recommendation	1 year
Deck Joint Repair	- Do not repair compression joint seals, assembly joint seals, steel armor expansions joints, and block out expansion joints; these should always be replaced. (MDOT, 2019) - NBI rating is 5 for joint (MDOT, 2019) (MDOT, 2017) - OR In response to inspector's work recommendation for repair (MDOT, 2019)	
Concrete Sealing	- Top surface of pier or abutments are below deck joints and, when contaminated with salt, salt can collect on the surface (MDOT, 2019) - OR Surface of the concrete has heavy salt exposure. Horizontal surfaces of substructure elements are directly below expansion joints (MDOT, 2019)	
Concrete Crack Sealing	- Concrete is in good or fair condition, and cracks extend to the depth of the steel reinforcement (MDOT, 2019) - OR NBI rating of 5, 6, or 7 for deck surface, and deck surface has between 2% and 5% area with deficiencies (MDOT, 2019) (MDOT, 2017) - OR Unsealed cracks exist that are narrow and/or less than 1/8" wide and spaced more than 8' apart (MDOT, 2019) - OR In response to inspector's work recommendation (MDOT, 2019)	5 years
Minor Concrete Patching	- Repair minor delaminations and spalling that cover less than 30% of the concrete substructure (MDOT, 2019) - OR NBI rating of 5 or 4 for abutments or piers, and comments indicate that their surface has less than 30% spalling or delamination (MDOT, 2019) (MDOT, 2017) - OR Pontis rating of 3 or 4 for the column or pile extension, pier wall and/or abutment wall, and surface has between 2% and 30% area with deficiencies (MDOT, 2019) (MDOT, 2009) - OR In response to inspector's work recommendation (MDOT, 2019)	

Preservation Action	Bridge Selection Criteria	Expected Service Life
HMA Surface Repair/Replacement	• HMA surface is in poor condition • <i>OR</i> In response to inspector's work recommendation	
Seal HMA Cracks/Joints	• HMA surface is in good or fair condition, and cracks extend to the surface of the underlying slab or sub course • <i>OR</i> In response to inspector's work recommendation	
Timber Repair	• NBI rating of 4 or less for substructure for timber members • <i>OR</i> To repair extensive rot, checking, or insect infestation	
Miscellaneous Repair	• Uncategorized repairs in response to inspector's work recommendation	
This table was produced by TransSystems and includes information from the following sources: [1] MDOT, <i>Project Scoping Manual</i>, MDOT, 2019. [2] MDOT, <i>MDOT NBI Rating Guidelines</i>, MDOT, 2017. [3] MDOT, <i>Bridge Deck Preservation Matrix - Decks with Uncoated "Black" Rebar</i>, MDOT, 2017. [4] MDOT, <i>Bridge Deck Preservation Matrix - Decks with Epoxy Coated Rebar</i>, 2017. [5] MDOT, <i>Pontis Bridge Inspection Manual</i>, MDOT, 2009. * From source with interpretation added.		

Appendix 3: Cost Estimate Worksheet

2020

- LOCAL GEORGIA - BRIDGE MAINTENANCE COST ESTIMATE WORKSHEET

REV. 9/18/2020

REGION: _____ FISCAL YEAR: _____ STRUCTURE NUMBER: _____ (3-5 digit)

SUPERVISOR: _____ DATE: _____

LOCATION: _____ DECK AREA: _____ SFT BRIDGE ID: **XXX-XXXXX**

PRIMARY WORK ACTIVITY: _____ DECK DIM: _____ STR. TYPE: _____

*Delete any item not used

<u>WORK ITEM</u>	<u>QUANTITY</u>	<u>UNIT</u>	<u>UNIT COST</u>	<u>TOTAL</u>
REPLACEMENT				
Bridge Replacement Cost (Georgia Bridge) [1]		SF	\$129.00 /SF	
New Superstructure [2]		SF	\$185.00 /SF	
New Deck [2]		SF	\$75.00 /SF	
DECK				
Bridge Railing Replacement [2]		FT	\$400.00 /FT	
Concrete Brush Block / Curb Patch [2]		FT	\$24.00 /FT	
Concrete Deck Patch [2]		SFT	\$30.00 /SFT	
Deep Overlay [2]		SFT	\$33.00 /SFT	
Epoxy Overlay [2]		SYD	\$30.00 /SYD	
Expansion Joint Gland Replacement [2]		FT	\$85.00 /FT	

Expansion Joint Replacement [2]		FT	\$600.00	/FT	
Full Depth Patch [2]		SFT	\$76.00	/SFT	
Healer / Sealer [2]		SYD	\$15.00	/SYD	
Overlay Removal [2]		SYD	\$16.00	/SYD	
Reseal Bridge Joints [2]		FT	\$16.00	/FT	
Deck Drainage [3]		SFT	\$5.00	/SFT	
Drain Casting Assembly [2]		EA	\$950.00	/EA	
Deck Drain , Extension [2]		EA	\$400.00	/EA	
Downspout Replacement [2]		EA	\$400.00	/EA	
Embedded Galvanic Anode [2]		EA	\$15.00	/EA	
Concrete Pavement [3]		SFT	\$14.82	/SFT	

SUPERSTRUCTURE

Bearing Realignment / Replacement [2]		EA	\$5,000.00	EA	
Pack Rust Repair [2]		FT	\$500.00	/FT	
Paint - Complete [2]		SFT	\$12.00	/SFT	
Paint - Partial / Spot / Zone [2]		SFT	\$24.00	/SFT	
PCI Beam End Blockout [2]		EA	\$7,200.00	EA	
Pin & Hanger Replacement [2]		EA	\$8,000.00	EA	
Structural Steel Repair [2]		EA	\$3,000.00	EA	

SUBSTRUCTURE

Substructure Patching [2]		CFT	\$300.00	/CFT	
Substructure Replacement [2]		CFT	\$180.00	/CFT	
Substructure Horizontal Surface Sealer [2]		SYD	\$40.00	/SYD	
Temporary Supports [2]		EA	\$2,500.00	EA	
Water Repellent Treatment, Penetrating [2]		SYD	\$16.00	/SYD	
Straddle Bents [3]		SFT	\$15.00	/SFT	
Basic MSE (Mechanically Stable Earth) walls [3]		SFT	\$50.00	/SFT	

MISCELLANEOUS

ROW costs [3]		ACRE	\$140,000.00	/ACRE	
Concrete Surface Coating [2]		SYD	\$28.00	/SYD	
Culvert Cleanout [2]		FT	\$30.00	/FT	
Epoxy Crack Injection [2]		FT	\$50.00	/FT	
Metal Mesh Panels [2]		SFT	\$20.00	/SFT	
Pressure Relief Joint [2]		FT	\$100.00	/FT	
Riprap [2]		SYD	\$175.00	/SYD	
Slope Protection Repairs [2]		SYD	\$100.00	/SYD	
Environmental Mitigation [3]		SFT	\$10.00	/SFT	

TRAFFIC CONTROL

Maintaining Traffic		LS		LS	
Other					

MOBILIZATION & CONTINGENCY

20 %	\$0	\$0
------	-----	-----

(DOES NOT INCLUDE PE & CE)

* Estimated as unit shown, Paid for as LUMP SUM

SOURCES:

[1] Bridge Replacement Unit Costs 2017 - Bridge Tables - National Bridge Inventory - Bridge Inspection - Safety - Bridges & Structures - Federal Highway Administration.

<https://www.fhwa.dot.gov/bridge/nbi/sd2017.cfm#b>.

[2] BRIDGE COST ESTIMATE WORKSHEET . MDOT University, Feb. 2020,

<https://mdotjboss.state.mi.us/stdplan/englishbridgemanual.htm>.

[3] Value Engineering Report: Brampton Road Connector . PI No. 0006328, GDOT, Michael Baker International, Georgia Ports Authority, 17 Oct. 2017.

**CONSTRUCTION
TOTAL**

\$0

Appendix 4: Funding Matrix

FUNDING MATRIX

Use this funding checklist/matrix to determine which funding sources your local government is applicable for. The section on the right provides helpful links for more information.

ADDITIONAL FUNDING SOURCES FOR LOCAL GOVERNMENTS

Eligibility/Criteria	LMIG	LOCBR	LIBP	GTIB	SPLOST	TSPLOST	Design Build Program
ELIGIBLE FOR:							
Amount based on formula	☒	☐	☐	☐	☐	☐	☐
Full Replacement	☐	☒	☒	☒	☒	☒	☒
Maintenance	☒	☐	☐	☒	☐	☐	☐
Replacement of Posted Bridges	☐	☒	☒	☒	☒	☒	☒
Grant	☒	☐	☒	☒	☐	☐	☐
Low-interest Loan 5-20 yrs.	☐	☐	☐	☒	☐	☐	☐
\$0.01 sales tax up to 5- 6 years	☐	☐	☐	☐	☒	☐	☐
\$0.01 sales tax up to 10 years	☐	☐	☐	☐	☐	☒	☐

Funding Source Info.

LMIG

Local Maintenance Improvement Grant. Provides coverage from GDOT for maintenance purposes.
Formula used for award amount = (Pop./State Pop.) x [33%] + (Mileage./Total State Mileage) x [66%]
<http://www.dot.ga.gov/PS/Local/LMIG>

LOCBR

Local Bridge Replacement Program aims to help Local Governments reduce the number of posted and closed bridges throughout the state
<http://www.dot.ga.gov/InvestSmart/BridgePrograms/Pages/LocalBridges.aspx>

LIBP

Low Impact Bridge Program LIBP projects must meet low impact criteria such as no geometry or grade changes, low environmental impacts and off-site detours are accepted by local entities. LIBPs are completed with expedited delivery by means of prefabricated bridge components.

<http://www.dot.ga.gov/InvestSmart/BridgePrograms/Pages/LocalBridges.aspx>

GTIB

Georgia Transportation Infrastructure Bank is a grant and low-interest loan program administered by the State Road and Tollway Authority (SRTA). Since inception, GTIB has provided over \$151 million in grants and loans to projects that have enhanced mobility and driven economic development in local communities throughout Georgia

<https://www.srta.ga.gov/gtib/>

ADDITIONAL FUNDING SOURCES FOR LOCAL GOVERNMENTS

CRITERIA FOR:	LMIG	LOCBR	LIBP	GTIB	SPLOST	TSPLOST	Design Build Program
Low-interest Loan Application	☐	☐	☐	☒	☐	☐	☐
Local Contribution of \$50,000 - \$100,000 for Right of Way phase	☐	☒	☐	☐	☐	☐	☐
Low impact criteria compliance	☐	☐	☒	☐	☐	☐	☐
Local match ranging from 10% - 30 %	☒	☐	☐	☐	☐	☐	☐
Off-site detour up to 12 months	☐	☒	☐	☐	☐	☐	☐
Low-interest Loan Application	☐	☐	☐	☒	☐	☐	☐
Define Projects	☒	☐	☒	☒	☒	☒	☒
Financially provide about 50% of ROW estimates	☐	☒	☐	☐	☐	☐	☐
Return solicited Memorandums of Agreement (MOA) for participation	☐	☒	☐	☐	☐	☐	☐
Defined on ballot	☐	☐	☐	☐	☒	☒	☐
Application fee \$250	☐	☐	☐	☒	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐

Funding Source Info.

SPLOST Types:

County SPLOST.

Imposed up to 5 years (6 years if certain conditions are satisfied), to be shared with its cities (for the proposed governmentally owned or operated capital outlays.

Regional TSPLOST

Counties within specified regions amounts up to 1¢ for proposed periods to fund proposed regional transportation projects and purposes.

<http://www.ga-tia.com/Home/>

County TSPLOST

Sales tax for specific periods up to 5 years to fund any transportation projects and activities for counties outside of MARTA jurisdiction

MARTA County TSPLOST.

Counties within MARTA jurisdiction can impose a different up to 1¢ TSPLOST to fund proposed transportation projects

Design-Build Bridge Replacement Program

The program allows GDOT to replace and update local bridges deemed structurally deficient. The program utilizes bridge bundles to maximize efficiency and speed in the replacement of locally owned bridges.

<http://www.dot.ga.gov/PartnerSmart/Innovative/Pages/DBBridgeReplacementProgram.aspx>

Appendix 5: Brief Overview of Available Local Funding Sources²⁵

Local Maintenance and Improvement Grant (LMIG)

The Local Maintenance & Improvement Grant is a GDOT program that funds local government's need for improvements on roadways. The program is funded by the state motor vehicle fuel tax. The annual LMIG allocation is based on the total centerline road miles for each local road system and the total population of each county or city as compared with the total statewide centerline road miles and total statewide population. Centerline Mileage is defined as the total length of a given road from its starting point to its end point. The LMIG program will allow local governments greater flexibility and quicker project delivery while allowing GDOT to effectively administer the program with a reduced workforce and new funding match requirements. The grant exclusively applies to local communities which is beneficial to local governments seeking out funding.

Table 11: Overview of GDOT's Local Maintenance & Improvement Grant

Overview of GDOT's Local Maintenance & Improvement Grant	
<u>Funding Type</u>	Grant
<u>Applicable Coverage</u>	Local bridge repair and replacement
<u>Award Period</u>	Grant at the beginning of each fiscal year
<u>Qualification based on</u>	Formula based on (2/3) total centerline road miles and (1/3) total population
<u>Amount</u>	Formula based
<u>What to Provide</u>	Project list, length in miles, project cost, project schedule, description of work
<u>How to Apply</u>	Application http://www.dot.ga.gov/PartnerSmart/Local/LMIGReportsForms/LMIGAPPLICATION.pdf

Local Bridge Replacement Program (LOCBR)

²⁵ Nguyen, A. (2020). Development of Bridge Asset Management for Local Georgia Governments (Master's thesis, University of Georgia, Athens, United States).

Georgia's Department of Transportation Local Bridge Replacement Program (LOCBR), combined with the efforts of local governments, help replace Off-System Deficient Posted Bridges. The replacement of a deficient, posted bridge is a considerable expense for local counties and municipalities. Posted bridges restrict certain vehicle types from crossing. "These include emergency vehicles, school buses, agricultural vehicles and, in some cases, even "Suburban-like" SUVs or pickup trucks." Within the state of Georgia there are approximately 1,400 posted bridges and the majority are locally-owned. Therefore, the Local Bridge Replacement Program aims to reduce the number of locally-owned posted bridges. GDOT specifies the type of aid that will be included in the program.

