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Assessing the Asset Management Programs of Locals: Bridges and Pavement Conditions

Richard Ajagu, Dongyoon Song, David Holguin Mejia,
Deepak Benny, Mohammadhosein Pourgholamali,
Isaiah C. Mwamba, Kumares Sinha, Samuel Labi

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AUTHORS

Richard Ajagu
Dongyoon Song
David Holguin Mejia
Deepak Benny
Mohammadhosein Pourgholamali
Isaiah C. Mwamba
Graduate Research Assistants
Lyles School of Civil and Construction Engineering
Purdue University

Kumares Sinha, PhD
Edgar B. and Hedwig M. Olson Distinguished Professor of Civil Engineering
Lyles School of Civil and Construction Engineering
Purdue University

Samuel Labi, PhD
Professor of Civil Engineering
Lyles School of Civil and Construction Engineering
Purdue University
(765) 494-5926
labi@purdue.edu
Corresponding Author

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NOTICE

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16. Abstract

Indiana's 2016 House Enrolled Act (HEA) 1001 provided a funding mechanism for transportation infrastructure that required Local Public Agencies (LPAs) to have an Asset Management Plan (AMP) to be eligible for funding. In 2022, the Indiana General Assembly desired to know the extent to which LPAs had adopted AMPs in response to this legislation. This study's literature review found that LPAs nationwide are increasingly adopting asset management practices. Analysis of aggregate data on local road expenditures and revenues in Indiana showed significant reductions in maintenance expenditures in post-HEA 1001-2016 years, suggesting the efficacy of the 2016 legislation. The data trend suggests a 2-year lag in the effects of the 2016 legislation—in 2018 and afterwards, the pavement conditions improved significantly.

Overall, the results of the present study indicate that goals of the 2016 legislation have largely been realized, as approximately 100% of Indiana's LPAs have developed AMPs of various levels of maturity, and the AMP-enabled asset management practices are yielding positive outcomes by reducing maintenance spending and improving road asset conditions. LTAP should continue to reach out to LPAs and provide technical support and training that could further advance existing AMPs, particularly at LPAs that face resource constraints.

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EXECUTIVE SUMMARY

Introduction

Indiana's 2016 House Enrolled Act (HEA) 1001-2016 provided a funding mechanism for transportation infrastructure that required Local Public Agencies (LPAs) to have an asset management plan to be eligible for funding. In 2022, the Indiana General Assembly wished to investigate whether HEA 1001-2016 had any impact on local agencies' asset management practices. This study analyzed the impact of HEA 1001-2016 on the LPAs' Asset Management Program (AMP) development, including their AMP features and capabilities, the extent of their AMP use in asset repair, and other routine management functions. The study was intended to provide guidance that will inform INDOT's recommendations to the legislature regarding HEA 1001-2016.

Methods

The literature review on LPAs' AMPs nationwide suggests that LPAs are increasingly adopting asset management practices. From the analysis of aggregate data on local road expenditures and revenues in Indiana, significant reductions in maintenance expenditures in post-HEA 1001-2016 years were observed. This suggests the efficacy of the 2016 legislation in Indiana that encouraged the practice of asset management by LPAs. Also, the data trend suggested a 2-year lag of the effects from the 2016 legislation. From 2018 on, the percentage of pavements in good condition increased significantly and it is projected to increase further. The percentage of pavements in poor condition decreased and is also projected to decrease further.

The questionnaire survey results suggested that nearly all of the LPAs set up AMPs to manage their assets (most were established after the 2016 legislation). LPAs that already had an AMP before the HEA 1001-2016 legislation (a third of responding LPAs) observed an increased use of their AMP for key asset management functions after the legislation was passed. An overwhelming majority of responding LPAs indicated current attainment of AMP development, which made them eligible for funding programs, such as the Community Crossings Matching Grant. These grants helped them estimate their asset preservation funding needs and carry out their routine asset management functions, such as planning work assignments, prioritizing improvements and making repair decisions. Significant variation was observed for specific capabilities of the LPA AMPs. Also, the LPAs identified critical barriers to the further advancement of their AMPs, including lack of adequate workforce and specialized asset management software, budgetary constraints, and the lack of updated asset inventory and historical records of past projects. Most LPAs, it appears, have yet to take full advantage of Local Technical Assistance Program (LTAP) resources to develop their AMPs further. Furthermore, interviews of LPAs confirmed that HEA 1001-2016 is recognized as the primary motivator of their AMP development. However, some LPAs were missing the potential benefits of AMP beyond merely achieving eligibility for matching funds. In addition, smaller LPAs could benefit significantly from assistance to overcome formidable barriers to AMP development in terms of financial, manpower, and equipment resources.

Findings

Overall, the results of this study indicated that the goals of the 2016 legislation have largely been realized. At the time of reporting, approximately 100% of Indiana's LPAs have developed AMPs of various levels of maturity, which range from incipient to advanced. Evidence from statewide and national level databases suggests that Indiana's AMP-enabled asset management practices are yielding positive outcomes in terms of reduced maintenance spending and superior asset conditions at LPAs. It is recommended that LTAP continue to reach out to resource-constrained LPAs and provide technical support and training and to catalyze sharing of AMP development resources across the LPAs.

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ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway Transportation Officials
ADA	American Disabilities Act
AID	Accelerated Innovation Deployment (Grant)
AMP	Asset Management Program
CCMG	Community Crossings Matching Grant
DOT	Department of Transportation
FHWA	Federal Highway Administration
HEA 1001-2016	House Enrolled Act 1001-2016
HRSF	Highway Road and Street Fund
LRBMGF	Local Road and Bridge Matching Grant Fund
LPA	Local Public Agency
LTAP	Local Technical Assistance Program
MDAs	Most Deserving Assets (for some repair/replacement action)
MPO	Metropolitan Planning Organization
NBI	National Bridge Inventory
NBIS	National Bridge Inspection Standards
NHS	National Highway System
PASER	Pavement Surface Evaluation and Rating
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PSR	Pavement Surface Rating
PWD	Public Works Department
TAM	Transportation Asset Management
TAMP	Transportation Asset Management Plan

1. INTRODUCTION

1.1 Study Background and Problem Statement

The House Enrolled Act (HEA) 1001-2016 was passed by the Indiana General Assembly into law in 2016. This legislation provided a funding mechanism for transportation infrastructure. This new funding mechanism, the Local Road and Bridge Matching Grant Fund, also known as the Community Crossings Matching Grant (CCMG) program, requires local agencies (LPAs) to have an asset management plan to be eligible for the funding.

There is evidence suggesting that LPAs are recognizing the benefits of detailing their infrastructure assets, assessing their condition, and having the capability to report pavement conditions at a network level. This enables the LPAs to forecast the budget required for their pavement and bridge networks (assets) and to analyze the tradeoffs between expenditures and expected performance, whether at a specific facility level or across an entire network ("network" meaning, all assets within a specified jurisdiction such as an entire state, district, subdistrict, county, or city, or town). For example, it has been reported that at the time of reporting, a vast majority of counties, cities, and towns have implemented a pavement asset management plan. Additionally, the eligibility for federal funding programs, such as Community Crossings, acquired when LPAs complete AMP development to a certain minimum level also serves as further motivation for LPAs to complete their AMPs.

In 2022, the Indiana General Assembly expressed a need to investigate whether HEA 1001-2016 had any impact on the asset management practices in Indiana, that is, the percentage of LPA using AMPs and the extent to which the AMPs are being used for managing the local highway assets.

1.2 Study Objectives

Against this background, INDOT requested a study to provide technical information to support INDOT's evaluation of HEA 1001-2016's effectiveness in achieving its intended goals. In a nutshell, INDOT sought answers to the following.

- What is the overall picture of Indiana LPAs' asset management practices and outcomes?
- What is the impact of HEA 1001-2016 on the following items?
  - AMP development,
  - the features and capabilities of the developed AMPs,
  - extent of AMP use in LPA's routine management functions, and
  - asset conditions in the LPA jurisdictions.
- How can INDOT/LTAP use LPAs to enhance their AMPs and thereby make them more eligible for federal funds including Community Crossings?

1.3 Study Methods

The methods used in this study include the following:

- a literature review of a sample of LPA practices in the United States,
- analysis of aggregate data on LPA road asset physical condition and expenditures,
- a questionnaire survey of LPAs in Indiana, and
- a set of interviews of selected LPAs in Indiana.

1.4 Study Scope

Based on the study objectives and using various combinations of the study mechanisms, the study examined the following.

(a) *Comparison of LPA AMPs Pre- and Post-HEA 1001-2016 Enactment*

- Comparing the efficacy of HEA 1001-2016 on LPA's asset management adoption, that is, was there an increase in the percentage of LPAs that use AMPs?
- Comparing the trend in AMP usage at the local level (particularly, at the town level) to ascertain whether "the 66% usage rate" has been trending up and might be keeping that number much lower than cities and counties. This is expected to lead to possible recommendations geared towards the smaller communities.
- The extent to which LPAs are using their AMPs for managing their assets; that is, what is the effect of any increased "buy-in" at the local level of AMP use, on overall asset conditions? For example, to estimate the effect on asset condition ratings that could result if 100% of LPAs continuously kept up-to-date AMPs.

(b) *Quality of Current AMP*

- If there are any instances of LPAs completing AMP at the minimum level that would make them eligible for funding programs such as Community Crossings.
- Whether there exist any areas of teaching/best practices that could help communities that may not be using their AMP to make local-level road asset preservation decisions or use it only once or twice a year when AMP is needed to apply for grants.
- How LPAs could use their AMP not just to satisfy funding requirements, but for their routine management functions.
- The limitations to LPAs' use of AMPs, and what can INDOT do to help LPAs overcome these deficiencies.

(c) *Other AMP-Related Issues*

Institutional Issues

- Is AMP development a management objective in the agency?
- Do manpower and equipment resources exist to support an AMP in the agency?
- Is the AMP being developed in-house by the agency? With the help of LTAP?
- From these institutional perspectives, what is the gap between LPA's AMPs and INDOT's AMP?

- How could INDOT help LPAs improve the institutional-related issues related to their existing AMPs?

Asset Management Program Features

- What is the current maturity of the AMP? What is the trajectory of the AMP maturity?
- What are the overall modules of the AMP, existing and anticipated—inventory and data collection on asset types, material types, design types; records of historical condition (poor/fair/good); projection of asset conditions using deterioration models; standard treatment types and their costs and effectiveness; life-cycle repair planning for each asset; prioritization of deserving assets for repairs at a specified year.
- From the perspective of AMP features, what is the gap between LPA's AMPs and INDOT's AMP?
- How could INDOT help LPAs improve the features of their existing AMPs?

Asset Management Program Capabilities

- Does the AMP provide information on the past, current, and expected future condition of the assets? It is recognized that at this point, most LPAs possess asset inventory and condition data only (which constitute the basic AMP building block).
- Does the AMP allow for assessment of monetary needs (based on inventory and trends in asset physical conditions)
- Does the AMP give an indication of available resources? What are the budget levels over time? What is the projected level of future funding?
- Does the AMP provide the capability to make cost-effective repair or replacement decisions that preserve, maintain, or improve our assets to ensure the maximum useful life and provide acceptable service to the public?
- Does the AMP provide the capability of asset managers to identify and analyze investment options for each asset type? What are their associated costs and benefits? Which option, or combination of options, is "optimal?"
- Does the AMP provide the capability to assess the consequences of not maintaining their assets? What visualization and reporting tools are available in the AMP to help the asset managers communicate the benefits of asset repairs to the end user?
- Does the AMP help the asset manager monitor the impact of our decisions?
- Does the AMP help the asset manager to choose and schedule repairs that cause least possible inconvenience to the motoring public?
- From the perspective of AMP capabilities, what is the gap between LPA's AMPs and INDOT's AMP?
- How could INDOT help LPAs improve the capabilities of their existing AMPs?

As stated in LTAP's publication titled *Administration and Management of Local Roads and Streets–A Handbook for Indiana County, City and Town Officials* (Turley & Martin, 2004), most of these questions are relevant and are of significant concern to managers and engineers responsible for the upkeep of local road infrastructure in Indiana.

2. REVIEW OF PUBLISHED INFORMATION RELATED TO LOCAL ROAD ASSET MANAGEMENT: INDIANA AND NATIONWIDE

2.1 Introduction

This chapter reviews published information on the statewide programs, enabling legislation, and the existing (and prospective) resources and outcomes of local road asset management in Indiana and nationwide. The sections of the chapter include: the Indiana Local Technical Assistance Program (LTAP), Indiana's HEA 1001-2016 and 1576-2021, and Transportation Asset Management (TAM) practices at selected LPAs nationwide.

2.2 The Indiana Local Technical Assistance Program

Indiana's LTAP is the greatest institutional resource that Indiana LPAs possess in the context of their AMP development, among others. LTAP was established to "foster a safe, efficient, and environmentally sound transportation system by improving the skills and knowledge of local transportation providers through training, technical assistance, and technology transfer" (LTAP, 2024). The organization serves as a valuable resource for training, technical assistance and technology transfer related to transportation at Indiana's cities, towns, and counties. LTAP also provides technical assistance and training to the LPAs, so they are placed in a better position to access external funding and other resources.

Part of a nationwide system of technology transfer centers established by the Federal Highway Administration (FHWA), LTAP partakes or organizes several state, regional, and national events thereby has a reach that spans the entire nation. These include the Purdue Road School, the County Bridge Conference, the Local Transportation Asset Management Conference, the Storm Water Drainage Conference, the Civil Engineering Professional Development Seminar (CEPDS), and the ITE/LTAP Transportation Conference. Additionally, Indiana's LPA staff benefit significantly from these events as well as other LTAP programs on road scholar development, equipment loan, and hazard elimination. LTAP communicates with LPAs in a variety of ways including in person (through statewide workshops and conferences), in print (through newsletters and flyers and reports published on Purdue e-Pubs), online (through tutorials and resources), and through smartphones (micro-learning apps).

LTAP maintains an asset management website for the benefit for LPAs. This website provides guidance to LPAs that seek to conduct various components of asset management in their agency, and to communicate the prospective outcomes of actions. The website also provides to LPAs, access to asset management data the Indiana's towns, cities, and counties. The data includes the road inventory and the current physical condition and trends thereof.

Further, LTAP serves as the compliance reviewer of AMPs, for the Local Road and Bridge Matching Grant Program. In this regard, LTAP assists LPAs to develop their AMPs by reviewing the AMPs, checking for compliance with the INDOT-approved guidelines, providing technical assistance, and providing and maintaining a portal (the LTAP Data Management System) where LPAs can submit their asset management plans to oversight agencies.

2.3 The House Enrolled Acts 1001-2016 and 1576-2021

In 2016, the Indiana General Assembly passed HEA 1001-2016, establishing a local road and bridge matching grant referred to as the Community Crossings Matching Grant (CCMG). In applying for the CCMG, LPAs need to submit AMPs that they have established for their road and bridge inventories.

From 2016 to the time of reporting, Indiana LTAP has received one or more asset management plans from 92 counties, 120 cities, and 392 towns, representing 100% of county data, 100% of city data, and 88% of town data, representing 99% of the existing local road network and 100% of the existing local bridge network (LTAP, 2024). This data is used to evaluate historical trends of local road and bridge condition level changes and represents 99% of the existing local road inventory in Indiana and 100% of the existing local bridge network as defined by the FHWA. The AMPs submitted to Indiana LTAP by LPAs include not only road and bridge condition data but also the list of standard preservation and rehabilitation treatments and their corresponding unit costs.

In 2021, Indiana's General Assembly passed the House Enrolled Act 1576-2021 (HEA 1576-2021) which required the LPA AMPs to be "available in electronic format and accessible on the internet by July 1, 2022." To facilitate LPA compliance, INDOT and LTAP set up the Indiana LTAP Local Road and Bridge Dashboard website that served as a platform to collect, house, manage, and make the asset management data available. This website provides the user with a view of not only the current condition but also the historical trends of condition level changes over time, of Indiana local agency roads and bridges. The HEA 1576-2021 legislation served as further impetus for LPAs to advance their AMPs.

2.4 AMP Practices at Selected LPAs Nationwide

As local transportation agencies face growing challenges in maintaining and upgrading critical infrastructure, the role of AMP-structured practices continues to become clear. Local agencies, unlike their state-level counterparts, often operate under constrained budgets and rely heavily on state and federal funding for essential repairs and improvements. With urban populations expanding and infrastructure aging, local governments can use AMP to make data-driven decisions to optimize resources, extend the lifespan of assets, and address infrastructure needs equitably across neighborhoods. Furthermore, AMP provides local agencies with a framework to plan proactively and tackle maintenance backlogs, which, if left unaddressed, lead to increased long-term costs and deteriorating levels of service.

2.4.1 Bay City, MI

The 2024 TAM plan for this metropolitan area (Scott, 2024) represents a good example of a local transportation agency's efforts to manage and maintain critical infrastructure assets, such as roads, bridges, and traffic signals, through structured asset management practices. Bay City manages 377 lane-miles of public roads, with 129 miles classified as "major roads" and 247 miles as "local roads." For road condition monitoring purposes, Bay City uses the Pavement Surface Evaluation and Rating (PASER) system, a tool commonly used across Michigan, to rate the pavement surface condition of road segments on a 1 (poor) to 10 (excellent) scale. The city's TAM plan indicates that for the "local roads" network, a significant portion of the network is in poor condition (87% of roads fall into the "poor" category), and for the "major roads" network, the situation is slightly less concerning (59% are rated as "poor"). Bay City's long-term goal is to increase the proportion of roads in good and fair condition by implementing preventive maintenance strategies and targeted rehabilitation projects.

Funding remains a central challenge for Bay City. The city receives revenue from various sources, including state funds via the Michigan Transportation Fund (MTF), federal grants for specific projects, and local contributions. However, the current budget, which allocates $2 million annually for major street projects, is not sufficient to meet the city's desired improvement goals. The AMP highlights that an additional $2–$4 million per year would be required to meet the city's pavement condition objectives for both major and local road systems. The plan outlines a 6-year schedule of planned projects based on the available budget but emphasizes that additional funding is necessary to close the gap between current and desired conditions.

In addition to roads, Bay City's AMP addresses bridge and traffic signal management. The city is responsible for three bridges, two of which are classified as "scour critical," meaning they are vulnerable to water damage. Nevertheless, the bridges are considered structurally stable and receive biannual inspections. Bay City plans to invest $450,000 annually in preventive maintenance to extend the service life of these structures. Additionally, the city manages 35 traffic signals, focusing on routine maintenance and repairs to ensure their continued functionality.

Bay City's AMP underscores the importance of strategic asset management at the local level. Using tools like Paser and Roadsoft for condition assessment and planning, Bay City's engineers recognize that they can make informed decisions regarding the effective

allocation of the rather limited resources. Above all, the AMP demonstrates the value of transparency in asset management, providing both local government officials and the public with clear information on the state of transportation assets and the financial requirements for maintaining them.

2.4.2 Central Indiana, IN

The 2021 Central Indiana Asset Management Report, prepared by the Indianapolis Metropolitan Planning Organization (IMPO), provides a comprehensive overview of how LPAs in Central Indiana manage their transportation assets, including roads and bridges (IMPO, 2021). The report provides details of asset management practices across eight counties: Boone, Hamilton, Hancock, Hendricks, Johnson, Marion, Morgan, and Shelby. Each LPA is required to submit asset management plans, which include a pavement inventory, objectives and measures, and a 5-year treatment plan, to be eligible for INDOT's CCMG program. There exists regular collaboration between the IMPO, local municipalities, and the Indiana LTAP which supports data collection and compliance for asset management plans.

Pavement conditions are evaluated using two primary systems: the PASER system and the Pavement Condition Index (PCI). Most of the participating LPAs use the PASER system, while the City of Indianapolis uses the PCI system. Of the LPAs that use the PASER system, in 2020, approximately 28% of pavement miles were in "good" condition, 49% in "fair" condition, and 23% in "poor" condition. Regarding Indianapolis, 22% of the roads were reported to be in "good" condition, 24% in "fair," and 54% in "poor" condition. These findings indicate the existence of significant need for maintenance and rehabilitation of transportation infrastructure across the region.

Pavement conditions are analyzed by functional class and surface type. The major arterials are generally in superior condition compared to local roads, with approximately 31% of principal arterials rated as "good" compared to local roads (26%). The most common surface type in the region is asphalt, covering 88% of the network, and composite surfaces were found to be in the best condition overall.

Bridge management is another critical focus of the LPAs, with 1,950 locally maintained bridges and culverts in the region. The condition of these bridges is tracked through the National Bridge Inventory (NBI) which classifies bridges into "good," "fair," and "poor" condition categories. In 2020, 42% of the bridges were rated as "good," 54% as "fair," and 4% as "poor." The LPAs also submit a bridge priority list that identifies projects for replacement, rehabilitation, widening, and repair.

Regarding future planning, the LPAs have submitted 5-year treatment plans that outline scheduled maintenance and rehabilitation projects for the years 2021–2026. A total of 9,678 miles of pavement work and $644 million in expenditures were planned for this period, reflecting the LPAs' commitment to improving their transportation assets in the face of funding challenges.

2.4.3 Hennepin, MN

The 2023 Hennepin County Asset Management Report (Hennepin County Public Works, 2023) offers a detailed case study on the TAM practices of the county's transportation agency. The report presents the condition of the county's transportation assets, the county's performance in maintaining these assets, and the challenges faced due to aging infrastructure and limited resources. Hennepin County's transportation assets are placed into five categories: roadway pavement, bridges, traffic and roadside assets, drainage systems, and pedestrian infrastructure. Each group is assessed vis-à-vis performance targets, with an emphasis on the current condition of the assets and the efforts required to maintain or improve them. The health of the county's road system is rated as "Fair to Good," but is noted to have an ongoing decline due to aging infrastructure. Nearly 41% of Hennepin County's roads are over 50 years of age and are facing increased rates of deterioration, and thus, timely and effective maintenance is paramount.

