



pennsylvania
DEPARTMENT OF TRANSPORTATION



Local Small Bridges

A Pennsylvania Transportation Advisory Committee Policy Study

FEBRUARY 2021

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Acknowledgements

About the Transportation Advisory Committee

The Pennsylvania Transportation Advisory Committee (TAC) was established in 1970 by Act 120 of the State Legislature, which also created the Pennsylvania Department of Transportation (PennDOT).

TAC has two primary duties. First, it "consults with and advises the State Transportation Commission and the Secretary of Transportation on behalf of all transportation modes in the Commonwealth." In fulfilling this task, TAC assists the Commission and the Secretary "in the determination of goals and the allocation of available resources among and between the alternate modes in the planning, development, and maintenance of programs, and technologies for transportation systems."

TAC's second duty is "to advise the several modes (about) the planning, programs, and goals of the Department and the State Transportation Commission." TAC undertakes in-depth studies on important issues and serves as a liaison between PennDOT and the general public.

TAC consists of the following members: the Secretary of Transportation; the heads (or their designees) of the Department of Agriculture, Department of Education, Department of Community and Economic Development, Public Utility Commission, Department of Environmental Protection, and the Governor's Policy Office; two members of the State House of Representatives; two members of the State Senate; and 18 public members—six appointed by the Governor, six appointed by the President Pro Tempore of the Senate, and six appointed by the Speaker of the House of Representatives.

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Executive Summary

Need and Purpose

In 2020, TAC commissioned this study to review the condition of local small bridges located in the Commonwealth of Pennsylvania. Local small bridges are defined as a bridge, culvert, or pipe(s) between 8 and 20 feet in length and are owned at the local level by counties and municipalities.

Based on a 2011-2012 statewide inventory by PennDOT, there are an estimated 7,000 small bridges owned by local governments. With a lack of any state or federal mandate that requires municipalities to conduct routine inventory and inspection, local governments are not required to plan for and fund the long-term capital needs of the local bridge inventory. Nearly 30 percent of the state's locally owned bridges greater than 20 feet are rated as being in poor condition despite biennial inspections and funding support through the Transportation Improvement Program (TIP). As a whole, local structures between 8 and 20 feet in length are likely in much worse condition.

Through the study process, TAC engaged in a dialogue with Pennsylvania's counties and municipalities to understand if and how organizations are inventorying, inspecting, and maintaining local small bridge structures and to identify the constraints on these efforts. By understanding local perspectives and needs, the study offers recommendations for how PennDOT can help create increased capacity and incentives to create uniformity in local small bridge asset management.

Study Outline

This study features seven sections that comprise the primary report elements. These sections include:

- **Background and Purpose:** An overview of conditions that have led to the study's development and the methodology followed by the Task Force and consultant team.
- **Bridge Inventory and Inspection:** An overview of state and federal bridge inspection regulations.
- **Pennsylvania's Locally Owned Bridges:** Background information on Pennsylvania's local small bridge inventory and existing funding sources for asset management.
- **Local Perspective:** A review of the online survey conducted as part of the study to understand local perspectives on inventory practices, inspections, asset management, and the funding.
- **State of the Industry Practices:** A summary of both national and statewide best practices for improving the inventory and maintenance of local small bridges.
- **Study Report Alternatives:** Key study findings and recommendations.

Study Findings

Study report alternatives were developed with recommendations for how PennDOT can help create increased capacity and incentives to facilitate uniformity in local small bridge asset management. These recommendations are meant to assist PennDOT, the Planning Partners, counties, and municipalities in achieving consistency through both new strategies and the already existing standards. Key findings included a standardized approach, capacity building, incentivization, and implementation.

- **Standardized Approach**

A standardized approach for inventorying and assessing the condition of local small bridge structures is needed to ensure consistency and accuracy of the data collected and maintained. This requires communication among PennDOT, the Planning Partners, counties, and municipalities regarding the methodology and requirements for the ongoing inventory, condition assessment, and management of local small bridges.

- **Capacity Building**

Technical assistance and training programs and tools are needed to increase local knowledge and proficiencies in asset management. Development of new or restructuring of existing training courses through PennDOT's Local Technical Assistance Program (LTAP), should be delivered to address the standardized approach and Innovative Financing for Local Small Bridges.

- **Incentivization**

Financial incentives are needed to increase and achieve statewide participation in a standardized asset management approach for local small bridges. PennDOT should utilize its grant programs to incentivize counties and municipalities to inventory, assess, and help maintain local small bridges. At the regional level, Planning Partners should educate municipal staff on alternative financing and technical mechanisms that can be leverage. Planning Partners may also consider including local small bridge inventory and assessment in their respective Unified Planning Work Programs (UPWP).

- **Implementation**

A dedicated team of subject matter experts is needed to serve as the lead champion for developing the technical details of the Standardized Approach and associated training curriculum. PennDOT, in conjunction with the TAC, should organize a "Local Small Bridge Action Team" to lead the implementation of the findings and actions specified by this study.



Bridge in Lycoming County | Bassett Engineering, Inc.

Background and Purpose

Background

While investing in transportation infrastructure has long been a core policy objective at the national and state levels, in recent years there has been a renewed commitment to improving the condition of transportation assets. In 2015, Congress passed the Fixing America's Surface Transportation (FAST) Act into law—the first long-term funding bill for transportation in more than a decade. Two years prior, in November 2013, the Commonwealth of Pennsylvania passed its own historic transportation funding bill known as Act 89.

Act 89 is Pennsylvania's most comprehensive piece of state transportation legislation in decades and provides for an annual investment of more than \$2.3 billion. For Pennsylvania's counties and municipalities, it has provided an estimated \$1.3 billion over the first five years of the law to help improve and rebuild more than 10,000 miles of road and thousands of bridges. The legislation has also provided an additional \$220 million per year in Liquid Fuels allocations for locally owned roads and bridges, a more than 60 percent increase over the previous allocation.

Today, Pennsylvania is starting to see the positive impacts of the federal and state commitment to transportation investment. Of the 6,000+ local bridges in the state that are more than 20 feet in length:

- The number of locally owned bridges rated poor has decreased from 2,231 to 1,793, representing a decrease of 438 or 20 percent between 2013 and 2020.
- The total number of bridges rated poor has been reduced from 35 percent to 27 percent.
- The number of closed and posted bridges has decreased by 13 and 250, respectively.
- For state owned bridges, the Pennsylvania Department of Transportation (PennDOT) is leveraging a 25-year, \$899 million Rapid Bridge Replacement P3 initiative to replace and maintain 558 bridges.

There is one element of the state's transportation system, however, that has not benefitted from the increases in transportation funding. Local small bridges – a bridge, culvert, or pipe(s) between 8 and 20 feet in length on the local roadway network – remain largely undocumented and receive a disproportionately low share of funding. All but five of Pennsylvania's 67 counties own bridges and 1,234 of the state's 2,562 municipalities also own bridges, creating a far-reaching transportation challenge that is not isolated to any particular region of the state.

Table 1 | Summary Statistics of Pennsylvania Bridges on Locally Owned Roads Greater than 20 Feet, 2013 and 2020

	Total Count	Closed Bridges	Posted Bridges	Poor Condition Count	% Poor Condition by Count	Poor Condition Deck Area	% Poor Condition by Deck Area
2013	6,354	213	1,691	2,231	35.1%	4.2551	29.5%
2020	6,608	200	1,441	1,793	27.1%	3.4793	22.9%
Change 2013-2020	254	-13	-250	-438	-0.08	-0.78	-0.07%

Source: PennDOT, 2020

In 2011-2012, PennDOT conducted an inventory of all local small bridges, partnering with the metropolitan planning organizations (MPO) and rural planning organizations (RPO) (collectively, Planning Partners) and the PennDOT District Municipal Services Representatives across the state. The inventory process found that Pennsylvania's counties and municipalities own more than 7,000 local small bridges. However, the effort lacked the deployment of a standardized data collection process, rendering PennDOT unable to enter the data into its statewide bridge inventory database. Accordingly, while PennDOT's 2011-2012 study provided a better understanding of the *magnitude* of the state's inventory of local small bridges, there remains uncertainty regarding their *condition*. In addition, without continued PennDOT support, there have been no additional inventory efforts since 2011-2012. The statewide inventory data that was collected is now outdated and municipalities continue to use a disparate array of internal processes, if any at all, to inventory, inspect, and maintain bridges.

With a lack of any state or federal mandate that requires municipalities to conduct routine inventory and inspection, local governments are not required to adequately plan and fund the long-term capital needs of the local bridge inventory. Nearly 30 percent of the state's locally owned bridges greater than 20 feet are rated as being in poor condition despite biennial inspections and funding support through the Transportation Improvement Program (TIP). As a whole, local structures between 8 and 20 feet in length are likely in much worse condition.



Dellville Road | Michael Baker International

Purpose

The purpose of this TAC study is not to conduct an inventory of local small bridges in Pennsylvania. Rather, the purpose is to engage in a dialogue with Pennsylvania's municipalities and counties to understand if and how organizations are inventorying, inspecting, and maintaining local small bridge structures and to identify the constraints on these efforts. By understanding local perspectives and needs, the study offers recommendations for how PennDOT can help create increased capacity and incentives to create uniformity in local small bridge asset management to, ultimately, achieve an even greater investment in the Commonwealth's local transportation network.

PennDOT's attention to local small bridges, which are inherently under local jurisdiction, is derived from economic and safety impacts that ripple beyond municipal boundaries. Primary considerations include the following:

- **Economic Development:** Many companies and agricultural businesses are dependent on small bridges that provide direct access to a company location and agricultural land. Many PennDOT Connects meetings, which is a program initiative to communicate regularly with municipalities on PennDOT's upcoming projects, has identified many businesses where access is wholly dependent on small bridges. For example, access to the Peach Bottom Exelon Atomic Power Plant in York County is accessible from the north only by the Flintville Road Bridge, which is a two-lane bridge 20 feet in length. The bridge provides access for more than 1,000 employees at the plant as well as up to 3,000 Exelon workers during safety training. If the bridge were to close, it would require a substantial detour that would require travel on a single lane dirt road. The bridge is owned by PennDOT and, accordingly, has undergone regular inspection and is slated for rehabilitation in 2025. However, if the bridge were hypothetically owned by Peach Bottom Township, there would be no regular mandate for inspection regardless of the bridge's importance to the local and regional economies.
- **Safety Concerns:** The state and federal requirements for bridges is predicated on a somewhat arbitrary parameter for bridge length. FHWA only requires inspections on local bridges that are greater than 20 feet. If a local bridge is 20 feet or less in length, even slightly shorter than FHWA's regulatory threshold, there is no mandate for inspection to ever occur. With the public traveling over local small bridges, including school buses, PennDOT recognizes there is an inherent public safety concern. Using the same example above, a second bridge provides access to the power plant from the south. An 18-ton weight limit was posted recently due to the condition of the bridge and increased signage has been needed as tractor trailer drivers have continued traveling over the structure. If the bridge was locally owned and 20 feet or less in length, it may or may not be posted today. There are antidotal reports of local small bridges remaining open to the public that are in serious or critical condition.

- **Environmental Concerns:** Without standard inventory, inspection, and asset management, local small bridges are at a greater risk of falling into a state of disrepair requiring closure. When local bridges close, vehicles must detour around the closed structure. Using the same example above, if the Flintville Road Bridge were to close, it would require a long detour involving a dirt road for hundreds of workers on a daily basis. This type of long-term detour would result in increased vehicle emissions. As another example, local roads are often integral components of detour routes for locals when a segment of a state highway or the Pennsylvania Turnpike must close due to a crash or construction. Small local bridge closures could greatly expand a detour for vehicles diverting off a state route.



Flintville Road Bridge | Google Maps

Methodology

To direct the study, a 15-member TAC Task Force committee was formed, which included representation from TAC and non-TAC members as listed in the Acknowledgements section of this document. The non-TAC members included state, regional, and county officials with expertise in transportation asset management including specific insights into and experience with the management and maintenance of local small bridges. The Task Force met quarterly between February and December 2020 and provided technical advice and guidance to the technical study process.

The study process included the following key tasks:

- Review of federal and state bridge inspection and inventory processes and requirements to understand the parameters in place guiding local organizations.
- Review of existing local small bridge inventory data from 2012.
- Facilitate stakeholder outreach to characterize municipal and county local small bridge inventory, inspection, and management processes, as well as asset management programs.
- Conduct research to identify pertinent national and Pennsylvania case studies to outline how peer organizations have managed and improved their local bridge inventories.
- Identify factors, limitations, and capacity constraints that impact the inventory, inspection, maintenance, and asset management of local small bridges in Pennsylvania.

Between January and April 2020, the Task Force and consultant team conducted the above tasks that included the development and administration of an online survey to collect information from municipalities, counties, and the Planning Partners on their respective methods and means for inventorying and inspecting small bridges as well as how they are funding maintenance, repair, and replacement. In addition, the survey obtained insights on the limitations and issues related to local small bridges, and recommendations for their resolution.

In light of the COVID-19 pandemic and the Commonwealth's social distancing and stay-at-home orders that took effect in March 2020, the Task Force and consultant team used online technologies to ensure the project's schedule proceeded as originally planned. In addition to conducting virtual meetings with Task Force members, the consultant team also hosted a virtual meeting with nearly 50 stakeholders to obtain further insights to issues on and solutions to the management and maintenance of local small bridges.



W. Yellow Breeches Road | Michael Baker International

Bridge Inventory and Inspection

Bridge Inventory

Bridge inventories are developed for the purpose of having a complete database that accounts for all bridges within a given system. In Pennsylvania, PennDOT maintains the primary bridge inventory for the Commonwealth for bridges. State-owned bridges eight feet or greater are included in the inventory as well as local bridges 20 feet or greater. This inventory data is also reported to and included in the National Bridge Inventory (NBI) maintained by the Federal Highway Administration (FHWA).

Bridge inventories include the following attribute data:

- Bridge identification information is a 14-digit code used to provide each structure in the system with a unique identification. Its format includes the county code, route number, segment, and offset, in the form 00-0000-0000-0000.
- Bridge type and specifications classify the type of bridge based on defined standard categories for bridge classification such as slabs, girder-floor-beam-stringer, truss, arch, rigid frame, or box culvert. Specifications also identify the material of the bridge components, deck, and deck wearing surface.
- Operational conditions provide information about the age of the structure as well as construction year, rehabilitation year, type of services and traffic carried over and/or under the structure, number of the lanes over and/or under the structure, average daily traffic, average daily truck traffic, and information regarding detours.
- Inspection and ratings data classify the integrity of the structure. Condition ratings, as assigned by the bridge inspector, include approach roadway, deck wearing surface, deck, superstructure, substructure, channel, and culverts. Appraisal ratings include structural condition appraisal, deck geometry, under clearances, waterway adequacy, and approach roadway alignment. Ratings are based on a scale from 0 to 9 (refer to Glossary).

Figure 1 | PennDOT Publication 100 Excerpt on Structure Type Coding

Structure Type Coding Item Comparison Chart	
Condition	Appraisal
6B39 Approach Roadway	4A09 Structural Condition Appraisal
6B40 Deck Wearing Surface	4A10 Deck Geometry
1A01 Deck	4A11 Underclearances
1A04 Superstructure	1A06 Waterway Adequacy
1A02 Substructure	4A02 Approach Roadway Alignment
1A05 Channel	
1A03 Culverts	

Interestingly, the definition of a bridge varies between federal and state manuals. For example, the federal government defines a bridge, per FHWA Bridge Inspector's Reference Manual (BIRM), as a structure that is more than 20 feet. PennDOT Publication 100A, alternatively, defines a bridge as a structure that has a length of eight feet or more. The implication is that inventories do not track the same bridges. While PennDOT's inventory captures bridges eight feet or longer, the federal NBI only captures bridges 20 feet in length or longer.

Asset Management

Regular inspections of bridge structures are critical for maintaining up-to-date inventory databases and understanding capital programming needs. By regularly evaluating the condition of each structure and the bridge network as a whole, local, county, state, and federal agencies are able to provide proactive asset management to ensure a state of good repair and reduced life-cycle costs. The following section discusses federal inspection regulations as well as how inspections are conducted in Pennsylvania.

ASSET MANAGEMENT

FHWA definition:

A strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both engineering and economic analysis based upon 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 (SOGR) over the life cycle of the assets at minimum practicable cost.

23 CFR 515.5

Federal Inspection Regulations

General Inspection Requirements Per NBIS

The standards for bridge inspections are set forth by FHWA in its [National Bridge Inspections Standards](#) (NBIS) Regulation. Historically, the 1968 Federal-Aid Highway Act directed the states to maintain an inventory of Federal-Aid highway system bridges (those that receive federal funding). The Surface Transportation Assistance Act of 1978, however, extended NBIS requirements to include all bridges longer than 20 feet on public roads.