Table 12: Overview of GDOT's Local Bridge Replacement Program

Overview of GDOT's Local Bridge Replacement Program	
<u>Funding Type</u>	Federal Funding Program
<u>Applicable Coverage</u>	Replacement of locally-owned posted bridges
<u>Award Period</u>	Through the completion of the project. Some up front
<u>Qualification based on</u>	Locally-owned posted bridges in need
<u>Amount</u>	GDOT provides preliminary engineering costs, any utility relocations, all construction costs and 50 percent of the preliminary right-of-way (ROW) estimate
<u>What to Provide</u>	Response to solicitation letter
<u>How to Apply</u>	N/A Solicitation letters

Low Impact Bridge Program

The Georgia Department of Transportation (GDOT) provides a Low Impact Bridge Program that provides expedited project delivery for "least complicated" type bridge replacement projects. The projects that are not selected for the program include those that have impacts to sensitive environmental resources, Federal Emergency Management Agency (FEMA) regulated streams or complex constructability issues, and time-consuming components. The desired candidates meet low-impact requirements such as minimal permits, minor utility impacts, no FEMA coordination, and no on-site detours. Additionally, they cannot exceed established environmental impact thresholds and thus qualify as a Categorical Exclusion (CE) determination in compliance with the National Environmental Policy Act (NEPA).

Table 13: Overview of GDOT's Low Impact Bridge Program

Overview of GDOT's Low Impact Bridge Program	
<u>Funding Type</u>	Federal Funding Program
<u>Applicable Coverage</u>	Bridge Replacement Only
<u>Award Period</u>	Through the completion of the project.
<u>Qualification based on</u>	Low Impact Criteria such as location, minor utility impacts, no FEMA coordination, no on-site detours, etc.
<u>Amount</u>	Project completion with expedited delivery by means of prefabricated bridge components
<u>What to Provide</u>	Criteria compliance
<u>How to Apply</u>	Decision-Making Form and Programmatic Categorical Exclusion for Eligible LIBP Projects

Georgia Transportation Infrastructure Bank (GTIB)

The Georgia Transportation Infrastructure Bank was created by the State Road and Tollway Authority to provide grants and low-interest loan programs to Georgia communities. The program has already aided local communities in Georgia providing \$151 million towards competitive transportation projects that “enhanced mobility and driven economic development”. GTIB aims to promote projects that are limited by traditional funding sources in local communities that want to boost its economy and transportation networks.

Table 14: Overview of State Road and Tollway Authority (SRTA)'s Georgia Transportation Infrastructure Bank (GTIB)

Overview of State Road and Tollway Authority (SRTA)'s Georgia Transportation Infrastructure Bank (GTIB)	
<u>Funding Type</u>	Grant and low-interest program
<u>Applicable Coverage</u>	Costs necessary for the qualified project, Maintenance and New Construction Projects
<u>Award Period</u>	First quarter of 2021 for 5 years to 20 years
<u>Qualification based on (not need to meet all)</u>	Local commitment, economic development and mobility improvements, close to construction, feasibility
<u>Amount</u>	Minimum \$25,000, interest rates dependent on loan period
<u>What to Provide</u>	Grant and Loan Application
<u>How to Apply</u>	Applications stating Sept 1- Oct 23 2020

Appendix 6: Sample Local Bridge Asset Management Plan

“Spalding County Bridge Asset Management Plan”

APPENDIX G : 2020 Spalding County Bridge Asset Management Plan

2020 SPALDING COUNTY BRIDGE ASSET MANAGEMENT PLAN



BR 25550200: Jenkinsburg Road Bridge

A plan describing Spalding County's Bridge assets and conditions



October 2020

Prepared for: Spalding County, GA

Prepared by: Angela Nguyen EIT Graduate Research Student with the direction of Spalding County

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**UNIVERSITY OF
GEORGIA**
College of Engineering



**Carl Vinson
Institute of Government
UNIVERSITY OF GEORGIA**



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INTRODUCTION

Bridge asset management is often an undervalued sector of a local government's infrastructure. Bridges are among the most important and most expensive assets in any community along with other assets like roads and utilities that support and affect the road network. Due to the cost of building and maintaining bridges, their importance to society, and the investment made by taxpayers, a high level of responsibility is placed on local governments to plan, build, and maintain the road and bridge network in an efficient manner. Spalding's Bridge Asset Management Plan is intended to report on how the county is meeting its obligations to maintain its bridges.

This plan overviews Spalding's bridge assets and conditions and explains how Spalding County works to maintain and improve the overall condition of those assets. Spalding owns and/or manages 57 bridges. A summary of its current bridge asset conditions, projected trends, and goals can be seen in Figure 1.

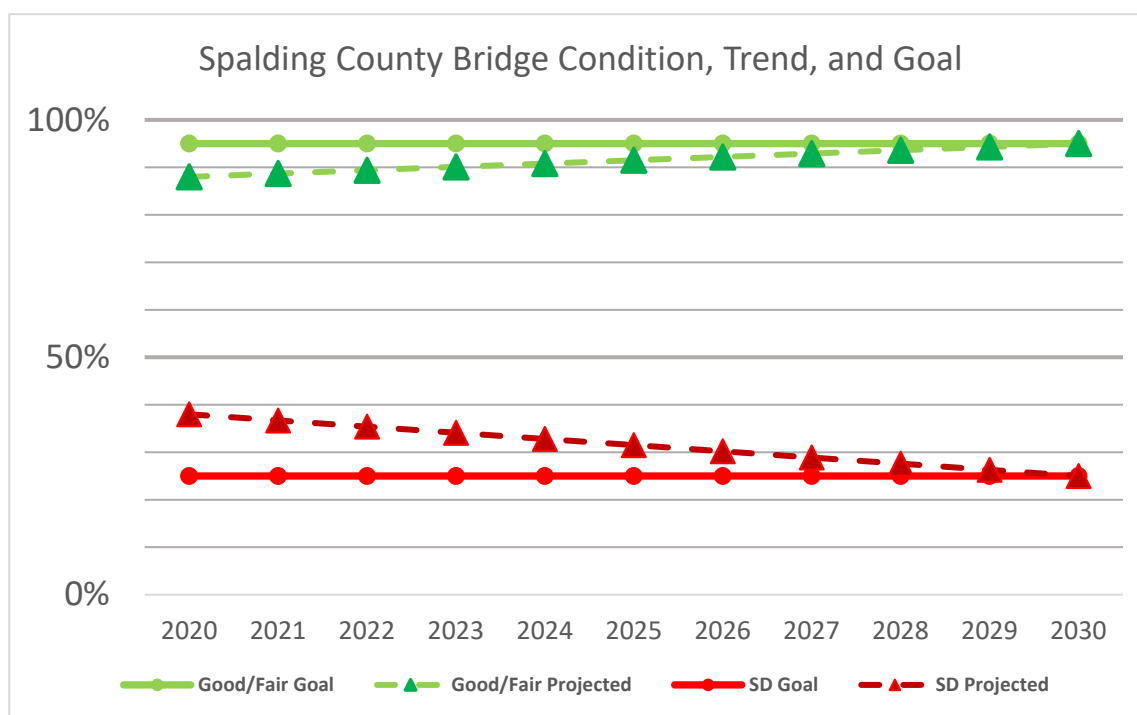


Figure 1: Spalding County Bridge Condition Progress Tracking

This bridge asset management plan helps demonstrate Spalding's responsible use of public funds by providing elected and appointed officials as well as the general public with inventory and condition information of Spalding's bridge assets and gives taxpayers the information they need to make informed decisions about investing in essential transportation infrastructure.

On the same note, this document provides an informational decision-making process that presents the public the technical and financial challenges of managing infrastructure with a limited budget. This unprecedented 2020 bridge plan outlines how Spalding determines its strategy to maintain and upgrade bridge asset

condition given goals, priorities of its bridge users, and resources provided. An updated plan is to be released approximately every 5 years to reflect changes in bridge conditions, finances, and priorities.

Preparation

This process of creating this plan followed the steps outlined in the *Bridge Asset Management Guide for Local Georgia Government* and the structure of this plan followed the template from the Center of Technology and Training¹. The research and implementation process were sponsored by the Georgia Chapter of the American Public Works Association who partnered with The Carl Vinson Institute of Government and College of Engineering at The University of Georgia. Please note that the content in this plan is subject to change and continuous development. The process of creating this plan involved series of virtual meetings with input from the County Manager and Public Works Director. The following were the dates of the 2020 Meetings:

- August 17th
- September 10th
- September 23rd
- October 1st
- October 9th
- October 14th

Contact Information

Questions regarding the use or content of this plan should be directed to
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A copy of this plan can be accessed on our website at www.spaldingcounty.com

¹ Asset management resources | center for technology & training. (n.d.). <http://ctt.mtu.edu/asset-management-resources>

Bridge Condition Background

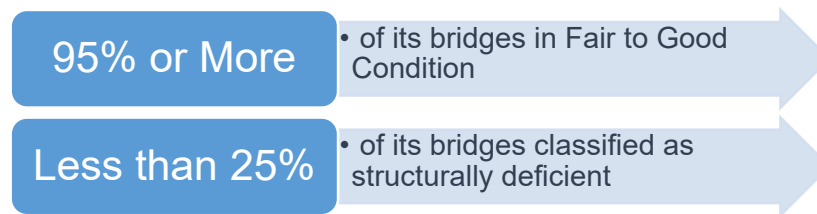
GDOT's bridge maintenance activities include conducting an inspection of all bridges and bridge culverts in Georgia within a two-year cycle and underwater bridge inspection every five years. Inspectors rate bridge condition on a 0-9 scale known as the National Bridge Inventory (NBI) rating scale (see Table 1 for a summary of the NBI Rating scale). 9 is classified as excellent condition and 0 is classified as failed condition. Elements of the bridge's superstructure, deck, substructure, and culvert (if it applies) all receive a rating. The minimum rating of those elements will classify the general bridge condition.

Table 1: NBI Bridge Condition Code

Code	Description	Common Actions
9	EXCELLENT CONDITION	Preservation/Cyclic Maintenance
8	VERY GOOD CONDITION —No problems noted.	
7	GOOD CONDITION —Some minor problems.	
6	SATISFACTORY CONDITION —Structural elements show some minor deterioration.	Preservation/ Condition-Based Maintenance
5	FAIR CONDITION —All primary structural elements are sound but may have some minor section loss, cracking, spalling, or scour.	
4	POOR CONDITION —Advanced section loss, deterioration, spalling, or scour.	Rehabilitation or Replacement
3	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.	
2	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, the bridge may have to be closed until corrective action is taken.	
1	IMMINENT 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 it back in light service.	
0	FAILED CONDITION —Out of service. Bridge is beyond corrective action.	

GOALS

Spalding seeks to implement an asset management program for its bridge structures. The goal of the management program is to preserve and/or improve the condition of its local bridge network within the means of its financial resources. Preservation is defined as actions that extend the bridge's useful service life OR time that a bridge remains in good or fair condition, which reduces future maintenance, rehabilitation, and premature replacement costs. To quantify this goal, over its 10-year plan Spalding County aims to have:



Spalding will monitor and report the annual change in the number of its bridges rated Good or Fair (5 or higher) and the annual change in the number of its bridges classified as structurally deficient. To measure the progress of the Bridge Asset Management Plan the projected goals in Figure 2 will be updated after every inspection cycle. Currently 88% of Spalding's bridges are in Fair to Good Condition 74% and 14% respectively and 38% are structurally deficient. The dotted lines represent a projected trend line towards Spalding's 10-year goal.

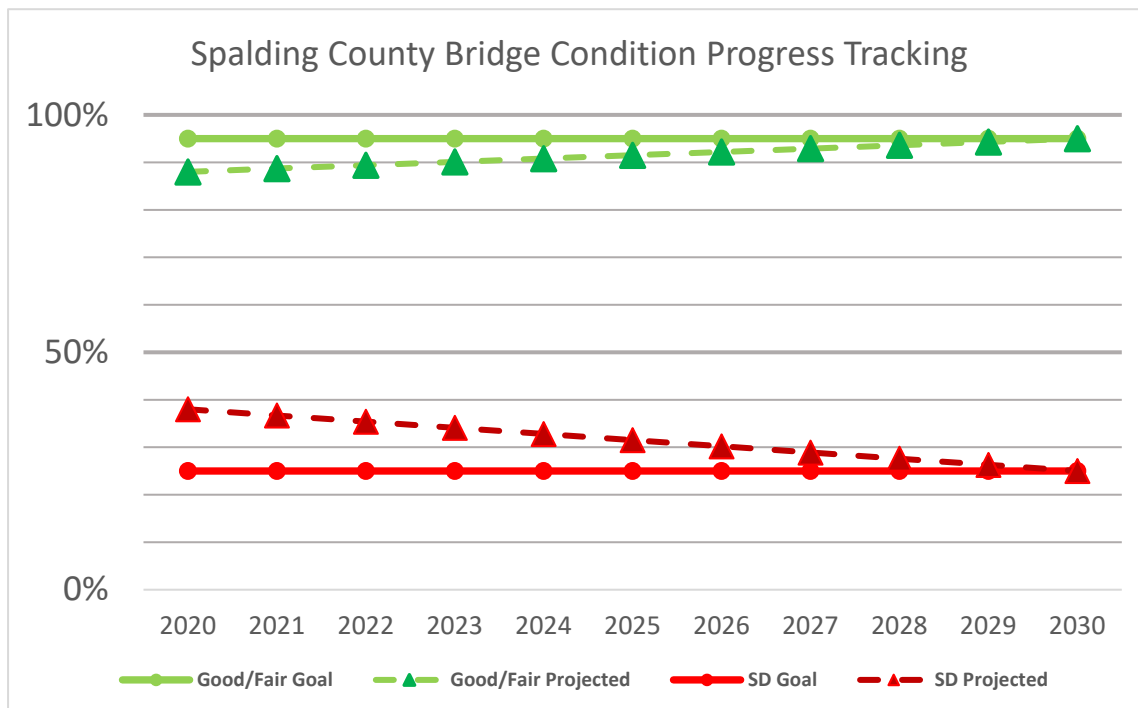


Figure 2: Spalding County Bridge Condition Progress Tracking

Spalding's Plan Objectives:

- Present the current condition of the county's bridges
- Develop a strategy that will:
 - Program preventative maintenance actions to impede deterioration of bridges in good and fair condition
 - Implement conditional or corrective repairs or rehabilitation for degraded bridge elements in order to restore functionality
 - Identify, prioritize, and program those eligible bridges in need of replacement
- Develop a method to prioritize the programmed actions with existing funding limitations
- Identify available funding sources, such as:
 - Dedicated county resources
 - GDOT local bridge programs
 - Opportunities to obtain other funding
- Improve the condition of bridges currently rated poor (4 or lower) and preserve bridges currently rated fair (5 or higher) in their current condition in order to extend their useful service life.

INVENTORY

Spalding is responsible for 57 bridges according to the NBI. Table 2 summarizes Spalding's bridge assets by type, sizes by bridge type, and condition by bridge type. Inspection inventory data, condition ratings, and proposed preventive maintenance actions for each bridge are contained in the tables in **APPENDIX 1-3**. The bridge inventory data was obtained from the National Bridge Inventory (NBI), GDOT 2018 bridge inspection report, and other sources.