Of particular concern is the county's roadway pavement system where performance targets are currently not being met. The county uses both the PCI and Pavement Surface Rating (PSR) assessment schemes to assess road pavement quality. Based on PCI, it is observed that 52% of roads are in "good" condition, 29% are in "fair" condition, and 19% are in "poor" condition. Based on PSR, it is observed that 56% of roads meet the "good" ride quality target but the system overall suffers from significant decline in road pavement conditions since 2018. This decline seems to reflect the growing gap between the county's available resources on one hand, and the growing need for rehabilitation and maintenance of pavement on the other hand.

Bridge asset management in Hennepin County is also associated with unmet targets. The target is to have over 50% of bridges in "good" condition and fewer than 4% in "poor" condition. However, only 40% of bridges meet the "good" standard, with 4% rated as "poor." This underscores the need for increased preventative maintenance to prevent further deterioration of the county's bridge infrastructure.

Additionally, the managers of traffic, drainage, and roadside assets are struggling to meet performance standards associated with those asset classes. In particular, traffic signal systems, culverts, and guardrails are failing to meet their performance targets, with an increasing number of traffic signal systems and drainage structures classified as "poor" due to aging and lack of maintenance. For example, 21% of the signal systems are over 35 years old, contributing to a substantial proportion being rated in poor condition. Finally, pedestrian infrastructure, particularly American Disabilities Act (ADA)-compliant curb ramps, has been

a focus for Hennepin County. The county has made progress in making pedestrian facilities ADA-compliant; however, only 72% of curb ramps meet the required standards, leaving 28% noncompliant. This indicates the ongoing challenge of ensuring accessibility as part of the county's asset management efforts.

2.4.4 Kittitas, WA

The 2022–2032 AMP for Kittitas County, Washington, offers a comprehensive example of how some local governments approach managing and maintaining their roads and bridges and other transportation infrastructure, and estimating the required revenue to meet those needs (Remeto & Cook, 2022). The report details two primary scenarios for asset intervention: preservation and rehabilitation/replacement. In the preservation scenario, the county seeks to maintain current service levels by continuing road maintenance and upgrading critical bridges. The county intends to cover this by increasing the road fund levy. It has been estimated that an increase of $0.15 per $1,000 of assessed property value will generate sufficient funds to continue preserving key assets. In the rehabilitation/replacement scenario, the county imposes no increase in the levy, and significant cuts to road and bridge maintenance spending will be needed, thereby accelerating asset deterioration. Under this approach, the county would have to divest from less critical assets and to prioritize more critical assets.

Kittitas County manages a network of rural roads that has aging infrastructure, posing significant challenges. The county has a projected $100 million funding shortfall regarding the needed improvements to the county's transportation assets over the 2022–2032 decade. Similar to rural road networks in other counties and other states, Kittitas's rural road system is critical for connecting the county's communities but continues to face growing strain due to rising costs, population growth, and urbanization. As a result, the county faces difficult decisions regarding which assets to prioritize for preservation and which to allow to deteriorate.

The county's TAM plan outlines the need for continued preventative maintenance, including regular chip sealing, crack sealing, and pre-leveling of roadways to maintain road conditions and prevent more costly repairs in later years. The county maintains approximately 70 miles of chip-sealed roads each year, a common preservation technique for rural roadways. The TAM recognizes that delaying preservation activities will lead to higher costs in the long run, as deferred maintenance would eventually require full-scale road reconstruction.

Regarding bridge management, the plan notes that several bridges in Kittitas County are in need of replacement, but the current funding levels cannot support these projects. The county uses the National Bridge Inventory (NBI) to record, assess, and monitor bridge conditions, and those with sufficiency ratings below 50 (on a scale of 0 (failed) to 100 (excellent)) are flagged for attention. The county recognizes that, without additional funding, some of these bridges may need to be closed rather than replaced, particularly if they are associated with local roads slated for divestment.

2.4.5 Walker, MI

The 2023 AMP for the City of Walker, Michigan, outlines the city's approach to managing its transportation assets, including roads, bridges, stormwater systems, and traffic signals (Mabry, 2023). The plan is structured around maintaining, preserving, and upgrading these assets in a cost-effective manner, using data-driven decisions supported by engineering principles and asset management frameworks provided by Michigan's Transportation Asset Management Council (TAMC).

Walker manages approximately 120 miles of public roads, consisting of segments with mostly asphalt surfaces. These roads are categorized as City Major (47.73 miles) and City Local (70.95 miles). City Major roads receive higher priority for state and federal funding through the National Highway System (NHS). Road pavement conditions are assessed using the PASER system, a tool widely used in Michigan. PASER assigns a rating from 1 to 10, with 10 representing excellent condition (a new road pavement) and 1 representing a failed pavement surface. In 2022, the weighted average PASER rating for Walker's City Major network was 5.5, while the City Local network had an average rating of 5.3. The city aims to maintain its average ratings in the "good" and "fair" categories (PASER > 4) to minimize expensive repairs on roads whose pavements fall into the "poor" category.

Walker is responsible for seven bridges that are inspected biennially using the National Bridge Inspection Standards (NBIS). The current condition of Walker's bridges includes one bridge rated "good" and six rated "fair." None of the bridges are rated "poor," although one, the Bristol Avenue bridge, is posted with a load restriction due to its age and unknown footing type. The City of Walker's goal is to maintain all bridges in the NBIS "good" and "fair" categories to ensure safety and service life. The city follows a strategy of cost-effective bridge management, focusing on preventive maintenance and strategic replacements. For example, the city intends to replace the 116-year-old railroad bridge over Bristol Avenue in 2024 and will partner with the Michigan Department of Transportation (MDOT) on the replacement and widening of the Fruit Ridge Avenue bridge over I-96 in 2025.

In addition, stormwater assets constitute a critical component of Walker's transportation system, including over 85 miles of stormwater pipes, 22 miles of open ditches, and thousands of related structures. The city's goal is to preserve these assets through regular maintenance, repair, and upgrade efforts. Similar strategies apply to traffic signals, with Walker managing several key intersections, often in partnership with the City of Grand Rapids, to ensure efficient traffic flow.

A significant challenge highlighted in Walker's AMP is funding. Most of the city's transportation revenue comes from the Michigan Transportation Fund (MTF), which allocates resources based on road mileage and population. However, federal grants and local contributions supplement this funding. Walker's strategy for managing financial constraints involves prioritizing the most critical projects while seeking opportunities to align with other public and private infrastructure projects to maximize efficiency and cost-effectiveness.

2.4.6 Washtenaw, MI

The 2021 AMP for Washtenaw County, Michigan, outlines the county's approach to managing and maintaining its extensive road and bridge infrastructure (Washtenaw County Road Commission, 2021). The Washtenaw County Road Commission (WCRC) is responsible for overseeing approximately 1,659 centerline miles of public roads, including 604.8 miles of county primary roads and 1,054.5 miles of county local roads. These roads are categorized based on state and federal classifications, with a significant portion of the primary roads eligible for federal funding due to their importance within the National Highway System (NHS).

A critical component of the county's AMP is the PASER system which is used to assess the condition of the paved road network. In 2020, 47% of the county primary roads were rated in "good" condition, 26% in "fair" condition, and 27% in "poor" condition, which indicates notably superior condition compared to similar federal-aid eligible roads statewide. However, the county local roads present a much more significant challenge, with 64% rated in poor condition, reflecting a severe backlog in maintenance and rehabilitation needs, a trend that is "partly driven by underfunding."

The county's asset management plan places a strong emphasis on data-driven decision-making to maximize the use of limited resources. WCRC had sought to achieve 80% of county primary roads in good or fair condition by 2023. To meet this goal, the plan outlines a "mix of fixes" approach, including reconstruction, mill and resurfacing, chip sealing, and other treatments designed to extend the service life of roads at various stages of deterioration. The plan emphasizes preventive maintenance, which is much more cost-effective than full-scale rehabilitation or reconstruction projects.

Bridge management is another crucial component of Washtenaw's transportation infrastructure. The county is responsible for 126 bridges, categorized by type and condition according to the NBI rating system. In 2020, 44% of the bridges were rated in "good" condition, 35% in "fair" condition, and 22% in "poor" condition, with several bridges marked as "scour critical" due to water damage vulnerabilities. To address these issues, the AMP outlines planned bridge replacements and rehabilitations, with a focus on securing funding from the Michigan Local Bridge Program.

Like most AMPs reviewed in this study, Washtenaw AMP's most significant challenge is the funding shortfall. The county relies heavily on the MTF, supplemented by federal grants and local contributions, but deems these sources rather insufficient to meet the county's extensive transportation infrastructure needs. The AMP identifies a substantial funding gap, particularly regarding the county local roads which receive minimal state and federal support. The continued existence of this funding constraint means that several needed pavement and bridge projects are deferred, resulting in accelerated deterioration and higher repair costs in the longer term.

2.4.7 Seattle, WA

The 2020 Seattle Department of Transportation (SDOT) *Asset Status & Condition Report* offers a comprehensive look into the city's transportation infrastructure assets, including roads, bridges, sidewalks, and traffic signals (SDOT, 2020). Seattle's rapid growth has increased the loads on its transportation infrastructure, intensifying the need for asset management to maintain service levels and safety. The report highlights SDOT's strategic approach to AMP which emphasizes proactive maintenance, preservation, and the efficient use of resources to ensure infrastructure sustainability.

The city's AMP approach is rooted in extending asset lifespans through regular, smaller investments to prevent significant failures. The total replacement cost for Seattle's transportation assets is estimated at $28.58 billion, with investments associated with seven high-value assets—such as arterial and non-arterial pavements, sidewalks, and bridges—constituting over 96% of this amount. Notably, the report stresses that Seattle's infrastructure funding has not kept pace with maintenance needs, resulting in a growing backlog of deferred maintenance.

SDOT uses a variety of asset management software tools to assess asset conditions, for managing data from regular physical inspections. These include Infor, BridgeWorks, and StreetSaver for data collection, analysis, and maintenance tracking. SDOT uses data on the asset replacement cost values and current/prospective condition ratings for each asset class to identify high-priority areas requiring immediate or preventative action. The report categorizes asset conditions using a five-point rating scale, ranging from "excellent" to "very poor." This is further supported by an annual asset maintenance and inspection schedule. This system enables SDOT to make informed, data-driven decisions on asset investment priorities.

SDOT's budget in 2020 was approximately $740 million; however, pandemic-induced revenue losses necessitated budget adjustments. SDOT's funding sources are diverse, with major contributors being the City's Transportation Fund, the Move Seattle Levy, and the Seattle Transportation Benefit District (STBD) funds. The 2020 budget adjustments reflect a focus on mobility capital projects and maintenance operations, as these categories directly affect the lifespan and

usability of transportation infrastructure. Despite these efforts, SDOT notes a significant gap between current funding and the estimated need for sustaining infrastructure. In particular, the report highlights that Seattle requires $470 million annually to cover infrastructure needs adequately, including deferred maintenance, though only a fraction of this amount is currently available. The accumulated consequence of underfunding, particularly for critical assets including bridges and arterial pavements is accelerated wear and increased cost of subsequent maintenance.

Seattle's transportation asset management plan also addresses equity and sustainability, aiming to ensure that its infrastructure serves all communities effectively. By focusing on equitable investment in public infrastructure, SDOT seeks to mitigate disparities in service quality across neighborhoods. Additionally, SDOT's strategy prioritizes resilience against environmental impacts, such as seismic activity and flooding, which are pressing concerns given Seattle's geomorphology and climate.

2.4.8 Mecosta County, MI

The Mecosta County Road Commission (MCRC) Asset Management Plan provides a detailed approach to managing and maintaining the county's 1,131 miles of roads, including primary, local, and urban roads (Mecosta County Road Commission, 2017). The AMP includes an asset inventory of 271.72 miles of primary roads, 859.54 miles of local roads, and 59.73 miles of urban roads. The surface type distribution is as follows—asphalt: 508.39 miles; gravel: 494.20 miles; earth roads: 33.69 miles; 72.97 miles: other or undefined.

The county uses the PASER system to assess the federal-aid eligible roads, totaling 219.71 miles. The assessment indicates that 13.61% of the roads are rated as excellent (PASER 9–10), while 23.58% are classified as poor to fair (PASER 3–4), and 20.22% are rated as failed (PASER 1–2), with an average PASER rating of 5.467. The TAM indicates that such evaluation helps guide the county's decision-makers on their road repair and improvement choices.

The financial aspect of the AMP is a critical component. As of December 31, 2017, the total current investment in road assets was valued at $42,547,057 (after accounting for depreciation, the net value stands at $25,195,033). In 2018, the MCRC expected to generate $10,052,239 in revenues, with the Michigan Transportation Fund contributing $5,713,500, alongside federal and state funds, township contributions, and State Trunkline Maintenance funds.

The MCRC's asset management strategy aligns with Michigan's asset management process, emphasizing the importance of understanding the assets, managing their lifecycle, adhering to rules, making informed decisions, and ensuring sustainability. For data management, the MCRC utilizes several key tools, including RoadSoft for asset management, MS Excel for annual planning and deterioration modeling, and Cogitate for accounting.

From a strategic viewpoint, MCRC's asset management goals are to preserve and improve the road system while enhancing safety for all road users. The agency's TAM plan stresses the need for cost-effective management, coordination with stakeholders, and prioritization of investments to optimize resources. Furthermore, the sustainability assessment highlights the agency's objective to maintain roads in good condition, prevent further deterioration of fair roads, and reconstruct poor roads when possible. The commission also explores new technologies and materials to extend pavement life, aiming for long-term road system sustainability.

2.4.9 Iosco County, MI

The Iosco County Road Commission's (ICRC) 2023 Transportation Asset Management Plan provides a detailed strategy for managing transportation infrastructure, focusing on maximizing the longevity of public assets such as roads, bridges, culverts, and traffic signals (Nunn, 2023). The county's transportation system comprises 852.84 centerline miles of roads, 31 bridges, approximately 1,200 culverts, and one (1) traffic signal. These assets are divided into two categories: county primary and county local. The plan emphasizes the use of data-driven decisions and cost-effective maintenance strategies to preserve the county's transportation network.

For road management, the ICRC uses the PASER system to assess and document pavement conditions on a scale of 1 to 10 (a score of 10 represents "excellent" condition, often associated with newly-constructed roads, and a score of 1 indicates a failed pavement). The county's primary network has 27% of roads rated in "good" condition, 44% in "fair," and 29% in "poor" condition. In contrast, the county's local network shows a more challenging condition, with only 6% of roads classified as "good," 34% as "fair," and 61% as "poor." The ICRC aims to improve these ratings over time, setting goals to increase the percentage of roads in "good" and "fair" conditions while reducing those in "poor" condition. For unpaved roads, ICRC uses an Inventory-Based Rating (IBR) system to assess factors such as surface width, drainage adequacy, and structural adequacy. The county's unpaved road network is assessed regularly, with the goal of maintaining or improving road conditions across the board.

Regarding bridge management, the ICRC is responsible for 31 bridges. Of these, in 2023, 10 are rated in "good" condition, 19 are rated as "fair," and two bridges are rated as "poor." The ICRC has implemented a preventative maintenance program aimed at extending the service life of these structures. Additionally, depending on funding availability, the commission plans to replace one bridge within the next three years, at an estimated cost of $2.7 million. The goal is to maintain the overall bridge network's condition and prevent deterioration.

Additionally, the document highlights the financial planning aspects of asset management, providing details on anticipated revenues and expenses. The ICRC faces significant funding challenges, with the primary source of transportation funding being the MTF, supplemented by federal grants, local contributions, and permit fees. The total estimated revenue for 2023 is $10.6 million, with expenditures planned for routine maintenance, winter operations, preservation, and structural improvements. However, there is a gap between the funds available and the amount required to meet all transportation needs. For example, the plan identifies a $580,000 annual shortfall in maintenance work needed to "stabilize" the physical condition of the county's local road network.

2.4.10 Northeast Ohio Areawide Coordinating Agency (NOACA), OH

The Northeast Ohio Areawide Coordinating Agency (NOACA) Transportation Asset Management Plan, completed in July 2016, outlines the agency's approach to managing transportation infrastructure assets within its jurisdiction, which includes Cuyahoga, Geauga, Lake, Lorain, and Medina counties (a region with a total population of over 2 million) (NOACA, 2016). The agency considers the TAM plan as essential for ensuring that the region's transportation system, including roads and bridges is maintained in a state of good repair and operates efficiently, despite limited financial resources and aging infrastructure. Through life-cycle management and data leveraging to inform investment decisions, NOACA aims to maximize the impact of its available resources and ensure the longevity of the region's transportation infrastructure.

One of the core elements of the NOACA AMP is a detailed assessment of the current condition of the transportation assets. The region has 8,494 lane miles of federal-aid-eligible roadways and 3,069 bridges. A key tool used for this assessment is the Pavement Condition Rating (PCR), a measure developed by the Ohio Department of Transportation (ODOT) to monitor road conditions over time. The PCR rates pavement conditions on a scale from 0 to 100, with scores of 90–100 indicating "very good" condition, 75–89 "good," 65–74 "fair," 55–64 "fair to poor," and 40–54 "poor." As of 2014, 46.1% of the region's roads were in "good" condition, while about 3.1% were in "poor" condition.

In addition to roads, bridge conditions are also a critical focus of the NOACA AMP. The report classifies bridge conditions using ODOT's NBI rating system, which categorizes bridges as "good," "fair," or "poor." At the time of the report, approximately 46.4% of the bridges in the region were in "good" condition while 6.9% were classified as "poor." The agency considers the maintenance of these bridges in a state of good repair to be vital, particularly for ensuring the safety of the region's transportation network and preventing the incurrence of more costly repairs later in the future.

The NOACA region faces significant challenges in maintaining its infrastructure due to funding limitations. The plan estimates that maintaining current pavement conditions will require an annual investment of $207 million, while maintaining bridge conditions will require about $70 million annually. Despite these needs, the actual available funding is projected to fall short of these amounts, particularly regarding the urban and local systems. This funding shortfall creates gaps in achieving the state-of-good-repair targets set by the agency. To address this, NOACA emphasizes the importance of life-cycle management strategies which prioritize timely preventive maintenance to extend the life of assets and reduce long-term costs.

Another critical component of the NOACA AMP is its focus on data-driven decision-making. The plan highlights the use of pavement management software (RoadMatrix) to analyze investment needs and optimize the allocation of available funds. This tool helps NOACA prioritize maintenance activities, determine the most cost-effective treatments for pavements, and project future condition scenarios based on various funding levels.

2.4.11 Region 2 Area, MI

The *2018–2019 Asset Management Report* for Region 2 in Michigan outlines the condition and management of federal-aid-eligible roadways in Hillsdale, Jackson, and Lenawee counties (Region 2 Planning Commission, 2019). The report, administered by the Region 2 Planning Commission (R2PC) and funded by MDOT, is a critical resource for understanding and improving the road infrastructure in this tri-county area. The focus is on the continuous evaluation and preservation of roads, with an emphasis on optimizing maintenance and strategically planning future improvements.

The road network covered in the report includes 1,642 miles of federal-aid-eligible roads, with 422 miles in Hillsdale County, 687 miles in Jackson County, and 533 miles in Lenawee County. These roads are divided into three categories: principal and minor arterials, major/urban collectors, and local roads. The asset management program prioritizes the condition assessment of these roads using the PASER system which rates road surfaces on a scale from 1 (failed) to 10 (excellent). The use of RoadSoft, a software developed by Michigan Technological University, facilitates data collection, ensuring consistency and accuracy in road condition assessments.

In Hillsdale County, PASER rating data collected in 2018 and 2019 indicated that 62% of federal-aid roads are in "poor" or "very poor" condition, and only 14% rated as "very good" or "excellent." Most of the "poor" condition roads are county primary roads (77% of these falls into the "poor" category) reflecting the need for substantial repair or rehabilitation of that class of

roads. Despite these challenges, 23% of state trunklines, which make up 27% of the federal-aid network, are in "fair" or "good" condition.

In Jackson County, the TAM data reveals similar issues, with 36% of roads rated in poor condition. However, 49% of the roads are in "fair" or "good" condition, and 15% are in "very good" condition. This distribution shows that while Jackson County's federal-aid roads are in slightly better condition compared to those in Hillsdale, there remains a significant need for investment, particularly in local county roads, where 88% are in "poor" condition.

Lenawee County also faces similar challenges, with 28% of federal-aid roads rated in "poor" condition. However, 53% of the roads are in "fair" or "good" condition, and 20% are in "very good" condition. County primary roads in Lenawee show the highest proportion of roads in "very good" condition (27%), reflecting a more robust preservation strategy in this part of the region.

One of the key challenges highlighted in the report is funding. The region's federal-aid roadways require significant investment to maintain and improve their condition levels, however, available funds are limited. This is a common issue in many local transportation agencies, where budgets rely heavily on state and federal support. The funding gap becomes even more apparent when comparing the region's needs to the actual resources allocated for road repairs and maintenance.

The report emphasizes the importance of preventive maintenance, which is more cost-effective than reactive repairs. By investing in sealcoating, resurfacing, and other preservation techniques early, the counties aim to extend the lifespan of their roadways and reduce the long-term costs of more extensive rehabilitation projects. However, the financial limitations of each county necessitate difficult decisions about which projects to prioritize.

In conclusion, the Region 2 Asset Management Report provides a comprehensive overview of the condition of federal-aid-eligible roads in Hillsdale, Jackson, and Lenawee counties. The agency emphasizes the need for strategic planning and preventive maintenance to preserve the region's transportation infrastructure. However, it also acknowledges significant funding challenges, particularly in maintaining local county roads (many of which are in poor condition." This case study illustrates the broader challenges local transportation agencies face in balancing limited resources with the need to maintain and improve aging infrastructure.

2.4.12 Summary

Table 2.1 summarizes the key elements of TAM reported by the sample of local agencies selected nationwide. The table presents, for each case study, the road inventory details, condition assessment tools used by the LPA, the current condition of assets (mostly, pavement assets), asset management related challenges, funding/financial position of the LPA for its assets, and the LPA's stated motivation or impetus for pursuing asset management practices.