In terms of inspection frequency, NBIS requires that every bridge greater than 20 feet in length is to be inspected at regular intervals not to exceed two years. Certain types or groups of bridges require inspection at less than two-year intervals depending on such factors as age, traffic characteristics, status of maintenance, and known deficiencies. Per NBIS, the evaluation of these factors is the responsibility of the individual in charge of the inspection program.

Based on NBIS requirements, inspection data must be entered into the appropriate system within 90 days of the date of inspection for state- and federally owned bridges and within 180 days of the date of inspection for all other bridges greater than 20 feet. Likewise, any bridge modifications that alter previously recorded data, new bridges, or changes to load restriction or closure status must be entered into the appropriate system within 90 days for state or federal bridges and within 180 days for all other bridges.



Michael Baker International

Inspection Responsibilities

Each state transportation department is responsible for ensuring that all bridges are inspected on public roads that are fully or partially located within the state's boundaries, except for bridges that are owned by federal agencies. For federal roads, federal agencies (e.g., U.S. Department of Transportation) oversee the inspections for bridges fully or partially located within their respective responsibility or jurisdiction.

Inspection Processes and Inventories in Pennsylvania

For Pennsylvania’s state-owned bridges, or those that are found on interstates and State Routes across the Commonwealth, PennDOT manages the inspection process. For county and municipal owned bridges that are greater than 20 feet in length, PennDOT also conducts the inspections through local bridge inspection contracts. Typically, a consultant engineer is engaged by PennDOT to conduct these inspections in collaboration with the applicable PennDOT Engineering Districts. All Pennsylvania bridge inspection and condition data is maintained in a PennDOT database known as the Bridge Management System 2 (BMS2).

As described in the *General Inspection Requirements Per NBIS* section above, all Pennsylvania bridges greater than 20 feet in length are subject to NBIS standards and are inspected at two-year intervals with the data inputted into BMS2. PennDOT does not facilitate the inspection of local small bridges. If inspected by the owner, bridge inspection data for bridges between 8 feet and 20 feet in length may be voluntarily submitted by counties and municipalities to PennDOT, but the inspection and submission of data is not mandated. Per PennDOT Design Manual 4, PennDOT does not require structures less than 8 feet to have a Structure Number. Absent a Structure Number, there is not a corresponding BRkey or BMS number (the unique identifier within BMS2). Generally, local small bridges less than 8 feet in length are not classified as a “structure”.

HISTORY OF PENNDOT’S BRIDGE MANAGEMENT SYSTEMS

BMS1:

BMS1 was developed by PennDOT in 1986 but was replaced by BMS2 due to limitations with the program. BMS1 did not allow PennDOT to track bridge deterioration, maintenance cost, or the priority of maintenance. The database simply captured NBI condition ratings.

BMS2:

BMS2 is the current PennDOT database that houses all bridge inventory and condition data, including inventory, condition, and appraisal data, as required by PennDOT and FHWA. BMS2 also has iForms functionality, which supports electronic data collection of bridge inspections for increased efficiency.

BMS2 is also known as PennDOT’s Bridge Asset Management System (BAMS). It provides a level of information and analytical tools that have enabled PennDOT to more efficiently support bridge planning, bridge programming, and bridge maintenance. Asset management supports PennDOT in prioritizing and performing timely bridge maintenance activities, thereby reducing far costlier replacements.

Local Small Bridges in Pennsylvania

Given that bridges shorter than 20 feet in length (those not on the federal aid system) are not eligible for federal funding and are not subject to the NBIS inspection standards, Pennsylvania does not have a full inventory of county and municipal local small bridges. With irregular inspections, municipalities are not able to effectively plan and program for capital improvements, and the lack of a standard process leaves structures vulnerable to deterioration and eventual failure. This leads to unnecessarily higher life-cycle costs for local small bridges.

This TAC study explores the implications of Pennsylvania's missing inventory for local small bridges and how PennDOT may be able to facilitate standardized inspections for all bridge structures regardless of length. Absent a federal mandate to conduct inspections, both technical and financial resources may need to be provided to support municipalities with their bridge asset management efforts.

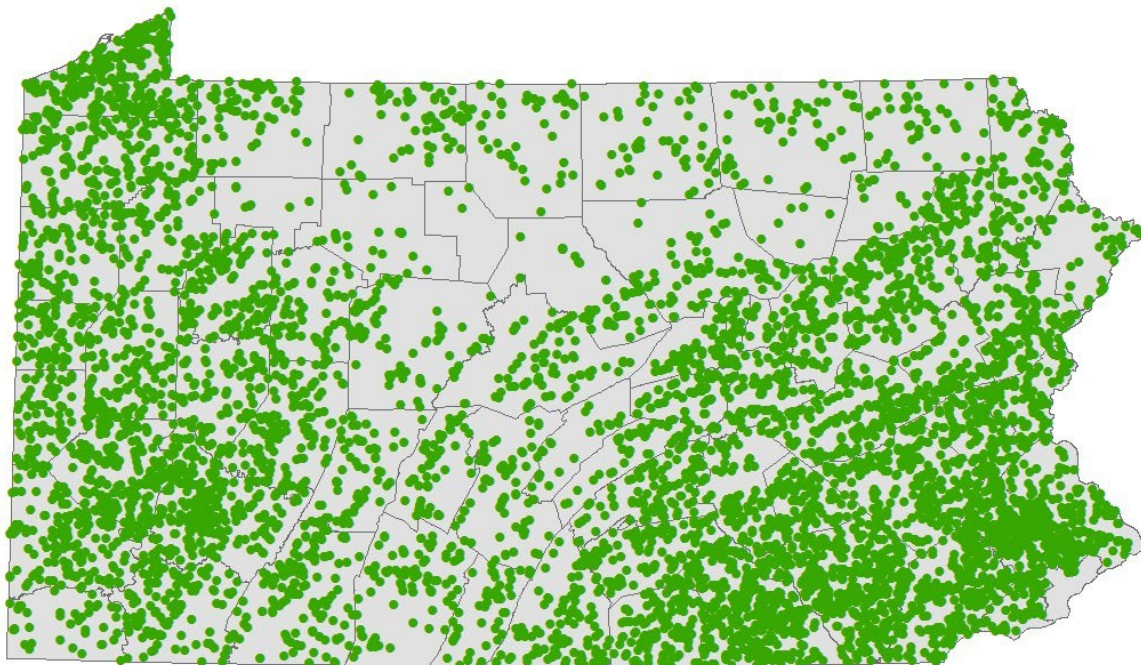
Pennsylvania's Locally Owned Bridges

Inventory and Condition

The primary inventory data available for local small bridges in Pennsylvania is from the 2012 Statewide Local Small Bridge Inventory Project. From 2009 to 2010, PennDOT piloted an inventory of local small bridges in Lycoming County. At the time, no county had a comprehensive inventory of small bridges and very little was known about the number and condition of the structures. After a successful pilot, PennDOT extended the project statewide from 2011 to 2012. Each county and Planning Partner, with the support of the PennDOT Program Center and District Municipal Services Representatives, went through a multi-step process to identify possible local small bridge locations, conduct site visits to record locations, and conduct a basic assessment of conditions. These visits were conducted by a range of staff depending on local resources and did not include formal NBIS Bridge Safety Inspections.

The inventory resulted in a database with records on 7,553 local small bridges between 8 and 20 feet, mapped in Figure 2. The data collected includes information on the owner, location, name of the facilities carried, type of structure, and materials.

Figure 2 | Local Small Bridges in Pennsylvania



Source: 2012 Statewide Local Small Bridge Inventory Project, PennDOT



Redington Avenue | Michael Baker International

Originally, the 2012 inventory data was not added to BMS2 due to concerns with data consistency and potential discrepancies. In 2020, however, it appears the Statewide Local Small Bridge Inventory project data has recently been added to BMS2 and is available to the public through PennShare and OneMap. This most recent data, which varies slightly from the original 2012 inventory data, reveals the following insights on Pennsylvania's local small bridges.

- Townships own approximately 83 percent of all local small bridges. On average, each town or township owns five bridges.
- Cities and boroughs own 10 percent of the local small bridges, and each city or borough owns, on average, three bridges.
- Counties make up 6 percent of bridge ownership, with 33 of Pennsylvania's 67 counties owning small bridges. While on average each county owns 15 bridges, 24 of the 33 counties own less than 10. Three counties – Allegheny, Mercer, and Luzerne – own 67 percent of all county-owned local small bridges. Because of these outliers, the average number of bridges per county owner is skewed to a higher number. When those three counties are not taken into consideration, the average number per county is approximately 6 bridges.

- Based on the original 2012 data, the average length of small bridges in Pennsylvania is 12 feet.
- An estimated 6 percent of the small bridges are on posted roads and 0.5 percent are closed to traffic.

Table 2: Local Small Bridge Ownership

Owner	Ownership	Average Number of Bridges per Owner
County	6%	15
Township	83%	5
City/Borough	10%	3
Other	1%	—

Source: PennShare 2020

Table 3: Bridge Type and Material

Structure	Percentage	Structural Material	Percentage
Pipe Culvert	29%	Steel	21%
Slab	20%	Cast in place Concrete	54%
I-Beams	13%	Precast Concrete	2%
Box Culvert	12%	Timber	1%
Frame Culvert	8%	Masonry	5%
Arch Culvert	6%	Concrete Encase Steel	1%
Pipe-Arch Culvert	6%	Others	16%
Arch Deck – Closed	3%		
Rigid Frame	2%		
Solid Timber Beams	1%		

Source: PennShare 2020

Table 4 | Average Daily Traffic (ADT)

Average ADT	1,800
Max ADT	33,000
ADT > 15,000	184

Source: PennShare 2020

While the 2012 Statewide Inventory has provided a picture of local small bridges within the state, the data lacks information regarding condition, year built, and last inspected. As previously discussed, during the inventory effort, NBIS Bridge Safety Inspections were not conducted and documentation was not consistent among counties. Accordingly, the accuracy and integrity of the current inventory and the lack of a recurring assessment has not enabled localities and counties to perform asset management. In addition, without sustained funding through PennDOT, there has been no uniformity in continued inventory and inspection. As reported by study stakeholders, the data is eight years old, yet remains the most recent inventory for many counties and municipalities. This highlights a need to develop a standardized approach and the local capacity for consistent and comprehensive inventory and inspection processes.



Bridge in Lycoming County | Bassett Engineering, Inc.

Funding

As outlined in the 2011 *Financial Needs of Counties and Municipalities for Highways and Bridges* TAC Final Report, local governments are responsible for an extensive network of transportation infrastructure comprised of 77,500 miles of public road, 14,000 traffic signals, and 12,000 local bridges, and face a significant funding gap in keeping the system in a state of good repair. At the time, the report estimated a gap of \$2.2 billion in funding.

In addition to understanding the existing inventory and condition of small local bridges, it is prudent to also understand how the assets are being maintained. Based on the municipal survey results (refer to Figure 19 and Figure 20) as well as information gathered from the STC, there are five common sources of local revenue—outside of municipal general funds—available to maintain local small bridge assets, including the following:



In terms of annual revenue, the municipal and county Liquid Fuels funds remain the most significant source of funding available to counties and municipalities. New funding sources have been created in recent years through Act 13 of 2012 and Act 89 of 2013, however, these sources remain a fraction of Liquid Fuels. With a continued funding gap, this document explores through case studies how municipalities and counties can leverage existing funding through innovative programs and partnerships to achieve more with limited dollars. This section below describes the sources of funding being used most commonly today.

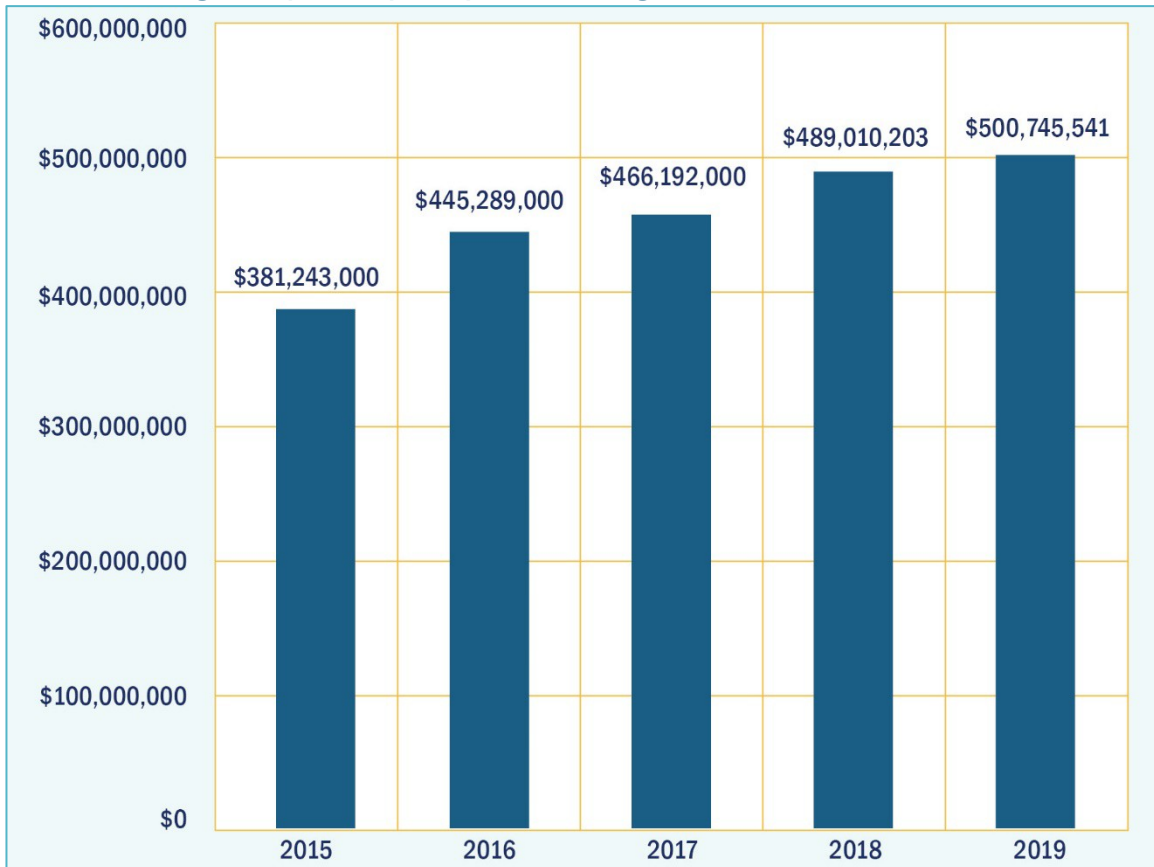
Municipal Liquid Fuels

Since 1956, municipalities have received payments from the Municipal Liquid Fuels Fund. As part of the program, PennDOT allocates taxes from liquid fuels under the State's Motor License Fund to municipalities to support the construction, reconstruction, maintenance, and repair of public roads or streets. The amount of funds received by each municipality is based on a 50/50 formula comprised of population and miles of roadway.