Types

Of the Spalding's 57 structures, 35 are concrete bridges, 15 are steel bridges, are 6 pre-stressed concrete bridges, and 1 is a timber bridge.

Locations and Sizes

Figure 3 illustrates the locations of bridge assets owned by Spalding. Details about the locations and sizes of each individual asset can be found in the NBI database for Spalding County. For more information, please refer to the contact listed in the *Introduction* of this bridge asset management plan.

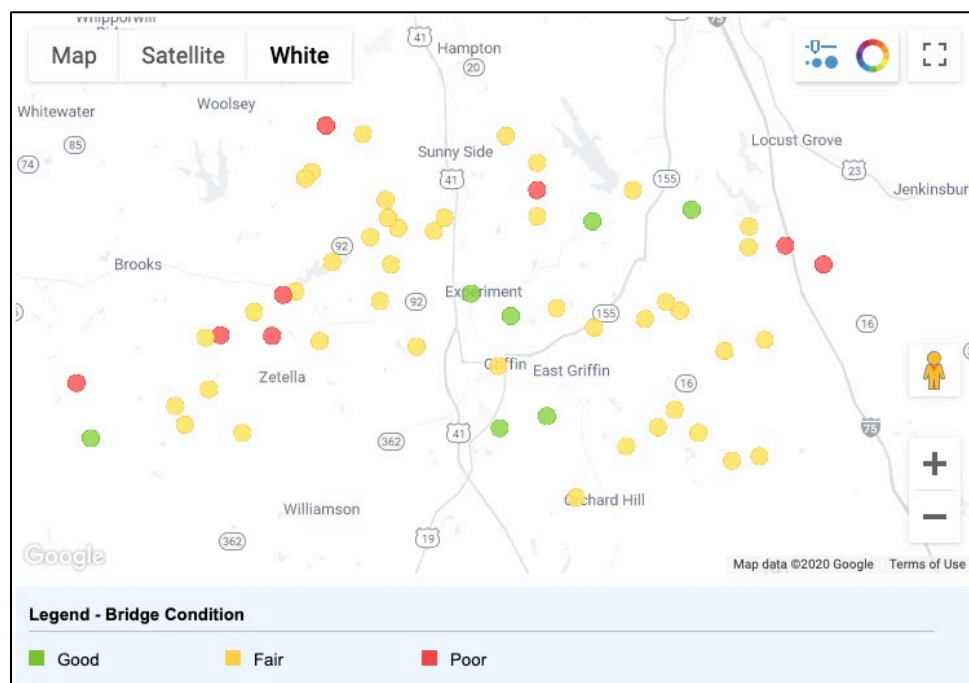


Figure 3: Map illustrating locations of Spalding's bridge assets Source: NBI

Bridge Assets Condition

Spalding evaluates its bridges according to the National Bridge Inspection Standards rating scale, a 9 to 7 signifies new to good condition, a rating of 6 and 5 signifies fair condition, and a rating of 4 or lower signifies poor or serious and critical condition. The current condition of Spalding's bridge network is:

- **7 (12 %) are Good**
- **42 (74 %) are Fair**
- **8 (14 %) are Poor**

Spalding's bridge inventory classifies 22 (39 %) bridges as structurally deficient, 18 (32%) bridges as posted, and 0 bridges as closed.

Structurally deficient bridges require significant maintenance and repair to remain in service to all traffic and will eventually require rehabilitation or replacement to address their deficiencies. In order to remain in service, these bridges are typically posted, which restricts the gross weight allowed on the bridge.

Posted bridges are those that have degraded to a point where a weight restriction is needed for "what would be considered a safe vehicular or traffic load passing over the bridge; designating a bridge as "posted" has no influence on its condition rating."

Closed bridges are those that are closed to all traffic loads.

Table 2: Bridge Assets by Type: Inventory, Size, and Condition

Bridge Type	Total Number of Bridges	Total Deck Area (sq ft)	Condition: Structurally Deficient, Posted, Closed			2018 Condition		
			Struct. Defic	Posted	Closed	Poor	Fair	Good
Concrete	35	58896.5	17	10	--	5	25	4
Prestressed Concrete	6	26493	--	--	--	0	4	2
Steel	13	22080.3	6	5	--	2	10	1
Steel Continuous	2	2855.9	--	1	--	--	2	--
Wood or Timber*	1	683	1	1	--	--	1	--
Total SD/Posted/Closed			22	18	0			
Total	57	111008.6				8	42	7
Percentage (%)			38%	32%	0%	14%	74%	12%

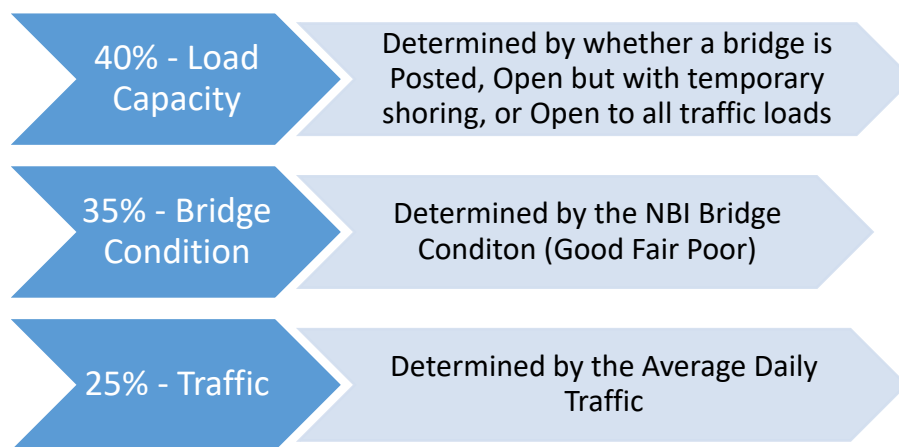
*There are an additional 9 local wood bridges that are owned and maintained by Spalding County and not included or inspected by GDOT or in this report.

The bridge conditions for local bridges in Georgia show that 5% are poor and 95% are good/fair, indicating that Spalding County has a greater percentage of poor bridges (14%) and lower percentage of Good/Fair bridges (88%) compared to the statewide average for local Georgia governments.

STRATEGY

Prioritization

Spalding prioritizes bridges for projects by evaluating three main factors and weighting them as follows: load capacity 40%, condition –35%, and traffic –25%, There are several components within each factor that are used to arrive at its score. The priority score calculated for each bridge is tabulated alongside the inventory in **APPENDIX 1**.



- Bridge load capacity and condition are main focuses for Spalding’s bridges since several bridges are depended on by school bus traffic. Further posting bridges and delaying the repairs of existing posted bridges in the county pose a risk to the general public.
- Each project under consideration is scored out of 1 (1 being the highest priority and 0 being the lowest priority), and its total score is then compared with other proposed project to establish a priority order.
- Furthermore, it is established that when selecting bridges for funding or action, those with similar priority scores would be further assessed by the bridge’s safety and detour restrictions.

Preservation Criteria

Spalding annually reviews the inspector's work recommendations contained in GDOT's Bridge Inspection Report 2018 Report in **APPENDIX 2**. The inspection inventory and condition data are consolidated in spreadsheet format for Spalding's bridges in **APPENDIX 1**.

Spalding then determines management and preservation needs and corresponding actions for each bridge in the Annual Operation & Maintenance Plan **APPENDIX 3**. The management and preservation actions are selected in accordance with criteria contained in the Summary of Preservation Criteria table (below) and adapted to Spalding's specific bridge network.

Table 3: Summary of Preservation Criteria

Preservation Action	Bridge Selection Criteria	Frequency or As Needed
Replacement		
Total Replacement	- NBI rating of 3 or less - OR Cost of rehabilitation exceeds cost of replacement - OR Bridge is scour critical with no counter-measures available	70 years
Superstructure Replacement	- NBI rating of 4 or less for the superstructure - OR Cost of superstructure and deck rehabilitation exceeds cost of replacement	40 years
Deck Replacement	- NBI rating of 4 or less for the deck surface and deck bottom - OR Replacement cost of deck is competitive with rehabilitation	60+ years
Substructure Replacement (Full or Partial)	- NBI rating of 4 or less for abutments, piers, or pier cap - Has open vertical cracks, signs of differential settlement, or active movement - OR Bridge is scour critical with no counter-measures available	40 years
Rehabilitation		
Concrete Deck Overlays	In response to GDOT Bridge Inspection	3 – 25 years
Steel Beam Repair	In response to GDOT Bridge Inspection	
Prestressed Concrete Beam Repair	In response to GDOT Bridge Inspection	
Substructure Concrete Patching and Repair	In response to GDOT Bridge Inspection	
Abutment Repair/Replacement	- In response to GDOT Bridge Inspection - In response to Spalding County Annual Inspections	
Railing/Barrier Replacement	- In response to GDOT Bridge Inspection - In response to Spalding County Annual Inspections	
Culvert Repair/Replacement	- NBI rating of 4 or less for culvert or drainage outlet structure - OR Has open vertical cracks, signs of deformation, movement, or differential settlement	
Pin and Hanger Replacement	In response to GDOT Bridge inspection and utility requirements	2 – 10 years
Conditional Maintenance		
Concrete Deck Patching	- In response to inspector's work recommendation - Or Minor delamination and spalling	5 years

Preservation Action	Bridge Selection Criteria	Frequency or As Needed
Deck Joint Replacement	- Always include when doing deep or shallow concrete overlays - OR when joint is leaking heavily - OR In response to inspector's work recommendation for replacement	
Zone Repainting	- In response to Inspections - OR During routine maintenance on beam ends or pins and hangers	10 years
Complete Repainting	In response to Inspections	15 years
Channel Improvements	- Removal of vegetation, debris, or sediment from channel and banks to improve channel flow - OR in response to inspector's work recommendation	
Scour Countermeasures	- When labeled as scour critical and not scheduled for replacement - In response to GDOT Bridge Inspection	
Repave Approaches	When HMA is in poor condition or in response to Inspector's work recommendation	5 years
Cyclical Maintenance		
Superstructure Washing	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	1- 2 years
Drainage System Clean-Out/Repair	When drainage system is clogged with debris OR Drainage elements are broken, deteriorated, or damaged	2 years
Spot Repainting	For zinc-based paint systems only. Do not spot paint with lead-based paints. In response to inspector's work recommendation	5 years
Seal Concrete Cracks/ Joints	Concrete is in good or fair condition and cracks extend to the depth of the reinforcement, or in response to Inspector's work recommendation	
Vegetation Control	- When vegetation traps moisture on structural elements - OR Vegetation is growing from joints or cracks - OR In response to inspector's work recommendation for brush cut	1 year
Debris Removal	- When vegetation, debris, or sediment accumulates on the structure or in the channel (piers/ abutments) - OR In response to inspectors work recommendation	1 year
Deck Joint Repair	- Do not repair compression joint seals, assembly joint seals, steel armor expansions joints, and block out expansion joints; these should always be replaced. - OR In response to inspector's work recommendation for repair	
Timber Repair	- NBI rating of 4 or less for substructure for timber members - OR To repair extensive rot, checking, or insect infestation	
Miscellaneous Repair	Uncategorized repairs in response to inspector's work recommendation	
*This table is expected to be further adjusted		

Spalding's asset management plan intends to implement a strategy that aims to move away from the "worst-first" approach and is made up of replacement, rehabilitation, preventive maintenance and/or scheduled maintenance.

Replacement is typically performed when a bridge is in poor condition, which is an NBI rating of 4 or less, and will improve to a good condition. Bridge replacement removes the entire bridge along with its bridge components and constructs a new bridge at the same location. The decision to perform a total replacement over rehabilitation should be made based on a life-cycle cost analysis since it involves substantial changes.

Rehabilitation involves repairs to improve the existing condition and extend the service life of the structure. Most often, bridges that have declined past what can be addressed with preventative maintenance need rehabilitation options. Rehabilitation is typically performed on poor-rated elements, which is an NBI rating of 4 or less, to improve them to a better condition. Rehabilitation can include a superstructure or deck replacement.

Conditional Preventive Maintenance work will improve and extend the service life of fair bridges. Conditional maintenance projects will be in response to a condition need from an inspection report. Routine maintenance will be performed by the Spalding's in-house maintenance team and/or contracted out for more complex work.

Cyclical Preventive Maintenance 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. Cyclical maintenance is a proactive approach. In-house maintenance crews will perform much of this work.

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.

Cost Estimate

Spalding County computes the estimated cost of each typical action using a combination of unit prices from the FEMA Document hourly rate charge, and developed cost estimate worksheet in **APPENDIX 4**. Currently Spalding County uses an hour by hour unit cost for in-house work. The county is moving towards utilizing and adjusting the cost-estimate worksheet further.

Operations and Maintenance Plan

Spalding County established a 2020 Annual Operations and Maintenance plan that follows the Bridge Preservation Criteria and programs bridges in need of replacement, rehabilitation, and preventative maintenance every year. Recommendations from the Bridge Inspection Report are reviewed and programed into the plan. The plan utilizes the priority score calculated in **APPENDIX 1** to prioritize which bridges need action and funding within the year. The 2020 Operations and Maintenance Plan can be observed in **APPENDIX 3**.

Five-Year Annual Cost Projection

The Five-Year Annual Cost Projection can be observed in **APPENDIX 5**. There is an average annual cost of \$275,100 for the maintenance of Spalding’s local bridges. Note that the bridge replacements funded by GDOT are not included in the estimated cost. Additionally, there is an estimate of \$10,000 for maintenance on a capacity of 7 different bridges per year.

Identifying Funding Sources

- Spalding County utilizes a combination of both GDOT’s Local Bridge Replacement Program (LOCBR) and Low Impact Bridge Program (LIBP) to cover bridge replacements. These amounts, roughly \$2 million per programmed bridge. Upcoming projects funded by LOCBR and LIBP can be seen in the Five-Year Annual Cost Projection in **APPENDIX 5**.
- State funded and SPLOST passed bridge projects that are in the process of being completed are listed in Figure 4. These have been outlined by the 2016 Comprehensive Transportation Plan (CTP) for the City of Griffin and Spalding County.