TABLE 2.1
Synopsis of Local Asset Management Practices Nationwide from the LPA Sample

Case Study	Road Inventory Details	Condition Assessment Tools	Asset Condition	Challenges	Financial Overview	TAM Impetus or Motivation (Cited from Source)
Bay City, MI (Scott, 2024)	376.503 lane miles (129.042 major, 247.461 local)	PASER system	Local roads: 87% are poor Major roads: 59% are poor	Insufficient budget; funding gap of $2–$4 million per year for pavement goals	Receives state funds, federal grants, and local contributions; current budget of $2 million annually for major street projects	"An asset management plan is required by Michigan Public Act 325 of 2018, and this document represents fulfillment of some of City of Bay City's obligations towards meeting these requirements."
Central Indiana, IN (IMPO, 2021)	9,678 miles across eight counties	PASER, PCI systems	PASER: 28% are good; 49% are fair; 23% are poor Indianapolis PCI: 22% are good; 24% are fair; 54% are poor	High need for maintenance; funding challenges	$644 million planned expenditure for 2021–2026, primarily from INDOT Community Crossings Matching Grant program	"This Asset Management Report was completed pursuant to IC.36-7-7.7-11, which requires the IMPO to develop a comprehensive asset management report compiling and analyzing the transportation asset management plans of each eligible political subdivision that is a member of the Indianapolis Metropolitan Planning Organization (IMPO)."
Hennepin County, MN (Hennepin County Public Works, 2023)	Roadway pavement, bridges, drainage systems, traffic and roadside assets, pedestrian infrastructure	PCI, Pavement Surface Rating (PSR)	52% roads are good; 29% are fair; 19% are poor 56% are good in terms of PSR ride quality	Aging infrastructure, increased deterioration, unmet performance targets	Limited funding; annual gap between needs and available resources	Not stated
Kittitas County, WA (Remeto & Cook, 2022)	Network of rural roads, aging infrastructure	National Bridge Inventory System (NBIS)	Rural road preservation is costly, necessitating strategic maintenance	$100 million funding shortfall projected over 10 years	Insufficient funding; preservation scenario requires a levy increase	"DPW created the department's first AMP in 2018….The 2018 plan was adopted by the Board of County Commissioners with Resolution 2018-165."
Walker, MI (Mabry, 2023)	118.68 miles (City major: 47.73, City local: 70.95)	PASER	City Major network PASER: 5.5; City local: 5.3	Financial constraints, road age, need for preventive maintenance	Michigan Transportation Fund primary revenue source; federal grants and local contributions supplement funds	"Public Act 325 of 2018 required the original submittal of this plan by October 1, 2020, with updates and resubmittal to TAMC every 3 years. This is the first update of the original plan. The next plan submittal is due by October 1, 2026."
Washtenaw County, MI (2021)	1,659 miles (Primary: 604.8, Local: 1,054.5)	PASER	Primary: 47% are good, 26% are fair, 27% are poor Local: 64% are poor	Funding limitations impacting local roads	Funding from Michigan Transportation Fund, federal grants; significant gap for local road maintenance needs	"An asset management plan is required by Michigan Public Act 325 of 2018, and this document represents fulfillment of WCRC's obligations towards meeting these requirements."

Continued

TABLE 2.1
(Continued)

Case Study	Road Inventory Details	Condition Assessment Tools	Asset Condition	Challenges	Financial Overview	TAM Impetus or Motivation (Cited from Source)
Seattle, WA (SDOT, 2020)	Various assets: arterial and non-arterial pavements, bridges, sidewalks, and signals; replacement cost: $28.58 billion	Asset management software (Infor, BridgeWorks)	Replacement values of assets at 96% of city's asset value; significant deferred maintenance and backlog	Rapid growth, maintenance backlog, insufficient funding	Annual funding gap of $470 million; reliance on local levies and city transportation fund	"The development of a TAM plan that meets the requirements of 49 CFR Part 625 fulfills state requirements for the development of a "maintenance management plan" or "maintenance and preservation management plans" as required in the following Revised Code of Washington (RCW)"
Mecosta County, MI (Mecosta County Road Commission, 2017)	1,131 miles (Primary: 271.72; Local: 859.54)	PASER	Excellent: 13.61% Poor–fair: 24% Failed: 20%	Resource constraints, high proportion of roads in need of repair	$10 million annual revenue primarily from Michigan Transportation Fund, alongside federal and local funds	"The MCRC also complies with Michigan Public Act 199 of 2007, which requires: The department, each county road commission, and each city and village of this state shall annually submit a report to the Council. This report shall include a multi-year program developed through the asset management process described in this section."
Iosco County, MI (Nunn, 2023)	852.84 miles (County Primary and Local)	PASER, Inventory-Based Rating (IBR) for unpaved	Primary: 27% are good, 44% are fair, 29% are poor; Local: 6% are good, 34% are fair, 61% are poor	Limited budget, especially for local network	$10.6 million revenue, shortfall of $580,000 annually for local roads maintenance	"An asset management plan is required by Michigan Public Act 325 of 2018, and this document represents fulfillment of some of ICRC's obligations towards meeting these requirements."
NOACA, OH (NOACA, 2016)	8,494 lane miles of federal-aid-eligible roadways, 3,069 bridges	Pavement Condition Rating (PCR)	Roads: 46.1% are good; 3.1% are poor Bridges: 46.4% are good; 6.9% are poor	Funding gap for maintaining good repair status	Requires $207 million for roads and $70 million for bridges annually; funding falls short for urban/local systems	"In 2014, NOACA launched an effort to develop a AMP with the support of a Federal Highway Administration (FHWA) Accelerated Innovation Deployment (AID) Grant."
Region 2 Area, MI (Region 2 Planning Commission, 2019)	1,642 miles in Hillsdale, Jackson, and Lenawee counties	PASER	Hillsdale: 62% of roads are poor. Jackson: 36% of roads are poor Lenawee: 28% of roads are poor	Limited funds for county road improvements	Heavy reliance on state and federal support for funding	Not stated

3. ANALYSIS OF AGGREGATE DATA ON LOCAL ROAD ASSET EXPENDITURES AND REVENUES: INDIANA AND NATIONWIDE

This chapter carries out analysis of aggregate data on two key elements of local road asset management—expenditures and asset condition. This is done first using Indiana data, and then comparing Indiana with other states in the U.S. The purpose of the comparison is not to identify any shortcomings of Indiana or other states relative to others, but to serve as a benchmark for further assessment of reasons for any such shortfalls, particularly from Indiana's perspective. The chapter includes quantitative analysis (and visualization of spatial trends) of aggregate data on statewide LPA expenditures in the United States.

3.1 LPA Expenditure Trends–Indiana

The expenditure data for the State of Indiana was sourced from the Highway Statistics Series, a comprehensive collection of annual reports that provide detailed statistical insights on various aspects of highway management and usage (Office of Policy and Governmental Affairs, n.d.). These online publications and spreadsheets present data on roadway mileage, travel patterns, and financial matters related to highway infrastructure. The series also present data related to local road revenues—motor fuel consumption, vehicle registrations, driver licenses, and highway user tax. For purposes of the current report, data were extracted specifically from the Highway Statistics Table LGF-2 (Local Government Disbursements for Highways), which presents expenditure amounts for each of several years, to identify trends and patterns across the states, and to ultimately calculate their normalized expenditures (spending per inventory mile). The findings from this dataset are compiled and presented in the tables and charts presented in this chapter. Table 3.1 presents the local government expenditures in Indiana (in millions of dollars), and Figure 3.1 presents the trends of local government expenditures in all road expenditure areas, Indiana, 2000–2021. Also, Figure 3.2 provides details on the annual local government expenditures on local roads in Indiana, 2000–2021, and Figure 3.3 breaks down the local government capital expenditures on local roads in Indiana, 2000–2021. Table 3.2 and Figure 3.4 present the trends of local road expenditures in Indiana, 2017–2023 (LTAP, n.d.).

Across the data plots (Figures 3.1–3.3), a significant peak in total local government disbursements in the years leading up to 2016 is observed. In addition, Figure 3.3 indicates that these investments were dominated by asset replacements and repairs (road and street construction, and system preservation) but also include other minor but related activities (acquisition of rights-of-way, and preliminary and construction engineering). Notably, the expenditures for these capital outlays matched the levels of maintenance costs observed in previous years, marking a shift in spending priorities. More interestingly, the massive and unprecedented investment in capital outlays in the years leading up to 2016 was accompanied by significant spending reductions (not only in maintenance expenditures but also in total expenditures) in subsequent years.

TABLE 3.1
Local Government Road Expenditures in Indiana in Millions of Dollars

Year	Capital Outlay	Maintenance	Traffic Services	Admin. Misc.	Highway Law Enforcement and Safety	Interest	Refunding Bonds	Current Revenues or Sinking Funds	Transfers to State Governments	Total
2000	184.71	676.37	24.86	65.08	47.19	14.35	11.12	0.00	33.01	1,056.69
2001	191.17	672.97	24.80	64.49	48.84	14.00	10.85	0.00	29.23	1,056.35
2002	196.72	695.31	25.01	66.63	50.46	13.78	10.68	0.00	0.00	1,058.60
2003	249.72	918.52	25.07	68.06	66.66	13.54	10.49	0.00	0.00	1,352.05
2004	247.86	907.33	24.62	68.57	69.78	17.61	10.26	0.00	469.81	1,815.84
2005	283.49	1,056.85	24.87	70.55	72.47	17.78	10.86	0.00	238.30	1,775.17
2007	286.26	1,056.24	25.08	71.90	75.98	18.12	10.85	0.00	233.49	1,777.93
2008	288.27	1,063.63	25.26	72.40	76.51	18.24	10.93	0.00	56.93	1,612.16
2008	288.93	1,066.09	25.32	72.57	76.69	18.29	10.95	0.00	38.88	1,597.72
2009	328.95	420.59	51.40	259.47	0.00	15.74	502.13	0.00	39.34	1,617.62
2010	337.44	431.46	52.73	266.17	0.00	10.17	515.10	0.00	0.00	1,613.08
2011	477.14	452.95	79.37	270.88	0.00	9.53	3.19	0.00	0.00	1,293.07
2012	483.82	459.29	80.48	274.67	0.00	9.66	3.24	0.00	57.39	1,368.55
2013	304.83	336.96	55.97	293.76	0.00	24.64	0.00	0.00	43.68	1,059.83
2014	308.20	340.69	56.59	297.01	0.00	21.13	0.00	0.00	63.21	1,086.83
2015	880.91	478.10	0.00	527.24	0.00	38.39	0.00	0.00	71.87	1,996.52
2016	1,040.43	634.34	163.36	290.05	0.00	0.29	122.48	0.00	49.96	2,300.91
2017	599.84	470.41	115.54	248.67	0.00	0.21	86.63	0.00	81.39	1,602.67
2018	499.50	513.74	116.03	363.03	0.00	7.40	14.70	0.00	81.20	1,595.61
2019	609.62	506.24	123.68	357.94	0.00	7.13	53.20	0.00	80.50	1,738.31
2020	612.13	500.63	122.31	345.64	0.00	7.05	52.61	0.00	83.04	1,723.43
2021	586.01	484.72	121.54	333.19	0.00	6.80	0.00	50.70	79.90	2,248.86

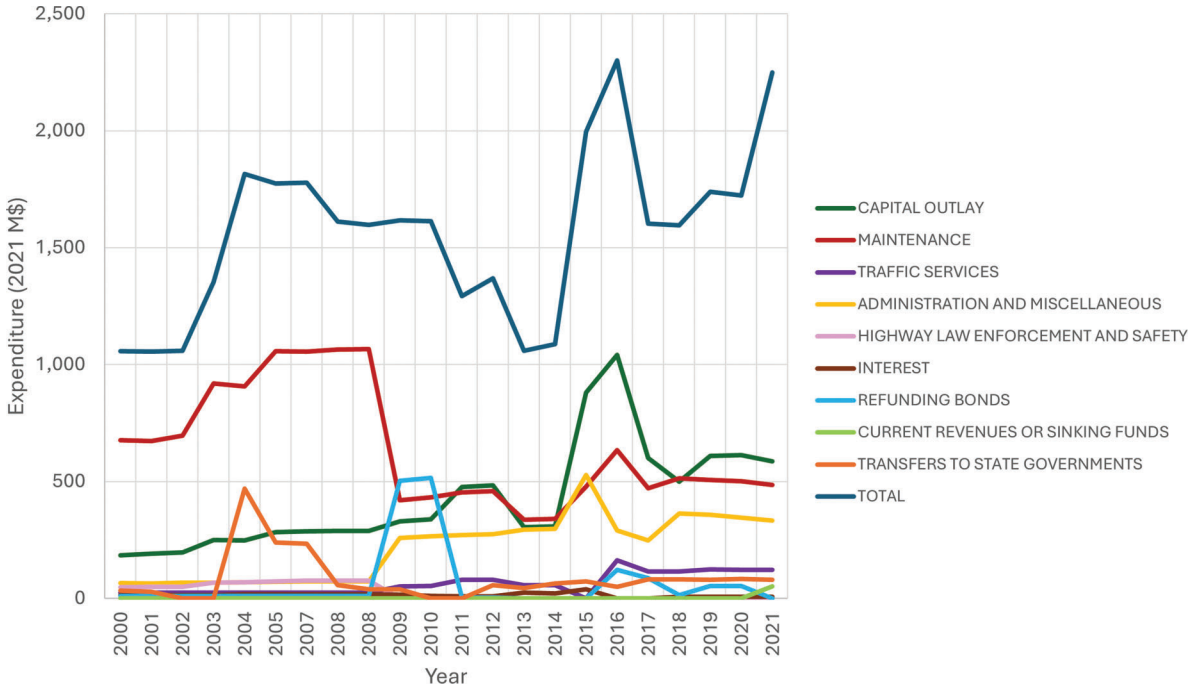


Figure 3.1 Long-term trends of local government expenditures categorized by expenditure area for highways in Indiana (in millions of dollars, 2000–2021) (Office of Policy and Governmental Affairs, n.d.).

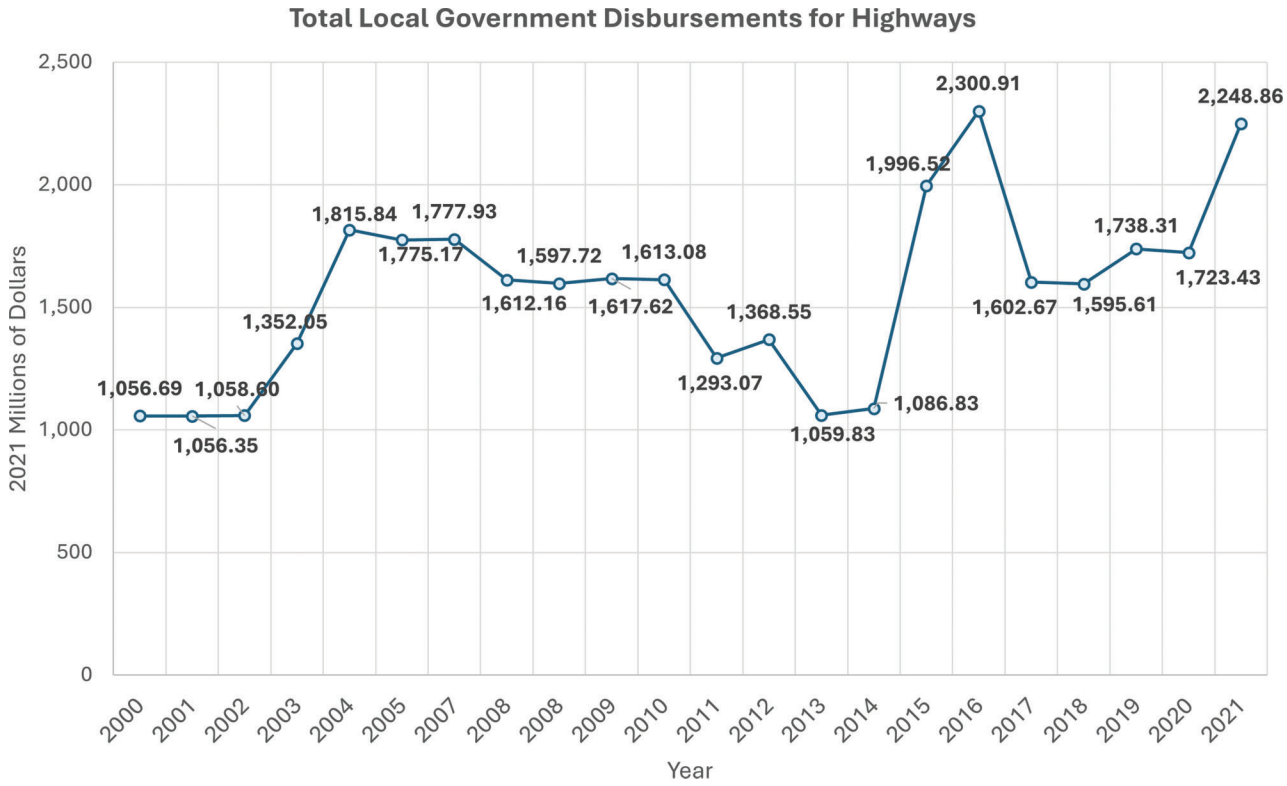


Figure 3.2 Long-term trends of annual local road expenditures in Indiana (in millions of dollars, 2000–2021) (Office of Policy and Governmental Affairs, n.d.).

This is indicative of the effect of the tradeoff between capital investments and maintenance spending. The trend corroborates a well-known maxim in asset management: spend more upfront in order to reduce your life cycle costs subsequently. The capital outlay breakdown is shown below.

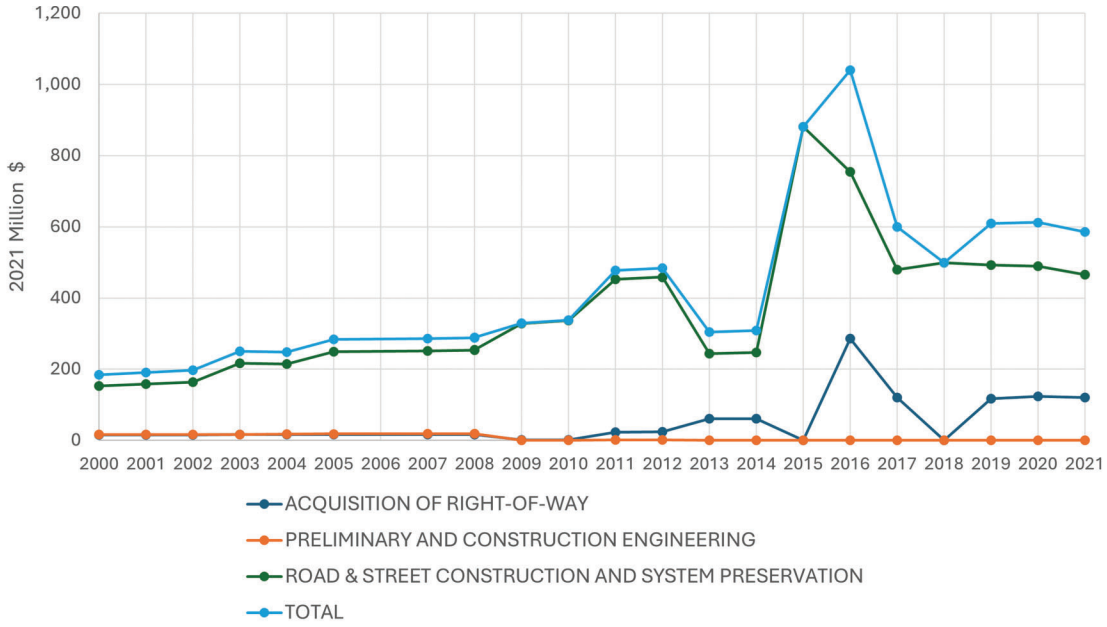


Figure 3.3 Breakdown of local road capital expenditures (in millions of dollars, 2000–2021) (Office of Policy and Governmental Affairs, n.d.).

3.2 Local Road Pavement Condition in Indiana, 2017–2023

The analysis in Section 3.1 suggests that Indiana LPAs adoption of asset management practices, spurred by the 2016 legislation HEA 1001-2016, was fully or partly responsible for the significant reduction in asset expenditures in the years after the legislation. However, an investigation of the physical conditions of the assets can provide a clearer picture of the effects of the legislation. Table 3.3 and Figure 3.5 prepared using data from LTAP (n.d.) present the trends of local road pavement conditions in Indiana from 2017 to 2023. The trend suggests a 2-year lag of the legislation's effects: in 2018 and thereafter, the percentage of pavements in good condition increased from approximately 12% to 27%, and the percentage of pavements in poor condition decreased from an average of 49% to 28%. Also, rough projections of these trends suggest that even after 2023, the percentage of poor-condition pavements will continue to decrease, while good-condition pavements will continue to increase. The lag is likely due to the time taken for the law to take effect, the process of project development, and the timing of road infrastructure assessment.

3.3 Comparison of Local Road Expenditures: Indiana and Nationwide

(a) Overall Patterns

Table 3.4 and Figure 3.6 present the total maintenance expenditures on local road assets in the U.S. at a snapshot in time (that is, year 2021), normalized by the road inventory size at that year. The total mileage of local roads is used here as a proxy for inventory size, with due caveats regarding the extenuating effects of the number of lanes and the presence of other asset types. It is assumed that the number of lanes generally is strongly correlated to the number of lane miles and the dimensions of other road assets (bridge deck areas, guardrail lengths, and so on) and therefore can represent the inventory size adequately. Using data from FHWA's Highway Statistics (Office of Policy and Governmental Affairs, n.d.), this section of the report compares local road expenditures in Indiana and nationwide. Figure 3.7 presents a visualization of the data of Table 3.4 that facilitates comparison across the states. The chart makes a compelling case for the argument that the local roads unit expenditures trend exhibits scale economies: States with smaller inventories spend more per mile for the upkeep of their local roads: for example, West Virginia (inventory size 3,549 miles) spends approximately $33,000 per mile, while Georgia (inventory size 107,849 miles) spends approximately $7,300 per mile. In this context of asset management, economies of scale can be explained by the realization that there are several fixed costs in road administration that do not vary by the network inventory size, including personnel costs at the central offices.