In 2019, over \$500 million was distributed through the Municipal Liquid Fuels Fund. This was \$11.7 million more than in 2018 and \$22.8 million more than in 2017. The

increase in 2018 and 2019 funding was a result of the passage of Act 89 in 2013, which removed the Liquid Fuels Tax and began the Oil Company Franchise Tax.¹

Figure 3 | Municipal Liquid Fuels Program Allocation, 2015-2019



Source: STC, 2020

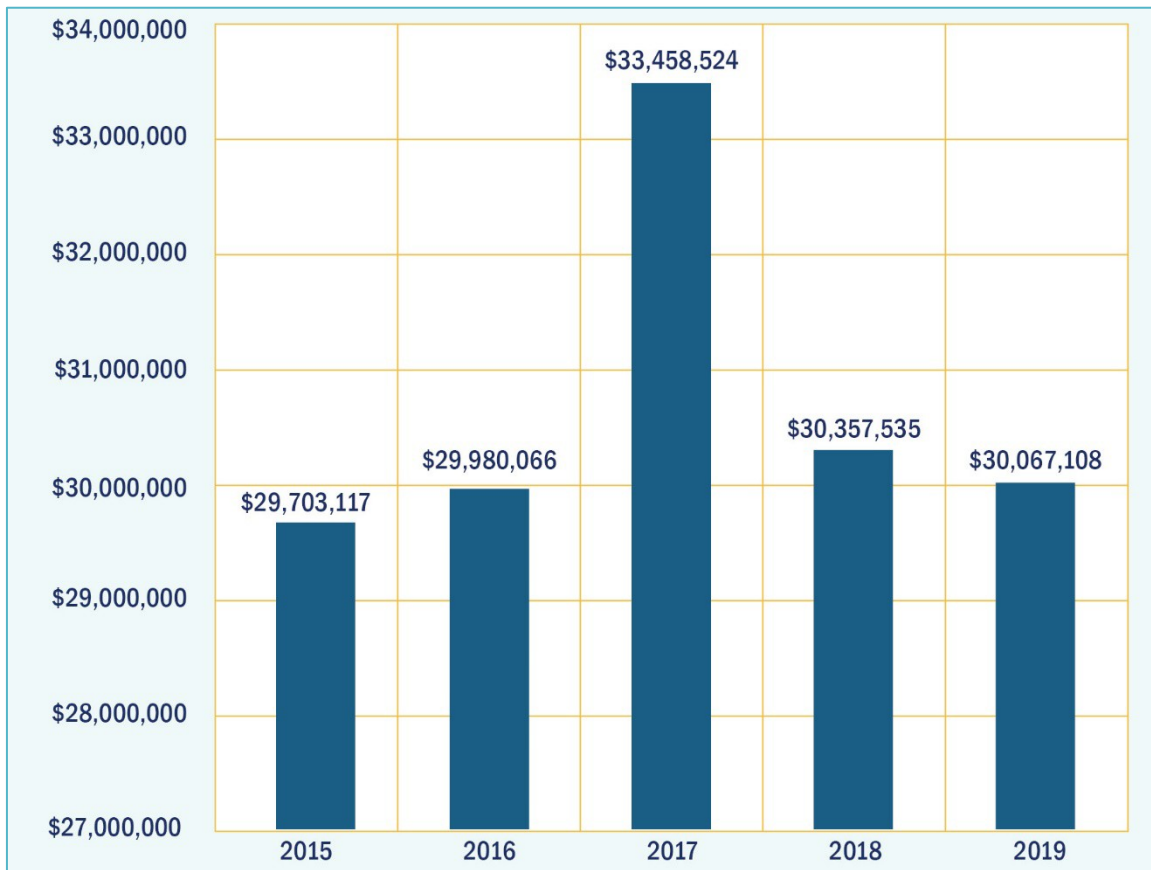
County Liquid Fuels

The Liquid Fuels Tax Act, codified in 1931, allows the distribution of funding to counties that are compliant with PennDOT guidelines to support road and bridge projects. In 2007, as a result of Act 44 of 2007, an additional \$5 million was added to the County Liquid Fuels Program. Funds for this additional allotment were based upon the ratio of square foot deck area of county-owned bridges to the total statewide deck area of county-owned bridges. County Liquid Fuels funding is to be used for the repair, replacement, construction, and maintenance of county roads and bridges or infrastructure within that county's cities, municipalities, and boroughs. Funds are not required to be spent within the fiscal year assigned and can be saved for future projects.

¹ State Transportation Commission, PennDOT 2020

In 2019, over \$30 million was distributed through the County Liquid Fuels Program, which is less than the amount distributed in both 2017 (by \$3 million) and 2018 (by \$290,000).

Figure 4 | County Liquid Fuels Program Allocation, 2015-2019



Source: STC, 2020

Act 13 of 2012 - Unconventional Gas Well Fund

Between 2009 and 2010, new methods of well boring such as hydraulic fracturing and horizontal drilling were introduced in the Marcellus Shale region of Pennsylvania and across the nation. In result, natural gas extraction in the Commonwealth boomed, creating a new multi-billion-dollar industry in Pennsylvania's economy.

Despite substantial job growth and economic development benefits, natural gas drilling also resulted in negative impacts, ranging from a surge in housing costs, a deterioration of transportation infrastructure due to heavy truck movement, and a range of environmental concerns. In response, Pennsylvania followed national trends and established a natural gas extraction impact fee in 2012 by amending Title 59 (Oil and Gas) of the Pennsylvania Consolidated Statutes. Known as a drilling impact fee, the fee is levied on every owner of unconventional gas wells in the Commonwealth for each separate active gas well they operate.



Bonnybrook Road | Michael Baker International

Revenue generated by the Act 13 impact fee is distributed via a set funding formula, as follows:

- Off the top, \$25.5 million is allocated to certain state agencies annually. This funding has been used to offer several grant programs.
- 60 percent goes to the Unconventional Gas Well Fund and is distributed directly to counties and municipalities based on the number of wells located within the locality. Recipients of Unconventional Gas Well Funds are required to report how the funding is spent annually.
- 40 percent goes to the Marcellus Legacy fund, which allocates a portion of the Marcellus Shale Impact Fee to the Highway Bridge Improvement Restricted Account in the Motor License Fund. These funds are distributed to counties (proportionately based on population) and are to be used to fund the replacement or repair of locally owned (county; municipal), at-risk, deteriorated bridges.

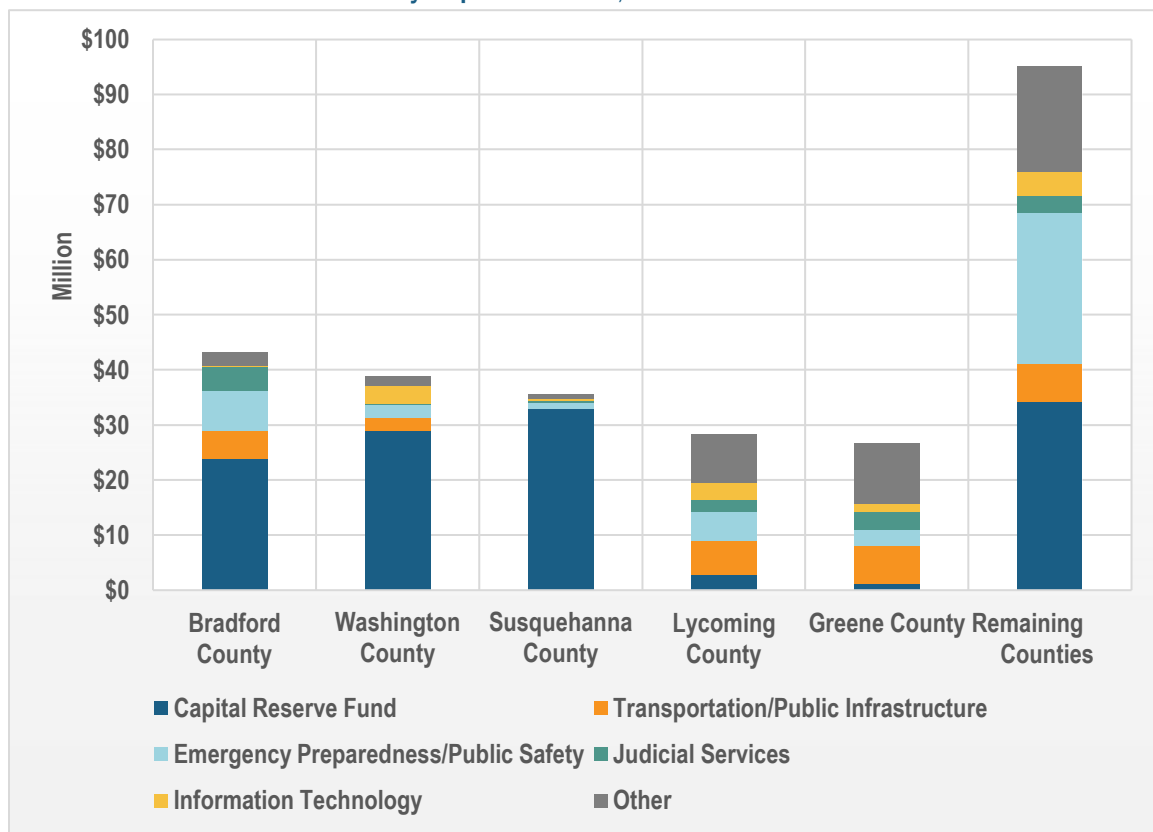
The Unconventional Gas Well Fund has and continues to generate millions of dollars every year that are directly allocated to counties and municipalities with active natural gas wells. Per Act 13, the funds may only be expended for 12 eligible uses, one of which includes the construction, reconstruction, maintenance, and repair of roadways, bridges, and public infrastructure.

Since 2011, \$266.4 million in funding from the Unconventional Gas Well Fund has been allocated to 37 of the 67 counties within the Commonwealth of Pennsylvania. As a stable, annual source of revenue, Act 13 funding represents a viable source that can help counties and municipalities address transportation infrastructure projects like local small bridges.

Interestingly, nearly 50 percent of all county Act 13 Unconventional Gas Well Funds have been diverted to capital reserves, making this the largest expenditure of the funds. Expenditures on emergency preparedness make up another 20 percent of county spending, followed by transportation and public infrastructure. In total, counties have only spent 7.6 percent, or \$25.9 million of \$266.4 million, of their Act 13 funding on transportation and public infrastructure.

The top five counties receiving Unconventional Gas Well Funds are Bradford, Washington, Susquehanna, Lycoming, and Greene Counties. These five counties have received total \$172.4 million and an annual average of \$5.0 million between 2011 and 2018. The remaining 27 counties eligible for funding received and expended \$93.9 million over the same period. Refer to Figure 5.

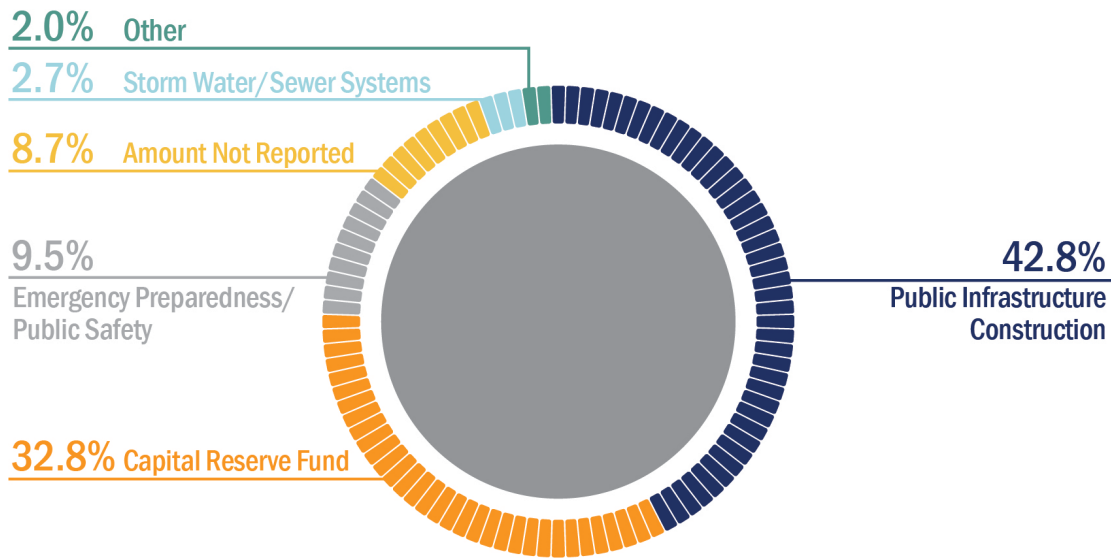
Figure 5 | Total Unconventional Gas Well Funding Expenditures by Top 5 Counties, 2011-2019



Source: Public Utility Commission, 2020

Among the municipalities that receive Unconventional Gas Well Funds, a total of \$451.8 million has been allocated between 2011 and 2017. Collectively, municipalities spent 42.8 percent of funding on transportation and public infrastructure, followed by an investment of 32.8 percent into capital reserve funds and 9.5 percent to improve emergency preparedness and public safety. Compared to counties, municipalities have been spending more funding on transportation and public infrastructure, although the municipal allocations are much less.

Figure 6 | Total Expenditure for Municipal Unconventional Gas Well funding, 2011 to 2017

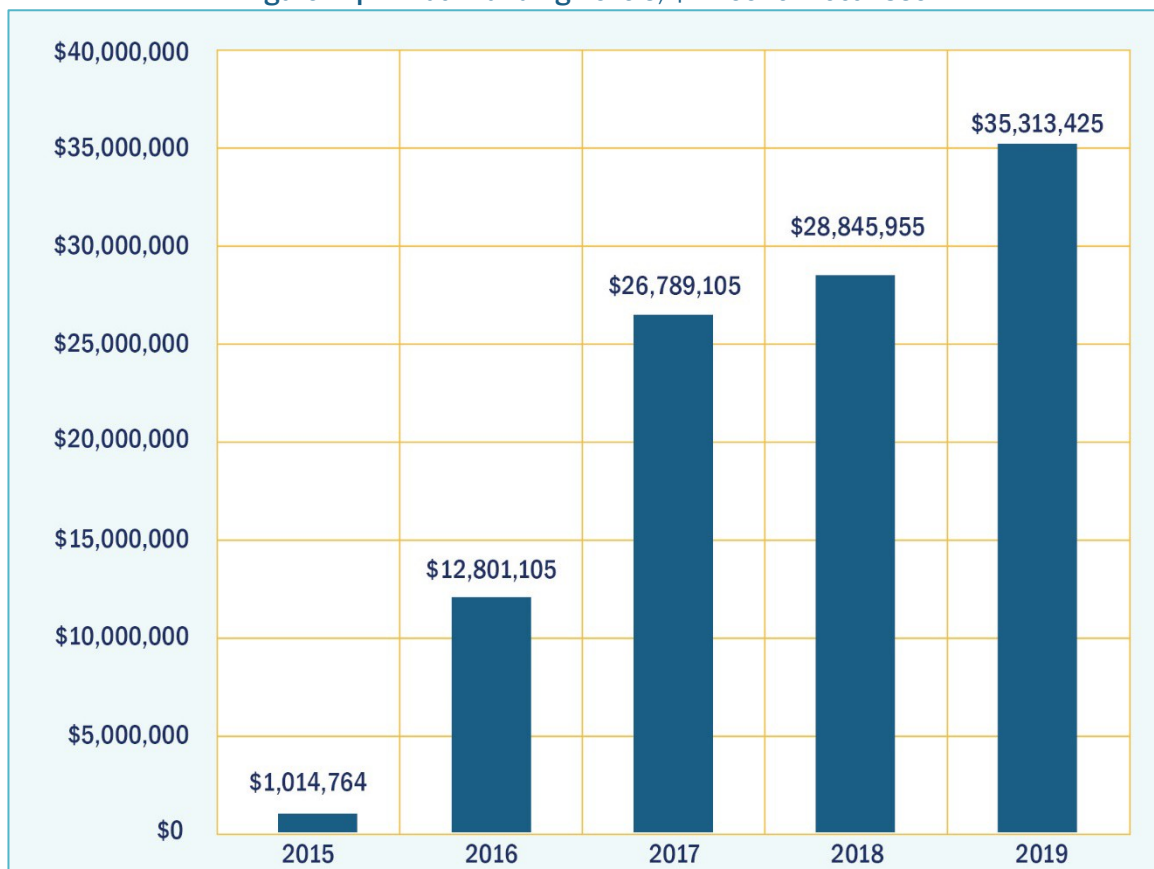


E. Yellow Breeches Road | Michael Baker International

Act 89 of 2013 - \$5 fee for Local Use

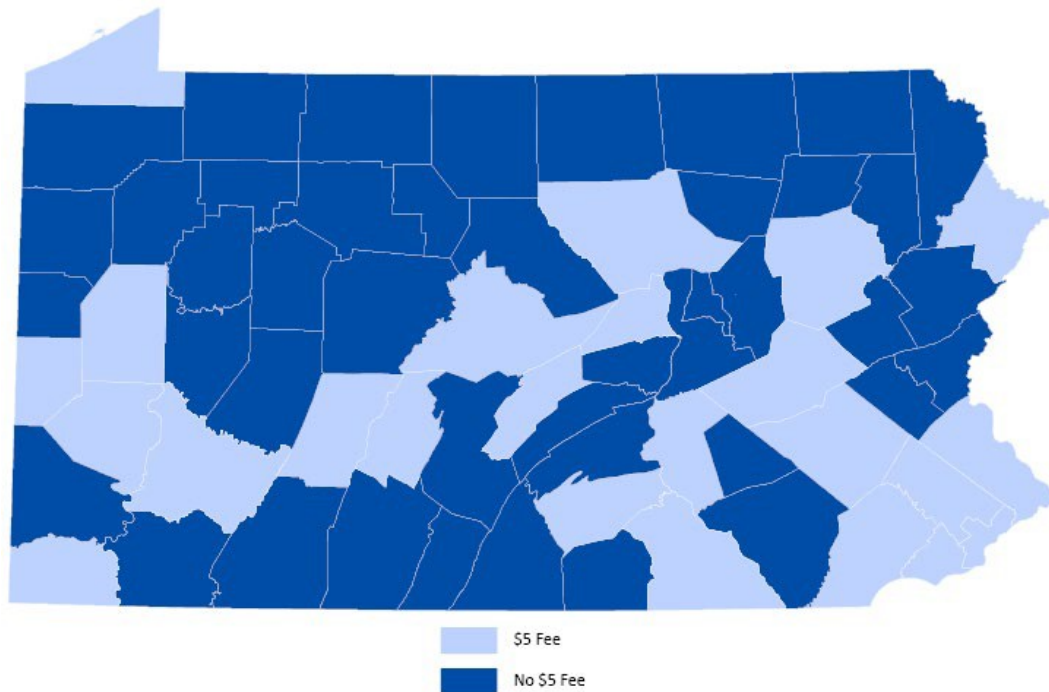
As part of the pivotal legislative package, Act 89 of 2013 establish a new “Fee for Local Use Fund” for Pennsylvania’s counties. These funds can be used for construction, reconstruction, maintenance, and repair of and safety on roadways and bridges. Specifically, the law allows counties to pass an ordinance permitting a \$5 annual fee to be charged for each vehicle registered within the county. The fee is collected at the time of registration or at registration renewal and can be collected at 1-year (\$5), 2-year (\$10), or 5-year (\$25) increments. In 2019, more than \$35 million was collected and distributed through the \$5 Fee for Local Use fund. Currently, 24 counties have adopted an ordinance and now collect the vehicle registration fee.