113-0019-0	CR 360/MCINTOSH RD @ FLINT RIVER @ FAYETTE/SPALDING CO LINE	\$ 2,105,280	State Bridge Fund, SPLOST, Local General Revenue
255-0040-0	JORDAN HILL ROAD AT TROUBLESOME CREEK, 4 MI N OF GRIFFIN	\$ 1,250,000	State Bridge Fund, SPLOST, Local General Revenue
255-5044-0	N SECOND ST EXT. AT CABIN CREEK, 2 MI NE OF GRIFFIN	\$ 1,267,200	State Bridge Fund, HB 170
255-0031-0	McDonough ROAD AT BUCK CREEK TRIB, 4 MI SE OF GRIFFIN	\$ 828,750	State Bridge Fund, HB 170
255-0042-0	BIRDIE ROAD AT GRIFFIN RESERVOIR TRIB, 5 MI NW OF GRIFFIN	\$ 2,129,400	State Bridge Fund, HB 170
255-0036-0	COUNTY LINE ROAD AT POTATO CREEK, 3 MI SE OF GRIFFIN	\$ 2,129,400	State Bridge Fund, HB 170
255-5042-0	JORDAN HILL ROAD AT TOWALIGA RIVER TRIB, AT HENRY CO. LINE	\$ 1,415,700	State Bridge Fund, HB 170
255-0030-0	HOLLONVILLE ROAD AT LINE CREEK TRIB, 12 MI W OF GRIFFIN	\$ 1,423,500	State Bridge Fund, HB 170
255-0038-0	VAUGHN ROAD AT SHOAL CREEK, 6 MI W OF GRIFFIN	\$ 2,843,100	State Bridge Fund, HB 170
255-0041-0	JORDAN HILL ROAD AT TROUBLESOME CREEK TRIB, 5 MI N OF GRIFFIN	\$ 1,415,700	State Bridge Fund, HB 170
255-5009-0	MUSGROVE ROAD AT CABIN CREEK TRIB, 2 MI E OF GRIFFIN	\$ 1,179,750	State Bridge Fund, HB 170

Figure 4: In Progress Funded Bridge Projects, Source: CTP Action Plan

- Currently, SPLOST and TSPLOST have not programmed/funded/passed any requested future bridge projects.
- Spalding should apply for more SPLOST and TSPLOST Bridge projects in the following years:
 - 2021 for SPLOST 2022 for TSPLOST
 - Amounts and project titles are to be determined
- Scheduled maintenance activities and minor repairs that are not affiliated with any applications, grants, or other funded projects will be performed by the Spalding’s in-house maintenance forces and funded through the Spalding’s annual general fund budget.
- Within the general fund budget, Spalding County receives approximately \$175,000 annually for the bridge work and maintenance.
- Spalding County’s Operation and Maintenance Plan will be utilized as a means for identifying needs for different funding sources. The plan underlines the priority score of each bridge needing repairs. The priority score can help prioritize bridge work with a limited budget and program and request additional funding sources for those bridges.
- A funding matrix and checklist has been created and reviewed to be able to check for the eligibility and criteria requirements for different funding sources for local Georgia bridges. This Funding Matrix in Figure 5.

FUNDING MATRIX

Use this funding checklist/matrix to determine which funding sources your local government is applicable for. The section on the right provides helpful links for more information.

ADDITIONAL FUNDING SOURCES FOR LOCAL GOVERNMENTS

Eligibility/Criteria	LMIG	LOCBR	LIBP	GTIB	SPLOST	TSPLOST	Design Build Program
ELIGIBLE FOR:							
Amount based on formula	☒	☐	☐	☐	☐	☐	☐
Full Replacement	☐	☒	☒	☒	☒	☒	☒
Maintenance	☒	☐	☐	☒	☐	☐	☐
Replacement of Posted Bridges	☐	☒	☒	☒	☒	☒	☒
Grant	☒	☐	☒	☒	☐	☐	☐
Low-interest Loan 5-20 yrs.	☐	☐	☐	☒	☐	☐	☐
\$0.01 sales tax up to 5- 6 years	☐	☐	☐	☐	☒	☐	☐
\$0.01 sales tax up to 10 years	☐	☐	☐	☐	☐	☒	☐

Funding Source Info.

LMIG
Local Maintenance Improvement Grant. Provides coverage from GDOT for maintenance purposes.
Formula used for award amount = (Pop./State Pop.) x (33%) + (Mileage./Total State Mileage) x (66%)
<http://www.dot.ga.gov/PS/Local/LMIG>

LOCBR
Local Bridge Replacement Program aims to help Local Governments reduce the number of posted and closed bridges throughout the state
<http://www.dot.ga.gov/InvestSmart/BridgePrograms/Pages/LocalBridges.aspx>

LIBP
Low Impact Bridge Program LIBP projects must meet low impact criteria such as no geometry or grade changes, low environmental impacts and off-site detours are accepted by local entities. LIBPs are completed with expedited delivery by means of prefabricated bridge components.
<http://www.dot.ga.gov/InvestSmart/BridgePrograms/Pages/LocalBridges.aspx>

GTIB
Georgia Transportation Infrastructure Bank is a grant and low-interest loan program administered by the State Road and Tollway Authority (SRTA). Since inception, GTIB has provided over \$151 million in grants and loans to projects that have enhanced mobility and driven economic development in local communities throughout Georgia
<https://www.srta.ga.gov/gtib/>

ADDITIONAL FUNDING SOURCES FOR LOCAL GOVERNMENTS

CRITERIA FOR:	LMIG	LOCBR	LIBP	GTIB	SPLOST	TSPLOST	Design Build Program
Low-interest Loan Application	☐	☐	☐	☒	☐	☐	☐
Local Contribution of \$50,000 - \$100,000 for Right of Way phase	☐	☒	☐	☐	☐	☐	☐
Low impact criteria compliance	☐	☐	☒	☐	☐	☐	☐
Local match ranging from 10% -30 %	☒	☐	☐	☐	☐	☐	☐
Off-site detour up to 12 months	☐	☒	☐	☐	☐	☐	☐
Low-interest Loan Application	☐	☐	☐	☒	☐	☐	☐
Define Projects	☒	☐	☒	☒	☒	☒	☒
Financially provide about 50% of ROW estimates	☐	☒	☐	☐	☐	☐	☐
Return solicited Memorandums of Agreement (MOA) for participation	☐	☒	☐	☐	☐	☐	☐
Defined on ballot	☐	☐	☐	☐	☒	☒	☐
Application fee \$250	☐	☐	☐	☒	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐

Funding Source Info.

SPLOST Types:

County SPLOST.
Imposed up to 5 years (6 years if certain conditions are satisfied), to be shared with its cities (for the proposed governmentally owned or operated capital outlays.

Regional TSPLOST
Counties within specified regions amounts up to 1¢ for proposed periods to fund proposed regional transportation projects and purposes.
<http://www.ga.tia.com/Home/>

County TSPLOST
Sales tax for specific periods up to 5 years to fund any transportation projects and activities for counties outside of MARTA jurisdiction

MARTA County TSPLOST.
Counties within MARTA jurisdiction can impose a different up to 1¢ TSPLOST to fund proposed transportation projects

Design-Build Bridge Replacement Program
The program allows GDOT to replace and update local bridges deemed structurally deficient. The program utilizes bridge bundles to maximize efficiency and speed in the replacement of locally owned bridges.
<http://www.dot.ga.gov/PartnerSmart/Innovative/Pages/DBBridgeReplacementProgram.aspx>

Figure 5: Funding Matrix Checklist

Measure, Report, and Update Process

An important part of an asset management plan is to make sure its progress tracked and measured over time. This information can inform government executives and the public of the plan's progress in order to continue their support. In order to produce the results, the plan needs to be executed and properly updated. Figure 6 illustrates the update process for Spalding's Bridge Asset Management Plan.

Measure, Report, and Update Process

Frequency Legend:

Low
Med
High

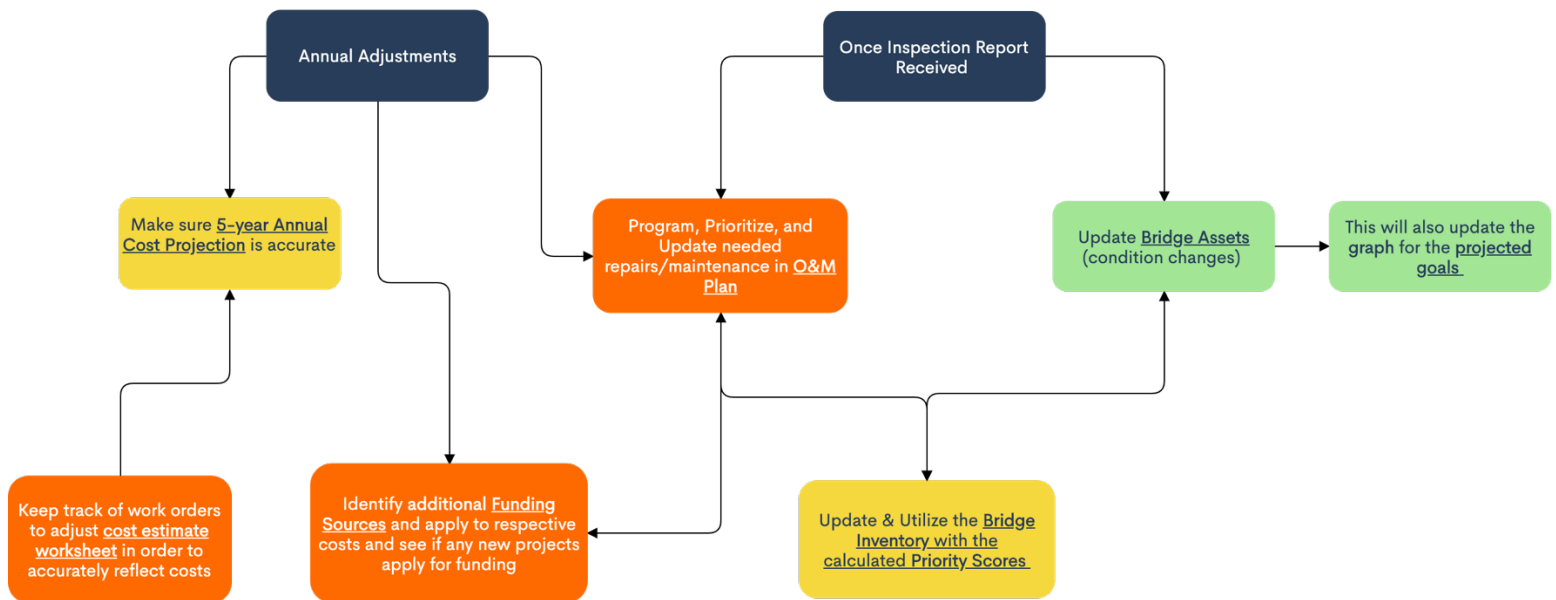


Figure 6: Update Process

APPENDIX

APPENDIX 1: Priority Score Inventory

8 - Structure Number	27 - Year Built	29 - Average Daily Traffic	30 - ADT Converted	43A - Main Design Mat Type Value	6A - Features Intersected	7 - Facility Carried By Structure	CAT10 - Bridge Condition	CAT10- CONDITION converted	41 - Structure Operational Status Code	42 - LOAD CONDITION converted	PRIORITY SCORE (highest = 1)	Structurally Deficient
25500300	1953	1780	0.208	Concrete	LINE CREEK TRIB	HOLLOWVILLE ROAD	Poor	1	P	1	0.802	No
25500380	1956	1780	0.208	Concrete	SHOAL CREEK	VAUGHN ROAD	Poor	1	P	1	0.802	Yes
25500390	1954	1780	0.208	Concrete	HEADS CREEK	VAUGHN ROAD	Poor	1	P	1	0.802	Yes
25500410	1958	1580	0.184	Concrete	TROUBLESOME CREEK TRIB	JORDAN HILL ROAD	Poor	1	P	1	0.796	Yes
25500200	1937	490	0.057	Steel	TOWALIGA RIVER	JENKINSBURG ROAD	Poor	1	P	1	0.764	Yes
25500440	1938	1940	0.226	Steel	CABIN CREEK	N SECOND ST EXT	Fair	0.5	P	1	0.632	No
25500310	1953	1750	0.205	Steel	BUCK CREEK TRIB	MCDONOUGH ROAD	Fair	0.5	P	1	0.626	No
25500400	1958	1560	0.182	Concrete	TROUBLESOME CREEK	JORDAN HILL ROAD	Fair	0.5	P	1	0.621	Yes
25500420	1954	1200	0.140	Concrete	GRIFT IN RESERVOIR TRIB	BIRDE ROAD	Fair	0.5	P	1	0.610	Yes
25500140	1958	850	0.099	Steel Continuous	CABIN CREEK	WALKERS MILL RD	Fair	0.5	P	1	0.600	No
25500430	1968	560	0.065	Concrete	BUCK CREEK	BARNESVILLE ROAD	Fair	0.5	P	1	0.591	No
25500340	1956	490	0.057	Steel	GRIFT IN RESERVOIR	CHEATHAM ROAD	Fair	0.5	P	1	0.589	Yes
25500660	1955	490	0.057	Concrete	HEADS CREEK	ELLIS ROAD	Fair	0.5	P	1	0.589	Yes
25500110	1957	400	0.047	Concrete	BUCK CREEK	MANGHAM ROAD	Fair	0.5	P	1	0.587	No
25500210	1959	360	0.042	Concrete	CABIN CREEK	TOMKICH ROAD	Fair	0.5	P	1	0.586	No
25500100	1970	120	0.014	Steel	CABIN CREEK	DIFTOMANS ROAD	Fair	0.5	P	1	0.579	Yes
25500180	1970	110	0.013	Wood or Timber	TOWALIGA RIVER TRIB	CHILI ROAD	Fair	0.5	P	1	0.578	No
25500260	1956	110	0.013	Concrete	TOWALIGA RIVER TRIB	NORTH POWHONA RD	Fair	0.5	P	1	0.578	Yes
25500450	1954	490	0.057	Steel	BEAR CREEK	WILLOWOOD ROAD	Poor	1	D	0.5	0.564	Yes
25500350	1959	230	0.027	Concrete	WILDCAT CREEK	MCDON ROAD	Poor	1	D	0.5	0.557	Yes
25500390	1957	120	0.014	Concrete	TOWALIGA RIVER	PULLAN ROAD	Poor	1	D	0.5	0.554	Yes
25500360	1956	3820	0.446	Concrete	POTATO CREEK	COUNTY LINE ROAD	Fair	0.5	D	0.5	0.486	Yes
25500420	1959	1740	0.203	Concrete	TOWALIGA RIVER TRIB	JORDAN HILL ROAD	Fair	0.5	D	0.5	0.426	Yes
25500010	1957	690	0.081	Concrete	HEADS CREEK TRIB	MANLEY ROAD	Fair	0.5	D	0.5	0.395	Yes
25500330	1956	690	0.081	Concrete	MANLEY CREEK	WEST MORELAND RD	Fair	0.5	D	0.5	0.395	Yes
25500270	1956	520	0.061	Concrete	BEAR CREEK TRIB	STELLE ROAD	Fair	0.5	D	0.5	0.390	Yes
25500020	1956	220	0.026	Concrete	HEADS CREEK TRIB	MANLEY ROAD	Fair	0.5	D	0.5	0.381	Yes
25500050	1959	190	0.022	Concrete	WILDCAT CREEK	ELLIS ROAD	Fair	0.5	D	0.5	0.381	Yes
25500250	1953	80	0.009	Steel	TOWALIGA RIVER	TRISTLE ROAD	Fair	0.5	D	0.5	0.377	Yes
25500250	1977	5430	0.634	Prestressed Concrete	NS RAILROAD	POPLAR STREET	Fair	0.5	A	0	0.333	No
25500330	1992	3150	0.368	Concrete	CABIN CREEK	MCDONOUGH ROAD	Fair	0.5	A	0	0.267	No
25500410	1956	2860	0.334	Concrete	SHOAL CREEK TRIB	PIKE HILL ROAD	Fair	0.5	A	0	0.258	No
25500660	2018	8570	1.000	Concrete	CABIN CREEK	HILL STREET	Good	0	A	0	0.250	No
25500540	1989	1670	0.195	Steel	HEADS CREEK TRIBUTARY	MCINTOSH ROAD	Fair	0.5	A	0	0.224	No
25500350	1989	1670	0.195	Prestressed Concrete	HEADS CREEK	MCINTOSH ROAD	Fair	0.5	A	0	0.224	No
25500340	1940	1660	0.194	Concrete	TOWALIGA RIVER	LOCUST GROVE RD	Fair	0.5	A	0	0.223	No
25500070	1956	1290	0.151	Steel	BUCK CREEK TRIB	REHOBOTH ROAD	Fair	0.5	A	0	0.213	No
25500280	1970	640	0.075	Concrete	HEADS CREEK	PATTERSON ROAD	Fair	0.5	A	0	0.194	No
25500500	1998	600	0.070	Steel	CABIN CREEK	BAILEY JESTER RD	Fair	0.5	A	0	0.193	No
25500290	1956	600	0.070	Concrete	FLINT RIVER TRIB	MOORE ROAD	Fair	0.5	A	0	0.193	No
25500030	1979	600	0.070	Concrete	HEADS CREEK	STEEL ROAD	Fair	0.5	A	0	0.193	No
25500090	1956	450	0.053	Prestressed Concrete	CABIN CREEK TRIB	MUSGROVE ROAD	Fair	0.5	A	0	0.188	No
25500130	1956	290	0.034	Steel	BUCK CREEK	WALKERS MILL RD	Fair	0.5	A	0	0.183	No
25500370	1960	280	0.033	Steel Continuous	BUCK CREEK	REHOBOTH ROAD	Fair	0.5	A	0	0.183	No
25500360	1974	200	0.023	Concrete	SHOAL CREEK	SHOAL CREEK ROAD	Fair	0.5	A	0	0.181	No
25500370	1956	190	0.022	Concrete	FLAT CREEK	BLANTONS MILL RD	Fair	0.5	A	0	0.181	No
25500310	1956	110	0.013	Concrete	FLINT RIVER TRIB	MUD BRIDGE ROAD	Fair	0.5	A	0	0.178	No
25500390	1986	110	0.013	Prestressed Concrete	FLAT CREEK	SCOTT BRANCH RD	Fair	0.5	A	0	0.178	No
25500480	1980	100	0.012	Steel	HEADS CREEK	CALDWELL ROAD	Fair	0.5	A	0	0.178	No
25500040	1958	90	0.011	Concrete	FLINT RIVER TRIB	CROWDER ROAD	Fair	0.5	A	0	0.178	No
25500380	1980	80	0.009	Concrete	FLINT RIVER	LINE CREEK ROAD	Fair	0.5	A	0	0.177	No
25500410	1984	5790	0.676	Prestressed Concrete	NS RAILROAD	EAST MCINTOSH RD	Good	0	A	0	0.169	No
25500550	2007	3630	0.424	Concrete	GRAPE CREEK	EAST COLLEGE STREET	Good	0	A	0	0.106	No
25500580	2007	2710	0.316	Concrete	ISOM BRANCH TRIB	COLDWATER DRIVE	Good	0	A	0	0.079	No
25500490	1995	2140	0.250	Concrete	LINE CREEK TRIB	HOLLOWVILLE ROAD	Good	0	A	0	0.062	Yes
25500150	1992	150	0.018	Steel	TROUBLESOME CREEK	WALKERS MILL RD	Good	0	A	0	0.004	No
25500610	2014	110	0.013	Prestressed Concrete	TROUBLESOME CREEK	SMOAK ROAD	Good	0	A	0	0.003	No