The U.S. average expenditure on local roads is approximately $22,000 per mile. From the perspective of scale economies, the mathematical relationship (obtained via curve-fitting) for the unit expenditure function is:

$$Unit\ expenditure = \frac{3{,}992{,}692{,}256}{Inventory\ size + 130{,}861}$$

The pattern seems clear: for smaller local road inventories, every 10,000 miles increase in inventory size is generally associated with a 7% decrease in unit expenditure on road maintenance; for larger inventories, every 10,000 miles increase in inventory size is generally associated with a 3.6% decrease in unit expenditure on road maintenance.

TABLE 3.2
Trends of Local Road Expenditures in Indiana, 2018–2023 (LTAP, n.d.)

Year	General Administration (%)	Construction, Reconstruction, Preservation (%)	Winter Operations (%)	Maintenance and Repair (%)	Other Expenditures (%)
2018	21.05	45.16	4.47	12.92	16.39
2019	18.17	48.28	3.49	13.84	16.23
2020	18.27	37.99	2.98	11.48	29.27
2021	21.15	46.36	4.40	13.37	14.73
2022	19.48	50.11	3.11	12.90	14.40
2023	18.36	46.12	2.91	11.77	20.84

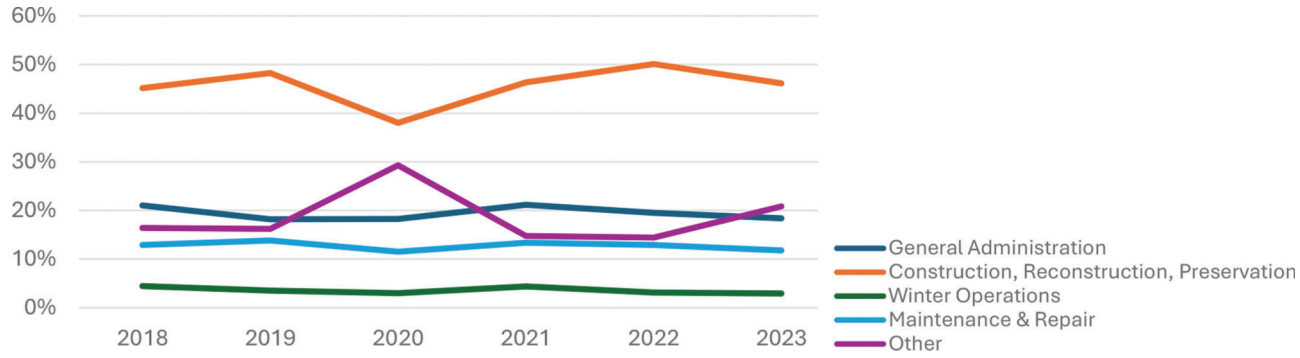


Figure 3.4 Trends of local road expenditure categories in Indiana, 2018–2023 (LTAP, n.d.).

TABLE 3.3
Distribution Trends of Local Road Pavement Condition in Indiana (2017–2023)

Year	Good (%)	Fair (%)	Poor (%)
2023	27.13	45.13	27.74
2022	26.74	43.96	29.30
2021	26.93	42.53	30.54
2020	25.16	43.99	30.86
2019	23.27	44.79	31.94
2018	11.61	39.79	48.60
2017	14.16	50.23	35.61

Averaged across all inventories, every 10,000 miles increase in inventory size is generally associated with a 5.2% reduction in unit expenditure on local road maintenance.

Examining the data closely reveals some pertinent trends. First, there exists a few outliers, and certain states with small inventories have remarkably low unit costs of local road repair spending. These include the far northeast states of Delaware, New Hampshire, Rhode Island, Vermont, and Maine. There are also states with large inventories that surprisingly have rather high unit costs of local road repair spending: California, Texas, Florida, and New York. As we explain in a subsequent section of this chapter, variations in unit costs are driven by several other factors, not only scale economies of inventory size. Second, there exist certain peer states (groups of states) based on their geographical location, or based on their scale economy levels, or both. For example, the Midwest states of Indiana, Wisconsin, Iowa, Tennessee, Nebraska, Michigan, and Ohio share similar geographical location but also occupy the middle area of the scale economy chart, with generally similar levels of inventory size and unit expenditure. A similar situation is observed for the northeast states of Delaware, New Hampshire, Rhode Island, Vermont, and Maine; and for Connecticut, New Jersey, and Massachusetts.

(b) Patterns Related to Indiana

Indiana occupies a position ($12,450/mile) which is 43% of the U.S. average, well below the national average and below the curve of best fit. At first glance, this superior position of Indiana's LPAs relative to other states could be attributed to the effect of the 2016 legislation in Indiana that motivated the LPAs to adopt asset management practices. On another note, however, the literature review (Chapter 2 of this report) indicates that in other states too, LPAs were encouraged or mandated to establish AMPs. Therefore, with all or most states having their LPAs develop AMPs, any superior position in asset management outcomes (lower spending, superior condition, etc.) could generally be attributed to more effective AMPs in terms of greater efficiency of manpower responsible for asset management, better monitoring of the asset condition, more optimal resource allocation to the most deserving assets, and so on.

Within its peer state group, Indiana seems to be in an average position. On one hand, Tennessee and Nebraska have smaller or similar inventories compared to Indiana and should have higher or similar unit expenditures, however, they have lower unit expenditures compared to Indiana; Indiana could probably learn from these states through peer exchange forums (it is worth noting, though, that Indiana's wet-freeze climate poses more challenging conditions compared to Nebraska (dry/freeze) and Tennessee (wet non/freeze)). On the other hand, Wisconsin, Ohio, Michigan, Minnesota, and Illinois have larger inventories compared to Indiana and should have smaller unit expenditures, however, they have higher unit expenditures

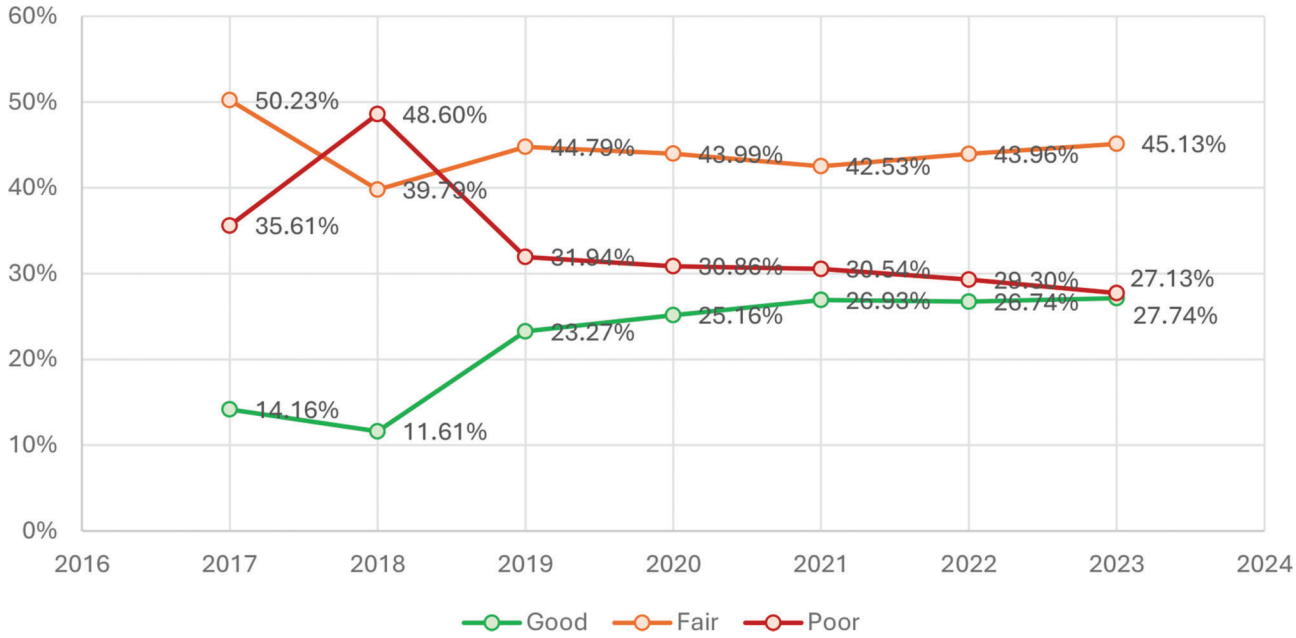


Figure 3.5 Trends of the distribution of local road pavement conditions in Indiana, 2017–2023 (LTAP, n.d.).

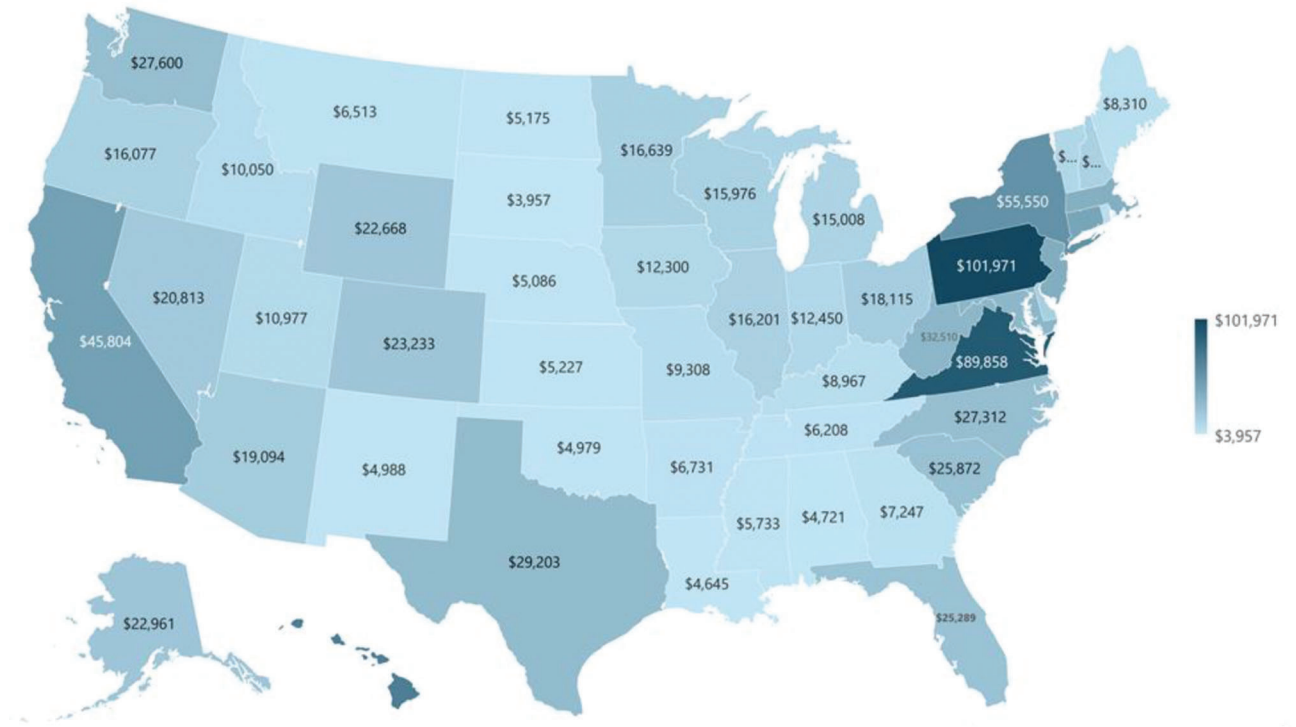


Figure 3.6 Unit expenditures on local road maintenance/reconstruction ($/mile), 2021.

compared to Indiana; these states could probably learn from Indiana through peer exchange forums.

(c) Other Factors That Affect the Unit Expenditure

In any analysis that attempts to compare the unit-cost "performance" of management processes across jurisdictions (in this case, states), the need for circumspection is paramount (Agbelie et al., 2015; Ghahari et al., 2019; Hartgen & Krauss, 1993; Hendren & Niemeier, 2008; London et al., 2012). The observed differences in unit local road expenditures across the states could be due a variety of factors. These factors are discussed below.

- *Scale Economies*
  As shown in Figure 3.6, and as explained in an earlier section, scale economies in local road spending are all too real, and larger states generally have

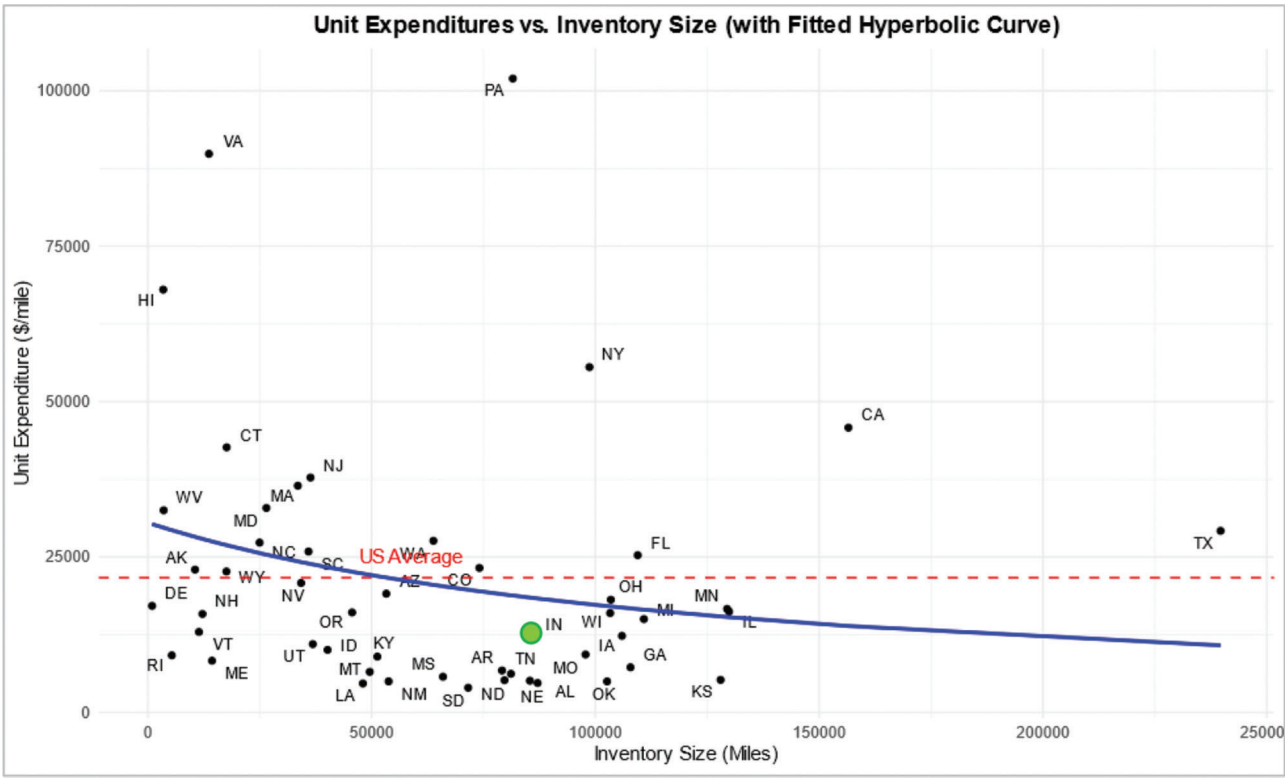


Figure 3.7 Scale economies in local road spending (unit expenditures vs. inventory size), 2021 data (the large green dot represents Indiana).

lower costs, as their ratio of variable costs to fixed costs, is larger, and normalization by the output variable yields a lower value.

- *Cohort Age Distribution of the Road Infrastructure*
  States with older generations of assets generally spend more on each mile, as aging is associated with higher levels of deterioration.
- *Climate Severity Variations*
  The Long-Term Pavement Performance (LTPP) program established four climate regions based on frost conditions and precipitation levels (Figure 3.8). States located in wet freeze regions tend to experience higher deterioration due to higher freeze-thaw cycles, freeze indices, and precipitation, and consequently spend more on the upkeep of their road assets, compared to dry or non-freeze regions. See Figure 3.7. For example, New Jersey and Utah have similar inventories, but New Jersey has over thrice the unit spending of Utah. This could be attributed in part to the more severe climate of the former.
- *Truck Loading Variation*
  Heavier loads impose higher stress on pavements, particularly where the pavements are not designed to withstand those loads. Certain states have higher loads on their pavements, and this may be due to less restrictive overweight policies at local roads, detours to local roads during construction of primary roads, or other spillover effects of truck traffic from the primary roads. In certain states, these effects are more pronounced than others.
- *Cost of Raw Materials*
  Certain states have easy and quick access to quality borrow pits and quarries, and asphalt supply points, thereby have lower costs of road construction and repair materials.
- *Cost of Labor*
  The price of labor varies significantly across the states. Generally, states that have lower labor costs will generally have lower costs of road repair, all other factors remaining the same.
- *Use of Data-Driven Tools for Road Asset Decisions*
  The local agencies of certain states have established well-functioning asset management plans, programs, and systems that help them make good decisions (regarding expenditure resource allocation and scheduling) that lead to superior condition yet overall lower unit expenditures in the long term. The cost-reduction efficacy of these decision support tools generally depends on their level of maturity.
- *Work Culture*
  The work culture in a local agency can influence the overall spending per mile. LPAs that make conscious efforts to reduce waste, enhance worker enthusiasm and accountability, ensure effect supervision of labor, promote continual training, and avoid corrupt practices, can generally be expected to produce superior performance outputs at lower unit costs.
- *Design and Construction Practices*
  For work contracted by the LPA or done in-house, the appropriateness of design standards, specifications, and the quality of technical drawings, will help produce quality products that are long-lasting and have little maintenance cost over their life cycle.
- *Road-Use Policies Designed to Protect the Infrastructure*
  Certain LPASs, recognizing that spillovers from primary roads pose hazard to their infrastructure in

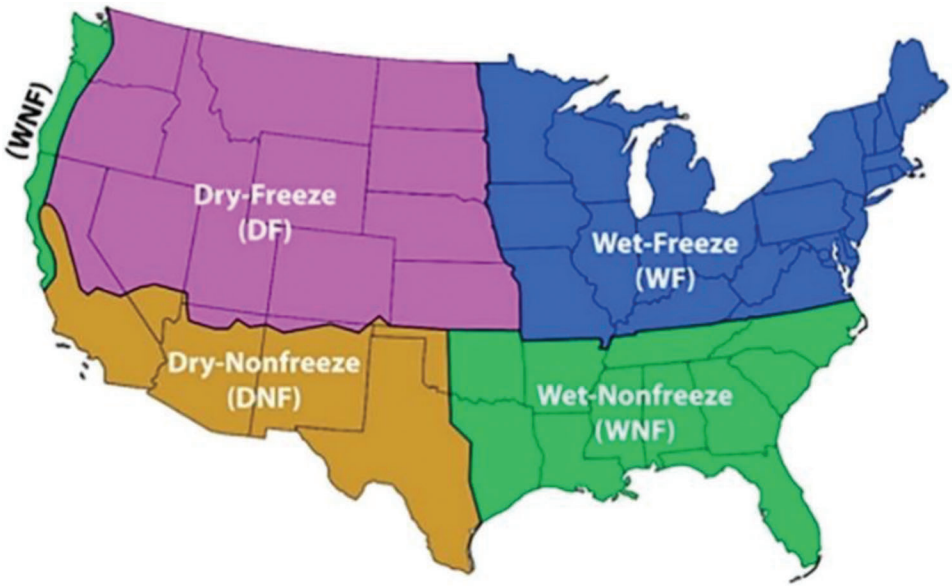
TABLE 3.4
Local Road Inventory Size, Expenditures, and Unit Expenditures ($M/mile) of All 50 States in 2021

	Total Expenditure on Local Roads ($M)	Local Road Inventory (Miles)	Unit Expenditure ($/Mile)
Alabama	411.16	87,088	$4,721
Alaska	242.41	10,557	$22,961
Arizona	1,017.51	53,290	$19,093
Arkansas	532.70	79,148	$6,731
California	7,170.04	156,536	$45,804
Colorado	1,721.18	74,082	$23,233
Connecticut	751.42	17,624	$42,637
Delaware[2]	16.47	962	$17,132
Florida	2,768.18	109,461	$25,289
Georgia	781.60	107,849	$7,247
Hawaii	234.07	3,442	$68,011
Idaho	403.67	40,168	$10,049
Illinois	2,104.12	129,872	$16,201
Indiana	1,070.72	86,000	$12,450
Iowa	1,303.08	105,938	$12,300
Kansas	668.90	127,981	$5,226
Kentucky	459.86	51,283	$8,967
Louisiana	223.22	48,058	$4,644
Maine	119.28	14,354	$8,310
Maryland	871.16	26,494	$32,881
Massachusetts	1,222.12	33,520	$36,459
Michigan	1,663.57	110,846	$15,008
Minnesota	2,153.74	129,436	$16,639
Mississippi	378.09	65,950	$5,733
Missouri	910.28	97,798	$9,307
Montana	323.01	49,591	$6,513
Nebraska	434.27	85,378	$5,086
Nevada	712.89	34,252	$20,813
New Hampshire	193.20	12,206	$15,828
New Jersey	1,373.29	36,353	$37,777
New Mexico[1]	268.40	53,811	$4,987
New York[1]	5,481.28	98,673	$55,549
North Carolina[2]	682.33	24,983	$27,312
North Dakota	412.42	79,695	$5,175
Ohio	1,874.21	103,459	$18,115
Oklahoma	510.87	102,608	$4,978
Oregon	733.75	45,639	$16,077
Pennsylvania	8,315.38	81,547	$101,970
Rhode Island	49.22	5,366	$9,173
South Carolina[1]	929.13	35,912	$25,872
South Dakota	283.25	71,579	$3,957
Tennessee	503.65	81,135	$6,207
Texas	6,999.24	239,677	$29,202
Utah	404.63	36,861	$10,977
Vermont	148.00	11,438	$12,940
Virginia[1,2]	1,228.03	13,666	$89,858
Washington	1,761.32	63,815	$27,600
West Virginia[2]	115.39	3,549	$32,510
Wisconsin	1,650.30	103,302	$15,976
Wyoming	398.36	17,574	$22,667

[1]Estimated by FHWA.
[2]Although most local roads and streets are under State control, local governments may raise and expend money on these roads and streets. State expenditures on these roads and streets are included in State Highway Finance Table series.

terms of the degradation of operational performance and structural longevity, impose restrictions to the use of local roads by certain classes of vehicles. For example, a county may prohibit overweight trucks from using their local roads during the spring season. Measures such as this can increase asset longevity and reduce the costs of maintenance.