Figure 7 | Annual Funding Levels, \$5 Fee for Local Use



Source: Public Utility Commission, 2020

Figure 8 | Counties Participating in the \$5 Fee for Local Use Fund

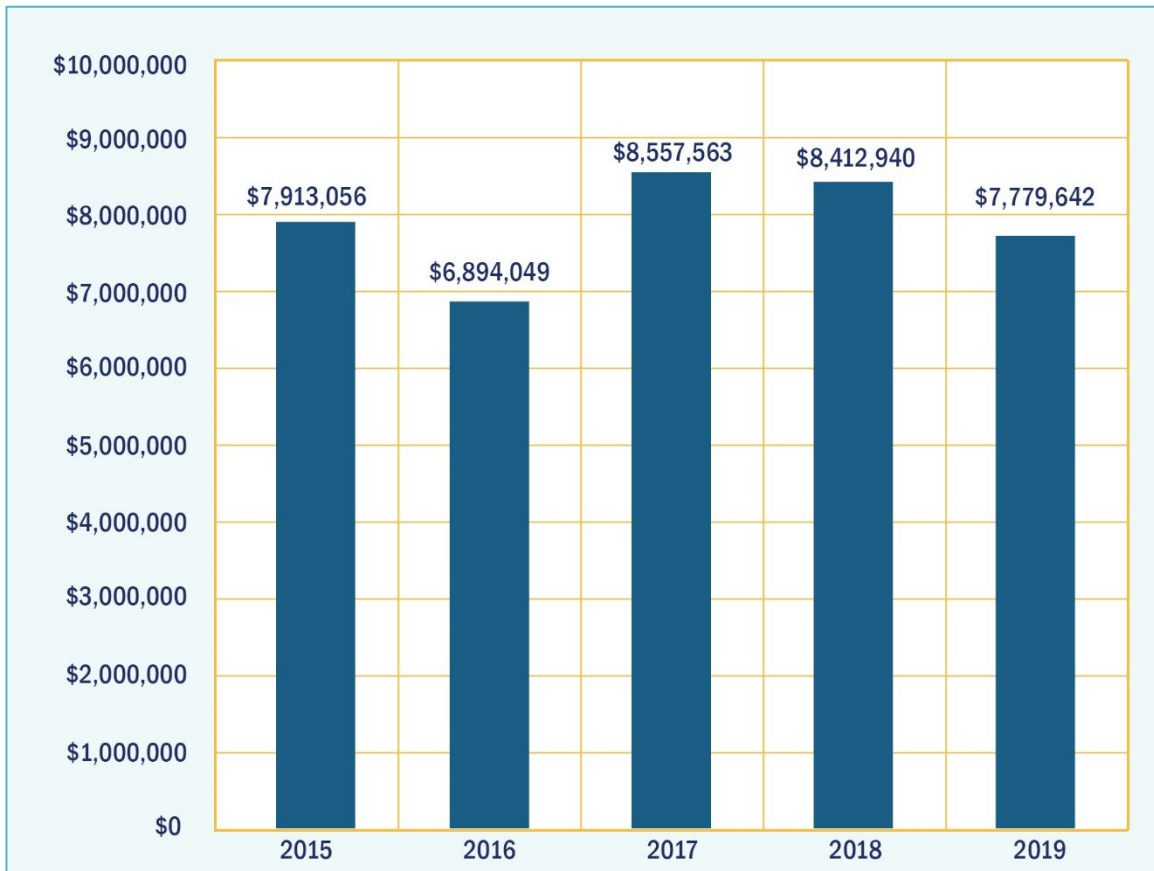


Source: PennDOT, May 2020

State Police Fines and Penalties

Each year, 50 percent of fines collected by the Pennsylvania State Police are distributed to municipalities across the Commonwealth. The distribution is based on the Municipal Liquid Fuels formula and is deposited into the municipalities' General Fund. Funds from fines and penalties can be used however municipalities deem necessary as there are not restrictions placed on its use. In 2019, nearly \$7.8 million was distributed to municipalities, down from \$8.4 million in 2018.

Figure 9 | State Police Fines and Penalty Payments to Municipal General Funds, 2015-2019

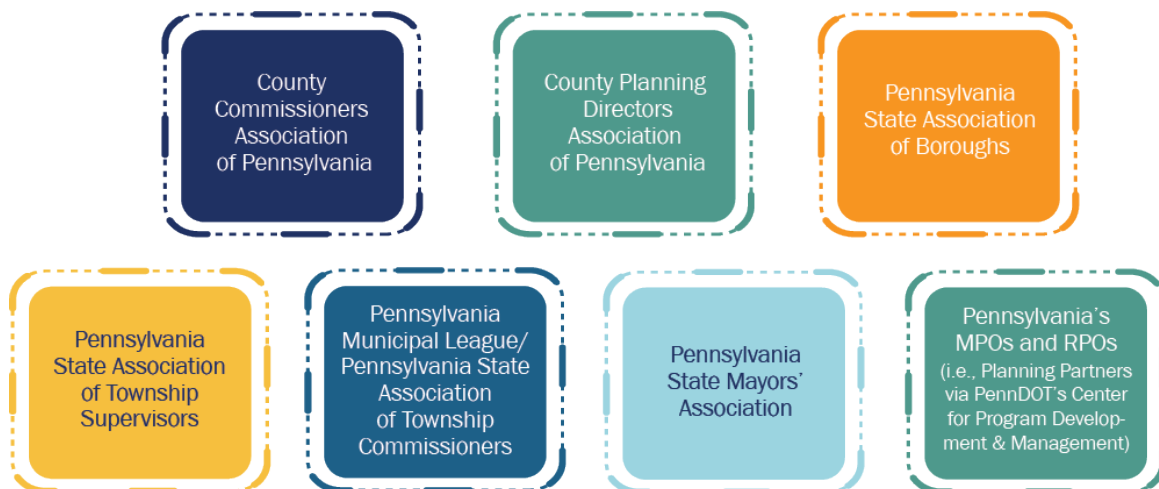


Source: STC, 2020

Local Perspective

Survey Overview

To understand the local perspective on small bridges in Pennsylvania, an online survey was developed and administered in early 2020 to solicit input from municipalities, counties, and the Planning Partners. Survey questions were designed to collect information on how organizations are inventorying and inspecting local small bridges as well as how they are funding maintenance, repair, and replacement. In addition, the survey was designed to help understand the limitations of implementing asset management from the local perspective.

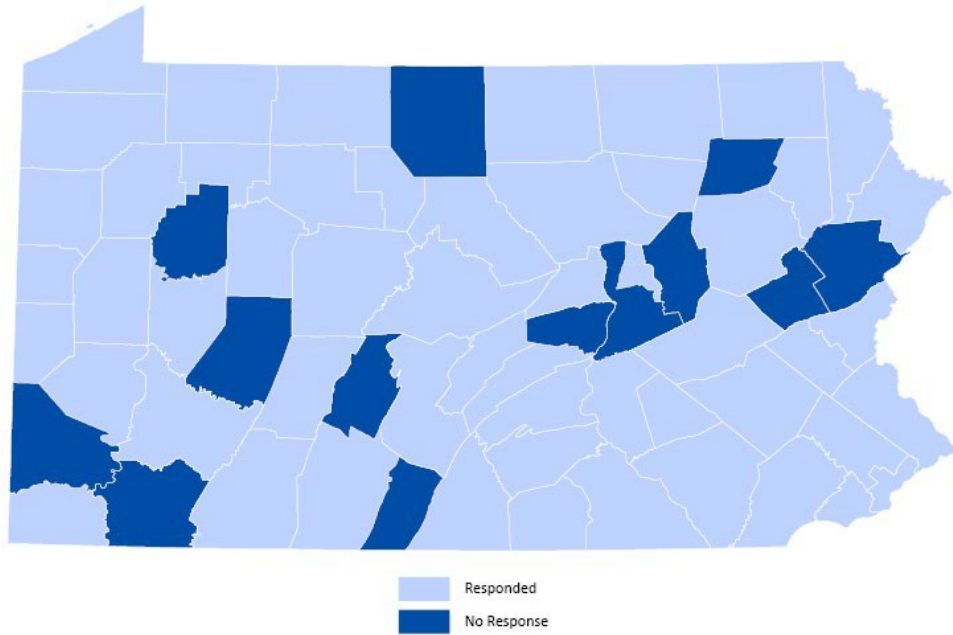


The survey was distributed to the Planning Partners, counties, and municipalities through the following organizations.

The survey was open from March 1, 2020, to April 30, 2020. In total, 651 survey responses were collected. Townships and boroughs represented 87 percent of all survey respondents, counties 8 percent, and all other organizational types 2 percent, as shown on Figure 10. In total, nearly 23 percent (581) of all Pennsylvania municipalities participated in the survey and 79 percent (53) of the Commonwealth's counties participated.

Following the survey period, the consultant team hosted a virtual follow-up meeting with nearly 50 survey respondents to obtain further insights to issues on and solutions to the management and maintenance of local small bridges.

Figure 10 | County (Top) and Municipal (Bottom) Survey Participants



Source: Michael Baker International Survey Results, 2020



Source: Michael Baker International Survey Results, 2020

Figure 11 | Type of Organization by Count



Source: Michael Baker International Survey Results, 2020

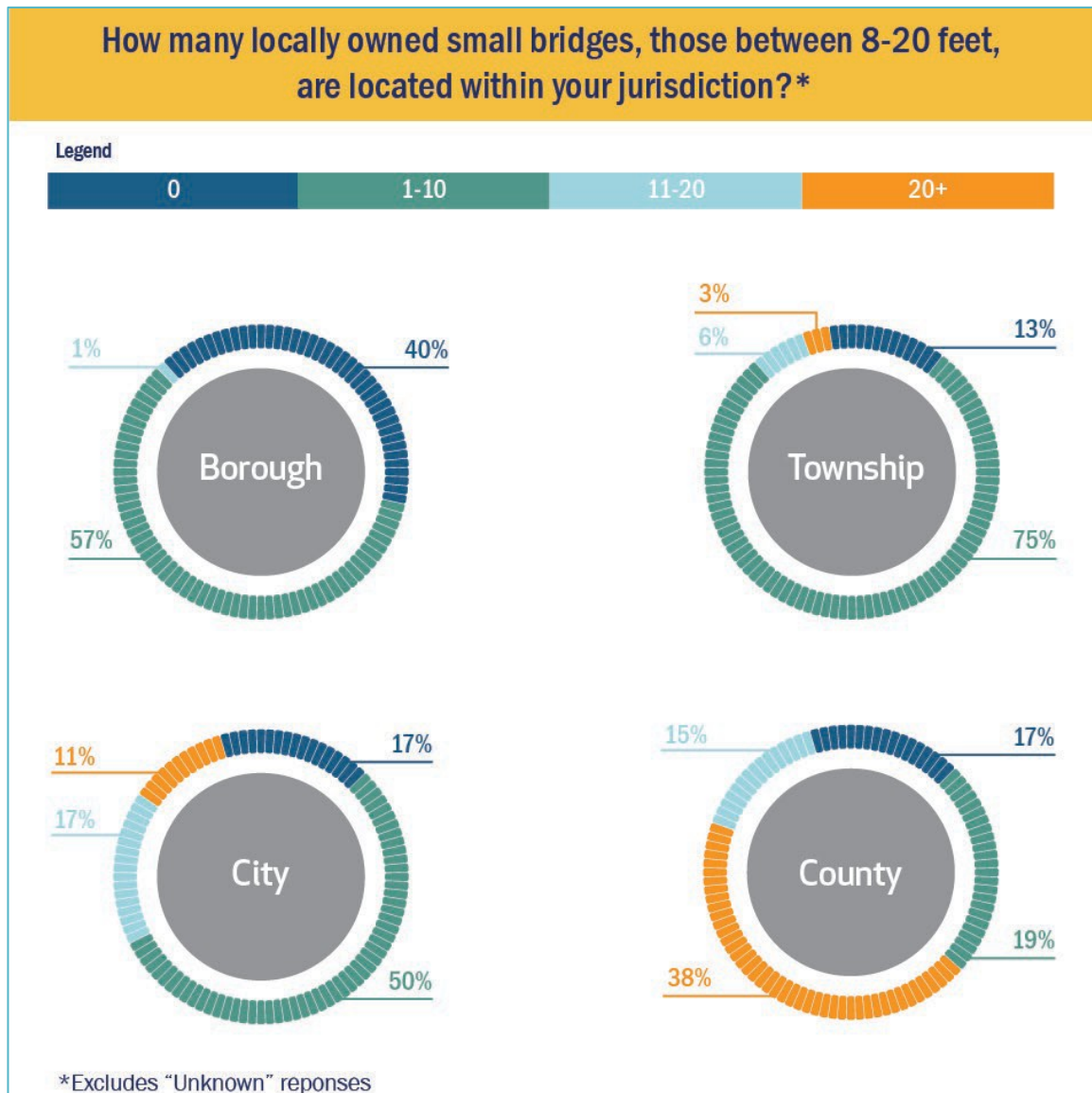


Oakbourne Bridge | Michael Baker International

Number of Bridges by Organizational Type

Of the municipalities completing the survey, the majority of the townships and boroughs have less than 10 local small bridges. For the counties that participated, 38 percent own 20 small bridges or more, 15 percent between 11 and 20 bridges, and 36 percent reporting 10 bridges or less. See Figure 12. This distribution is fairly representative of the statewide averages as reported in Table 2; the average number of local small bridges per township is 5 and per county is 15.