APPENDIX 2: 2018 Bridge Inspection Report

County	008 - Bridge Serial Number	Georgia Bridge Owner Type	007B - Facility Carried by Structure	006A - Features Intersected	Location	Priority	Comments	Completion Date
Spalding	255-0025-0	02-County Highway Agency.	POPLAR STREET	NS RAILROAD	Abutment 1	B	Abutment 1 slope has severe erosion and needs to be repaired.	
Spalding	255-0025-0	02-County Highway Agency.	POPLAR STREET	NS RAILROAD	Bents 2 and 3	B	Steel piles need to be encased	
Spalding	255-0025-0	02-County Highway Agency.	POPLAR STREET	NS RAILROAD	Steel Piles	B	Steel piles need to be cleaned and painted.	
Spalding	255-0030-0	02-County Highway Agency.	HOLLONVILLE ROAD	LINE CREEK TRIB	Both banks	B	Minor scour at both banks needs to be repaired.	
Spalding	255-0030-0	02-County Highway Agency.	HOLLONVILLE ROAD	LINE CREEK TRIB	Both slopes	B	Stone slope protection at both slopes needs to be added/repared.	
Spalding	255-0031-0	02-County Highway Agency.	McDONOUGH ROAD	BUCK CREEK TRIB	Forward left	B	Replace hazard board at the forward left end.	
Spalding	255-0031-0	02-County Highway Agency.	McDONOUGH ROAD	BUCK CREEK TRIB	Steel components	B	All steel has rust and corrosion and needs to be cleaned and painted	
Spalding	255-0033-0	02-County Highway Agency.	McDONOUGH ROAD	CABIN CREEK	Inlet	B	Remove drift and debris from inlet.	
Spalding	255-0033-0	02-County Highway Agency.	McDONOUGH ROAD	CABIN CREEK	inlet and Outlet	B	Repair scour.	
Spalding	255-0034-0	02-County Highway Agency.	LOCUST GROVE RD	TOWALIGA RIVER	Bent 4, column 2.	B	Repair bent 4, column 2, abrasion with loss of aggregate rear face near the waterline.	
Spalding	255-0034-0	02-County Highway Agency.	LOCUST GROVE RD	TOWALIGA RIVER	Span 4 rear	B	Repair beam spall at span 4 rear, beam #3.	8/27/18

Spalding	255-0035-0	02-County Highway Agency.	McINTOSH ROAD	HEADS CREEK	Bent 2	B	Bent 2, piles 2 and 3, encasements are undermined and need to be extended to a point 2.0' below the mudline.	
Spalding	255-0035-0	02-County Highway Agency.	McINTOSH ROAD	HEADS CREEK	Steel piles	B	All exposed steel piles need to be cleaned and painted.	
Spalding	255-0036-0	02-County Highway Agency.	COUNTY LINE ROAD	POTATO CREEK	Abutment 1 and abutment 4 cap.	B	Repair rear left erosion hole 2' diameter x 2.0' deep x 3.0' under approach slab; and repair the minor settlement under abutment 4 cap.	
Spalding	255-0037-0	02-County Highway Agency.	REHOBOTH ROAD	BUCK CREEK	Beams	B	Clean and paint beams.	8/1/18
Spalding	255-0037-0	02-County Highway Agency.	REHOBOTH ROAD	BUCK CREEK	Bent 2	B	Bent 2, pile 4 needs to be shimmed; has no bearing under cap.	
Spalding	255-0037-0	02-County Highway Agency.	REHOBOTH ROAD	BUCK CREEK	Both approach roadways	B	Approach roadways have minor settlement with asphalt cracking and need to be leveled.	
Spalding	255-0037-0	02-County Highway Agency.	REHOBOTH ROAD	BUCK CREEK	Deck Joints	B	Deck joints need to be cleaned and sealed.	
Spalding	255-0038-0	02-County Highway Agency.	VAUGHN ROAD	SHOAL CREEK	Abutment 5	B	Abutment 5 has erosion under the left end 2.0' back x 4.0' high x 6.0' long; also, forward left shoulder erosion 1.5' deep x 1.5' wide x 4.0' long, undermining the approach roadway asphalt up to 2.5'.	
Spalding	255-0038-0	02-County Highway Agency.	VAUGHN ROAD	SHOAL CREEK	Bent 2	B	Repair spalls in bent 2 cap.	
Spalding	255-0038-0	02-County Highway Agency.	VAUGHN ROAD	SHOAL CREEK	Bents 2, 3, and 4	B	Bent 2, piles 3 and 5 have moderate to severe decay and rot and need to be scheduled for replacement. Bent #3, pile #4 has moderate to severe decay and rot and need to be scheduled for replacement. Bent #4, pile #1 has moderate to severe decay and rot and need to be scheduled for replacement.	
Spalding	255-0039-0-D	02-County Highway Agency.	VAUGHN ROAD	HEADS CREEK	Bent 4	B	Bent 4; piles 2 and 4 have moderate to severe rot and decay and need to be scheduled for replacement.	

Spalding	255-0039-0-D	02-County Highway Agency.	VAUGHN ROAD	HEADS CREEK	Bent 6	B	Bent #6; pile 3 has no bearing and needs to be shimmed. 2018: Has been shimmed with thin metal plates.	8/16/18
Spalding	255-0039-0-D	02-County Highway Agency.	VAUGHN ROAD	HEADS CREEK	Both approach roadways	B	Both approach roadways have settlement with asphalt cracking and spalling and need to be leveled. 2018: Has been repaired with asphalt overlay.	8/16/18
Spalding	255-0039-0-D	02-County Highway Agency.	VAUGHN ROAD	HEADS CREEK	Bottom of deck	B	Bottom of deck has moderate spalling; some with exposed rebar and needs to be repaired.	
Spalding	255-0040-0	02-County Highway Agency.	JORDAN HILL ROAD	TROUBLESOME CREEK	Repair utility mounting brackets. Shim piles 6 and 8 at bent 2. Repair approach roadways. Posting signs could be removed.	B		
Spalding	255-0040-0	02-County Highway Agency.	JORDAN HILL ROAD	TROUBLESOME CREEK	Substructure	B	Repair or replace rotten piles as needed throughout structure.	
Spalding	255-0040-0	02-County Highway Agency.	JORDAN HILL ROAD	TROUBLESOME CREEK	deck joints.	B	Clean and seal deck joints.	
Spalding	255-0042-0	02-County Highway Agency.	BIRDIE ROAD	GRIFFIN RESERVOIR TRIB	Bent 2	B	Bent 2, piles 2 and 3 have extensive rot and need to be scheduled for replacement.	
Spalding	255-0042-0	02-County Highway Agency.	BIRDIE ROAD	GRIFFIN RESERVOIR TRIB	Span 2 Forward	B	Span 2 forward bottom of deck over bent 3 piles 4 and 6	
Spalding	255-0044-0	02-County Highway Agency.	EAST McINTOSH RD	NS RAILROAD	Cut and remove the large amount of vegetation from under and around the structure.	B		
Spalding	255-0044-0	02-County Highway Agency.	EAST McINTOSH RD	NS RAILROAD	Remove or cover up graffiti on both abutment caps and intermediate pier columns.	B		
Spalding	255-0044-0	02-County Highway Agency.	EAST McINTOSH RD	NS RAILROAD	Repair settlement at the right rear approach sidewalk.	B		
Spalding	255-0044-0	02-County Highway Agency.	EAST McINTOSH RD	NS RAILROAD	Repair the washout at both abutment slopes	B	Wash out at both abutments slopes and settlement under both abutment caps.	

					and settlement at both abutments.			
Spalding	255-5001-0	02-County Highway Agency.	MANLEY ROAD	HEADS CREEK TRIB	Deck	B	Repair spalls in the bottom of deck.	
Spalding	255-5002-0	02-County Highway Agency.	MANLEY ROAD	HEADS CREEK TRIB	Bent 3	B	Bent 3, piles 2 and 4 need to be repaired or scheduled for replacement due to rot and decay.	
Spalding	255-5002-0	02-County Highway Agency.	MANLEY ROAD	HEADS CREEK TRIB	Intermediate Bent Caps	B	Repair spalling with exposed rebar in intermediate bent caps.	
Spalding	255-5002-0	02-County Highway Agency.	MANLEY ROAD	HEADS CREEK TRIB	Rear approach	B	Rear approach roadway has asphalt cracking and spalling with minor settlement.	
Spalding	255-5003-0	02-County Highway Agency.	STEEL ROAD	HEADS CREEK	All barrels	B	Repair spalls with exposed rebar.	
Spalding	255-5003-0	02-County Highway Agency.	STEEL ROAD	HEADS CREEK	Rear left shoulder	B	Erosion hole rear left shoulder 10' long x 5' wide x 2' deep.	
Spalding	255-5004-0	02-County Highway Agency.	CROWDER ROAD	FLINT RIVER TRIB	Deck Joints	B	Deck joints need to be cleaned and sealed.	
Spalding	255-5005-0	02-County Highway Agency.	ELLIS ROAD	WILDCAT CREEK	Deck Joints	B	Deck joints need to be cleaned and sealed.	
Spalding	255-5005-0	02-County Highway Agency.	ELLIS ROAD	WILDCAT CREEK	Straddle Bent Caps	B	Straddle bent caps need to be cleaned and painted.	
Spalding	255-5006-0	02-County Highway Agency.	ELLIS ROAD	HEADS CREEK	Bent 2	B	Bent 2, pile 1 has moderate decay and needs to be repaired or replaced.	
Spalding	255-5006-0	02-County Highway Agency.	ELLIS ROAD	HEADS CREEK	Bottom of deck	B	Repair spalls in the bottom of deck.	