- *Funding Availability*
  An LPA may encounter the problem of fast-deteriorating assets but may not have adequate



Climate Zone	Annual Rainfall (Inch)	Freezing Index (°F-Days)
Wet Non-Freeze	> 28	< 100
Wet Freeze	> 28	> 100
Dry Non-Freeze	< 28	< 100
Dry Freeze	< 28	> 100

Figure 3.8 The four climatic regions in the U.S. (Office of Highway Policy Information, 2016).

funds to address this situation. In such cases, unit spending will be low not because that is what is needed to maintain the assets but because that is what is available. Therefore, in such cases, low spending does not reflect a truly superior position. Therefore, to facilitate a more holistic assessment of the jurisdictions, the condition of their infrastructure needs to be considered, similar to the work done by researchers including Agbelie et al., 2015; Downes et al., 2017; Ghahari et al. (2019); Goode et al., 1993; Hartgen & Krauss, 1993; and Hendren and Niemeier, 2006, 2008. In the aggregate nationwide analysis in this study, we focus only on expenditures in the context of scale economies. As we recommend in the last chapter of this report, a future study on this subject could take a deep dive on both the effectiveness (pavement and bridge conditions) and unit expenditures on these assets, at each state's LPA.

(d) Effect of the HEA 1001-2016 Legislation in Indiana's Aggregate (Nationwide) Position

The effect of the HEA 1001-2016 legislation on the unit expenditures on local roads in Indiana was also investigated. Before the HEA 1001-2016 legislation (year 2015), the unit expenditure was $14,333. After the legislation, the unit expenditures were $11,114 (year 2018), $12,372 (year 2019), and $12,472 (year 2020). The years immediately following the legislation were avoided because there typically exists a significant time lag between the year of passage of legislation and its implementation and outcomes. Even without correcting for inflation, the trends seem clear: the aftermath of the legislation was characterized by a significant reduction in the unit expenditures on local roads. Combining this observation with the data shown in Figure 3.5 (which indicate increasing superior asset condition after the legislation), it seems apparent that there were some interventions during that period which spawned such improvement in local road management efficiencies in terms of expenditures vs. condition. One of those interventions, from all indications, is the HEA 1001-2016 legislation, the effect of which started to kick-in in 2018 (Figure 3.5).

4. DESIGN OF THE QUESTIONNAIRE SURVEY

The questionnaire survey was meant to be completed by the individual (or team) directly responsible for and/or most knowledgeable about asset management practices in each LPA, or someone appointed by the LPA manager. The survey respondents were requested to answer the questions as thoroughly as possible, providing details where necessary. Respondents were asked to provide their contact for possible follow-up interviews based on their responses provided. The contact information included the name of the respondent and their local agency they represent and the LPA type (township, city, or county), their job title, phone number, and email address. There were 19 respondents.

To remove any ambiguity, the survey instrument provided upfront, the definition of an AMP as "a formalized systematic framework for organizing, monitoring, and predicting the physical condition of an LPA's assets (pavements and bridges) and for assessing the costs and benefits of alternative repair actions including do-nothing, repair, rehabilitation, and replacement." For most questions posed in the survey, the respondents were provided with an opportunity to elaborate on their responses. The design of the survey questionnaire was carried out in collaboration with LTAP engineers, particularly, Patrick Conner and Jennifer Sharkey who provided valuable insights and input towards the design of specific questions. A copy of the survey is provided in Appendix A of this report.

4.1 The Practice of Asset Management in LPAs

The respondents were asked to indicate, whether pursuant to HEA 1001-2016, their LPA had a formalized systematic program for monitoring road or bridge asset conditions or making asset management decisions. Options included: possession and use of such AMP, possession but non-use of the AMP, and non-possession of an AMP.

4.2 Obstacles to Possession or Use of AMPs

This question sought to identify the barriers to possession of an AMP or use of one, such as: the LPA finds no need to have one; or the LPA does not have (but needs) an AMP but lacks the manpower, requisite skills, or financial resources to develop and maintain an AMP. Respondents were also given an opportunity to elaborate on their response.

4.3 Impact of HEA 1001-2016 on Use Extent of LPAs' AMPs

The respondents were asked whether the HEA 1001-2016 had any significant impact on their LPA's use of its AMP in monitoring their asset conditions and in for decision support regarding their asset repair or replacement activities. For each of these two questions, the options were: increased use, decreased use; and just about the same before the legislation.

4.4 Quality of AMPs Currently Used at LPAs

This question, intended to gauge the efficacy of the LPA's AMP in addressing the key questions posed in Chapter 1 of this report, consistent with several questions regarding.

- Current eligibility of the LPA for applying funding programs such as Community Crossings due to the LPA's AMP development.
- Capability of the LPA's AMP to estimate funding needs.
- Capability of the LPA's AMP to carry out routine asset management functions, such as planning work assignments, prioritizing improvements, and making repair decisions.
- Limitations of the LPA's AMP in carrying out the asset management functions described in the previous question.
- Any general assistance that could prospectively be provided by INDOT or LTAP to help the LPA overcome any of these identified challenges of their AMP.
- Any best practices in a specific area of the LPA's AMP where other LPAs could learn from.

4.5 Maturity and Features of LPAs' AMPs

Respondents were asked about the current level and trajectory of their AMP's level of maturity, and other features of the AMP. These questions were as follows.

- Length of time over which the LPA has had an AMP.
- The current level of maturity of the LPA's AMP.
- The trajectory of the AMP's maturity over the past few years.
- The *existing* modules that constitute the architecture of the LPA's AMP.
- Any *planned* modules to be added to the architecture of the LPA's AMP.
- How INDOT or LTAP could help the LPA specifically to improve the architecture and capabilities of its AMP.

Definitions of the various levels of AMP maturity (Figure 4.1), developed by Mr. Patrick Conner of LTAP, were provided to the respondents.

4.6 Specifics of LPAs' AMPs

From the researchers' experience, at several state and local agencies nationwide, AMP development has not proceeded beyond the first few initial steps, namely, having a database of the asset inventory. This could be thought of as "what do you use the AMP for" to provide some confirmation of the indicated level of maturity. Therefore, the question on the "specifics" of the LPA's asset management program was intended to obtain information on the LPA AMP's capability to do the following.

- Provide information on the past, current, and expected future condition of the assets.
- Assess monetary needs based on inventory and trends in the physical conditions.
- Provide an indication of available resources, regarding the budget levels over time and the projected levels of future funding needs.
- Make cost-effective repair or replacement decisions that preserve, maintain, or improve assets to ensure the maximum useful life and provide acceptable service to the public.
- Identify and analyze investment options for each asset.
- Assess the consequences of not maintaining the assets.
- Help the asset managers monitor the impact of their decisions.
- Help choose and schedule repairs that cause the least possible inconvenience to the motoring public.

LEVEL	DESCRIPTION
Level 1	Meet the minimum state requirements to be eligible for Matching Grant Programs for Roads or Bridges (i.e. Community Crossings)
Level 2	Utilize spreadsheets to manage pavement data, calculate and report average pavement condition indexes, (percent Good, Fair, Poor); report breakdown in roadway surface types, pavement conditions based on functional classification. Collect pavement data on paper or by laptop.
Level 3	Use pavement data and treatment data to report the years of added life compared to the years of life remaining (NCPP Quick Health Check) and/or use pavement data and financial data to report your service cycle (how many years it would take to repave all your roads).
Level 4	Use a combination of GIS and spreadsheets to collect, manage, and report pavement data. Collect pavement data with mobile collector and use GIS maps to report pavement conditions.
Level 5	Use performance measures and a network level analysis to drive your treatment strategy.
Level 6	Use deterioration modeling to predict future funding levels and impacts that funding and different treatment strategies have on network performance levels.

Figure 4.1 Definitions of the various levels of AMP maturity.

- Visualize and report on the AMP analysis outcomes to help the asset managers communicate the benefits of asset repairs to the end users/motoring public.

4.7 Agency Support for AMP Improvement

In any agency, there typically exists significant institutional inertia regarding the initiation and sustained use of new decision support systems. This is often overcome when the new system receives adequate support in various forms. This question was designed to provide an indication of the levels and types of support and reasons for any perceived or real lack of support. The questions addressed the following elements.

- Prioritization (by the LPA's management) of continual development of AMP in the LPA
- Additional resources required to further enhance the LPA's AMP development
- Utilization of consultants for any aspect of the AMP
- In-house development of the LPA's AMP
- Receipt of LTAP help for the LPA's AMP improvements

4.8 Barriers to Initiation or Continued Development of LPAs' AMPs

In a bid to develop recommendations for AMP enhancement, the survey design included a question on the most impactful barriers to AMP advancement in the LPA, on an ordinal scale of 1 (least impactful) to 7 (most impactful).

- Limited budget
- Limited workforce
- Lack of expert staff
- Lack of support by the upper management
- Lack of updated asset inventory and historical project activities
- Lack of special analysis tools (i.e., GIS capabilities)
- Lack of specialized asset management software

5. RESULTS OF THE QUESTIONNAIRE SURVEY AND INTERVIEWS

5.1 Results: The Survey of Indiana LPAs

The survey questionnaire (details of which are discussed in the previous chapter) was administered to the 268 local agencies (cities, towns, and counties) in Indiana with the assistance of LTAP engineers Patrick Conner and Jennifer Sharkey. The platform was a Purdue managed Qualtrics site. Prospective respondents were provided a link to the website through an email sent by LTAP. Their responses were recorded by the platform. During the survey, the respondent was given the flexibility to save their work and return to it later. Also, the platform allowed respondents to go back to earlier sections, if needed, to modify their answers. A copy of the survey is provided in Appendix A of this document.

5.1.1 Distribution of Local Agencies Responding to the Survey

Of the survey respondents, 63% were counties, 26% were cities, and 11% were townships (Figure 5.1). This is a fair reflection of the distribution of counties, cities, and towns in the state.

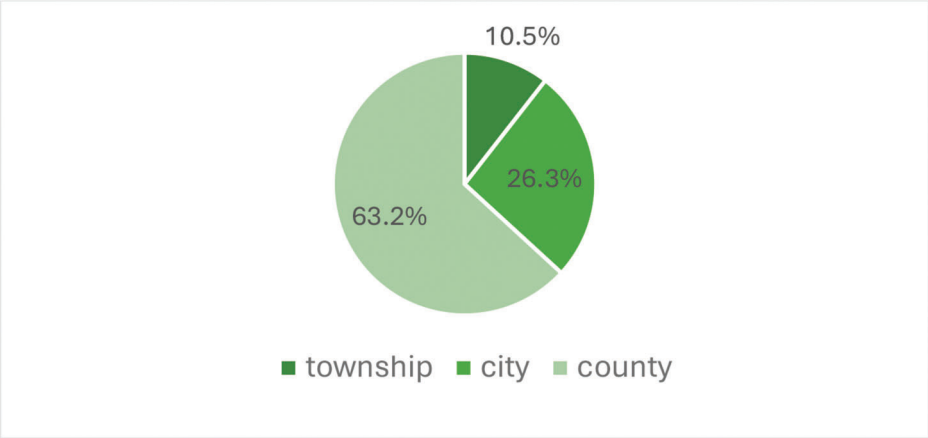


Figure 5.1 Distribution of local agencies responding to the survey.

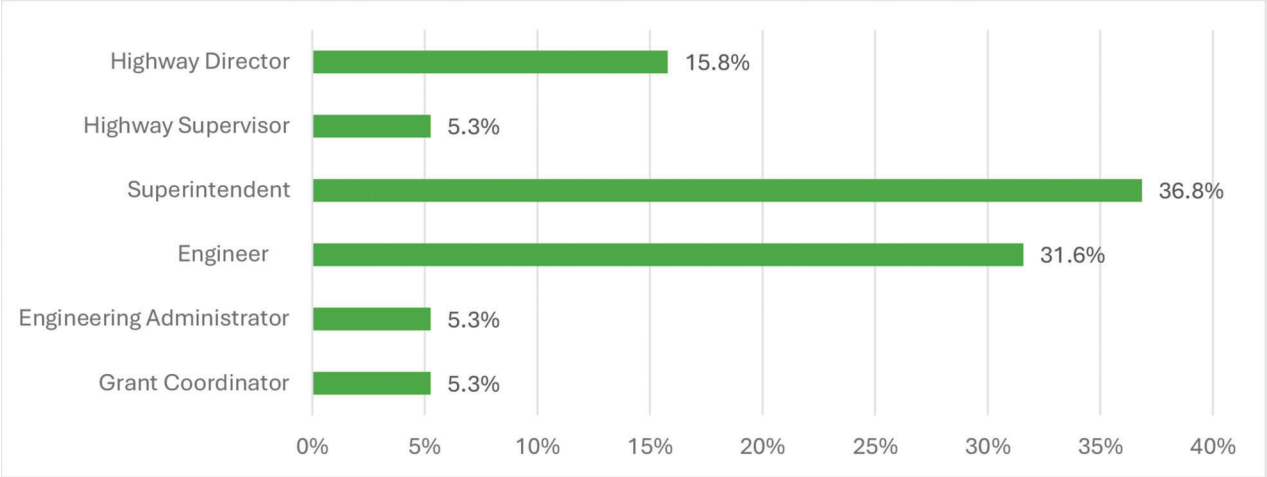


Figure 5.2 Distribution of the job title of survey respondents.

5.1.2 Distribution of the Job Titles of Persons Responding to the Survey

It was observed that the job titles of persons responding to the survey ranged widely (Figure 5.2). It was interesting to note that the respondents did not include persons specifically designated as "asset manager." Rather, the respondents were persons with other job titles but playing the role of asset manager or playing some role partly related to asset management. The most mentioned title is "superintendent," followed by "engineer," and "highway director." Other, less mentioned job titles are "highway supervisor," "engineering administrator," and "grant coordinator." It is noteworthy that except for grant coordinator, most of these job titles already existed prior to HEA 1001-2016. This suggests that the duties of asset manager were added on top of the job responsibilities of existing staff who were already playing some role in the agency.

5.1.3 Use of Asset Management Practices

The respondents overwhelmingly (95%) indicated that they possess and use an AMP for various functions (Figure 5.3). Surprisingly, 5% indicated non-possession of an AMP; of these, the oft-cited reason in the comments section was, "We do not have the manpower."

5.1.4 Impact of HEA 1001-2016 on the Use of AMPs for Monitoring Asset Condition

Fifty-three percent (53%) of the respondents indicated that subsequent to HEA 1001-2016, they observed an increase in the extent to which their LPA uses its AMP for monitoring asset condition; forty-seven percent (47%) indicated that it was just about the same extent of use. Regarding the use of the LPA for making asset repair/replacement decisions, forty-one percent (41%) of the respondents indicated that subsequent to

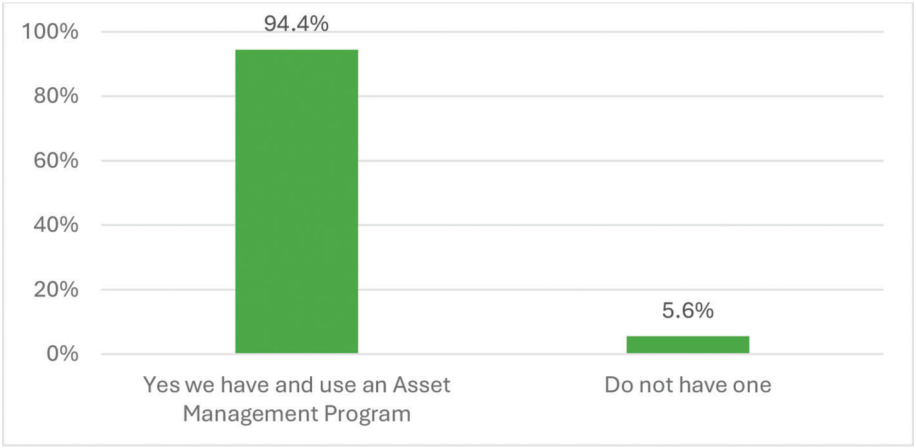


Figure 5.3 Widespread possession and use of AMPs.

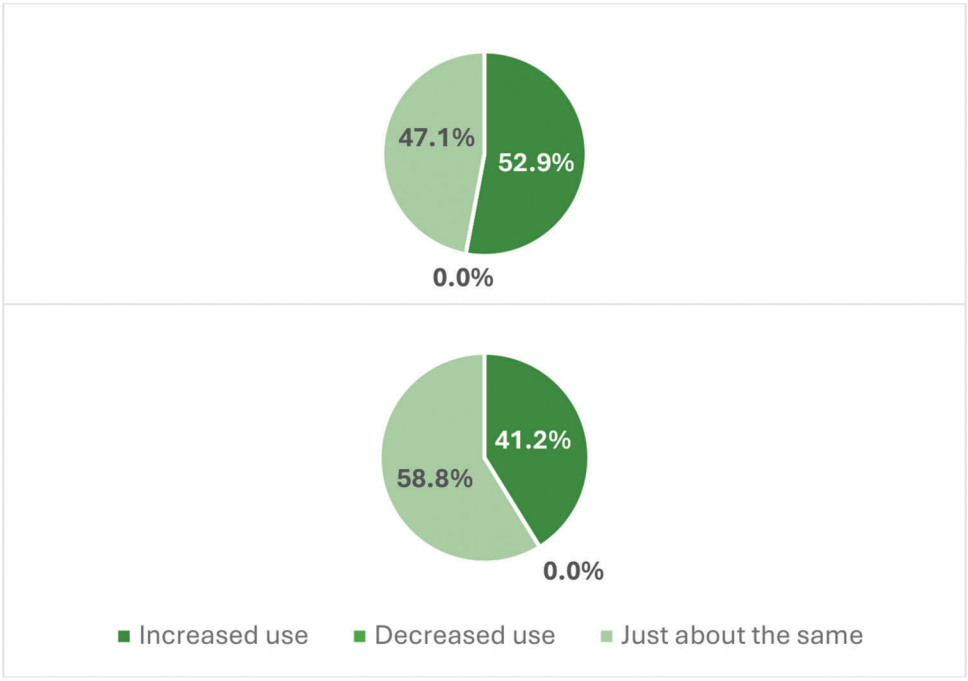


Figure 5.4 Impact of HEA 1001-2016 on the use of AMPs for (a) monitoring asset condition, and (b) making repair decisions.

HEA 1001-2016, they observed an increase in the extent to which their LPA uses its AMP for that purpose; fifty-nine percent (59%) indicated that it was just about the same extent of use. See Figure 5.4.

5.1.5 Quality of LPA's AMPs

Of the responding LPA that indicated that they possess an AMP, the following observations were made.

- One hundred percent (100%) indicated that their agency has reached a level of asset management development that makes their LPA eligible for funding programs such as Community Crossings.
- Eighty-three percent (83%) indicated that AMP capable of helping your LPA estimate funding needs (Figure 5.5).
- Ninety-two percent (92%) indicated that their AMP is capable of helping them carry out routine asset management functions such as planning work assignments, prioritizing improvements, and making repair decisions; 8% indicated otherwise (Figure 5.6).

5.1.6 Maturity and Features of the LPAs' AMPs

The next set of questions helped acquire insight into the maturity and features of the responding LPAs' AMPs, as follows.

- *Length of Time of Past Use (Figure 5.7)*
  The majority (36%) of respondents indicated that they have been using an AMP or for the past 6–10 years. This is consistent with the length of time since HEA 1001-2016. Twenty-seven percent (27%) and ten percent (10%) have been using AMPs in the last 11–15 years and at least

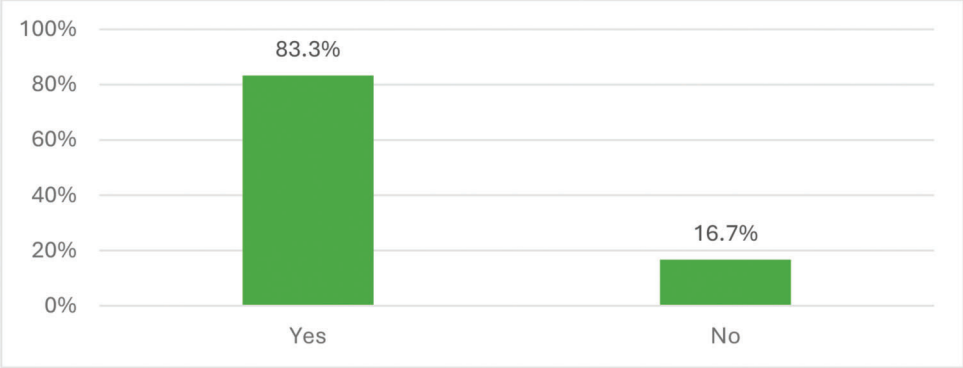


Figure 5.5 LPAs whose AMPs help estimate funding needs.