Figure 12 | Number of Local Small Bridges by Organizational Type



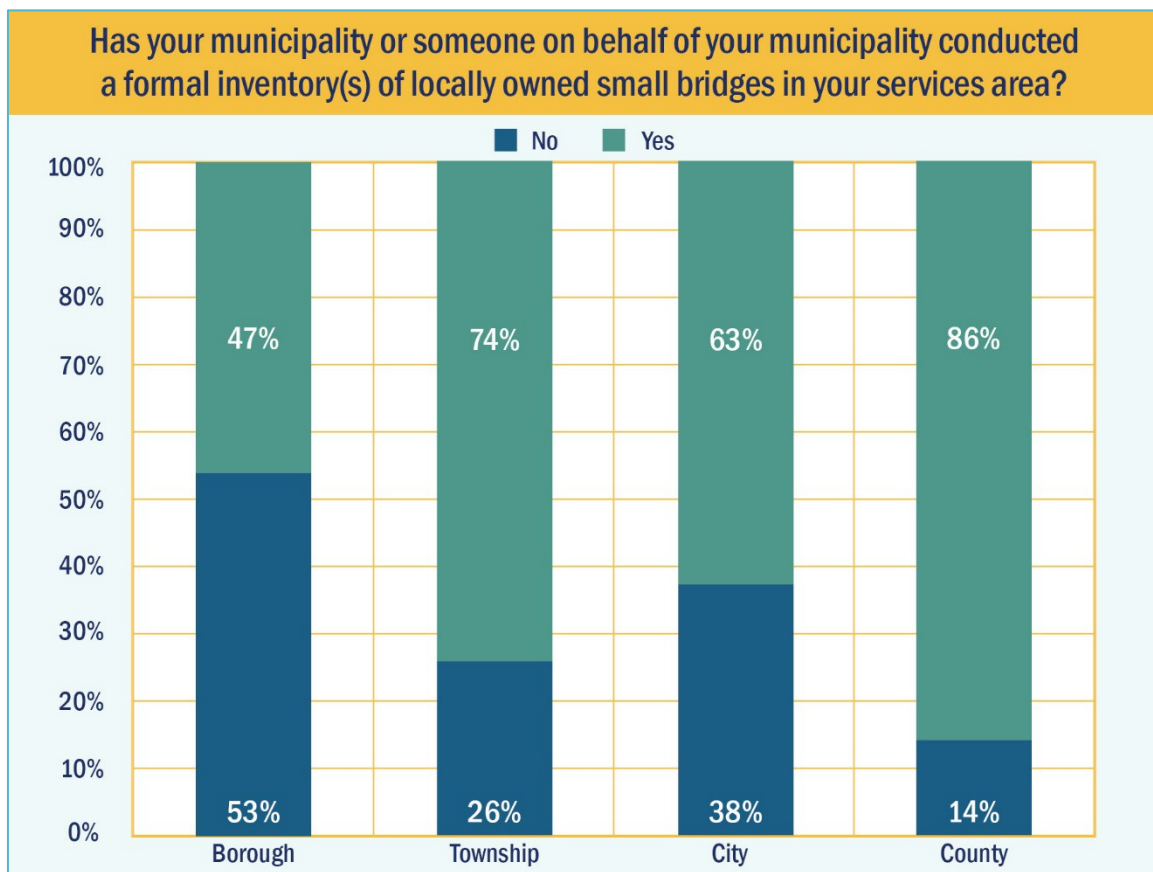
Source: Michael Baker International Survey Results, 2020

Inventory Practices

The survey asked respondents if their organizations maintain a formal inventory of their local small bridges and, if so, how the inventory is maintained. For example, organizations could use a paper list, electronic list (e.g., Excel file), or a spatial database such as a Geographic Information System (GIS). The survey results suggest boroughs are most likely to not have a formal inventory of their local small bridges, followed by cities. Townships, at 74 percent responding yes, are more likely to complete and maintain formal inventories. Counties also reported high rates of completing formal inventories, although counties may be referring to the PennDOT statewide inventory effort that was conducted in 2011-2012.

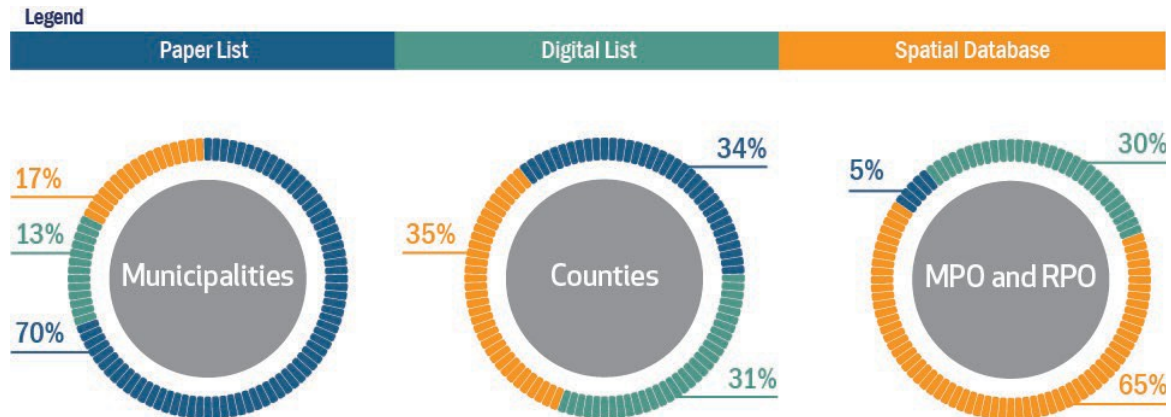
The findings suggest that counties and townships have more capacity to conduct inventories than do boroughs and cities. Interestingly, 13 of the 16 MPOs and RPOs that responded to this survey question also indicated they maintain a formal inventory of local small bridges within their jurisdiction. Again, this may point back to the 2011-2012 statewide inventory.

Figure 13 | Formal Inventory Practices



Of the organizational types, municipalities are the most likely to maintain a paper list of their bridge inventory, with 70 percent reporting their inventories are maintained on paper. Of the responding counties, 34 percent also report using paper lists. The Planning Partners are much more likely to use spatial tools, such as GIS, to inventory their bridges. Only 17 percent of municipalities and 35 percent of counties use a spatial database for inventory purposes.

Figure 14 | Inventory Management



Source: Michael Baker International Survey Results, 2020

Based on follow-up dialogue with survey participants, it is understood that some municipalities are relying on institutional knowledge as their informal inventory resource.

Planning Partners noted that while they do have GIS inventories in place, keeping the databases up-to-date is often a challenge. The lack of funding and staff time constraints were noted as limiting factors in updating databases. This qualitative information suggests that some or all of the 13 MPOs and RPOs with inventories developed them during the 2011-2012 statewide effort but have not updated them because there has been no ongoing inventory funding by PennDOT.

Some municipalities rely on institutional knowledge as their informal local small bridge inventory resource.

Bridge Inspection

Inspecting bridges at regular intervals helps local owners identify structural deterioration (i.e., risk of structural safety or serviceability loss) in a predictable manner over time.² Although neither PennDOT nor FHWA policy currently requires local small bridges (20 feet in length or less) to be inspected, some local governments choose to conduct inspections as part of their asset management program.

As shown in Figure 15, 73 percent of respondents report inspecting all or some of their local small bridges, while 28 percent of respondents report they do not conduct routine inspections. In terms of the different organizational types, the survey results suggest approximately 75 percent of all organizations, including municipalities and counties, are conducting routine inspections. Approximately one-quarter of all organizations, however, are not completing routine inspections.

Figure 15 | Routine Local Small Bridge Inspections



Source: Michael Baker International Survey Results, 2020

For organizations reporting that they do not routinely inspect structures, the respondents indicated that the lack of an inspection mandate as well as the lack of funding are the two primary factors. To a lesser extent, the lack of inspection standardization was also cited as a factor.

During follow-up dialogue with survey participants, a consultant engineering firm indicated that municipal clients generally have not prioritized inspecting small bridges, unless there is a problem with a specific bridge. When there is a problem, the

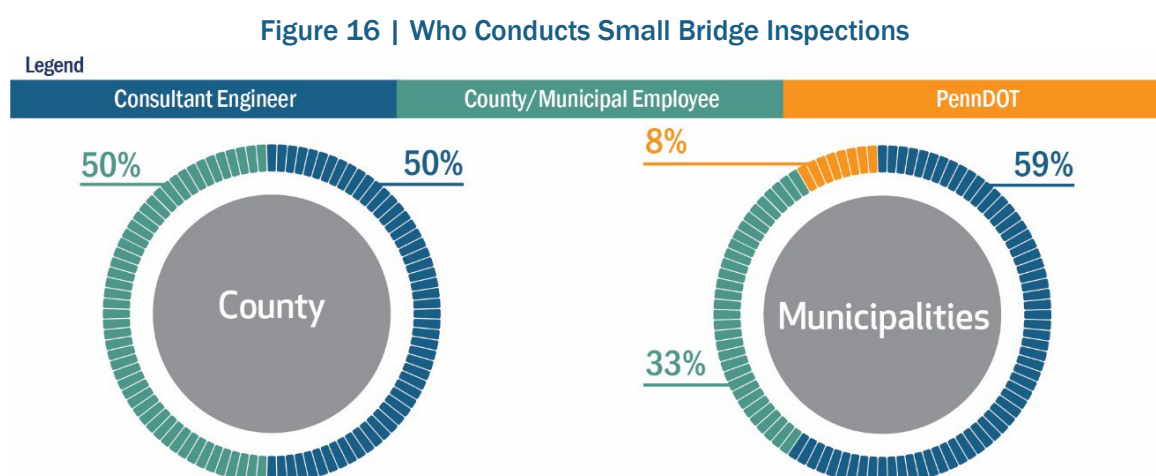
² U.S. Department of Transportation, Federal Highway Administration. Risk-Based, Routine Inspection Interval Implementation Guidance. June 8, 2018. <https://www.fhwa.dot.gov/bridge/nbis/180608.pdf>

unplanned nature of it results in a “scramble” to assess the condition. Anecdotally, many small bridges that need to be closed are not on high travelled routes, but the roads still affect emergency response, school bus routes, trash services, and local commerce.

Inspection Process

The survey asked respondents who their organization uses to conduct inspections. For municipalities, municipal employees, at 59 percent, typically conduct local small bridge inspections. In addition, 33 percent of municipalities are utilizing their consultant engineer and 8 percent report using PennDOT (PennDOT support may vary by District).

In counties, the survey findings suggest both in-house staff and consultant engineers are commonly used.



Source: Michael Baker International Survey Results, 2020

The survey also asked respondents how frequently inspections are conducted. Overall, fewer participants were able to answer this question; only 222 of the 651 participants responded to the question. Of those that did respond, the survey data shows that annual and biennial inspections are most prevalent, at 68 percent of all responses. This survey finding demonstrates that many local organizations are routinely inspecting their local small bridges.

The survey results indicate that inspection data is submitted to PennDOT approximately 50 percent of the time, regardless of owner. For those that indicated they do not submit the data, the fact that PennDOT does not require the data to be submitted was a common reason given.

Asset Management

Asset management is a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both safety and financial impact. An asset management analysis is intended to outline when maintenance, preservation, repair, rehabilitation, and replacement actions should occur for the purpose of sustaining a state of good repair over the life cycle of the assets at minimum practicable cost. Requirements for asset management were set forth by MAP-21 and the FAST Act to help departments of transportation develop and implement risk-based asset management plans for the National Highway System (NHS). PennDOT utilizes the Pennsylvania Transportation Asset Management Plan (TAMP) to:

- Establish targets for NHS pavement and bridge condition, in compliance with FHWA-required condition thresholds;
- Summarize Pennsylvania's inventory of NHS pavement and bridge assets by structure type, class, owner, and condition;
- Forecast NHS asset condition by year for at least a 12-year planning horizon at current funding levels; and
- Outline PennDOT's asset management practices, which are integrated into long-range planning, project programming, financial planning, and risk assessment processes.³

Although the TAMP is focused on the NHS per FHWA requirements, asset management is also a best practice for municipalities managing a range of infrastructure—it allows the greatest value to be derived from investments in infrastructure, which is especially important given the tight budgets all municipalities are facing.

A significant percentage of respondents (85 percent) indicate there is not an asset management plan for their local small bridges. In fact, only 15 percent of municipalities indicate they have an asset management plan and only 9 percent of counties report the same. Of the municipalities and counties that indicate they are conducting routine inspections for all or some bridges, only 10 percent reported they have an asset management plan (refer to Figure 18 on page 41). In addition, 43 percent of Planning Partners report utilizing an asset management plan, but more than 50 percent of Planning Partners are not.

The survey findings suggest that even if organizations are conducting local small bridge inspections and maintaining an inventory, more than three-quarters are not using the information for proactive asset management.

³ <https://www.penndot.gov/ProjectAndPrograms/Asset-Management/Pages/default.aspx>

The implication of the survey findings, from this question as well as the inspection and inventory questions described above, suggest that even if organizations are conducting inspections and maintaining an inventory, they are not utilizing the information to proactively manage bridge assets.

Figure 17 | Asset Management Plans for Small Bridges



Source: Michael Baker International Survey Results, 2020



Alexander Springs Road | Michael Baker International

Figure 18 | Percentage of Municipalities and Counties Conducting Routine Small Bridge Inspections



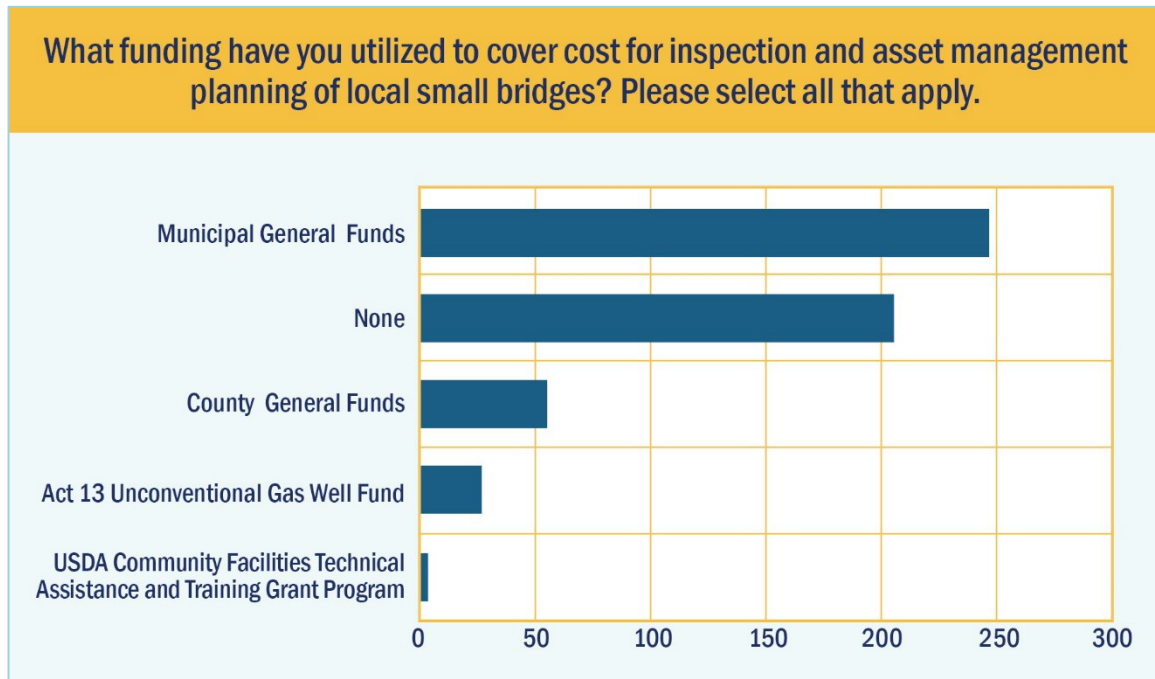
Source: Michael Baker International Survey Results, 2020

Funding for Local Small Bridges

The online survey asked a series of questions regarding how local organizations are funding their inventory, inspections, and maintenance costs associated with local small bridges. Not surprisingly, municipal general funds were reported as the predominant source of funding, or municipalities reported having no local small bridge funding at all. Additionally, municipal Liquid Fuels funding is also used.

In Pennsylvania, there are a variety of funding mechanisms that can be used to help maintain local bridges, such as those funding sources outlined in Figure 20 on page 44. The Dauphin County Infrastructure Bank is an example of an innovative county-level program used to fund transportation projects, including bridges. The County invested surplus Liquid Fuels funds to leverage state funding (Pennsylvania Infrastructure Bank loan) to create a revolving loan fund with very favorable rates. To date, approximately \$20 million in local transportation projects have been completed in the past 6-7 years. Additional case study examples are described in the State of the Industry Practices of this report.