Spalding	255-5006-0	02-County Highway Agency.	ELLIS ROAD	HEADS CREEK	Rear approach	B	Rear approach roadway has minor settlement with asphalt cracking and needs to be leveled.	
Spalding	255-5006-0	02-County Highway Agency.	ELLIS ROAD	HEADS CREEK	Span 5 left	B	Bridge rail has impact damage and needs to be repaired.	
Spalding	255-5007-0	02-County Highway Agency.	REHOBOTH ROAD	BUCK CREEK TRIB	Beams and bearings.	B	Beams and bearings have minor rust and corrosion and need to be cleaned and sealed.	
Spalding	255-5007-0	02-County Highway Agency.	REHOBOTH ROAD	BUCK CREEK TRIB	Bent 3 pile encasement	B	Piles have 24" corrugated metal but have not been filled with concrete	
Spalding	255-5007-0	02-County Highway Agency.	REHOBOTH ROAD	BUCK CREEK TRIB	Deck	B	Deck spalls with exposed rebar need to be repaired; bottom of deck has moderate spalls.	
Spalding	255-5007-0	02-County Highway Agency.	REHOBOTH ROAD	BUCK CREEK TRIB	Deck Joints	B	Deck joints at the abutments need to be cleaned and sealed.	
Spalding	255-5007-0	02-County Highway Agency.	REHOBOTH ROAD	BUCK CREEK TRIB	Intermediate bents	B	Bent 3, piles need to be encased. (in the flood plain) Repair spalls in the bent caps.	
Spalding	255-5009-0	02-County Highway Agency.	MUSGROVE ROAD	CABIN CREEK TRIB	Bent 2	B	Bent 2 has an accumulation of drift and debris that needs to be removed.	
Spalding	255-5009-0	02-County Highway Agency.	MUSGROVE ROAD	CABIN CREEK TRIB	Bent 2	B	Repair spall in bent 2 cap.	
Spalding	255-5009-0	02-County Highway Agency.	MUSGROVE ROAD	CABIN CREEK TRIB	Both Abutments	B	Both abutments have minor settlement/erosion that needs to be repaired.	
Spalding	255-5010-0	02-County Highway Agency.	DUTCHMANS ROAD	CABIN CREEK	All steel.	B	Clean and paint beams.	8/6/18
Spalding	255-5010-0	02-County Highway Agency.	DUTCHMANS ROAD	CABIN CREEK	Approach roadways.	B	Repair settlement.	8/6/18

Spalding	255-5010-0	02-County Highway Agency.	DUTCHMANS ROAD	CABIN CREEK	Span 2	B	Repair or replace decayed timber beams.	
Spalding	255-5011-0	02-County Highway Agency.	MANGHAM ROAD	BUCK CREEK	Deck top	B	Seal moderate cracking in the deck top.	
Spalding	255-5013-0	02-County Highway Agency.	WALKERS MILL RD	BUCK CREEK	Abutment 1	B	Repair or replace wing walls at Abutment #1.	
Spalding	255-5013-0	02-County Highway Agency.	WALKERS MILL RD	BUCK CREEK	Abutment 1 cap	B	Repair spalls in abutment 1 cap.	
Spalding	255-5013-0	02-County Highway Agency.	WALKERS MILL RD	BUCK CREEK	Bottom of deck	B	Repair spalls in the bottom of deck.	
Spalding	255-5013-0	02-County Highway Agency.	WALKERS MILL RD	BUCK CREEK	Forward approach roadway	B	Has settlement and needs to be leveled.	
Spalding	255-5013-0	02-County Highway Agency.	WALKERS MILL RD	BUCK CREEK	Left rear shoulder	B	Repair erosion at the rear left shoulder.	
Spalding	255-5013-0	02-County Highway Agency.	WALKERS MILL RD	BUCK CREEK	Right rear	B	Repair impact damage to bridge rail	8/1/18
Spalding	255-5014-0	02-County Highway Agency.	WALKERS MILL RD	CABIN CREEK	Abutment #1 right wing	B	Repair erosion	
Spalding	255-5014-0	02-County Highway Agency.	WALKERS MILL RD	CABIN CREEK	All Steel	B	Clean and paint all Steel	
Spalding	255-5014-0	02-County Highway Agency.	WALKERS MILL RD	CABIN CREEK	Forward approach	B	Level forward approach roadway	
Spalding	255-5014-0	02-County Highway Agency.	WALKERS MILL RD	CABIN CREEK	Rear right and forward left wing walls	B	Seal cracking and stabilize wing walls.	

Spalding	255-5015-0	02-County Highway Agency.	WALKERS MILL RD	TROUBLESOME CREEK	All Steel	B	All Steel components need to be cleaned and painted.	
Spalding	255-5015-0	02-County Highway Agency.	WALKERS MILL RD	TROUBLESOME CREEK	Approaches.	B	Level approach roadways.	
Spalding	255-5018-0	02-County Highway Agency.	CHULI ROAD	TOWALIGA RIVER TRIB	Deck	B	Repair decayed deck boards.	
Spalding	255-5018-0	02-County Highway Agency.	CHULI ROAD	TOWALIGA RIVER TRIB	Span 2 rear, beam 24	B	Repair decayed beams.	
Spalding	255-5020-0	02-County Highway Agency.	JENKINSBURG ROAD	TOWALIGA RIVER	Deck boards	B	Deck has several deck boards that have become loose and need to be tightend/secured.	8/27/18
Spalding	255-5020-0	02-County Highway Agency.	JENKINSBURG ROAD	TOWALIGA RIVER	Left B 4 Gusset plate	B	Top left interior and exterior B 4 gusset plate has loose nuts that need to be tightened.	
Spalding	255-5020-0	02-County Highway Agency.	JENKINSBURG ROAD	TOWALIGA RIVER	Stringers and floor beams	C	Stringer bearings, and floor beams need to be cleaned and painted.	
Spalding	255-5020-0	02-County Highway Agency.	JENKINSBURG ROAD	TOWALIGA RIVER	Truss	B	Repair corrosion and section loss in the structural members.	
Spalding	255-5021-0	02-County Highway Agency.	TOMOCHICHI ROAD	CABIN CREEK	Bents 2 and 3	B	Repair spalls in bents 2 and 3 caps.	8/30/18
Spalding	255-5021-0	02-County Highway Agency.	TOMOCHICHI ROAD	CABIN CREEK	Deck Joints	B	Deck joints need to be cleaned and sealed.	
Spalding	255-5025-0	02-County Highway Agency.	TRESTLE ROAD	TOWALIGA RIVER	Abutment 1	B	Abutment #1 left has minor to moderate erosion; undermining the cap 4.5' and needs to be repaired.	
Spalding	255-5025-0	02-County Highway Agency.	TRESTLE ROAD	TOWALIGA RIVER	Bents 5 and 6.	B	Bents #5 and 6; column #1 at both bents have areas of concrete deterioration near the base and need to be repaired.	

Spalding	255-5025-0	02-County Highway Agency.	TRESTLE ROAD	TOWALIGA RIVER	Forward approach roadway	B	Forward approach roadway (dirt) has pot holes and needs to be leveled.	
Spalding	255-5025-0	02-County Highway Agency.	TRESTLE ROAD	TOWALIGA RIVER	Steel beams and bearings	B	Steel beams and bearings have minor minor rust and corrosion and need to be cleaned and painted.	
Spalding	255-5026-0	02-County Highway Agency.	NORTH POMONA RD	TOWALIGA RIVER TRIB	Bent 2	B	remove debris at bent 2	
Spalding	255-5026-0	02-County Highway Agency.	NORTH POMONA RD	TOWALIGA RIVER TRIB	Both Abutments	B	Repair erosion at both abutments. Abutment 1 rough pour concrete footing has mod scour undermining footing 2' back x 15' long, up to 8" high.	
Spalding	255-5026-0	02-County Highway Agency.	NORTH POMONA RD	TOWALIGA RIVER TRIB	Forward right shoulder	B	Repair forward right corner erosion of the shoulder.Repair erosion at both abutments,	8/7/18
Spalding	255-5026-0	02-County Highway Agency.	NORTH POMONA RD	TOWALIGA RIVER TRIB	Rear Left Shoulder.	B	Repair rear left erosion of the shoulder.	
Spalding	255-5027-0	02-County Highway Agency.	STELLE ROAD	BEAR CREEK TRIB	Abutment 3	B	Abutment 3 has erosion 8" high x 2' back at both ends.	
Spalding	255-5027-0	02-County Highway Agency.	STELLE ROAD	BEAR CREEK TRIB	Bent 2	B	Bent 2, left lane has a spill at the deck joint that needs to be repaired. (1.0 sq. ft.) Seal moderate abrasion/honeycombing in the deck surface.	8/14/18
Spalding	255-5027-0	02-County Highway Agency.	STELLE ROAD	BEAR CREEK TRIB	Forward approach	B	Forward approach roadway has minor settlement and needs to be leveled.	
Spalding	255-5028-0	02-County Highway Agency.	PATTERSON ROAD	HEADS CREEK	Barrels	B	Repair spalls	
Spalding	255-5028-0	02-County Highway Agency.	PATTERSON ROAD	HEADS CREEK	Inlet and outlet	B	Repair scour	
Spalding	255-5029-0	02-County Highway Agency.	MOORE ROAD	FLINT RIVER TRIB	Abutment 4 left	B	Abutment 4 left has an erosion hole undermining the cap, (4.0'L x 2.0' under) that needs to be repaired.	

Spalding	255-5029-0	02-County Highway Agency.	MOORE ROAD	FLINT RIVER TRIB	Bent 2 Pile 1	B	Bent 2 pile 1 rear face has rotten section 5' down from cap 3"wide x 1.5"deep and bent 2 pile 1 forward face has rotten section 5' down from cap 4"wide x 2.5"deep.	
Spalding	255-5029-0	02-County Highway Agency.	MOORE ROAD	FLINT RIVER TRIB	Bent 3 Cap	B	Bent 3 Cap has moderate cracking and has spalled and also has delamination on the right end of cap with efflorescence; needs to be repaired.	
Spalding	255-5029-0	02-County Highway Agency.	MOORE ROAD	FLINT RIVER TRIB	Forward left shoulder	B	Forward left shoulder has moderate erosion, 2.0' from the edge of pavement and needs to be repaired.	
Spalding	255-5031-0	02-County Highway Agency.	MUD BRIDGE ROAD	FLINT RIVER TRIB	Bent 2	B	Bent 2, pile 1 has a rotten section (2.5" deep x 12" wide) and needs to be scheduled for replacement.	8/14/18
Spalding	255-5031-0	02-County Highway Agency.	MUD BRIDGE ROAD	FLINT RIVER TRIB	Caps	B	Repair spalls in the caps with and without exposed rebar.	
Spalding	255-5031-0	02-County Highway Agency.	MUD BRIDGE ROAD	FLINT RIVER TRIB	Deck joints	B	Deck joints need to be cleaned and sealed.	8/14/18
Spalding	255-5033-0	02-County Highway Agency.	WEST MORELAND RD	MANLEY CREEK	Abutment 1	B	Repair erosion and scour at abutment 1.	
Spalding	255-5034-0	02-County Highway Agency.	CHEATHAM ROAD	GRIFFIN RESERVOIR	Abutment 10	B	Abutment 10 has erosion exposing 2 piles less than 1.0' and needs to be repaired.	
Spalding	255-5034-0	02-County Highway Agency.	CHEATHAM ROAD	GRIFFIN RESERVOIR	All beam.	B	Clean and paint all steel components.	
Spalding	255-5034-0	02-County Highway Agency.	CHEATHAM ROAD	GRIFFIN RESERVOIR	Bents 3, 6, and 7	B	Repair or replace timber piles with moderate decay at bents 3, 6, and 7.	
Spalding	255-5034-0	02-County Highway Agency.	CHEATHAM ROAD	GRIFFIN RESERVOIR	Both approach roadways	B	Both approach roadways; asphalt cracked and spalling and needs to be repaired. (causing a bump)	
Spalding	255-5035-0	02-County Highway Agency.	MOON ROAD	WILDCAT CREEK	Bent 4	B	Bent 4, pile 3 has severe rot and decay (1.7" Hull center is rotten) and needs to be scheduled for replacement.	

Spalding	255-5035-0	02-County Highway Agency.	MOON ROAD	WILDCAT CREEK	Intermediate Bent Caps	B	Repair spalls in the intermediate bent caps (some with exposed rebar).	
Spalding	255-5035-0	02-County Highway Agency.	MOON ROAD	WILDCAT CREEK	Span 6 left	B	Repair the deck spall on span 6 left.	
Spalding	255-5036-0	02-County Highway Agency.	SHOAL CREEK ROAD	SHOAL CREEK	Inlet and outlet	B	Repair scour	
Spalding	255-5037-0	02-County Highway Agency.	BLANTONS MILL RD	FLAT CREEK	Abutment 1.	B	Erosion under abutment 1 cap is now up to 3.0' back with loss of fill and needs to be repaired.	
Spalding	255-5037-0	02-County Highway Agency.	BLANTONS MILL RD	FLAT CREEK	Bent 2 Cap	B	Repair spall in bent 2 cap, bottom left face; some spalls have been sealed with epoxy.	
Spalding	255-5038-0	02-County Highway Agency.	LINE CREEK ROAD	FLINT RIVER	Bent 5	B	Repair pile encasements at bent #5.	
Spalding	255-5038-0	02-County Highway Agency.	LINE CREEK ROAD	FLINT RIVER	Bent Caps and Beams	B	Bents 2, 3, and 4; Caps have spalls with exposed rebar and need to be repaired. Repair spalls with exposed rebar in the beam ends throughout.	
Spalding	255-5038-0	02-County Highway Agency.	LINE CREEK ROAD	FLINT RIVER	Deck Joints	B	Deck joints need to be cleaned and sealed.	
Spalding	255-5038-0	02-County Highway Agency.	LINE CREEK ROAD	FLINT RIVER	Forward Right	B	Repair washout at the forward right approach slope.	
Spalding	255-5038-0	02-County Highway Agency.	LINE CREEK ROAD	FLINT RIVER	Piles	B	Clean and paint piles.	
Spalding	255-5038-0	02-County Highway Agency.	LINE CREEK ROAD	FLINT RIVER	Span 2 overhang	B	Repair spalls with exposed rebar; span #2 right overhang at bent #2.	
Spalding	255-5038-0	02-County Highway Agency.	LINE CREEK ROAD	FLINT RIVER	Span 3	B	Repair spalls in the left barrier wall, span #3 forward at bent #3.	

Spalding	255-5039-0	02-County Highway Agency.	SCOTT BRANCH RD	FLAT CREEK	Steel piles	B	Steel piles need to be cleaned and painted.	
Spalding	255-5041-0	02-County Highway Agency.	PINE HILL ROAD	SHOAL CREEK TRIB	All barrels	B	Remove up to 3.5' of silt from barrels	
Spalding	255-5041-0	02-County Highway Agency.	PINE HILL ROAD	SHOAL CREEK TRIB	Inlet	B	Remove drift	
Spalding	255-5042-0	02-County Highway Agency.	JORDAN HILL ROAD	TOWALIGA RIVER TRIB	Abutment 1 and 3	B	Abutment 1 has moderate slope erosion 3' high x 5' wide x 1' under cap exposing 2 piles less than 1'. Abutment 3 has erosion 8" high x 2' back x full length exposing timber piles less than 1'. (see photo)	
Spalding	255-5042-0	02-County Highway Agency.	JORDAN HILL ROAD	TOWALIGA RIVER TRIB	Bent 2	B	Remove debris at bent 2, repair undermining of footing at bent 2.	
Spalding	255-5042-0	02-County Highway Agency.	JORDAN HILL ROAD	TOWALIGA RIVER TRIB	Deck joint	B	Need to be cleaned and sealed	
Spalding	255-5042-0	02-County Highway Agency.	JORDAN HILL ROAD	TOWALIGA RIVER TRIB	Rear right	B	Shoulder erosion of rear right 1 abutment.	8/7/18
Spalding	255-5043-0	02-County Highway Agency.	BARNESVILLE ROAD	BUCK CREEK	Deck gutter line	B	Debris and dirt in the gutter line	
Spalding	255-5043-0	02-County Highway Agency.	BARNESVILLE ROAD	BUCK CREEK	Forward approach slab	B	Forward approach slab has settlement causing traffic to bounce and needs to be leveled.	
Spalding	255-5043-0	02-County Highway Agency.	BARNESVILLE ROAD	BUCK CREEK		B		8/4/16
Spalding	255-5044-0	02-County Highway Agency.	N SECOND ST EXT.	CABIN CREEK	Abutment 1.	B	Repair spalls.	
Spalding	255-5044-0	02-County Highway Agency.	N SECOND ST EXT.	CABIN CREEK	Abutment 2.	B	Repair cracks.	