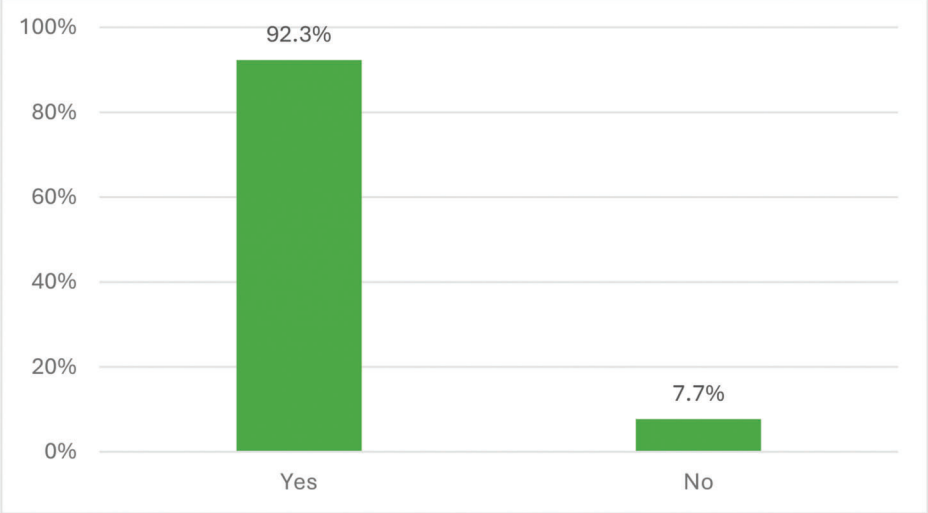


Figure 5.6 LPAs whose AMPs help carry out routine asset management functions, such as planning work assignments, prioritizing improvements, and making repair decisions.

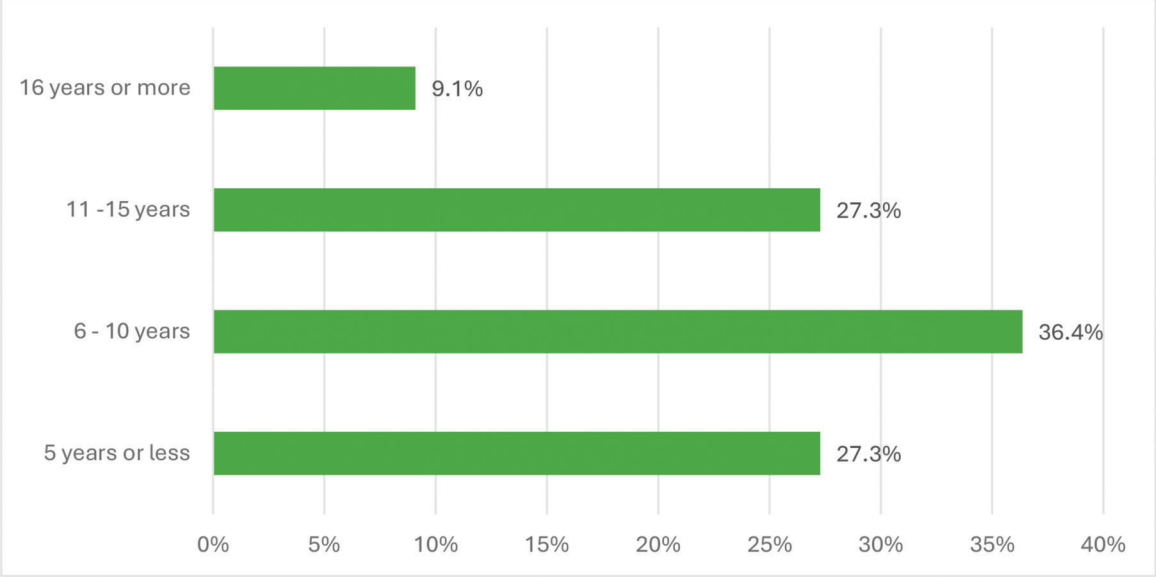


Figure 5.7 Length of time of LPA's use of AMP.

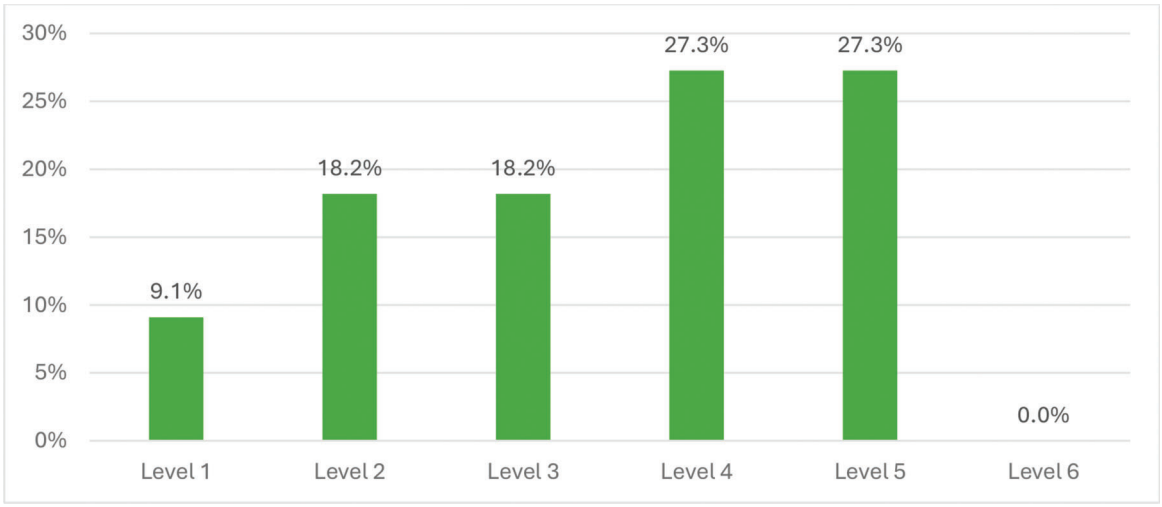


Figure 5.8 Level of maturity of the LPA's AMP needs.

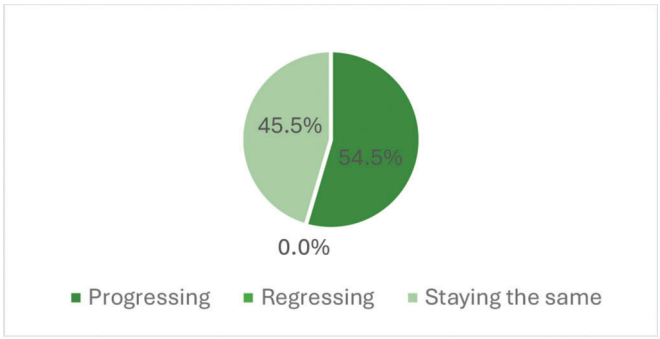


Figure 5.9 Trajectory of the maturity of LPA's AMP.

16 years, respectively; this suggests that AMPs were being used by LPAs even before HEA 1001-2016. Twenty-seven percent (27%) have been using AMPs in the last 0–5 years, suggesting that some LPAs were rather late in setting up AMPs, obviously for reasons indicated subsequently in the survey.

- *Maturity Level of the LPAs' AMPs (Figure 5.8)*
  The negative-skew distribution of the level of AMP maturity suggests that the existing AMPs at LPAs are generally at high levels of maturity. Fifty-four percent (54%) of respondents indicated that their AMP's have reached either maturity levels 4 or 5. Thirty-six percent (36%) indicated a maturity level of either 2 or 3, and ten percent (10%) indicated a maturity level of 1. None of the responding LPAs indicated a maturity level of 6 (meaning, full maturity).
- *Trajectory of Maturity of the LPAs' AMPs (Figure 5.9)*
  Fifty-five percent (55%) of respondents held the view that their AMP maturity has been progressing over the years, while forty-five percent (45%) felt that their AMP level of maturity has remained the same. None felt that their AMP level of maturity has regressed over the years.
- *Existing Modules of the LPAs' AMPs (Figure 5.10)*
  The three most frequent modules that LPAs possess in their AMPs are: an inventory of their assets, records of the historical condition (poor/fair/good) of their assets, and a list of the standard treatment types applied by the LPA to their assets. Eighteen percent (18%) indicated possession of these modules. Fourteen percent (14%) and twelve percent (12%) of responding LPAs indicated, respectively, that their AMPs keep records of the historical costs of the standard treatment types and that their LPAs have a prioritization process that identifies the most deserving assets (MDAs) for repair or replacement at a specified year. Only six percent (6%) of the responding LPAs indicated that their AMPs have modules that address the projection of asset conditions using deterioration models, store data on the historical effectiveness of the standard treatment types and carry out life-cycle based repair planning for each asset in their inventory.
- *Planned or Prospective (future) Modules of the LPA's AMP (Figure 5.11)*
  The responding LPAs indicated that going forward, not only will they maintain the existing modules that their AMPs currently possess, but also, they would like to further develop certain key modules (that affect the efficacy of other modules), namely, the asset inventory module (19%), the standard treatment types list and historical condition records module (14% each), historical costs data module and deterioration curves module (12%). Regarding the remaining modules (project prioritization, data on treatment effectiveness of the standard treatment types, and life-cycle based repair planning for each asset),

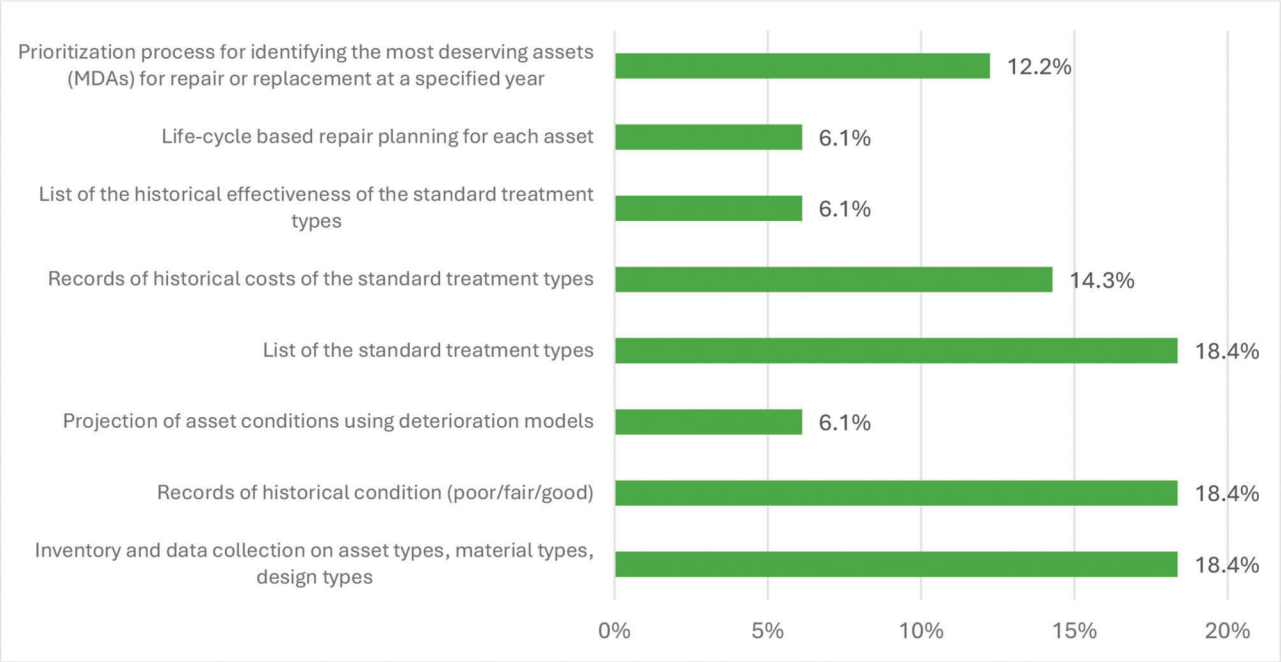


Figure 5.10 Existing modules of LPA's AMP.

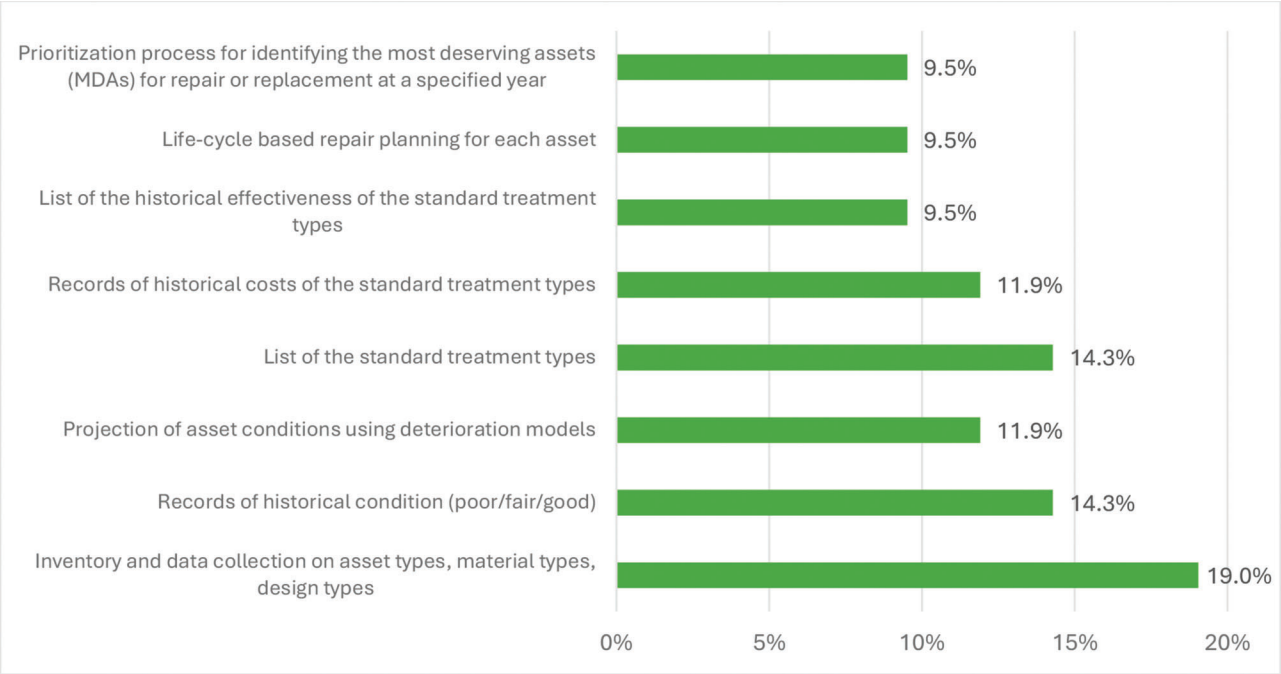


Figure 5.11 Planned or prospective (future) modules of LPA's AMP.

10% of the respondents indicated plans to implement each one of these modules in their LPA AMPs.

5.1.6 Specifics of the LPA's AMP

This question captured information on the LPAs' AMP capability to carry out specific functions. Their answers served as a check on their responses to previous questions on their AMP levels of maturity and the existing modules (because modules are tied to the functions, except in cases where the module exists but is not being used for its intended purpose). Regarding the capability of LPAs' AMPs to do the following.

- *Provide Information on the Past, Current, and Expected Future Condition of LPA's Assets (Figure 5.12)*

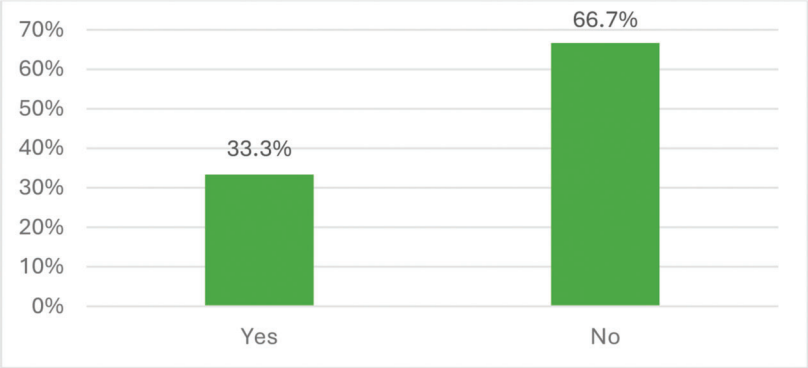


Figure 5.12 Capability of LPA's AMP to provide information on the past, current, and expected future condition of LPA's assets.

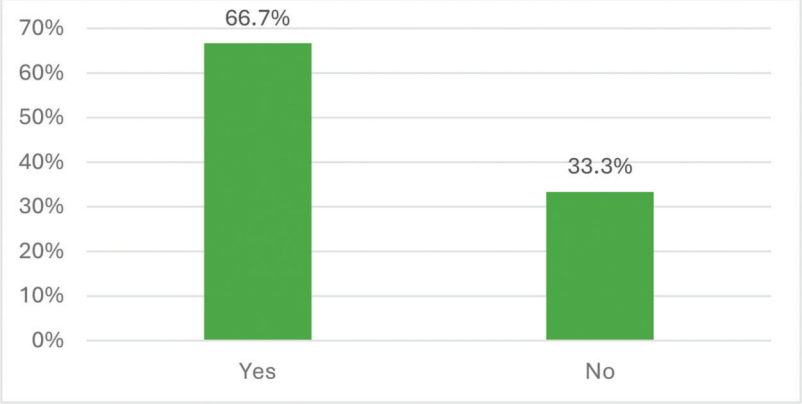


Figure 5.13 Capability of LPA's AMP to assess monetary needs (based on inventory and trends in the physical condition).

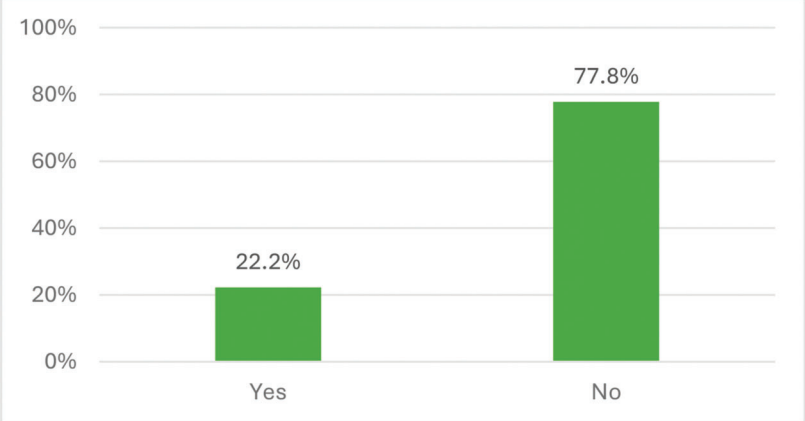


Figure 5.14 Capability of LPA's AMP for financial planning.

Thirty-three percent (33%) of the responding LPAs indicated that their AMPs provide such information; and sixty-seven percent (67%) indicated otherwise.

- *Assess Monetary Needs (based on inventory and trends in the physical conditions (Figure 5.13))*
  Sixty-seven percent (67%) of the responding LPAs indicated that their AMPs have the capability to carry out this function; and thirty-three percent (33%) indicated otherwise.
- *Provide an Indication of Available Resources, Regarding the Budget Levels Over Time and the Projected Levels of Future Funding Needs (Figure 5.14)*
  Twenty-two percent (22%) of the responding LPAs indicated that their AMPs provide the capability for doing this; and seventy-eight percent (78%) indicated otherwise.
- *Make Cost-Effective Repair or Replacement Decisions that Preserve, Maintain, or Improve Assets to Ensure the*

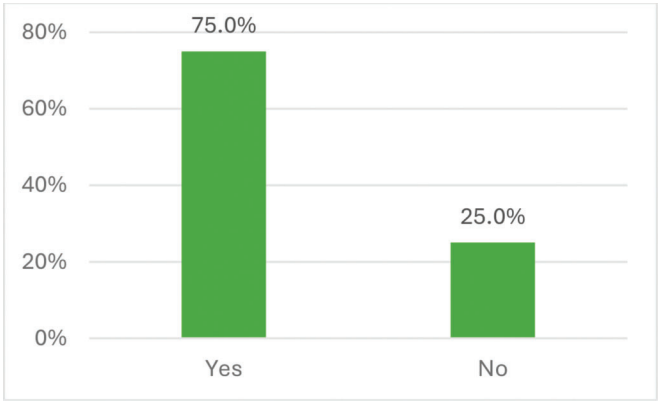


Figure 5.15 Capability of LPA's AMP to make cost-effective repair/replacement decisions.

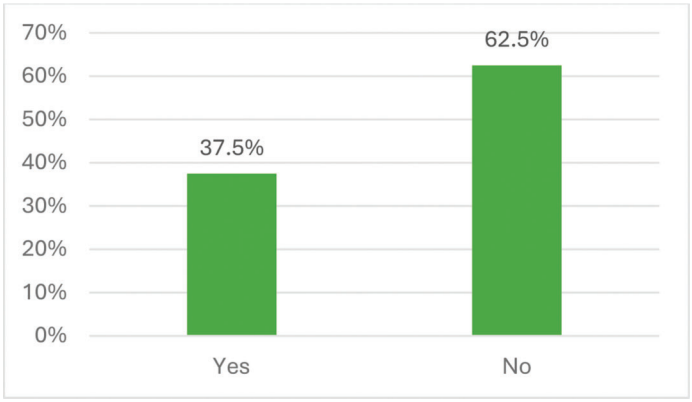


Figure 5.16 Capability of LPA's AMP to identify/analyze investment options for each asset.

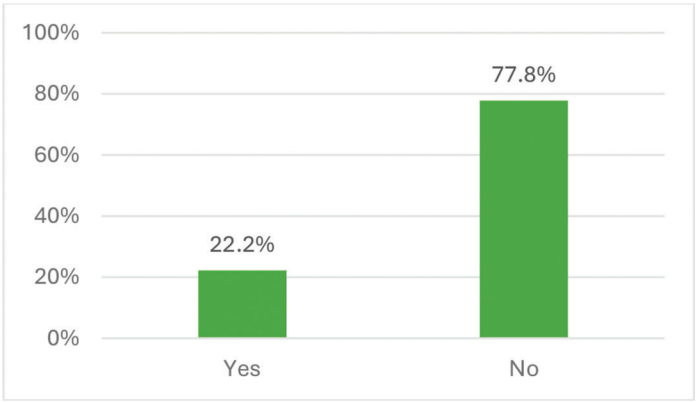


Figure 5.17 Capability of LPA's AMP to assess the consequences of deferred maintenance.