Figure 19 | Funding Sources for Inspection and Asset Management

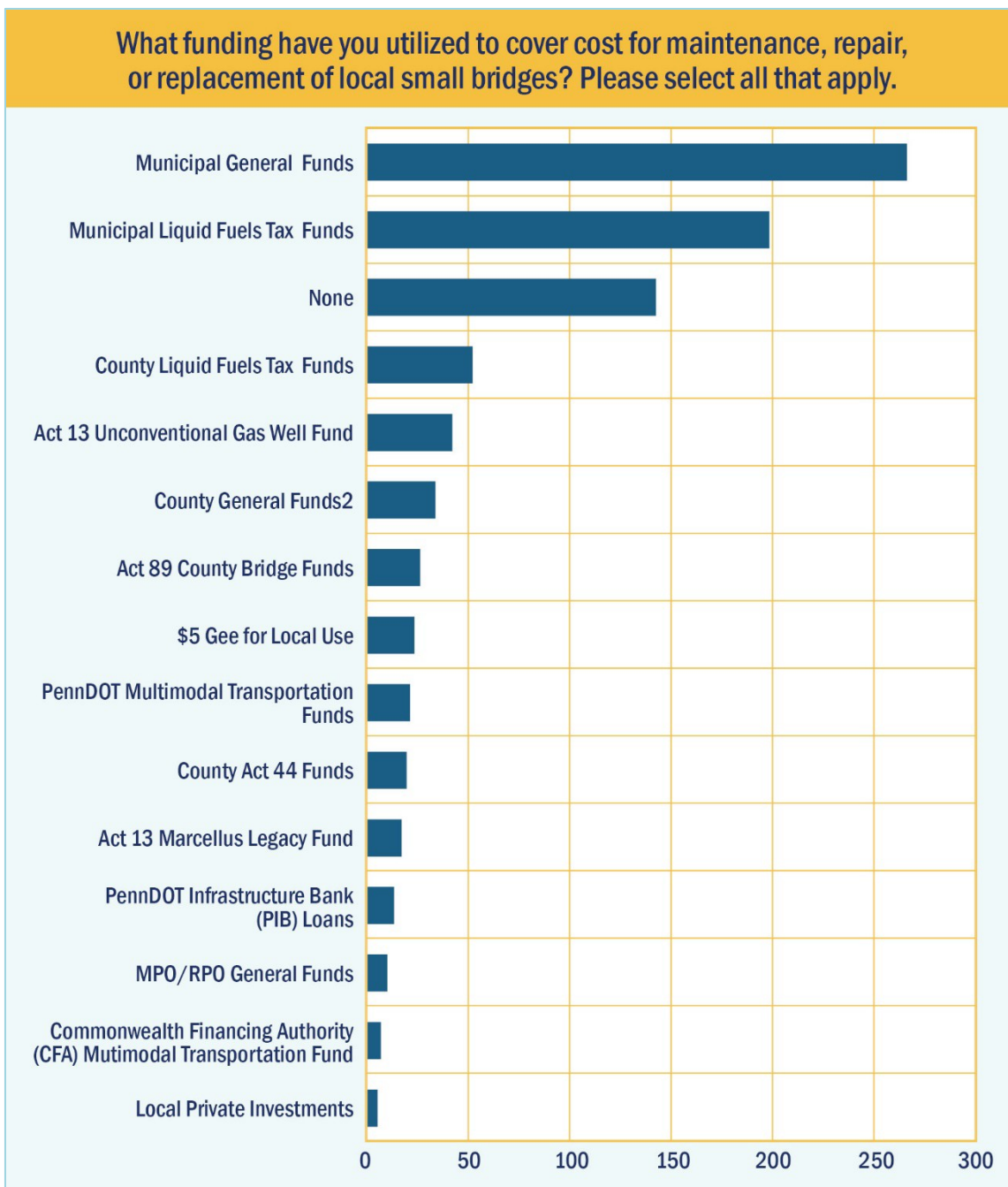


Source: Michael Baker International Survey Results, 2020



Alexander Springs Road | Michael Baker International

Figure 20 | Funding Sources for Capital Improvement



Source: Michael Baker International Survey Results, 2020

Survey Findings

Key findings from the online survey include following.

- Survey results suggest that boroughs are most likely to not maintain a formal inventory of their local small bridges, followed by cities. Townships, at 74 percent responding yes, are most likely to complete and maintain formal inventories. Both counties and the Planning Partners also reported high rates of completing formal inventories.
- Only 17 percent of municipalities and 35 percent of counties are utilizing a spatial database for inventory purposes. Municipalities are the most likely to maintain a paper list of their bridge inventory, with 70 percent reporting their inventories are maintained on paper.
- Survey results suggest approximately 73 percent of all organizations, including municipalities, counties, and the Planning Partners, are conducting routine inspections.
- For municipalities, municipal employees, at 59 percent, typically conduct local small bridge inspections while 33 percent of municipalities are utilizing their consultant engineer. This finding suggests that training for municipal staff is important because municipalities rely on in-house staff for inspections.
- The survey findings suggest inspection data is submitted to PennDOT by approximately 50 percent of all organizations, regardless of type. Since there is no mandate, submission is voluntarily.
- Survey findings suggest that while organizations are often conducting inspections and even maintaining an inventory, they are not utilizing the information to proactively manage bridge assets. In fact, only 11 percent of municipalities indicate they have an asset management plan and only 6 percent of counties report the same.
- Municipal general funds and liquid fuels were reported as the predominant sources of funding for inventorying, inspecting, and maintaining locally small bridges. Unlike most other sources identified in Figure 20, municipalities maintain a significant level of control and authority over their general fund and liquid fuel dollars and therefore are able to readily allocate these resources to support their local bridge management and maintenance activities. Many of the other sources are controlled at either the county or state levels, and certain funding mechanisms like the Pennsylvania Infrastructure Bank (PIB) are not well known or understood as an effective financing option.

State of the Industry Practices

Summary of Industry Practices

The following sub-sections review both national and statewide practices for improving the inventory and maintenance of local small bridges. As presented in Table 5, the research findings demonstrated there are five primary programs and initiatives being utilized to help improve the long-term viability of local small bridges.

Table 5 | Case Study Initiatives to Address Small Local Bridges

PRIMARY PROGRAMS AND INITIATIVES	DESCRIPTION
Bridge Bundling	A bridge bundling program is a program that “targets a defined set of bridges that are planned for preservation/preventive maintenance, rehabilitation, or replacement in a timely and efficient manner through a series of bridge bundling contracts with the support of various funding options and/or partnerships and may include a program completion time frame”. ⁴
Asset Management/Inventory	<p>A bridge asset management/inventory contains information for bridges based on inspections including but not limited to location, owner, length, structural reliability, and condition. Maintaining an asset management/bridge inventory is beneficial in making informed and effective decisions on the operation, maintenance, preservation, replacement, and improvement of bridges in a bridge inventory.</p> <p>In order to receive local road and bridge matching grant funds, Indiana DOT required local agencies to have a current asset management plan for roads and bridges, allowing Indiana to expand their asset management for bridges and roadway and improve their understanding of local infrastructure conditions.</p>

⁴ https://www.fhwa.dot.gov/ipd/pdfs/alternative_project_delivery/bridge_bundling_guidebook_070219.pdf

PRIMARY PROGRAMS AND INITIATIVES	DESCRIPTION
Infrastructure Bank	An infrastructure bank is a source of funding for infrastructure improvements. An infrastructure bank uses a small investment to provide loan funding for infrastructure projects. As loans are repaid, the bank funds are replenished, creating a revolving loan fund to finance future infrastructure project.
Redundancy Studies	Redundancy studies are conducted to identify operationally redundant bridges for closure and removal. Identifying redundancy bridges can help in prioritizing future bridge rehabilitation or replacement projects.
Policies and Legislation	Policies and legislation can be re-written and adapted to better manage and maintain local bridges. In 2001, Maine amended the local bridge program policies to redefine bridge classification and clarify capital/maintenance responsibility for the structures.

Source: Michael Baker International Research Findings

National Best Practices

Nationally, most bridge discussion and research focuses on bridges longer than 20 feet due to the federal requirements to regularly inspect these structures. Some states have begun to consider small bridges as part of their transportation infrastructure programs and policies. The three case studies outlined below describe the design, funding, and policy related to local small bridges in peer states and offer suggestions for how Pennsylvania could begin to revisit its local small bridge inventory.

Indiana Reporting Requirements

In 2016, the Indiana State Legislature created a local road and bridge matching grant fund. This dedicated funding pool provides local governments with a 50% match for local projects up to \$1,000,000. To be eligible for the grant, the local agency must have a current asset management plan for roads and bridges. The plans must meet Indiana DOT (INDOT) requirements which were set to maximize flexibility for local officials while ensuring quality and consistent data is provided across the state. The plans require basic asset information such as structure length and location to facilitate the creation and maintenance of a statewide database by INDOT. For bridges, NBIS sufficiency ratings are required. INDOT supports local agencies creating plans by offering clear and simple guidance on the plan structure and offering training in advance of the first grant period opening. The first year, over 50% of local governments

submitted asset management plans, significantly improving the state's understanding of local infrastructure condition. Over time as different agencies submit plans, INDOT will continue to improve the statewide local inventory and its understanding of the local transportation system. Local agencies are investing time and resources to conduct condition assessments. The available incentive must be large enough to spur action for local agencies that might not otherwise be interested.

Minnesota Culvert Pipe Service Life and Maintenance Study

In 2011-2012, the Minnesota Department of Transportation (MnDOT) commissioned a study by the University of Minnesota to evaluate the factors affecting the service life of culvert pipe materials and develop guidance on material selection to be incorporated into MnDOT's hydraulic evaluation materials. The study, completed for \$30,000, was able to recommend several changes to the design and construction phases of culvert pipes including projecting the design life of pipes to 100 years for cross drains. The impetus of the study was due to the significant cost associated with road closures and repairs to replace pipe under the road. A follow-up 2014 study looked at the cost and effectiveness of different repair and maintenance strategies on the life of culvert pipes. Taken together, these two studies allowed MnDOT to create a culvert-specific life-cycle cost model to guide decisions during the design phase that support long life and manageable maintenance once constructed.

Culverts are a significant portion of local small bridges for many organizations in Pennsylvania. As one component of asset management, PennDOT could create guidance materials for pipe selection and maintenance practices to support local agencies in the management of their culverts.

Maine Inspection and Funding Legislation

In 2001, the Maine State Legislature rewrote the policies for the state's local bridge program. The new program classified structures in the state as "bridges" being over 20 feet and "minor spans" being between 10 and 20 feet. It further divided these two classes depending on the owner and average daily traffic (ADT) count. The classification of a structure dictates the amount and type of state funding available for maintenance and improvements to the structure. Minor spans on local roadways are available for limited technical support from the state but are generally the responsibility of the local government and not eligible for state funds. However, in return, the state now takes responsibility for all maintenance and improvements of most bridges, including those on local roadways. The exception is "low-use" bridges with average daily traffic (ADT) of less than 100 and "redundant" bridges where the ADT times the length of the detour, in miles, is less than 200. "Low-use" and "redundant" bridges on local roads are strongly encouraged to be reviewed for closure. If a local agency wants to maintain a structure, it is responsible for all maintenance and can petition the state for a 50/50 share of capital responsibility.

This legislative change shifted responsibility between different levels of government and was only put in place after extensive discussions between representatives from all involved parties. Limiting responsibility to bridges allowed Maine DOT to better leverage federal bridge funds and shift state level funding to other local funding streams. The state assumed extra responsibility for bridges on local roadways but cut back on support and funding available for “minor spans.”

Legally requiring critical review of “low-use” structures may result in the closure of such structures though the blanket definition of less than 100 ADT. This may not be appropriate for rural parts of Pennsylvania where the region’s economy depends on heavy agricultural vehicles having efficient access to various properties. PennDOT could explore policies that limit or exclude certain low use or redundant structures from receiving state funding as a way to prioritize limited funding. It would be important to allow redundant or low-use structures to be eligible for state funding related to the closure and removal of the structure.

Pennsylvania Best Practices

Across the Commonwealth, local government organizations at every level have developed innovative solutions to address the inventory, maintenance, and replacement of locally owned bridges. Some of the case studies highlighted focus specifically on small bridges. Others have created programs for large bridges that could be modified to include small bridges or broader infrastructure systems that include small and large bridges.

The case studies highlight how counties and Planning Partners can work with municipalities to build capacity and provide regional approaches and solutions for local small bridge asset management. Many of the case studies include multiple levels of government working together with the private sector to leverage resources and expertise.

Table 6 | Summary of Case Studies

COUNTIES	TOOLS	DESCRIPTION	BRIDGES	COST	ACTIVE
Butler County	Infrastructure Bank	A county infrastructure bank was established in 2017 to support local municipalities for infrastructure improvements. The bank uses Act 13 funds and projects must also be eligible under Act 13.	-	-	2017 - Present

COUNTIES	TOOLS	DESCRIPTION	BRIDGES	COST	ACTIVE
Centre County	Asset Management/ Bridge Inventory	100 bridges were identified during the inventory. 24 bridges were observed to be severely deteriorated and reported to the local municipality for further inspection.	100	-	2013 - 2014
Centre County	Bridge Bundling	Using funding from the Multimodal Transportation Fund, Act 13 and Act 89, two bridge bundling projects were initiated to complete three bridge rehabilitation and two box culvert replacement.	5	4.95 million	-
Cumberland County	Asset Management/ Bridge Inventory	Cumberland County inventory local bridges and develop a capital improvement plan to maintain, repair, replace the bridges.	28	~\$40 million	2009
Cumberland County	Bridge Bundle	Funding from the Pennsylvania Infrastructure Bank and \$5 registration fee allowed Cumberland County to bundle three bridges together.	28	~\$4.7 million	2019 - 2021
Dauphin County	Infrastructure Bank	The Dauphin County Infrastructure Bank has supported nine municipal bridge projects from 2015 to 2020.	9	-	2013 - Present
Dauphin County	Bridge Bundling	The bridge bundle includes nine county bridges and up to 12 municipal bridges.	21	~\$20 million	2019 - 2021

COUNTIES	TOOLS	DESCRIPTION	BRIDGES	COST	ACTIVE
DVRPC (Bucks, Chester, Delaware, Montgomery, and Phila. Counties)	Managed Competitive Program and PennDOT Retro- Reimbursement Process	Two different competitive programs were established cooperatively by the MPO, PennDOT District 6, and MPO regional member governments to set aside federal and state funds to advance and prioritize local county and municipal bridge structures. In addition to the typical PennDOT design and review process, PennDOT's Retro-Reimbursement Process is also employed.	51	\$153 million	2012 - Present
Lycoming County	Asset Management/ Bridge Inventory	The inventory identified 83 new local small bridges and conducted a quick condition assessment. This assessment was not an in- depth inspection in accordance with NBIS requirements and initial inspection were estimated to be \$165,000.	83	\$165,000	2009 - 2010
Lycoming County	Bridge Bundling	The bridge bundle includes 17 municipal-owned bridges that need replacements and rehabilitations. The selection was made based on the BMS2 data and municipality outreach.	17	6.8 million	2020 - 2024
Northampton County	Bridge Bundling	Northampton County used a P3 program to bundle and replace their bridges. The bundle also includes 10 years of maintenance on the bridges.	281	\$34 million ¹	2017 - 2030
Northwest Pennsylvania RPO	Redundancy Study	The Northwest RPO conducted a redundancy study to identify potential bridges for closure and removal that are operationally redundant.	33	-	2016

¹ The bundle originally included 33 bridges and a total of 38.5 million but in 2019 seven bridges and \$4.5 million were removed from the program contract.

Northwest Redundancy Study

In 2016, the Northwest Pennsylvania Regional Planning and Development Commission (the Commission), undertook a five-county study to look at the aging local bridges (over 20 feet) in the county and identify possible redundant structures to consider for closure and removal. At the time, there were 338 permanent bridges over 20 feet long on locally owned roads in the counties of Clarion, Crawford, Forest, Venango, and Warren in Northwest Pennsylvania.

To determine if a structure was considered redundant, the Commission followed an established PennDOT study process outlined in Appendix AD of Publication 10X. This 10-step process uses bridge condition information from PennDOT's BMS2 database and GIS mapping to identify structures based on average traffic volumes, structure condition, detour length, and potential impacts to local residents, businesses, and emergency responders.

In total, 45 bridges, or 13 percent of total local bridges greater than 20 feet within the five counties, were identified as possibly redundant. Field visits to each of the 45 identified bridges were conducted to analyze redundancy and outline findings. The Commission also utilized several public meetings in the area to gain feedback from local residents.

In total, 33 bridges were identified as redundant and recommended for permanent closure and removal. Seven of the bridges were already closed, but funding had not been secured for structural removal. In an effort to manage the impacts of bridge closures and removals, mitigation strategies were performed to identify detour routes able to handle higher traffic volumes, detour signing, and the development of turnaround solutions.

As local municipalities work on updating inventories and creating asset management plans for local small bridges, redundancy studies can be an important tool. Identifying redundant structures can help prioritize funding and eliminate excess burden on tight infrastructure budgets. Municipalities with redundant structures will need to secure funding to safely remove structures identified as redundant.

Lycoming County Local Inventory Pilot

In 2009 and 2010, in partnership with PennDOT and the Williamsport Area MPO, the Lycoming County Planning Commission (LCPC) completed a comprehensive inventory of all locally owned bridges between eight and 20 feet long. Lycoming County did not own any of the bridges, but understood from local municipalities that the total number, location, and condition of local small bridges in many communities were unknown.

Lycoming County is the largest county in the Commonwealth by land area, with over 1,500 miles of locally owned roads crossing over a mountainous 1,200 square miles.