Spalding	255-5044-0	02-County Highway Agency.	N SECOND ST EXT.	CABIN CREEK	All steel.	B	Clean and paint steel.	7/31/18
Spalding	255-5045-0	02-County Highway Agency.	WILDWOOD ROAD	BEAR CREEK	Abutment 1	B	Abutment 1 has scour underneath 3.5' back x 1.0' high exposing 2 timber piles and needs to be repaired.	
Spalding	255-5045-0	02-County Highway Agency.	WILDWOOD ROAD	BEAR CREEK	Bents 2 and 3	B	All steel components needs to be cleaned and painted. (Straddle bent caps)	
Spalding	255-5045-0	02-County Highway Agency.	WILDWOOD ROAD	BEAR CREEK	Deck Joints	B	Deck joints need to be cleaned and sealed.	
Spalding	255-5047-0	04-City or Municipal Highway Agency.	MERIWETHER STREET	NS RAILROAD	Caps and columns	B	Repair spalls in the abutment caps, bent caps, and columns. (some with exposed rebar) Repair left rear wing wall.	
Spalding	255-5047-0	04-City or Municipal Highway Agency.	MERIWETHER STREET	NS RAILROAD	Deck Joints	B	Deck joints have moderate adhesion loss and need to be cleaned and sealed.	
Spalding	255-5047-0	04-City or Municipal Highway Agency.	MERIWETHER STREET	NS RAILROAD	Span 2	B	Repair spall in post 1	
Spalding	255-5047-0	04-City or Municipal Highway Agency.	MERIWETHER STREET	NS RAILROAD	Spans 1 and 3	B	Repair erosion in the slopes at spans 1 and 3.	
Spalding	255-5048-0	02-County Highway Agency.	CALDWELL ROAD	HEADS CREEK	Inlet and Outlet	B	Repair scour and undermining at inlet.	
Spalding	255-5048-0	02-County Highway Agency.	CALDWELL ROAD	HEADS CREEK	Inlet end	B	Fence at inlet end is causing drift and debris to accululate and needs to be removed.	
Spalding	255-5048-0	02-County Highway Agency.	CALDWELL ROAD	HEADS CREEK	Pipes	B	Bituminous lining has failed throughout both pipes and needs to be replaced.	

Spalding	255-5050-0	02-County Highway Agency.	BAILEY JESTER RD	CABIN CREEK	Beams and Piles	B	Steel beams and piles need to be cleaned and painted.	
Spalding	255-5050-0	02-County Highway Agency.	BAILEY JESTER RD	CABIN CREEK	Both Abutments	B	Both abutment joints need to be cleaned and sealed.	
Spalding	255-5054-0	02-County Highway Agency.	McINTOSH ROAD	HEADS CREEK TRIBUTARY	All Pipes	B	Repair rust and corrosion	
Spalding	255-5055-0	02-County Highway Agency.	EAST COLLEGE STREET	GRAPE CREEK	Inlet	B	Moderate drift and debris at Inlet needs to be removed.	
Spalding	255-5055-0	02-County Highway Agency.	EAST COLLEGE STREET	GRAPE CREEK	Inlet and Outlet	B	Bushes inlet and outlet needs to be cut and removed.	
Spalding	255-5058-0	02-County Highway Agency.	COLDWATER DRIVE	ISON BRANCH TRIB	Inlet and Outlet	B	Large amount of vegetation at both ends of the structure needs to be cut and removed.	
Spalding	255-5061-0	02-County Highway Agency.	SMOAK ROAD	TROUBLESOME CREEK	Both sides of structure	B	Large amount of vegetation on both sides of the structure that needs to be cut and removed	

APPENDIX 3: 2020 Operations & Maintenance Plan for Spalding County

STATUS
Not Started
In Progress
Complete
On Hold

BRIDGE NO.	TASK NAME	BRIDGE PRIORITY SCORE	STATUS	ASSIGNED TO	ANTICIPATED START DATE	ANTICIPATED END DATE	COMMENTS
	REPLACEMENT						
25500410	JORDAN HILL ROAD BRIDGE	0.796	In Progress	GDOT	09/20	09/21	
	-						
	REHABILITATION						
25550380	LINE CREEK ROAD BRIDGE	0.177	In Progress				
25550200	JEKINSBURG ROAD BRIDGE	0.764	In Progress	Paragon			
25550290	MOORE ROAD BRIDGE	0.193	complete				
	-						
	MAINTENANCE						
	AMELIA ROAD BRIDGE		Not Started	SPALDING COUNTY BRIDGE CREW			
25550500	BAILEY JESTER ROAD BRIDGE	0.193	Not Started	SPALDING COUNTY BRIDGE CREW			Both abutment joints need to be cleaned and sealed. Steel beams and piles need to be cleaned and painted.
25550430	BARNESVILLE ROAD BRIDGE	0.591	Not Started	SPALDING COUNTY BRIDGE CREW			Forward approach slab has settlement causing traffic to bounce and needs to be leveled.
25500420	BIRDIE ROAD BRIDGE	0.61	Not Started	SPALDING COUNTY BRIDGE CREW			Span 2 forward bottom of deck over bent 3 piles 4 and 6. Bent 2, piles 2 and 3 have extensive rot and need to be scheduled for replacement.
25550370	BLANTON MILL ROAD BRIDGE	0.181	Not Started	SPALDING COUNTY BRIDGE CREW			Repair spall in bent 2 cap, bottom left face; some spalls have been sealed with epoxy. Erosion under abutment 1 cap is now up to 3.0' back with loss of fill and needs to be repaired.

25550480	CALDWELL ROAD BRIDGE	0.178	Not Started	SPALDING COUNTY BRIDGE CREW			Fence at inlet end is causing drift and debris to accululate and needs to be removed.Bituminous lining has failed throughout both pipes and needs to be replaced.Repair scour and undermining at inlet.
25550340	CHEATHAM ROAD BRIDGE	0.589	Not Started	SPALDING COUNTY BRIDGE CREW			Abutment 10 has erosion exposing 2 piles less than 1.0' and needs to be repaired. Clean and paint all steel components. Repair or replace timber piles with moderate decay at bents 3, 6, and 7.
25500360	COUNTY LINE ROAD BRIDGE	0.486	Not Started	SPALDING COUNTY BRIDGE CREW			Repair rear left erosion hole 2' diameter x 2.0' deep x 3.0' under approach slab; and repair the minor settlement under abutment 4 cap.
25550040	CROWDER ROAD BRIDGE	0.178	Not Started	SPALDING COUNTY BRIDGE CREW			Deck joints need to be cleaned and sealed.
25550100	DUTCHMAN ROAD BRIDGE	0.579	Not Started	SPALDING COUNTY BRIDGE CREW			Clean and paint beams. Repair settlement. Repair or replace decayed timber beams.
	EAST MCINTOSH BRIDGE		Not Started	SPALDING COUNTY BRIDGE CREW			
25550550	EAST COLLEGE STREET BRIDGE	0.106	Not Started	SPALDING COUNTY BRIDGE CREW			Bushes inlet and outlet needs to be cut and removed. Moderate drift and debris at Inlet needs to be removed.
25550490	HOLLONVILLE ROAD BRIDGE	0.062	Not Started	SPALDING COUNTY BRIDGE CREW			
25550200	JEKINSBURG ROAD BRIDGE	0.764	Not Started	SPALDING COUNTY BRIDGE CREW			Deck has several deck boards that have become loose and need to be tightend/secured. Top left interior and exterior B 4 gusset plate has loose nuts that need to be tightened. Stringer bearings, and floor beams need to be cleaned and painted. Repair corrosion and section loss in the structural members.
25500410	JORDAN HILL ROAD BRIDGE	0.796	Not Started	SPALDING COUNTY BRIDGE CREW			
25500400	JORDAN HILL ROAD BRIDGE	0.621	Not Started	SPALDING COUNTY BRIDGE CREW			
25550380	LINE CREEK ROAD BRIDGE	0.177	Not Started	SPALDING COUNTY BRIDGE CREW			Repair pile encasements at bent #5. Bents 2, 3, and 4; Caps have spalls with exposed rebar and need to be repaired. Repair spalls with exposed rebar in the beam ends throughout. Deck joints need to be cleaned and sealed.
25500340	LOCUST GROVE ROAD BRIDGE	0.223	Not Started	SPALDING COUNTY BRIDGE CREW			Repair bent 4, column 2, abrasion with loss of aggregate rear face near the waterline. Repair beam spall at span 4 rear, beam #3.
25550110	MANGHAM ROAD BRIDGE	0.587	Not Started	SPALDING COUNTY BRIDGE CREW			Seal moderate cracking in the deck top.

25550010	MANLEY ROAD BRIDGE	0.381	Not Started	SPALDING COUNTY BRIDGE CREW			Repair spalls in the bottom of deck. Bent 3, piles 2 and 4 need to be repaired or scheduled for replacement due to rot and decay. Repair spalling with exposed rebar in intermediate bent caps.
25550350	MOON ROAD BRIDGE	0.557	Not Started	SPALDING COUNTY BRIDGE CREW			Bent 4, pile 3 has severe rot and decay (1.7" Hull center is rotten) and needs to be scheduled for replacement. Repair spalls in the intermediate bent caps (some with exposed rebar).
25550290	MOORE ROAD BRIDGE	0.193	Not Started	SPALDING COUNTY BRIDGE CREW			Abutment 4 left has an erosion hole undermining the cap, (4.0'L x 2.0' under) that needs to be repaired. Bent 2 pile 1 rear face has rotten section 5' down from cap 3"wide x 1.5"deep and bent 2 pile 1 forward face has rotten section 5' down from cap 4"wide x 2.5"deep.
25550310	MUD BRIDGE ROAD BRIDGE	0.178	Not Started	SPALDING COUNTY BRIDGE CREW			Bent 2, pile 1 has a rotten section (2.5" deep x 12" wide) and needs to be scheduled for replacement. Repair spalls in the caps with and without exposed rebar. Deck joints need to be cleaned and sealed.
25550090	MUSGROVE ROAD BRIDGE	0.188	Not Started	SPALDING COUNTY BRIDGE CREW			Bent 2 has an accumulation of drift and debris that needs to be removed.
25500310	N MCDONOUGH ROAD BRIDGE	0.626	Not Started	SPALDING COUNTY BRIDGE CREW			All steel has rust and corrosion and needs to be cleaned and painted
25550660	N HILL STREET BRIDGE	0.25	Not Started	SPALDING COUNTY BRIDGE CREW			
25550260	N. POMONA ROAD BRIDGE	0.578	Not Started	SPALDING COUNTY BRIDGE CREW			Repair erosion at both abutments. Abutment 1 rough pour concrete footing has mod scour undermining footing 2' back x 15' long, up to 8" high. Repair forward right corner erosion of the shoulder.Repair erosion at both abutments,
25550440	NORTH 2ND STREET EXT. BRIDGE	0.632	Not Started	SPALDING COUNTY BRIDGE CREW			Repair spalls. Repair cracks. Clean and paint steel.
25550130	NORTH WALKERS MILL BRIDGE	0.183	Not Started	SPALDING COUNTY BRIDGE CREW			Repair or replace wing walls at Abutment #1. Repair spalls in abutment 1 cap. Repair spalls in the bottom of deck. Repair erosion at the rear left shoulder.
25550140	NORTH WALKERS MILL ROAD BRIDGE	0.6	Not Started	SPALDING COUNTY BRIDGE CREW			Repair erosion. Clean and paint all Steel. Level forward approach roadway. Seal cracking and stabilize wing walls.
25550280	PATTERSON ROAD BRIDGE	0.194	Not Started	SPALDING COUNTY BRIDGE CREW			Repair spalls. Repair scour.
	REHOBOTH CHURCH ROAD BRIDGE		Not Started	SPALDING COUNTY BRIDGE CREW			
25500370	REHOBOTH ROAD BRIDGE	0.213	Not Started	SPALDING COUNTY BRIDGE CREW			

	S WALKERS MILL ROAD BRIDGE		Not Started	SPALDING COUNTY BRIDGE CREW			
25550390	SCOTT BRANCH ROAD BRIDGE	0.178	Not Started	SPALDING COUNTY BRIDGE CREW			Steel piles need to be cleaned and painted.
25550360	SHOAL CREEK ROAD	0.181	Not Started	SPALDING COUNTY BRIDGE CREW			Repair scour
25550610	SMOAK ROAD BRIDGE	0.003	Not Started	SPALDING COUNTY BRIDGE CREW			Large amount of vegetation on both sides of the structure that needs to be cut and removed
25550150	SOUTH WALKERS MILL BRIDGE	0.6	Not Started	SPALDING COUNTY BRIDGE CREW			All Steel components need to be cleaned and painted.
25550030	STEEL ROAD BRIDGE	0.193	Not Started	SPALDING COUNTY BRIDGE CREW			Repair spalls with exposed rebar.
25550270	STEELE ROAD BRIDGE	0.39	Not Started	SPALDING COUNTY BRIDGE CREW			Abutment 3 has erosion 8" high x 2' back at both ends. Bent 2, left lane has a spall at the deck joint that needs to be repaired. (1.0 sq. ft.) Seal moderate abrasion/honeycombing in the deck surface.
25500330	SOUTH MCDONOUGH ROAD BRIDGE	0.267	Not Started	SPALDING COUNTY BRIDGE CREW			All steel has rust and corrosion and needs to be cleaned and painted
25550210	TOMOCHICHI ROAD BRIDGE	0.586	Not Started	SPALDING COUNTY BRIDGE CREW			
25550250	TRESTLE ROAD	0.377	Not Started	SPALDING COUNTY BRIDGE CREW			
25500380	VAUGHN ROAD BRIDGE	0.802	Not Started	SPALDING COUNTY BRIDGE CREW			
25500390	VAUGHN ROAD BRIDGE	0.802	Not Started	SPALDING COUNTY BRIDGE CREW			
25550050	W. ELLIS ROAD BRIDGE	0.381	Not Started	SPALDING COUNTY BRIDGE CREW			
	W. ELLIS ROAD BRIDGE		Not Started	SPALDING COUNTY BRIDGE CREW			
	W. MCINTOSH ROAD BRIDGE		Not Started	SPALDING COUNTY BRIDGE CREW			
	W. MCINTOSH ROAD BRIDGE		Not Started	SPALDING COUNTY BRIDGE CREW			
25550330	WESTMORELAND ROAD BRIDGE	0.395	Not Started	SPALDING COUNTY BRIDGE CREW			Repair erosion and scour at abutment 1.
25550450	WILDWOOD ROAD BRIDGE	0.564	Not Started	SPALDING COUNTY BRIDGE CREW			