Maximum Useful Life and Provide Acceptable Service to the Public (Figure 5.15)
Seventy-five percent (75%) of the respondents stated that that their AMPs are currently able to carry out this function; and twenty-five percent (25%) indicated otherwise.

- *Identify and Analyze Investment Options for Each Asset (Figure 5.16)*
  Of the responding LPAs, thirty-eight percent (38%) indicated that their AMP is capable of this function; and sixty-three percent (62%) indicated otherwise.
- *Assess the Consequences of Not Maintaining the Assets (Figure 5.17)*
  Twenty-two percent (22%) of the respondents stated that their AMP is capable of assessing the consequences of deferred maintenance; the others (78%) indicated otherwise.
- *Visualize and Report on the AMP Analysis Outcomes to Help the Asset Managers Communicate the Benefits of Asset Repairs to the End Users/Motoring Public (Figure 5.18)*
  Thirty-eight percent (38%) of the responding LPAs stated that their AMPs use GIS tools to visualize the inputs and outcomes of their asset management data

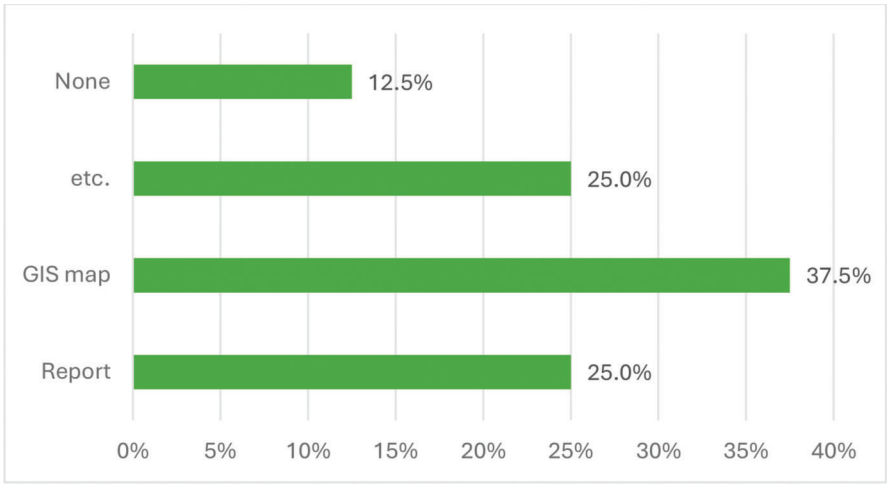


Figure 5.18 AMP's visualization and reporting tools.

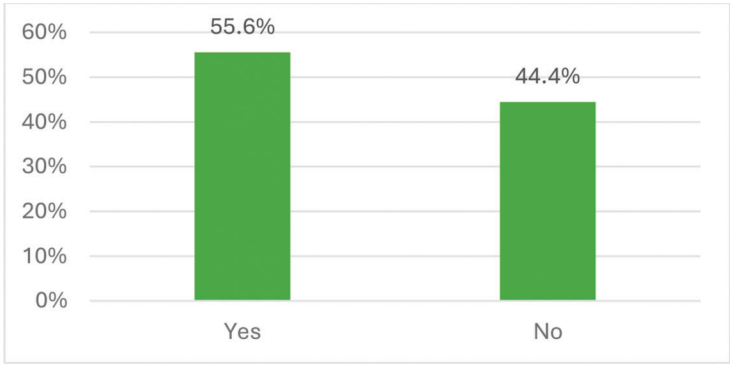


Figure 5.19 AMP's capability to analyze and inform asset managers of the potential impact of their decisions.

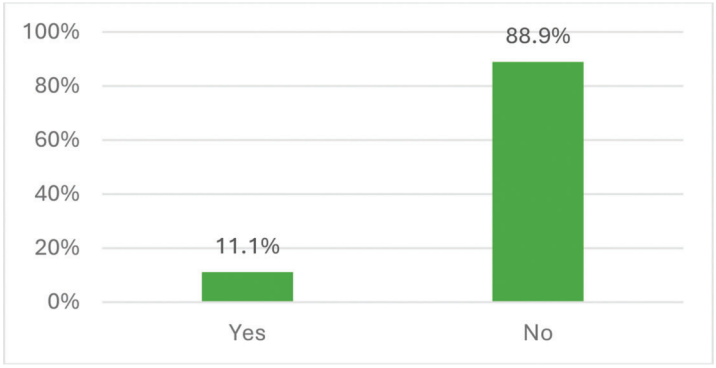


Figure 5.20 AMP's capability to help asset managers choose and schedule repairs that cause the least amount of inconvenience to the motoring public.

analysis and for reporting. A quarter (25%) of respondents stated that they use their AMPs to generate data for reporting and other purposes. Thirteen percent (13%) indicated that they currently do not use their AMP for developing products such as visualization or reporting.

- *Help the Asset Managers Monitor the General Impacts of Their Decisions (Figure 5.19)*
  Of the responding LPAs, fifty-six percent (56%) indicated that their AMP has the capability to provide the asset manager with information on the prospective outcomes of their asset-related decisions. The remaining forty-four percent (44%) indicated their AMP has no such capability at the current time.
- *Help the Asset Manager Choose and Schedule Repairs that Cause Least Possible Inconvenience to the Motoring Public (Figure 5.20)*
  Only eleven percent (11%) of the LPA respondents stated that their AMP is capable of carrying out this task.

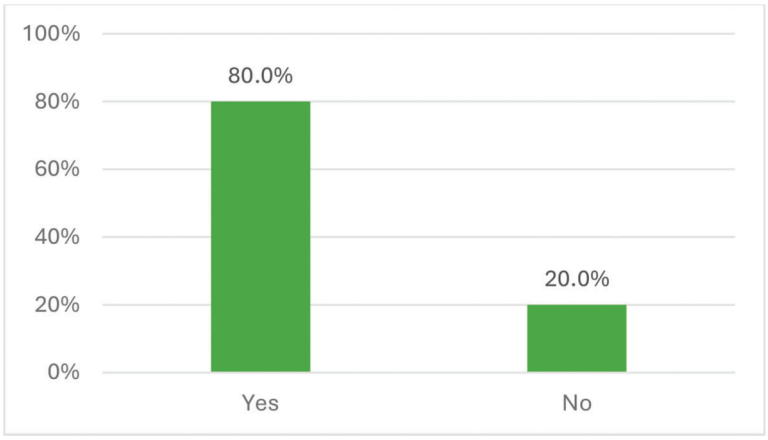


Figure 5.21 Agency prioritization of AMP improvement.

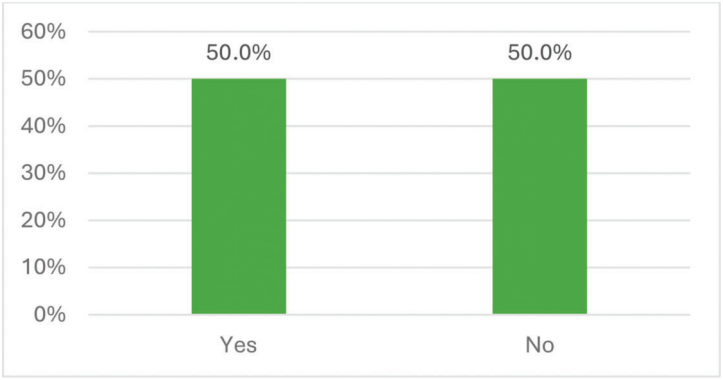


Figure 5.22 Use of consultants for AMP development.

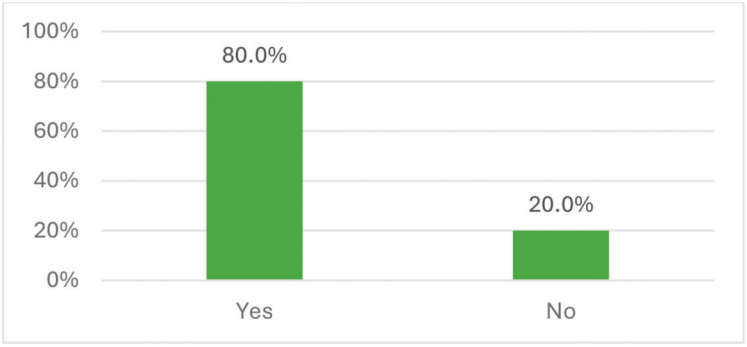


Figure 5.23 Role of in-house staff in the continued development of AMP.

5.1.7 Agency Support for AMP Improvement

This question was designed to provide an indication of the levels and types of support for AMP development within the LPA, and reasons for any perceived or real lack of support. The questions addressed the following elements.

- *Prioritization AMP Development in the LPA (Figure 5.21)*
  Eighty percent (80%) of the responding LPAs indicated that their agencies provide adequate support for their AMP development; twenty percent (20%) indicated otherwise.
- *Utilization of Consultants for Any Aspect of the AMP (Figure 5.22)*
  The extent of consultant use was evenly split among the survey respondents: fifty percent (50%) of them use consultants for their AMP development or maintenance, the other half do not.
- *In-House Development of the LPA's AMP (Figure 5.23)*
  Eighty percent (80%) of the respondents stated that they use in-house staff for continued development of their AMPs. This suggests that even those that use consultants also have in-house staff assisting with this effort. Twenty percent (20%) of respondents indicated that they do not use in-house resources to develop or maintain their AMP.

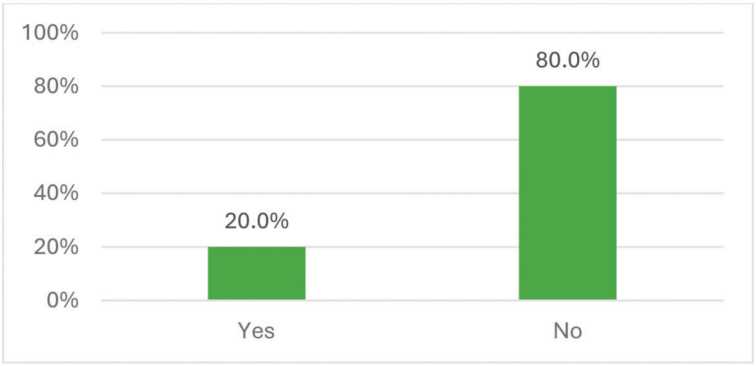


Figure 5.24 LTAP help for AMP improvements.

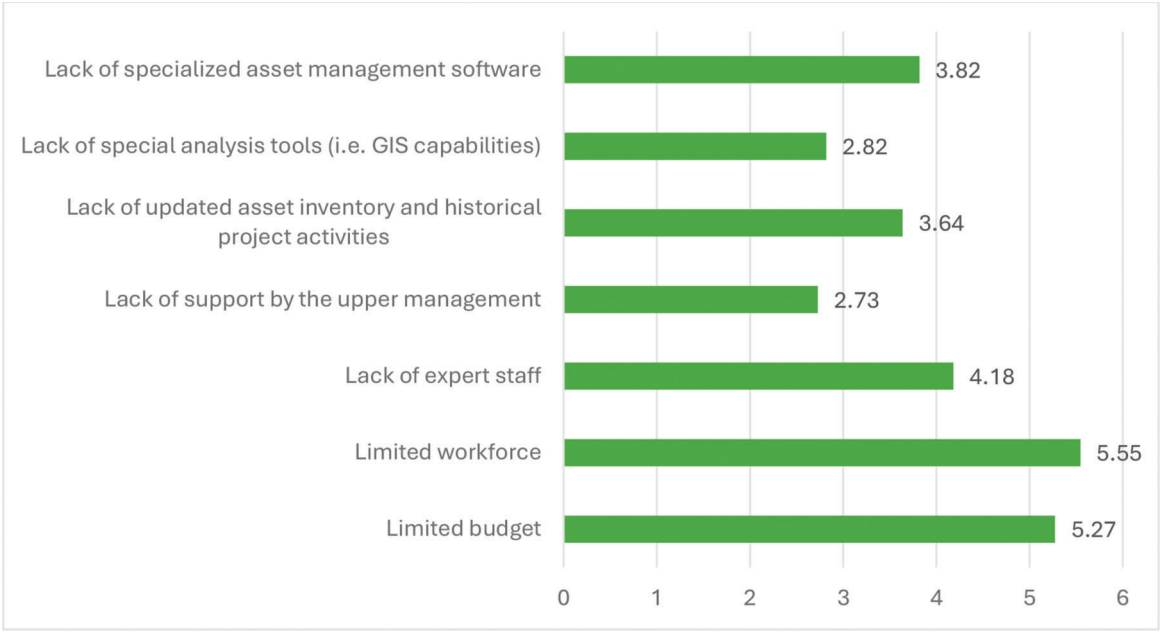


Figure 5.25 Barriers to initiation or continue development of LPA's AMP.

- *Receipt of LTAP Help for the LPA's AMP Improvements (Figure 5.24)*
  Only twenty percent (20%) of the responding LPAs indicated that they use LTAP help in their AMP development. This suggests that several LPAs are not taking advantage of the capability and availability of LTAP to play such support roles.

5.1.8 Barriers to Initiation or Continued Development of LPA's AMP

The survey design included a question on the most critical barriers to AMP advancement in the LPA, on an ordinal scale of 1 (least impactful) to 7 (most impactful), to serve as a basis for making recommendations in the report, towards AMP enhancement in Indiana's LPAs (Figure 5.25). The lack of an adequate workforce emerged as the most critical reason (average of 5.55 criticality across the respondents), followed by the limited budget (5.27), lack of expert staff (4.18), lack of specialized asset management software (3.82), and lack of updated asset inventory and historical records of past projects (3.64). Of these inhibitors, the least critical were identified as the lack of specialized analysis software such as GIS and the lack of upper management support.

5.2 Results: Interviews of Indiana LPAs

5.2.1 Interview 1: LaPorte County LPA

Name and position of interviewee: Jay Sullivan, County Engineer

- This LPA is a relatively large agency compared to most others in the state.
- AMP development was motivated primarily by the HEA 1001-2016 legislation.
- Platform used for the AMP: Roadsoft (https://roadsoft.org/).

- Had sought a program for several months prior to finally choosing Roadsoft (reason for choosing this vendor: because it is being used by other agencies in nearby Michigan).
- Scope of asset types managed by the LPA using Roadsoft: pavement assets only (does not include bridges).
- Outside contractor hired to operate Roadsoft, and to carry out PASER assessment of road sections; Current (as of fall 2024) level of AMP maturity: High (Level 5).
- Very satisfied with the outcomes of the decision to develop and use an AMP to manage their assets (Roadsoft has been effective as a platform for AMP).
- Has identified opportunities to expand the AMP to include other asset classes (culverts, catch basins, road signs, etc.).
- Bridge management is done in-house, with data from a bridge inspector for condition assessment.
- The AMP does the following:
  - helps the LPA to keep inventory of existing assets;
  - helps to keep track of the details of past work—maintenance, rehabilitation, and reconstruction—particularly, Mill & Fill, a common activity in the county; and
  - provides work details that include date of the work, specific treatment applied, and so on.
- The Community Crossings style of input and assessment of road segments works well if done for combined (long) road segments. However, the requirement of separate calculation spreadsheets for each constituent roadway segment can be challenging if this is to be done for multiple short segments instead of longer (combined) segments. Thus, having several short segments may be inimical to Community Crossings applications.
- AMP maturity progressing well, insofar as the task of adding more assets to the existing inventory of assets.
- Increased AMP software functionality not desired at this time, due to the cost of doing so; the county does not think it would be cost effective to do so.

5.2.2 Interview 2: City of Goshen LPA

Name and position of interviewee: Boston Snyder, Asset Manager

- Adopted Asset Management practices in 2016, motivated by the HEA 1001-2016 legislation.
- AMP development concept was promoted by the Michiana Area Council of Governments (MACOG) starting with PASER pavement data collection; MACOG "came in" to explain the PASER rating system.
- GIS program used to store data on road asset inventory and PASER condition, useful for asset condition assessment.
- AMP is used to keep track of pavement conditions; bridges are maintained by the county (Elkhart).
- LPA is developing the ability to make forecasts of pavement condition (PASER gains and losses); LPA hopes to implement this feature this year (2024).
- Institutional inertia/resistance to the AMP development has been observed in a few cases.
- LPA has established PASER dashboard for viewing pavement and bridge conditions throughout the city.
- Pavement condition assessments: The initial policy of 2-year intervals was found to be too lengthy; thus, switched recently to 1-year intervals.
- LPA considers street and road-related revenue matters (sources, amounts, and forecasts) as an integral aspect of its AMP.

5.2.3 Interview 3: Starke County LPA

Name and position of interviewee: Rachel Oestereich, Superintendent

- The LPA is relatively small compared to others.
- AMP development was motivated by the HEA 1001-2016 legislation.
- Current level of maturity: 1.
- Use spreadsheets (not software) for AMP.
- AMP maturity growth affected recently by personnel restructuring/shifts.
- PASER ratings (pavement condition monitoring) done in-house.
- LPA does not use consultants as LPA cannot afford the fees (often as high as $50k annually).
- In prioritizing projects, county may revert to the historical practice (of prioritizing truck routes over other routes).
- AMP used to meet matching grant applications but not always successful.
- AMP not used to make funding prioritization decisions (these are done using expert opinion of county leadership).
- Keeps inventory on asset types and records of historical condition of assets.
- For bridges, external inspectors are used to assign condition ratings.
- Commended LTAP staff (Ms. Laura Slusher) in consistently providing valuable assistance toward project evaluation/recommendation; would welcome similar LTAP technical assistance in the future.
- Suggested LTAP/Purdue's Annual Road School as a prospective avenue to generate and maintain collaboration with technical staff.

5.2.4 Summary of the Interview Outcomes

- HEA 1001-2016 achieved the intended effect of motivating LPAs to establish AMPs.
- Some LPAs may be missing the benefits of AMP besides merely achieving eligibility for matching funds.
- Small LPAs face formidable barriers to AMP development, in terms of financial, manpower, and equipment resources.
- Small LPAs generally lack funding to hire a full-time engineer; more unlikely to hire a consultant or adopt a software program for their asset management.
- Small LPAs suggested the concept of shared staff: they indicated that they could benefit significantly from financial support to share an Engineer or a Consultant with other LPA.

6. DISCUSSION AND CONCLUSIONS

6.1 Summary

In 2016, the Indiana General Assembly passed into law, House Enrolled Act 1001-2016, which provided a funding mechanism for transportation infrastructure. This new funding mechanism, the Local Road and Bridge Matching Grant Fund, required Local Public Agencies (LPAs) to have an AMP to be eligible for the funding. In 2021, the Indiana General Assembly expressed a need to investigate whether HEA 1001-2016 had any impact on the asset management practices in Indiana. INDOT commissioned the Joint Transportation Research Program to undertake a study to provide technical information to support the agency's evaluation of the effectiveness of HEA 1001-2016 in achieving its intended goals.

The study mechanisms include (a) a literature review of AMP development at selected LPAs in the United States; (b) quantitative analysis of the aggregate trends of LPA expenditures in Indiana and nationwide, and LPA asset physical condition in Indiana; and (c) questionnaire survey of LPA engineers and managers, and interview of selected LPAs in Indiana. The study analyzed the impact of HEA 1001-2016 on LPAs' AMP development including their AMP features and capabilities, the extent of their AMP use in asset repair and other routine management functions, and asset condition monitoring. The study also identified ways by which INDOT could help LPAs enhance their AMPs and thereby make them more eligible for federal funds including Community Crossings. Overall, this study provided guidance that can inform INDOT's recommendations to the legislature regarding HEA 1001-2016.

6.2 Conclusions

The results of the literature review regarding LPA asset management programs nationwide suggest that at each state, local road inventories continue to dominate statewide inventories albeit have lower traffic volumes; use asset management tools that were motivated by legislation or policy, were developed in-house or by consultants, and currently focus on condition assessment; address pavement assets mostly; provide data on the current condition of assets and condition trends over the recent past years; could benefit from more staff resources and training to enhance the asset management tool being used; provide indication of inadequate funding for asset replacement and repairs. Overall, the nationwide trend is that asset management practices are increasingly being adopted by LPAs as they have been shown to produce cost-effective management decisions that reduce asset life-cycle cost while promoting asset longevity.

From the analysis of aggregate data on local road asset expenditures and revenues in Indiana, it was found that the massive and unprecedented investment in capital outlays in 2016 was accompanied by significant reductions in maintenance expenditures in subsequent years. This is indicative of the effect of two forces: (a) the efficacy of the 2016 legislation in Indiana that encouraged the practice of asset management by LPAs in the state, and (b) the lagged tradeoff between capital investments and subsequent maintenance spending.

Also, the data trend suggests that the policy-outcome lag length, in other words, the length of time between the HEA 1001-2016 legislation and the outcome is 2 years. It is observed that in 2018 and afterward, the percentage of pavements in good condition increased significantly and is projected to increase further, and the percentage of pavements in poor condition decreased significantly and is projected to decrease further even after 2023.

The questionnaire survey results suggest that almost all the LPAs have set up an AMP for purposes of managing their assets, and most of these were established after the 2016 legislation. Those who do not have an AMP cited lack of manpower as the reason. There is no formal position titled "asset manager" and the work done by staff in longstanding positions, particularly, the county superintendent or city engineer. For LPAs that already had an AMP prior to the HEA 1001-2016 legislation (a third of responding LPAs), they observed increased use of their AMP for key asset management functions after the legislation was passed. An overwhelming majority of responding LPAs indicated current attainment of AMP development that makes them eligible for funding programs such as Community Crossings, enables them to estimate their asset preservation funding needs, and helps them carry out their routine asset management functions such as planning work assignments, prioritizing improvements, making repair decisions. A quarter of LPAs established their AMPs only recently, citing a lack of resources as the reason for the delay. For most responding LPAs, their existing AMPs are currently at high levels of maturity, generally, with over half of respondents indicating a sustained increase in AMP maturity in the recent past. The survey also revealed that most LPAs AMPs have progressed much beyond the baby steps of asset inventory listing. As evidenced in the types of modules that currently exist in their AMPs and the asset management functions for which they are being used. Most LPAs indicated much optimism regarding the trajectory of their AMPs regarding the AMP maturity, diversity of modules and prospective use of the modules in routine asset management tasks. Regarding specific capabilities of their AMPs (providing information on the past/current/future condition, monetary needs assessment, funding availability estimation, decision support for cost-effective repair/replacement, assessing consequences of decisions including maintenance deferment, visualizing/reporting AMP analysis outcomes, and project scheduling considering user costs), there was significant diversity in what the LPA AMPs were capable of doing; however, overall, most LPAs indicated the capability to carry out a reasonable number of these specific asset management functions. It was observed that as much as possible, LPA upper management generally provides

support for LPA development. A variation was observed in the mix of using in-house and consultants for AMP initial development and maintenance. The LPAs indicated that the critical barriers to further advancement of their AMPs include lack of adequate workforce, budgetary constraints, lack of specialized asset management software, and lack of updated asset inventory and historical records of past projects. Most LPAs, it seems, are not taking advantage of the resources available by LTAP in developing their AMPS further.