The size of the county made manually surveying every mile of roadway unrealistic, so county officials used Geographic Information Systems (GIS) to develop a shortlist of possible local small bridge locations. The list was created by first comparing local roadways with known water flow locations to determine where bridges were likely to exist. Next, the locations of bridges over 20 feet in length were removed, leaving a total of 1,144 possible locations for local small bridges. These locations were mapped and presented to municipal officials who were able to share local insights on many of the locations, confirming that in many of the locations water flow was served by a small pipe that would not qualify as a bridge. A total of 172 sites were identified for a field visit.

The field visits were completed by PennDOT District 3-0 Municipal Services staff who identified a total of 83 structures that qualified as local small bridges. When a qualifying structure was located, data was collected to be entered into the PennDOT BMS2 bridge database and a quick conditions assessment was conducted. The conditions assessments were possible because Municipal Services staff are certified bridge inspectors with PennDOT.

In addition to creating a database of local small bridges, the program also created a workplan and cost estimate to develop a systematic inspection program for local small bridges. It was estimated initial inspections of the 83 structures would cost approximately \$165,000, with future costs lower depending on the frequency of inspections and number of structures in poor condition. Lycoming County used County Liquid Fuels funds in 2010 to conduct initial inspections in all municipalities that agreed to participate in the program.

The information gathered from the program has been used to inform transportation planning and investment priorities in the county. Continuation of the program and routine inspections of local small bridges is dependent on continued funding. Lycoming County officials view investing in the inspection and repair of the local transportation system as a critical piece to economic development for the county, specifically as it relates to the natural gas industry. Local municipalities are not required to participate in the inspections, and some opt out for different reasons. Responsibility for municipally owned structures remains with the municipalities but Lycoming County has shown how county officials can leverage resources and lead programs for structures within their jurisdiction. The economic impacts of local small bridges do not stop with the structure owners. Counties and nearby regions can be impacted by the condition of the local transportation network.

Lycoming County Bridge Bundling Program

In 2019 and 2020, Lycoming County partnered with 17 local municipalities to replace or repair 17 bridges throughout the county. Of these 17 bridges, 10 are small bridges under 20 feet in length. All were owned locally by municipalities and were only identified for replacement through the comprehensive county-led inspections completed in 2009 and 2010.

The Bridge Bundle Program was facilitated through memorandum of understanding between each municipality and the County to temporarily provide Lycoming County authority over the structures. The total cost for design and construction for the 17 structures was \$7 million. The construction has been financed through a Pennsylvania Infrastructure Bank loan and is being repaid through a combination of the County's Act 89 \$5 fee funding and Act 13 funds. Additionally, each local municipality is providing a five percent match to the County.

Bundling 17 structures into a single bridge package can increase the risks of complications and prohibit smaller, local construction companies and suppliers from bidding on the project. To address this concern, Lycoming County released a Request for Proposals (RFP) for a single engineering contract to design the 17 structures. However, the construction will be broken down into several construction contracts over 2 – 3 years. Breaking the construction bundles into smaller groups over multiple years is intended to allow local contractors to be competitive during the bidding process.

Lycoming County and its bundled bridge engineering consultant team, Bassett Engineering and Wallace Montgomery are currently proceeding with the project's preliminary engineering and design, and ultimately letting the projects for construction over the next 2–3 years.

Table 7 | Lycoming County Bridge Bundling Program

BRIDGE OWNER	BRIDGE LOCATION	IMPROVEMENT	COST ESTIMATE
Eldred Township	T-850 (Calebs Creek Rd) over Calebs Run	Bridge Replacement	\$300,000
Fairfield Township	T-541 (Old Cement Rd) over Tules Run	Bridge Replacement	\$265,000
Franklin Township	T-469 (Smith Rd) over Tributary to German Run	Bridge Replacement	\$339,000
Gamble Township	T-625 (Winner Ln) over West Branch Murray Run	Bridge Replacement	\$735,000
Hepburn Township	T-489 (Klump Rd) over Tributary to Mill Creek	Bridge Replacement	\$420,000
Jersey Shore Borough	Wilson St over Pfouts Run	Bridge Replacement	\$445,000
Lewis Township	T-857 (Upper Bodines Rd) over Slacks Run	Bridge Replacement	\$551,000
Limestone Township	T-305 (Mill Rd) over Unnamed Stream	Bridge Replacement	\$318,000
Loyalsock Township	T-616 (Sheridan St) over McClures Run	Bridge Replacement	\$466,000
Mifflin Township	T-358 (Zinck Rd) over Tributary to Larrys Creek	Bridge Replacement	\$466,000
Montgomery Township	Montgomery Park Bridge over Adams Creek	Replace Superstructure	\$265,000
Moreland Township	T-638 (Bill Sones Rd) over Laurel Run	Bridge Repair	\$221,000
Muncy Township	T-516 (Auchmuty Rd) over Oak Run	Bridge Replacement	\$330,000
Penn Township	T-571 (Logue Hill Rd) over Marsh Run	Bridge Replacement	\$402,000
Susquehanna Township	T-392 (Valley Rd) over Bender Run	Bridge Replacement	\$360,000
Washington Township	T-384 (Gap Rd) over White Deer Hole Creek	Bridge Replacement	\$826,000
Wolf Township	T-250 (Penn Dr) over Gregs Run	Bridge Repair	\$183,000
TOTAL	17 Bridges		\$6,892,000

Northampton County (Modeled after the PA Bridge Bundling Program)

Northampton County has a Bridge Division staff of three people with an annual budget of \$780,000. It is responsible for 119⁵ bridges of various sizes located within 24 different townships and cities in the county. The [Northampton County Bridge Renewal Program](#) was modeled after the [Pennsylvania Rapid Bridge Replacement Project](#) to quickly and efficiently address multiple bridges identified as being in poor condition. In 2017, Northampton was the first local government to enter into a public-private partnership (P3) for a transportation-related project. Under the program, the county is replacing 28 bridges and rehabilitating an additional five structures for a total of \$37.5 million. The final contract also includes 10 years of maintenance on the 33 structures. The county estimates savings of 20-30 percent per bridge as a result of the P3 program.

The project required the creation of a General Purpose Authority (GPA) because Act 88 of 2012 does not allow counties to enter P3 agreements. Northampton County deeded ownership of the bridges to the GPA, which became the official public authority in the partnership. The project was let as a design-build-finance-maintain (DBFM) where the contractor is responsible for securing financing and the county makes regular payments through the GPA. An engineering firm was hired by GPA to administer the project and perform necessary reviews and inspections on behalf of GPA.

Bridge bundling with P3 contracts has been demonstrated to present cost savings at the state level. Achieving these saving depends on a thorough contract and a clear understanding of expectations for all involved parties. During the contracting process, Northampton County deviated from the program outline used by PennDOT for state bridges in key areas including right-of-way acquisitions and utility relocation. As the project progressed to design and construction, the Northampton GPA has seen delays and is engaged in litigation with the primary constructor for the project. In January of 2019, 7 structures and \$4.5 million were removed from the program contract. Litigation was still in progress during the spring of 2020.

P3 bridge bundling can be effective way to save costs and expedite repair of bridge structures but, as demonstrated through Northampton County's experience, it requires a clear and detailed contract.

⁵ The 119 bridges reference all county-owned bridges, including bridges greater than 20 feet.

Dauphin County Local Bridge Improvement Programs

Dauphin County created a plan to systematically and efficiently address the poor condition of local bridges in 1984. Over the next 30 years, the County repaired or replaced 51 county owned bridges (over 20 feet) using the County Liquid Fuels funds. In 2018, with the overall condition of the county's bridges significantly improved, the County worked with its consultant engineer to determine an annual budget necessary to maintain a state of good repair for its local bridges. Based on the annual budget projections, Dauphin County estimated an annual surplus of approximately \$350,000 after its proactive annual bridge maintenance.

Traditional funding alternatives were considered for how Dauphin County should invest the full \$350,000—to a single project or divide the money among its municipalities. Neither of these options would allow the County to make a meaningful change in infrastructure projects. After exploring alternative options for the excess funds, it was determined that establishing a county infrastructure bank would allow Dauphin County to maximize the funding's impact within the local community.

Created in 2013, the Dauphin County Infrastructure Bank works in tandem with the PIB to provide extremely low-interest (generally 0.5-1.2 percent) loans for local infrastructure projects. The County provides administrative and engineering support through the life of all projects, utilizing the bank program to ensure projects successfully follow all state and federal regulations required to receive PIB funding. From 2015 to 2020, the bank supported over \$18.6 million worth of projects in the county, including nine municipal bridge projects.

In 2016, Dauphin County began collecting the \$5 vehicle registration fee and has used the funding to introduce the Dauphin County Bridge Bundling Program. The program offers 60 percent county funding to participating municipal bridge projects, and municipalities are still eligible to apply for loans through the County Infrastructure Bank for their 40 percent of project funding. Through the program, Dauphin County aims to improve all poor bridges (over 20 feet) in the county by 2021.

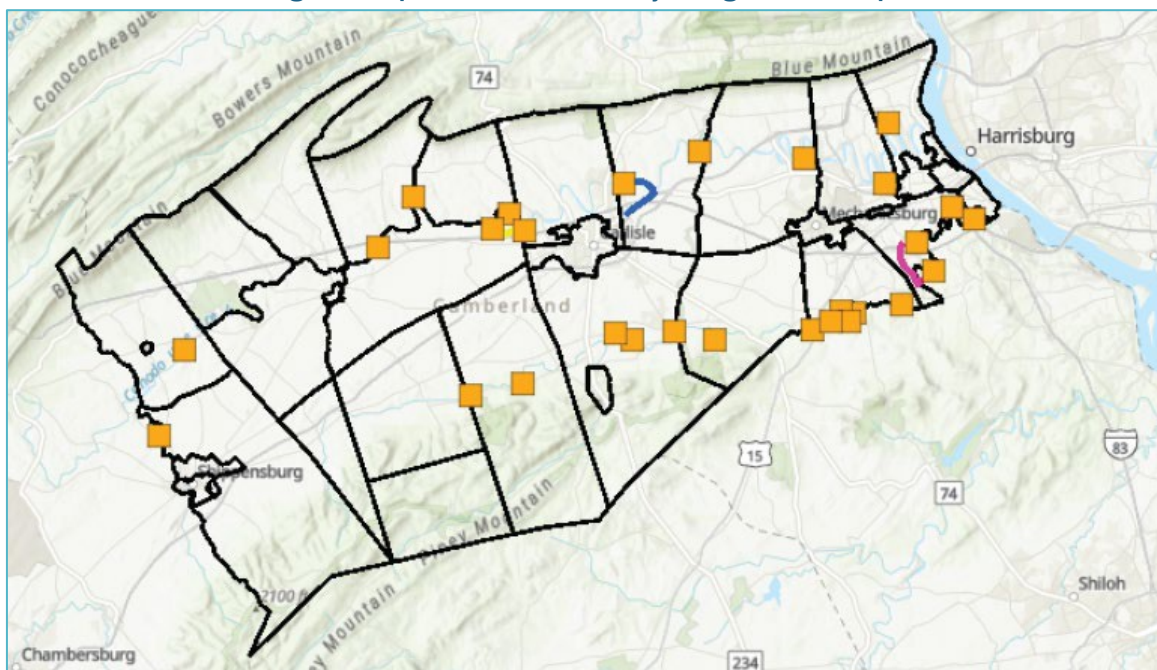
The Dauphin County Infrastructure Bank would not have been possible without decades of asset management to improve the condition of county-owned structures. With all bridges over 20 feet projected to be in a state of good repair over the next few years, Dauphin County, and its local municipalities, may be able to develop sustainable maintenance plans for larger bridges and turn their focus to small bridges.

Cumberland County Local Bridge Improvement Program

In 2009, Cumberland County began working with a consultant to inventory local bridges (over 20 feet) and develop a capital improvement plan to prioritize limited funding for 28 bridges owned by the county or jointly with neighboring York County. This strategy has allowed the County to pursue additional funding and target investments to minimize negative impacts on the local transportation network.

When Act 89 passed in 2013 and enabled the county to enact a \$5 fee on local vehicle registrations, County officials saw it as an opportunity to leverage more funds to address more bridges and larger projects. In 2015, Cumberland County became the first county in the Commonwealth to pass the local legislation required to collect the \$5 fee. In 2019, the County began the process to leverage the \$5 fee funding to secure state run low-interest financing through the Pennsylvania Infrastructure Bank (PIB). The borrowed money will allow Cumberland County to implement cost-saving measures such as bridge bundling and is projected to improve all bridges in poor condition by 2021.

Figure 21 | Cumberland County Bridges Web Map



Source: Cumberland County, PA

Centre County Bridge Inventory Project

The Centre County Metropolitan Planning Organization (CCMPO) conducted an inventory of local bridges between 8-20 feet in 2011-2012 as part of the PennDOT statewide inventory. In total, CCMPO identified 100 structures owned by local municipalities including a variety of pipes made of PVC, concrete, and different types of metals. Structures that were severely deteriorated were reported to the local municipality for further inspection. After the inventory, CCMPO identified the need for

an improved asset management strategy to maintain and improve conditions of the structures. This conclusion was integrated into the 2044 Long Range Transportation Plan (LRTP) to raise awareness of the current state of local small bridges.

Centre County Bridge Bundling Program

In 2019, Centre County initiated bridge bundling projects to complete three bridge rehabilitations totaling \$1.95 million and the replacement of two box culverts totaling \$3 million. The projects were both funded through a Multimodal Transportation Fund (MTF) grant from PennDOT as well as a combination of Act 13 and Act 89 (\$5 local fee) funds used to match PennDOT's grant.

Centre County staff have prioritized the ability to leverage outside funding when planning local infrastructure projects. The strategy was requested by the County Commissioners as a way to maximize the impact of local resources, including the Act 89 \$5 fee implemented in 2017. Legislation that implemented the \$5 fee in Centre County included 5-year sunset that will require the fee to be reauthorized by County Board of Commissioners in 2022. Recognizing the fee as an important resource that raises more than \$250,000 each year, Centre County officials have been intentional about creating clear, public-facing documents that highlight projects made possible by the funding. The project selection process for Centre County also includes a metric for community impact to ensure that the impact on the community as well as bridge condition are considered.

Butler County Infrastructure Bank

Butler County also created a County Infrastructure Bank to support local municipalities in achieving infrastructure goals. Created in 2017, the bank uses Act 13 funds which can be used for a greater variety of end uses than Liquid Fuels-funded banks (such as in Dauphin County). This strategy has enabled the County to support local municipalities in addressing a variety of different needs beyond transportation.

DVRPC's Municipal Bridge Programs

The DVRPC MPO/District 6 region has implemented two different local bridge programs since 2012 to help focus attention and funds to address poor condition locally owned structures. Combined, the DVRPC Municipal Bridge Retro-Reimbursement Program (MBRP) and an on-going DVRPC County Bridge Line Item in the DVRPC Transportation Improvement Program (TIP) total over \$150 million state and federal funds dedicated to projects selected via a competitive process.

The MBRP funds locally owned, poor condition bridge rehabilitation or replacement projects within Bucks, Chester, Delaware, Montgomery, and Philadelphia counties that employ PennDOT's retro-reimbursement process. State bridge funds in the DVRPC PA Transportation Improvement Program (TIP) are set aside and made available for selected municipal bridge projects with existing deck spans of 20 feet (20') in length or greater. Structures must also be included in a Pennsylvania Bridge Bill. Bridges less than 20' were not deemed eligible for the program since there are

not currently either federal or PA state requirements for regular, consistent bridge inspections that would permit all structures to be evaluated fairly against each other.

The MBRP is a competitive program requiring an application for funding requests submitted by the county or municipality and only projects selected and recommended for funding through the retro-reimbursement process and listed on the federally approved TIP would be eligible to employ PennDOT's retro-reimbursement procedure. This method for funding local bridges ensures that infrastructure investment is reviewed and prioritized as part of the regional MPO and District planning processes and prevents “one-offs” from entering the pipeline without appropriate review, evaluation, and prioritization by the District and MPO. State and local funds must be used for the retro-reimbursement mechanism, and local entities are reimbursed after the bridge work is completed and a reimbursement request is submitted to PennDOT for approval and funding. The mechanism allows local sponsors to embark on a simpler design, review, and construction process, while still ensuring standards and meeting state requirements. Since 2014, 21 structures have been approved for this process at a cost of \$23 million.