APPENDIX 4: Cost Estimate Worksheets

The full FEMA's Schedule of Equipment Rates can be viewed at:

https://www.fema.gov/media-library-data/1566918062583-b079c79b86366aa3819da87b011dbe73/FEMA_Schedule_of_Equipment_Rates_2019_508clean_081319.pdf

FEMA Code ID		Equipment Description					2019 Updated Rate
Cost Code	Equipment	Specifications	Capacity or Size	HP	Notes	Unit	
8010	Air Compressor	Air Delivery	41 CFM	to 10	Hoses included.	hour	\$ 1.62
8011	Air Compressor	Air Delivery	103 CFM	to 30	Hoses included.	hour	\$ 9.86
8012	Air Compressor	Air Delivery	130 CFM	to 50	Hoses included.	hour	\$ 12.49
8013	Air Compressor	Air Delivery	175 CFM	to 90	Hoses included.	hour	\$ 20.98
8014	Air Compressor	Air Delivery	400 CFM	to 145	Hoses included.	hour	\$ 32.13
8015	Air Compressor	Air Delivery	575 CFM	to 230	Hoses included.	hour	\$ 57.05
8016	Air Compressor	Air Delivery	1100 CFM	to 355	Hoses included.	hour	\$ 95.60
8017	Air Compressor	Air Delivery	1600 CFM	to 500	Hoses included.	hour	\$ 98.55
8040	Ambulance			to 150		hour	\$ 28.09
8041	Ambulance			to 210		hour	\$ 41.18
8050	Board, Arrow			to 8	Trailer Mounted.	hour	\$ 4.53
8051	Board, Message			to 5	Trailer Mounted.	hour	\$ 11.60
8060	Auger, Portable	Hole Diameter	16 in	to 6		hour	\$ 2.34
8061	Auger, Portable	Hole Diameter	18 in	to 13		hour	\$ 4.65
8062	Auger, Tractor Mntd	Max. Auger Diameter	36 in	to 13	Includes digger, boom and mounting hardware.	hour	\$ 3.25
8063	Auger, Truck Mntd	Max. Auger Size	24 in	to 100	Includes digger, boom and mounting hardware. Add this rate to tractor rate for total auger and tractor rate.	hour	\$ 34.93
8064	Hydraulic Post Driver					hour	\$ 35.27
8065	Auger	Horizontal Directional Boring Machine	250 X 100	300	DD-140B YR-2003	hour	\$ 172.29
8066	Auger	Horizontal Directional Boring Machine	50 X 100	24	Average to 7,000 lbs	hour	\$ 33.83
8067	Auger, Directional Boring Machine	Auger, Directional Boring Machine	7,000 - 10,000 lbs	45	JT920L (2013)	hour	\$ 41.04
8068	Bush Hog	Bush Hog - Model 326	Single Spindle Rotary Cutters			hour	\$ 20.61
8068-1	Bush Hog	Bush Hog - Model 3210	Lift, Pull, Semi-Mount & Offset Model			hour	\$ 28.74
8068-2	Bush Hog	Bush Hog - Model 2815	Flex Wing Rotary Cutters			hour	\$ 43.17
8070	Automobile			to 130	Transporting people.	mile	\$ 0.545
8071	Automobile			to 130	Transporting cargo.	hour	\$ 12.43
8072	Automobile, Police			to 250	Patrolling.	mile	\$ 0.545
8073	Automobile, Police			to 250	Stationary with engine running.	hour	\$ 16.05
8075	Motorcycle, Police					mile	\$ 0.505
8076	Automobile - Chevy Trailblazer	6 or 8 cl		285 to 300		hour	\$ 23.99
8077	Automobile - Ford Expedition	Fire Command Center	EcoBoost V-6	360	2015 Model	hour	\$ 19.62
8078	MRAP Armored Rescue Vehicle	Search and Rescue	Military Suplus Vehicle	375-450	Qualified foe operational rate on	Hr.	\$ 51.80
8079	MRAP C-MTV	Multi-Theater (Military Surplus)Vehicle	gvwr 55000 Lbs	to 350	Qualified foe operational rate on	Hr.	\$ 48.35

2020

- LOCAL GEORGIA -
BRIDGE
MAINTENANCE
COST ESTIMATE
WORKSHEET

REV. 9/18/2020

REGION: _____ FISCAL YEAR: _____ STRUCTURE NUMBER: _____ (3-5 digit)

SUPERVISOR: _____ DATE: _____

LOCATION: _____ DECK AREA: _____ SFT BRIDGE ID: XXX-XXXXX

PRIMARY WORK ACTIVITY: _____ DECK DIM: _____ STR. TYPE: _____

*Delete any item not used

<u>WORK ITEM</u>	<u>QUANTITY</u>	<u>UNIT</u>	<u>UNIT COST</u>	<u>TOTAL</u>
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REPLACEMENT

Bridge Replacement Cost (Georgia Bridge) [1]		SF	\$129.00	/SF	
New Superstructure [2]		SF	\$185.00	/SF	
New Deck [2]		SF	\$75.00	/SF	

DECK

Bridge Railing Replacement [2]		FT	\$400.00	/FT	
Concrete Brush Block / Curb Patch [2]		FT	\$24.00	/FT	
Concrete Deck Patch [2]		SFT	\$30.00	/SFT	
Deep Overlay [2]		SFT	\$33.00	/SFT	
Epoxy Overlay [2]		SYD	\$30.00	/SYD	
Expansion Joint Gland Replacement [2]		FT	\$85.00	/FT	
Expansion Joint Replacement [2]		FT	\$600.00	/FT	
Full Depth Patch [2]		SFT	\$76.00	/SFT	
Healer / Sealer [2]		SYD	\$15.00	/SYD	
Overlay Removal [2]		SYD	\$16.00	/SYD	
Reseal Bridge Joints [2]		FT	\$16.00	/FT	
Deck Drainage [3]		SFT	\$5.00	/SFT	
Drain Casting Assembly [2]		EA	\$950.00	/EA	
Deck Drain , Extension [2]		EA	\$400.00	/EA	
Downspout Replacement [2]		EA	\$400.00	/EA	
Embedded Galvanic Anode [2]		EA	\$15.00	/EA	
Concrete Pavement [3]		SFT	\$14.82	/SFT	

SUPERSTRUCTURE

Bearing Realignment / Replacement [2]		EA	\$5,000.00	EA	
Pack Rust Repair [2]		FT	\$500.00	/FT	
Paint - Complete [2]		SFT	\$12.00	/SFT	
Paint - Partial / Spot / Zone [2]		SFT	\$24.00	/SFT	
PCI Beam End Blockout [2]		EA	\$7,200.00	EA	
Pin & Hanger Replacement [2]		EA	\$8,000.00	EA	
Structural Steel Repair [2]		EA	\$3,000.00	EA	

SUBSTRUCTURE

Substructure Patching [2]		CFT	\$300.00	/CFT	
Substructure Replacement [2]		CFT	\$180.00	/CFT	
Substructure Horizontal Surface Sealer [2]		SYD	\$40.00	/SYD	
Temporary Supports [2]		EA	\$2,500.00	EA	
Water Repellent Treatment, Penetrating [2]		SYD	\$16.00	/SYD	
Straddle Bents [3]		SFT	\$15.00	/SFT	
Basic MSE (Mechanically Stable Earth) walls [3]		SFT	\$50.00	/SFT	

MISCELLANEOUS

ROW costs [3]		ACRE	\$140,000.00	/ACRE	
Concrete Surface Coating [2]		SYD	\$28.00	/SYD	
Culvert Cleanout [2]		FT	\$30.00	/FT	
Epoxy Crack Injection [2]		FT	\$50.00	/FT	
Metal Mesh Panels [2]		SFT	\$20.00	/SFT	
Pressure Relief Joint [2]		FT	\$100.00	/FT	
Riprap [2]		SYD	\$175.00	/SYD	
Slope Protection Repairs [2]		SYD	\$100.00	/SYD	
Environmental Mitigation [3]		SFT	\$10.00	/SFT	

TRAFFIC CONTROL

Maintaining Traffic		LS		LS	
Other					

MOBILIZATION & CONTINGENCY

20 %

\$0

\$0

(DOES NOT INCLUDE PE & CE)

* Estimated as unit shown, Paid for as LUMP SUM

SOURCES:

CONSTRUCTION TOTAL**\$0**

- [1] Bridge Replacement Unit Costs 2017 - Bridge Tables - National Bridge Inventory - Bridge Inspection - Safety - Bridges & Structures - Federal Highway Administration. <https://www.fhwa.dot.gov/bridge/nbi/sd2017.cfm#b>.
- [2] BRIDGE COST ESTIMATE WORKSHEET . MDOT University, Feb. 2020, <https://mdotjboss.state.mi.us/stdplan/englishbridgemanual.htm>.
- [3] Value Engineering Report: Brampton Road Connector . PI No. 0006328, GDOT, Michael Baker International, Georgia Ports Authority, 17 Oct. 2017.

APPENDIX 5: Spalding County Annual 5-year Cost Projection

Strategy	2020	2021	2022	2023	2024	2025
New Bridge						
N/A	\$ -					
Subtotal	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Replacement						
JORDAN HILL ROAD 255-0041-0	2 Million GDOT					
VAUGHN ROAD 255-0038-0		2 Million GDOT				
DUTCHMAN ROAD 255-5010-0			2 Million GDOT	\$ -		
WILDWOOD 255-5045-0			2 Million GDOT		\$ -	
COUNTY LINE ROAD 255-0036-0					2 Million GDOT	\$ -
			\$ -			
Subtotal	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Rehabilitation						
AMELIA ROAD	\$ -	\$2,500				
BAILEY JESTER ROAD		\$ -				\$2,500
BARNESVILLE ROAD			\$2,500			
BIRDIE ROAD		\$ 2,500.00				
BLANTON MILL ROAD					\$ 2,500.00	
CALDWELL ROAD		\$ 2,500.00		\$ -		
CHEATHAM ROAD						\$ 2,500.00
COUNTY LINE ROAD		\$ 2,500.00				
CROWDER ROAD			\$ 2,500.00			
DUTCHMAN ROAD						\$ 2,500.00
EAST MCINTOSH						
EAST COLLEGE STREET						
HOLLONVILLE ROAD		\$ 2,500.00				
JEKINSBURG ROAD	\$ 2,500.00					
JORDAN HILL ROAD 255-0041-0			\$ 2,500.00			
JORDAN HILL ROAD						
LINE CREEK ROAD	\$ 2,500.00					
LOCUST GROVE ROAD		\$ 2,500.00				
MANGHAM ROAD			\$ 2,500.00			
MANLEY ROAD					\$ 2,500.00	

MOON ROAD				\$ 2,500.00		
MOORE ROAD						\$ 2,500.00
MUD BRIDGE ROAD					\$ 2,500.00	
MUSGROVE ROAD				\$ 2,500.00		
N MCDONOUGH ROAD		\$ 2,500.00				
N HILL STREET					\$ 2,500.00	
N. POMONA ROAD			\$ 2,500.00			
NORTH 2ND STREET EXT.						\$ 2,500.00
NORTH WALKERS MILL	\$ 2,500.00					
NORTH WALKERS MILL ROAD						\$ 2,500.00
PATTERSON ROAD				\$ 2,500.00		
REHOBOTH CHURCH ROAD		\$ 2,500.00				
REHOBOTH ROAD						\$ 2,500.00
S WALKERS MILL ROAD			\$ 2,500.00			
SCOTT BRANCH ROAD						\$ 2,500.00
SHOAL CREEK ROAD		\$ 2,500.00				
SMOAK ROAD						\$ 2,500.00
SOUTH WALKERS MILL				\$ 2,500.00		
STEEL ROAD			\$ 2,500.00			
STEELE ROAD BRIDGE					\$ 2,500.00	
SOUTH MCDONOUGH ROAD				\$ 2,500.00		
TOMOCHICHI ROAD		\$ 2,500.00				
TRESTLE ROAD				\$ 2,500.00		
VAUGHN ROAD						
VAUGHN ROAD						
W. ELLIS ROAD				\$ 2,500.00		
W. ELLIS ROAD			\$ 2,500.00			
W. MCINTOSH ROAD			\$ 2,500.00			
W. MCINTOSH ROAD						
WESTMORELAND ROAD			\$ 2,500.00			
WILDWOOD					\$ 2,500.00	
(WOODEN) BUCK CREEK ROAD	\$ 500.00					
(WOODEN) CHEHAW ROAD		\$ 500.00				
(WOODEN) CHULI ROAD			\$ 500.00	\$ -		
(WOODEN) JOHNSON ROAD				\$ 500.00	\$ -	

(WOODEN) LINDSEY ROAD					\$ 500.00	
(WOODEN) SCOTT BRANCH ROAD						\$ 500.00
(WOODEN) TRI COUNTY ROAD	\$ 500.00					
(WOODEN) YARBOROUGH MILL ROAD		\$ 500.00				\$ -
(WOODEN) PAYTON ROAD			\$ 500.00			
	\$ 8,500.00	\$26,000	\$ 26,000.00	\$ 18,000.00	\$ 15,500.00	\$ 23,000.00
Conditional Maintenance						
JENKINSBURG ROAD	\$200,000					
LINECREEK ROAD	\$2,500					
NORTH WALKERS MILL BRIDGE	\$2,500					
MOORE ROAD	\$7,100					
BRIDGE 1 AS NEEDED		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
BRIDGE 2 AS NEEDED		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
BRIDGE 3 AS NEEDED		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
BRIDGE 4 AS NEEDED		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
BRIDGE 5 AS NEEDED		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
BRIDGE 6 AS NEEDED		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
BRIDGE 7 AS NEEDED		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Subtotal	\$ 221,600.00	\$ 97,000.00	\$ 97,000.00	\$ 88,500.00	\$ 86,000.00	\$ 93,500.00
Scheduled Cyclical Maintenance- Performed by in-house forces for all bridges						
Subtotal**	\$ -	\$ 170,000.00	\$ 170,000.00	\$ 170,000.00	\$ 170,000.00	\$ 170,000.00
Other	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total	\$ 230,100.00	\$ 293,000.00	\$ 293,000.00	\$ 276,500.00	\$ 271,500.00	\$ 286,500.00

* Values are for estimation purposes only

**\$170,000 is the cost of Spalding's in-house bridge crew