The outcomes of the interviews indicate that HEA 1001-2016 is recognized by the LPA as the main motivator of their AMP development. Some LPAs may be missing the benefits of AMP besides merely achieving eligibility for matching funds. In addition, the relatively small LPAs face formidable barriers to AMP development in terms of financial, manpower, and equipment resources, and have identified LTAP as a potential source of technical assistance in this regard.

Overall, the results of the present study indicate that goals of the 2016 legislation have largely been realized. Approximately 100% of Indiana's LPAs have developed AMPs of various levels of maturity ranging from incipient to advanced. Also, the empirical evidence at state and national levels suggests that the LPAs' AMP-enabled asset management practices are yielding positive outcomes in terms of reduced maintenance spending and superior asset conditions. It is recommended that LTAP continues to reach out to LPAs to provide technical support and training that could further advance existing AMPs, particularly at LPAs that face resource constraints. and could benefit from sharing AMP development resources (particularly, staff) with other LPAs.

6.3 Recommendations from the Study

(a) *Resource Sharing*
It is recommended that LTAP explore assisting smaller LPAs to form collaborative groups that pool resources to share consultant to manage their AMPs. This applies to the smaller LPAs that currently face constraints in terms of financial, manpower, and equipment resources. Also, sharing of in-house staff could be pursued, to further lower costs.

(b) *Training of AMP Consultant Personnel and Their LPA Clients*
Continual AMP training is recommended, not only for the consultants, but also for the LPAs that hired them.

(c) *Training of Personnel that Manage AMPs Developed In-House*
Regarding LPAs that chose in-house development of AMPs for at least one road asset class, continual training for the AMP staff is recommended.

(d) *Forums*
INDOT should help ensure that LTAP possesses the needed resources to conduct meetings at least thrice a year, for purposes of technical training, networking, sharing case studies, and general peer exchange.

- During road school, LTAP organized workshops; AMP-related sessions
- During CEPDS: LTAP organized sessions
- A suitable time during the year (once a year): LTAP organized webinar on Zoom for LPAs including their AMP consultants

(e) *Continual Monitoring*
INDOT should help ensure that LTAP possesses the resources needed to monitor the following.

(i) The ***inputs*** expended by the LPAs in their AMPs

- The annual levels of inputs (types and costs of resources) expended on LPA AMPS

(ii) The AMP ***outputs*** (AMP maturity, effectiveness, and benefits) in terms of the long-term trends in the following.

- AMP maturity
- Total cost of average cost of asset upkeep
- Improvements in asset condition
- Improvements in asset condition per dollar of spending (normalized by inventory size)
- Reduced normalized cost of Indiana's LPA spending compared to those of other peer states
- Transitions of Indiana's cost-efficiency values relative to the national cost-efficiency curve for local road assets

6.4 Study Limitations

The survey questionnaire has a few limitations that need to be acknowledged. The follow-up interviews were designed to obviate these limitations, at least to some extent. The first limitation was the length of the survey. The initial version of the questionnaire instrument survey was rather lengthy and required approximately 40 minutes to complete. Several drafts were shared with the SAC and LTAP engineers (Mr. Patrick Conner and Ms. Jennifer Sharkey), and with their assistance, the size was reduced to 20 minutes which is still lengthy but less onerous compared to the initial version. The second was the language of the survey. Terminology in asset management (and indeed, in any functional area) of an LPA, can (and does) vary significantly from one LPA to another. As such, certain terms of words may be interpreted by the respondent differently compared to respondents at other LPAs. The LTAP engineers reviewed the initial draft and made language changes to reduce the effect of such taxonomical variations. Thirdly, the survey administrators did not have full control in ensuring that a specific LPA respondent who received the email solicitation is the most knowledgeable person in the LPA regarding asset management practices. Fourth, the survey response rate was rather low, and it is hoped that the number of responding LPAs provided information that is reflective of the larger population of LPAs in the state.

6.5 Suggested Avenues for Future Research

Future work in this area could make efforts to reach a larger sample of the population of LPAs. In addition, future researchers could undertake site in-person visits to a sample of the LPAs to carry out field assessments of their LPA capabilities and level of maturity. The identification of obstacles could extend beyond mere average deficiencies to those associated with specific modules and functions of each LPA's AMP. This way, the maturity of specific modules, not the overall AMP, could be assessed for each LPA.

REFERENCES

Agbelie, B. R. D. K., Labi, S., Noureldin, S., & Sinha, K. C. (2015). Linking interstate pavement preservation investment to performance: An exploratory aggregate analysis. *ASCE Journal of Infrastructure Systems*, *21*(4). https://doi.org/10.1061/(ASCE)IS.1943-555X.0000256

Downes, R., Moretti, D., & Nicol, S. (2017). Budgeting and performance in the European Union: A review by the OECD in the context of EU budget focused on results. *OECD Journal of Budgeting*, *17*(1), 1–60.

Ghahari, S. A., Alabi, B. N. T., Alinizzi, M., Alqadhi, S., Chen, S., & Labi, S. (2019). Examining relationship between infrastructure investment and performance using state-level data. *Journal of Infrastructure Systems*, *25*(4), 04019026. https://doi.org/10.1061/(ASCE)IS.1943-555X.0000505

Goode, L., Jeff, G., MacGillivray, I., & Pedersen, N. (1993). Response to "resources vs. results: Comparative performance of state highway systems, 1984–1990." *Policy Studies Journal*, *21*(2), 375–378. https://doi.org/10.1111/j.1541-0072.1993.tb01829.x

Hartgen, D. T., & Krauss, R. T. (1993). Resources versus results: Comparative performance of state highway systems, 1984–1990. *Policy Studies Journal*, *21*(2), 357–374. https://doi.org/10.1111/j.1541-0072.1993.tb01828.x

Hendren, P., & Niemeier, D. A. (2006). Evaluating the effectiveness of state department of transportation investment decisions: Linking performance evaluation criteria to resource allocation. *Journal Infrastructure System*, *12*(4), 216–229. https://doi.org/10.1061/(ASCE)1076-0342(2006)12:4(216)

Hendren, P., & Niemeier, D. A. (2008). Identifying peer states for transportation system evaluation and policy analyses. *Journal Transportation*, *35*(4), 445–465. https://doi.org/10.1007/s11116-008-9158-8

Hennepin County Public Works. (2023). *Asset management dashboard 2023*. https://www.hennepin.us/en/residents/transportation/asset-management

IMPO. (2021, September). *Analysis of central Indiana asset management plans*. Indianapolis Metropolitan Planning Organization. https://d16db69sqbolil.cloudfront.net/mpo-website/downloads/Asset-Management/Central-Indiana-Local-Road-Conditions_10.08..21_including-DPW-Update.pdf

London, M., McNeil, S., & Li, Q. (2012). Using data envelopment analysis to explore state transportation infrastructure performance and economic health. In *Proceedings of the 91st Annual Meeting of the Transportation Research Board*. Transportation Research Board.

LTAP. (n.d.). *LTAP asset management* [Webpage]. Indiana Local Technical Assistance Program. https://inltaptraining.azurewebsites.net/public/asset-management.html#!/home

LTAP. (2024). *Indiana LTAP local road & bridge report*. Indiana Local Technical Assistance Program. https://www.purdue.edu/inltap/resources/2024-08-20-Indiana-Local-Road-and-Bridge-Report---FINAL.pdf

Mabry, T. (2023). *City of Walker 2023 transportation asset management plan*. City of Walker. https://www.walkermi.gov/DocumentCenter/View/3343/Walker-Transportation-Asset-Management-Plan-PDF

Mecosta County Road Commission. (2017). *Asset management plan for pavements*. https://cms6.revize.com/revize/mecostaroad/Asset%20Management%20Plan%202017.pdf

NOACA. (2016, July). *NOACA transportation asset management program: Transportation asset management plan*. Northeast Ohio Areawide Coordinating Agency. https://www.noaca.org/home/showpublisheddocument/23052/636747889911230000

Nunn, M. (2023). *Iosco County Road Commission 2023 transportation asset management plan*. https://www.ioscoroads.org/filestorage/2012/9937/Iosco_County_Road_Commission_2023_Asset_Management_Plan.pdf

Office of Highway Policy Information. (2016, December). *Highway performance monitoring system, field manual* (Office of Management & Budget (OMB) Control No. 2125-0028). https://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/hpms_field_manual_dec2016.pdf

Office of Policy and Governmental Affairs. (n.d.). *Highway statistics series* (2000–2021) [Webpage]. U.S. Department of Transportation Federal Highway Administration. https://www.fhwa.dot.gov/policyinformation/statistics.cfm

Region 2 Planning Commission. (2019, November). *2018–2019 asset management report: Hillsdale County federal-aid eligible roads*. https://www.region2planning.com/wp-content/uploads/2020/01/2018-2019-Asset-Management-Report_Hillsdale-County.pdf

Remeto, L., & Cook, M. R. (2022). *Kittitas County Department of Public Works 2022–2032 transportation asset management plan*. https://www.co.kittitas.wa.us/uploads/documents/public-works/construction/2022-10-Year-TAMPlan.pdf

Scott, J. (2024). *2024 Bay City transportation asset management plan*. https://www.baycitymi.gov/DocumentCenter/View/8027/2024-Transportation-Asset-Management-Plan?bidId=

SDOT. (2020). *Asset status & condition report: Asset & performance management*. Seattle Department of Transportation. https://www.seattle.gov/documents/Departments/SDOT/About/DocumentLibrary/Reports/AMStatusCondRpt2020Final.pdf

Turley, J., & Martin, T. (2004). *Administration and management of local roads and streets: A handbook for Indiana county, city and town officials*. Indiana Local Technical Assistance Program. https://docs.lib.purdue.edu/cgi/viewcontent.cgi?params=/context/inltappubs/article/1011/&path_info=Administration_and_Management_of_Local_Roads_and_Streets_2004.pdf

Washtenaw County Road Commission. (2021). *Transportation asset management plan 2021–2023*. https://www.wcroads.org/wp-content/uploads/Budget_Transparency/WCRC-Transportation-Asset-Management-Plan-2021.-Approved-Sept.-7-2021.pdf

APPENDICES

Appendix A. Questionnaire Survey

APPENDIX A. QUESTIONNAIRE SURVEY

Indiana Questionnaire Survey of Local Public Agencies on Asset Management Practices

Introduction and Survey Description

In 2016, Indiana Legislatures passed into law, HEA 1002, a new funding mechanism for transportation infrastructure, the Local Road & Bridge Matching Grant Fund. This mechanism requires local agencies (LAs) to have a plan to manage these assets to be eligible for the funding. Over the last 3-5 years, 100% of counties, 100% cities, and 75% of towns have implemented some form of pavement asset management plan; ranging from a biannual collection and submission of PASER scores to comprehensive full programs to track, inform spending decisions, and forecast future conditions of infrastructure. In 2023, the Indiana Legislatures expressed a desire to evaluate these practices.

In response to the legislature's request, the Indiana Department of Transportation commissioned Purdue University to carry out a research project to:

(a) Determine the extent to which Local Public Agencies (LPAs) are (as of 2024) using Asset Management Practices (AMPs) for their assessment of asset conditions and making repair decisions.

(b) Examine the effect of increased "buy-in" of AMPs on overall asset conditions.

(c) Examine the specifics of current AMPs, namely if there exist instances of LPAs completing AMPs at some minimum level that would make them eligible for funding programs such as "Community Crossings," and

(d) determine if there exist any areas of teaching/best practices that could help LPAs to not only use their AMPs for federal and state grant applications (including Community Crossings) but also to more efficiently make asset repair decisions.

As a part of the research effort, this survey is being conducted to address these research questions.

Instructions

This PDF is for reference: the survey is on Qualtrics via the link provided.
This survey is meant to be completed by the individual (or team) directly responsible for and/or most knowledgeable about Asset Management Practices in your LPA, or someone appointed by the LPA Manager.

Please note the Directly Responsible Individual (or Team).

Please answer the questions as thoroughly as possible, providing details where necessary. This survey does not need to be completed in one sitting. The responses to the survey will be invaluable to this research. The research results will be made available to you in a final project report. Your time and effort are greatly appreciated.

Contact Information

Contact information for a possible follow-up interview (based on responses provided).

Local Agency Represented (Township, City, or County):
Click or tap here to enter text.

Respondent Name(s): Click or tap here to enter text.
Job Title: Click or tap here to enter text.
Phone Number: Click or tap here to enter text.
Email Address: Click or tap here to enter text.

Definition

DEFINITION For our research, we have adopted the following definitions.

Asset Management Program (AMP): A formalized systematic framework for organizing, monitoring and predicting the physical condition of an LPA's assets (pavements and bridges) and for assessing the costs and benefits of alternative repair actions including do-nothing, repair, rehabilitation, and replacement.

Can alternatively be referred to as an Asset Management System (AMS), or specifically, Pavement Management System (PMS) or Bridge Management System (BMS), if the focus is on those asset types.

1. Does your LPA use Asset Management Practices?

Pursuant to HEA 1002, Does your LPA have a formalized systematic program **for monitoring road or bridge asset condition or making asset management decisions**?

- ○ Yes we have and use an Asset Management Program
- ○ Have but do not use it for decisionmaking
- ○ Do not have one

2. If your LPA does NOT have/use AMP: (please answer and then skip to Q7):

What is the main obstacle?

- ○ We do not need a formalized system to manage our assets
- ○ We do not have the manpower
- ○ We do not have the financial resources
- ○ We do not have the skills or training

(Optional comment- please elaborate: Click or tap here to enter text.)

3. Impact of HEA 1002 on the extent of use of AMPs

Q3.1 Subsequent to HEA 1002, have you observed a change in the extent to which your LPA uses its AMP **for monitoring asset condition**?

- ◉ Increased use
- ○ Decreased use
- ○ Just about the same

(Optional comment- how so?: Click or tap here to enter text.)

Q3.2 Subsequent to HEA 1002, have you observed a change in the extent to which your LPA uses its AMP **for making asset repair/replacement decisions**?

- ○ Increased use
- ○ Decreased use
- ○ Just about the same

(Optional comment-how so?: Click or tap here to enter text.)

4. Quality of your current AMPs

Q4.1 In your opinion, has your agency reached a level of Asset Management development that makes your LPA eligible for funding programs such as “Community Crossings”?

- Yes
- No

Q4.2 Is your AMP capable of helping your LPA estimate funding needs? Please explain.

- Yes
- No

Click or tap here to enter text.

Q4.3 Is your AMP capable of helping your LPA carry out routine asset management functions such as planning work assignments, prioritizing improvements, making repair decisions?

- Yes
- No

Q4.4 What are the limitations to your LPAs’ use of the AMP in better carrying out the asset management functions described previously?

Click or tap here to enter text.

Q4.5 What can INDOT or LTAP do to help your LPA overcome any of these identified challenges of your LPAs AMP?

Click or tap here to enter text.

Q4.6 Are there any best practices in your LPA’s AMP that you feel other LPAs could benefit from?

Click or tap here to enter text.

5. Maturity & Features of Your LPA's Asset Management Practices

Maturity levels of Asset Management Programs:

LEVEL	DESCRIPTION
Level 1	Meet the minimum state requirements to be eligible for Matching Grant Programs for Roads or Bridges (i.e. Community Crossings)
Level 2	Utilize spreadsheets to manage pavement data, calculate and report average pavement condition indexes, (percent Good, Fair, Poor); report breakdown in roadway surface types, pavement conditions based on functional classification. Collect pavement data on paper or by laptop.
Level 3	Use pavement data and treatment data to report the years of added life compared to the years of life remaining (NCPP Quick Health Check) and/or use pavement data and financial data to report your service cycle (how many years it would take to repave all your roads).
Level 4	Use a combination of GIS and spreadsheets to collect, manage, and report pavement data. Collect pavement data with mobile collector and use GIS maps to report pavement conditions.
Level 5	Use performance measures and a network level analysis to drive your treatment strategy.
Level 6	Use deterioration modeling to predict future funding levels and impacts that funding and different treatment strategies have on network performance levels.

Q5.1 How long have you had an AMP for your LPA (# years, # months)?

Click or tap here to enter text.

Q5.2 Which Level best describes the maturity of your AMP (Give level of maturity w/ examples)

Level: Choose a level. Examples: Click or tap here to enter text.

Q5.3 What is the trajectory of your AMP's maturity? (progressing, regressing, staying the same, etc)

AMP trajectory: Click or tap here to enter text.

Q5.4 What are the overall modules of your LPA's AMP **(existing)**
(select all that apply)

- ☐ Inventory and data collection on asset types, material types, design types
- ☐ Records of historical condition (poor/fair/good)
- ☐ Projection of asset conditions using deterioration models;
- ☐ List of the standard treatment types
- ☐ Records of historical costs of the standard treatment types
- ☐ List of the historical effectiveness of the standard treatment types
- ☐ Life-cycle based repair planning for each asset

☐ Prioritization process for identifying the most deserving assets (MDAs) for repair or replacement at a specified year.

Q5.5 What are the overall modules of the AMP **(planned or in progress)** (select all that apply)

☐ Inventory and data collection on asset types, material types, design types
☐ Records of historical condition (poor/fair/good)
☐ Projection of asset conditions using deterioration models;
☐ List of the standard treatment types
☐ Records of historical costs of the standard treatment types
☐ List of the historical effectiveness of the standard treatment types
☐ Life-cycle based repair planning for each asset
☐ Prioritization process for identifying the most deserving assets (MDAs) for repair or replacement at a specified year.

Q5.6 How could INDOT or LTAP better help your LPA improve the capabilities of your Asset Management?

Click or tap here to enter text.

6. Specifics of Your LPA's Asset Management Program

Q6.1 Does your LPA's AMP provide information on the past, current, and expected future condition of the assets?

○ Yes
○ No

Q6.2 Does your LPA's AMP allow for assessment of monetary needs (based on inventory and trends in the physical conditions?

○ Yes
○ No

Q6.3 Does your LPA's AMP give an indication of available resources? What are the budget levels over time? What is the projected level of future funding?

○ Yes
○ No

Click or tap here to enter text.

Q6.4 Does your LPA's AMP provide the capability to make cost-effective repair or replacement decisions that preserve, maintain, or improve assets to ensure the maximum useful life and provide acceptable service to the public? (Network level)

- ○ Yes
- ○ No

Q6.5 Does your LPA's AMP provide the capability to identify and analyze investment options for each asset? (Project level). If not, state how this could be addressed.

- ○ Yes
- ○ No Click or tap here to enter text.

Q6.6 Does your LPA's AMP provide the capability to assess the consequences of not maintaining the assets? (Network level) If not, state how this could be addressed.

- ○ Yes
- ○ No Click or tap here to enter text.

Q6.7 What visualization and reporting tools are available in your AMP to help the asset managers communicate the benefits of asset repairs to the end users/motoring public?

Click or tap here to enter text.

Q6.8 Does your LPA's AMP help the asset managers monitor the impact of their decisions?

- ○ Yes
- ○ No

Q.6.9 Does your LPA's AMP help you to choose and schedule repairs that cause least possible inconvenience to the motoring public?

- ○ Yes
- ○ No

7. Agency support for AMP improvement

Q7.1 Is the continued development of AMP a management priority in your LPA?

- ○ Yes
- ○ No

Q7.2 What additional resources would be required to further enhance your LPA's AMP?

Click or tap here to enter text.

Q7.3 Does your LPA utilize consultants for any aspect of your AMP? If so, in what manner?

- ○ Yes Click or tap here to enter text.
- ○ No

Q7.4 Is the continued development of your AMP being done in-house by your LPA?

- ○ Yes
- ○ No

Q7.5 (If applicable) Are you receiving help from LTAP for your AMP improvements? To what extent?

- ○ Yes Click or tap here to enter text.
- ○ No

8. Barriers to initiation or continued development of Your LPA's AMP

Q8.1 Which of the following are the most important barriers in advancing further your LPA's AMP? (Rank by importance: 1-7)

- _ Limited budget
- _ Limited workforce
- _ Lack of expert staff
- _ Lack of support by the upper management
- _ Lack of updated asset inventory and historical project activities
- _ Lack of special analysis tools (i.e. GIS capabilities)
- _ Lack of specialized asset management software

About the Joint Transportation Research Program (JTRP)

On March 11, 1937, the Indiana Legislature passed an act which authorized the Indiana State Highway Commission to cooperate with and assist Purdue University in developing the best methods of improving and maintaining the highways of the state and the respective counties thereof. That collaborative effort was called the Joint Highway Research Project (JHRP). In 1997 the collaborative venture was renamed as the Joint Transportation Research Program (JTRP) to reflect the state and national efforts to integrate the management and operation of various transportation modes.

The first studies of JHRP were concerned with Test Road No. 1—evaluation of the weathering characteristics of stabilized materials. After World War II, the JHRP program grew substantially and was regularly producing technical reports. Over 1,600 technical reports are now available, published as part of the JHRP and subsequently JTRP collaborative venture between Purdue University and what is now the Indiana Department of Transportation.

Free online access to all reports is provided through a unique collaboration between JTRP and Purdue Libraries. These are available at http://docs.lib.purdue.edu/jtrp.

Further information about JTRP and its current research program is available at http://www.purdue.edu/jtrp.

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