The DVRPC County Bridge Line Item in the regional TIP also serves the 5 DVRPC PA counties and addresses county owned structures. Counties submit a funding request, description, condition, and proposed schedule of structure repair/replacement which is discussed, evaluated, and prioritized by the DVRPC PA Subcommittee of the Regional Technical Committee for evaluation, prioritization, and funding as possible by the allocated amount of funding for each “round” of funding. Since 2012, \$130 million has been allocated to address 30 structures in Bucks, Chester, Delaware, Montgomery, and Philadelphia counties. These structures tend to be longer and larger with more square feet of deck surface, and are more costly than most municipal bridge projects (excluding the City of Philadelphia, which is both a County and a municipality, but has not to date been able to employ the Retro-Reimbursement process). Retro-Reimbursement process may be utilized when applicable for County bridges, but typical PennDOT federal design and review process has mostly been used for this program as federal funds are used. Commitments are made to fund the structure, so cost and schedule adjustments are addressed with each TIP Update.

PennDOT Traffic Signal Asset Management System

The Traffic Signal Asset Management System (TSAMS) Data Collection Project was initiated through PennDOT's Bureau of Maintenance and Operations (BOMO), whose goal was to collect data on existing conditions of traffic signal devices. The primary purpose of this project was to address the need for consistent, accurate, and available traffic signal asset data to promote statewide interagency coordination and enhance infrastructure management for improved planning, design, operation, and maintenance of the Commonwealth's signalized intersections.

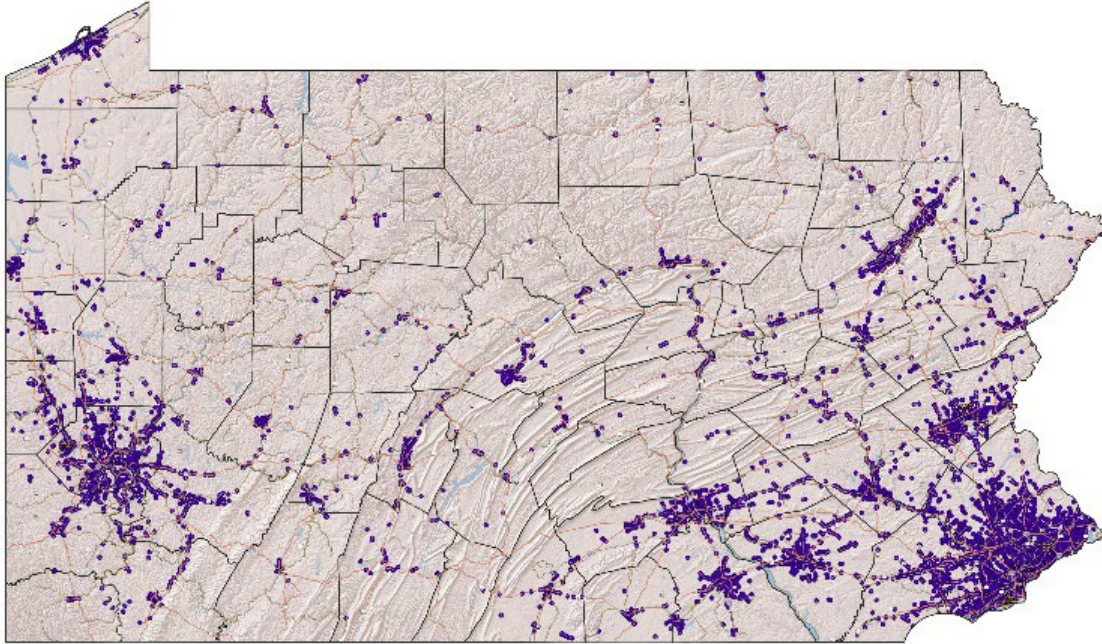
The primary need for the project was similar to the conversations surrounding Pennsylvania's local small bridges. In Pennsylvania, there are roughly 13,100 signalized intersections throughout the Commonwealth that are owned and maintained by hundreds of local municipalities. This dynamic has resulted in decades of varying standards of care for the maintenance and operation of traffic signal devices.

Performing a comprehensive inventory of each signal device was paramount to provide the TSAMS with the critical information needed to allow stakeholders to make informed decisions, improve operations, and analyze maintenance life cycles while promoting safer roadways. To acquire the information necessary to populate the TSAMS database, PennDOT's consultant team embarked on three different phases of data collection—each combining traffic engineering experience with innovative data collection technologies.

- **Mobile LiDAR Collection:** Two full-time collection systems travelled over 82,000 miles throughout the Commonwealth. They captured 11,000 miles of LiDAR data in approximately 6 months.
- **Asset Inventory:** The initial inventory of signalized intersections comprised assets and attributes resulting in over 26.5 million database entries.
- **Data Discovery:** There was also outreach and coordination with all District and municipal signal owners/stakeholders to identify and collect more than 242,000 paper and electronic documents.

Like the 2012 local small bridge inventory effort, the intent of the traffic signal inventory was to capture a snapshot of asset conditions as they currently exist. The data collection effort did not attempt to evaluate whether the traffic signal assets were in acceptable condition or complied with federal or state standards. However, BOMO is utilizing its Green Light-Go grant program to incentivize municipalities to assess their traffic signals and update the information in the TSAMS database, which can be accessed via the [TSAMS website](#) and is available for free to all municipalities. In order to apply to the grant program, which exclusively funds improvements and upgrades to existing traffic signals, municipalities must update the TSAMS database to justify projects.

Figure 23 | Traffic Signals in Pennsylvania



Source: Michael Baker International

Like local small bridges, BOMO determined that lack of consistent, available, and accurate traffic signal asset data is the largest threat to making significant improvements to the traffic signals throughout Pennsylvania. The GLG program, municipal budgeting for maintenance and operations, traffic signal management, equipment life cycle analysis, long-range planning, and driver safety have all benefitted from an accurate traffic signal asset management system that is now being provided through TSAMs.

Study Report Alternatives

Findings and Actions

Based on the research and analysis conducted as part of the Locally Owned Bridges Study, the TAC Task Force has identified the following key findings pertaining to local small bridges between 8 and 20 feet in length.

Standardized Approach

- **Finding:** A standardized approach based on the NBIS for inventorying and assessing the condition of local small bridge structures is needed to ensure consistency and accuracy of the data collected and maintained.
- **Action:** PennDOT, in collaboration with the Planning Partners, counties, and municipalities, should communicate the methodology and requirements for the ongoing inventory, condition assessment, and management of local small bridges.
 - Reference – Communicate PennDOT’s standardized methodology and requirements to Planning Partners, counties, and municipalities for the update and management of the local small bridge data in BMS2. PennDOT is currently developing a data maintenance cycle that will include local bridges under 20 feet. The maintenance cycle process will include a new and improved application that District staff and local Planning Partners will use to keep the data current.
 - Condition Assessment – Using the NBIS, BMS2 Coding Manual (PennDOT Publication 100A), and the supporting AASHTO Manual for Condition Evaluation of Bridges as the basis, a subset(s) of these standards should be identified and formally adopted as acceptable inspection procedures and load rating practices for local small bridges 20 feet or less in length, as well as acceptable inventory reporting. Consideration should also be given to establishing standards (and associated inspection forms and templates) based on the bridge length and level of safety risk. For example, a smaller number of requirements for bridges under 12 feet may be considered.
 - Asset Management – The inventory and condition assessment data should be regularly (minimum every two years) submitted to PennDOT for incorporation into the Department’s BMS2 database and a local asset management plan. Authorized users may then be granted access to BMS2 to view and maintain inventory and inspection information for local small bridges. BMS2 Web supports decision-making to help maintain the long-term health of bridges and to formulate optimal programs for bridge maintenance and rehabilitation. In addition, PennDOT and the counties should serve as active partners with municipalities in the management of local bridge structures and to ensure the appropriate standards are applied uniformly across local owners, all of which have a role in the decision to rehabilitate, replace, or remove local small bridges.

Capacity Building

- **Finding:** Technical assistance and training programs and tools are needed to increase local knowledge and proficiencies in asset management.
- **Action:** PennDOT's Local Technical Assistance Program (LTAP) should be used to develop and deliver a new, day-long training course on the Standardized Approach described above and include a lesson module on Innovative Financing for Local Small Bridges based on the alternative financing mechanisms and case studies presented in this report. The course would be delivered regionally via PennDOT Engineering Districts (similar to the PennDOT Connects Training approach) and include Planning Partners, counties, and municipalities. LTAP's current Bridge and Culvert Inspection for Municipalities (RS2-M23-A2 Road Scholar 2) and new Asset Management Course could be used as the basis for the training and be revised/amended to incorporate the approach methods and procedures resulting from the above action. The training will need to be developed in collaboration with county and municipal associations (CCAP, PSATS, Municipal League, etc.).
- **Action:** An asset management peer program should be organized among PennDOT, the Planning Partners, counties, and municipalities to transfer and share bridge asset management expertise and tools among and between all entities.

Incentivization

- **Finding:** Financial incentives are needed to increase and achieve statewide participation in a standardized asset management approach for local small bridge structures.
- **Action:** The General Assembly or PennDOT should utilize its various grant programs to incentivize counties and municipalities to inventory, assess, and help maintain local small bridges. To be an eligible grant applicant, PennDOT should require counties and municipalities to have an asset management plan and update BMS2 data in accordance with applicable standards.
- **Action:** The General Assembly or PennDOT should consider instituting a phase-in of reporting requirements/standards associated with liquid fuels funds with incentives offered for having a local bridge asset management plan (See Implementation, Step 3 – Best Management Tools and Practices).
- **Action:** Planning Partners should consider including local small bridge inventory and assessment (as well as appropriate redundancy studies) in their respective Unified Planning Work Programs (UPWP) as critical transportation planning tasks and activities to be programmed for the following state fiscal year (SFY).
- **Action:** Planning Partners and counties should work with the various municipal associations to advocate for alternative financing and technical mechanisms and approaches outlined herein that will help educate municipal staff and address the local small bridge asset management issues and needs.

Implementation

- **Finding:** A dedicated team of subject matter experts is needed to serve as the lead champion for developing the technical details of the Standardized Approach and associated training curriculum.
- **Action:** PennDOT in conjunction with the TAC should organize a “Local Small Bridge Action Team” (Action Team) to lead the implementation of the findings and actions specified by this study. In addition to bridge asset management, LTAP training, and fiscal policy experts, the Action Team must also include representation from PennDOT’s executive leadership team to ensure decisive decisions can be made to efficiently advance the study’s implementation.

In concert with the above actions, the Action Team will need to consider the following immediate steps:

- Step 1 – Inventory and Inspection: The Action Team should develop a scope of work, schedule, and budget to confirm and communicate the standards and requirements for local bridge asset management based on PennDOT’s BMS2 standards and requirements. The scope of work is needed to determine the level of effort (including cost) required to develop a new baseline statewide inventory of small local bridges and culverts throughout the state. Note, consideration of previous or planned bridge evaluation studies (e.g., redundancy studies) should be considered to optimize the scope of work).
- Step 2 – Resource Allocation: Based on the Action Team’s scope of work, appropriate funding and technical resources must continue to be allocated to perform the baseline inventory of locally-owned bridges and upload the data into the BMS2 system. Resource allocation should be based on a priority level approach and be budgeted over a period of consecutive years. In addition, a dedicated and recurring source of funding should also be identified to ensure the asset management efforts are maintained.
- Step 3 – Best Management Tools and Practices: The Action Team in partnership with the Planning Partners and counties should develop best management tools and practices to increase asset management awareness and knowledge at the municipal level. In addition to the recommended LTAP training and educational materials, an asset management plan template based on the NBIS, BMS2 Coding Manual (PennDOT Publication 100A), and the supporting AASHTO Manual for Condition Evaluation of Bridges should be developed. The template should be used by all Planning Partners, counties, and municipalities participating in the new standardized baseline inventory and inspection process and requesting technical and financial assistance to support the process.

Glossary

Average Daily Traffic (ADT):	The average number of vehicles traveling over a specific length of roadway per day.
Bridge and Culvert Inspection for Municipalities (RS2-M23-A2 Road Scholar 2):	A Pennsylvania Department of Transportation Local Technical Assistance Program regarding bridge and culvert inspection for municipalities.
Bridge Inspector's Reference Manual (BIRM):	A manual developed by the Federal Highway Administration to direct field and remote inspection of bridges.
Bridge Management Systems 2 (BMS2):	A Pennsylvania Department of Transportation database which contains bridge inspection and condition data for bridges within the Commonwealth of Pennsylvania which require inspection.
Bureau of Maintenance and Operations (BOMO):	A subdivision of the Pennsylvania Department of Transportation dealing with the operation and maintenance of roadways and bridges.
Design-Build-Finance-Maintain (DBFM):	Refers to a project approach in which the private sector designs, builds, finances, and maintains a project.
Federal Highway Administration (FHWA):	A subdivision of the United States Department of Transportation which specifically oversees the administration of the Nation's highway system.
Fixing America's Surface Transportation (FAST):	A federal bill passed in December 2015 for the purpose of funding surface transportation.
Geographic Information Systems (GIS):	A database of spatial information used for the purpose of planning, mapping, and data analysis.
Geospatial Coordinating Board (GeoBoard):	A board of advisors for the Pennsylvania Governor and public on geospatial issues, coordination, and efficiency.

Indiana Department of Transportation (INDOT):	The governing body responsible for administration of transportation infrastructure in the State of Indiana.
Local Small Bridge:	A bridge, culvert, or pipe(s) between 8 and 20 feet in length on the local roadway network.
Local Technical Assistance Program (LTAP):	A program overseen by the Federal Highway Administration for the purpose of training and assisting state highway departments.
Long Range Transportation Plan (LRTP):	Strategic plans created to support the development of Transportation Improvement Plans at a regional level.
Metropolitan Planning Organization (MPO):	An organization created for the purpose of transportation planning within a regional metropolitan area.
Multimodal Transportation Fund (MTF):	A Pennsylvania Department of Transportation grant program which awards funding to encourage economic development and infrastructure investment.
National Bridge Inspection Standards (NBIS):	The document specifying Federal Highway Administration standards and requirements for bridges longer than 20 feet.
National Bridge Inventory (NBI):	A Federal Highway Administration database containing the locations and specifications of all bridges longer than 20 feet within the United States.
National Highway System (NHS):	The collective highways of the United States, including some major roadways which connect important locations such as rail terminals, ports, or airports.
Pennsylvania Infrastructure Bank (PIB):	A Pennsylvania Department of Transportation Program which offers low-interest loans to fund infrastructure development and planning within the Commonwealth of Pennsylvania.

Public-Private Partnership (P3):	Collaboration between a government entity and a private business to finance, operate, or maintain a project.
Request for Proposals (RFP):	A method by which a government entity will solicit proposals from private entities.
Rural Planning Organization (RPO):	An organization created for the purpose of transportation planning within a rural area.
State Fiscal Year (SFY):	The year which a State's budget is legally valid; the Pennsylvania Fiscal Year begins on July 1 st each year.
Traffic Signal Asset Management System (TSAMS):	A program which was initiated by the Pennsylvania Department of Transportation Bureau of Maintenance and Operations with the goal of collecting data on existing conditions of traffic signal devices.
Transportation Asset Management Plan (TAMP):	A strategic and systematic process of operating, maintaining, and improving transportation infrastructure assets, focused on the economics as well as engineering of transportation assets.
Transportation Improvement Program (TIP):	A strategic plan developed by a Metropolitan Planning Organization or a Rural Planning Organization for the purpose of prioritizing and financing local infrastructure projects.
Unified Planning Work Programs (UPWP):	An annual or biennial report establishing the planning priorities and activities to be carried out within an organization.

Rating Codes: Bridge condition is determined by the lowest rating of National Bridge Inventory (NBI) condition ratings for Item 58 (Deck), Item 59 (Superstructure), Item 60 (Substructure), or Item 62 (Culvert). If the lowest rating is greater than or equal to 7, the bridge is classified as Good; if it is less than or equal to 4, the classification is Poor. Bridges rated 5 or 6 are classified as Fair.

Bridge Condition Rating	Description
N – Not Applicable	
9 – Excellent Condition	
8 – Very good Condition	No problems noted.
7 – Good Condition	Some minor problems.
6 – Satisfactory Condition	Structure elements show some minor deterioration.
5 – Fair Condition	All primary structure elements are sound but may have minor section loss, cracking, spalling, or scour.
4 – Poor Condition	Advanced section loss, deterioration, spalling or scour.
3 – Serious Condition	Loss of section, deterioration, spalling or scour may 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, it may be necessary to close the bridge 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 back in light service.
0 – Failed Condition	Out of service – beyond corrective action.

Source: FHWA, Recording and Coding Guide for the Structural Inventory and Appraisal of the Nation's Bridges (FHWA Green Book)